FINAL REPORT

DREDGING FEASIBILITY STUDY

FOR

HIGHLAND LAKE

IN THE

TOWN OF WINCHESTER,

CONNECTICUT

Prepared For The

HIGHLAND LAKE COMMISSION

&

STATE OF CONNECTICUT

DEPARTMENT OF ENVIRONMENTAL PROTECTION

June 1991

Wengell, McDonnell & Costello, Inc.
-Consulting Engineers-

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I. PROJECT UNDERSTANDING

Wengell, McDonnell & Costello, Inc. (WMC) was selected by the Town of Winchester's Highland Lake Commission to prepare a report discussing the feasibility of dredging five coves areas on Highland Lake located in the Town. The study was funded under a 75% grant program administered by the Connecticut Department of Environmental Protection's (DEP) Clean Lakes Program (Section 22a-339 CGS).

It appeared, from previously prepared reports and observations, that dredging activities within the study areas could be accomplished by dry excavation of the sediments following the yearly drawdown of the Lake. This study, therefore focuses on the dry excavation of sediment, while also discussing other potential methods of dredging such as hydraulic and drag line dredging.

The work plan was based on the findings of the previously prepared Highland Lake Diagnostic Feasibility Study. The scope of the work is described in this section.

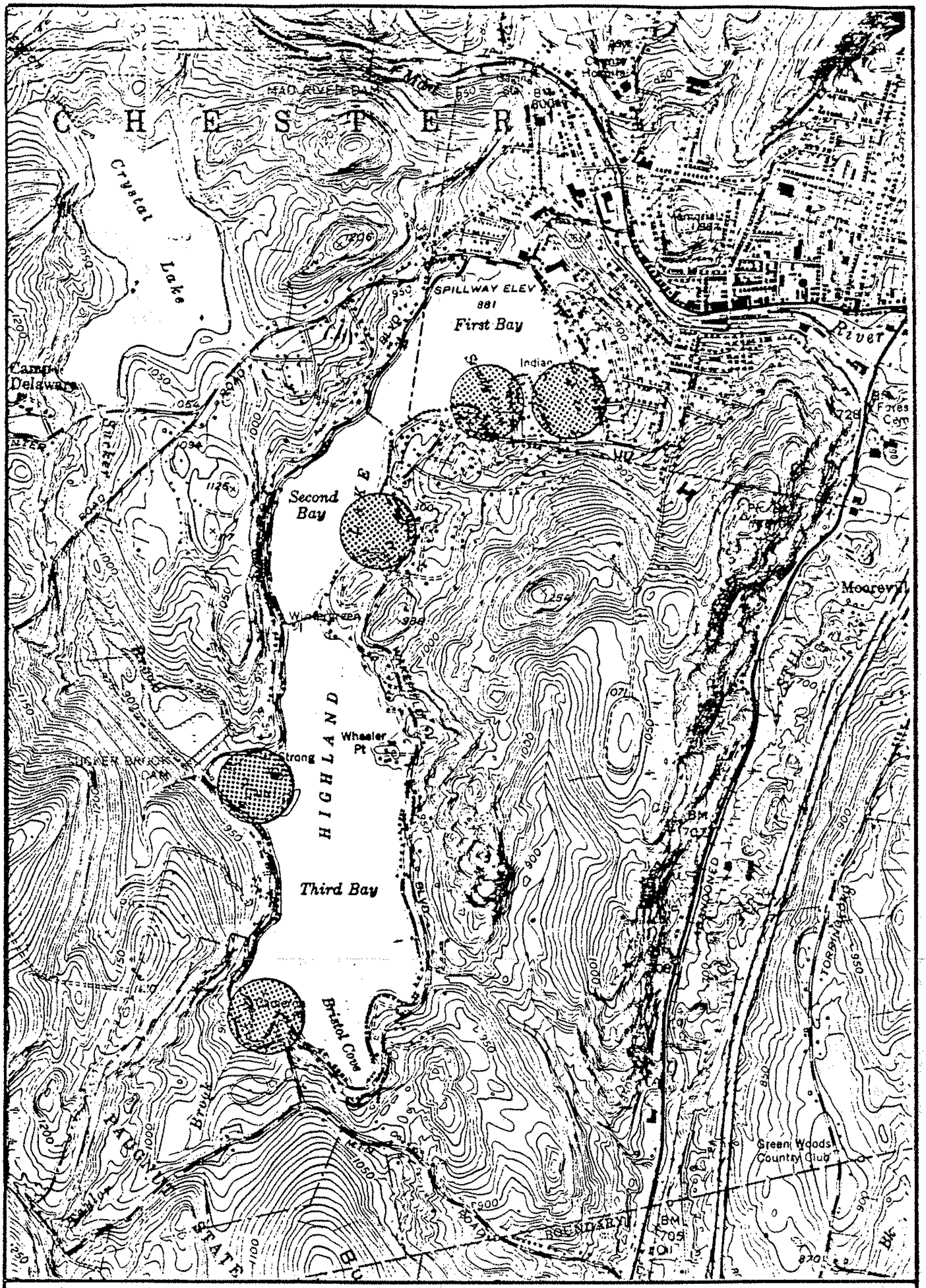
Background Description

Highland Lake is located in the Town of Winchester and has been identified as a priority recreational water body (See Figure 1 - Project Location Plan). In the recent past, Highland Lake has experienced problems with lake water quality. Water quality monitoring investigations by the DEP following winter drawdown of the Lake led to the theory that potential sources of these water quality problems are the deposition of unconsolidated sediments in several coves around the Lake (Reference No.1) and uncontrolled macrophyte growth.

Attempts were made to control macrophyte growth by drawing the lake down to the maximum possible in the winter in order to kill off growth. This was not effective, and in fact had some negative effect. During the winter drawdown, when the sediments were exposed, they tended to wash into the central Lake area so that in the spring when Lake activity was high, these sediments became suspended in the Lake water, thus reducing water quality. Additionally, these sediments contain organic materials which may be decomposing, thereby causing a reduction in oxygen levels in the Lake water. According to residents living on the Lake, many coves that used to have sandy bottoms 20 to 30 years ago, are now covered with these soft sediments.

Introduction

It has been shown through past experience, that Highland Lake can be drawn down approximately 8 feet to expose the lake bottom in the shallow cove areas. Based on this fact, the DEP has suggested that a feasibility study for removing this unconsolidated sediment should be performed, with the focus on drawdown and dry excavation of sediments rather than hydraulic dredging.



PROJECT LOCATION PLAN

SCALE: 1" = 2000'	WMC CONSULTING ENGINEERS	FIGURE 1

As discussed later in this report, hydraulic dredging requires a substantially longer time to perform and will usually be more expensive than dry excavation.

Hydraulic dredging also requires large containment areas in close proximity to the lake for dewatering and storage of the dredged material prior to disposing of the settled sediment off-site. This requirement alone can determine whether or not hydraulic dredging is a feasible alternative for removal of unconsolidated soil from the lake cove bottom areas.

In addition, operational problems for hydraulic dredging could be expected in the study coves, due to the irregular nature of the cove bottoms, large boulders, miscellaneous debris and the presence of docks on permanent concrete piers.

A significant problem associated with hydraulic dredging is that land of sufficient contiguous area for use in containment of dredged materials, in proximity to the coves, is not readily available. This is due to the fact that the land that may be available for this purpose is owned by many different individuals and is developed with individual residences. In addition, the topography is usually excessive in slope and the engineering properties of the soils are not considered adequate for either excavated or embankment type containment areas.

Cost differences between hydraulic dredging and dry excavation is another reason why dry excavation was to be given greater consideration in this report.

Other drawbacks to performing hydraulic dredging may include:

1) Limited operational capabilities; the dredge would encounter many underwater obstructions such as piers and boulders.

2) Hazardous conditions to lake recreational users; the dredge requires a cable system extending to shorelines for operations and must provide warning markers to protect lake users such as motorboats, sailboats and swimmers.

For the above noted reasons, and due to the fact that the Lake can be drawn down to expose the cove bottoms, hydraulic dredging was considered by the DEP, the HLC and by WMC to have very low feasibility.

This report, therefore, focuses on the dry excavation of sediments.

The five study areas are identified in Figure 1 - Project Location Plan.

The five study areas are identified in Figure 1 - Project Location Plan.

The coves studied are as follows:

1) Resha Beach Cove, located at the southeast corner of First Bay.

2) Sandy Cove, located at the south shore at the east side of First Bay, just west of Shore Drive.

3) Sucker Brook Cove, located at the outlet of Sucker Brook on the west side of the Third Bay.

4) Taylor Brook Cove, located at the southwest corner of the Third Bay.

5) Jean Lore Cove, located at the east shore of the Third Bay just north of Wheeler Point.

II. COVE STUDY AREA INVESTIGATIONS

Investigations Performed

During October of 1990, topographic and hydrographic survey of the five coves were performed. This survey information enabled the development of several maps used in this report. As part of the survey, water surface pipe probes, located by survey, were used to determine sediment depths. The probes were conducted in a grid pattern with no less than 20 probes per cove performed in order to develop a sediment depth contour map and determine volumes of sediment to be removed (See Section VI., Existing and Proposed Lake Cove Bottom Mapping).

Additionally, a minimum of four borings at each cove were conducted by the use of a barge mounted boring rig. These borings not only served to increase accuracy of the estimates of the depths of sediment but were also used to determine bearing capacity of the soils and to extract two samples from each boring; one from the unconsolidated soft sediment layer and one from the underlying granular material.

In addition to the boring samples, a minimum of four grab samples per cove of the unconsolidated sediment layer were also taken. The samples were analyzed to determine material characteristics.

The cove study area investigations were conducted when the Lake was at its normal pool level with an assumed elevation of 880.00 feet based on the United States Geologic Survey quadrangle map for this area. Additional survey and observations were made once the annual drawdown of the Lake was completed.

Laboratory testing of the samples extracted from the borings and the grab samples of the unconsolidated sediment layer were conducted to determine the following properties when applicable:

- grain size
- organic carbon
- dewatering/drying characteristics
- commercial/agricultural attributes

Additionally, one sample from each cove was analyzed for metal toxicity.

The sediment samples were analyzed by the Connecticut Agricultural Experiment Station Laboratory, New Haven, Connecticut for all of the properties indicated previously, excluding the test for Metals Toxicity. Metals toxicity testing was conducted by Northeast Laboratories of Watertown, Connecticut, a State of Connecticut Licensed Lab.

Results of Investigation and Testing

The results of the borings and the surface water pipe probes indicate that the depth of sediment in the coves averaged approximately three feet, while in some coves, particularly Sucker Brook and Taylor Brook Cove, the sediment depths reached in excess of five feet (see Appendix B, Boring Results).

The soil borings also indicate the penetration resistance of the underlying consolidated soils determined by dropping a 140 pound weight from a height of 30 inches onto the 2 inch diameter boring sampler. The penetration resistance is measured in the number of blows of the weight it took to cause the sampler to penetrate 1 foot into the sediment. This information enabled a preliminary determination of the suitability of the underlying consolidated soils to support the type of excavation machinery that might be used in the removal of the unconsolidated sediment. Given the penetration resistance of the soils, 5 blows per foot in the worst case and 50 blows per foot in the best cases, the bearing capacity of the underlying consolidated soils can be estimated to be in the range of approximately 1000 pounds per square foot (psf) to 8000 psf. The bearing capacity of the consolidated soils can be assumed to remain relatively unchanged after lake water level drawdown since the soils are, in general, cohesionless with trace amounts of silt.

The results of the laboratory tests indicate that the unconsolidated sediment can be dry excavated and used for a general fill material or if mixed with a high organic content material could be used as topsoil without health hazards.

The Connecticut Agricultural Experiment Station Laboratory has recommended the addition of limestone, and 5-10-10 fertilizer should the sediments be proposed for use as topsoil.

The laboratory tests also indicate the following ranges and observations for the sediment samples:

1) The range of soil texture for the sediments is from sand to loamy sand.

2) The organic content ranges from very low to high.

3) The pH range for the samples is from 4.9 to 6.3, slightly acidic.

   Various amounts of limestone are recommended to be added to adjust the pH of the sediment.

4) Nitrate nitrogen results range from low medium to low high.

5) The ammonia nitrogen ranges from low to high.

6) The phosphorus ranges from low to high.

7) The potassium ranges from low to medium.

8) The calcium ranges from low to medium high.

9) The magnesium ranges from low to medium high content.

Thus, the recommendation for the addition of a fertilizer if the sediment is to be used as a topsoil (see Appendix C for laboratory test results).

Additional testing would be required once the sediments are excavated, transported to their final destination and their use identified, to determine exact amounts of limestone or fertilizer to be added if to be used as topsoil.

Northeast Laboratories of Watertown, Connecticut has performed the metal toxicity (EP Toxicity) testing and as indicated in Table 1, all parameters are well below threshold limits established by the U.S. Environmental Protection Agency.

The levels of barium were at slightly higher concentrations than normally found in this region, but are still well below established limits.

The following table summarizes the test results:

TABLE 1

TOXICITY CHARACTERISTIC LEACHING PROCEDURE TEST RESULTS
(all concentrations in milligrams/liter)

Test Parameter	Cove: Resha Beach	Cove: Sandy	Cove: Sucker Brook	Cove: Taylor Brook	Cove: Jean Lore	Threshold EP Toxicity Maximum Conc.
Lead	.01	.01	.03	.01	.01	5.0
Cadmium	<.01	<.01	<.01	<.01	<.01	1.0
Chromium	.03	.02	.02	.02	.03	5.0
Arsenic	.04	.03	.04	<.01	.05	5.0
Selenium	<.01	<.01	<.01	<.01	<.01	1.0
Mercury	<.005	<.005	<.005	<.005	<.005	0.2
Barium	3.0	10.0	<1.0	4.0	8.0	100.0
Silver	<.01	<.01	<.01	<.01	<.01	5.0

(See Appendix C for complete laboratory test data.)

Implications of Results on the Feasibility of Dredging

Since historically it has been shown possible to draw down the Lake approximately 8 feet (to elevation 872), and underlying consolidated soils appear to be capable of supporting excavation machinery, dry excavation of the sediments appears to be a highly feasible alternative to hydraulic dredging of the sediments.

A disadvantage of dry excavation is that all of the sediments can not be removed by dry excavation alone. The level of groundwater in the immediate area of the coves can be assumed to be relatively the same as the water surface elevation of Highland Lake. Assuming an elevation of 880 feet for normal water surface and a drawdown of the water surface of 8 feet for dry excavation operations, the groundwater elevation will be approximately 872 feet.

At this elevation of 872, not all of the unconsolidated sediments will be exposed for dry excavation. Removal of the remaining unconsolidated sediments could be accomplished by a combination of drag line excavation and hydraulic dredging, if desired. The cost for this additional dredging may be prohibitive, however, and is reported on in latter sections of this report. In addition, since the Lake is now typically drawn down only 4 feet, the remaining sediments will not be exposed to erosion and deposition into to the deeper Lake areas.

The approximate total volume of saturated, unconsolidated sediments for each cove area was determined based on the investigations performed. These volumes are approximations based upon the somewhat limited data collected and would be confirmed during final design of any dredging project. The estimated volumes are as follows:

1) Resha Beach Cove	:	41,000 cubic yards (total)
2) Sandy Cove	:	8,000 cubic yards (total)
3) Sucker Brook Cove	:	56,000 cubic yards (total)
4) Taylor Brook Cove	:	20,000 cubic yards (total)
5) Jean Lore Cove	:	11,000 cubic yards (total)
Total	:	136,000 cubic yards (total)

As noted, all of these materials could not be dry excavated due to water elevations. Based upon this fact, the following summarizes the sediments that could be removed by dry excavation alone:

1) Resha Beach Cove	:	21,000 cubic yards
2) Sandy Cove	:	6,000 cubic yards
3) Sucker Brook Cove	:	50,000 cubic yards
4) Taylor Brook Cove	:	17,000 cubic yards
5) Jean Lore Cove	:	6,000 cubic yards
Total	:	100,000 cubic yards

Based on dry excavation alone, and a depth of drawdown of 8 feet, the total volume of sediments that could be removed is approximately 100,000 cubic yards.

Conventional excavation machinery for removal of the dry unconsolidated sediments above elevation 872, should consist of articulated dump trucks for earth moving within the cove areas (off street), street dump trucks, wheel loaders, low earth pressure bull dozers, and low earth pressure tracked excavators.

Additional work to enable efficient removal of the sediments by these means may involve, but may not be limited to: construction of temporary haul roads and ramps, and placement of temporary soil bridging materials such as timber beams or mats to enable excavation of and in soft areas (areas with low bearing capacity) and hand excavation around piers and docks.

The exact method and equipment used to perform the dry excavation would be determined during final design of any dredging program by the designer and ultimately by the selected excavation contractor.

The approximate limits of sediment removal within each cove are indicated in Figures 2, 3, and 4. These figures indicate the existing sediment depths currently existing in the coves, the water depths currently existing (existing bathymetry) and the proposed bathymetry after removal of the sediments.

As noted, additional materials could be dredged from the cove areas by hydraulic dredging beyond the limits of the dry excavation (beyond the limits of the 8 foot draw down). The approximate additional total saturated volume of unconsolidated sediments that could be removed only by hydraulic excavation for each cove area is as follows:

1) Resha Beach Cove	:	20,000 cubic yards
2) Sandy Cove	:	2,000 cubic yards
3) Sucker Brook Cove	:	6,000 cubic yards
4) Taylor Brook Cove	:	3,000 cubic yards
5) Jean Lore Cove	:	5,000 cubic yards
Total	:	36,000 cubic yards

Based on hydraulic excavation and a depth of drawdown of 8 feet the total additional volume of sediments that could be removed after dry excavation is 36,000 cubic yards.

Areas of the study coves that would require hydraulic dredging for total removal of the unconsolidated sediments are, as noted, below elevation 872.

Since hydraulic dredging has low feasibility technically, is relatively expensive and these sediments will not be exposed to erosion forces to any great degree in the future, it is recommended that sediments below elevation 872 remain.

While it is anticipated that there will be somewhat less total volume to excavate once the Lake water level has been drawn down a few months due to the dewatering of the sediments resulting in shrinkage of the volumes, the potential decrease in the volume is considered to be inconsequential to this feasibility study.

Therefore, based on a dry excavation and a depth of drawdown of 8 feet the total volume of sediments to be removed is estimated to be 100,000 cubic yards.

Thus, to summarize the results of the investigation and sediment sampling, dry excavation of the sediments is a feasible method to remove the unconsolidated sediments found in the Lake coves, and it appears to have much greater feasibility than hydraulic dredging.

WINSTED, CONN.
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1956
PHOTOREVISED 1984
DMA 6367 I NE-SERIES V816

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

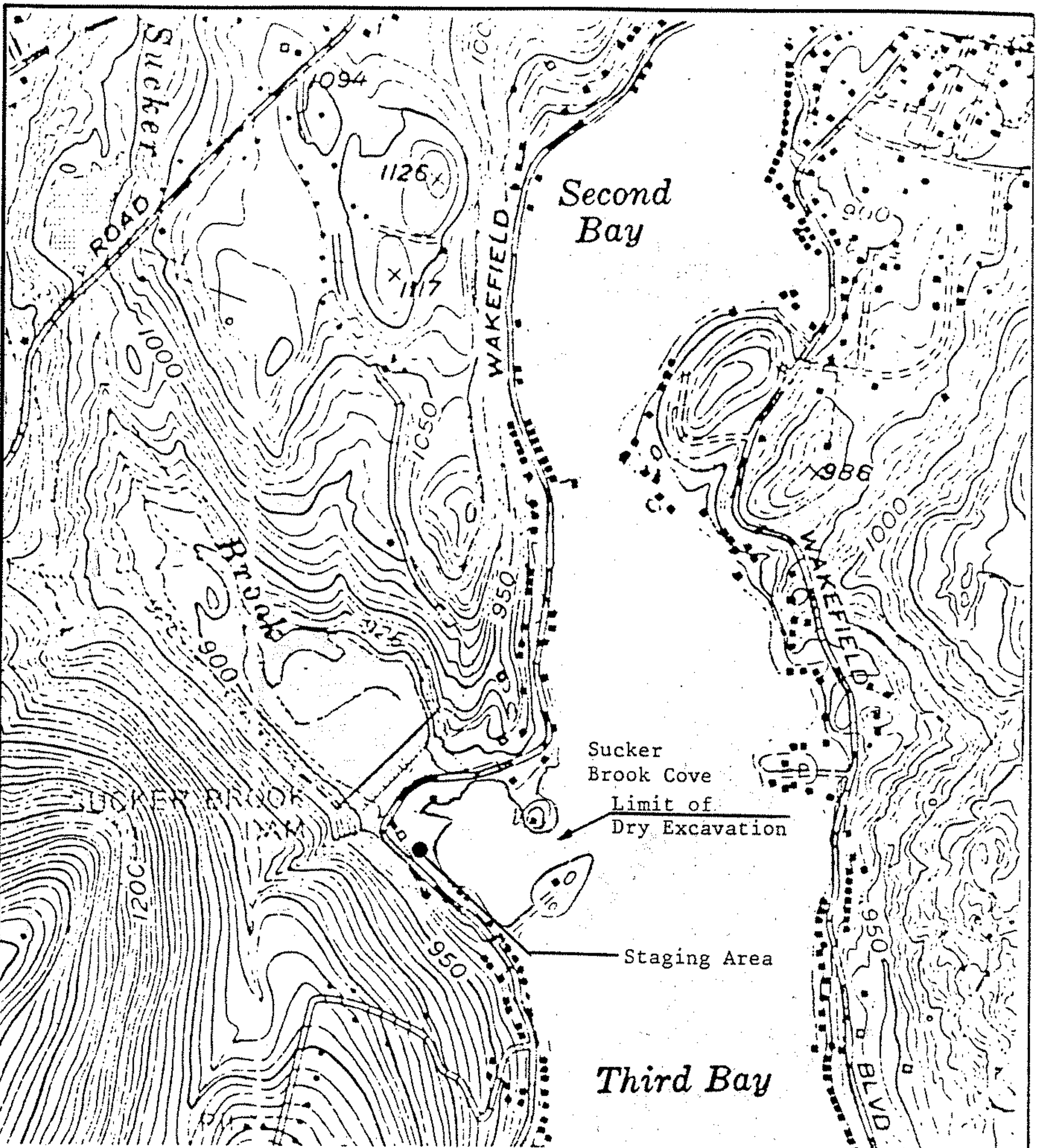
CONNECTICUT
QUADRANGLE LOCATION

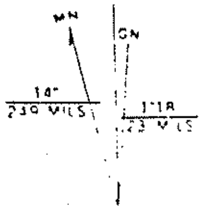
WINSTED QUADRANGLE
CONNECTICUT
7.5 MINUTE SERIES (TOPOGRAPHIC)

MN GN
14° 249 MILS
1°18 23 MILS

LIMITS OF DRY EXCAVATION & STAGING AREA
RESHA BEACH, SANDY & JEAN LORE COVE

N.T.S.	WMC CONSULTING ENGINEERS	FIGURE 2





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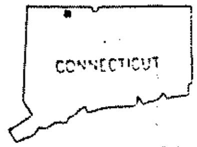
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

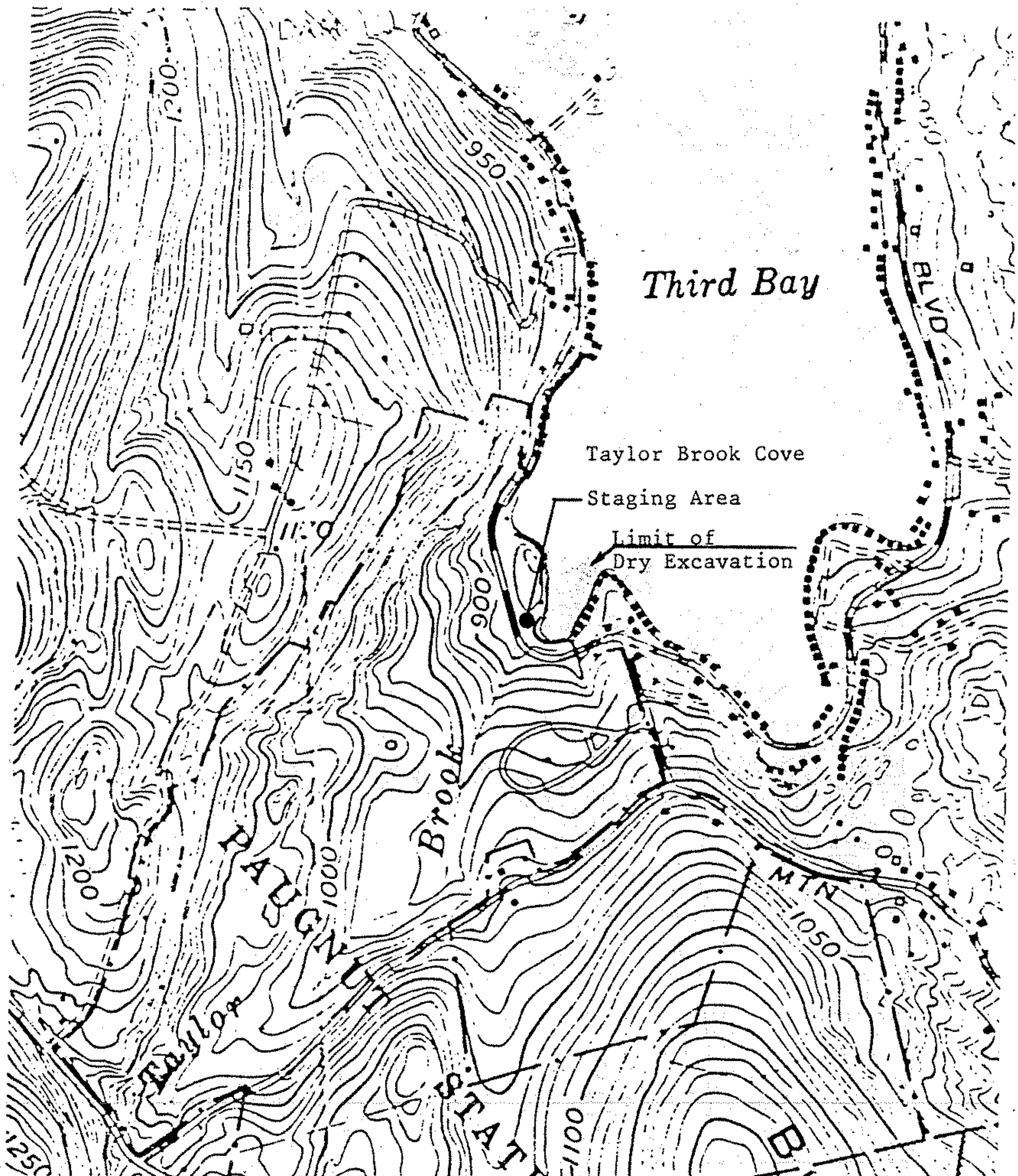


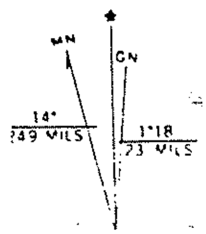
QUADRANGLE LOCATION

WINSTED QUADRANGLE
CONNECTICUT
7.5 MINUTE SERIES (TOPOGRAPHIC)

LIMITS OF DRY EXCAVATION & STAGING AREA
SUCKER BROOK COVE

N.T.S.	WMC CONSULTING ENGINEERS	FIGURE 3





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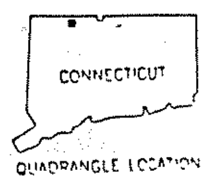

UNITED STATES
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WINSTED QUADRANGLE
CONNECTICUT
7.5 MINUTE SERIES (TOPOGRAPHIC)

LIMITS OF DRY EXCAVATION & STAGING AREA
TAYLOR BROOK COVE

N.T.S.	WMC CONSULTING ENGINEERS	FIGURE 4

As noted, not all of the unconsolidated sediments can be removed by dry excavation without a drawdown of the Lake levels below elevation 872, approximately 8 feet below normal water surface level due to high groundwater and excavation in the water.

Drawdown of the Lake in excess of 8 feet in order to expose additional soft sediments is technically feasible, but may not be desireable. A drawdown of the Lake's water level below 8 feet will require the use of pumps or siphons at the Lake spillway. The drawdown in excess of 8 feet may, however, adversely affect fish and other aquatic life as well as other environmentally sensitive areas and this must be considered in the final design of the dredging program.

A high percentage (approximately 74 percent) of the soft sediments made up of organic materials and fines contained in the coves will be removed. These materials will no longer be available in large quantities to wash into the central Lake area during the winter drawdown of the Lake, subsequently becoming suspended in the water and reducing water quality when Lake activity is high.

Additionally, the volume of organic materials contained in the coves will be greatly reduced. It can therefore be expected that less organic material will be decomposing and thus, oxygen levels in the lake water may be stabilized or in fact improved.

It is expected that on average, the depth of the lake coves will increase by approximately three feet and Lake water quality and user enjoyment when fishing, swimming and boating should improve. The increased depths will not entirely prohibit weed growth, but will remove organic sediments thus improving water quality and inhibiting growth.

Laboratory testing has confirmed that the sediments to be removed from the coves could be utilized in a number of ways. Possibly and in many cases, the soils could be used as a topsoil material once they have been screened, treated with lime, fertilizer, and if desired, additional organic material. Another use for the soils is as a general fill material, which would not require any additions to the soils. Toxicity tests confirm that once the materials are removed they should pose no significant health hazard.

III. REMOVAL OF THE SEDIMENTS IN THE FIVE STUDY AREAS

Several methods are available for removal of sediments for lake bottom areas. However, not all methods are applicable due to project operational concerns and project expense concerns.

This section of the report discusses the methods of dredging and the recommended method of dry excavation.

Methods of Dredging

Hydraulic dredging and wet drag-line excavation are performed under water, and are generally performed from a barge or barges, with the equipment (hydraulic dredge or dragline with clam shell) operating on a cable stayed/operated barge.

Wet Drag-Line/Clam Shell Excavation

Wet drag-line or clam shell excavation is generally performed from the shoreline but may be performed from a barge. The excavation equipment typically consists of a crane with a cable controlled clam shell or bucket. The clam shell is swung out (cast) into the lake and sediment is "grabbed", the clam shell is withdrawn and the sediment deposited either on shore or on a barge. For the dragline method, the bucket is dragged, via cable, into the sediment and the sediment withdrawn for deposition on the shore or barge.

When drag-line excavation is performed from the shoreline, excavation is usually capable out to at least 20 feet from the shore. The cast (length that the clam shell or bucket can be thrown) of the drag-line may be reduced due to obstructions of the crane's boom. Obstructions in the path of the boom's swing are usually removed prior to operations. Obstructions and other items which limit or determine the feasibility of drag line operations from shore are: 1) Trees and brush, 2) Overhead utility wires, 3) and various structures.

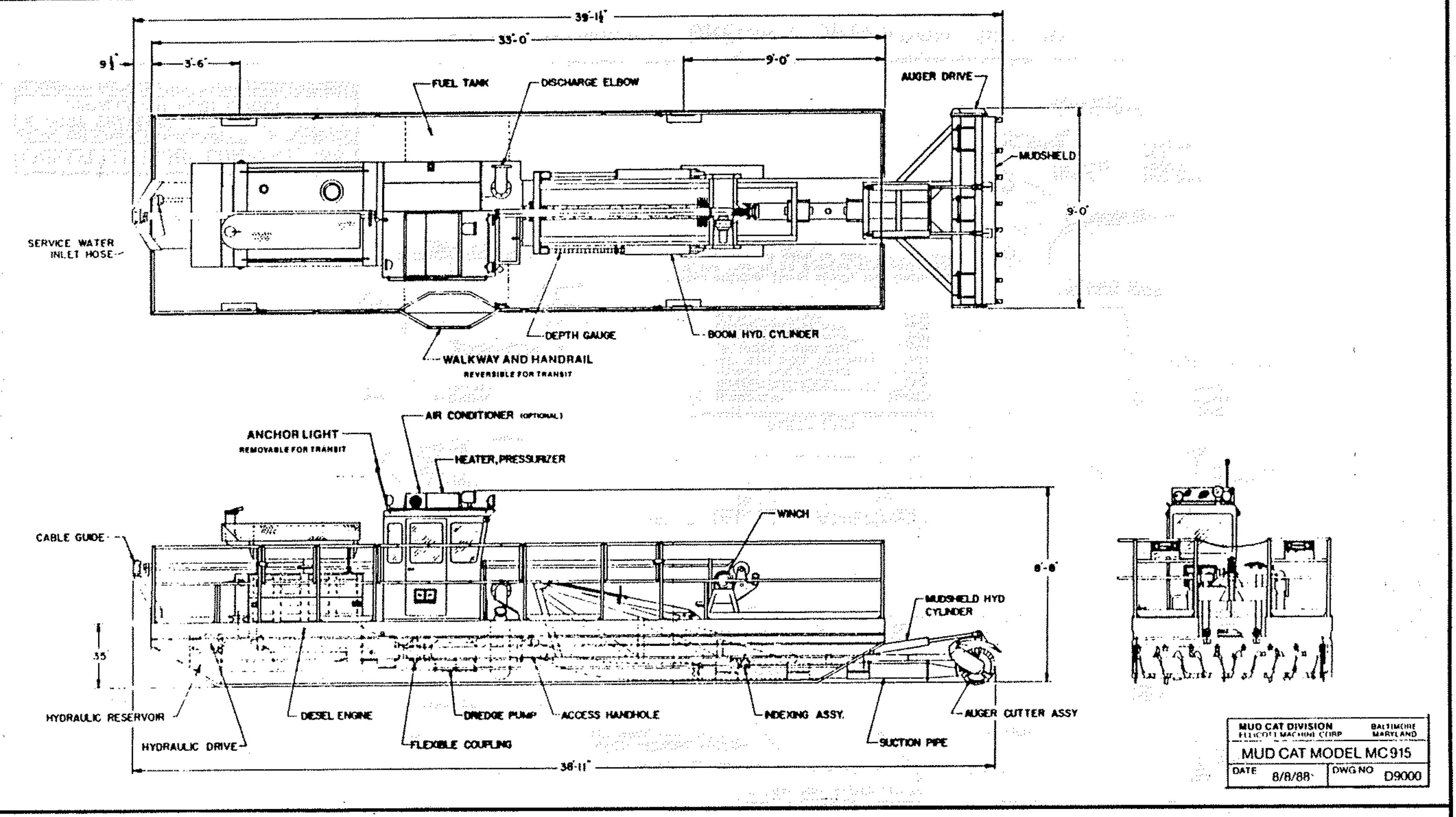
Drawbacks to this type of dredging include lake water turbidity problems and wash off (sediment slurry) into the lake and onto surrounding upland areas. Barge mounted drag-line excavators require an additional barge to receive excavated sediment and to haul or pump the sediment to a containment area located on shore. Containment areas are discussed below under hydraulic dredging.

Additionally, a cable system is required for the operation of the barges in order to keep the barges in known locations for accurate removal of sediments.

Hydraulic Dredging

Hydraulic dredging is performed from a barge with traversing cable, lateral positioning cables, and corner anchors with positioning winches and clevis ends (See Figures 5a and 5b - Typical hydraulic dredging setup). The equipment that is mounted onto the barge consists of a diesel engine to power the auger/tiller cutterhead, severe duty centrifugal slurry pump and a traverse winch.

There are several manufactures providing complete hydraulic dredging equipment and private contractors are available with dredging equipment.



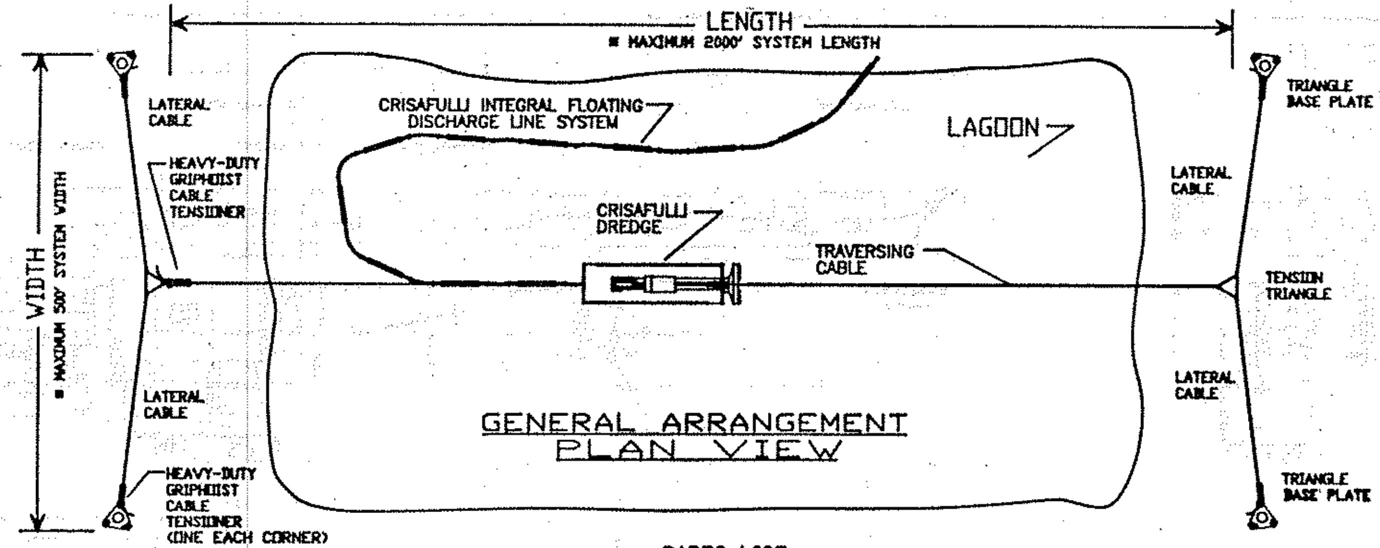
TYPICAL HYDRAULIC DREGING OPERATION SET UP

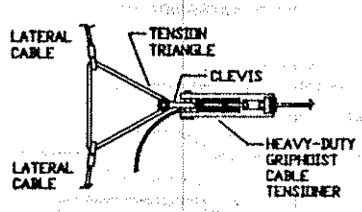
N.T.S.

REFERENCE 17

WMC CONSULTING ENGINEERS

FIGURE 5



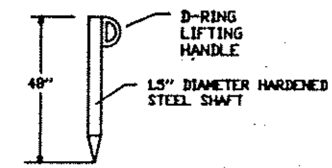


TENSION TRIANGLE DETAIL

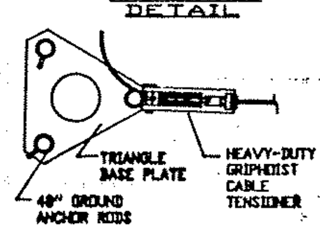
PARTS LIST

ITEM	DESCRIPTION	QUANTITY
1.	TRIANGLE BASE PLATES	4 EACH
2.	TRIANGLE TENSION PLATES	2 EACH
3.	GRIP HOIST CABLE TENSIONERS	5 EACH
4.	48" GROUND ANCHOR RODS	12 EACH
5.	TRAVERSING CABLE W/ HOOK	1 EACH*
6.	LATERAL CABLE W/ HOOK	4 EACH*
7.	HEAVY-DUTY CLEVIS	1 EACH

* When ordering, please specify the dimensions of the area to be dredged and add about 10' to 15' feet extra to allow for the base plate offset as shown.



ANCHOR ROD DETAIL



BASE PLATE DETAIL

CRISAFULLI PUMP COMPANY, INC.
P.O. BOX 1051 GLENDIVE, MONTANA 59330 | PHONE: 1-800-442-7867
4 POST TRAVERSING CABLING SYSTEM
INSTALLATION PLAN LAYOUT
No Scale | Drawn By: CKR | Ckd | Date: FEB.3,1990 | Drawing #CPC-90144

TYPICAL HYDRAULIC DREGING OPERATION SET UP

N.T.S.
REFERENCE 18

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FIGURE 5
CONTINUED

The hydraulic dredge works by lowering a boom with an auger/tiller cutterhead and centrifugal slurry pump into the sediment to be removed and winching the dredge into the sediment. The process proceeds along a single preset path along the traversing cables until the end of the line. The cutter head/boom is then raised and the lateral cables are adjusted to position the dredge and cutter head over the next path of sediment to be removed. In order to insure that all of the sediment to be dredged at the current boom depth is dredged, a slight overlap of the current path of cutter head and the previous path of the cutter head is provided.

Hydraulic dredge operational problems could be expected if this alternative is selected due to the irregular nature of the cove bottoms, large boulders, miscellaneous debris and the presence of docks on permanent concrete piers. Debris and large boulders are sometimes felt by the operator who must then raise and then lower the boom. If the operator does not feel obstructions or debris such as football size rocks, the cutterhead jams and must be raised and freed. This will lower the sediment removal efficiency of the hydraulic dredge.

After the dredged sediment is augered out, it is pumped to the water surface through flexible conduit then via this conduit with integral floats to shore. After reaching the shore the material is conveyed via rigid conduit to a discharge point in a prepared containment area.

Land of sufficient contiguous area for use in containment and treatment (settlement, flocculation and dewatering) of the dredged sediment slurry in close proximity to the coves is a requirement of hydraulic dredging activities as well as with wet drag-line excavation. In general, the sediment slurry, which in this case is expected to be 70 percent liquid and 30 percent solids, is pumped through rigid conduit to the containment areas. Booster pumps are required for extreme elevation differences or for pumping distances over 3,000 linear feet. If this alternative for sediment removal is selected, assuming adequate containment area could be located, booster pumps will be utilized due to extreme elevation differences and the length of pipe that will be required.

The containment area should consist of three impoundment areas (lagoons) with flow through the lagoons in series. The first lagoon would accept the slurry and act as the primary settlement lagoon where liquid and solids separate under quiescent conditions. The second lagoon would accept overflow from the primary lagoon and would also serve as a settlement lagoon. The third lagoon would act as the final clarifier after which the water should be suitable for return to the lake.

Floc inducing chemicals, not unlike those use to clarify drinking water may be added in the lagoons to speed the settlement process. Testing of the sediments in pilot studies would be required to determine the chemicals and methods to be used.

The clarified return water from the final lagoon would flow via rigid conduit to the lake.

Hydraulic dredging equipment, specifically the dredge engine, pumps, auger,and piping are maintenance intensive. In the case where the sediments to be pumped are coarse in nature, such as some of those found in this study, pumping and piping costs will tend to be relatively high. The cutterhead and motor will experience increased wear and the transfer pipes will tend to wear out quickly especially at bends and elbows.

Maintenance of the containment lagoons is also a requirement of the hydraulic dredging operations. During non-dredging periods (which are usually determined by available capacity in the lagoons or weather/season) the lagoons are drawn down to dewater settled material and to provide for dry excavation and removal of excavated material. The dry excavated material is then hauled off site to its final land disposal destination or other use as discussed below in the sediment disposal section of this report.

It should be noted that, based on previous experiences of contractors involved in dredging operations, vandalism of various support equipment such as boats, fuel barges, maintenance equipment and of the discharge and return water lines must be given high consideration and this tends to add to the cost of the dredging project.

Prior to start of hydraulic operations it would be necessary to secure various rights and easements from private land owners which may increase the costs for this alternative. The easements are required for piping across private property and for the containment area requirements.

Additionally, various Federal, State and Local permits for the proposed activities involved in dredging and sediment disposal are required to be obtained prior to start of work.

Methods of Dry Excavation

Equipment and Method of Excavation

Dry excavation of the sediments can be performed using conventional excavation machinery for removal of the dry sediments. The machinery used in the excavation and moving of the material consists of articulated dump trucks for earth moving within the cove areas (off street), street dump trucks, wheel loaders, low earth pressure bull dozers, and low earth pressure tracked excavators.

Additional work to enable efficient removal of the sediments by these means may involve, but may not be limited to: construction of temporary haul roads and ramps; placement of temporary soil bridging materials such as timber beams or mats to enable excavation of and in soft areas (areas with low bearing capacity); and hand excavation around docks and piers. The exact method and equipment used to perform the dry excavation is determined during final design of the dredging program and by the selected contractor prior to, and during operations.

Once the lake level has been drawn down, work commences immediately on installation of various erosion and sediment control measures within cove areas and work areas adjacent to the coves (see Section VI., Erosion and Sedimentation Control).

Ability of Substrata to Support Earth Moving Equipment

Results of the standard penetration tests performed during the soil boring program indicate that the penetration resistance of the underlying consolidated soils is sufficient to support the dry excavation machinery that would be used. From the penetration tests, the bearing capacity of the underlying consolidated soils is estimated to be in the range of approximately 1000 pounds per square foot (psf) to 8000 psf. The bearing capacity of the consolidated soils can be assumed to remain relatively unchanged after lake water level drawdown since the soils are, in general, cohesionless with only trace amounts of silt.

Most of the dry excavation of the sediment from the lake cove bottoms would be performed by low ground pressure bulldozers. These bulldozers typically apply appproximately 30% less pressure to the ground than conventional machinery. For example, a conventional CAT D7 dozer applies a minimum of 1300 pounds per square foot (psf) of pressure using the widest shoe (treads) available while a D7 low pressure dozer applies 910 psf. The bulldozers would excavate and push the sediment to a temporary central stock pile area located near the cove access road. The sediment would then be loaded into dump trucks by wheel loaders.

Loading of the sediment will lag somewhat behind the excavation and dozing operation to permit a stock piling of material in sufficient quantity to ensure efficient use of equipment and to further drain the excavated material. These stockpiles would be protected by erosion and sedimentation control measures as discussed in following sections.

Based on the tests performed on samples of the sediment and observation of the exposed coves, it appears that dewatering will not be required for dry excavation. If, in the opinion of the design engineer and the selected excavation contractor, sediments require drying, small volumes of the sediment could be temporarily stockpiled and allowed to drain.

At the base of the stockpiles, relatively small stilling pools may need to be constructed to intercept seepage of water from the stock pile in order to prevent this sediment laden water from reaching the Lake untreated. The temporary drying stock piles would be then surrounded by erosion and sediment controls. A small diameter stilling pool discharge pipe would be required to drain the water and would outlet in a cove stream channel.

Other available methods of dewatering such as mechanical dewatering, freezing, containment dewatering, etc. are technically feasible, but are considered to be too elaborate, expensive and are not needed.

Water Management

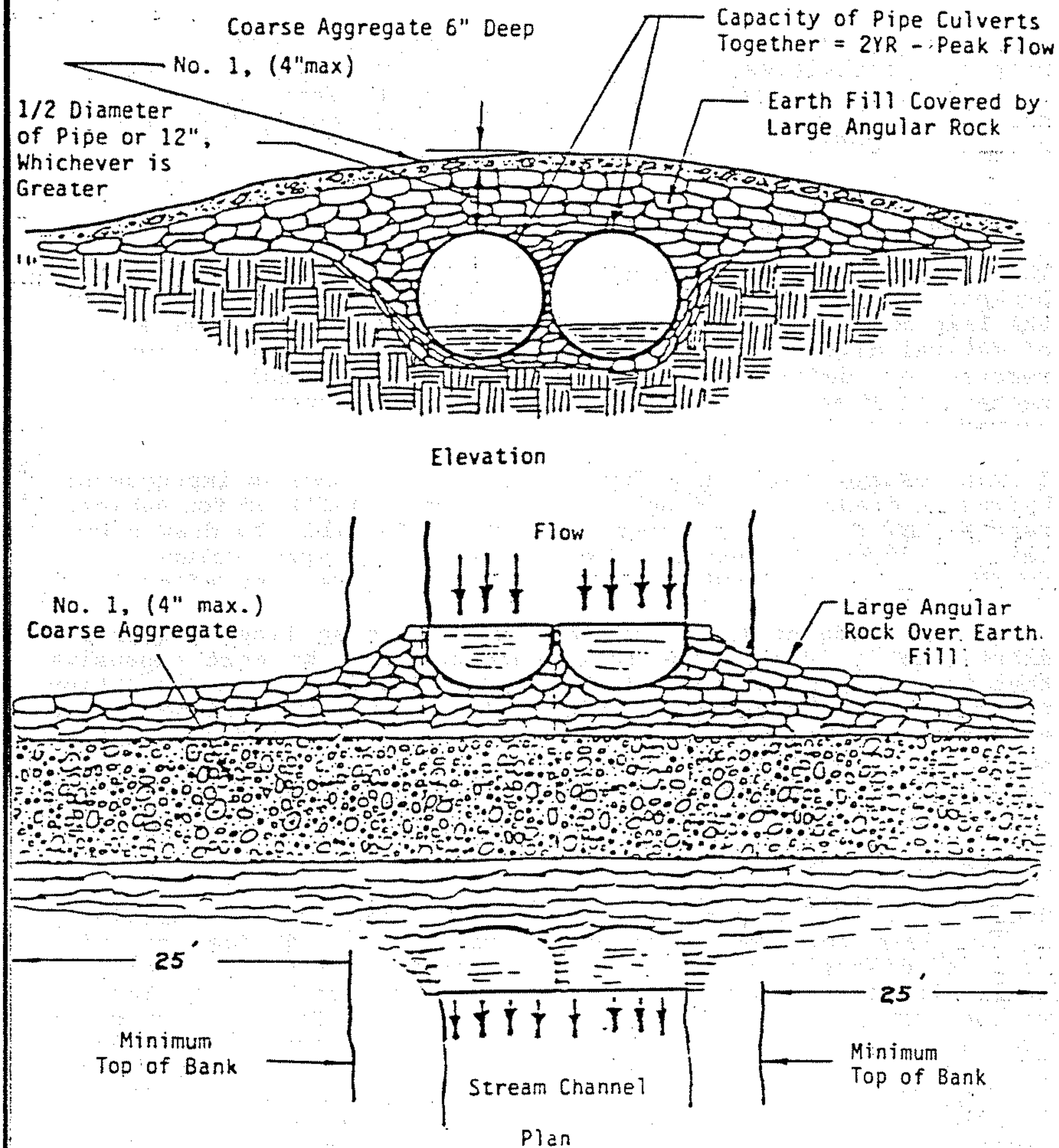
Water management will be a continuous effort in all coves but will be more extensive in Taylor Brook and Sucker Brook Coves as these coves provide a continuous inflow of water into Highland Lake. In the remaining coves, water management will generally be required during rainfall and runoff events. All of the coves have points of storm drainage discharge which will require management.

The stockpiled soils, if not stabilized, and exposed sediments will tend to erode and sediment laden runoff from these areas will require management. Lastly, dewatering activities, if required, will require water management.

For Taylor and Sucker Brook Coves, once the Lake is drawn down, a stream channel will exist along the bottom of the coves. The excavation of sediment will take place up to the stream's edge but not below the level of the stream, which is assumed to be the ground water level. If necessary, depending upon the time of year and excavation method employed, temporary dikes may be constructed parallel to the stream flow path in order to minimize flooding of work areas and contain the streams to their discharge point at the waters edge. If required, temporary stream forges (crossings) will be constructed by placing corrugated plastic storm drainage pipe on a bed of crushed stone and filter fabric in the stream flow path (See Figure 6 - Temporary Stream Forge). The streams and lake will be protected from erosion and sedimentation by the methods described in Section VI. Implementation Plan.

In most coves, diversion ditches will be excavated to ensure that excavations and work areas remain dry. Diversion ditches will also be required for storm drainage outfall locations and for discharges from dewatering activities if any. The use of diversion ditches with periodic check dams should be sufficient to control water in all other areas.

Prior to start of dry excavation operations it will be necessary to secure various rights and easements from private land owners for access to the coves and perhaps for stockpiling of sediments.



Source: Virginia Erosion and Sediment Control Handbook, 1980. Virginia Soil and Water Conservation Commission.

Figure 8-94 - Temporary Stream Crossing

TEMPORARY STREAM FORGE

N.T.S. REFERENCE 16	WMC CONSULTING ENGINEERS	FIGURE 6

Additionally, various Federal, State and Local permits for the proposed activities involved in dry excavation and sediment disposal are required to be obtained prior to start of work. The subsection entitled Permit Requirements addresses the required permits in detail.

Comparison Of Sediment Removal Methods

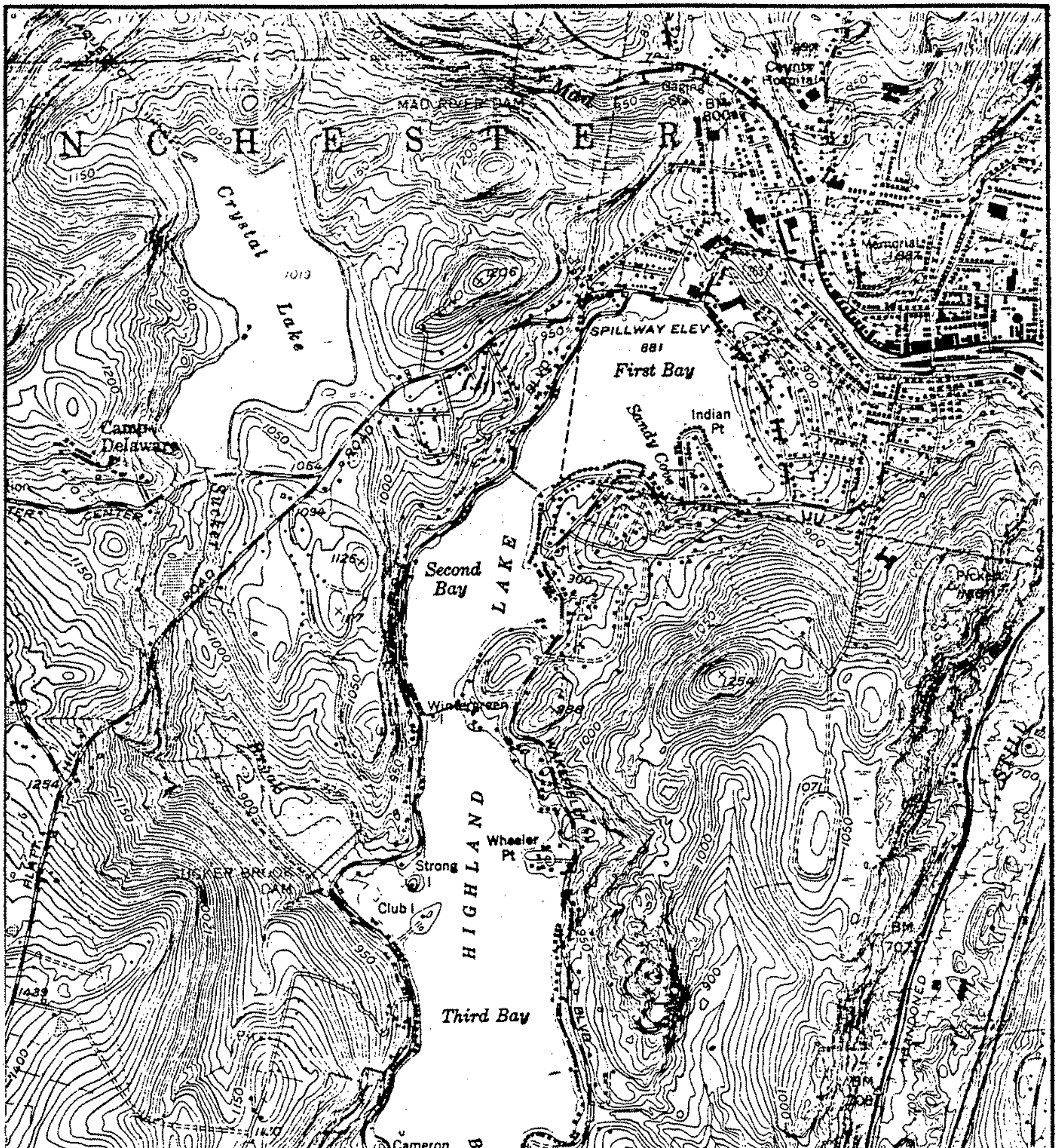
The sediments in the coves under study consist of a combination of organic and granular material. The removal of these sediments from the lake cove bottom areas can be accomplished by utilizing any one of several different methods discussed in this report. Primarily, removal of sediments is accomplished by hydraulic dredging, mechanical dredging, dry excavation or any combination of these methods.

In many cases, where it is not simple to draw down an impoundment, hydraulic dredging and dragline excavation is utilized for sediment removal operations. However, when it is feasible to draw down a lake or canal to expose areas containing large volumes, dry excavation can be conducted and is usually more cost effective.

Hydraulic dredging (including the use of a drag line) requires a substantially longer time to execute and will be more expensive than the dry excavation method of sediment removal. An exception to this is when highly organic, silty, clay-like sediments are encountered. These types of sediment will tend to retain moisture which will necessitate dewatering of the sediments if dry excavation is attempted. The sediments will also be more difficult to move by dry excavation machinery than a more granular type of sediment since they are cohesionless and machinery tends to slip and become stuck.

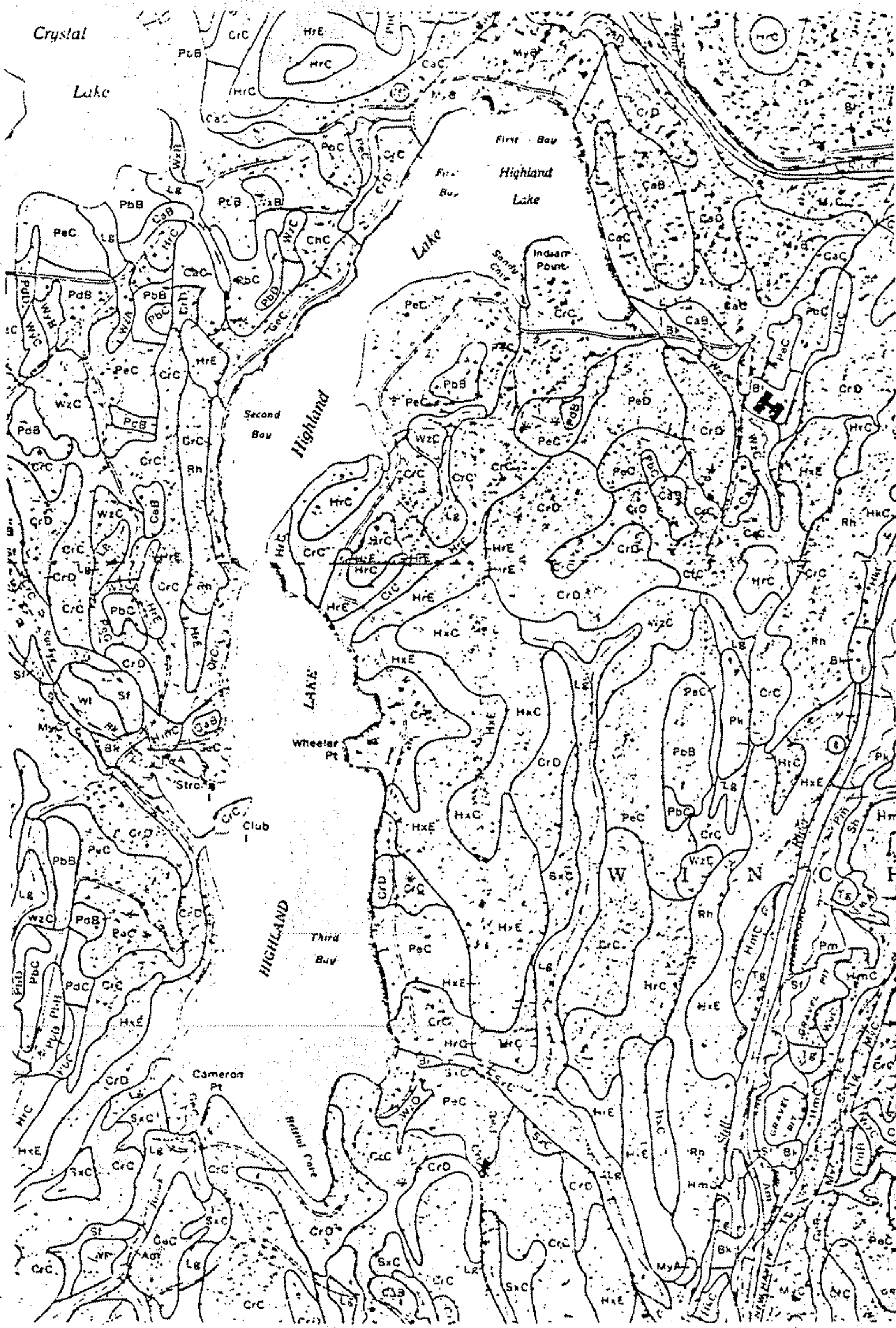
Hydraulic dredging requires large containment areas in proximity to the lake for dewatering and storage of the dredged material prior to disposing of the settled sediment off-site. A search of available land in proximity to the lake based on U.S.G.S. mapping was performed and it was found that land of sufficient contiguous area for use in containment of dredged sediments in proximity (within ± 3000 feet) to the coves is not available. This is due to the fact that available land is owned by many different individuals, is developed with individual residences, is in general excessive in slope and the engineering properties of the soils are not considered adequate for either excavated or embankment type containment areas (See Figure 7, USGS Quadrangle Map, Figure 8, USDA Soil Conservation Services Soil Survey Map, and Appendix D, Soil Descriptions).

If containment areas were available, construction easements would have to be secured for the hydraulic dredging method.



WINSTED USGS QUADRANGLE MAP

SCALE: 1" = 2000'	WMC CONSULTING ENGINEERS	FIGURE 7



USDA SCS LITCHFIELD COUNTY SOIL SURVEY

N.T.S.

REFERENCE 3

WMC CONSULTING ENGINEERS

FIGURE 8

Hydraulic dredge operational problems could be expected due to the irregular nature of the cove bottoms, the granular nature of portions of the sediments, large boulders, miscellaneous debris and the presence of docks on permanent concrete piers. These factors result in inefficient, imprecise and incomplete sediment removal.

In comparison, machinery used in dry excavation has the ability to work in and around such obstructions. The excavation process also has the advantage of seeing, by general observation and by conventional survey, exactly what has been excavated and where excavation has taken place.

Other drawbacks to performing hydraulic dredging include hazardous conditions to lake recreational users as the dredge would have to maintain a cable system connected to the shoreline for operations and would have to provide warning markers to protect lake users such as motorboats, sailboats and swimmers. The cable system required for hydraulic dredging would, in most coves, require closing down the individual cove to all lake traffic and recreational uses. In addition, the containment areas would have to be fenced in and warning signs place to prevent accidents.

Piping is a requirement of hydraulic dredging which the dry method of sediment removal does not have to address. For example, piping from the dredge to the containment areas requires additional construction easements through private property. Additionally, excavation and installation of a piping sleeve for road crossings is required. Lastly, the opportunity for vandalism is increased and must be checked constantly.

The potential for increased lake turbidity from dredging operations would be greater for hydraulic dredging than for the method of dry excavation of sediments. Dry excavation would, if performed in accordance with the work plan guidelines, produce little to no turbidity in the lake as a result of operations.

It is estimated that approximately 75 percent of the sediments in the coves could be removed by dry excavation methods where as approximately 90 percent removal could be obtained by hydraulic dredging alone.

The dry excavation of sediment can only be conducted to elevation 872 where as hydraulic excavation should be capable of reaching deeper. The result is that while dry excavation should increase cove depths approximately 3 feet from current depths, hydraulic dredging operations will not only increase cove depths an approximate 3 feet but will also create (assuming removal of all unconsolidated sediments) deep holes within the coves. Some of the holes that would be created especially in Taylor Brook Cove and Sucker Brook Cove would increase the depth of water in these location by 5 to 8 feet.

Dry excavation methods require little work outside of the cove areas. Work would likely be limited to construction of a haul road and ramp for dump truck and other machinery access. Hydraulic dredging operations require that massive concrete anchors be placed and trees and vegetation be cleared for operation of the cable system.

Both methods would utilize similar staging areas for equipment.

The ability of the lake bottom to support dry excavation machinery may be a problem in a few of the cove areas, however since many methods of dry excavation exist and various types of equipment exist to deal with low bearing capacities of supporting soils, operations will not be adversely effected.

Table 2 summaries an opinion of the various advantages and disadvantages of the different methods of sediment removal. This table summarizes the reasons why hydraulic dredging is considered to be much less feasible and desireable in comparison to dry excavation.

TABLE 2

COMPARISON OF EXCAVATION METHODS

Item	Hydraulic Dredging	Dry Excavation
1) Sediment Excavation Approx. Time per cove (Assuming Production Unlimited by Containment Area)	5 years	10 months.
2) Containment Area	Requires large areas, easements, maintenance, disruption of uplands, vegetation shoreline, etc.	Not Required
3) Operational Problems	Irregular cove bottoms, debris, large boulders, docks on piers, imprecise sediment removal inherent.	Water Management difficult during rainfall events, Soft Soils.

TABLE 2 (continued)

Item	Hydraulic Dredging	Dry Excavation
4) Potential Hazards	Anchor and cable system and floating pipes across coves. Containment area Hazards to public and animals. Long lengths of unprotected pressure pipe.	Large earth excavation operation.
5) Discharge Piping	Long runs of pipe. High pumping costs. Vandalism to piping. Easements required for piping.	N/A N/A N/A N/A
6) Ability of Substrata to support machinery	N/A	Potentially low bearing capacities of substrata.
7) Relative Lake Water Turbidity	High	Low
8) Sediment Removal, Approximate %	± 90%	± 75%
9) Shoreline work	Construction of containment areas and anchors. Staging area. Not Required.	Not Required Staging area Access ramp & haul road
10) Efficiency of Removal	Moderate	High
11) Potential Fisheries Impact	High	Low
12) Relative Costs	High	Low

IV. POTENTIAL COSTS

The potential cost to perform excavation of the unconsolidated sediments in the lake cove areas are developed as a guide to determine the feasibility of dredging.

Volumes To Be Removed

As previously presented, the approximate total saturated volume of unconsolidated sediments to be removed for the study coves by the dry excavation method is approximately 100,000 cubic yards.

Also as previously presented, the approximate total saturated volume of unconsolidated sediments that could be removed only by hydraulic excavation (where dry excavation is not possible) is approximately 36,000 cubic yards.

These volumes are presented to develop costs for comparison. It is concluded, by various investigations performed, that hydraulic excavation of the sediments has a very low to negligible feasibility.

For the option of hydraulic excavation alone the sum of the volumes for each cove of 136,000 cubic yards is used to develop costs for comparison.

Costs Based On Volumes and Results Of Investigations Performed

Costs are developed for each cove with various options for dredging the coves. These costs are based upon current industry construction costs for similar work and were confirmed by contacting construction contractors with specific expertise in hydraulic, dragline and dry excavation.

The options for dredging the coves are:

- A - Dry excavation of sediments above the 8 foot drawdown elevation of 872.
- B - Hydraulic dredging of the volumes of sediment that can not be reached by dry excavation alone, ie. below elevation 872.
- C - Dry excavation combined with hydraulic excavation.
- D - Hydraulic excavation exclusively.

Costs presented are intended to provide a comparison of the estimated costs to perform the various options.

TABLE 3

ESTIMATED CONSTRUCTION COSTS FOR EXCAVATION OF SEDIMENTS
(All $ X 1,000)

Method	Resha Beach	Sandy	Cove Sucker Brook	Cove Taylor Brook	Cove Jean Lore	Total
A. Dry Excavation	$238	$ 67	$377	$202	$ 72	$ 956
B. Hydraulic Excavation (below elev. 872)*	$444	$ 99	$169	$105	$144	$ 961
C. Total of A & B*	$682	$166	$546	$307	$216	$1917
D. Hydraulic Excavation Of All Sediment*	$773	$196	$1054	$401	$240	$2664

* Assumes adequate area for a containment area can be located within reasonable pumping distance (± 1 mile.), however no area of suitable size was identified by this study. Therefore, costs are for comparison only.

These costs are for construction only. Engineering, legal and administrative costs could add approximately 20% to the costs. For example, the total estimated project cost for option "A" would be $956,000 X 1.2 = **$1,147,000.**

The cost to perform dry excavation of the sediments in the lake cove areas ranges from approximately 31 percent to 67 percent less costly than by performing excavation by a combination of dry and hydraulic excavation. The cost to perform dry excavation ranges from approximately 50 percent to 70 percent less costly than by performing the excavation by hydraulic dredging exclusively.

V. SEDIMENT DISPOSAL

One of the largest obstacles to overcome in virtually any dredging program is final disposal of the sediments. In some cases, where the sediment is uniform in quality and consistency, it may be possible to derive revenue from the sale of the sediments, particularly if they meet the criteria for topsoil. For Highland Lake, some of the sediments have topsoil qualities while some are only suitable for routine fill. As part of this study, a number of end users and disposal locations were contacted to determine if there were adequate locations for disposal in the region.

Based upon the variable nature of the sediments, it is assumed, for the purposes of this study, that no revenue could be derived from the sale of the sediments. At the time of actual dredging, this should be reevaluated as market conditions may have changed.

From the investigations, it was found that many possible disposal locations are currently available and there appears to be no problem in securing disposal locations.

Regardless of which method of excavation of sediments from the coves is chosen, locations and agreements for acceptance of the material for permanent land disposal should be secured prior to construction. At this time, it is almost impossible to predict where or who will commit to accepting the material, because the actual dredging of the coves may be several years away. However, due to the anticipated volumes of sediment to be removed (approximately 100,000 cubic yards), more than one location or method of disposal should be available prior to the start of any activity.

One possible disposal area for the sediments that was explored was the Regional Refuse Disposal District No.1 (RRDD #1) landfill located in the Town of Barkhamsted. Sediments could be hauled to the regional landfill for use as both interim and final cover material. The RRDD #1 has indicated that ultimately, approximately 100,000 cubic yards could be accepted for use as cover material. The exact amount that could be accepted would depend on the date of availability of the material and the status of the landfill at that time. If the material were to be available 5 to 10 years from now, quantities in excess of 100,000 cubic yards could potentially be utilized during the closeout operations at the landfill. However if the landfill is still functioning at the time the material becomes available, limited quantities could be utilized for interim or daily cover. It should be noted that further testing of the soils will be required by The State of Connecticut Department of Environmental Protection (DEP) to determine if the sediments meet the DEP requirements for use as cover material.

Another possible disposal area, although only temporary, would be on the grounds of the Town of Winsted's Department of Public Works (DPW) Facilities. Sediments could be hauled to the back or side yard of the DPW facilities and stockpiled by the excavation contractor. The Director of the DPW has indicated that approximately 50,000 cubic yards of material could be accommodated on the grounds of the facility (Reference No. 5).

By stockpiling the sediments in this location, the Town could potentially recoup some of the costs of the Highland Lake dredging project by various methods. The Town could use the stockpile of excavated material as general fill (non-structural fill) in miscellaneous DPW improvement and maintenance projects. The Town at the same time could offer the material to the general public at an attractive price.

If placement of the excavated material could be adequately controlled, two stockpiles could be created, one for material to be reused as general fill and the other to be reused, after screening, as topsoil. The separation into two classes of materials may increase the demand for the stockpiled sediments by the public, however this may also increase the cost due to additional preparation.

Towns adjacent to Winsted were contacted to determine if any could use portions of the excavated material. Only adjacent Towns were considered, since haul costs to towns further away would tend to offset the any benefit obtainable by the Town of Winsted. The only Town that expressed an interest in the material was the Town of Norfolk, which could use some of the material as general fill (Reference 13).

An alternative for disposal of the excavated materials is to require that the selected excavation contractor retain ownership of the sediments excavated. This will tend to increase the overall cost of the project due to the cost of haul distances but may be a means of disposal of the excavated material.

During the final design of the dredging project, nurseries or farms should be contacted prior to excavation of the organic materials to determine if quantities of the material could be accepted or removed from temporary stockpiles by the nurseries or farms. Some interest has been expressed for this purpose, however no one would firmly commit to an interest because of the nebulous time frame for the project. Gravel pit owners or operators could also be contacted prior to excavation to determine if quantities of the granular material could be accepted or removed from temporary stockpiles by the owner/operators.

VI. IMPLEMENTATION PLAN

The following implementation plan has been developed with a focus on the needs of the Highland Lake Commission and The DEP. The plan is developed so that excavation of the unconsolidated sediments in each of the five problem areas can be implemented independently over several years. This may be necessary due to time constraints for the excavation process and due to funding constraints.

General Plan Procedures - Applicable to All Coves

Several procedures, methods and other items of the implementation plan for the five coves are typical and are discussed in the following paragraphs.

When implementing the plans for specific coves, these procedures should be followed. When required due to specific circumstances with a particular cove, these procedures should be modified accordingly in the individual cove plan.

Drawdown Procedures

Drawdown of the Highland Lake is currently conducted annually, commencing in late September and/or early October. The drawdown is conducted by The Town of Winsted's Water Department. Drawdown of the lake is gradual, taking several weeks to approximately one month to complete. The drawdown levels have historically varied from a four to eight foot drawdown.

During the drawdown, downstream flooding problems have not been reported to date as a result of the gradual drawdown.

In order to excavate the sediments from the cove areas it is recommended that the lake drawdown proceed following existing methods, however increased release rates should be investigated during final design. The drawdown of the lake should also commence as early as possible September, thus permitting more time to perform the dry excavation of sediments during favorable weather conditions and a longer time period to conduct operations in the coves.

The lake water level would remain at this lower level (assumed to be elevation 872) until January 1 (see calculations in Appendix F). On January 1, the lake water level would then start to be brought back up to normal pool level by closing the outlet gate. It is anticipated that the normal pool elevation should be attained by April 1 depending upon climatological conditions.

As part of the lake drawdown process residents along the shore of the lake coves should be required to remove, to the degree possible, their docks, rafts and other items from the cove area prior to the start of operations.

Equipment Feasibility

In general, the results of the soil borings performed appear to indicate that the ability of the underlying consolidated soils to support the dry excavation machinery is adequate. Dry excavation of the sediment from the lake cove bottoms should be completed by low ground pressure bulldozers. The ability of the lake bottom to support dry excavation machinery may be a problem in only a few areas of the coves, where deeper soft sediments exist. Since many methods of dry excavation exist and various types of equipment exists to deal with low bearing capacities of supporting soils, operations should not be adversely affected.

Permit Requirements

Excavation within the lake cove areas will require Federal, State and local permits be obtained prior to the commencement of any activities.

An Army Corps of Engineers permit for the proposed removal of sediments may be required in order to comply with Section 404 of the Federal Clean Water Act. If acceptable, plans and operations are usually approved with modifications and conditions for operations and are usually given a time limit by which operations are to be completed. In addition, other federal agencies may require approval be issued by these agencies' requests directed through the Army Corps of Engineers.

Additional approvals from the Town of Winsted's Inland Wetlands and Watercourses Commission will be required, as well as approval by the Town's Planning and Zoning Commission. As part of the permitting process, residents along the shore of the lake coves should be required to remove their docks, rafts and other items from the cove areas prior to the start of operations. Sufficient notice to residents by certified mail is suggested.

Other permits and approvals may be required in the future due to changes in the scope of operations, specific excavation methods to be used by the selected excavation contractor or legislation.

The approximate time to obtain the various approvals and permits is a factor that must be considered in determining when the project will commence. It is anticipated that approvals, excluding the preparation of supporting documentation could take at least a year to obtain. Preliminary meetings and correspondence is highly recommended prior to implementation of the permitting processes.

Fisheries Concerns

Comments on this report were solicited from the DEP Fisheries Unit and these are included in this report as Appendix G.

Of concern to fisheries is the method of excavation to be utilized. The method to be utilized should not result in the suspension of large quantities of sediment in the water column. The method detailed below for dry excavation should be capable of avoiding this problem of suspension of sediment fines in the Lake water.

The hydraulic dredging and dragline methods of excavation may produce the undesirable effect of suspension of sediment fines in the lake and thus could potentially have adverse effects on the fish population within the Lake.

Another potential fisheries concern is the disruption of cover and spawning areas within the coves. Compensation of disruption of cover areas should be provided for during completion of sediment removal operations in the coves. This could be done by leaving large boulders in place and by piling smaller boulders in groups throughout the cove in addition to brush piles. It is recommended that these boulders, if left in place, extend to within 4 feet of the normal water surface and that permanent connections for the securing of marker buoys be installed.

A positive fisheries impact, resulting from removal of soft sediments from the coves, thus increasing spawning locations, may occur.

The noted negative concerns may not be valid and will be determined during the permit process by the DEP. (Reference 14).

It is extremely important that restoration of the Lake level begin by spawning time for fish and therefore the January 1 start date for beginning to refill the Lake should be adhered to and monitored closely.

Disposal Options

As noted, various options for the disposal of the excavated sediments are available. The most probable disposal locations for the sediments could be the Regional Refuse Disposal District No.1 and the grounds of the Town of Winsted's Department of Public Works (DPW) Facilities for ultimate use by the DPW or by the general public. Another disposal option would be to require the selected excavation contractor to retain ownership of the excavated materials. Other possibilities include disposal of the excavated material with local farms, nurseries and gravel pits.

Prior to the commencement of operations and during the permitting process of the proposed dredging of lake cove bottoms, locations and agreements for acceptance of the material for permanent land disposal should be secured.

Storage of Excavated Material

Material from the lake cove bottoms will be excavated and temporarily stockpiled within the cove area. The temporary stockpile will be centrally located near the cove access/haul road. Loading of sediment will lag somewhat behind the excavation and dozing operations to permit a stockpiling of material in sufficient quantity to ensure efficient use of equipment. The sediment will then be loaded into dump trucks by wheel loaders. It is anticipated that large quantities of stockpiled materials will only exist for short periods of time.

Erosion and Sedimentation Protection

Upon completion of the lake drawdown, establishment of the limits of the cove by survey staking should be conducted. These limits will also identify where placement of erosion control fencing should be placed. Erosion control silt fencing should be placed across the cove along the limits of the cove. Temporary erosion control silt fencing should be place at intermediate points of the cove to intercept sediment that may be eroded during rainfall and runoff events and to slow the erosion of exposed sediments.

As work in the cove progresses, the location and methods of erosion and sediment control will be required to be revised to permit efficient removal of the sediments.

Inspection of erosion controls should be performed daily, before and after expected rainfall and runoff events. To monitor control measures and to prevent sediment from reaching the Lake, it is recommended that the contractor be required to maintain a log of erosion and sedimentation control inspection and maintenance procedures.

If stockpiled materials are organic in nature and are to remain untouched for more than a few weeks for any reason, the contractor should provide erosion protection in the form of a temporary vegetative cover (if the sediments stockpiled are organic in nature) or fabric covering to reduce wind and water erosion. All stockpiled material, regardless of the permanence, should be enclosed by silt fencing.

A portion of the silt fencing can be removed to provide access to the materials for the bull dozers and the wheel loaders but upon cessation of work the silt fencing should be replaced and inspected.

Access/haul roads should exit through a common point for each cove. At this "funnel" location, the installation of a crushed stone anti-tracking pad should be installed with a minimum recommended length of 100 feet. This pad will require constant maintenance, however it is considered essential to reducing the transport of sediments onto paved surfaces.

The contractor should be required to have, on the project site, a high capacity street sweeper capable of removing tracked sediment for paved roads without producing excessive dust and disruption to traffic. The streets along haul routes should be swept clean once a day at the end of the work day as a minimum and as needed throughout the work day.

To reduce erosion and sedimentation problems, consideration of prohibiting work during rainfall and runoff events should be given.

Staging Areas and Preparatory Work

During the Lake drawdown process, the selected excavation contractor should begin mobilization of equipment that will be utilized during the project. This should also include the preparation of a designated work staging area. Further action during the Lake drawdown process includes establishment of construction control points such as elevation and coordinate benchmarks and establishment of a baseline for monitoring the operations. Additionally, the construction of temporary access roads and associated erosion control should commence.

Additional work such as cove bank stabilization by individual residents should be coordinated through the excavation contractor to ensure that conflicting work does not impede the sediment removal operations.

Existing and Proposed Lake Cove Bottom Mapping

Existing and proposed lake cove bottom mapping has been prepared for the coves under consideration. As described in Section II., the investigations performed enabled the preparation of existing and proposed lake cove bottom maps which should be followed during final design and construction. These maps are shown in Appendix A - Plans.

As part of the scope of work to be performed by the inspecting engineer or the excavation contractor, pre and post condition cross section survey of the coves should be required. Survey should include but not be limited to topographic and location type survey of existing (prior to commencement of operations) and finished, as built conditions.

Specific Plan Procedures for Each Cove

Assuming the plans for the proposed operations have been finalized and all Federal, State and Local permits and approvals have been obtained and all required easements have been secured, implementation of the dry excavation of unconsolidated sediments to elevation 872 can commence.

The following outlines specific plans for individual coves where required because of specific cove requirements. Many of the aspects of the plans are applicable to all coves.

Resha Beach Cove

Drawdown of the Lake as outlined previously should commence as early in September as possible and drawdown of the lake approximately 8 feet from normal pool elevation should be complete by mid October.

During the Lake drawdown process, the excavation contractor should begin mobilization of equipment that will be utilized during the project. This should also include the preparation of a work staging area. A possible location for this area is the existing Resha Beach parking area (See Figure 2). This area could also be utilized for operations in Sandy Cove and Jean Lore Cove. The reason for this is due to the proximity of Sandy Cove and Jean Lore Cove, the lack of usable area adjacent to the cove and the relatively densely populated area that surrounds both coves.

Further action during the lake drawdown process would be the establishment of construction control points such as elevation and coordinate benchmarks and the establishment of a baseline for the operations.

Upon completion of the lake drawdown, erosion and sedimentation control measures may commence as outlined above in the subsection entitled Erosion and Sedimentation Control. Simultaneously, the construction of the access road should commence. The access road should be constructed from the edge of the existing paved street and continue to the edge of the cove.

Just prior to removal of sediments, water management specifics should be implemented. Points of storm drainage discharge into the cove should be located and management techniques employed. It is anticipated that, in most cases, diversion ditches will be utilized to ensure that excavation and work areas remain dry. The use of diversion ditches with periodic check dams at 100 foot intervals should be sufficient to control water within the cove area. An alternative to diversion ditches would be the installation of flexible piping to carry the water from it's outlet point to the lakes edge.

At this point, removal of the unconsolidated sediments should proceed. Bulldozing of the sediments at the edge of the cove near the access road should commence until sufficient material is stockpiled to permit removal by wheel loaders. It is recommended that material be stockpiled near the western side of the cove near the existing beach to facilitate removal and water management operations.

Traffic control in the form of warning signs and the use of flagmen should be implemented due to hazards that may occur due to slow moving vehicles or stopped vehicles at the staging area near the intersection of East Lake Street and Hurlbut Street.

The sediments in the Resha Beach Cove area, in general, can be characterized as material containing a mixture of sand and organic material. The content of sand is relatively moderate with the content of organic material ranging from moderate to high. The excavated material after removal and disposal could possibly be used as topsoil.

The expected volume of sediments to be removed as a result of dry excavation of the sediments is approximately 21,000 cubic yards.

In most cases large earth moving equipment will be utilized for sediment excavation and moving, however, smaller equipment such a backhoe loaders will have to be utilized for removal of sediments in and around permanent docks and concrete piers. This will slow the excavation operation and add cost to the operations.

It is estimated that the dry excavation of sediments from Resha Beach Cove will cost approximately $238,000 (Refer to Table 3.

The approximate time table and length of construction will depend on a number of variables, a few of which may dictate when and how quickly the dry excavation of the unconsolidated sediments can occur. The timetable for operations and the length of construction is estimated and is shown in Table 4, Timetable and Length of Construction. Operations should start in early September and continue through to January of the following year. Operations may stop in winter due to frozen ground conditions.

TABLE 4

TIMETABLE AND LENGTH OF CONSTRUCTION

Construction Operation Description		Estimated Time To Complete
Lake drawdown to elevation 872		45 days
Mobilization, staging area preparation		15 days
Construction survey (baselines & benchmarks)		15 days
Placement of erosion and sedimentation controls		7 days
Construction of access road(s)		7 days
Dry excavation of sediments		
	Resha Beach Cove	30 days
	Sandy Cove	30 days
	Jean Lore Cove	30 days
	Taylor Brook Cove	30 days
	Sucker Brook Cove	180 days
Miscellaneous Construction		15 days
As-built survey		7 days

Sandy Cove

Drawdown of the lake as outlined previously under Section VI., Plan Procedures Applicable To All Coves, should commence as early in September as possible.

During the Lake drawdown process the excavation contractor should begin mobilization of equipment that will be utilized during the project. This should also include the preparation of a work staging area, which could be the existing Resha Beach parking area. This area would also be utilized for operations in Resha Beach Cove. The reason for this is due to the proximity of Resha Beach Cove, the lack of usable area adjacent to Sandy Cove and the relatively densely populated area that surrounds Sandy Cove.

The recommended plan for Resha Beach should also be followed for Sandy Cove.

Traffic control in the form of warning signs and the use of flagmen should be implemented due to hazards that may occur due to slow moving vehicles or stopped vehicles in Shore Drive and along Hurlbut Street and at the staging area near the intersection of East Lake Street and Hurlbut Street.

The sediments in the Sandy Cove area can generally be characterized as material containing a mixture of sand and organic material. The content of sand ranges from high to moderate with the content of organic material moderate. The excavated material after removal and disposal could possibly be used as general fill. If removal of the sediments can be organized to facilitate segregation of material into two different classes then some of the material removed could be utilized as topsoil.

The expected volume of sediments to be remove as a result of dry excavation of the sediments is approximately 6,000 cubic yards.

It is estimated that the dry excavation of unconsolidated sediments from Sandy Cove will cost approximately $ 67,000 (Refer to Table 3 - Estimated Costs For Dry Excavation of Unconsolidated Sediments).

The timetable for operations and the length of construction is estimated and is shown in Table 4.

Sucker Brook Cove

Drawdown of the lake as outlined previously under Section VI., Plan Procedures Applicable To All Coves, should commence as early in September as possible. During the lake drawdown process the excavation contractor should begin mobilization of equipment that will be utilized during the project and a work staging area prepared, possibly near the western edge of the cove near Wakefield Boulevard (See Figure 3).

Since Sucker Brook flows in a channel along the northeastern edge of the cove when the lake is drawn down, the work will likely commence in two phases. Work will proceed from the western side of the cove to the edge of Sucker Brook in phase one. In phase two the sediment will be removed in areas of the cove that remain.

A two year construction period may be necessary for the removal of the unconsolidated sediment in the cove due to the large volume of sediment to be removed and the presence of Sucker Brook. If the drawdown of the lake could be permitted during the summer months it should be possible to perform removal of the sediments within the same year.

Placement of erosion and sediment control measures should commence approximately one week after the drawdown of the lake is complete. This lag in time should provide enough time for the sediments to be excavated to dry out by draining. The placement of the control measures should conform in general to the above subsection entitled Erosion and Sedimentation Control. Specifically, the placement of erosion controls should continue up to the edge of Sucker Brook.

Temporary stream forges should be constructed during low flow periods and should be utilized only if access from the other side of the cove is not feasible or would substantially increase costs to complete the operations (See Figure 12).

Construction and placement of the access/haul road for the cove should take place at the same time as placement of the erosion and sedimentation controls. The access road should be constructed from the edge of the paved street to the edge of the cove. Once this has been completed the removal of the sediments should commence in the immediate area of the access road and cove edge.

Just prior to the removal of the sediments, water management specifics should be implemented. Storm drainage discharge points should be located throughout the cove area and management techniques implemented. Installation of flexible storm drainage pipe running from the various points of discharge to the brook or lake which ever is closest should be installed. This work could be done by hand to minimize soil disturbance and sedimentation. An alternate to this method would be construction of diversion ditches with check dams at 100 foot intervals.

It should be noted that a rainfall event occurring in tributary areas to Sucker Brook and the Cove could slow operations and may cause work to cease until flows from Sucker Brook recede.

Bulldozing of the sediments at the edge of the cove near the access road should commence until sufficient material is stockpiled to permit removal by wheel loaders. It is recommended that material be stockpiled near the western edge of the cove near the street and access road.

It is anticipated that removal operations will be somewhat difficult and time consuming due water management efforts that will be required for Sucker Brook which is a continuously discharging stream and a major input of water to the Lake.

Traffic control in the form of warning signs and the use of flagmen should be implemented due to hazards that may occur due to slow moving vehicles or stopped vehicles in and along Wakefield Boulevard and at the staging area near the Cove.

The sediments in the Cove area in general can be characterized as material containing a mixture of sand and organic material. The material in the cove has a medium content of medium sand with a medium to high content of organic material. The excavated material after removal could be used as general fill, cover or topsoil after slight treatment with additional organic material or fertilizers.

The expected volume of sediments to be removed as a result of dry excavation of the sediments is approximately 50,000 cubic yards.

In most cases large earth moving equipment will be utilized for sediment excavation and moving. Management of Sucker Brook will tend to slow the excavation operations and may add cost to the operations.

It is estimated that the dry excavation of unconsolidated sediments from Sucker Brook Cove will cost approximately $377,000.

The timetable for operations and the length of construction is estimated and is shown in Table 4, Timetable and Length of Construction. Operations should start in early September and continue through to January of the following year. The removal of unconsolidated sediments to elevation 872 in accordance with plans and specifications should be completed within a year from the start of operations. If the drawn down of the lake could be permitted during the summer months it should be possible to perform removal of the sediments in about half the time of operations conforming to the above limited time frame of lake level drawdown.

Taylor Brook Cove

Drawdown of the lake as outlined previously under Section VI., Plan Procedures Applicable To All Coves, should commence as early in September as possible.

During the lake drawdown process the excavation contractor should mobilize equipment that will be utilized during the project. This should also include the preparation of a work staging area which could be near the western edge of the cove near Wakefield Boulevard at the former State Recreational area (See Figure 4).

Since Taylor Brook flows in a channel almost directly up the length of the cove when the lake is drawn down, the work will likely commence in two phases. Work will proceed from the western side of the cove to the edge of Taylor Brook in phase one. In phase two the sediment will be remove in areas of the cove that remain. In all phases, free passage through the channel should be maintained.

Placement of erosion and sediment control measures should commence approximately one week after the drawdown of the lake is complete. This lag in time should provide enough time for the sediments to be excavated to dry out by draining in place. The placement of the control measures should conform in general to the above subsection entitled erosion and sedimentation control. Specifically the placement of erosion controls should continue up to the edge of Taylor Brook.

Temporary stream forges should be constructed during low flow periods and should be utilized only if access from the other side of the cove is not feasible or would substantially increase costs to complete the operations.

Just prior to the removal of the sediments water management specifics should be implemented. Storm drainage discharge points should be located throughout the cove area and management techniques implemented. Installation of flexible storm drainage pipe running from the various points of discharge to the brook or lake whichever is closest should be installed. This work could be done by hand to minimize soil disturbance and sedimentation. An alternate to this method would be construction of diversion ditches with check dams at 100 foot intervals.

It should be noted that a rainfall event occurring in the tributary areas to Taylor Brook and the cove could slow operations and may cause work to cease until flows from Taylor Brook recede.

Bulldozing of the sediments at the edge of the cove near the access road should commence until sufficient material is stockpiled to permit removal by wheel loaders. It is recommended that material be stockpiled near the western edge of the cove near the access road. It is anticipated that removal operations will be somewhat difficult and time consuming due water management efforts that will be required for Taylor Brook which is a continuously discharging stream and a major input of water to the Lake.

Traffic control in the form of warning signs and the use of flagmen should be implemented due to hazards that may occur due to slow moving vehicles or stopped vehicles in and along Wakefield Boulevard and at the staging area near the Cove.

The sediments in the Cove area in general can be characterized as material containing a mixture of sand and organic material.
The material in the cove has a medium to high content of medium sand with a low to medium content of organic material.

The excavated material after removal and disposal could be used as general fill, cover or topsoil after addition of organic material and treatment with recommended fertilizers.

The expected volume of sediments to be removed as a result of dry excavation of the sediments is approximately 17,000 cubic yards.

In most cases large earth moving equipment will be utilized for sediment excavation and moving. However smaller equipment such as backhoe loaders will have to be utilized for removal of sediments in and around permanent docks and concrete piers. This, along with management of Taylor Brook will slow and add cost to the operations.

It is estimated that the dry excavation of unconsolidated sediments from Taylor Brook Cove will cost approximately $202,000.

The timetable for operations and the length of construction is estimated and is shown in Table 4, Timetable and Length of Construction. Operations should start in early September and continue through to late February of the following year.

Jean Lore Cove

Drawdown of the lake as outlined previously under Section VI., Plan Procedures Applicable To All Coves, should commence as early in September as possible.

During the lake drawdown process the excavation contractor should begin mobilization of equipment that will be utilized during the project and a work staging area prepared. A possible location for this area could be the existing Resha Beach parking area (See Figure 2). This area would also be utilized for operations in Resha Beach Cove and Sandy Cove. This area was selected since there appears to be no area of suitable size for a staging area near the cove due to existing topography and the relatively densely populated area that surrounds the cove. Additionally, the establishment of a one staging area for Resha Beach Cove, Sandy Cove and Jean Lore Cove could result in a time and cost savings.

Bulldozing of the sediments at the edge of the cove near the access road should commence until sufficient material is stockpiled to permit removal by wheel loaders. It is recommended that material be stockpiled near the northeastern end of the cove near the street and access road.

It is anticipated that removal operations will be somewhat difficult and time consuming due to limited work area for stockpiling of material and access into the cove from the street.

Traffic control in the form of warning signs and the use of flagmen should be implemented due to hazards that may occur due to slow moving vehicles or stopped vehicles in and along Wakefield Boulevard and at the staging area near the intersection of East Lake Street and Hurlbut Street.

The sediments in the cove area, in general, can be characterized as material containing a mixture of sand and organic material. The material in the lower half of the cove (the portion east of the midpoint of the cove) has a content of medium sand with a high content of organic material. The excavated material after removal and disposal could be used as topsoil. The material in the remaining areas of the cove has a medium to high content of sand with moderate to low content of organic material. The material could possibly be utilized as general fill or cover.

The expected volume of sediments to be removed as a result of dry excavation of the sediments is approximately 6,000 cubic yards.

It is estimated that the dry excavation of unconsolidated sediments from Sandy Cove will cost approximately $72,000.

The removal of unconsolidated sediments to elevation 872 in accordance with plans and specifications should be completed prior to March of the year following start of construction.

Miscellaneous Considerations

Additional work such as cove bank stabilization not capable by individual residents or by residents not willing to participate in preservation of completed improvements should be considered to be included in the operations for restoration of the lake coves. This work could be done through the excavation contractor at a considerable cost savings over stabilization at a later date.

The placement of gross particle separators in storm drainage systems just prior to outfall locations along with a maintenance of these and other drainage structures would greatly reduce sediment loads in Resha Beach, Sandy, and Jean Lore Cove.

Enforcement and required implementation of an erosion and sediment controls for new construction or for existing areas of land currently eroding or having the potential to cause sedimentation within the lake's watershed should be also be given high consideration.

The excavation of sediment should be considered only a temporary improvement to the Lake coves and to the Lake. Water quality and recreational user problems as stated, may or may not improve as a result of dredging operations. Watershed monitoring and control of erosion is essential to improving the lakes many benefits.

Construction Funding Sources

There are several potential sources of grant funds that may be available to the Town for performing the dredging work. Foremost among these sources is the Federal Clean Water Act 314 administered by the U.S. Environmental Protection Agency (EPA), which is administered locally by the DEP.

This program, which has been successfully utilized by other Connecticut lakes programs, is designed to work with the DEP 22a-339 CGS program. If Federal funds are received under this program and DEP funds are received, the total grant percentage is 75%, with the Town paying the remaining 25%. Highland Lake is eligible for this funding because it has a State boat launch providing access to the Lake and a diagnostic feasibility study has already been performed on the Lake. The project would have to compete against other projects for funding, however and so there is no guarantee of funding.

Potential sources of funds for the Town's share include special Connecticut legislative grants and local funding.

It is recommended that the Town pursue these sources of grant funds if it is desired to implement the dredging program described in this study.

VII. REFERENCES

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5. Personal Communication, Steve Janssen, Director of Public Works, Town of Winchester, January 1991.

6. Personal Communication, Mat Dominy, Director of Public Works, Town of Torrington, December 1990.

7. Personal Communication, James Sheehy, Director of Engineering, Town of Wethersfield, December 1990.

8. Personal Communication, First Selectmans Office, Town of Colebrook, January 1991.

9. Personal Communication, William Flagg, First Selectman, Town of Hartland, January 1991.

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16. Connecticut Guidelines For Soil Erosion and Sediment Control The Connecticut Council On Soil And Water Conservation, January 1988.

17. 4 Post Traversing Cabling System - Installation Plan Layout, Crisafulli Pump Company, Inc., Glendive, Montana, Drawing #CPC-90144, February 3, 1990.

18. Mud Cat Model MC915, Mud Cat Division Ellicot Machine Corp., Baltimore, Maryland, DWG NO. D9000, 8/8/88.

19. Memorandum from Don Mysling, DEP Technical Assistance Fisheries Biologist, Inland Fisheries, Western District, to Chuck Lee, DEP Senior Environmental Analyst, May 20, 1991.

20. Memorandum from Chuck Phillips, DEP District Fisheries Supervisor, Inland Fisheries, to Chuck Lee, DEP Senior Environmental Analyst, June 21, 1991.

21. Calculation of water budget for refilling of Highland Lake performed by Chuck Lee, DEP Senior Environmental Analyst, June 24, 1991.

VIII. APPENDICES

A. Plans

B. Boring Results

C. Laboratory Testing Results

D. Soil Survey Descriptions

E. Scope of Services

F. Water Budget Calculations

G. DEP Fisheries Comments on the Report

APPENDIX A

PLANS

APPENDIX B

BORING LOGS

Appendix B

Boring Hole Numbers in Relation to Study Cove Locations.

COVE NAME	BORING NUMBER
Resha Beach Cove	Boring No.'s 17, 18, 19, 20.
Sandy Cove	Boring No.'s 13, 14, 15, 16.
Sucker Brook Cove	Boring No.'s 5, 6, 7, 8.
Taylor Brook Cove	Boring No.'s 1, 1A, 2A, 3, 4.
Jean Lore Cove	Boring No.'s 9, 10, 11, 12.

CONNECTICUT TEST BORINGS, INC.

SOILS CORRELATION CHART

PENETRATION RESISTANCE & SOIL PROPERTIES

Predominant sand and gravel *COHESIONLESS SOILS*		Predominant silt and clay *COHESIVE SOILS*		*COMPRESSIVE*
Blows per foot	Relative Density	Blows per foot	Consistency	Strength (qu*)
U to 4	very loose	0 to 2	very soft	below .25
4 to 10	loose	2 to 4	soft	.25 to .50
10 to 30	medium	4 to 8	medium	.50 to 1.0
30 to 50	dense	8 to 15	stiff	1 to 2
over 50	very dense	15 to 30	very stiff	2 to 4
		over 30	hard	over 4

NOTES:

Above based on 2" O.D. sampler x 1-⅜" i.d. 140 Wt. x 30" Fall (qu*) = Tons per square Foot

STATE OF CONNECTICUT BASIC BUILDING CODE

TABLE 15. PRESUMPTIVE SURFACE BEARING VALUES OF FOUNDATION MATERIALS

	CLASS OF MATERIAL	Tons per Square Foot
1	Massive crystalline bed rock including granite, diorite, gneiss, trap rock hard limestone and dolomite.	100
2	Foliated rock including bedded limestone, schist and slate in sound condition.	40
3	Sedimentary rock including hardshales, sandstones, and thoroughly cemented conglomerates.	25
4	Soft or broken bed rock (excluding shale) and soft limestone.	10
5	Compacted, partially cemented gravels, sand and hardpan overlying rock.	10
6	Gravel and sand-gravel mixtures.	6
7	Loose gravel, hard dry clay, compact coarse sand, and soft shales.	4
8	Loose, coarse sand and sand-gravel mixtures and compact fine sand (confined).	3
9	Loose medium sand (confined), stiff clay.	2
10	Soft broken shale, soft clay.	1.5

Not responsible for sample storage after 30 days.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

ATE START 10/25/90

DATE FINISH 10/25/90

EIGHT OF HAMMER 140 xxx

HAMMER FALL 30" xxx

PROJ. NO.

LOCATION Taylor Brook Cove

xxxxxxxxxx Winsted, Ct.

OFFSET

GROUND ELEVATION

HOLE NO. B-1

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/25/90	0 hrs.	1'6" Deep

WMC Consulting Engineers
630 Oakwood Avenue
Suite 450
West Hartford, Ct. 06110

AMPLER O.D. 2" I.D. 1 3/8"

TYPE OF RIG Barge/Tripod

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE I.D.		1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV FT.	Type of Sample	Blows per 6" on sampler From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
	1'6"to 3'1"	SS	0	1	2 50/1	Loose Wet	1'6"	Lake water	1	19	12
							3'1"	Br. silty f-m sand, little root fibers.			
								Spoon refusal			
10											
20											
30								Bottom of boring 3'1".			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.

HELPER: M.C.

SOILS ENGINEER: Kelly

DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

DATE START 10/25/90
DATE FINISH 10/25/90
WEIGHT OF HAMMER 140 xxx
HAMMER FALL 30" xxx

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/25/90	0 hrs.	1'6" Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood AVe.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.
LOCATION Taylor Brook Cove
xxxxxxxx Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-1A

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½"	1 3/8	

Depth Below Surface	Casing Blows	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
	C 0								Lake water			
	A 3	1'6"to	SS	0	1	2	V.Loose	1'6"		1	24	12
	S 7	2'6"				3	Wet		Br. silty f-m sand, little root fibers.			
	I 15											
	N 12											
	G 13							6'				
	B 31	7'to	SS	21	21	20	Dense		Br. silty f-m sand, little f-m gravel.	2	24	24
	L	9'				18	Wet					
	O							9'				
10	W											
	S											
20												
									Bottom of boring 9'.			
30												
40												

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER: Kelly
DRILLING INSPECTOR:

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START 10/25/90
DATE FINISH 10/25/90
WEIGHT OF HAMMER 140 XXX
HAMMER FALL 30" XXX

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/25/90	0 hrs.	2'6" Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood AVe.
Suite 450
West Hartford, Ct. 06110

SHEET 1 of 1
PROJ. NO.
LOCATION Taylor Brook Cove
XXXXXXXXXX Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-2

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½"	1 3/8"	

Depth Below Surface		SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
C	0								Lake water			
A	1	2'6"to	SS	0	1	1	V.Loose			1	24	6
S	2	3'6"				1	Wet	2'6"				
I									Br. silty f-sand, tr. root fibers.			
N	2											
G	2											
B	2											
L	50	8'to	SS	50/0			V.Dnse.	8'		2	0	0
O		8'					Wet		Casing refusal 8'.			
W	10											
S												
	20											
	30											
	40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

'S AFTER ... E STC ... E FOR ... ESP

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

DATE START	10/25/90
DATE FINISH	10/25/90
WEIGHT OF HAMMER	140 ~~300~~
HAMMER FALL	30" ~~xxx~~

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/25/90	0 hrs.	5' Deep

SAMPLER O.D. 2" I.D. 1 3/8"

TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.	
LOCATION	Taylor Brook cove
LINE & STA.	Winsted, Ct.
OFFSET	
GROUND ELEVATION	
HOLE NO.	B-2A

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½"	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
0								Lake Water			
0											
0											
0											
0	5'to	SS	0	0	1	V.Loose	5'		1	24	6
0	7'				0	Wet		Br. silty f-sand, tr. root fibers.			
0											
0											
0											
8	9'to	SS	1	1	4	Loose			2	24	24
10	11'				16	Wet	10'				
							11'	Br. f-c sand.			
20											
								Bottom of boring 11'.			
30											
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

DATE START	10/25/90
DATE FINISH	10/25/90
WEIGHT OF HAMMER	140
HAMMER FALL	30"

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/25/90	0 hrs.	2'6" Deep

SAMPLER O.D.	2"	I.D.	1 3/8"
TYPE OF RIG	Barge/Tripod		

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.	
LOCATION	Taylor Brook Cove
	Winsted, Ct.
OFFSET	
GROUND ELEVATION	
HOLE NO.	B-3

	CASING	SAMPLER	CORE BARREL
TYPE		SS	
SIZE I.D.		1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE.	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Lake Water			
	2'6" to	SS	3	4	6	Loose			1	24	12
	4'6"				5	Wet	2'6"				
								Br. f-c sand, little f-m gravel.			
							4'6"				
10											
20											
30								Bottom of boring 4'6".			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER: Kelly
DRILLING INSPECTOR:

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

DATE START 10/25/90
DATE FINISH 10/25/90
WEIGHT OF HAMMER 140 XXX
HAMMER FALL 30" XXX

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/25/90	0 hrs.	4'6" Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG BArge/Tripod

WMC Consulting Engineers
630 Oakwood AVe.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.
LOCATION Taylor Brook Cove
XXXXXXXX Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-4

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½"	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
C 0								Lake Water			
A 0											
S 0											
0	4'6"to 6'6"	SS	0	1	1 0	V.Loose Wet	4'6"		1	24	8
N 0											
G 1								Br. silty f-m sand, tr. root fibers.			
2							7'				
16								Same with little gravel.			
O 31											
106									2	0	0
50/6"	10'6"to 10'6"	SS	50/0				10'6"				
								Casing and spoon refusal 10'6".			

- 20
- 30
- 40

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

NOT RESPONSIBLE FOR SAMPLE STORAGE AFTER 30 DAYS

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START 10/30/90
DATE FINISH 10/30/90
WEIGHT OF HAMMER 140 xxx
HAMMER FALL 30" xxx

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/30/90	0 hrs.	5' Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
WEst Hartford, Ct. 06110

SHEET 1 of 1
PROJ. NO.
LOCATION Sucker Brook Cove
xxxxxxxxxx Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-5

	CASING	SAMPLER	CORE BARREL
TYPE	B	SS	
SIZE I.D.	3"	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
	5'to	SS	0	1	1	Loose	5'		1	24	6
	7'				1	Wet		Br. organics with f-silty sand.			
- 10								Same			
							12'6"				
	13'to	SS	5	9	7	M.Comp.		Gry. f-m sand, tr. silt.	2	24	8
	15'				5	Wet	15'				
- 20											
- 30								Bottom of boring 15'.			
- 40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%.

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

NOT RESPONSIBLE FOR SAMPLE STORAGE AFTER .. DAYS

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 388-3857

TE START 10/30/90
E FINISH 10/30/90
IGHT OF HAMMER 140 XXX
HAMMER FALL 30" XXX

GROUND WATER OBSERVATIONS

ATE	TIME	DEPTH
10/30/90	0 hrs.	5' Deep

MPLER O.D. 2" I.D. 1 3/8"
E OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

SHEET 1 of 1
PROJ. NO.
LOCATION Sucker Brook Cove
XXXXXXXXXXX Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-6

	CASING	SAMPLER	CORE BARREL
TYPE	B	SS	
SIZE I.D.	3"	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
	5' to	SS	0	1	0	Loose	5'		1	24	20
	7'				1	Wet		Br. organic silt, f-sand.			
10	10' to	SS	4	5	5	Loose	10'		2	24	12
	12'				4	Wet	12'	Gry. f-c sand.			
20											
30											
								Bottom of boring 12'.			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

DATE START 10/30/90
DATE FINISH 10/30/90
WEIGHT OF HAMMER 140 xxx
HAMMER FALL 30" xxx

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/30/90	0 hrs.	2' Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.
LOCATION Sucker Brook Cove
xxxxxxxx Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-7

	CASING	SAMPLER	CORE BARREL
TYPE	B	SS	
SIZE I.D.	3"	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
	2' to 4'	SS	1	0	1 1	Loose Wet	2'		1	24	24
								Br. organic silt, some f-sand.			
	7' to 9'	SS	5	6	19 12	M.Comp. Wet	7'	Same	2	24	18
							9'	Gry. f-c sand.			
10											
20											
30								Bottom of boring 9'.			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER: Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START	10/30/90
DATE FINISH	10/30/90
WEIGHT OF HAMMER	140 XXX
HAMMER FALL	30" XXX

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/30/90	0 hrs.	4 ' Deep

SAMPLER O.D.	2" I.D. 1 3/8"
TYPE OF RIG	Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

SHEET	1 of 1
PROJ. NO.	
LOCATION	Sucker Brook Cove
XXXXXXXXX	Winsted, Ct.
OFFSET	
GROUND ELEVATION	
HOLE NO.	B-8

	CASING	SAMPLER	CORE BARREL
TYPE	B	SS	
SIZE I.D.	3"	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
	4'to	SS	0	0	0	Loose	4'		1	24	6
	6'				0	Wet		Br. organic silt, little f-sand.			
	8'6"to	SS	16	36	14	Dense			2	24	18
	10'6"				16	Wet	8'6"				
10								Gry. f-c sand, tr. gravel.			
							10'6"				
20											
30								Bottom of boring 10'6".			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER: Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START 10/30/90
DATE FINISH 10/30/90
WEIGHT OF HAMMER 140 xxx
HAMMER FALL 30" xxx

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/30/90	0 hrs.	3' Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.
LOCATION Jean Lore Cove
xxxxxxxxxxx Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-9

	CASING	SAMPLER	CORE BARREL
TYPE	B	SS	
SIZE I.D.	3"	1 3/8"	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								WATER			
	3' to 5'	SS	0	0	1 / 1	Loose Wet	3'		1	24	6
							5'	Br. organics, f-sand.			
	5' to 7'	SS	12	12	13 / 16	M.Comp. Wet	7'	Gry. f-m sand.	2	24	18
- 10											
- 20											
- 30								Bottom of boring 7'.			
- 40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START 10/30/90
DATE FINISH 10/30/90
WEIGHT OF HAMMER 140 xxx
HAMMER FALL 30" xxxx

SHEET 1 of 1
PROJ. NO.
LOCATION Jean Lore Cove
xxxxxxxxx Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-10

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/30/90	0 hrs.	3'6" Deep

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

	CASING	SAMPLER	CORE BARREL
TYPE	B	SS	
SIZE I.D.	3"	1 3/8"	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								WATER			
	3'6"to 5'6"	SS	0	0	1 1	Loose Wet	3'6"		1	24	18
	5'6"to 5'9"	SS	50/3			V.Dnse. Wet	5'9"	Br. organics, f-sand.	2	3	0
								Refusal 5'9".			
10											
20											
30											
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER: Kelly
DRILLING INSPECTOR:

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

DATE START 10/30/90
DATE FINISH 10/30/90
WEIGHT OF HAMMER 140 XXX
HAMMER FALL 30" XXX

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/30/90	0 hrs.	7'6" Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood AVe.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.
LOCATION Jean Lore Cove
XXXXXXXX Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-11

	CASING	SAMPLER	CORE BARREL
TYPE	B	SS	
SIZE I.D.	3"	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								WATER			
	8' to 10'	SS	4	5	6 9	M.Comp. Wet	7'6"		1	24	24
							8'	Br. organics.			
10							10'	Gry. f-c sand.			
20											
30											
40								Bottom of boring 10'.			

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START: 10/30/90
DATE FINISH: 10/30/90
WEIGHT OF HAMMER: 140 3XX
HAMMER FALL: 30" 2XX

SHEET 1 of 1
PROJ. NO.
LOCATION: Jean Lore Cove
XXXXXXXXX: Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO.: B-12

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/30/90	0 hrs.	10'6" Deep

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

SAMPLER O.D.: 2" I.D.: 1 3/8"
TYPE OF RIG: Barge/Tripod

	CASING	SAMPLER	CORE BARREL
TYPE	B	SS	
SIZE I.D.	3"	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								WATER			
10	10'6" to 12'6"	SS	1	5	6 / 7	M.Comp. Wet	10'6"		1	24	18
							11'	Br. organics (surface boulders).			
							12'6"	Gry. f-c sand.			
20											
30								Bottom of boring 12'6".			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: S.A.
HELPER: M.C.
SOILS ENGINEER: Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START 10/31/90
DATE FINISH 10/31/90
WEIGHT OF HAMMER 140 xxx
HAMMER FALL 30" xxx

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/31/90	0 hrs.	2' Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

SHEET 1 of 1
PROJ. NO.
LOCATION Sandy Cove
xxxxxxxxxx Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-13

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
							2'				
								Br. f-sand, & silt, tr. root fibers.			
	3' to	SS	0	2	2	Loose			1	24	8
	5'				5	Wet	5'				
	5' to	SS	10	11	11	M.Comp.		Gry. m-f sand, some m-f gravel, tr. silt.			
	7'				12	Wet	7'		2	24	14
10											
20											
								Bottom of boring 7'.			
30											
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: M.C.
HELPER: V.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

DATE START	10/31/90
DATE FINISH	10/31/90
WEIGHT OF HAMMER	140 ~~xxx~~
HAMMER FALL	30" ~~xxx~~

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/31/90	0 hrs.	3' Deep

SAMPLER O.D. 2" I.D. 1 3/8"

TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.	
LOCATION	Sandy Cove
~~xxxxxxxxxx~~	Winsted, Ct.
OFFSET	
GROUND ELEVATION	
HOLE NO.	B-14

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
	3' to	SS	0	2	2	Loose	3'		1	24	8
	5'				3	Wet		Gry. br. f-sand & silt, tr. root fiber.			
							6'				
	6' to	SS	8	9	11	M.Comp.		Gry. br. m-f sand, some m-f gravel, tr. silt.	2	24	12
	8'				11	Wet	8'				
10											
20											
30								Bottom of boring 8'.			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: M.C.
HELPER: V.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START 10/31/90
DATE FINISH 10/31/90
WEIGHT OF HAMMER 140 XXX
HAMMER FALL 30" XXX

SHEET 1 of 1
PROJ. NO.
LOCATION Sandy Cove
XXXXXXXXXXX Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-15

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/31/90	0 hrs.	5' Deep

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
	5'to	SS	0	2	9	M.Comp.	5'		1	24	12
	7'				10	Wet	6'	Br. vf-sand & silt, root fiber.			
							7'	Gry. br. m-f sand, tr. silt.			
10											
20											
30								Bottom of boring 7'.			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: M.C.
HELPER: V.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 - VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

TE START 10/31/90

DATE FINISH 10/31/90

IGHT OF HAMMER 140 XXX

HAMMER FALL 30" XXX

SHEET 1 of 1

PROJ. NO.

LOCATION Sandy Cove

XXXXXXX Winsted, Ct.

OFFSET

GROUND ELEVATION

HOLE NO. B-16

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/31/90	0 hrs.	6' Deep

WMC Consulting Engineers
630 Oakwood AVe.
Suite 450
West Hartford, Ct. 06110

MPLER O.D. 2" I.D. 1 3/8"

TYPE OF RIG Barge/Tripod

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
							6'				
	6' to	SS	0	2	4	Loose	7'	Gry. vf-sand & silt, with root fiber.	1	24	8
	8'				8	Wet	8'	Gry. br. m-f sand, tr. silt.			
10											
20											
30											
								Bottom of boring 8'.			
40											

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: M.C.
HELPER: V.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

TE START 10/31/90
DATE FINISH 10/31/90
IGHT OF HAMMER 140 300 xx
HAMMER FALL 30" 24 xxx

SHEET 1 of 1
PROJ. NO.
LOCATION Resha Beach
xxxxxxxxxx Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-17

GROUND WATER OBSERVATIONS

ATE	TIME	DEPTH
.. 31/90	0 hrs.	3' Deep

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

MPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
							3'				
	3'to	SS	0	2	2	Loose		Dark gry. vf-sand, & silt, with root fiber.	1	24	8
	5'				5	Wet	5'				
	5'to	SS	6	8	10	M.Comp.		Gry. br. m-f sand, tr. silt.			
	7'				11	Wet	7'		2	24	6
- 10											
- 20											
- 30											
								Bottom of boring 7'.			
- 40											

Proportions used. trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: M.C.
HELPER: V.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50 + VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

NOT RESPONSIBLE FOR SAMPLE STORAGE AFTER 90 DAYS

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

SHEET 1 of 1

DATE START 10/31/90
DATE FINISH 10/31/90
WEIGHT OF HAMMER 140 XXX
HAMMER FALL 30" 2XXX

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/31/90	0 hrs.	5' Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

PROJ. NO.
LOCATION Resha Beach
XXXXXXXXX (LINE & STA.) Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-18

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
	5' to	SS	0	0	1	Loose	5'		1	24	6
	7'				1	Wet		Dark br. vf-sand & silt, with root fiber.			
	9' to	SS	8	8	9	M.Comp.	9'		2	24	10
10	11'				9	Wet		Gry. vf-sand, some silt.			
							11'				
20											
30								Bottom of boring 11'.			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: M.C.
HELPER: V.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START 10/31/90
DATE FINISH 10/31/90
WEIGHT OF HAMMER 140 XXX
HAMMER FALL 30" XXX

SHEET 1 of 1
PROJ. NO.
LOCATION Resha Beach
LINE & STA. Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-19

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/31/90	0 hrs.	6' Deep

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
	6' to	SS	0	0	1	V.Loose	6'		1	24	6
	8'				1	Wet		Dark br. vf-sand & silt, with root fiber.			
10											
								Same			
	13' to	SS	6	8	8	M.Comp.	13'		2	24	12
	15'				8	Wet		Gry. vf-silty sand, tr. clay.			
							15'				
20											
30											
								Bottom of boring 15'.			
40											

Proportions used: trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: M.C.
HELPER: V.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C - CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP - TEST PIT
UT - UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

SOIL SAMPLING LOG

CONNECTICUT TEST BORINGS, INC.

Sub-Surface Specialists
P. O. Box 69
SEYMOUR, CONNECTICUT
(203) 888-3857

DATE START	10/31/90
DATE FINISH	10/31/90
WEIGHT OF HAMMER	140
HAMMER FALL	30"

SHEET 1 of 1
PROJ. NO.
LOCATION Resha Beach
Winsted, Ct.
OFFSET
GROUND ELEVATION
HOLE NO. B-20

GROUND WATER OBSERVATIONS

DATE	TIME	DEPTH
10/31/90	0 hrs.	8' Deep

WMC Consulting Engineers
630 Oakwood Ave.
Suite 450
West Hartford, Ct. 06110

SAMPLER O.D. 2" I.D. 1 3/8"
TYPE OF RIG Barge/Tripod

	CASING	SAMPLER	CORE BARREL
TYPE	BW	SS	
SIZE I.D.	2½	1 3/8	

Depth Below Surface	SAMPLE NO. DEPTHS ELEV. FT.	Type of Sample	BLOWS PER 6" ON SAMPLER From 0-6	To 6-12	12-18	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOILS REMARKS	SAMPLE NO.	PEN	REC.
								Water			
							8'		1	0	0
	8' to 8'	SS	50/0			V.Dnse. Wet					
10											
20											
								Bottom of boring 8'.			
30								Note: Hit boulders. Probed hole 3 times, hit boulders or rock on all holes! Inspector called hole!			
40											

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

DRILLER: M.C.
HELPER: V.C.
SOILS ENGINEER Kelly
DRILLING INSPECTOR

SAMPLE TYPE
C = CORED W = WASHED
SS = SPLIT SPOON
UP = UNDISTURBED PISTON
TP = TEST PIT
UT = UNDISTURBED THINWALL

COHESIONLESS DENSITY
0-10 LOOSE
10-30 MED. COMP.
30-50 DENSE
50+ VERY DENSE

TOTAL FOOTAGE:
Earth Boring Ft.
Rock Coring Ft.
HOLE NO.

NOT RESPONSIBLE FOR SAMPLE STORAGE AFTER ... DAYS

APPENDIX C

LABORATORY TESTING RESULTS

Appendix C

Soil Sample Numbers in Relation to Study Coves.

COVE NAME	EP TOXICITY TEST SAMPLE NUMBER
Resha Beach Cove	Sample No.5 (#1884C)
Sandy Cove	Sample No.4 (#1883C)
Sucker Brook Cove	Sample No.1 (#1880C)
Taylor Brook Cove	Sample No.2 (#1881C)
Jean Lore Cove	Sample No.3 (#1882C)

NORTHWEST ENVIRONMENTAL WATER LABS INC.

429 Main Street
Watertown, CT 06795
203 274-5445

November 16, 1990

WMC, Inc.
630 Oakwood Avenue, Suite 450
West Hartford, Ct. 06110

NEWL#: 1880C (#1), 1881C (#2), 1882C (#3), 1883C (#4), 1884C (#5)

Date Sample Collected: 11/2/90
Date Sample Received: 11/2/90
Date Analysis completed: 11/15/90

Parameter	Sample #1 #1880C	Sample #2 #1881C	Sample #3 #1882C	Sample #4 #1883C	Sample #5 #1884C
Lead	.03	.01	.01	.01	.01
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium, Total	0.02	0.02	0.03	0.02	0.03
Arsenic	0.04	<0.01	0.05	0.03	0.04
Selenium	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	<0.005	<0.005	<0.005	<0.005	<0.005
Barium	<1.0	4	8	10	3
Silver	<0.01	<0.01	<0.01	<0.01	<0.01

Results in mg/L.

Kellee L. Synnott
Laboratory Director

Analysis conducted in accordance with EPA 600/4-79-020 methods for chemical analysis of water and wastes.

Connecticut Certified Public Health Laboratory No. PH 0537 - EPA No. 061

The Connecticut Agricultural Experiment Station

123 HUNTINGTON STREET BOX 1106 NEW HAVEN, CONNECTICUT 06504

Founded 1875 *Putting science to work for society*

November 27, 1990

Ms. Kelly Fontana
Wengell, McDonnell & Costello, Inc.
630 Oakwood Avenue
West Hartford, CT 06110

Dear Ms. Fontana:

Enclosed are the results of our tests on the sediment from Highland Lake. The pyrophosphate test, which categorizes the state of organic matter, was not performed because it is usually irrelevant in samples which are not classified as organic (greater than 20% OM). Although sample B/9 was an organic sample, it shrunk so much upon drying we did not have enough to test. If you would like the test done on this sample, please submit additional sediment.

Feel free to call if you have questions.

Sincerely,

Greg Bugbee

Greg Bugbee
Department of Soil and Water
(203) 789-7235

GB/sc

enc.

THE CONNECTICUT AGRICULTURAL
EXPERIMENT STATION
123 HUNTINGTON ST.,P.O. BOX 1106
NEW HAVEN, CT 06504

KELLY FONTANA
630 OAKWOOD AVE.
WEST HARTFORD 06110

NOV 29

ATTN. HIGHLAND LAKE

PARTICLE SIZE ANALYSIS (%/WT.)

	....	....	SAND	....	....	TOTAL				
SAMPLE I.D	VCS	CS	MS	FS	VFS	SAND	SILT	CLAY	O.M.	TEX.
B1	0.7	8.6	18.7	45.3	12.9	86.3	11.0	2.5	2.6	LS
B2	0.8	4.8	4.0	59.3	17.8	86.9	10.0	2.9	2.9	LS
B3	6.2	23.2	16.9	44.6	5.6	96.8	1.8	1.2	0.4	S
B4	0.7	9.2	6.9	50.7	10.0	77.6	16.1	6.1	7.8	LS
B5	1.2	2.5	1.2	19.2	14.1	38.4	45.1	16.4	4.9	L
B6	0.0	1.3	1.3	36.4	14.5	53.6	37.0	9.2	3.6	SL
B7	0.7	4.5	5.2	30.0	15.0	55.6	39.5	4.8	2.3	SL
B8	0.0	5.0	1.0	25.2	13.1	44.4	44.6	10.9	2.7	SL
B9	3.1	9.3	6.2	25.0	9.3	53.1	31.8	15.0	10.3	SL
B10	6.2	17.8	8.9	27.6	11.6	72.3	21.2	6.4	4.8	LS
B11	10.9	30.6	18.0	24.0	7.6	91.2	5.6	3.0	0.9	S
B12	2.6	11.3	7.3	42.6	10.0	74.0	20.6	5.3	0.5	LS
B13	14.7	20.8	12.7	30.2	7.3	85.9	9.5	4.5	2.6	LS
B14	11.6	27.6	12.5	25.0	8.0	84.8	9.8	5.3	3.7	LS
B15	4.5	17.2	9.1	33.3	11.4	75.8	16.3	7.8	4.4	LS
B16	32.0	32.7	9.8	14.8	3.0	92.5	4.1	3.2	1.8	S
B17	1.3	6.5	5.2	31.5	18.4	63.1	25.7	11.0	16.8	SL
B18	2.8	12.6	7.0	39.4	12.6	74.6	15.7	9.5	8.4	LS
B19	3.6	4.5	5.4	17.2	8.1	39.0	13.6	47.2	29.2	O
B24	3.9	9.9	3.9	31.6	17.8	67.3	19.2	13.4	6.9	SL

FERTILITY OF SOIL

STATE OF CONNECTICUT
Office of Policy and Management

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

The accompanying "Soil Testing," folder explains the symbols used below and contains other information helpful in understanding this report. If you took samples as suggested in "Soil Testing," the treatments suggested should be helpful on the areas sampled.

KELLY FONTANA
630 OAKWOOD AVE.
WEST HARTFORD CT 06110

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
123 HUNTINGTON STREET
P.O. BOX 1106
NEW HAVEN, CT 06504-1106
TELEPHONE 789-7235

SEDIMENT FROM HIGHLAND LAKE

DATE: 11/14/90 PAGE 1

	TEST RESULTS					
LABORATORY NUMBER	4357	4358	4359	4360	4361	4362
YOUR SAMPLE	B1	B2	B3	B4	B5	B6
CROP TO BE GROWN						
SOIL TEXTURE	LS	LS	S	LS	L	SL
ORGANIC MATTER CONTENT	ML	ML	VL	MH	M	M
pH	6.3	5.4	6.3	4.9	5.3	5.4
NITRATE NITROGEN	L	L	ML	L	L	L
AMMONIA NITROGEN	ML	ML	ML	ML	MH	H
PHOSPHORUS	H	MH	H	MH	MH	H
POTASSIUM	ML	L	L	L	M	L
CALCIUM	H	M	M	ML	H	MH
MAGNESIUM	H	M	MH	M	M	ML

SUGGESTED TREATMENT IN POUNDS PER 1000 SQUARE FEET

LIMESTONE AMOUNT						
FERTILIZER GRADE						
FERTILIZER AMOUNT						

REMARKS

If a new seedbed, work lime in first *(if indicated)*; then apply fertilizer and rake in; finally, seed. If an established lawn, apply fertilizer when grass is dry.

FERTILITY OF YOUR SOIL MEASURED BY THE MORGAN METHOD. A PRODUCT OF RESEARCH AT THIS STATION

RTILITY OF SOIL

STATE OF CONNECTICUT
Office of Policy and Management

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

The accompanying "Soil Testing," folder explains the symbols used below and contains other information helpful in understanding this report. If you took samples as suggested in "Soil Testing," the treatments suggested should be helpful on the areas sampled.

KELLY FONTANA
630 OAKWOOD AVE.
WEST HARTFORD CT 06110

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
123 HUNTINGTON STREET
P.O. BOX 1106
NEW HAVEN, CT 06504-1106
TELEPHONE 789-7235

SEDIMENT FROM HIGHLAND LAKE

DATE: 11/14/90 PAGE 2

	TEST RESULTS					
LABORATORY NUMBER	4363	4364	4365	4366	4367	4368
YOUR SAMPLE	B7	B8	B9	B10	B11	B12
CROP TO BE GROWN						
SOIL TEXTURE	SL	SL	SL	LS	S	LS
ORGANIC MATTER CONTENT	ML	ML	H	M	L	L
pH	5.4	5.1	5.8	5.6	5.6	5.7
NITRATE NITROGEN	L	L	L	L	L	L
AMMONIA NITROGEN	M	MH	L	ML	L	L
PHOSPHORUS	MH	MH	MH	MH	MH	MH
POTASSIUM	L	ML	L	ML	L	ML
CALCIUM	ML	M	H	H	MH	MH
MAGNESIUM	M	M	H	H	H	H

SUGGESTED TREATMENT IN POUNDS PER 1000 SQUARE FEET						
LIMESTONE AMOUNT						
FERTILIZER GRADE						
FERTILIZER AMOUNT						

REMARKS

If a new seedbed, work lime in first *(if indicated)*; then apply fertilizer and rake in; finally, seed. If an established lawn, apply fertilizer when grass is dry.

FERTILITY OF YOUR SOIL MEASURED BY THE MORGAN METHOD. A PRODUCT OF RESEARCH AT THIS STATION

RTILITY OF SOIL

STATE OF CONNECTICUT
Office of Policy and Management

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

The accompanying "Soil Testing," folder explains the symbols used below and contains other information helpful in understanding this report. If you took samples as suggested in "Soil Testing," the treatments suggested should be helpful on the areas sampled.

KELLY FONTANA
630 OAKWOOD AVE.
WEST HARTFORD CT 06110

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
123 HUNTINGTON STREET
P.O. BOX 1106
NEW HAVEN, CT 06504-1106
TELEPHONE 789-7235

SEDIMENT FROM HIGHLAND LAKE

DATE: 11/14/90 PAGE 3

	TEST RESULTS					
LABORATORY NUMBER	4369	4370	4371	4372	4373	4374
YOUR SAMPLE	B13	B14	B15	B16	B17	B18
CROP TO BE GROWN						
SOIL TEXTURE	LS	LS	LS	S	SL	LS
ORGANIC MATTER CONTENT	ML	ML	M	L	VH	MH
pH	5.7	6.2	5.5	5.4	5.8	5.9
NITRATE NITROGEN	L	L	L	L	L	L
AMMONIA NITROGEN	L	L	L	L	L	L
PHOSPHORUS	MH	M	H	H	ML	MH
POTASSIUM	L	L	L	L	L	L
CALCIUM	ML	M	M	ML	ML	MH
MAGNESIUM	MH	MH	MH	MH	MH	H

SUGGESTED TREATMENT IN POUNDS PER 1000 SQUARE FEET						
LIMESTONE AMOUNT						
FERTILIZER GRADE						
FERTILIZER AMOUNT						

REMARKS

If a new seedbed, work lime in first *(if indicated)*; then apply fertilizer and rake in; finally, seed. If an established lawn, apply fertilizer when grass is dry.

FERTILITY OF YOUR SOIL MEASURED BY THE MORGAN METHOD. A PRODUCT OF RESEARCH AT THIS STATION

RTILITY OF SOIL

STATE OF CONNECTICUT
Office of Policy and Management

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SEDIMENT FROM HIGHLAND LAKE

DATE: 11/14/90 PAGE 4	TEST RESULTS					
LABORATORY NUMBER	4375	4376				
YOUR SAMPLE	B19	B24				
CROP TO BE GROWN						
SOIL TEXTURE	O	SL				
ORGANIC MATTER CONTENT	VH	M				
pH	5.5	5.2				
NITRATE NITROGEN	L	L				
AMMONIA NITROGEN	L	L				
PHOSPHORUS	L	M				
POTASSIUM	L	L				
CALCIUM	ML	L				
MAGNESIUM	MH	L				

SUGGESTED TREATMENT IN POUNDS PER 1000 SQUARE FEET

LIMESTONE AMOUNT						
FERTILIZER GRADE						
FERTILIZER AMOUNT						

REMARKS

I. ⌐ new seedbed, work lime in first *(if indicated)*; then apply fertilizer and rake in; finally, seed. If an established lawn, apply fertilizer when grass is dry.

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The Connecticut Agricultural Experiment Station

123 HUNTINGTON STREET BOX 1106 NEW HAVEN, CONNECTICUT 06504

Founded 1875 Putting science to work for society

December 4, 1990

RECEIVED DEC 5

Ms. Kelly Fontana
Wengell, McDonnell and Costello, Inc.
630 Oakwood Avenue
West Hartford, CT 06110

Dear Ms. Fontana:

In response to your phone call of December 3, 1990 I am categorizing the possible uses of your Highland Lake samples based upon our test results.

Sample ID	Characteristics	Possible Use
B3, B11, B12, B16	High sand, low OM	Fill
B1, B2, B5, B6, B7 B8, B13, B14, B19	Medium high sand, medium low OM or high silt and clay (B5) or high OM with high shrink swell (B19)	Fill or low quality topsoil
B4, B10, B15, B24	Medium sand, medium OM	Topsoil
B9, B17, B18	Medium sand, high OM	Good topsoil

Various mixtures of the above samples may expand the uses of the lower quality materials. Limestone and fertilizer should be added according to the suggestions on the enclosed soil tests. Please call if you have any questions.

Sincerely,

Greg Bugbee

Greg Bugbee
Department of Soil and Water

GB/sc

enc.

FERTILITY OF SOIL

STATE OF CONNECTICUT
Office of Policy and Management

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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DEC 5

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SEDIMENT FROM HIGHLAND LAKE

DATE: 11/14/90 PAGE 1	TEST RESULTS					
LABORATORY NUMBER	4357	4358	4359	4360	4361	4362
YOUR SAMPLE	B1	B2	B3	B4	B5	B6
CROP TO BE GROWN						
SOIL TEXTURE	LS	LS	S	LS	L	SL
ORGANIC MATTER CONTENT	ML	ML	VL	MH	M	M
pH	6.3	5.4	6.3	4.9	5.3	5.4
NITRATE NITROGEN	L	L	ML	L	L	L
AMMONIA NITROGEN	ML	ML	ML	ML	MH	H
PHOSPHORUS	H	MH	H	MH	MH	H
POTASSIUM	ML	L	L	L	M	L
CALCIUM	H	M	M	ML	H	MH
MAGNESIUM	H	M	MH	M	M	ML

SUGGESTED TREATMENT IN POUNDS PER 1000 SQUARE FEET

LIMESTONE AMOUNT	25 lbs.	80 lbs.	25 lbs	175 lbs.	150 lbs.	125 lbs.
FERTILIZER GRADE	← 5-10-10 →					
FERTILIZER AMOUNT	← 20 lbs. →					

REMARKS

If a new seedbed, work lime in first *(if indicated)*; then apply fertilizer and rake in; finally, seed. If an established lawn, apply fertilizer when grass is dry.

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WEST HARTFORD CT 06110

DEC

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123 HUNTINGTON STREET
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SEDIMENT FROM HIGHLAND LAKE

DATE: 11/14/90 PAGE 2	TEST RESULTS					
LABORATORY NUMBER	4363	4364	4365	4366	4367	4368
YOUR SAMPLE	B7	B8	B9	B10	B11	B12
CROP TO BE GROWN						
SOIL TEXTURE	SL	SL	SL	LS	S	LS
ORGANIC MATTER CONTENT	ML	ML	H	M	L	L
pH	5.4	5.1	5.8	5.6	5.6	5.7
NITRATE NITROGEN	L	L	L	L	L	L
AMMONIA NITROGEN	M	MH	L	ML	L	L
PHOSPHORUS	MH	MH	MH	MH	MH	MH
POTASSIUM	L	ML	L	ML	L	ML
CALCIUM	ML	M	H	H	MH	MH
MAGNESIUM	M	M	H	H	H	H

SUGGESTED TREATMENT IN POUNDS PER 1000 SQUARE FEET

LIMESTONE AMOUNT	125 lbs.	150 lbs.	75 lbs.	100 lbs.	80 lbs.	75 lbs.
FERTILIZER GRADE	←		5-10-10	→		
FERTILIZER AMOUNT	←		20 lbs	→		

REMARKS

If a new seedbed, work lime in first *(if indicated)*; then apply fertilizer and rake in; finally, seed. If an established lawn, apply fertilizer when grass is dry.

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SEDIMENT FROM HIGHLAND LAKE

DATE: 11/14/90 PAGE 3

TEST RESULTS						
LABORATORY NUMBER	4369	4370	4371	4372	4373	4374
YOUR SAMPLE	B13	B14	B15	B16	B17	B18
CROP TO BE GROWN						
SOIL TEXTURE	LS	LS	LS	S	SL	LS
ORGANIC MATTER CONTENT	ML	ML	M	L	VH	MH
pH	5.7	6.2	5.5	5.4	5.8	5.9
NITRATE NITROGEN	L	L	L	L	L	L
AMMONIA NITROGEN	L	L	L	L	L	L
PHOSPHORUS	MH	M	H	H	ML	MH
POTASSIUM	L	L	L	L	L	L
CALCIUM	ML	M	M	ML	ML	MH
MAGNESIUM	MH	MH	MH	MH	MH	H

SUGGESTED TREATMENT IN POUNDS PER 1000 SQUARE FEET						
LIMESTONE AMOUNT	75 lbs	25 lbs.	100 lbs.	75 lbs.	100 lbs.	75 lbs.
FERTILIZER GRADE	← 5-10-10 →					
FERTILIZER AMOUNT	← 20 lbs →					

REMARKS

If a new seedbed, work lime in first *(if indicated)*; then apply fertilizer and rake in; finally, seed. If an established lawn, apply fertilizer when grass is dry.

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YOUR SAMPLE	B19	B24				
CROP TO BE GROWN						
SOIL TEXTURE	O	SL				
ORGANIC MATTER CONTENT	VH	M				
pH	5.5	5.2				
NITRATE NITROGEN	L	L				
AMMONIA NITROGEN	L	L				
PHOSPHORUS	L	M				
POTASSIUM	L	L				
CALCIUM	ML	L				
MAGNESIUM	MH	L				

SUGGESTED TREATMENT IN POUNDS PER 1000 SQUARE FEET

LIMESTONE AMOUNT	100 lbs.	125 lbs				
FERTILIZER GRADE	← 5-10-10 →					
FERTILIZER AMOUNT	← 20 lbs. →					

REMARKS

On new seedbed, work lime in first *(if indicated)*; then apply fertilizer and rake in; finally, seed. If an established lawn, apply fertilizer when grass is dry.

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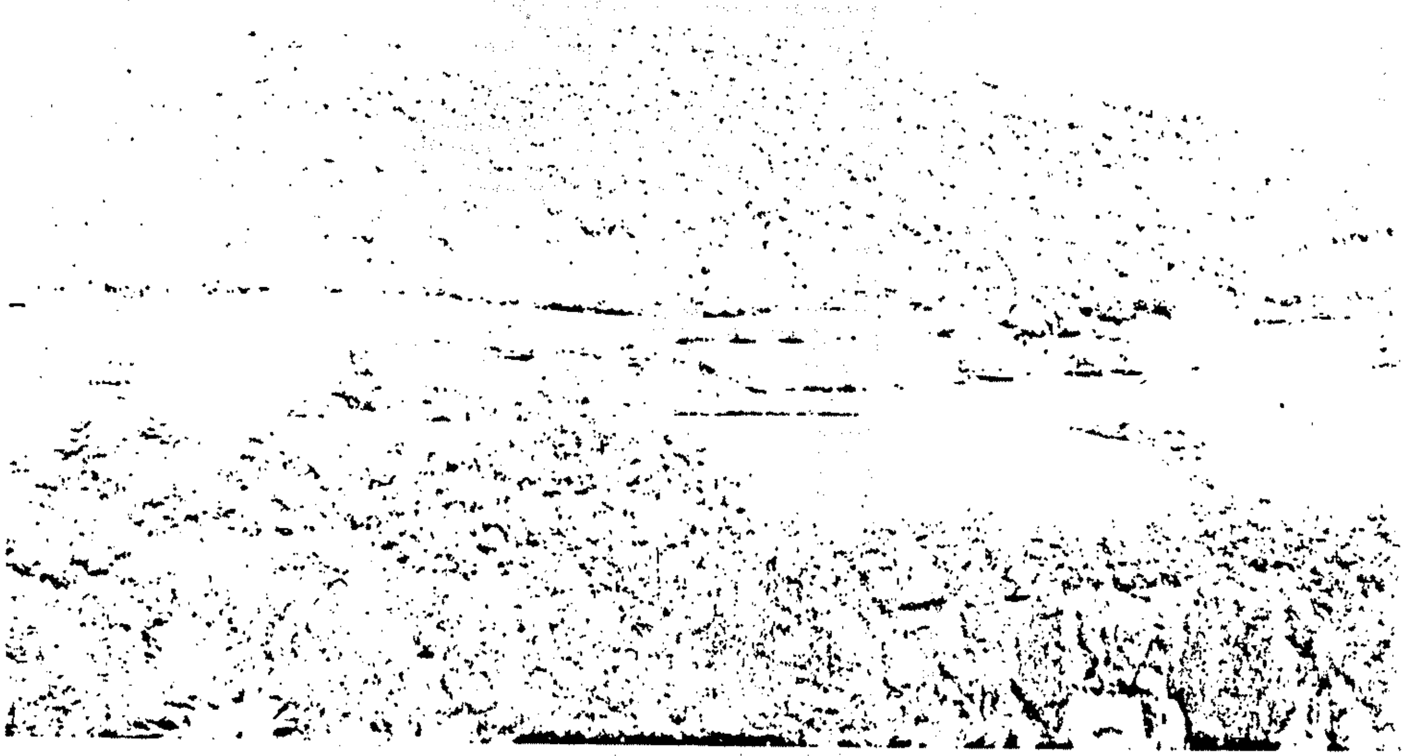
APPENDIX D

SOIL SURVEY DESCRIPTIONS

Issued Novem

SOIL SURVEY
Litchfield County Connecticut



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
CONNECTICUT AGRICULTURAL EXPERIMENT STATION
and
STORRS AGRICULTURAL EXPERIMENT STATION

SOIL LEGEND

The first capital letter in each symbol is the initial one of the soil name. The second capital letter, A, B, C, D, or E, if used, shows the slope. Some symbols which contain no slope letter are for nearly level soils or land types; some are for soils or land types that have considerable range in slope. A final number, 2, in a symbol shows that the soil is eroded.

SYMBOL	NAME
GaB	Gloucester sandy loam, 3 to 8 percent slopes
GaC	Gloucester sandy loam, 8 to 15 percent slopes
GaD	Gloucester sandy loam, 15 to 25 percent slopes
GbB	Gloucester stony sandy loam, 3 to 8 percent slopes
GbC	Gloucester stony sandy loam, 8 to 15 percent slopes
GbD	Gloucester stony sandy loam, 15 to 25 percent slopes
GeC	Gloucester very stony sandy loam, 3 to 15 percent slopes
GeE	Gloucester very stony sandy loam, 15 to 35 percent slopes
Gf	Genesee silt loam
Gn	Granby loamy fine sand
GrA	Groton gravelly sandy loam, 0 to 3 percent slopes
GrC	Groton gravelly sandy loam, 3 to 15 percent slopes
HbA	Hartland silt loam, 0 to 3 percent slopes
HbB	Hartland silt loam, 3 to 8 percent slopes
HbC	Hartland silt loam, 8 to 15 percent slopes
HeA	Hero loam, 0 to 3 percent slopes
HeB	Hero loam, 3 to 8 percent slopes
HkA	Hinckley gravelly sandy loam, 0 to 3 percent slopes
HkC	Hinckley gravelly sandy loam, 3 to 15 percent slopes
HmA	Hinckley gravelly loamy sand, 0 to 3 percent slopes
HmC	Hinckley gravelly loamy sand, 3 to 15 percent slopes
HoC	Hollis rocky fine sandy loam, 3 to 15 percent slopes
HrC	Hollis very rocky fine sandy loam, 3 to 15 percent slopes
HrE	Hollis very rocky fine sandy loam, 15 to 35 percent slopes
HxC	Hollis extremely rocky fine sandy loam, 3 to 15 percent slopes
HxE	Hollis extremely rocky fine sandy loam, 15 to 35 percent slopes
HyC	Holyoke very rocky silt loam, 3 to 15 percent slopes
HzE	Holyoke extremely rocky silt loam, 15 to 35 percent slopes
Ka	Kendaia silt loam
Ke	Kendaia-Lyons very stony silt looms
Lc	Leicester fine sandy loam
Le	Leicester stony fine sandy loam
Lg	Leicester, Ridgebury and Whitman very stony fine sandy loams
Lm	Limerick silt loam
Ly	Lyons silt loam
Ma	Made land
MyA	Merrimac sandy loam, 0 to 3 percent slopes
MyB	Merrimac sandy loam, 3 to 8 percent slopes
MyC	Merrimac sandy loam, 8 to 15 percent slopes
On	Ondawa fine sandy loam
PbA	Paxton fine sandy loam, 0 to 3 percent slopes
PbB	Paxton fine sandy loam, 3 to 8 percent slopes
PbB2	Paxton fine sandy loam, 3 to 8 percent slopes, eroded
PbC	Paxton fine sandy loam, 8 to 15 percent slopes
PbC2	Paxton fine sandy loam, 8 to 15 percent slopes, eroded
PbD	Paxton fine sandy loam, 15 to 25 percent slopes
PbD2	Paxton fine sandy loam, 15 to 25 percent slopes, eroded
PbE	Paxton fine sandy loam, 25 to 35 percent slopes
PdB	Paxton stony fine sandy loam, 3 to 8 percent slopes
PdC	Paxton stony fine sandy loam, 8 to 15 percent slopes
PdD	Paxton stony fine sandy loam, 15 to 25 percent slopes

SYMBOL	NAME
PeA	Paxton very stony fine sandy loam, 0 to 3 percent slopes
PeC	Paxton very stony fine sandy loam, 3 to 15 percent slopes
PeD	Paxton very stony fine sandy loam, 15 to 35 percent slopes
Pk	Peat and Muck
Pm	Muck, shallow
Po	Podunk fine sandy loam
Rc	Raynham silt loam
Rd	Ridgebury fine sandy loam
Re	Riverwash
Rg	Ridgebury stony fine sandy loam
Rh	Rock land
Ru	Rumney fine sandy loam
Sb	Saco silt loam
Sf	Scarboro loamy fine sand
SkC	Shapleigh very rocky sandy loam, 3 to 15 percent slopes
SkE	Shapleigh very rocky sandy loam, 15 to 35 percent slopes
SmC	Shapleigh extremely rocky sandy loam, 3 to 15 percent slopes
SmE	Shapleigh extremely rocky sandy loam, 15 to 35 percent slopes
SnA	Stockbridge loam, 0 to 3 percent slopes
SnB	Stockbridge loam, 3 to 8 percent slopes
SnB2	Stockbridge loam, 3 to 8 percent slopes, eroded
SnC	Stockbridge loam, 8 to 15 percent slopes
SnC2	Stockbridge loam, 8 to 15 percent slopes, eroded
SnD2	Stockbridge loam, 15 to 25 percent slopes, eroded
SpB	Stockbridge stony loam, 3 to 8 percent slopes
SpC	Stockbridge stony loam, 8 to 15 percent slopes
SpD	Stockbridge stony loam, 15 to 25 percent slopes
SrC	Stockbridge very stony loam, 3 to 15 percent slopes
SrD	Stockbridge very stony loam, 15 to 35 percent slopes
St	Suncook loamy fine sand
SvA	Sutton fine sandy loam, 0 to 3 percent slopes
SvB	Sutton fine sandy loam, 3 to 8 percent slopes
SwA	Sutton stony fine sandy loam, 0 to 3 percent slopes
SwB	Sutton stony fine sandy loam, 3 to 8 percent slopes
SxA	Sutton very stony fine sandy loam, 0 to 3 percent slopes
SxC	Sutton very stony fine sandy loam, 3 to 15 percent slopes
Tg	Terrace escarpments
TwA	Tisbury and Sudbury soils, 0 to 3 percent slopes
TwB	Tisbury and Sudbury soils, 3 to 8 percent slopes
Wl	Walpole and Raynham soils
Wmx	Wareham loamy fine sand, nonacid variant
Wp	Whitman stony fine sandy loam
WvA	Windsor loamy fine sand, 0 to 3 percent slopes
WvB	Windsor loamy fine sand, 3 to 8 percent slopes
WvC	Windsor loamy fine sand, 8 to 15 percent slopes
WxA	Woodbridge fine sandy loam, 0 to 3 percent slopes
WxB	Woodbridge fine sandy loam, 3 to 8 percent slopes
WxC	Woodbridge fine sandy loam, 8 to 15 percent slopes
WyA	Woodbridge stony fine sandy loam, 0 to 3 percent slopes
WyB	Woodbridge stony fine sandy loam, 3 to 8 percent slopes
WyC	Woodbridge stony fine sandy loam, 8 to 15 percent slopes
WzA	Woodbridge very stony fine sandy loam, 0 to 3 percent slopes
WzC	Woodbridge very stony fine sandy loam, 3 to 15 percent slopes

Soil map constructed 1968 by Cartographic Division, Soil Conservation Service, USDA, from 1963 aerial photographs. Controlled mosaic based on Connecticut plane coordinate system, State zone, Lambert conformal conic projection, 1927 North American datum.

APPENDIX E

SCOPE OF SERVICES

HIGHLAND LAKE DREDGING FEASIBILITY STUDY

SCOPE OF SERVICES

PROJECT DESCRIPTION

In the recent past, Highland Lake has experienced problems with lake water quality. Investigation by the Highland Lake Commission (HLC) and the State of Connecticut Department of Environmental Protection (DEP) determined that one of the potential sources of these water quality problems is the deposition of unconsolidated sediments in several coves around the lake. According to residents on the lake, many cove areas that used to have sandy bottoms 20 to 30 years ago, are now covered with sediment.

During the winter drawdown of the Lake, when these sediments are exposed, they wash into the central lake area so that in the spring when the lake is re-filled and again during the summer when lake activity is high, these sediments become suspended in the lake water and reduce water quality. Additionally, these sediments contain organic materials which appear to be decomposing, thereby causing a reduction in oxygen levels in the lake water.

It has been shown through past experience, that Highland Lake can be drawn down approximately 6 to 8 feet to expose the lake bottom in the shallow cove areas. Based on this, the DEP has determined that a feasibility study for removing this sediment should be performed, focusing on drawdown and dry excavation of sediments. Hydraulic dredging, which can take longer than excavation and requires a large containment area close to the lake for draining and storage of the dredged material prior to disposing of it off-site shall also be studied.

The study areas are identified as five coves at the following locations:

1) Resha Beach - southwest corner of first bay

2) Sandy Cove - south shore at east side of first bay, just west of Shore Drive

3) Sucker Brook Cove - outlet of Sucker Brook on the west shore of third bay

4) Taylor Brook Cove - outlet of Taylor Brook on the southwest corner of third bay

5) Un-named cove - east shore of second bay

SCOPE OF SERVICES

I. DETAILED WORKPLAN

WMC shall prepare a detailed workplan for the study that will be acceptable to the HLC and the DEP. This workplan shall include all requirements of this scope of services and any other requirements of the DEP. The fee for preparation of this workplan is included in the lump sum price proposed for the study.

II. SITE INVESTIGATION

A. SURVEY - The DEP has required performance of survey and sub-surface exploration when the Lake is at a normal level and therefore all work should be considered to be performed from the water surface.

B. SUBSURFACE INVESTIGATION - As with the survey schedule and methods, borings should be performed with barge mounted rigs, performing the work when the Lake level is high.

A minimum of four borings shall be taken at each cove. At each of the five problem areas, two samples will be extracted from each boring; one from the unconsolidated sediment layer and one from the underlying granular material. Four additional grab samples will be taken from the surface of the unconsolidated sediment layer in each cove, as required to determine the material characteristics. In addition to the borings, pipe probes to determine sediment depths shall be performed using a grid pattern that is appropriate for the size and accessibility of each cove under study. An average of 20 probes per cove shall be performed.

C. LABORATORY TESTING - Four sediment samples per cove shall be analyzed for the following properties; grain size, organic carbon, dewatering/drying characteristics and commercial/agricultural attributes. At least one sediment sample from each cove shall be analyzed for metal toxicity (EP Toxicity).

III. FEASIBILITY REPORT

A. MAPPING - From the survey, boring and pipe probe data, separate maps shall be prepared for each cove showing normal water depths before and after removal of sediments, unconsolidated sediment depths, and approximate water table depths after drawdown.

Additionally, a map showing lake depths during the different drawdown depths will be prepared for the five coves.

B. REPORT - A final report shall be prepared describing the various site investigations performed, testing results and the effects the results may have on the feasibility of dredging the lake. The report will focus on removal of sediments in the five study areas, including disposal location options and potential uses of the excavated sediments, ability of the substrata to support earth moving equipment, and an opinion of the potential costs based on the volumes of sediment to be removed and the results of site investigation and testing described above. The study shall include different methods of dredging such as hydraulic dredging and wet drag-line excavation shall be studied for applicability and comparison with the dry excavation method.

IV. IMPLEMENTATION PLAN

An implementation plan shall be devised based on the needs of the Highland Lake Commission and the DEP. This plan shall be prepared so that construction in each of the five problem areas can be implemented independently over several years. The plan for each of the five study areas shall describe existing and proposed lake bathymetry, existing and proposed cove bottom contours, sediment characteristics and volumes, drawdown procedures, detailed dredging procedures, equipment feasibility and access, erosion and sedimentation control, disposal options, sedimentation and storage pond locations and procedures, sedimentation dewatering procedures, permit requirements, fisheries concerns, timetables and costs.

In addition, sources of grant funds for performance of the dredging work shall be explored and presented in the report.

Twenty five copies of the draft report shall be prepared and submitted to the HLC for review and forwarding to the DEP for preliminary review.

Following receipt of comments from the HLC and DEP, and modification of the report, as necessary, twenty five copies of the final report shall be submitted.

Monthly meetings shall be held with the HLC to present status updates on the progress of the study. In addition, WMC shall meet with representatives of DEP to prepare and finalize the workplan and to periodically discuss the status of the study.

Following completion and acceptance of the report by the HLC and the DEP, WMC will attend and present the findings of the report at three public meetings. These presentations shall include graphic presentations of study findings for ease of understanding by the public.

APPENDIX F

WATER BUDGET CALCULATIONS

Data from Water Resources Inventory of Connecticut
Farmington River Basin, USGS

JUN 24 1991

HIGHLAND LAKE DRAWDOWN

Surface Area = 444 acres = 19,340,640 ft^2
Surface area at 6.5 ft = 336 acres = 14,636,160 ft^2
Surface area at 13.1 ft = 270.6 acres = 11,787,336 ft^2

Volume of frustrum = $^h/3\ (A_1 + A_2 + \sqrt{A_1 \times A_2})$
h = depth of frustrum
A_1 = area of frustrum surface
A_2 = area of frustrum bottom

Frustrum #1

$^{6.5}/3\ (19,340,640 + 14,636,160 + \sqrt{19,340,640 \times 14,636,160})$

2.17 (19,340,640 + 14,636,160 + 16,824,765)

110,239,396 ft^3

Frustrum #2

$^{13.1}/3\ (19,340,640 + 11,787,336 + \sqrt{19,340,640 \times 11,787,336})$

4.37 (19,340,640 + 11,787,336 + 15,098,829)

202,011,138 ft^3

6.5 + 13.1 = 19.6
expected drawdown = 8
therefore 19.6 ÷ 2.45 = 8

Frustrum 1 = 110,239,396 ft^3
Frustrum 2 = 202,011,138 ft^3

F1 + F2 = 312,250,534 ft^3

312,250,534 ÷ 2.45 = 127,449,197 ft^3

CHARLES LEE
SENIOR ENV. ANALYST
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER MANAGEMENT
TELEPHONE
(203) 566-6691
(203) 566-2588
122 WASHINGTON ST.
HARTFORD, CT 06106
PRINTED ON RECYCLED PAPER

Watershed area = 7.05 mi^2 or 196,542,720 ft^2

Mean monthly runoff 1931-1960 Farmington River Basin

March 4.10" = .342 ft
Feb. 2.05" = .170 ft
Jan. 2.38" = .198 ft

March .342 ft x 196,542,720 ft^2 = 67,217,610 ft^3
Feb. .170 ft x 196,542,720 ft^2 = 33,412,262 ft^3
Jan. .198 ft x 196,542,720 ft^2 = 38,980,973 ft^3

139,610,844 ft^3

127,449,197 ft^3 ÷ 139,610,844 ft^3 = .913 or 91.3 % of the average available runoff between January 1st and March 31st is needed to refill the lake given a 8ft drawdown. Refill should begin by January 1st.

APPENDIX G

DEP FISHERIES REPORT COMMENTS

* install and maintain all appropriate erosion and sediment control devices

* maintain free passage through the channel of Taylor Brook as trout from the Lake may be utilizing the stream for spawning

I strongly suggest that you solicit input from Chuck Phillips or Eric Schluntz (DEP Inland Fisheries, Eastern District) as they have the "hands on" knowledge of the Lake and would be better able to address concerns and/or potential impacts to the coldwater fishery component.

CC: R. Jacobson, Inland Fisheries, Hartford
C. Phillips, E. Schluntz, Inland Fisheries, Marlborough
Files

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MESSAGE

To	Name, Title Chuck Lee	Date 6/21/91
	Agency, Address DEP, Water Compliance, 122 washington St., Hartford, CT 06106	
From	Name, Title Chuck Phillips, District Fisheries Supervisor	Telephone 344-2115
	Agency, Address DEP, Inland Fisheries, 209 Hebron Rd, Marlborough, CT 06447	

Subject: Highland Lake Dredging Feasibility Study

1. Eric Schluntz and I have reviewed subject document and the comments made by Donald Mysling, Technical Assistance Biologist. We are in concurrence with his comments.

2. Additionally, as the planning process continues, we would welcome the opportunity to meet with the consultant and representatives from the lake community to discuss the use of habitat improvement structures at the mouths of Taylor and Sucker Brooks. These structures would be designed to improve cover for brown trout entering the stream mouth areas in preparation for spawning in the late fall. The structures would be low cost and easily installed by two workers.

3. These structures would be particularly effective in protecting brown trout from predators during years when the lake is drawn down.

Chuck
Chuck

cc: D. Mysling
R. Jacobson
W. Hyatt

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