Memorandum

To: *Paul Holzen, PE*
David Hodnett, PE

From: *Dave Mason, PE, PMP*
Zack Daniel, PE

Date: *February 19, 2019*

Subject: *Scope of Work for Robinson Lake Dam – Final Rehabilitation Design*
Franklin, Tennessee

The purpose of this memorandum is to provide a scope of work and cost proposal for final design of rehabilitation measures for Robinson Lake Dam in Franklin, Tennessee. This scope of work includes a geotechnical investigation to evaluate subsurface conditions for the lake and dam and lake rehabilitation needs summarized in the *Conceptual Engineering Report, Robinson Lake Dam* (CER) dated December 8, 2017 prepared by CDM Smith Inc. (CDM Smith).

Background

The existing Robinson Lake Dam is an earth embankment dam with a concrete spillway in the right abutment discharging to the Harpeth River. The dam has a structural height of 22.5 feet and hydraulic height of 19 feet, with a storage capacity of 91 acre-feet at normal pool and 136 acre-feet at maximum pool.

CDM Smith was recently engaged by the City of Franklin to perform a conceptual engineering design study of Robinson Lake Dam prior to the City acquiring the property on which the dam and lake are located. The purpose of the assessment was to identify potential dam safety deficiencies and provide recommendations for a rehabilitation alternative and an Opinion of Probable Construction Costs (OPCC) as discussed in the Conceptual Engineering Report (CER). Following the submittal of the CER, the City purchased the property from the landowner. Subsequently, the City has selected CDM Smith to perform additional geotechnical investigations and design rehabilitation measures for the dam to meet the requirements of the Tennessee Department of Environmental Conservation (TDEC) dam safety regulations. The design must also consider the plans developed by others to construct a park on the subject property.

Scope of Services

Task 1.0 Initial Meetings

Task 1.1 Project Kickoff Meeting and Project Quality Management (PQM) Workshop

CDM Smith will conduct a project kickoff meeting within two weeks from receipt of a written authorization from the City. This meeting will provide an opportunity for interested and affected parties to understand the scope, schedule, budget, and individual responsibilities for project completion. In conjunction with the typical project kickoff activities, the kickoff meeting will include facilitation of a Project Quality Management (PQM) workshop. The PQM is a facilitated session by a project-independent PQM facilitator where key stakeholders (including City staff if desired) participate in a consensus-building exercise to confirm the project goals and define the critical success factors (CSFs); the processes, activities, and tasks (PATs) needed to achieve success; and, to assign responsibilities for carrying out the tasks.

City staff including Engineering and Parks Department representative(s) should attend both the kickoff meeting and workshop. CDM Smith attendees will include the PQM Facilitator, the Project Manager and the Client Service Leader. CDM Smith geotechnical and structural representatives will participate via conference call.

CDM Smith will prepare and distribute a summary of meeting minutes for the kickoff meeting and Action Items from the PQM to document items discussed with the parties in attendance.

Task 1.2 TDEC Meeting

CDM Smith will coordinate a meeting with TDEC at their headquarters within one month from receipt of a written authorization from the City. The purpose of the meeting will be to review the project and confirm regulatory requirements. City staff, the CDM Smith project manager and senior geotechnical engineer will attend at TDEC's office, and the CDM Smith geotechnical engineer and structural engineer will participate via conference call.

CDM Smith will prepare and distribute a summary of meeting minutes to document items discussed with the parties in attendance.

Task 2.0 Geotechnical Investigation

Task 2.1 Geophysical Surveys

CDM Smith will engage a local geophysical firm, S&ME, Inc. (S&ME), to perform geophysical surveys over the dam embankment, in the downstream areas, across the lake and sinkhole areas within the property to investigate subsurface conditions and identify approximate sediment and overburden thicknesses, depth to bedrock, and potential karst features. The geophysical exploration will consist of land and over-water phases. The proposed test line locations are shown on **Figure 1** and **Figure 1b**.

The geophysical land phase investigations will focus on using Frequency Domain Electromagnetics (FDEM), Electrical Resistivity Tomography (ERT), and Spontaneous Potential (SP) that are summarized below. The field data acquisition is anticipated to take up to four days. The proposed methods will evaluate potential areas of seepage along the dam and downstream areas, identify potential buried structures in the embankment, provide the overburden thickness and top of limestone bedrock and investigate the cause of sinkholes east of the dam. FDEM will be performed over the entirety of the dam embankment and park areas in a grid pattern. FDEM is capable of covering a large area in a limited period of time and permits the ERT test lines and SP to focus on select areas that exhibit subsurface anomalies. The ERT will consist of up to two test lines run along the length of the dam crest and length of the downstream slope or toe of the dam. ERT test lines will also run through the area of known sinkholes in the park. The SP would be performed in the general vicinity of the ERT lines.

The geophysical over-water phase investigations will focus on the lake itself using FDEM and ERT. The field data acquisition is anticipated to take up to five days. FDEM will be conducted in a grid pattern and used initially to map the areas of overburden to identify the top of bedrock and potential karst conditions. Based on the FDEM results, up to three ERT test lines will be conducted at select locations across the lake to identify potential karst features.

CDM Smith's level of effort for this task includes time for arranging the geophysical program and field coordination with the geophysical subcontractor to confirm the appropriate data are collected.

Task 2.2 Sediment Sounding

CDM Smith will engage a local commercial diving firm, Mainstream Commercial Divers, Inc. (MCD), to perform sediment depth readings across the lake using a probe rod and plate. A plate will be attached to the probe rod to measure the depth to the top of the sediment, and the probe rod will be pushed to the approximate bottom of sediment. The readings will be taken on a grid spacing of 20 feet within 100 feet of the dam crest and on a grid spacing of 50 feet over the remainder of the lake. The readings will be taken from a small jon boat or by wading, and each reading will be surveyed using a GPS device.

CDM Smith's level of effort for this task includes time for arranging the sediment sounding program and field oversight for the first day of work to verify that appropriate methods are used. The CDM Smith representative will also collect up to three sediment samples for environmental analysis to be conducted in general accordance with United States Environmental Protection Agency (USEPA) analysis methods for sediment.

Task 2.3 Geotechnical Test Boring and Laboratory Testing Program

CDM Smith will engage a local geotechnical drilling firm, S&ME, to perform field explorations on the dam embankment, in the downstream and abutment areas and in the vicinity of known sink holes to identify potential karst features. The geotechnical exploration will consist of a minimum of 13 Standard Penetration Test (SPT) borings including the following:

- 13 land borings: two borings along the dam crest, two borings along the existing auxiliary spillway, four borings along the proposed emergency spillway and associated crest, one boring at the proposed outlet structure, one boring near the right abutment and three in the vicinity of the known sink holes in the park. The assumed depth of boring ranges from 15-25 feet per location with an assumed rock coring length of 10-20 feet per location. The boring locations are shown on **Figure 2.**

The borings will include continuous sampling through the overburden, and NQ-size rock coring. It is assumed that packer testing will be conducted in up to five of the borings for evaluation of bedrock permeability.

CDM Smith's level of effort for this task includes field oversight by a qualified geotechnical engineer to direct the work, log the borings, and verify that appropriate methods are used. This oversight is typical for CDM Smith projects where dam safety investigations are performed.

Geotechnical laboratory tests will be performed on selected samples from the borings. The tests will include grain size tests, moisture content, Atterberg limits, triaxial tests, and laboratory mini-vane tests.

Task 3.0 Final Studies and Analyses

Task 3.1 Final Dam Breach Analysis and Spillway Evaluation

Following the meeting with TDEC to confirm the requirements for the dam hazard classification, CDM Smith will perform an updated dam breach analysis to develop the basis for a new dam hazard classification. The updated analysis will use the previous modeling effort performed by CDM Smith for the Conceptual Engineering Report as the baseline. The following tasks will be completed for this updated analysis:

- Simulation of "stormy day" dam failure flood waves and resulting incremental inundation extents for determining loss-of-life hazards. The "stormy day" is based on the 100-year, 1/3 Probable Maximum Precipitation (PMP), and ½ PMP design storms in support of determining the hazard classification.

- Evaluation of the hazard classification of Robinson Lake Dam based on downstream potential for loss of life during a dam failure.

- Summarize the results of the H&H analysis and document impact of the floodwave resulting from dam breach scenarios and associated hazards in technical memorandum.

- Provide recommendations for hazard classification in accordance with requirements of the Rules of Tennessee Department of Environment and Conservation Water Resources Division Chapter 0400-45-07-.05 Classification of Dams.

- Determination of the 6-hour design storm associated with the updated hazard classification and a SMALL size dam as defined in Section (3)(B) of TDEC Rule 0400-45-07-.05.

- Hydraulic calculations to size the primary spillway, downstream impact stilling basin/energy dissipation structure, auxiliary spillway, and emergency spillway based on the required design storm of the appropriate hazard classification

Task 3.2 Final Geotechnical Analyses

CDM Smith will perform geotechnical design analyses for the dam rehabilitation design. The analyses will include seepage, stability, settlement and other analyses required for the rehabilitation design. CDM Smith will also perform a spillway alternatives analysis to include in the draft design report.

Task 3.3 Final Structural Analyses and Design

CDM Smith will perform structural design analyses for the dam rehabilitation. The analyses will include structural design of the drop-inlet, downstream impact stilling basin/energy dissipation structure, and auxiliary spillway replacement.

Task 3.4 Draft Design Report Deliverable

CDM Smith will prepare a draft design report summarizing the data collection completed in Task 2, provide updated modeling and analyses completed under Tasks 3.1 and 3.2 and will include preliminary design figures. The report will generally be presented as follows:

- Summary of field data collection
- Design criteria for rehabilitation design
- Hydrologic/hydraulic, geotechnical and structural analyses
- Summary of rehabilitation design
- Revised summary of permitting requirements
- Opinion of probable construction cost (OPCC)
- Preliminary construction drawings
- Proposed table of contents for technical specifications

Three hard copies and one digital copy of the draft design report will be provided to the City for review. Comments will be incorporated, and three hard copies and one digital copy of the PDR will be provided to the City.

The proposed contract drawing list is included in **Attachment A**.

Task 3.4.1 Progress Meeting No. 1

A progress meeting will be conducted near the end of Task 3.4 to present the findings for Task 3.0 and decide the rehabilitation measures for the dam and lake. Prior to Progress Meeting No. 1, CDM

Smith will provide the City with the draft PDR that will be finalized following the conclusion of the meeting. City staff and the CDM Smith project manager will attend this progress meeting that will be held at the City's office. CDM Smith geotechnical and structural representative(s) will attend via conference call. City stakeholders, such as a representative of the Parks Department, should attend this meeting to confirm that the proposed design and spillway alignment will not impact key components of the planned park project that is being completed by others.

CDM Smith will prepare and distribute a summary of meeting minutes to document items discussed with all parties in attendance.

Task 4.0 Preparation of Contract Documents

CDM Smith will prepare final design documents for bidding and construction of the project. The preliminary design evaluation conducted by CDM Smith will be used as the basis for the final design.

The following is a description of the design submittals and technical review approach.

Task 4.1 60-Percent Design Submittal

CDM Smith will prepare a 60-percent design package that will include design drawings with comments incorporated from the draft PDR review by the City, draft project specifications, and an opinion of probable construction cost. The cost will be developed by CDM Smith's cost estimating group and will include an evaluation of recent bid tabulation data and local contractor input for similar projects.

Project specifications will be developed using the Construction Specifications Institute (CSI) 50 division format. CDM Smith will use the City Contract Forms, General Conditions, and appropriate Supplementary Conditions for the contractual requirements. The entire draft construction contract will be submitted for review.

Three hard copies and one digital copy of the 60-percent design submittal will be provided to the City for review.

Task 4.1.1 Progress Meeting No. 2

A progress meeting will be held after the City has reviewed the 60-percent design and provided written comments to CDM Smith. City staff and the CDM Smith project manager and senior geotechnical engineer will attend this progress meeting that will be held at the City's office. CDM Smith's geotechnical engineer and structural engineer will attend via conference call.

CDM Smith will prepare and distribute a summary of meeting minutes to document items discussed with all parties in attendance.

Task 4.2 90-Percent Design Submittal

CDM Smith will prepare a 90-percent design package that will include design drawings with comments incorporated from the 60-percent design review by the City, project specifications, and an opinion of probable construction cost. The cost will be developed by CDM Smith's cost estimating group and will include an evaluation of recent bid tabulation data and local contractor input for similar projects.

Three hard copies and one digital copy of the 90-percent design submittal will be provided to the City for review.

Task 4.2.1 Progress Meeting No. 3

A progress meeting will be held after the City has reviewed the 90-percent design and provided written comments to CDM Smith. City staff and the CDM Smith project manager will attend this progress meeting that will be held at the City's office. CDM Smith's geotechnical engineers and structural engineer will attend via conference call.

CDM Smith will prepare and distribute a summary of meeting minutes to document items discussed with all parties in attendance. Any comments provided in writing by the City or at the Progress Meeting will be addressed in the 100-percent design submittal.

Task 4.2.2 Finalize Design Report

The final design report will be updated based upon the draft design report and will reflect any updates from the design submittals. The final design report along with the 90-percent design package will be the basis of required submittals to the permitting agencies for project approval.

Task 4.3 100-Percent Design Submittal

CDM Smith will prepare final design drawings and specifications for the 100-percent design submittal. The 100-percent design submittal will be provided to the City and considered final.

Three hard copies and one digital copy of the 100-percent design submittal will be provided to the City. Digital files will include PDF files and AutoCAD™ files of the design and survey files.

TASK 5 Permitting Services

Task 5.1 Permit Package Development and Submittals

Implementing the proposed project will require multiple permits from several agencies. This scope of work includes labor by CDM Smith staff to meet with the respective agencies, develop the appropriate permitting packages for each agency and to respond to one round of comments on the permit submittals for each agency. All fees associated with the permit submittal applications will be paid by the City of Franklin. It is anticipated that the proposed spillway alignment and/or park improvements (to be completed by others) will likely impact one or more existing wetlands on-site. This scope of services does NOT include preparation of a wetland mitigation plan as it has not yet been determined if such a plan is required. The scope of work also does not include the design of a

wetland mitigation project. If meetings with the regulatory agencies for the permits below conclude that a wetland mitigation plan is required, additional compensation in the form of a contract amendment may be necessary.

The following subsections summarize the anticipated permit requirements:

- **Local City of Franklin Permits** – Per communication with David Hodnett via email in December 2018, City staff will be responsible for obtaining all local permits. CDM Smith design plans will be used to support these permits submittals, but CDM Smith will not be responsible for developing the permit packages.

- **TDEC Aquatic Resource Alteration Permit (ARAP)** – CDM Smith will meet with the relevant agency and prepare a complete submittal package for approval. This scope of work assumes that a general permit will be issued for this project. If an individual ARAP is required, additional compensation in the form of a contract amendment may be required. Any public notice requirements associated with the permit will be the responsibility of the City of Franklin.

- **TDEC Alteration Permit** - A Safe Dams Alteration Certificate will need to be issued for the rehabilitation of the Robinson Lake Dam. The plans, specifications and engineering report for the rehabilitation will need to be submitted for approval prior to the issuing the project for bid. CDM Smith will prepare this submittal package for approval.

- **TDEC NPDES Stormwater Construction General Permit** – This scope of work includes the development of the NOI and associated SWPPP. CDM Smith will complete the NOI and prepare the project specific SWPPP to be submitted to TDEC for approval.

- **FEMA No-Impact Certification** – This scope of work assumes that the proposed project will not cause a rise in the FEMA regulated floodplain. CDM Smith will prepare the supporting documentation and application for a No-Impact Certification to be submitted to the City of Franklin Floodplain Administrator.

- **USACE Pre-Construction Notification** – A Pre-Construction Notification (PCN) is required to be submitted to the USACE. The notification application form requires a delineation of wetlands on the site. The level of effort to perform a wetland delineation on the site is included in this level off effort, along with the preparation of the PCN submittal package.

- **USACE Section 404 Permit** – The project as proposed is likely to require a Nationwide Permit 3 from the USACE. The scope and fee associated with this effort assumes that a general Nationwide permit will be granted. CDM Smith will prepare the relevant materials for this permit submittal. If the USACE determines that an individual permit is required, the level of effort for the submittal package will increase and additional compensation for services will be required.

Task 6.0 Bidding Services

Task 6.1 Pre-Bid Meeting

The City of Franklin staff will facilitate a pre-bid meeting to discuss the project with prospective bidders and provide a site visit. City staff and the CDM Smith project manager will attend the meeting in person. The CDM Smith geotechnical engineer (Engineer of Record) will participate in the meeting via conference call.

The City of Franklin will prepare and distribute a summary of meeting minutes to document items discussed with the parties in attendance as part of the first addendum. CDM Smith will contribute to the meeting minutes by providing answers to specific questions. CDM Smith is not responsible for distribution of plan sets to prospective bidders.

Task 6.2 Addenda

The City of Franklin will coordinate all responses to contract and design document addenda. CDM Smith staff will assist the City in providing technical responses associated with the design.

General

Project management and administration costs associated with this scope of work are included within each task.

Schedule

CDM Smith will begin work on this project immediately upon receipt of a written authorization from the City. It is anticipated that the work will be completed within a 15-month period. A proposed milestone schedule is provided herein. A detailed project schedule will be developed after the project kickoff meeting.

Key Milestone and/or Deliverable	Anticipated Timeline
Notice to Proceed	April 1, 2019
Draft Design Report & Preliminary Drawings	August 31, 2019
60 Percent Design Package	December 20, 2019
90 Percent Design Package	March 30, 2020
100% Design Package	June 30, 2020

The schedule milestones are contingent upon timely review by City staff of deliverables. It has been assumed that deliverables will be reviewed within two weeks of submittals. The final, 100% design package timeline is contingent upon timely review of permit packages by the respective regulatory agencies. This schedule assumes a 60-day review period for regulatory agencies.

Budget

CDM Smith will perform Tasks 1.0 to 6.0, billed hourly, for a not-to-exceed upper limit of $602,300, which includes CDM Smith labor, outside professionals (including a 10% markup for administration), and other direct costs not included within the billing rates.

Invoices will be submitted to the City monthly based on hours completed and charges incurred within the billing period. A project status report will accompany each invoice. A table of billing rates and a summary of costs by task is provided below:

City of Franklin, Tennessee
Robinson Lake Dam Final Rehabilitation Design
February 2019

Task	Description	Task Hours	Labor Cost	Other Direct Costs	Outside Professionals	Total Cost
1	Initial Meetings	75	$ 12,900	$ 2,400	$ -	$ 15,300
2	Geotechnical Investigation	319	$ 43,300	$ 6,000	$ 119,100	$ 168,400
3	Final Studies and Analyses	1,173	$ 156,000	$ 1,200	$ -	$ 157,200
4	Preparation of Contract Documents	1,514	$ 209,500	$ 1,200	$ -	$ 210,700
5	Permitting Services	331	$ 44,900	$ -	$ -	$ 44,900
6	Bidding Services	33	$ 5,800	$ -	$ -	$ 5,800
	TOTAL BASIC SERVICES =	3,445	$ 472,400	$ 10,800	$ 119,100	$ 602,300

Project Billing Rates	
Category	**Rate**
Officer	$225
Project Manager	$200
Senior Technical Specialist	$210
Technical Specialist	$190
Senior Engineer/Scientist	$165
Engineer/Scientist III	$145
Engineer/Scientist II	$130
Junior Engineer/Scientist	$120
Construction Cost Estimator	$160
Senior Designer	$165
Designer/Drafter/GIS Technician	$110
Project Accounting	$100
Administrative	$100

Attachment A – Proposed Contract Drawing List

1. G-0 Cover Sheet
2. G-1 General Notes, Symbols and Abbreviations
3. G-2 Construction Sequence
4. C-1 Existing Conditions Plan
5. C-2 Horizontal Control Plan
6. C-3 Demolition and Temporary Bypass Plan
7. C-4 Stream Diversion Plan
8. C-5 Stream Diversion Details I
9. C-6 Stream Diversion Details II
10. C-7 Foundation Grouting Plan and Details
11. C-8 Lake Sediment Excavation Plan
12. C-9 Lake Sediment Excavation Sections
13. C-10 Proposed Conditions Plan
14. C-11 Proposed Dam Sections I
15. C-12 Proposed Dam Sections II
16. C-13 Grading Plan
17. C-14 Emergency Spillway Plan, Sections and Details
18. C-15 Erosion and Sedimentation Control Plan (Phase 1)
19. C-16 Erosion and Sedimentation Control Plan (Phase 2)
20. C-17 Stabilization Plan
21. CD-1 Erosion and Sedimentation Control Details I
22. CD-2 Erosion and Sedimentation Control Details II
23. CD-3 Civil Details I

24.	CD-4	Civil Details II
25.	CD-5	Stabilization Notes
26.	S-1	Standard Structural Notes and Abbreviations
27.	S-2	Riser Inlet Plans and Sections
28.	S-3	Riser Inlet Sections and Details
29.	S-4	Impact Stilling Basin Plan and Section
30.	S-5	Impact Stilling Basin Sections and Details
31.	S-6	Auxiliary Spillway Replacement Plan
32.	S-7	Auxiliary Spillway Replacement Sections and Details
33.	SD-1	Standard Structural Details I
34.	SD-2	Standard Structural Details II

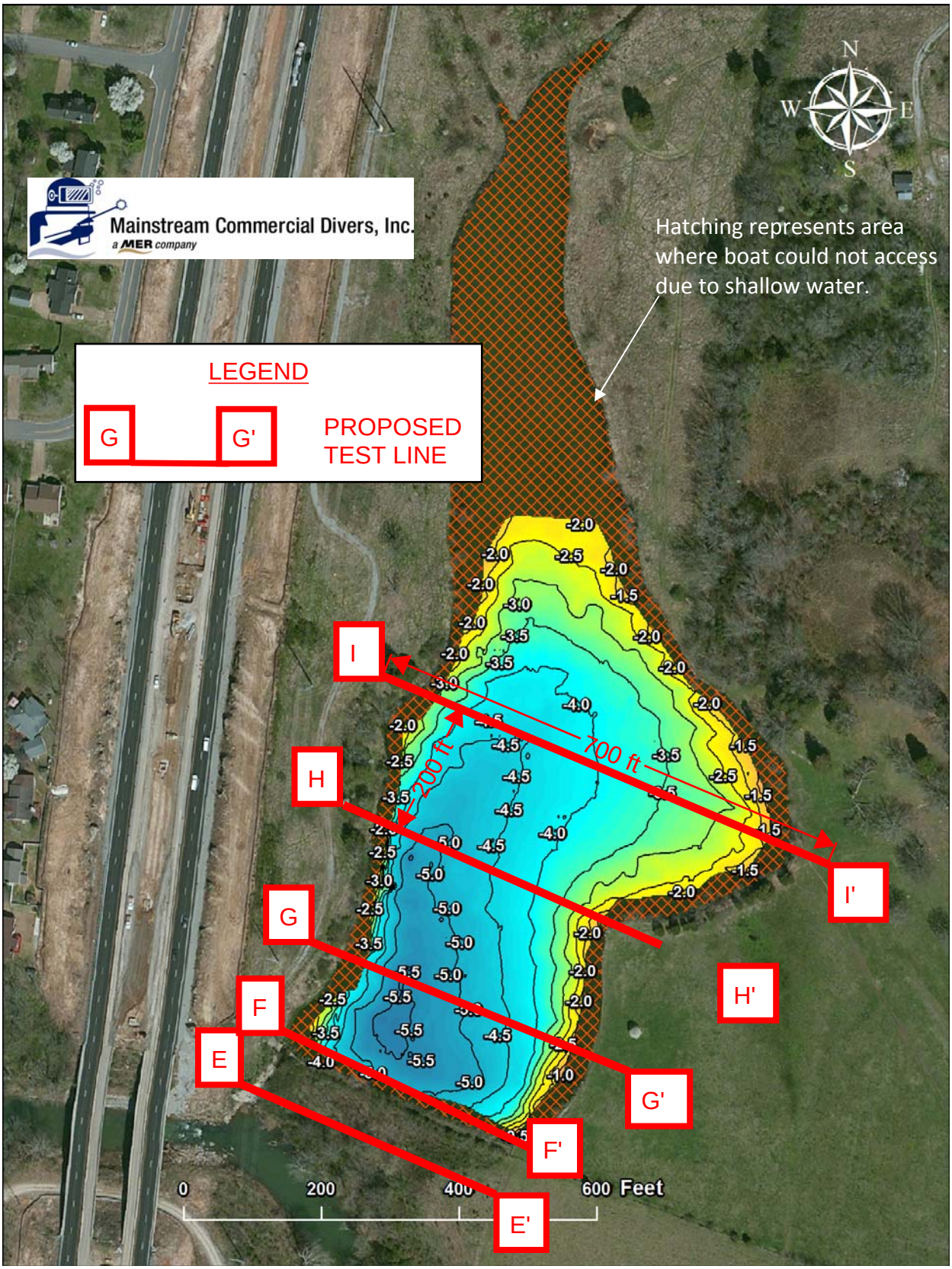
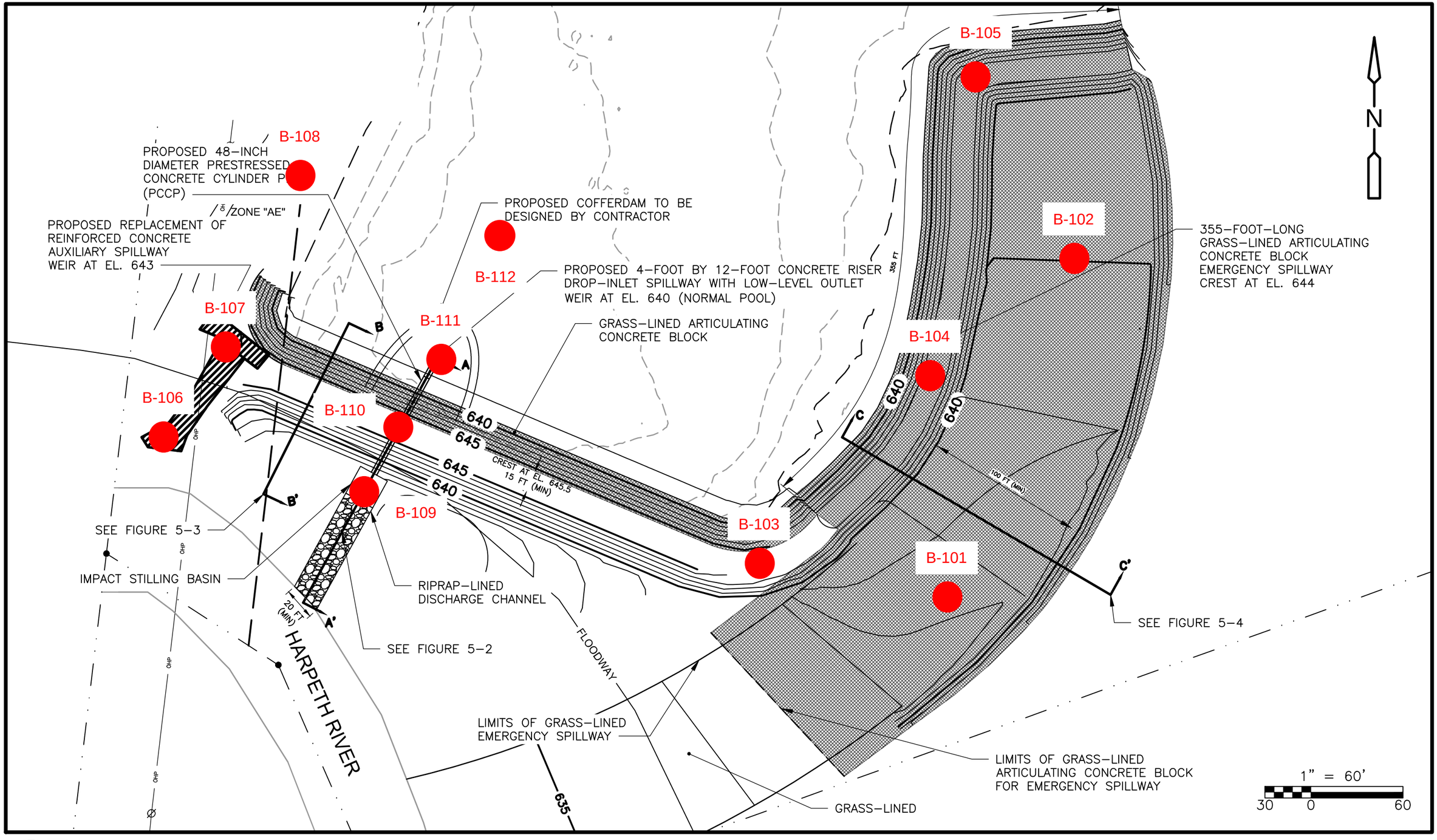


FIGURE 1 -
PROPOSED GEOPHYSICAL ERT
TEST LINE LOCATION PLAN

Figure 1b – Geophysical Test Lines in park area to investigate sinkholes



CDM Smith

CITY OF FRANKLIN, TENNESSEE
ROBINSON LAKE DAM
ROBINSON LAKE
FRANKLIN, TENNESSEE

FIGURE 2 -
PROPOSED BORING LOCATION PLAN