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Weston Solutions, Inc.
Suite 100
2501 Jolly Road
Okemos, Michigan 48864
517 381-5920 • Fax 517 381-5921

Technical Memorandum

TO: Ralph Dollhopf, United States Environmental Protection Agency

FROM: Sonny Rutkowski, Rex Johnson, Chris Lantinga Weston Solutions, Inc. (WESTON) START

DATE: October 22, 2012

SUBJECT: Enbridge Oil Spill Submerged Oil Containment Strategy: Recommendations for Submerged Oil Containment at Morrow Lake Delta, Ceresco Dam, and Mill Pond Impoundments

On behalf of the U.S. Environmental Protection Agency (U.S. EPA), the Weston Solutions, Inc. (WESTON) Superfund Technical Assessment and Response Team (START) has prepared this Technical Memorandum to summarize the recommendations for winter reconfiguration of submerged oil containment for the Morrow Lake Delta (MLD) installed in Summer 2012. Also included are recommendations for installation of submerged oil containment systems at the Ceresco Dam and Mill Ponds impoundment areas. Evidence from poling data within all three locations shows accumulations of moderate and heavy submerged oil (sub oil) which could be mobilized further downstream during episodic higher flows historically likely in late winter and spring.

OBJECTIVE

The goal of the adjustments to the existing E4 containment system in MLD and installation of submerged oil containment at the Ceresco Dam and Mill Pond impoundments is to prevent the further migration of the accumulated submerged oil through the winter and spring runoff, considering the potential risk of damage and/or compromise from surface ice buildup, until such time that recovery of the submerged oil within these three areas can be completed.

BACKGROUND

MORROW LAKE DELTA

The primary concern with retaining the current E4 containment system through the winter is the vulnerability of the surface boom to ice floes and resultant forces on the anchor posts and curtains. To allow passage of ice through the system, the re-design of the containment should avoid having boom or support cables and curtain within the top 1’ (or more) of the water column to minimize damage from and allow passage of ice (ice zone).

Similar to the strategy of the June 2012 installation, the strategy of the proposed winter reconfiguration at MLD allows the mid and upper water column to pass unimpeded. However, curtains and cables are lowered to minimize contact with anticipated ice floes. Chains to weight the bottom of the curtain should continue to be used to ensure the curtain bottom remains in contact with the river bottom. The full extent of forces on the anchor posts, given the recommended curtain reconfiguration and anticipated river velocities and ice floes, should be understood and documented prior to installation. A plan schematic and cross sections depicting the proposed revised curtain alignment at the MLD are shown in Figure 1.

CERESCO DAM AND MILL POND IMPOUNDMENTS

Submerged oil containment structures are also required at the Ceresco Dam and Mill Pond impoundments to prevent the further migration of submerged oil through the winter and spring runoff periods. Plan schematics depicting proposed containment alignments and cross sections showing the areas in which the submerged oil containment could be considered at Ceresco Dam and Mill Pond impoundments are shown in Figure 2 and Figure 3, respectively. Because no submerged oil containment system currently exists in these areas, Weston START considered containment system alternatives other than the subsurface cable and curtain system proposed at the MLD.

SITE DATA REVIEW

The target areas for winter submerged oil containment are located within major impoundment areas upstream of a series of dams on the Kalamazoo River (e.g., Ceresco, Mill Pond, and Morrow Lake). The respective impoundments are characterized by lower river gradients and slower current velocities when compared to other locations along the river and, as a result, they are sites of widespread fine sediment and submerged oil deposition/accumulation.

Data reviewed for each of the target areas included the submerged oil distribution determined from poling assessments, bathymetry, site geomorphology, soft sediment thickness, river discharge and water levels, velocity data (typical and intermediate historical data and modeled flood event data), and monitoring (poling) data for the existing E4 boom/curtain system at MLD.

The 2011 and 2012 poling reassessment data were examined to identify the spatial variation in submerged oil accumulations within each of the impoundment areas. The 2011 and 2012 poling data generally show similar patterns of widespread heavy and moderate submerged oil accumulations within shallow, low velocity portions of the impoundments. Additionally, the 2012 poling data appear to show a trend of increased areal extent of heavy and moderate submerged oil within deeper, channelized portions of the impoundments which are potentially exposed to greater water velocities. This latter distribution may be due to the overall low flow conditions observed in the Kalamazoo River during 2012. Generally, individual containment features under consideration for the impoundment areas were selected to be downstream of heavy and moderate submerged oil accumulation areas, especially those located in channelized portions of the impoundments.

Bathymetry data for the impoundments were examined in order to identify water depth conditions and select locations for subsurface containment features. Contour maps of bathymetry were developed for each impoundment using water depth measurements recorded during the Spring 2012 poling reassessment and the Summer 2012 velocity survey tasks. These maps show that each of the impoundments includes large shallow areas with typical low-flow water depths of 1-2 feet, and narrow channelized areas with corresponding water depths of 3-9 feet. A low-flow water depth of 3 feet was generally targeted as the practical minimum depth required for placement of subsurface winter containment using silt curtains. Based on these criteria, the winter containment would generally be limited to the channelized portions of the impoundments. Alternatives for shallower water depths were also evaluated.

Geomorphic subdivision of the impoundment areas has been performed based on a combination of bathymetry and bottom sediment composition and thickness inferred from poling and/or sediment coring data. The deeper channelized areas typically contain bottom sediments consisting of relatively thin accumulations (e.g., 0.5 to 1.5 feet) of sand with some gravel which are difficult to penetrate during poling or coring. In contrast, the broad shallow impoundment areas typically contain a thicker sequence (e.g., 1.0 to 3.0 feet or greater) of soft sediments consisting of predominantly silt that are readily penetrated during poling. Channel bar deposits of mixed composition (e.g., sand and silt) and intermediate thickness are present intermittently along the margins of the channels in some of the impoundment areas. The channelized areas are generally inferred to coincide with the location of the former pre-dam river channel which has retained some of its original sediment characteristics, whereas the adjacent shallow areas likely represent former overbank areas in which post-dam, predominantly fine-grained sediments have accumulated. Soft sediment thickness values measured during Spring 2012 poling were contoured for each of the target impoundment areas. The resulting soft sediment thickness contours generally agree with the trends described above. However, accumulations of soft sediment were detected within channelized portions of the Ceresco Dam, Mill Pond and MLD impoundments which also coincide with areas of heavy and moderate submerged oil accumulations. These materials are tentatively inferred to represent low flow sediment accumulations which are potentially subject to remobilization during high flow conditions.

Historic discharge data provide important constraints for both the timing of installation and the design of proposed submerged oil containment systems in the Kalamazoo River. Median discharge values recorded at the USGS Kalamazoo River gage stations typically indicate annual minimum values in Jan-Feb and Aug-Sept, and annual maximum values in March-May and Dec-Jan. The Jan-Feb minimum likely results from freezing conditions, whereas the Aug-Sept discharge minimum coincides with a seasonal precipitation minimum. Similarly, the March-May maximum reflects snow melt plus increased precipitation, whereas the Dec-Jan maximum coincides with a late fall seasonal increase in precipitation and runoff. In order to be most effective, it will be necessary for the submerged oil containment features to be in place prior to the period of maximum discharge in March-May. As it is impractical to attempt installation during the short interval between ice breakup and onset of maximum discharges, it would therefore be preferable to install the subsurface containment prior to ice formation. This target date further requires that the containment features would have to be installed below the estimated maximum depth of ice formation at the specified locations.

Water levels in the river generally track the discharge trends, with the added observation that the impoundments typically show the least variation in water levels resulting from changes in discharge (e.g., due to greater water storage capacity available at impoundment locations). Assuming typical freezing conditions, low water levels are expected during the initial period (e.g., Jan- Feb). Recent September 2012 discharges recorded at the USGS Kalamazoo River gages were well below the median discharge values for the Jan-Feb period; therefore, corresponding water levels (e.g., water surface elevations) for this period were selected as conservative estimates of projected minimum water surface elevations in the respective impoundment areas during the upcoming winter period (it is emphasized that the specified selection assumes freezing conditions; water levels may be considerably higher if no freezing occurs). These selected elevation data, combined with an allowance for maximum ice thickness, provide an upper elevation limit for placement of subsurface containment features. In combination with the bathymetry, these data were used to confirm suitable locations for containment features as well as to determine the target heights above the river bottom for any submerged oil containment features.

Representative velocity measurements have been obtained from all of the impoundment areas under typical low flow (e.g., 300-500 cubic feet per second (cfs) at the USGS Kalamazoo River Battle Creek (KRBC) gage; June-July 2012 period) and intermediate flow conditions (e.g., 600-800 cfs at the USGS KRBC gage; Oct-Nov. 2011 period). Additional simulated velocities are available for higher flow/discharge conditions from the preliminary site hydrodynamic model (HDM). The measured velocities confirm that the maximum velocities within the impoundments occur within the channelized areas. Maximum average velocities recorded during low flow conditions in channel areas at the MLD and Ceresco Dam impoundments were similar at 0.6 to 0.8 feet per second (ft/sec), while slightly higher maximum average velocities of 0.8 to 1.0 ft/sec were recorded at the Mill Pond impoundment. It is noted that the indicated low-flow measured velocities are considered to be representative of expected sub-ice winter velocities, given that the discharge values recorded at the time of the measurements are similar to projected winter values (e.g., under frozen conditions). The maximum average velocities for the intermediate flow event at the MLD and Ceresco locations were similar to the low flow values, while slightly higher values of 1.0 to 1.2 ft/sec were reported for the Mill Pond impoundment; however, these differences could in part reflect the timing of the measurements relative to changes in the discharge hydrograph for the measurement period. The preliminary HDM results for representative higher flow events (e.g., 2,000 cfs at the USGS KRBC gage = est. 1 year recurrence interval; May 16-23, 2011 period) show maximum velocities of 1.0 to 1.5 ft/sec for targeted portions of all three impoundment areas. The available velocity data confirm the range of velocities expected in the target impoundment areas of the Kalamazoo River during the time that the submerged oil containment features would be in place. They also indicate that the maximum velocities in all three target areas would be similar, with possibly slightly higher velocities occurring in the Mill Pond impoundment.

The current E4 containment system consists of a series of surface booms and bottom half-curtains placed in the MLD. Construction of the system was completed on July 20, 2012. Discharge rates since installation have been in the low-flow range of 300-500 cfs at the USGS KRBC gage. Monitoring of the E4 system has consisted of repeated visual and video inspections of the bottom half-curtain relative to the river bottom, and one round of poling reassessment on the upstream and downstream sides of all of the curtains. The visual inspections have confirmed that the weighted half curtain has consistently remained on the river bottom over the range of discharges and velocities experienced at this location. Based on similar conditions at all three impoundment areas, this information indicates that similar installations would be suitable for all three areas, particularly under projected winter conditions. Poling data indicate possible additional accumulation of submerged oil along near-shore portions of the containment system only, with little change in submerged oil or sediment accumulation elsewhere along the boom/curtain configuration. These data indicate that the current installed system has been and will continue to be nominally effective at retaining sediment and submerged oil in place during low-flow conditions. It is also suggested that any modifications of the existing E4 system may need to include some degree of on-going submerged oil containment/retention within near-shore areas.

RECOMMENDED ADJUSTMENTS TO E4 CONTAINMENT SYSTEM

The top cable currently suspending the existing half curtains should be lowered to a minimum of depth of 1'(or deeper) below the anticipated water/ice surface. The surface boom should be removed to limit high forces from surface ice loads. The half curtains would be supported using straps similar to the current configuration. Stronger suspension straps with less surface area should be considered to reduce potential ice fouling.

To allow adequate flow passage during freeze conditions, the straps should be adjusted so the bottom of the curtain remains in contact with the riverbed and the top of the curtain is the lesser value of 2' above the riverbed or half the elevation difference between the riverbed and the bottom of the ice zone (See Figure 5). Removal of the existing float at the top will be required prior to lowering the cable to the acceptable depth for ice clearance. In the current configuration, this float provides the necessary vertical stability force to prevent sagging and keep the cable and boom on the water surface. The new configuration must incorporate a similar cable stability component into the design. Based on rough estimates of the observed water displacement of the existing booms, the vertical force required countering the weight of the cable and boom against sagging below the surface is approximately 2-5 lbs per linear foot. Ball buoys could be affixed to the realigned cable at depth and even spacing. The size and spacing would be approximately 8- inch balls at 25-ft spacing; 10-inch balls at 50 foot spacing; or 12-inch balls at 100-ft spacing. See Figures 4 and 5.

Half curtains should terminate where water depths are less than 3 feet, including the ice zone, where by definition, less than 2 feet of water column exists between the bottom of the ice zone and riverbed. Anchor posts for the segments where curtains are removed may be left in place for re-installation of the current configuration anticipated in Spring 2013.

The shoreward ends of the cables should be affixed to the riverbed where water depths exceed 2 feet. The shoreward end of each curtain segment currently attaches to a tree (typical) or anchor post at an elevation within a few feet above the water surface. If these existing anchoring systems are used for the winter configuration, the sections of cable length nearest the shoreline should be lowered to the riverbed or imbedded so they are not exposed to ice floes. An additional anchor post or heavy weight with cable fasteners could be used to redirect and secure the cable against the riverbed at the 1-2 foot water depth nearest the shoreline. This would serve the dual purpose of aligning the cable at least 1foot below water surface for ice clearance, and keep the shoreward end of the cable closer to the riverbed at the margins of the river where it will be better protected from ice forces. See Figures 6, 7, and 8 for possible anchoring reconfigurations.

The cable attached to anchor posts at the deep water end of segments (typically mid-river) should be lowered and re-attached to the anchor post at a point 2 feet below the water depth or deeper. At no time during installation should the curtains (those remaining for the winter) loose contact with the riverbed for more than 1 hour to minimize remobilization of sub oil trapped behind the curtain.

The curtains in the MLD which can be removed in accordance with the above criteria (less than 3 feet water depth along the entire length) include C1, B1& B2, A1&A2, and D (upstream segment). The remaining containment curtain segments should remain. It is recommended that curtains should remain on sections of the remaining segments in 3 feet of design water depth or deeper since it would allow submerged oil containment up to one foot from the bottom, while retaining 1foot plus for ice clearance.

RECOMMENDED SUBMERGED OIL CONTAINMENT FOR CERESCO AND MILL POND IMPOUNDMENTS

Submerged oil containment should be installed at the apparent depositional areas at the Ceresco Dam and Mill Pond impoundments using either the same submerged cable and curtain system as discussed above, or an alternate submerged containment effective at containing the submerged oil accumulation areas. See figures 9, 10, and 11 for three possible alternative concepts. If a cable and curtain system is used, it should be installed to allow 1foot vertical ice clearance between the top of curtain and design water/ice surface, continuously in water depths of 3 feet or greater. The suggested configurations at the Ceresco Dam and Mill Pond impoundments are based on the most recent bathymetry data (Figure 2 and Figure 3). Design water elevation will be 868.0 feet at Ceresco and 826.2 feet at Mill Pond.

DESIGN CONSIDERATIONS

Design drawings and calculations should be prepared and submitted which include a free body diagram (force diagram) and clearly demonstrate how the containment system will maintain contact with the river bottom across the entire length for the design conditions. Specifically, the force balance should clearly demonstrate that the containment system remains in the intended position given the hydraulic loading on the curtain and resultant forces of the anchoring system and ballast system. All dimensions should be provided on the drawings including:

- Detail on how vertical dimensions of the half curtain will vary with water depths across the channel.
- Height of the half curtain at each location along the entire length or if field determined, the target half curtain height relative to the water depth in that location.

The following design parameters for each half curtain or other containment alternative shall be considered:

- Effective resistance capacity anchor posts to ice floes given post dimensions and as-built soil imbedment depths.

- Ice loading assumptions for which the design is based.
- Fastening details at anchor posts including attachment/anchoring elevations of half curtain cable and bottom half curtain cables.
- Specification sheets of all materials proposed to be used.
- Cross section and plan view drawings showing planned minimum and maximum length of each curtain given the experimental nature of installation and field conditions.
- Velocity measurements along the location of each curtain to record pre-installation conditions.

SAFETY

When possible, field data collection for as-built conditions as well as monitoring and maintenance of containment structures should be performed when surface icing is minimal to minimize risk of personal injury and/or damage to equipment. Prolonged periods of sub-freezing temperatures are likely to persist for long periods during which monitoring must be performed. As such, adjustments to work approach and equipment including use of airboats and ice breaking equipment to access containment structures for measurements will be required. A health and safety plan amendment should be prepared and address the issues associated with cold weather work, working on boats in frozen and partially frozen waterways and emergency plans for man overboard.

MONITORING AND MAINTENANCE

Initial Monitoring Tasks:

- Underwater video shall be collected of the curtain correlated to each containment structure. This video should be recorded and filed in a manner which makes it easy for reviewers to correlate the electronic video files to the pertinent structure.

- ADCP velocity mapping (for select boom locations in the neck at E4 and Ceresco and Mill Pond impoundment areas) should be performed along a series of transects in the neck area located perpendicular to flow, parallel to flow, and along booms E and F at MLD. Similarly, ADCP mapping should be performed at representative containment structures within the areas representing the highest velocities at the Ceresco Dam and Mill Pond impoundments. Two ADCP transects perpendicular to the flow should completed across representative sections of each of the three locations. ADCP transects parallel to the flow should be completed both north and south of centerline of flow (e.g., two longitudinal transects; across the representative booms); the longitudinal transects should be placed such that the starting velocities at the upstream end are at least 70 percent of the maximum velocity measured along the perpendicular transects. At a minimum, each longitudinal transect should encompass the following three segments: 200 ft to 5 ft upstream and downstream of representative containment structures. ADCP velocity mapping along the booms should be completed along all representative containment structures; the respective transects should be placed approximately 5-10 ft upstream of each structure. The measurements should consist of continuous moving transect ADCP measurements similar to those performed previously by the USGS. The measurements should include at least two repeat passes yielding discharge values that are in agreement within 10 percent.

On-going Monitoring Tasks

Monitoring of the containment systems should be performed on each of the components on a regular basis to ensure it is performing as designed. Understanding that data collection cannot be completed on the entire system, monitoring efforts should be scheduled to ensure the observations, measurements, documentation and submittal are performed on all applicable components of the system at a frequency of once every one to two weeks depending on the structure and limitations related to access and weather (icing). On-going monitoring components should include:

- Boom and curtain measurements: Record the water depth and elevation of the top of the half-curtain at reasonable increments along curtain or other containment structure. Document in the most effective manner based on conditions the bottom of the curtain is resting on the mud-line using a combination of measurements and/or video (performed weekly).
- Anchor system monitoring: Record any deflection or movement anchor posts and other anchor and stabilizing systems such as stakes, ball buoys, screw anchors, etc. (if observed by photographing anchor posts on a visual line perpendicular to the boom). Any damage or evidence of increased stress on anchor system should be documented (performed once per week and within 24 hrs of peak flow events).
- Condition of curtain: Assessment of the curtain for bio-fouling and/or sedimentation and report an estimate of the resultant loss of permeability at a minimum of one location per boom system (performed once every two weeks or after peak flow events).
- Repeat Poling: Repeat poling should be performed periodically along each newly installed boom/curtain combination. Poling should be performed within 5 ft of the boom on the upstream side and 10-20 ft on the downstream side at 25 ft increments along the boom, using standard poling procedures (performed monthly).
- Repeat ADCP velocity mapping: ADCP velocity mapping along the same transects in the neck used for the initial monitoring should be completed for other typical river flow conditions in order to fully document the velocity patterns in the vicinity of important containment elements existing in this area. The measurements should be performed using the same procedures used for the initial monitoring ADCP velocity mapping as described above.

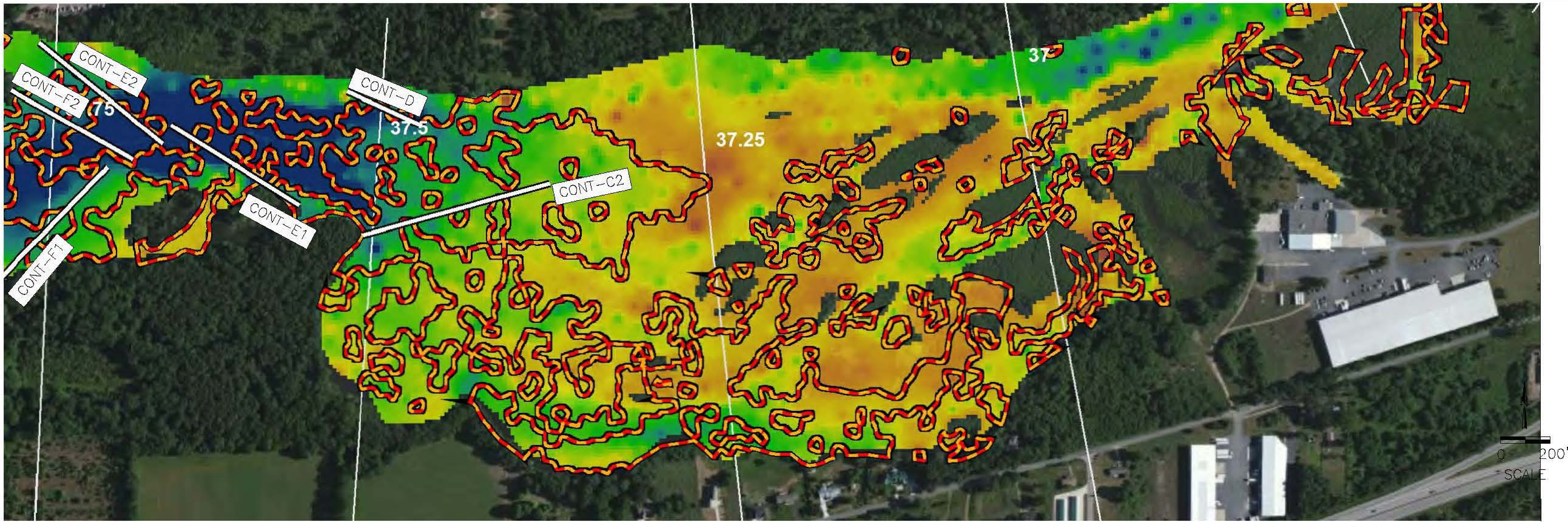
"As-built" Documentation - Provide a GIS plan drawing of the final containment system as constructed in the field to record any changes from the original design.

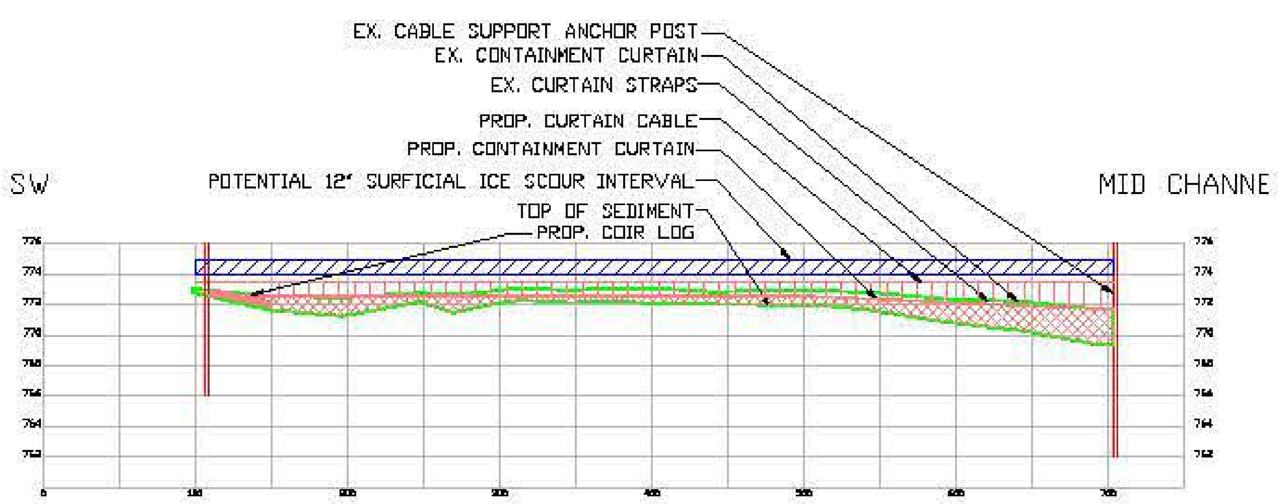
- Installed position of the reconfigured or new containment systems including top of containment structures and elevations and water depths and bathymetry based on field measurements collected during installation. These measurements should be taken on reasonable increments which reflect the variation along each curtains length. i.e. inflection points or other bends, if applicable. It is recommended that measurements are recorded between 10 ft and 50 ft increments for each containment structure.

- Final as-built dimensions and GPS coordinates of anchor system depths below mud-line, water depths at anchor systems for each containment structure, whichever type is used at each location. Note any changes to the design which impacted the force calculations in the initial design.

PERMITTING

Permit(s) and access agreements required for the installation of the submerged oil containment systems shall be obtained from MDEQ and property owners. The existing MDEQ permit for the E4 containment system at the MLD could presumably be modified to include the changes to the curtain associated with the winter configuration. New permits will be required for the new containment installation at Ceresco Dam and Mill Pond impoundments, including permissions from property owners for all access necessary to install, monitor and maintain containment systems.





CONT–F1

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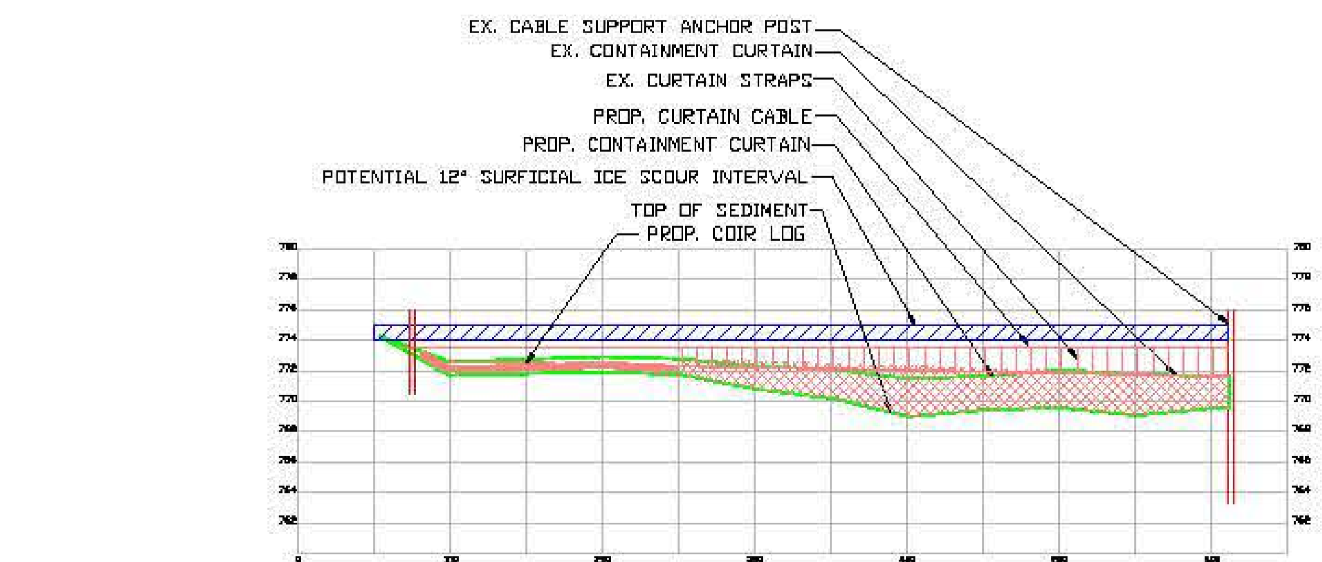

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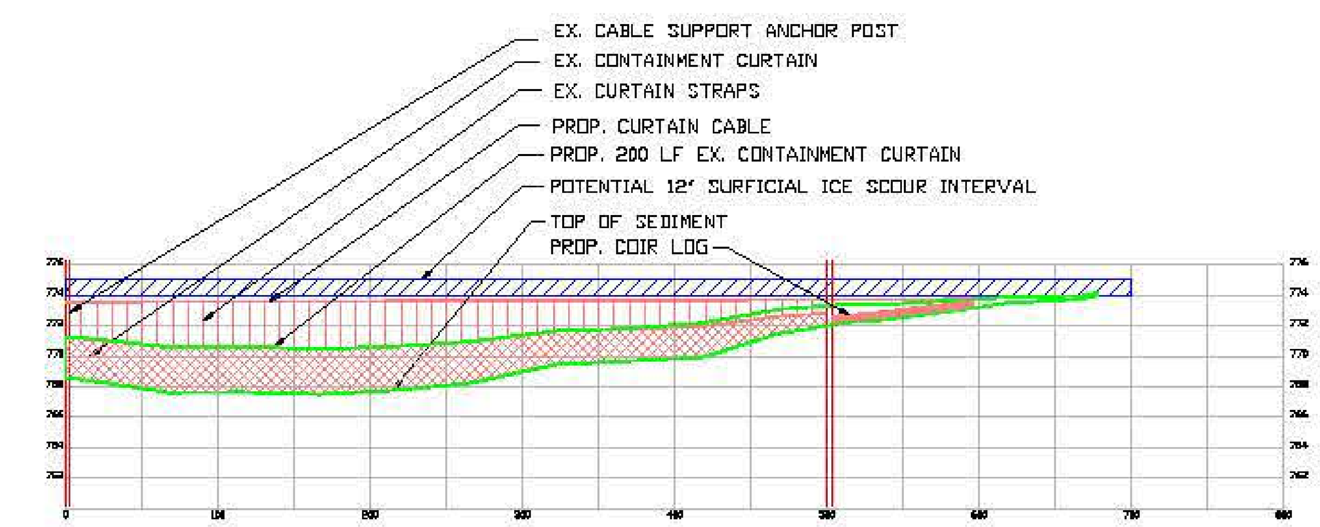

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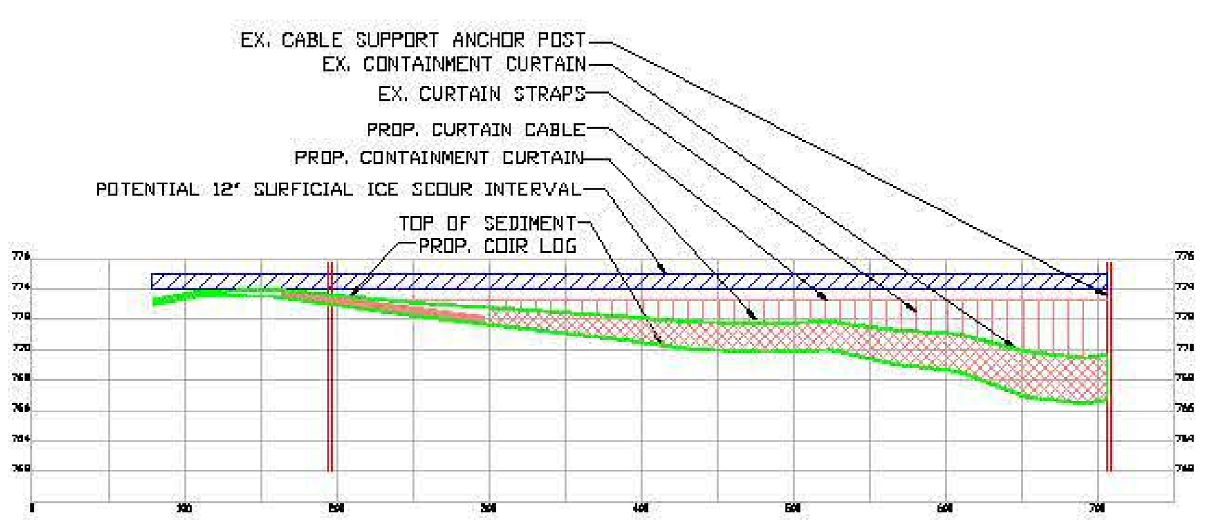

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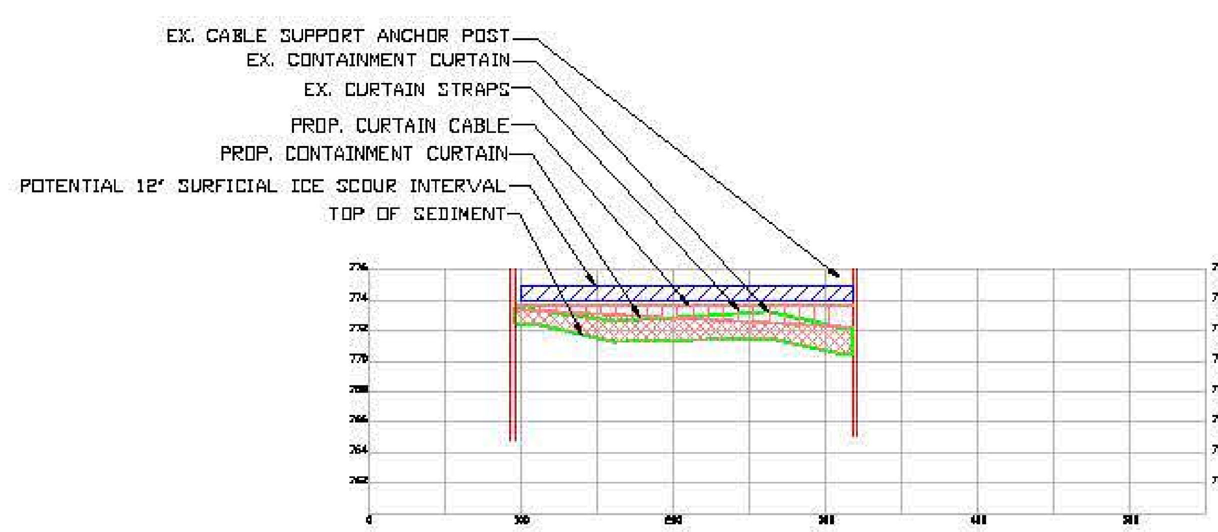

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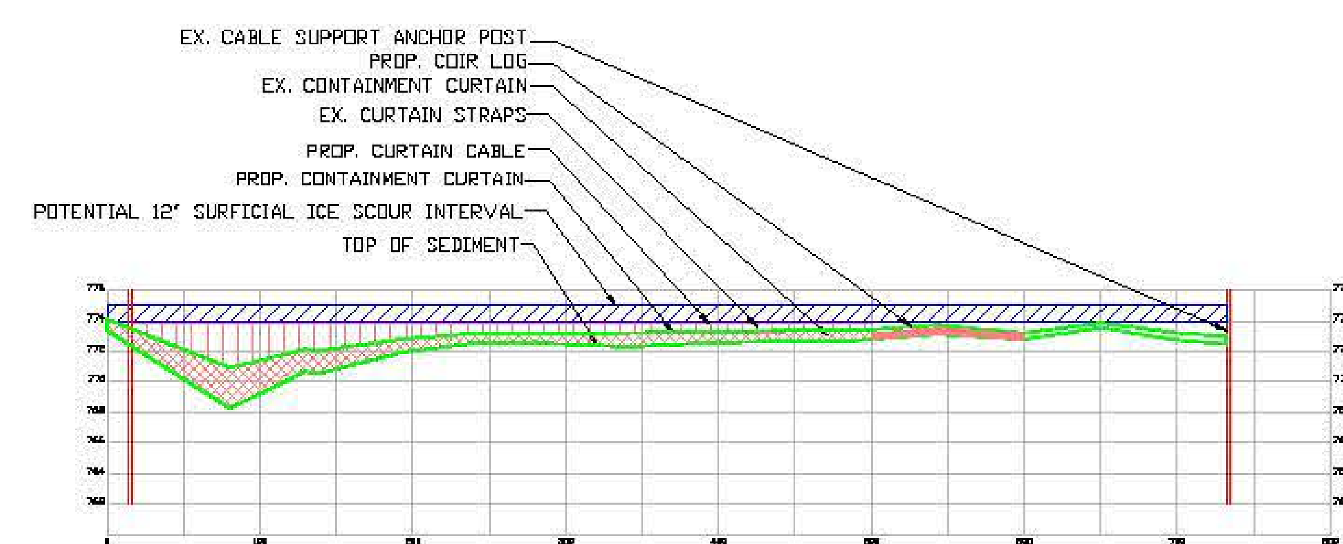


CONT–C2

SCALE: 1" = 100'

FOR OFFICIAL USE
USE ONLY

Bathymetry (Approximate)

Value

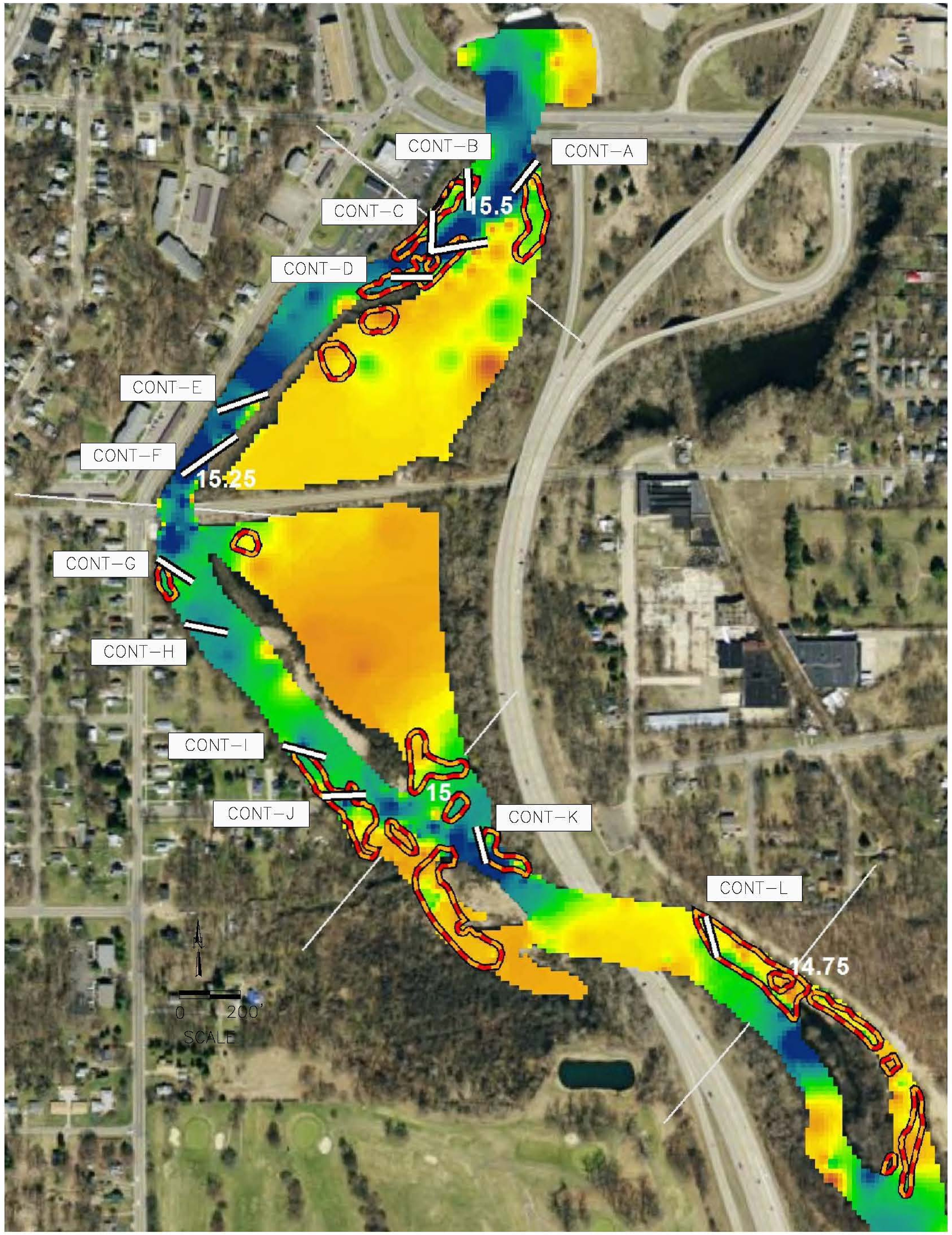
High : 777.351

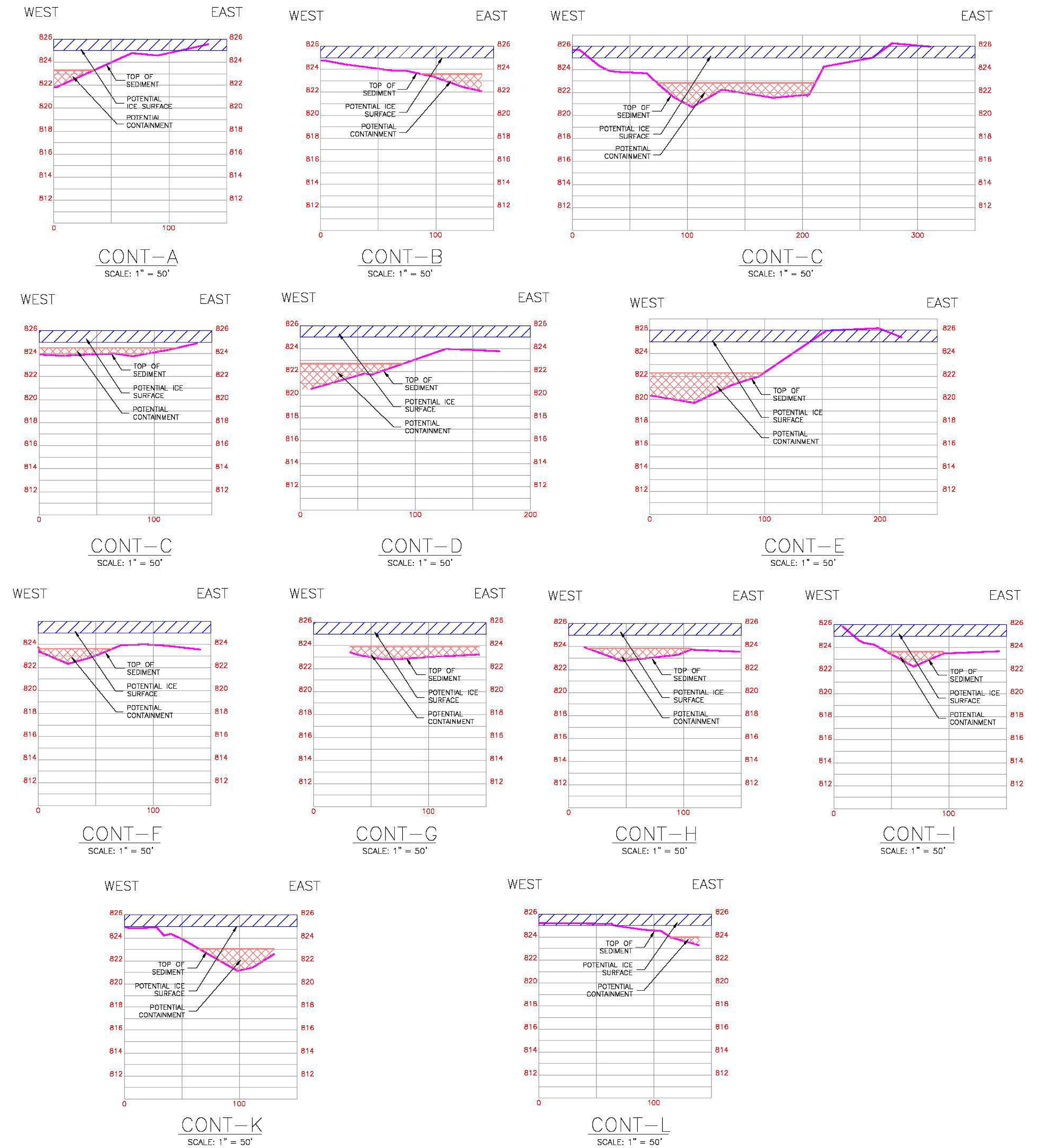
Low : 766.61

Prepared for:
U.S. EPA. REGION V
Contract No: EP-S5-06-04
TDD: S05-0005-1007-030
DCN: 1154-2B-BBRD

Prepared by:
WESTON SOLUTIONS, INC.
2501 Jolly Road, Suite 100
Okemos, MI

FIGURE 1
WINTER SUB–OIL CONTAINMENT OPTIONS
MORROW LAKE DELTA IMPOUNDMENT
ENBRIDGE OIL SPILL
KALAMAZOO & CALHOUN COUNTIES, MI
CREATED: OCTOBER 2012





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Bathymetry (Approximate)

Value

High : 827.376

Low : 819.896

Prepared for:
U.S. EPA. REGION V
Contract No: EP-S5-06-04
TDD: S05-0005-1007-030
DCN: 1154-2B-BBRD

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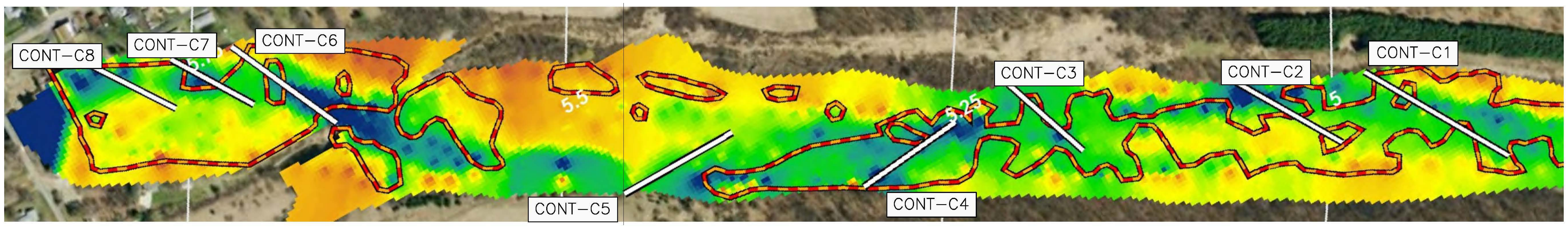
FIGURE 2
WINTER SUB–OIL CONTAINMENT OPTIONS
MILL POND IMPOUNDMENT
ENBRIDGE OIL SPILL
KALAMAZOO & CALHOUN COUNTIES, MI
CREATED: OCTOBER 2012



0 100'
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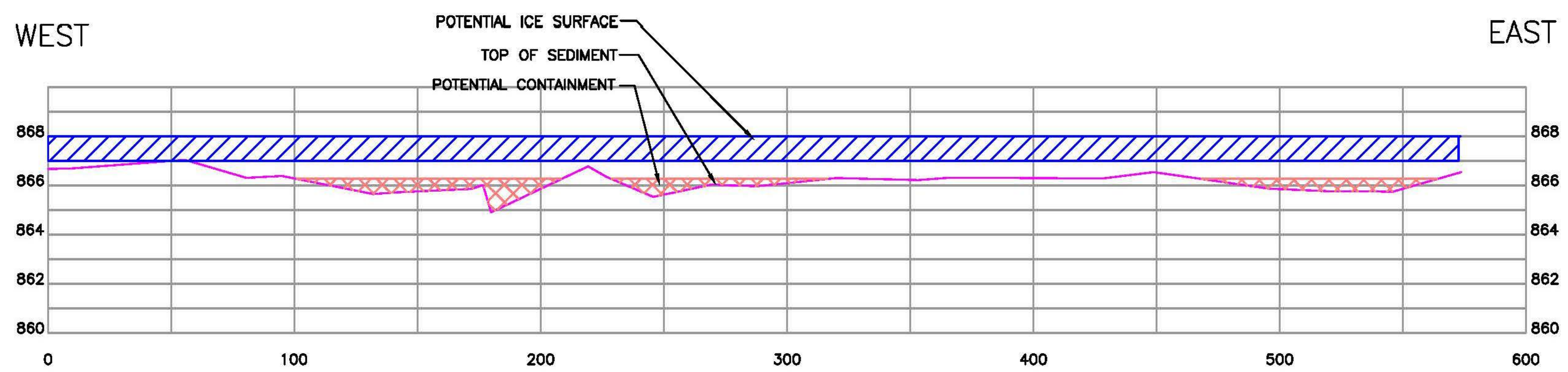

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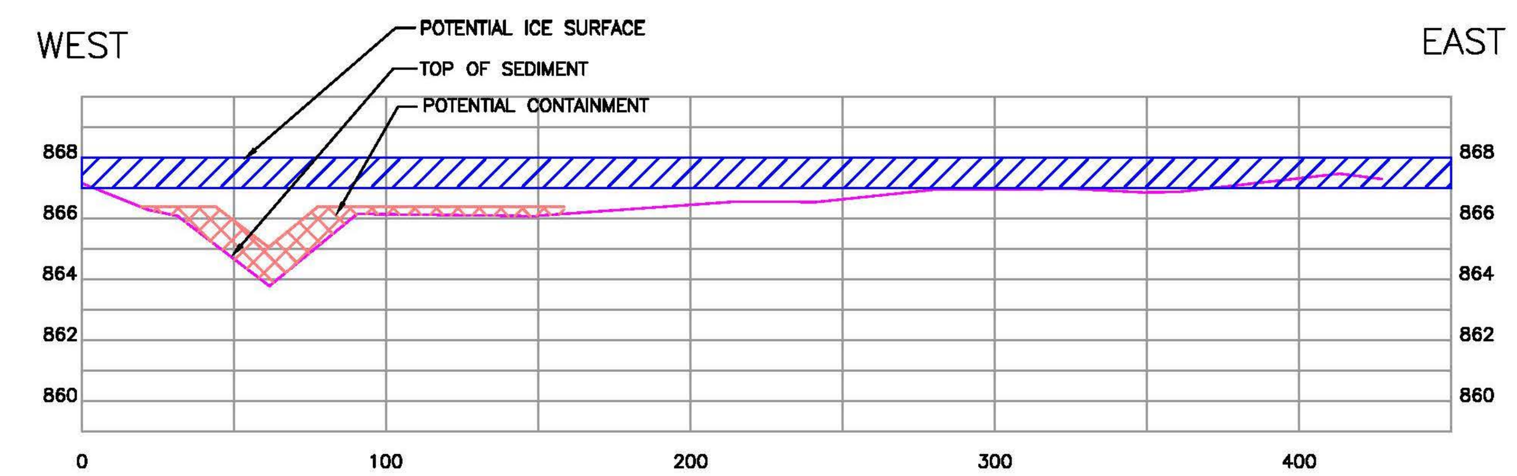

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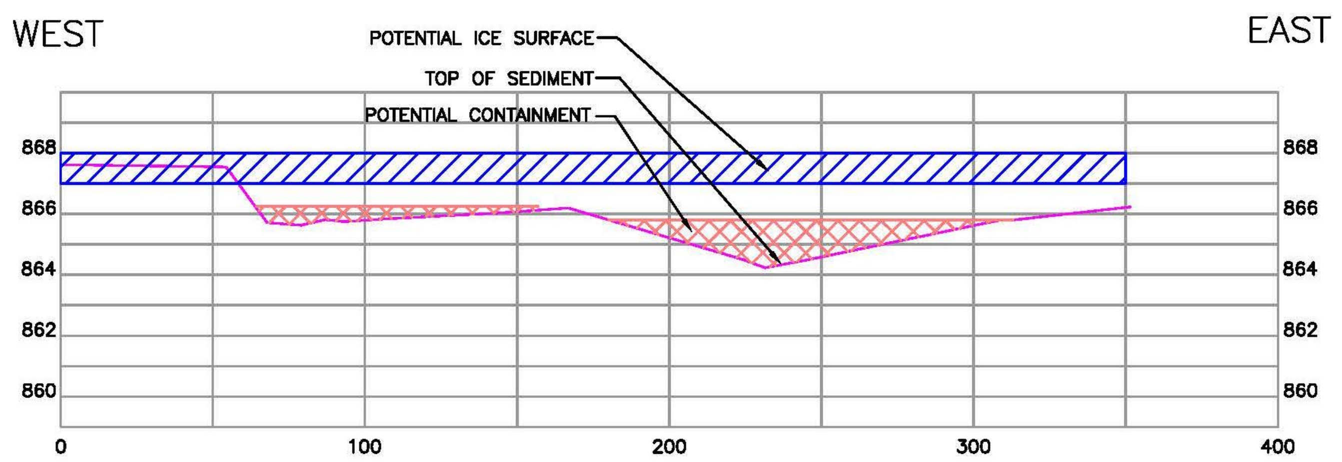

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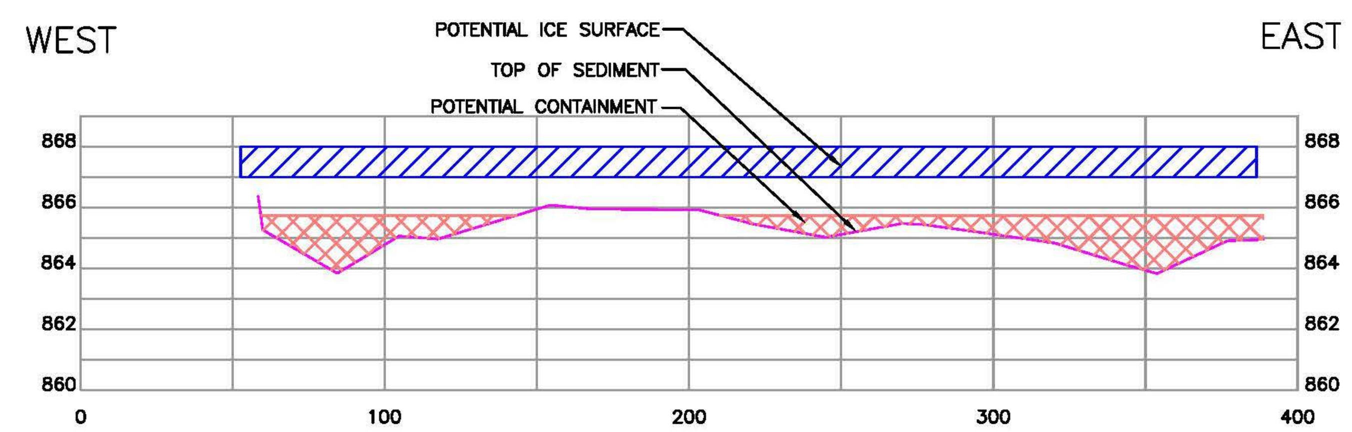

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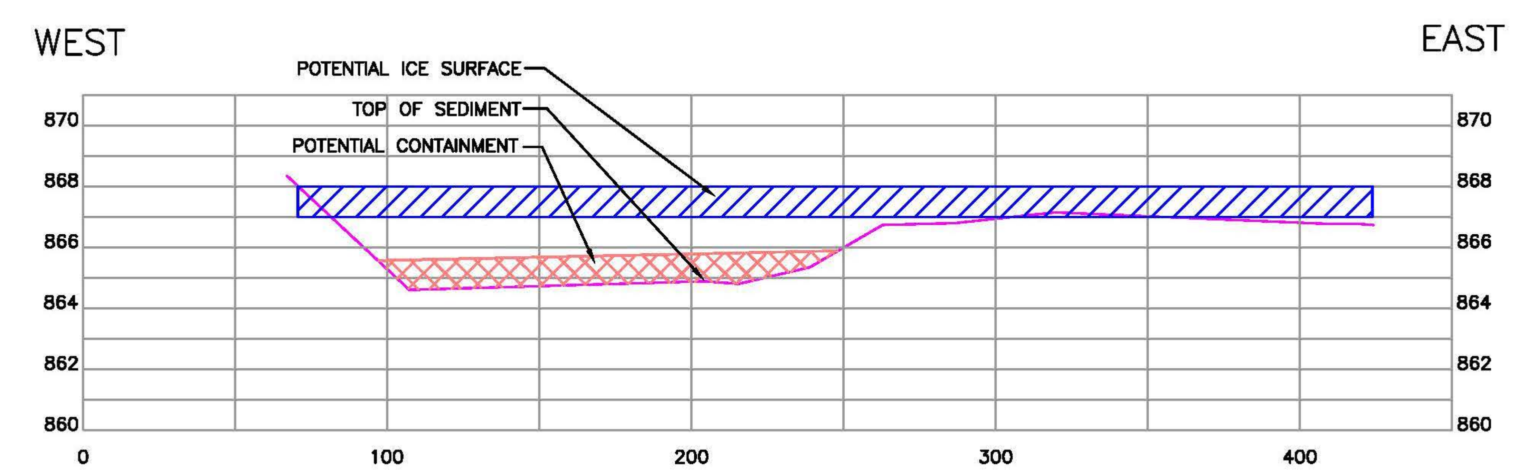

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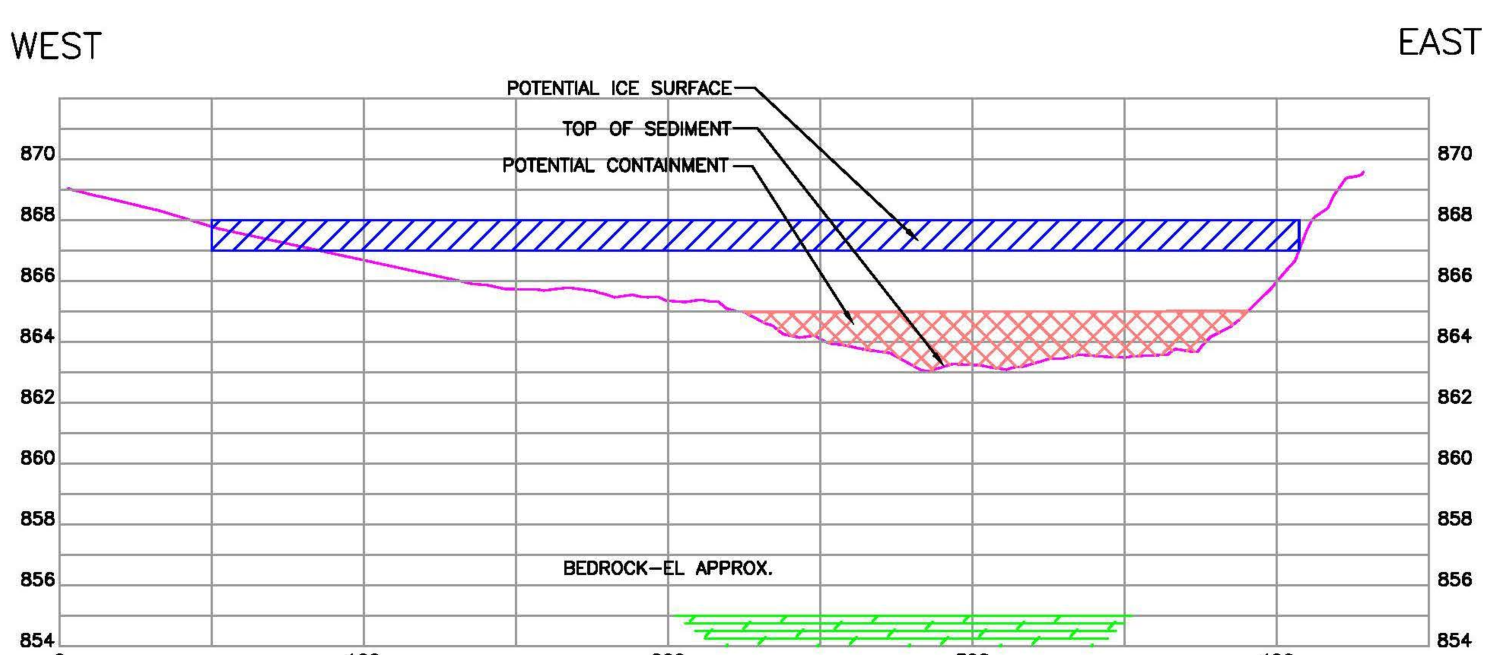

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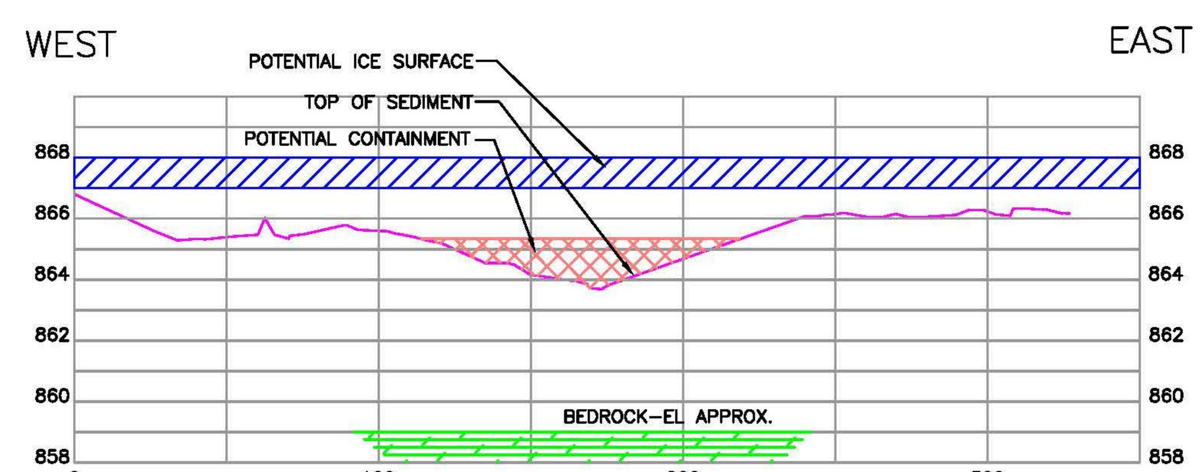

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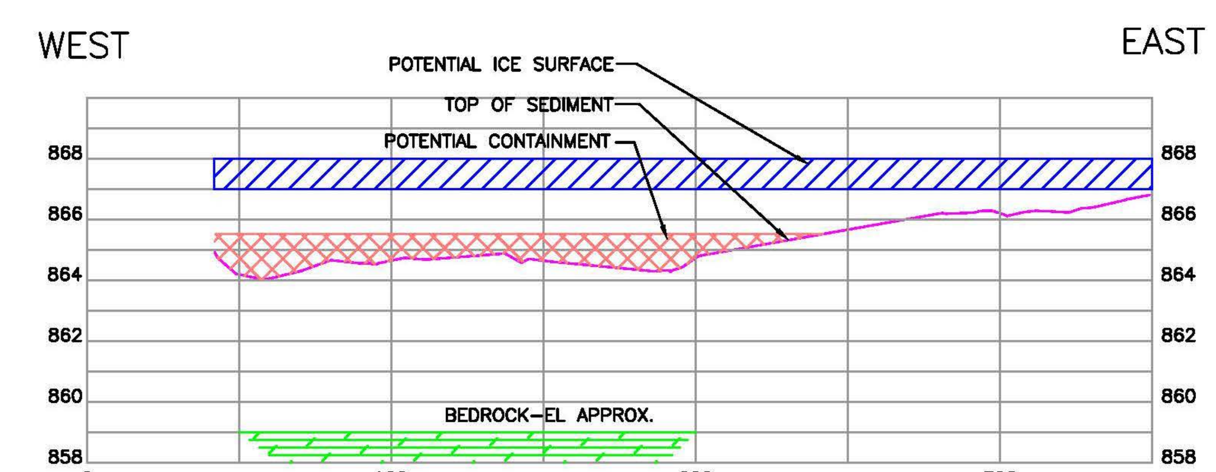

CONT–C8
SCALE: 1" = 50'

FOR OFFICIAL USE
USE ONLY

Bathymetry (Approximate)
Value
High : 869.2
Low : 862.5
Values apply to area above dam only

LSR_2012_Delins_Ceresco_Hand_Drawn

Prepared for:
U.S. EPA. REGION V
Contract No: EP-S5-06-04
TDD: S05-0005-1007-030
DCN: 1154-2B-BBRD

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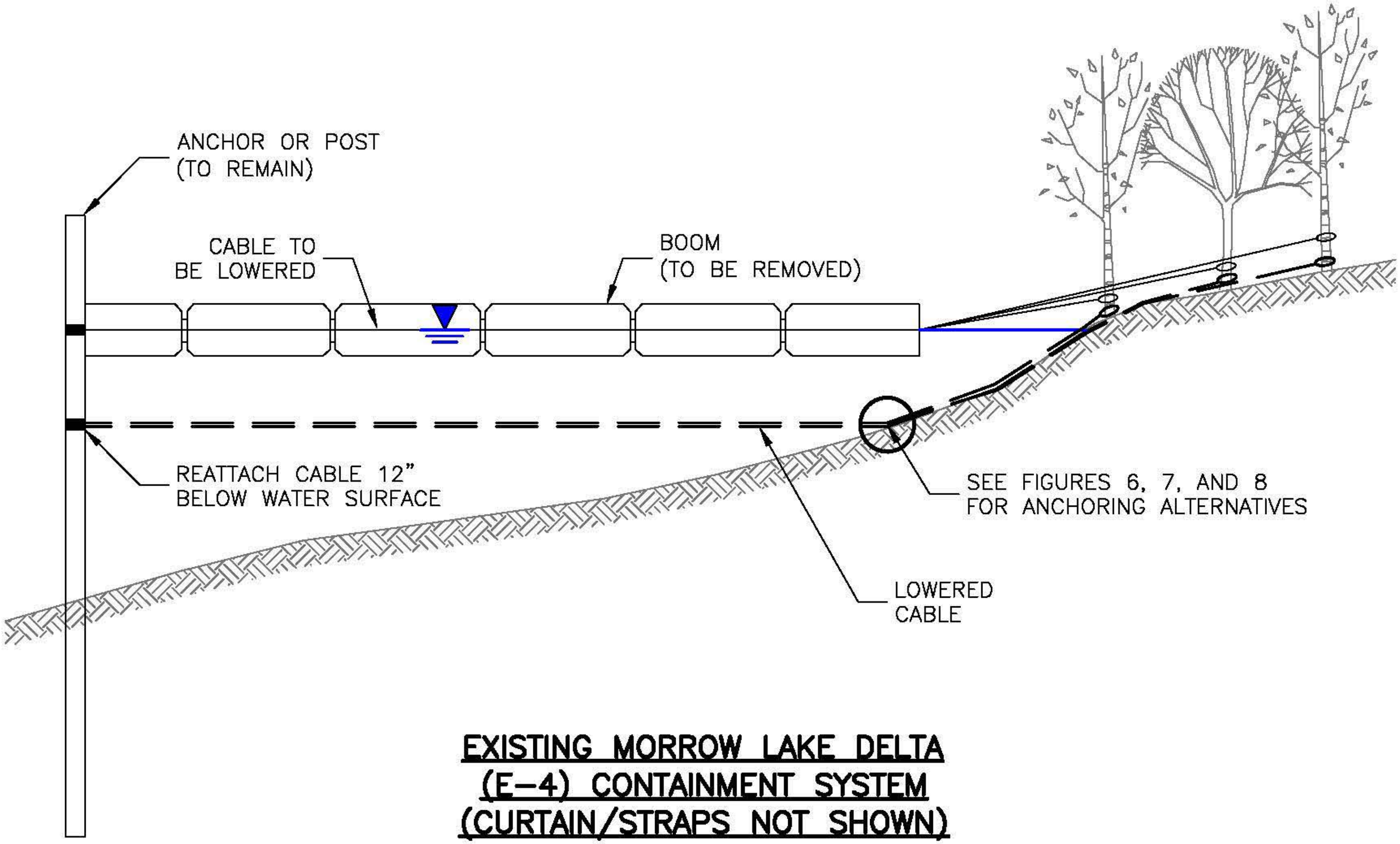
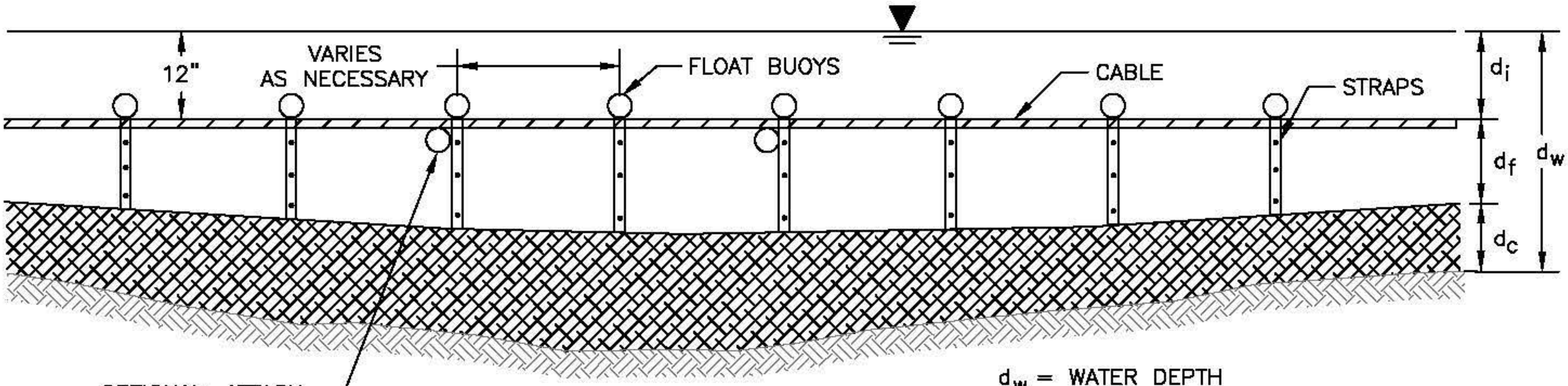
FIGURE 3
WINTER SUB–OIL CONTAINMENT OPTIONS
CERESCO DAM IMPOUNDMENT
ENBRIDGE OIL SPILL
KALAMAZOO & CALHOUN COUNTIES, MI
CREATED: OCTOBER 2012



EXISTING MORROW LAKE DELTA
(E-4) CONTAINMENT SYSTEM
(CURTAIN/STRAPS NOT SHOWN)
N.T.S.

Prepared for: U.S. EPA. REGION V Contract No: EP-S5-06-04 TDD: S05-0005-1007-030 DCN: 1154-2B-BBRD	Prepared By: WESTON SOLUTIONS, INC 20 N. Wacker, Suite 1210 Chicago, Illinois 60606	Figure 4 Existing E-4 Containment System



CABLE STAY BETWEEN ANCHOR – ALTERNATE 1

N.T.S.

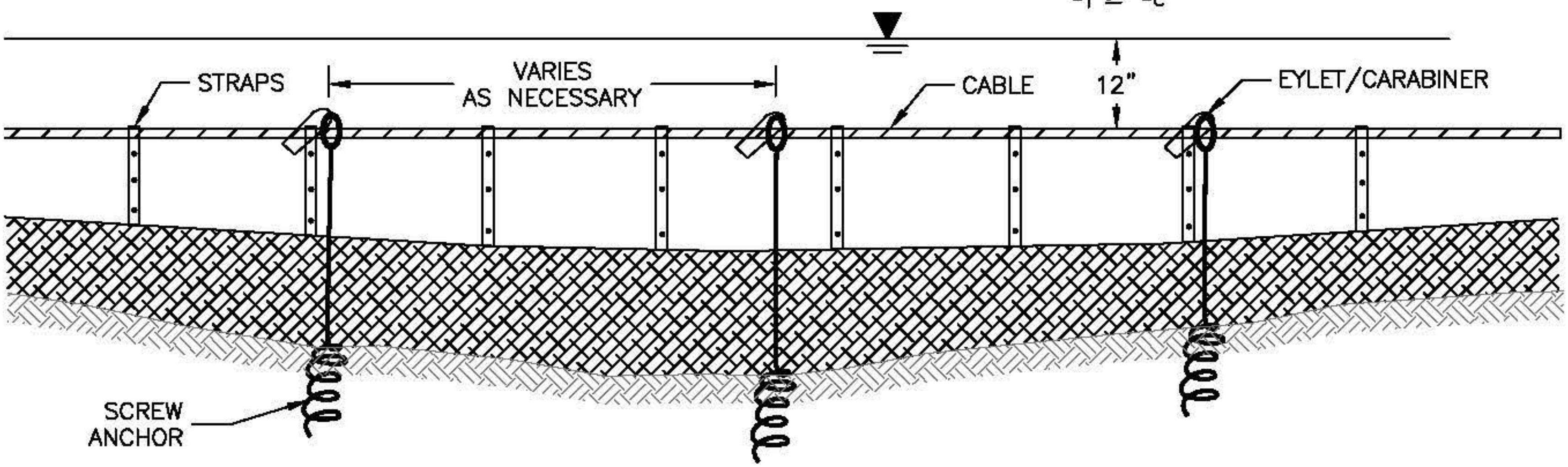
d_w = WATER DEPTH

d_i = ICE DEPTH >12" MIN

d_f = FLOW DEPTH

d_c = CURTAIN DEPTH (HEIGHT) $\leq$24" (6–12" MIN.)

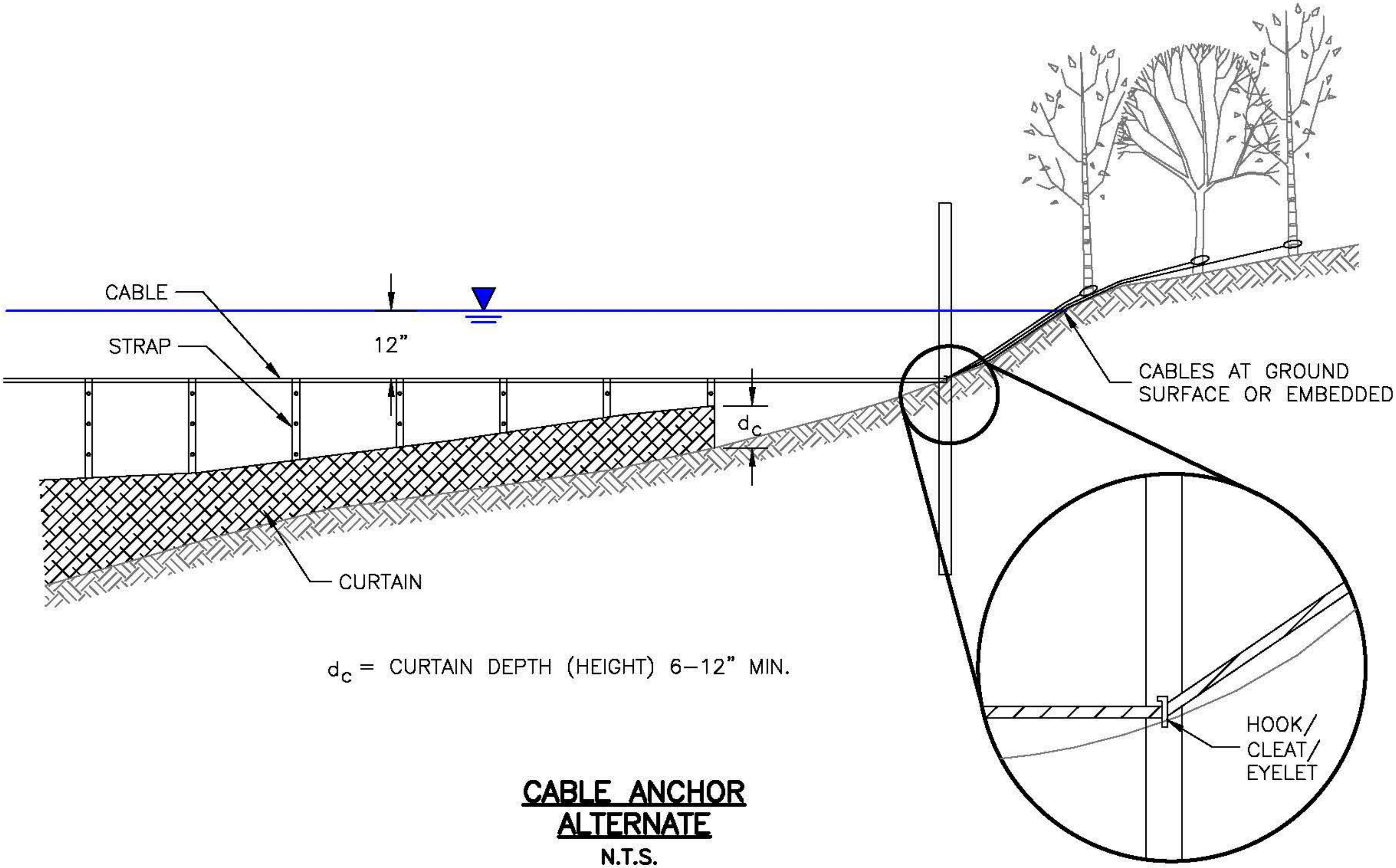
$d_f \geq d_c$



CABLE STAY BETWEEN ANCHOR – ALTERNATE 2

N.T.S.

Prepared for: U.S. EPA. REGION V Contract No: EP-S5-06-04 TDD: S05-0005-1007-030 DCN: 1154-2B-BBRD	Prepared By: WESTON SOLUTIONS, INC 20 N. Wacker, Suite 1210 Chicago, Illinois 60606	Figure 5 Cable Stay Between Anchor Alternates



CABLE ANCHOR ALTERNATE

N.T.S.

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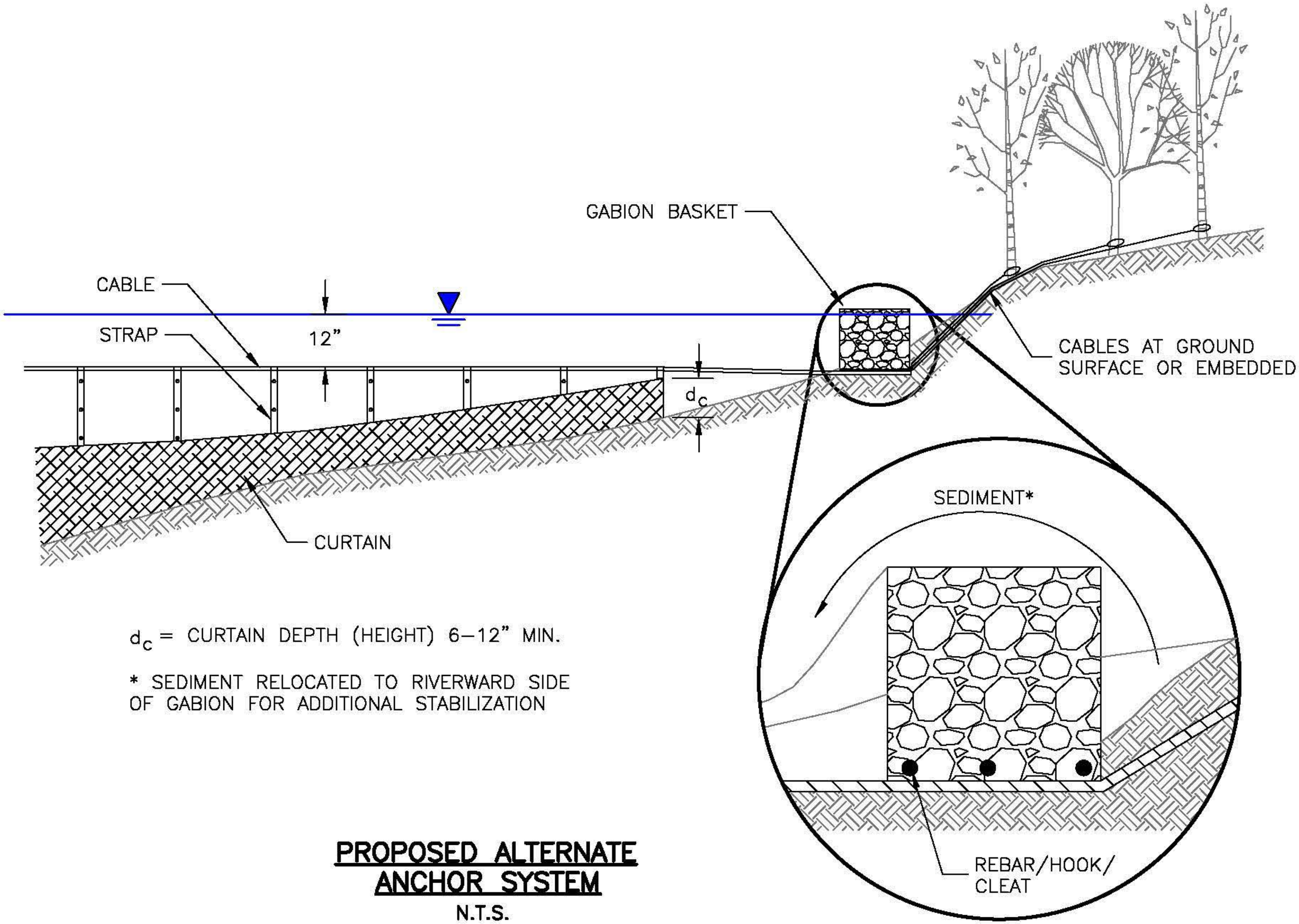

PROPOSED ALTERNATE ANCHOR SYSTEM

N.T.S.

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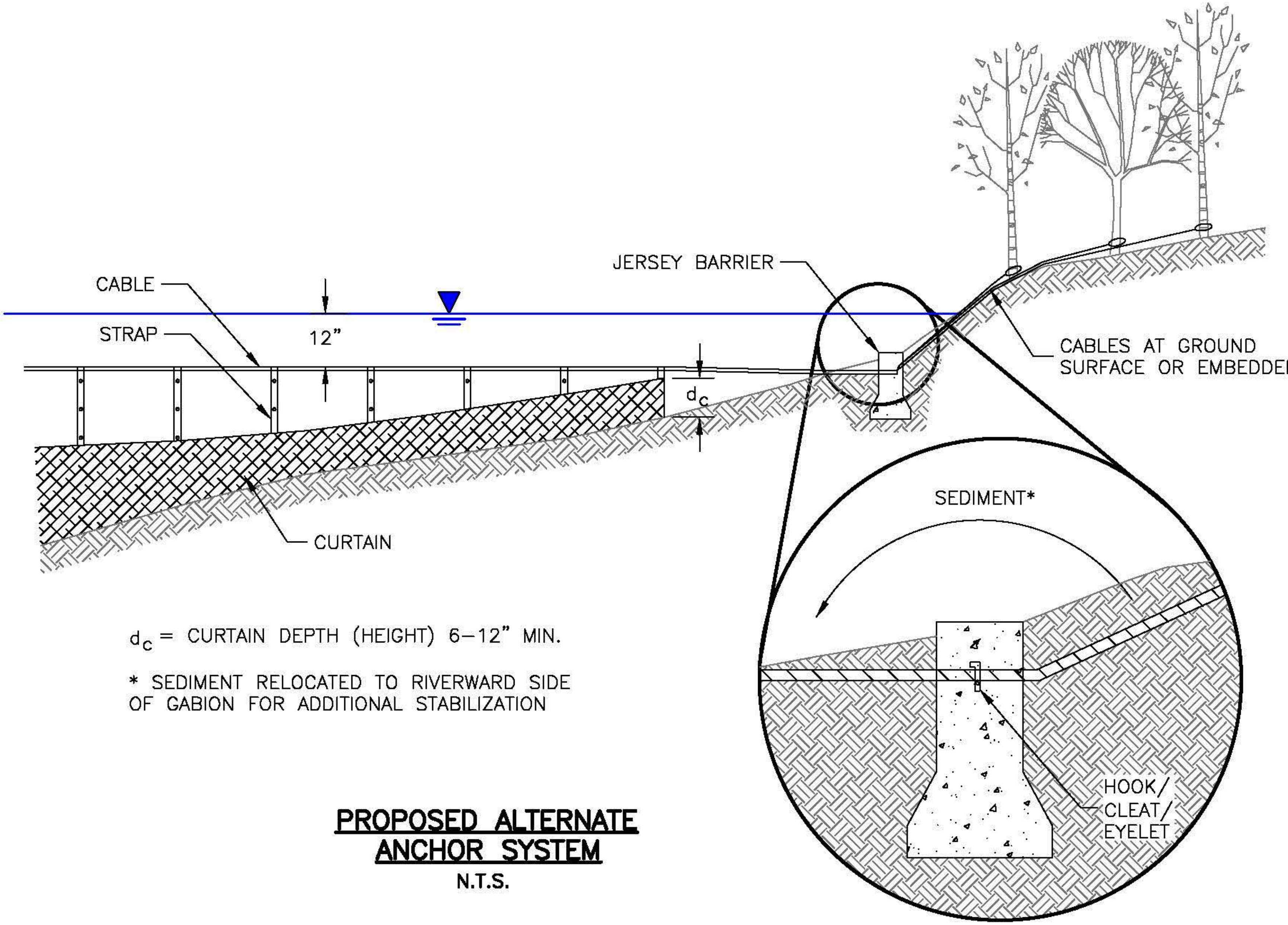

d_C = CURTAIN DEPTH (HEIGHT) 6–12" MIN.

* SEDIMENT RELOCATED TO RIVERWARD SIDE OF GABION FOR ADDITIONAL STABILIZATION

PROPOSED ALTERNATE ANCHOR SYSTEM

N.T.S.

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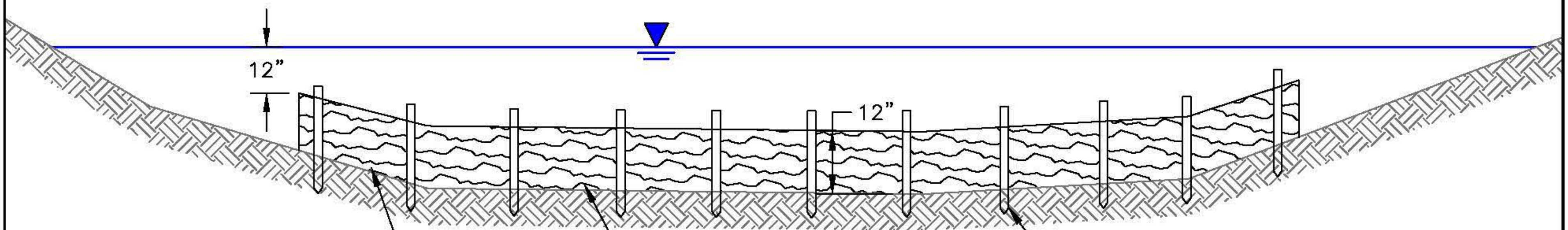

PROPOSED ALTERNATE SHALLOW WATER CONTAINMENT SYSTEM – COIR LOG (CERESCO MILL POND)

N.T.S.

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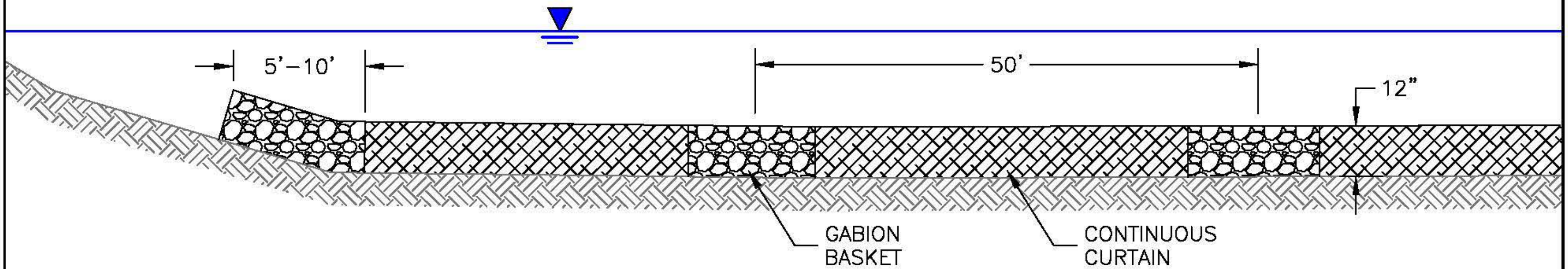
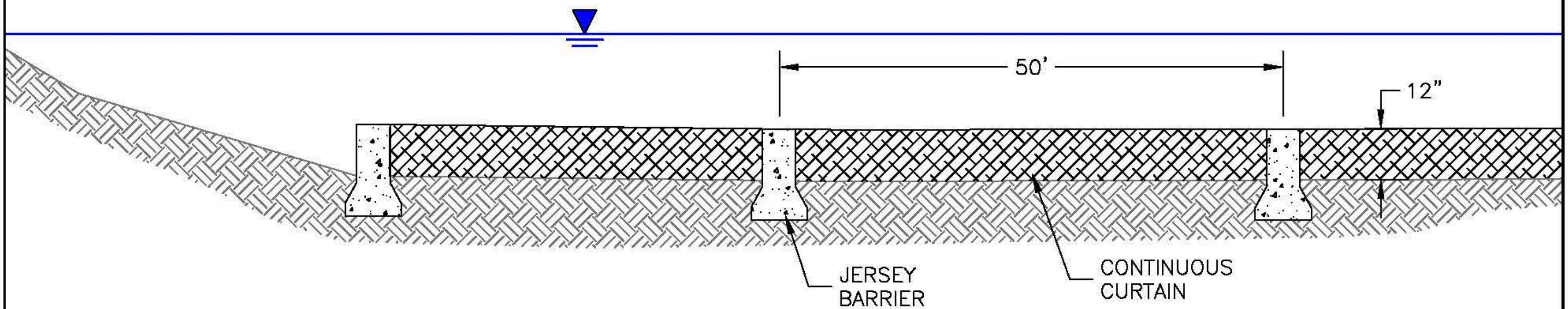


PROPOSED ALTERNATE CONTAINMENT SYSTEM
GABION WITH CURTAIN
(CERESCO/MILL POND)
N.T.S.

Prepared for: U.S. EPA. REGION V Contract No: EP-S5-06-04 TDD: S05-0005-1007-030 DCN: 1154-2B-BBRD	Prepared By: WESTON SOLUTIONS, INC 20 N. Wacker, Suite 1210 Chicago, Illinois 60606	Figure 10 Gabion and Curtain Alternate



PROPOSED ALTERNATE CONTAINMENT SYSTEM
JERSEY BARRIER WITH CURTAIN
(CERESCO/MILL POND)
N.T.S.

Prepared for: U.S. EPA. REGION V Contract No: EP-S5-06-04 TDD: S05-0005-1007-030 DCN: 1154-2B-BBRD	Prepared By: WESTON SOLUTIONS, INC 20 N. Wacker, Suite 1210 Chicago, Illinois 60606	Figure 11 Jersey Barrier and Curtain Alternate

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