# CRYSTAL LAKE & ELIGINWOOD POND

## EVALUATION OF CONTAINMENT BASIN CONSTRUCTABILITY AS PART OF A HYDRAULIC DREDGING PROGRAM PEABODY, MASSACHUSETTS

## APRIL 12, 2013

**SUBMITTED TO:**

**CITY OF PEABODY –COMMUNITY DEVELOPMENT AND PLANNING**
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## 1.00 INTRODUCTION

In accordance with our contract for professional services dated September 25, 2012 and authorized by the City of Peabody on December 6, 2012, GZA has conducted the requested evaluation of the City-owned land (parcels 034-006, 024-077x, and 025-024) south of Crystal Lake to determine the feasibility of constructing a containment basin and flocculation basin on site as part of a revised hydraulic dredging program for Crystal Lake and Elginwood Pond. This effort was based upon the City-provided GIS mapping of planimetric and topographic features on the project site, information taken from various prior studies performed on Crystal Lake and Elginwood Pond (see Appendix A), and GZA's field investigations. This report summarizes the work performed, and presents our findings, recommendations, and associated costs for a revised dredging program.

## 2.00 CONTAINMENT AND FLOCCULATION BASIN OVERVIEW

Typically, a containment basin is an excavated or bermed holding area in which a dredged slurry is allowed to separate by gravity into sediment and water. More than 80 percent of this slurry is water, which must be discharged either back to the pond or to adjacent watercourses, depending on the siting of the containment basin relative to the pond. The containment basin must also be sized to provide an adequate quiescent time to allow the solids to settle, plus provide storage volume for the sediments removed. A twenty-four hour detention time is usually sufficient to settle virtually all sediments, including most of the silt fraction; however, a small volume of the silt, clay, and organic particles typically remain in suspension or in a colloidal state. Although the percent of material may be very small, the turbidity associated with this fraction is generally unacceptable for release back to the natural environment. Based upon GZA's experience with similar hydraulic dredging programs, the need for flocculating agents is anticipated. Flocculating agents are electrically charged chemical compounds that attract and coagulate very fine particles in a water column until they are sufficiently dense to settle out of suspension by gravity. Generally, the flocculating agents are dispersed into the decanted discharge (supernatant) from the containment basin and are then allowed to activate in a second, smaller, basin (i.e., flocculation basin). The discharge from the flocculation basin can be sufficiently clarified to meet permit discharge standards and may be returned directly to the pond or watercourse.

The objective during hydraulic dredging will be to maintain a continuous return flow back to the pond to avoid pond dewatering and inter-basin transfer of water. By manipulation of adjustable stoplogs within the containment and flocculation basin outlet structures, flow from the basins can be modulated to approach a steady-state rate of return flow to the pond. During operation, a suitably-sized dredge for this project would discharge to the basin a flow of 2,000 – 3,000 gallons per minute (gpm). Operation of a dredge at the

uppermost range of discharge would lead to a total discharge of up to 2,160,000 gallons per 12-hour shift. The stoplogs in the containment and flocculation basins can be adjusted such that it requires approximately 24-hours to discharge the daily pumped volume back to the pond, thus reducing the average rate of return to the pond down from 2,000 – 3,000 gpm to 1000 – 1500 gpm.

At the start of dredging, the discharge line from the dredge is typically positioned at the bottom of the containment basin, at the furthest practicable location from the containment basin outlet. All stoplogs should be in place in both the containment basin and flocculation basin prior to dredging commencement, which will allow the water level in each basin to reach maximum pool level. The discharge line from the dredge will rise (float) as the containment basin fills up with the dredged slurry. As the supernatant decants from the containment basin, the selected flocculating agent will be added at the manhole immediately downstream of the containment basin outlet structure. This location provides ease of operation and adequate mixing time and energy to ensure the full effectiveness of the flocculating agent prior to reaching the quiescent water of the flocculation basin. The flocculating agent is generally administered in low dosages on the scale of 5-20 parts per million and usually requires pre-mixing with water for proper dilution and dispersal. The pre-mix is typically fed into the supernatant flow stream by an adjustable stroke pump.

The types of flocculating agents appropriate for the described process are utilized in the treatment of drinking water, and are typically non-toxic cationic or anionic polymer aqueous solutions when used properly. These agents have been used for decades to reduce turbidity of drinking water prior to distribution. Their exact chemical compositions are generally proprietary, as the industry which supplies these materials is highly competitive. As part of a very large hydraulic program in the neighboring state of Connecticut, the Connecticut Department of Health laboratory conducted a series of aquatic toxicity tests on flocculating agents. The additives were judged environmentally benign to aquatic life.

During the initial startup of operations, there typically will be several days of dredging to fill the basins before any return water discharges to the pond. This allows sufficient time to properly adjust the flocculating agent feed rate to achieve the maximum reduction of effluent turbidity.

Discharge to the containment basin may continue until the detention time (total volume of free water in containment basin ÷ rate of inflow from dredge) has reduced to the point that adequate settling of the solids is no longer taking place. At this time, dredging should temporarily discontinue to allow for the continuing consolidation of the settled solids within the containment basin. When dredging highly organic peaty sediments such as found at Crystal Lake/Elginwood Pond, sediment consolidation within the containment basin typically continues for several months. If dredging is stopped for a few weeks, it would not be unusual to note a 20-25% reduction in the volume of dredged sediments

within the containment basin. The rate at which this reduction takes place will decrease considerably over time.

The construction costs of the containment and flocculation basins are primarily a function of the earthwork for embankment construction and the inter-basin piping and outlet structures. The soils at the City-owned property appear to be composed of sand and gravels, which are well suited for embankment construction. Exploratory borings at the site should be performed to determine the likelihood of encountering bedrock or large boulders. The site does not have a large supply of on-site topsoil, so temporary stabilization techniques will need to be applied to the basin side-slopes to prevent erosion.

This basic process has been successfully utilized at numerous dredging projects in which GZA has participated. It is anticipated that the process is appropriate for the dredging of Crystal Lake/Elginwood Pond.

## 3.00 SITE INFORMATION

On October 17, 2012, GZA engineers walked the City-owned property to become familiarized with the site. Using aerial photography to assist in navigating the property and determining its boundaries, potential areas for locating a containment basin and flocculation basin were observed.

On October 23, 2012, a GZA wetland scientist walked the site and estimated the wetland resource areas within the property based upon field inspection and aerial photograph interpretation, positioning the approximate delineation on a base map for preliminary use. The estimated location of the wetlands is shown on Figure 1. Additionally, GZA reviewed the 2012 Massachusetts Natural Heritage and Endangered Species Program (MA NHESP) Certified Vernal Pool data-layer prior to walking the site. The data-layer indicates that several certified vernal pools are located on site (see Figure 1). During the October 23rd site visit, several areas of potential vernal pool habitat were identified; however, no obvious vernal pools were observed in the open upland area west of Johnson Street and southwest of Taylor Street. It is possible that the vernal pool locations on the MA NHESP map are not correctly geo-referenced. GZA **strongly** suggests that the aforementioned upland area be revisited by a GZA wetland scientist during appropriate climatic and seasonal conditions to verify the presence/absence and correct geographical position of the vernal pools shown. GZA cautions that water levels were low during our site visit, and the fall is not the optimal time of year to investigate for this habitat feature.

In November, the City provided GZA with GIS mapping of the City-owned property adjacent to Crystal Lake, as well as mapping of the surrounding area. GZA utilized the topographic, property line, edge of water, and storm & sanitary sewer information to create

a base plan in AutoCAD format. GZA supplemented the AutoCAD base plan with the information gathered from our site visits and utilized the resultant existing conditions plan to evaluate different basin configurations.

## 4.00 CONAINMENT AND FLOCCULATION BASIN ALTERNVATIVES

### 4.10 LIMITING FACTORS AND ASSUMPTIONS

The on-site wetland resource areas are limiting factors in determining the area within the City-owned land available for use to construct both a containment basin and flocculation basin for the hydraulic dredging of Crystal Lake and Elginwood Pond. Working on the assumption that there are no vernal pools located in the previously described upland area abutting Taylor Street, the total contiguous area of the City owned parcels available for the intended use, minus the resource areas estimated by GZA, is approximately 610,000 SF (14± acres).

A prior study conducted by ENSR in November of 2000 on both water bodies (see Appendix A) indicates that Crystal Lake and Elginwood Pond contain 60,000± CY and 30,000± CY of accumulated sediment, respectively. Ideally, both ponds would be hydraulically dredged in one phase. In order for this to be a reality, a containment basin with a storage volume in excess of 150,000 CY would need to be constructed (assuming a bulking factor of 1.7). The on-site wetlands fragment the site into two distinct areas where construction of a containment basin and flocculation basin might be feasible (Figure 1), but these areas do not provide sufficient space for a 150,000 CY containment basin. Project phasing will be required.

GZA developed and reviewed multiple containment basin and flocculation basin configurations with the goal of providing the maximum amount of storage volume while minimizing the amount of material that needs to be trucked in or disposed of (i.e., “balance” the cut and fill on site).

Other limiting factors and assumptions in the preliminary designs of the basins include:

- the location of groundwater (assumed to be Elevation 58.0± for purposes of conceptual design only);
- the need to maintain positive drainage between the containment basin, flocculation basin, and Crystal Lake (GZA provided for this by setting the bottom of the containment basin to Elevation 62.0, the bottom of the flocculation basin to Elevation 60.0, and the return water outlet to Crystal Lake to Elevation 58.0);
- a maximum berm height from top of berm to basin bottom of twenty feet (20’);

- maximum berm cut and fill slopes of 3H:1V;
- a minimum berm top width of twelve feet (12');
- a minimum freeboard of two feet (2') (i.e., the maximum operating fill height of both the containment basin and flocculation basin was set to 2' below the berm crest)
- minimum setback to wetlands of five feet (5'); and
- no direct impact to wetlands, but full utilization of available buffer zone (subject to permitting)

Please note that incidental impact to the wetland canopy and placement of erosion controls might require temporary direct impact to wetlands. Construction methodology would need to be constrained to minimize construction related impacts. Additionally, the Site wetland boundaries are approximate only, and the exact allowable configuration of the proposed containment and flocculation basins would need to be determined, likely in coordination with the Conservation Commission.

## 4.20 CONTAINMENT BASIN ALTERNATIVES

After reviewing the portions of the subject property potentially available for a containment basin, GZA selected the open upland area bound by Taylor Street to the east, and wetlands to the north and west (Figure 1). This area appears to be the remnant of a prior gravel operation and, in GZA's opinion, is the only viable spot on site for a containment basin of any significant size. Access to the containment basin site is proposed to be directly off of Taylor Street, and an area has been provided along the easterly property boundary for a contractor laydown or staging area. Many basin configurations in this area were evaluated, four of which are summarized below.

**Alternative #1:** Holding the basin crest to El. 82.0 and keeping the basin completely within the City-owned property, an operating storage volume (between El. 62.0 and El. 80.0) of 33,300 CY was calculated. This configuration (see Figure 2) maximizes the basin vertically (20' basin height), has an 18' maximum depth of contained sediment, requires 19,000± CY of onsite earthwork (cuts to fill), and requires 38,500± CY of borrow material from an unspecified offsite source.

**Alternative #2:** Holding the basin crest to El. 74.0 and keeping the basin completely within City-owned property, an operating storage volume (between El. 62.0 and El. 72.0) of 28,400 CY was calculated. This configuration (see Figure 3) has a 10' maximum depth of contained sediment, requires 27,500± CY of onsite earthwork, and eliminates the need for offsite borrow material.

**Alternative #3:** The parcel directly abutting the City-owned property to the east, and located at the southwest corner of Taylor Street and Johnson Street, exhibits a 28'-high cut-slope (El. 62.0 to El. 90.0). This embankment is an excellent candidate for incorporation into the containment basin design as it could significantly increase the basin's storage volume with limited need for additional earthwork; however, it will require that the City acquire a grading and use easement from the property owner. With the basin crest set at El. 82.0, and extending the basin onto the adjacent property, the resultant operating storage volume was calculated to be 57,700 CY. This configuration (see Figure 4) has an 18' maximum depth of contained sediment, approximates the maximum storage volume available within the constraining parameters, requires 19,000± CY of onsite earthwork, and requires 37,000± CY of borrow material from an unspecified offsite source.

**Alternative #4:** The basin in Configuration #2 was extended into the adjacent property, and the resultant operating storage volume was calculated to be 42,200 CY. This fourth and final configuration (see Figure 5) has a 10' maximum depth of contained sediment, requires approximately 33,000± CY of onsite earthwork, and eliminates the need for offsite borrow material. Again, this configuration requires that the City acquire a grading and use easement from the property owner.

## 4.30 FLOCCULATION BASIN ALTERNATIVES

GZA selected the open area east of the bike path and south of Crystal Lake as the location for the proposed flocculation basin. Its close proximity to Crystal Lake facilitates discharge of the return water from the flocculation basin to the lake. Access to the flocculation basin is proposed to be directly off of the bike path (a.k.a. Crystal Drive) which can be temporarily modified to allow equipment access. Two basin configurations in this area were evaluated and are summarized below. As with the containment basins, these configurations were laid out to avoid direct impacts to wetland resource areas, but essentially maximize temporary utilization of the buffer zone. Additionally, the flocculation basin was sized to provide a detention time of approximately 24 hours for a hydraulic dredge discharging to the containment basin at a rate of 3,000 gallons per minute (gpm) for 12 hours per day. This relationship has proved to be adequate to provide for sufficient removal of the suspended solids within the containment basin supernatant flows.

**Alternative #1:** Holding the basin crest to El. 74.0 and keeping the north/northeast section of the basin crest coincident with the existing berm, an operating storage volume (between El. 60.0 and El. 72.0) of 10,700 CY was calculated. This configuration (see Figure 6) utilizes the existing topography to form one side of the basin, has a maximum operating depth of 12', requires 7,000± CY of onsite earthwork, and requires 13,500± CY of borrow material from an unspecified offsite source.

**Alternative #2:** Holding the basin crest elevation to El. 68.0, the basin was shifted into the existing berm in an attempt to limit the amount of earthwork needed to form the basin. An operating storage volume (between El. 60.0 and El. 66.0) of 10,400 CY was calculated. This configuration (see Figure 7), has a maximum operating depth of 6', requires 8,500± CY of onsite earthwork, and eliminates the need for offsite borrow material.

4.40 BASIN OUTLET STRUCTURES

A typical outlet structure is shown in Figure 8. The outlet from the containment basin to the flocculation basin would be installed in the northwest corner of the containment basin embankment. Site constraints, mainly the location and size of the onsite wetlands, require that the outlet be piped a distance of 780 ± LF to the flocculation basin. The outlet from the flocculation basin back to Crystal Lake will also require piping of the discharge, but to a lesser extent. Direct discharge to the wetlands could result in erosion and therefore the discharge has been located at the pond's edge. The length of pipe estimated for the flocculation discharge is approximately 40 LF (see Figure 9).

4.50 OTHER BASIN SITE CONSIDERATIONS

There is an existing sewer manhole located in the vicinity of the proposed containment basin. The GIS information provided to GZA by the City did not include the location of any sewer lines entering or leaving this structure. There is also an existing sanitary force main in the vicinity of the proposed flocculation basin. Additional investigative measures should be taken to determine if the manhole structure and any associated piping, or the sanitary force main, would be in conflict with the proposed basin designs. The stability and condition of the structure and piping should be investigated as well, to determine if the proposed work may place an unbearable load on these existing utilities. For safety purposes, it is recommended that the basins be fenced to discourage unauthorized entry. The costs for this fencing have been included in the conceptual cost estimates.

## 5.00 RECOMMENDED BASIN CONFIGURATION

GZA recommends selecting Containment Basin Alternative #4 and Flocculation Basin Alternative #2. The combination of these two basin configurations will require approximately 41,500 CY of onsite earthwork (cuts to fill) and no off-site borrow material. The resultant containment basin storage volume of approximately 42,000 CY will require that the hydraulic dredging of the ponds take place in a phased approach.

After reviewing the physical characteristics of the sediment from the prior sediment testing results, GZA assumed a sediment bulking factor of 1.7:

90,000 CY * 1.7 Bulking Factor = 153,000 CY
153,000 CY / 42,000 CY per phase = 3.6 ≈ 4 phases

Another potential option is to use Basin Configuration #3 (57,700 CY) if the 40,000 CY of fill anticipated from a pending City stormwater project is determined to be suitable for use in the creation of the basin embankment. If the material is found to be adequate, then the phasing would decrease from four phases to three phases:

153,000 CY / 57,700 CY = 2.6 ≈ 3 phases

## 6.00 DISPOSAL OPTIONS

Assuming four phases of dredging, the dewatered dredged material may potentially be disposed of on the remaining upland areas of the City-owned property adjacent to Crystal Lake. The dredged material from the fourth and final dredging phase is proposed to remain in the containment and flocculation basins.

Alternately, and in GZA's opinion a more practicable option, the material can be removed from the basins after each phase and disposed of at a local landfill, or, pending permitting, re-used at an upland area for non-structural grading material.

## 7.00 REGULATORY AGENCIES AND PERMITS

A review of the permits previously acquired for the hydraulic dredging of Crystal Lake and Elginwood Pond has found that the necessary permits have either expired or are no longer relevant to the proposed work.

### 7.10 LOCAL PERMITTING

A new Notice of Intent must be filed with the Peabody Conservation Commission to acquire an Order of Conditions for both the hydraulic dredging of the pond and the construction and operation of the containment and flocculation basins. A separate Notice of Intent could be filed for just the work associated with the basins, or the City can opt to file a Notice of Intent for both the dredging and the basin construction in the same application. The proximity of the proposed basins to on-site wetland resources puts them in the Commission's jurisdiction.

## 7.20 STATE PERMITTING

At the state level, the dredging of Crystal Lake and Elginwood Pond will require filing a new Environmental Notification Form (ENF) with the State MEPA unit.

GZA reviewed the latest Natural Heritage & Endangered Species Program (NHESP) Estimated Habitat of Rare Wildlife maps and determined that the work proposed for the Crystal Lake and Elginwood Pond Restoration Project does not fall within Estimated Habitat as defined by NHESP; however, there are certified vernal pools in the vicinity of the work area (Figure 1). As previously mentioned, a GZA wetland scientist should visit the site during appropriate climatic and seasonal conditions to verify the presence/absence and correct geographical position of the vernal pools shown on the map.

A Section 401 Water Quality Certificate (WQC) will need to be requested from the Massachusetts Department of Environmental Protection (MassDEP). None of the chemical compounds detected in the limited sediment sampling performed for the original WQC were deemed to be an impediment to attaining Water Quality Certification; however, new policies currently in place will require additional and more stringent sediment sampling under a sampling plan that must be submitted and subsequently approved by MassDEP prior to sample collection.

## 7.30 FEDERAL PERMITTING

A Section 404 Wetlands Permit from the United States Army Corp of Engineers (USACE) will not be required for the project, as the adjacent wetlands are not proposed to be altered by the containment and flocculation basin. Hydraulic dredging does not require a USACE permit.

Table 1 indicates the anticipated project permits and their typical timeframes from submission of application to receipt of the required permit. Please note that the Wetlands Protection Act timeframe is additive to the 401 timeframe, resulting in a total permitting task requiring 20 – 32 weeks.

**Table 1: Anticipated Project Permits, Permitting Authorities, and Permitting Timelines.**

| Permit | Permitting Authority | Typical Time to Obtain Permit / Approval after Filing Applications |
|---|---|---|
| Secretary's Certificate on the Environmental Notification Form (ENF) | Massachusetts Environmental Policy Act (MEPA), Executive Office of Environmental Affairs (EOEA) | 6 weeks |
| Order of Conditions as per the Wetlands Protection Act | Peabody Conservation Commission | 6 – 10 weeks |
| Section 401 Water Quality Certificate | Massachusetts Department of Environmental Protection Division of Wetlands and Waterways | 14 – 22 weeks |

## 8.00 PROGRAM COSTS

### 8.10 LAND-BASED OPERATIONS

The construction of a containment site for dewatering of the dredged materials can be accomplished by an experienced site contractor prior to bidding any of the actual dredging work. The work can then be inspected by prospective bidders for the dredging portion of the project. For the purposes of evaluation of alternatives, the following preliminary opinions of construction costs have been prepared by GZA, assuming 2013 cost information.

| ITEM DESCRIPTION | UNITS | QUANTITY | UNIT COST | EXTENTION |
|---|---|---|---|---|
| Clearing and Grubbing | Acre | 8.2 | $7,500 | $61,500 |
| Erosion Controls | L.F. | 3,650 | $5.00 | $18,250 |
| Construction Access | Lump Sum | 1 | $10,000 | $10,000 |
| Earthwork | C.Y. | 41,500 | $6.00 | $249,000 |
| Topsoil Borrow | C.Y. | 2,300 | $30.00 | $69,000 |
| Outlet Structures | Each | 2 | $20,000 | $40,000 |
| Piping | L.F. | 900 | $40.00 | $36,000 |
| Manholes | Each | 2 | $4,000 | $8,000 |
| 6'-high Chain Link Fence | L.F. | 3100 | $35.00 | $108,500 |
| Seeding | Acre | 2.8 | $6,500 | $18,200 |
| | | | Subtotal | $618,450 |
| | | | 25% Contingency (Design, Permitting, Construction) | $154,600 |
| | | | Total | $773,050 |
| | | | **SAY** | **$773,000** |

## 8.20 DREDGING AND SEDIMENT DISPOSAL

The recommended conceptual containment basin design provides storage for 42,000 C.Y. of dredged materials (≈ 22,500 CY *in situ*), necessitating a multiple-phase approach towards dredging. It is assumed that a dredging contractor will mobilize to the site once for each phase of dredging. Assuming 12-hour shifts, a production rate of approximately 120 cubic yards per hour, and 20% down time, each dredging phase will require a minimum of about 20 dredging days. Including mobilization and de-mobilization, this equates to a period of 6-8 weeks. The cost estimation includes a figure of $5.00 per cubic yard for the removal of sediments from the containment basin and ultimate disposal/reuse of the dredged materials. This figure is based on the success of being able to dispose of the dredged material as non-structural grading material in a location in close proximity to the site.

GZA's preliminary opinion of probable costs **for each dredging phase of the project** are tabulated below, again assuming 2013 cost information.

| **ITEM DESCRIPTION** | **UNITS** | **QUANTITY** | **UNIT COST** | **EXTENTION** |
|---|---|---|---|---|
| Mobilization | Lump Sum | 1 | $50,000 | $50,000 |
| Hydraulic Dredging | C.Y. | 22,500 | $8 | $180,000 |
| Flocculent for Dredging | L.S. | 1 | $10,000 | $10,000 |
| Removal/Disposal of Dredged Materials | C.Y. | 22,500 | $5 | $112,500 |
| | | | Subtotal | $352,500 |
| | | | 25% Contingency (Design, Permitting, Construction) | $88,125 |
| | | | Total | $440,625 |
| | | | **SAY** | **$441,000** |

## 8.30 SUMMARY OF COSTS

Incorporating GZA's recommended phased approach to the hydraulic dredging program for Crystal Lake and Elginwood Pond, utilizing Containment Basin Alternative #4 and Flocculation Basin Alternative #2, the estimated total program cost is as follows:

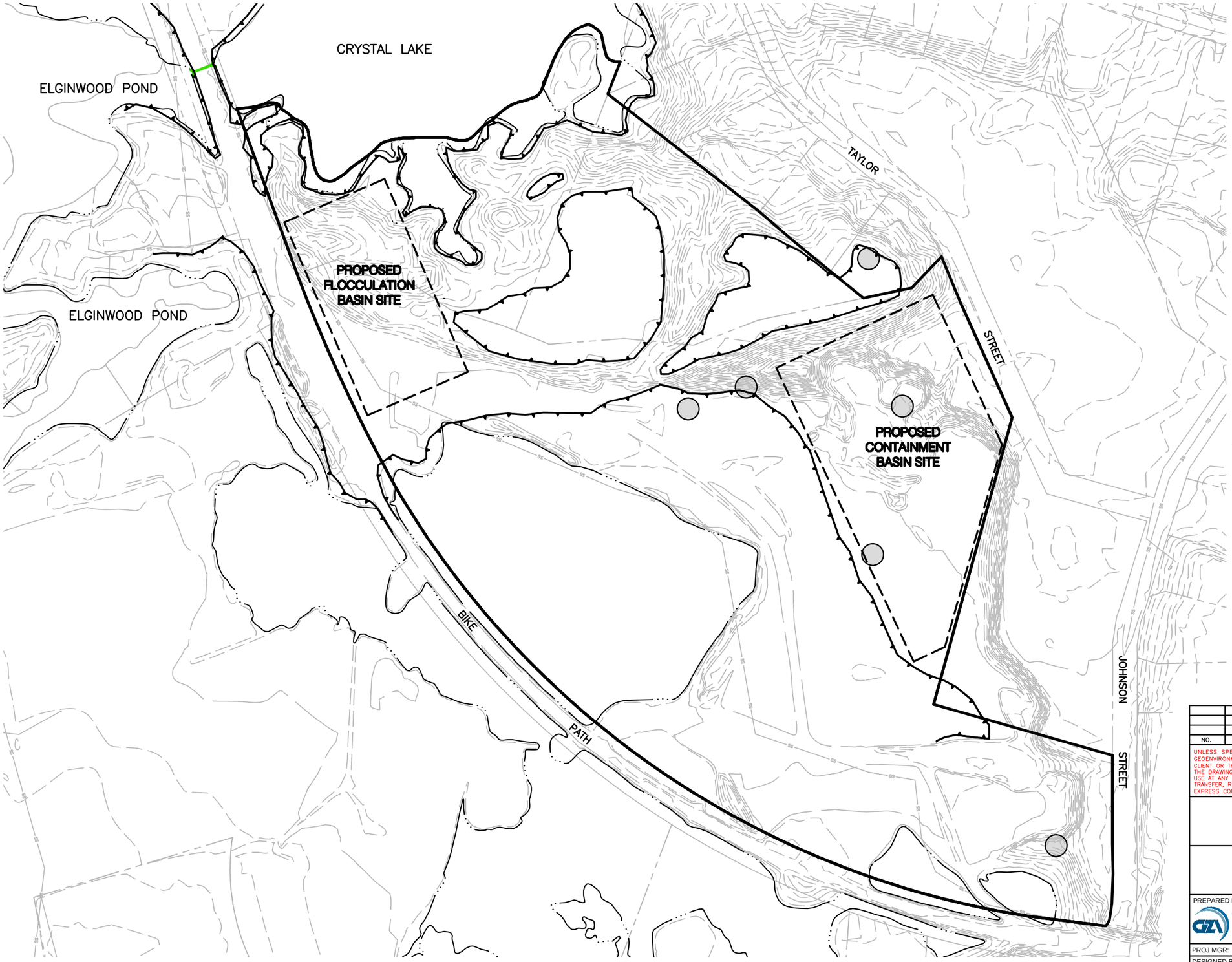
| | |
|---|---|
| Basin Construction | $773,000 |
| Dredging Phase 1 | $441,000 |
| Dredging Phase 2 | $463,000 |
| Dredging Phase 3 | $486,000 |
| Dredging Phase 4 | $510,000 |
| **Total =** | **$2,673,000** |

This total assumes project startup in 2013, and that each dredging phase will require one calendar year, with basin cleanout occurring between dredging years. A 5% escalation factor is included for dredging phases 2, 3, and 4. Additionally, each dredging phase includes a contingency for engineering and permitting; however, please note that a disproportionate amount of the total project contingency may be spent early on in the project (i.e., in Phase 1). Lastly, the total does not include any cost to close out the basins and restore the buffer zone, as may be required by the local Conservation Commission.

## 9.00 CONCLUSIONS

The above report provides a reasonable conceptual approach to the hydraulic dredging of Crystal Lake and Elginwood Pond. Based upon this analysis, it would appear that the project is potentially feasible from a technical standpoint, utilizing the available adjacent land for a containment basin and flocculation basin. The project would likely need to consist of four phases to allow for sequenced dredging and would proceed presumably over several years. The estimated cost for the full project, assuming project start up in 2013, is about $2.7 million.

# FIGURES




N

LEGEND

- APPROXIMATE WETLAND BOUNDARY
- EXISTING 10 FT CONTOUR
- EXISTING 2 FT. CONTOUR
- EDGE OF WATER
- PROJECT PROPERTY LINE
- EXISTING SANITARY SEWER
- LOCATIONS OF CERTIFIED VERNAL POOLS (2013 NHESP MAP)

BASE PLAN INFORMATION AND TOPOGRAPHY TAKEN FROM G.I.S. DATA PROVIDED TO GZA BY THE CITY OF PEABODY.

GRAPHIC SCALE

0 100 200 400

1"=200'

| NO. | ISSUE/DESCRIPTION | BY | DATE |
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CRYSTAL LAKE & ELGINWOOD POND
RESTORATION PROJECT
PEABODY, MA

# OVERALL SITE PLAN

PREPARED BY:
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PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA

| | | | |
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| PROJ MGR: STD | REVIEWED BY: STD | CHECKED BY: TEJ | FIGURE |
| DESIGNED BY: STD | DRAWN BY: EDM | SCALE: 1"=200' | 1 |
| DATE: APR. 2013 | PROJECT NO. 15.0166128.01 | REVISION NO. | SHEET NO. |

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LEGEND

- APPROXIMATE WETLAND BOUNDARY
- EXISTING 10 FT CONTOUR
- EXISTING 2 FT. CONTOUR
- EDGE OF WATER
- PROJECT PROPERTY LINE
- EXISTING SANITARY SEWER
- (96) PROPOSED 2 FT. CONTOUR

BASE PLAN INFORMATION AND TOPOGRAPHY TAKEN FROM G.I.S. DATA PROVIDED TO GZA BY THE CITY OF PEABODY.

GRAPHIC SCALE

0 40 80 160

1"=80'

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CRYSTAL LAKE & ELGINWOOD POND
RESTORATION PROJECT
PEABODY, MA

PROPOSED CONTAINMENT BASIN
ALTERNATIVE No. 1

PREPARED BY:
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Engineers and Scientists
www.gza.com

PREPARED FOR:
CITY OF PEABODY
24 LOWELL STREET
PEABODY, MA

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|---|---|---|---|
| PROJ MGR: STD | REVIEWED BY: STD | CHECKED BY: TEJ | FIGURE 2 |
| DESIGNED BY: STD | DRAWN BY: EDM | SCALE: 1"=80' | |
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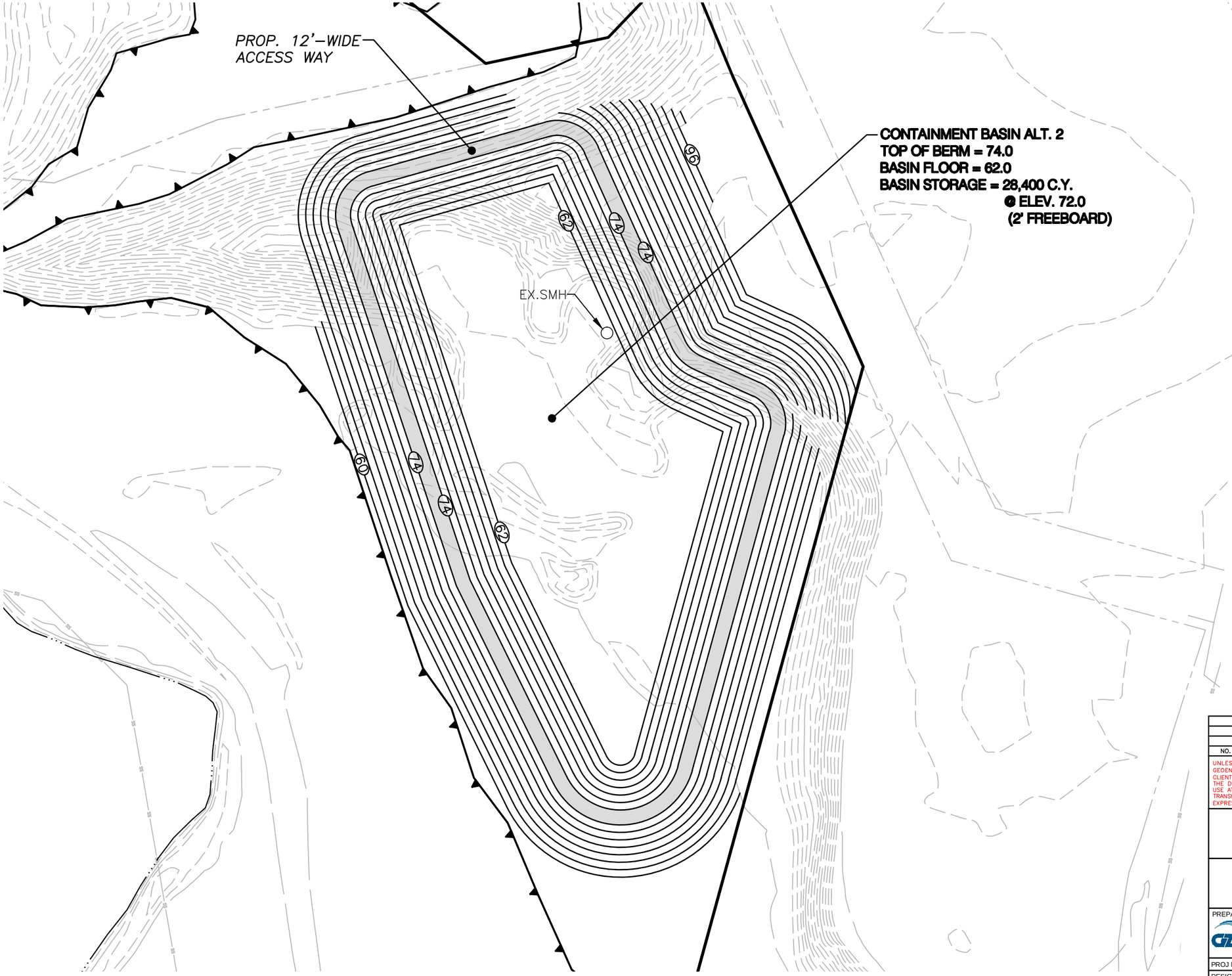


LEGEND

- APPROXIMATE WETLAND BOUNDARY
- EXISTING 10 FT CONTOUR
- EXISTING 2 FT. CONTOUR
- EDGE OF WATER
- PROJECT PROPERTY LINE
- EXISTING SANITARY SEWER
- (96) PROPOSED 2 FT. CONTOUR

GRAPHIC SCALE

0 40 80 160

1"=80'

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PEABODY, MA

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| PROJ MGR: STD | REVIEWED BY: STD | CHECKED BY: TEJ | FIGURE 3 |
| DESIGNED BY: STD | DRAWN BY: EDM | SCALE: 1"=80' | |
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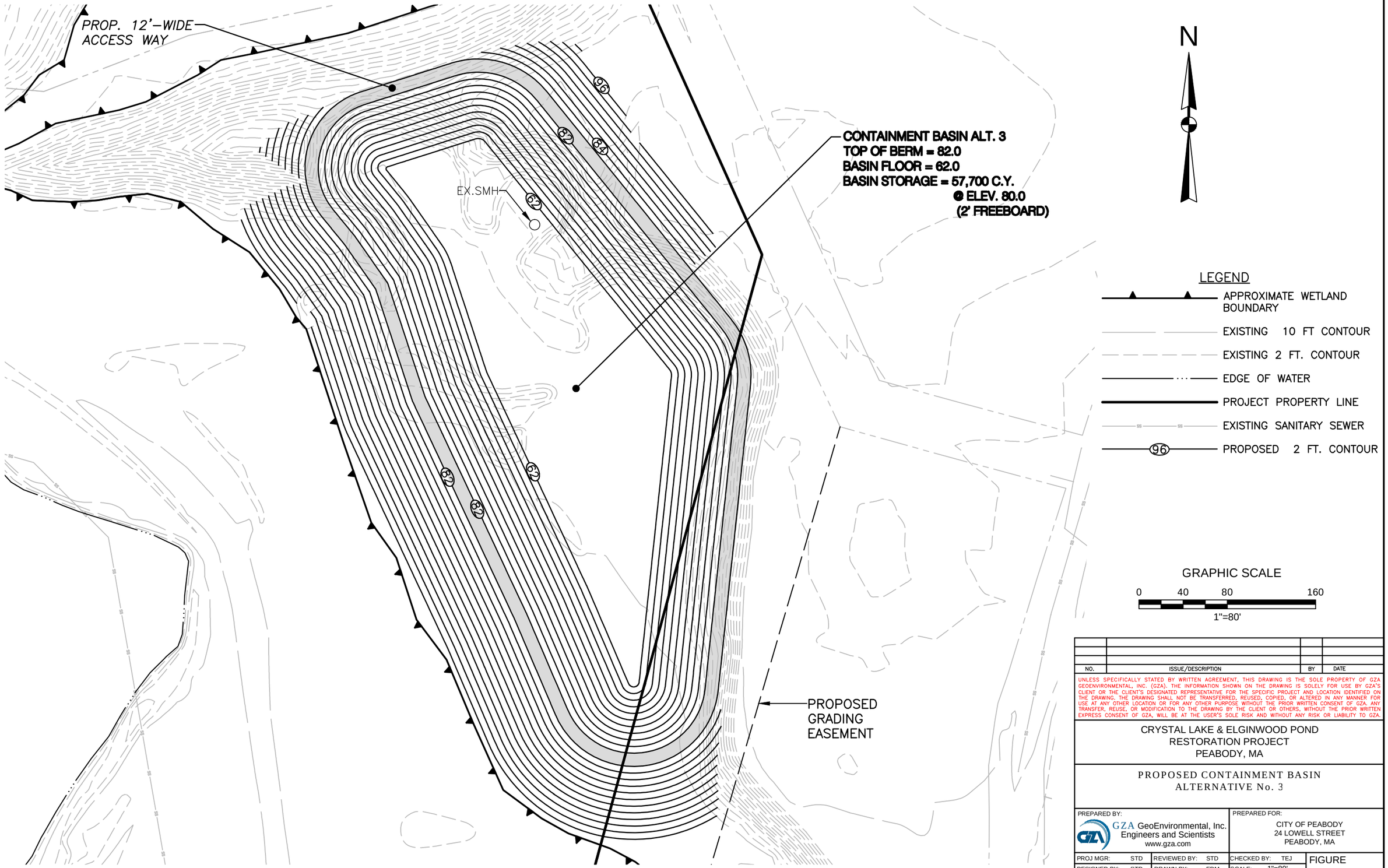


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CRYSTAL LAKE & ELGINWOOD POND
RESTORATION PROJECT
PEABODY, MA

PROPOSED CONTAINMENT BASIN
ALTERNATIVE No. 3

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| PROJ MGR: STD | REVIEWED BY: STD | CHECKED BY: TEJ | FIGURE 4 |
| DESIGNED BY: STD | DRAWN BY: EDM | SCALE: 1"=80' | |
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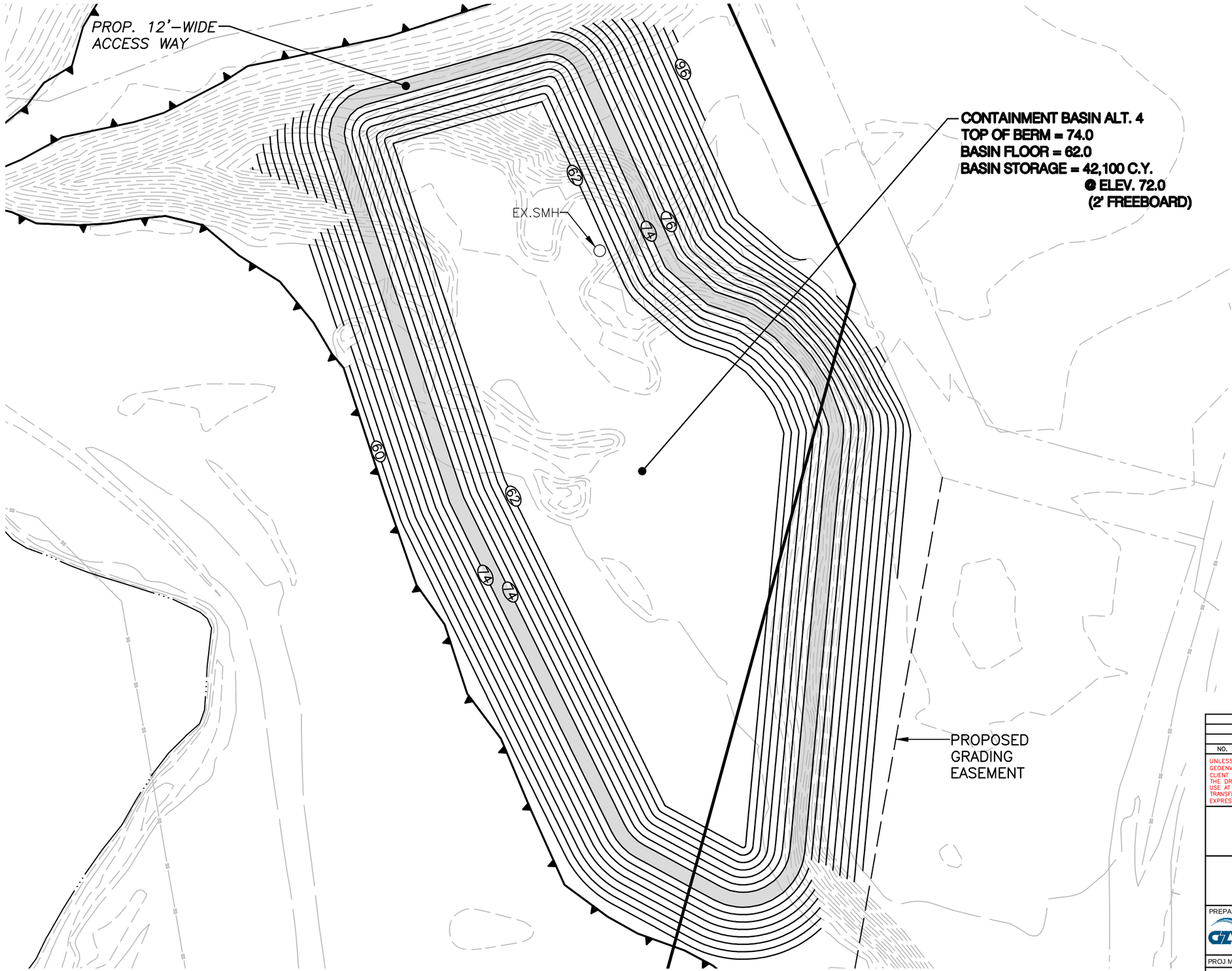


LEGEND

- APPROXIMATE WETLAND BOUNDARY
- EXISTING 10 FT CONTOUR
- EXISTING 2 FT. CONTOUR
- EDGE OF WATER
- PROJECT PROPERTY LINE
- EXISTING SANITARY SEWER
- (96) PROPOSED 2 FT. CONTOUR

GRAPHIC SCALE

0 40 80 160

1"=80'

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PROPOSED CONTAINMENT BASIN
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| PROJ MGR: STD | REVIEWED BY: STD | CHECKED BY: TEJ | FIGURE |
| DESIGNED BY: STD | DRAWN BY: EDM | SCALE: 1"=80' | 5 |
| DATE: APR. 2013 | PROJECT NO. 15.0166128.01 | REVISION NO. | SHEET NO. |

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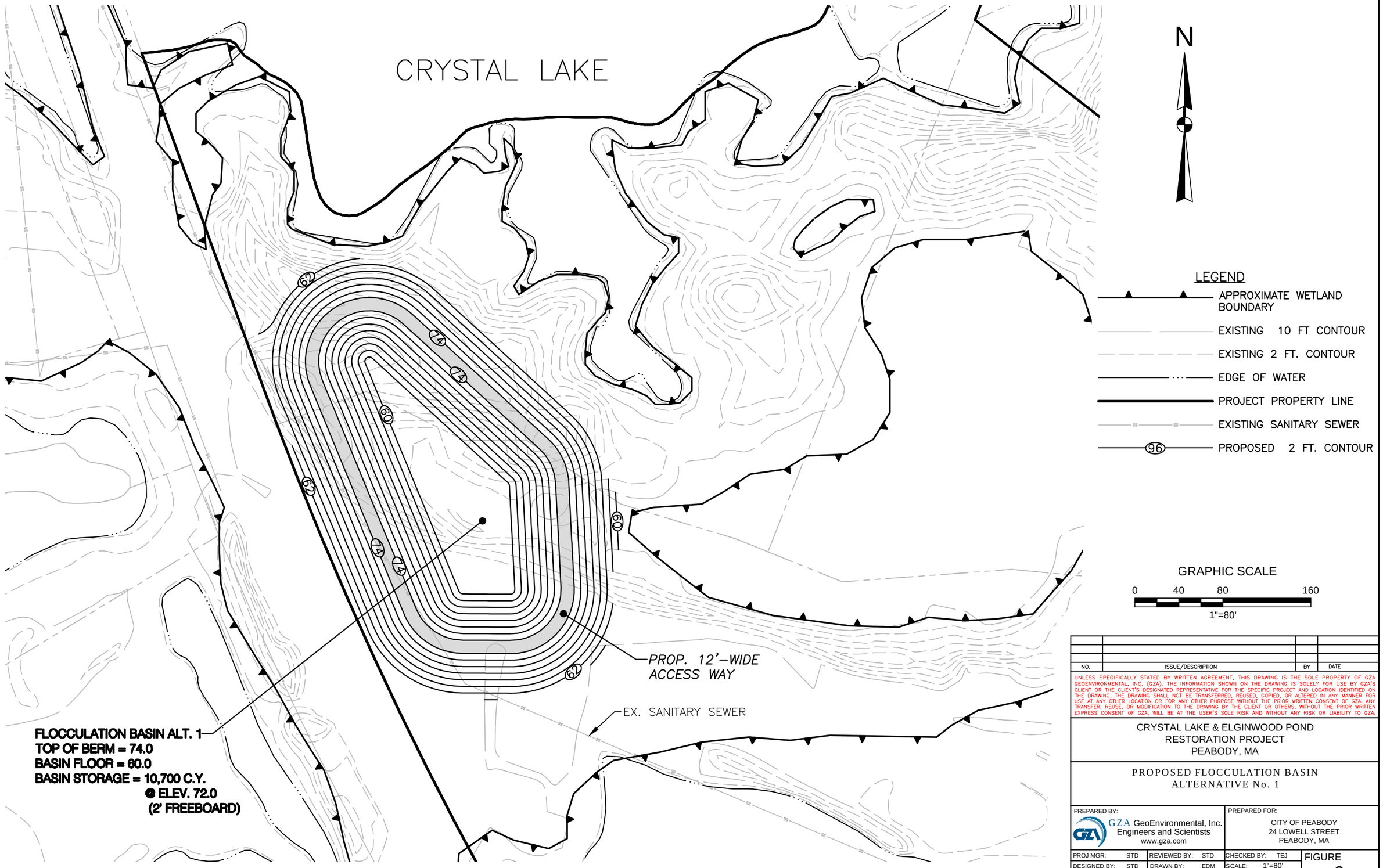


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RESTORATION PROJECT
PEABODY, MA

PROPOSED FLOCCULATION BASIN
ALTERNATIVE No. 1

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| PROJ MGR: STD | REVIEWED BY: STD | CHECKED BY: TEJ | FIGURE 6 |
| DESIGNED BY: STD | DRAWN BY: EDM | SCALE: 1"=80' | SHEET NO. |
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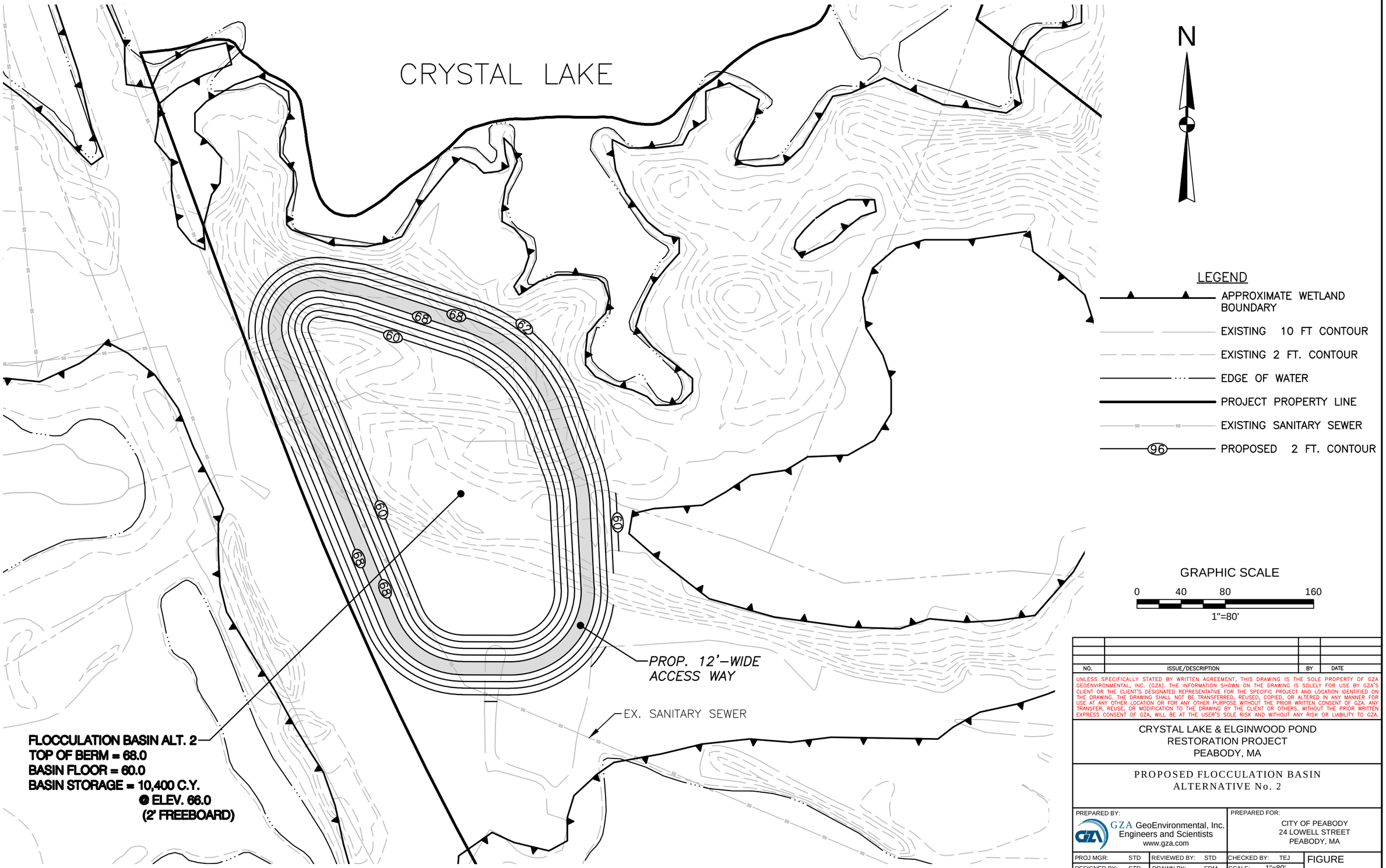


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CRYSTAL LAKE & ELGINWOOD POND
RESTORATION PROJECT
PEABODY, MA

PROPOSED FLOCCULATION BASIN
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| PROJ MGR: STD | REVIEWED BY: STD | CHECKED BY: TEJ | FIGURE 7 |
| DESIGNED BY: STD | DRAWN BY: EDM | SCALE: 1"=80' | |
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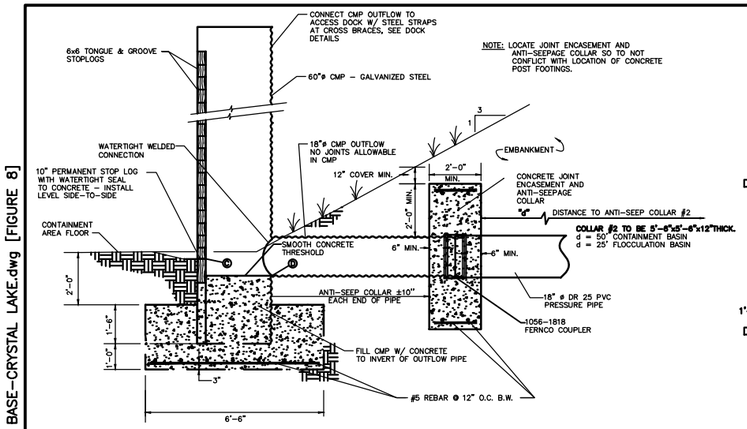
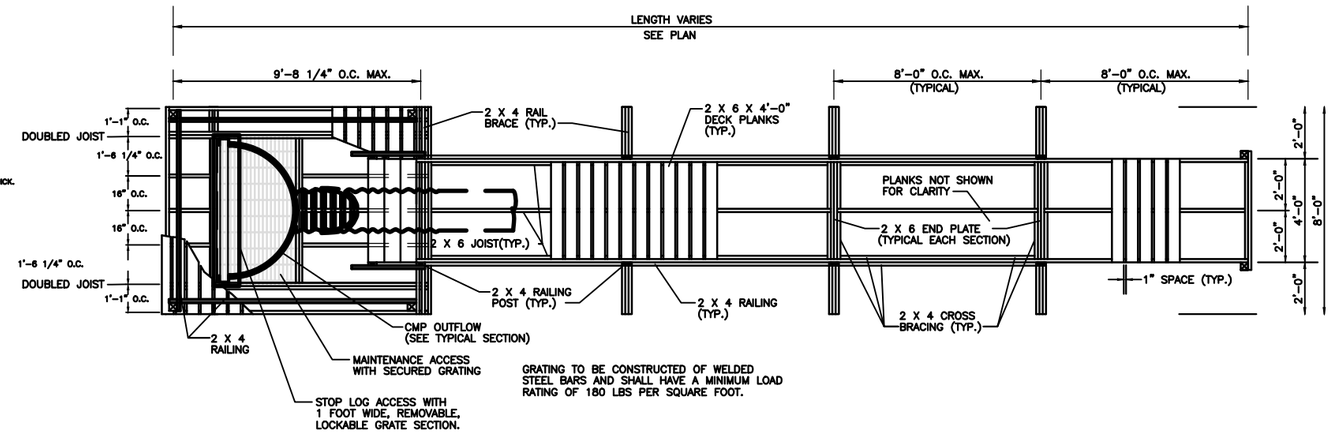
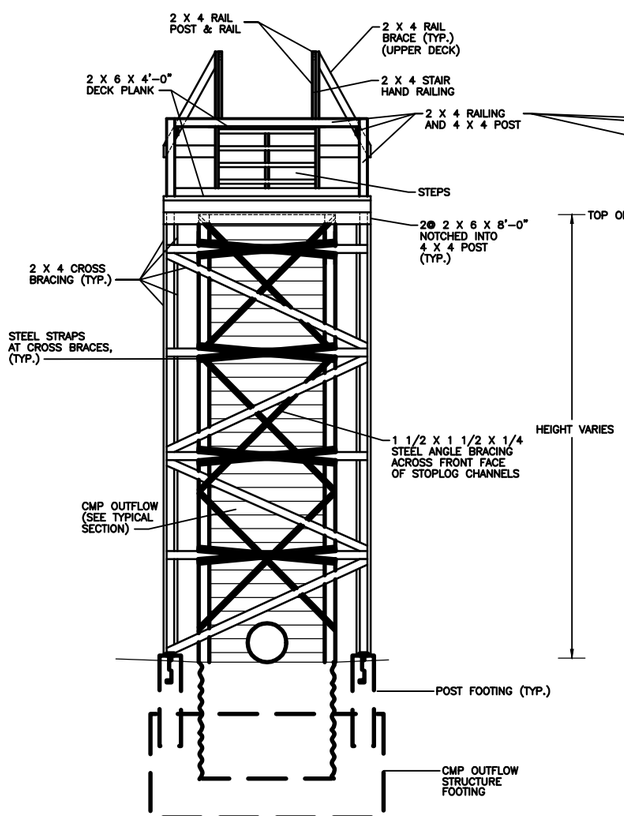



**TYPICAL SECTION–CMP OUTLET STANDPIPE**

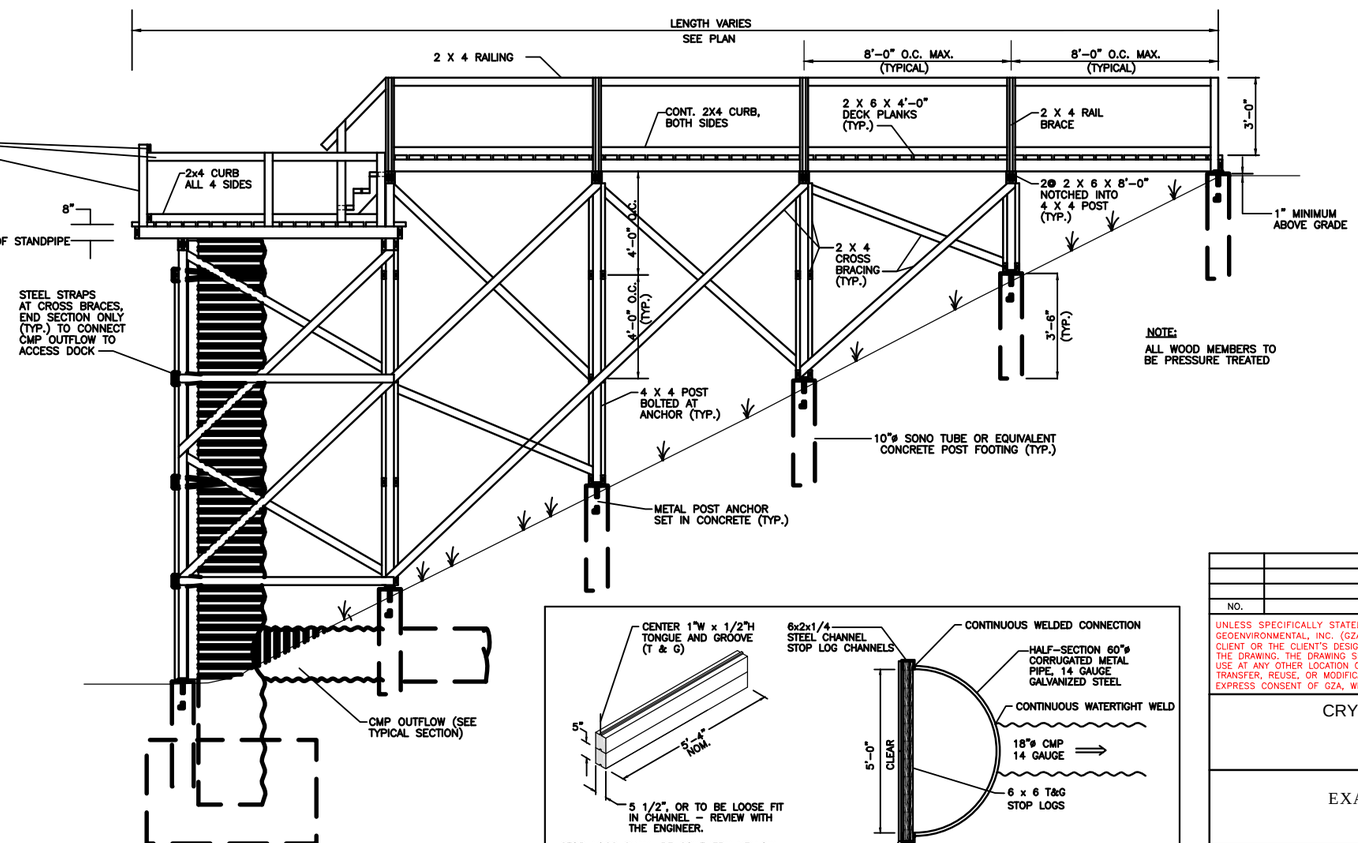
NTS




**PLAN VIEW**




**END VIEW**

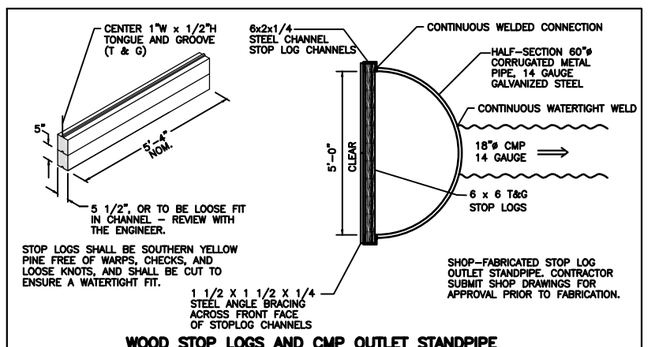



NOTE:
ALL WOOD MEMBERS TO BE PRESSURE TREATED

**ELEVATION**

**BASIN OUTLET STRUCTURE**

NTS




**WOOD STOP LOGS AND CMP OUTLET STANDPIPE**

1/2" = 1'-0"

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CRYSTAL LAKE & ELGINWOOD POND
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EXAMPLE OUTLET STRUCTURE

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| PROJ MGR: STD | REVIEWED BY: STD | CHECKED BY: TEJ | FIGURE 8 |
| DESIGNED BY: STD | DRAWN BY: EDM | SCALE: NTS | |
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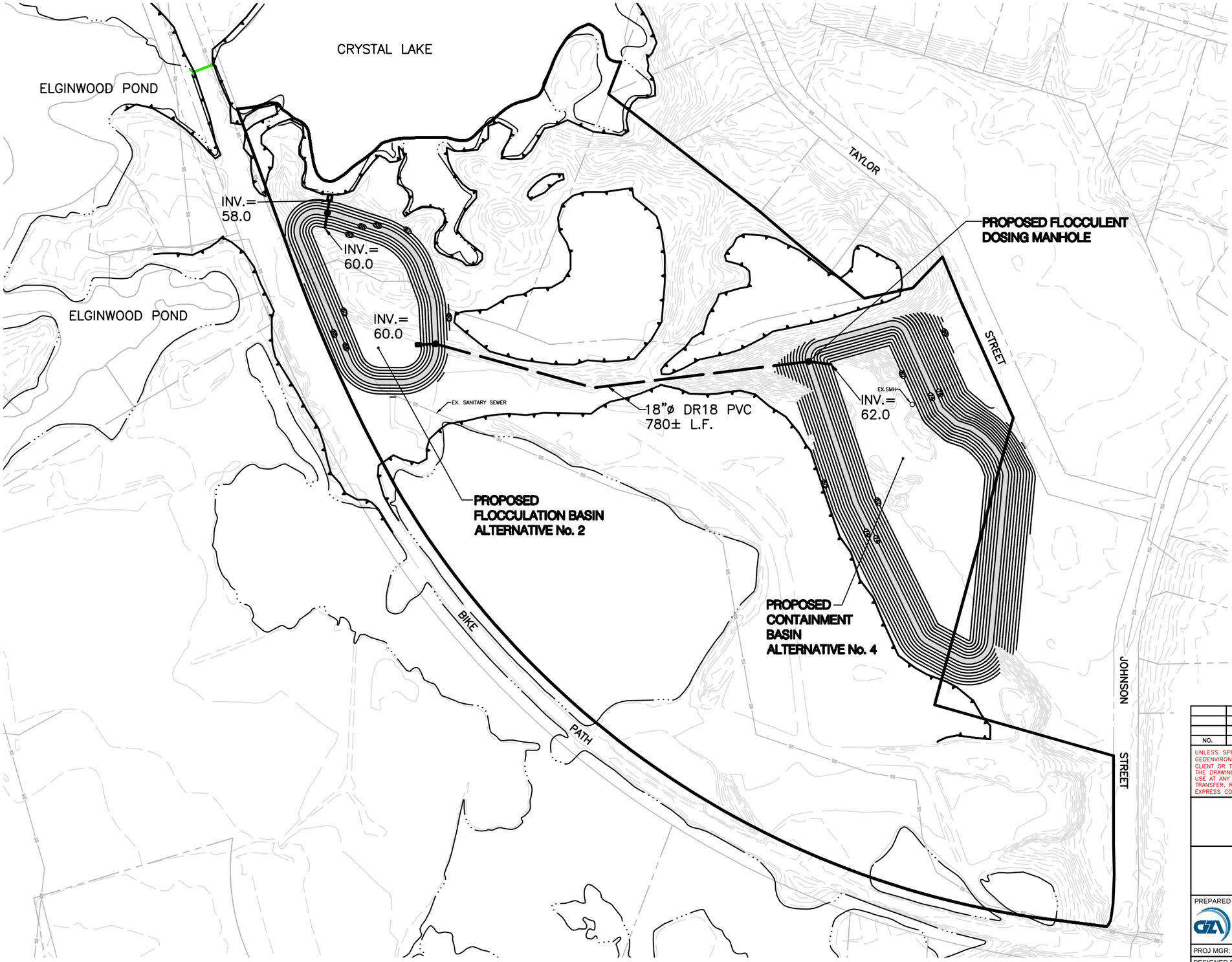


LEGEND

- APPROXIMATE WETLAND BOUNDARY
- EXISTING 10 FT CONTOUR
- EXISTING 2 FT. CONTOUR
- EDGE OF WATER
- PROJECT PROPERTY LINE
- EXISTING SANITARY SEWER
- PROPOSED MANHOLE
- PROPOSED INTER-BASIN PIPING

GRAPHIC SCALE

0 100 200 400

1"=200'

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RESTORATION PROJECT
PEABODY, MA

RECOMMENDED BASIN ALTERNATIVES

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# APPENDIX A: LIST OF PRIOR REPORTS

- "Results of the 1995 Limnological Investigation of Crystal Lake and Elginwood Pond, Peabody, Massachusetts", prepared by Fugro East, Inc., December 1995
- "Executive Summary for dredging Crystal Lake & Elginwood Pond", prepared by the Conservation Commission Ad Hoc Committee, July 31, 1997.
- "Notice of Project Change and Waiver Request – Crystal Lake/Elginwood Pond Dredging Project, Peabody, Massachusetts", prepared by ENSR, November 14, 2000
- "Crystal Lake/Elginwood Pond Aquatic Vegetation, Bathymetric and Sediment Depth Survey", prepared by Geosyntec Consultants, August 21, 2008
- "Study Potential Dewatering Locations at Crystal Lake and Elginwood Pond", prepared by Bioengineering Group, December, 2008.