

**Estimated Sediment Volume:  
Bridge Street Dam  
Impoundment**

Estimated Volume of  
Accumulated Sediment  
Bridge Street Dam Impoundment  
Royal River, Yarmouth, Maine



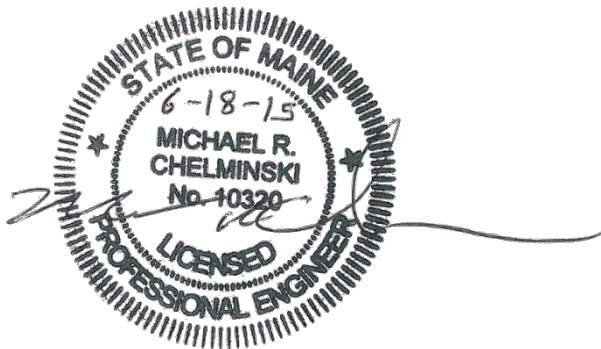
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June 19, 2015

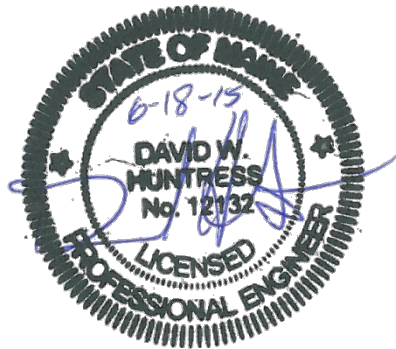
## Sign-off Sheet

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Michael Chelminski, P.E.



Reviewed by \_\_\_\_\_  
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**ESTIMATED SEDIMENT VOLUME:  
BRIDGE STREET DAM IMPOUNDMENT**

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# ESTIMATED SEDIMENT VOLUME: BRIDGE STREET DAM IMPOUNDMENT

Introduction  
June 19, 2015

## 1.0 INTRODUCTION

This report presents information on the composition, volume, and potential mobility of accumulated sediment in the Bridge Street Dam impoundment on the Royal River in Yarmouth, Maine, and was prepared for the Town of Yarmouth, Maine (Town) by Stantec Consulting Services Inc. (Stantec).

The objective of this study is to provide estimates of the volume and composition of accumulated sediment in the Bridge Street Dam impoundment. The dam impoundment, which is the area that is influenced by the backwater created by the dam, extends from the dam upstream to Middle Falls on the Royal River, and has an overall length of approximately 2,000 feet (ft). The normal pool surface area of the impoundment is approximately 9 acres, and the maximum depth of water at the normal pool water surface elevation is approximately 15 ft.

### 1.1 BACKGROUND INFORMATION

Bridge Street Dam is owned by the Town and located approximately 2,000 feet (ft) upstream from the head-of-tide in the Royal River in the vicinity of the East Main Street (State Route 88 Bridge). The Town is evaluating potential alternatives to maintaining the dam, including removal of the dam, and has convened a group of stakeholders to address concerns related to removal of the dam. The primary identified concern to removal of the dam is the potential for remobilization of sediment from the Bridge Street Dam impoundment and transport and deposition of remobilized sediment in the tidally affected reach of the Royal River seaward from the East Main Street and Interstate 295 (I295) bridges. Specific concern associated with remobilization of sediment from the Bridge Street Dam impoundment include 1) the potential for this material to contribute to shoaling in Yarmouth Harbor, and 2) remobilization of environmental contaminants that may be present in the impoundment and deposition of this material in the harbor.

Information obtained as part of previous project studies indicate that there is little accumulated sediment in the Bridge Street Dam impoundment, and that impoundment is subject to scour during high-flow events. Factors that may contribute to the apparent lack of accumulation of sediment in this impoundment appear to include: 1) limited transport of coarse sediment (i.e., gravel-size material and larger) into this impoundment, and 2) relatively high-speed flow in the impoundment during high-flow events that continually remobilize finer-grained sediments and deliver them to the downstream reach of the river. Observations during a drawdown of the impoundment appear to support the above mentioned factors, in that relatively shallow bedrock outcrops with little to no accumulated material were observed in areas of the impoundment during the prior drawdown and during a drawdown on November 12, 2014, during the field study described in this report.



## ESTIMATED SEDIMENT VOLUME: BRIDGE STREET DAM IMPOUNDMENT

Field Study  
June 19, 2015

### 2.0 FIELD STUDY

#### 2.1 PREPARATION FOR FIELD STUDY

Sediment probing locations were established prior to the initiation of field studies to provide approximate locations of 13 survey transects. Prior to the field study, the endpoints of each transect were loaded into a Global Positioning System (GPS) receiver to facilitate locating the survey transects during the field study.

#### 2.2 FIELD STUDY

The field study was performed on Wednesday, November 12, 2014, and coincided with a drawdown of the Bridge Street Dam impoundment. Field surveys were performed by a two-person crew from a small boat and wading in shallow areas. Sediments were manually probed using a fiberglass survey rod at intervals of approximately 20 ft along 13 transects spaced approximately 150 ft apart along the impoundment, and provided measurements at 109 locations in the impoundment. Sediment depths were recorded as the difference between the measured depth of water and the measured depth-to-refusal based on manually advancing the survey rod into sediment. The horizontal position of probed locations was obtained with a Wide Area Augmentation System-enabled GPS receiver.

The locations of the 13 transects across the Bridge Street Dam impoundment are depicted in Figure 1. The survey transects (red lines in Figure 1) are numbered sequentially (1 – 13) progressing upstream from the dam, and the locations where sediment depths were measured to refusal are depicted (red dots) along each transect.

Depths were recorded relative to the water surface during the field studies and not to a specific elevation. The height of the water surface below the right upstream training wall of the fishpass was measured as 4.6 ft prior to the initiation of the sediment probing work at 7:10 AM and as 4.5 ft at 15:15 pm at the completion of the sediment probing field surveys. Of note is that the impoundment drawdown results in exposure of bedrock ledge (Photo 1) upstream from the footbridge over the Royal River along the Beth Condon Memorial Trail. When exposed, this ledge forms the hydraulic control for the upstream reach of the river to the base of Middle Falls and results in higher water surface elevations relative to the reach of the impoundment downstream from the ledge.

**ESTIMATED SEDIMENT VOLUME:  
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Field Study  
June 19, 2015

**Photo 1: Ledge Upstream from Beth Condon Memorial Trail Footbridge  
(flow is from right to left)**



In addition to the measurements of sediment depth in the impoundment, 8 sediment probes were performed at two locations along the left<sup>1</sup> side of the impoundment in areas along the edge of the normal impoundment, including an area of emergent vegetation downstream from the U.S Route 1 Bridge. Probing in these locations was performed using a 4'-2" steel rod. These probe locations are depicted as yellow dots in Figure 1.

Sediment characteristics were estimated and recorded at selected sediment locations. The sediment characteristics were estimated based on the felt response during the sediment probe and referenced to each location in the field notes and in the codes entered into the GPS receiver at the selected locations. A copy of the field notes is included as Appendix A.

Following the sediment probing on November 12, 2014, Stantec canoed the perimeter of the impoundment between Bridge Street Dam and the exposed ledge to observe apparent conditions. Observations during this cruise confirm the presence of accumulations of fine sediment along the margins of the dewatered sediment, including benches that may support emergent vegetation, and a number of areas with localized accumulations of fine sediment (sand). Localized accumulations of fine sediment were observed immediately upstream from the Sparhawk Mill hydroelectric facility trashrack and at two locations where stormwater is discharged to the impoundment.

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<sup>1</sup> Directionals "left" and "right" are based on an observer facing downstream.

**ESTIMATED SEDIMENT VOLUME:  
BRIDGE STREET DAM IMPOUNDMENT**

Field Study  
June 19, 2015

**Photo 2: Accumulated Sediment at Stormwater Outfall (left side of river immediately upstream from U.S. Route 1 Bridge)**



- 1 CROSS SECTION OF MANUAL PROBING
- TOP OF SEDIMENT
- BOTTOM OF SEDIMENT
- TRANSECT GPS PROBE POINT
- BANK GPS PROBE POINT

1. CROSS SECTION DATA WAS DEVELOPED FROM MANUAL PROBING COLLECTED BY GPS AND PERFORMED BY STANTEC ON NOVEMBER 12, 2014.
2. 2012 MAINE AERIAL ORTHOIMAGERY PROVIDED BY MAINE OFFICE OF GEOGRAPHIC INFORMATION SYSTEMS (MEGIS).
3. ORIENTATION OF ALL CROSS SECTION VIEWS ARE FACING DOWNSTREAM.


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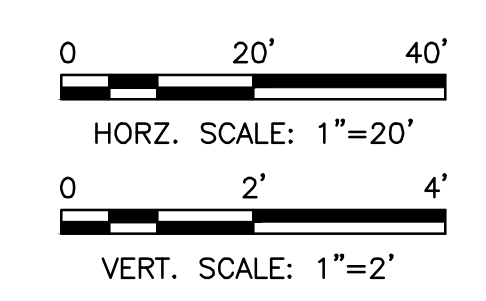
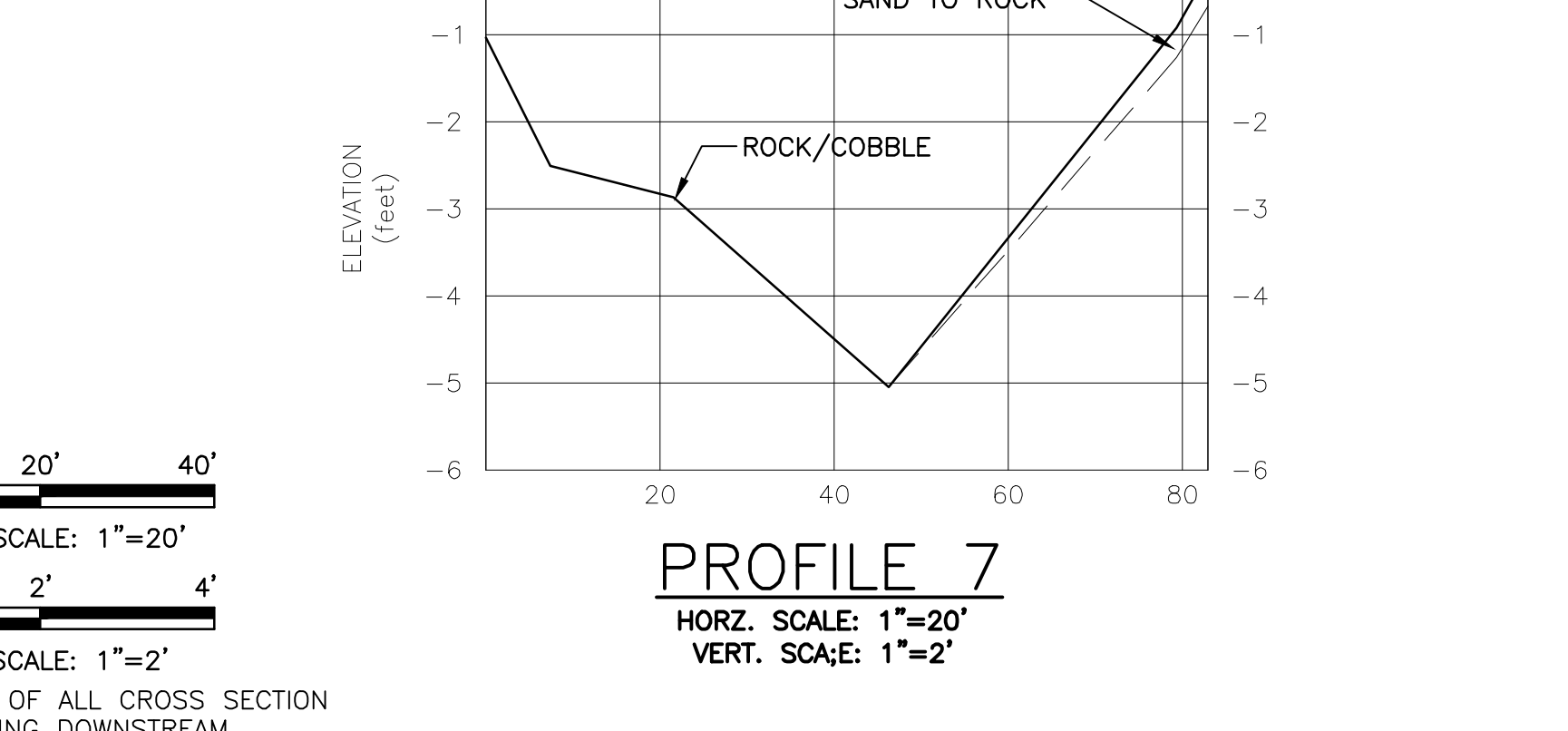
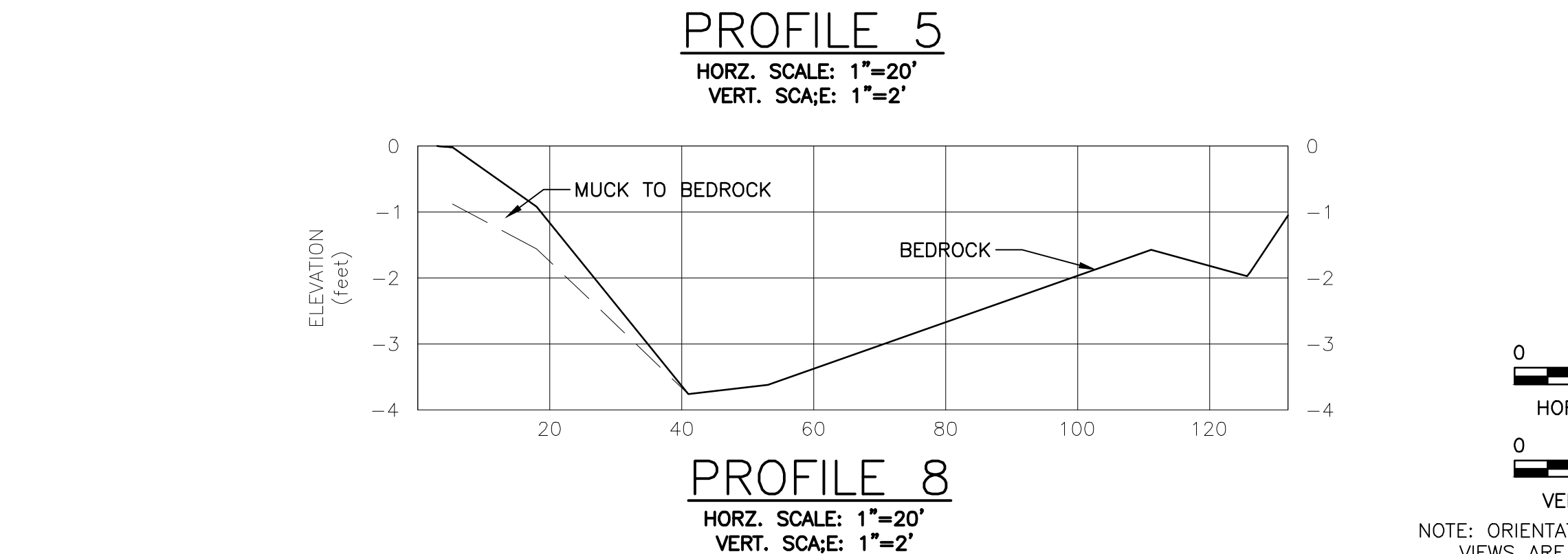
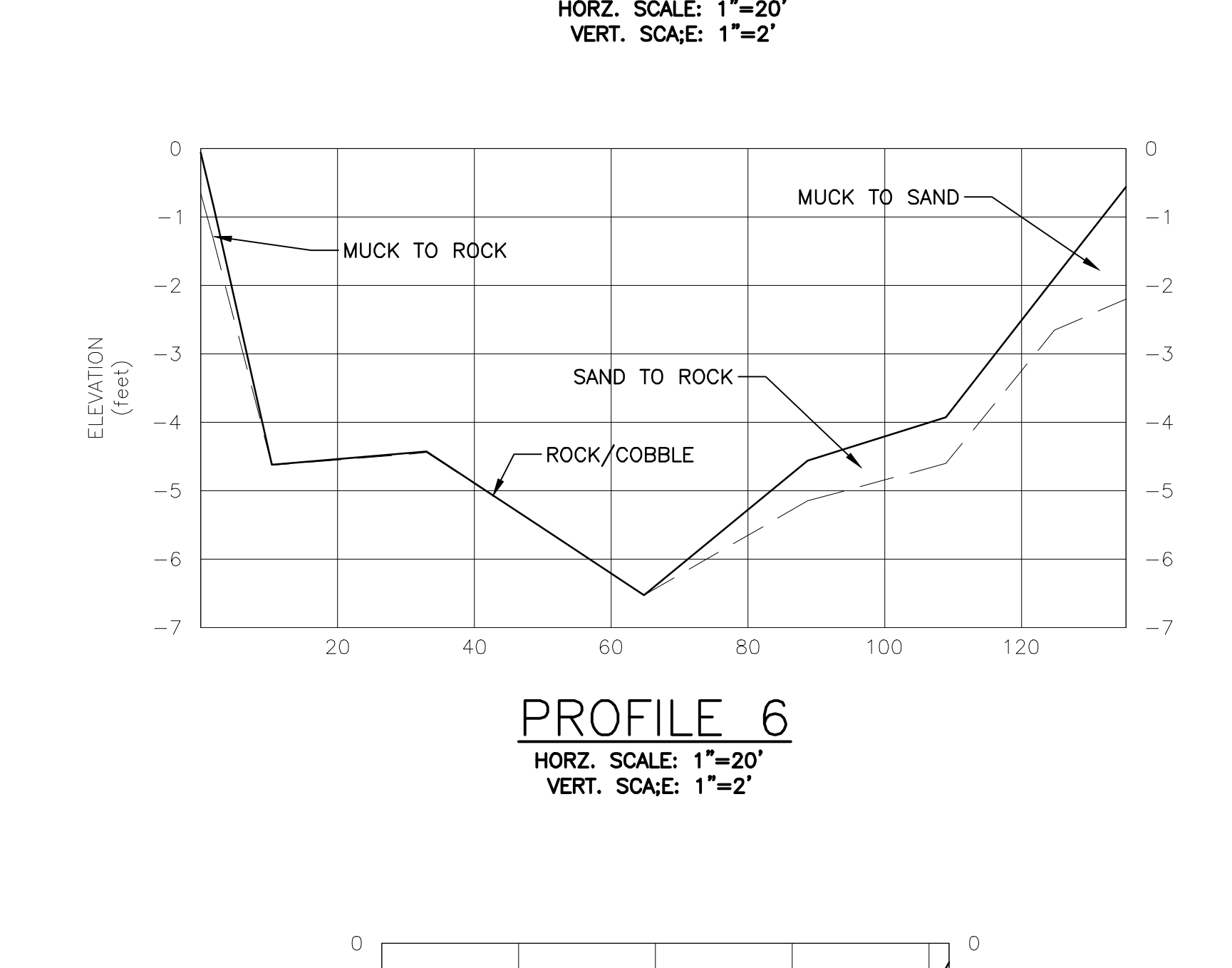
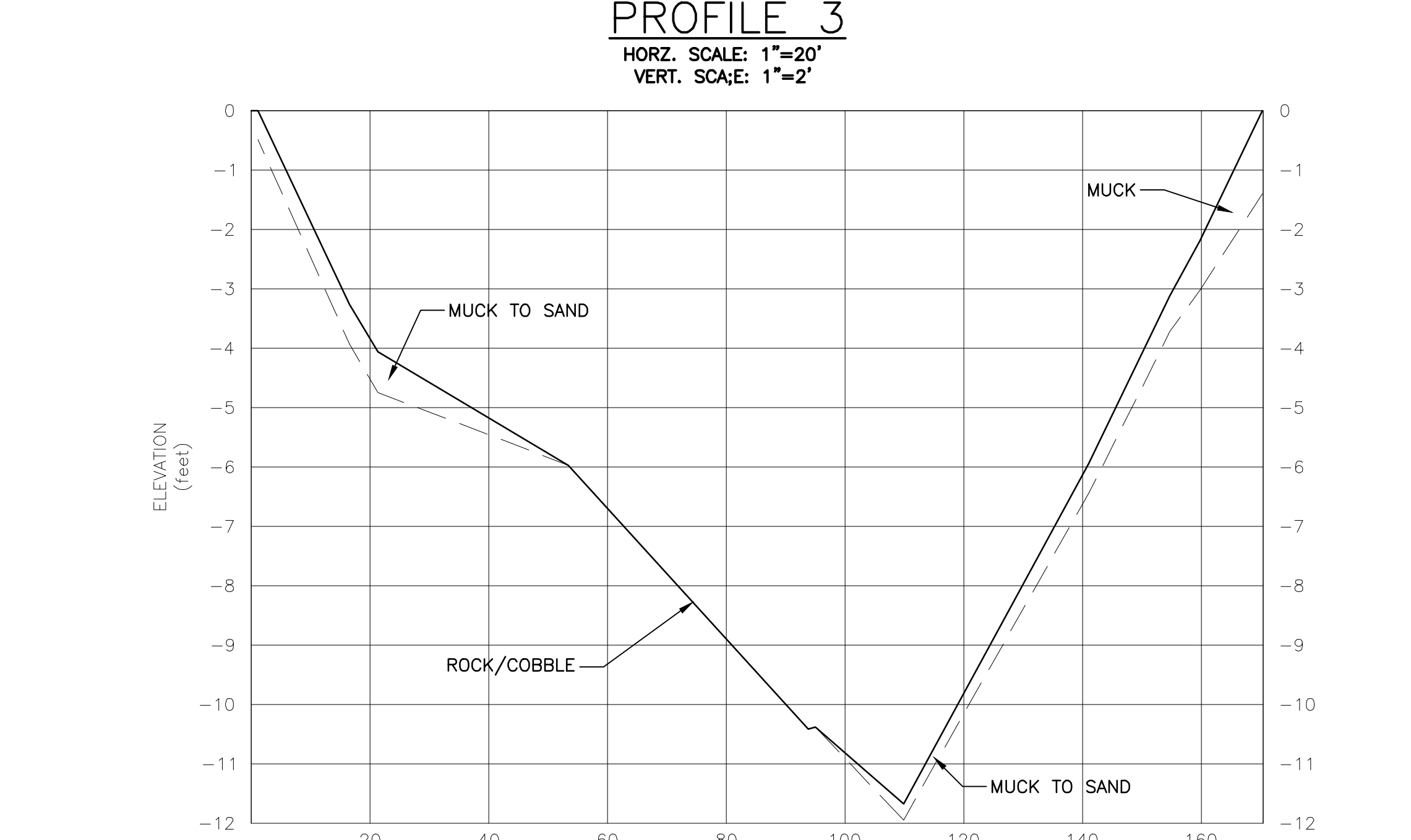
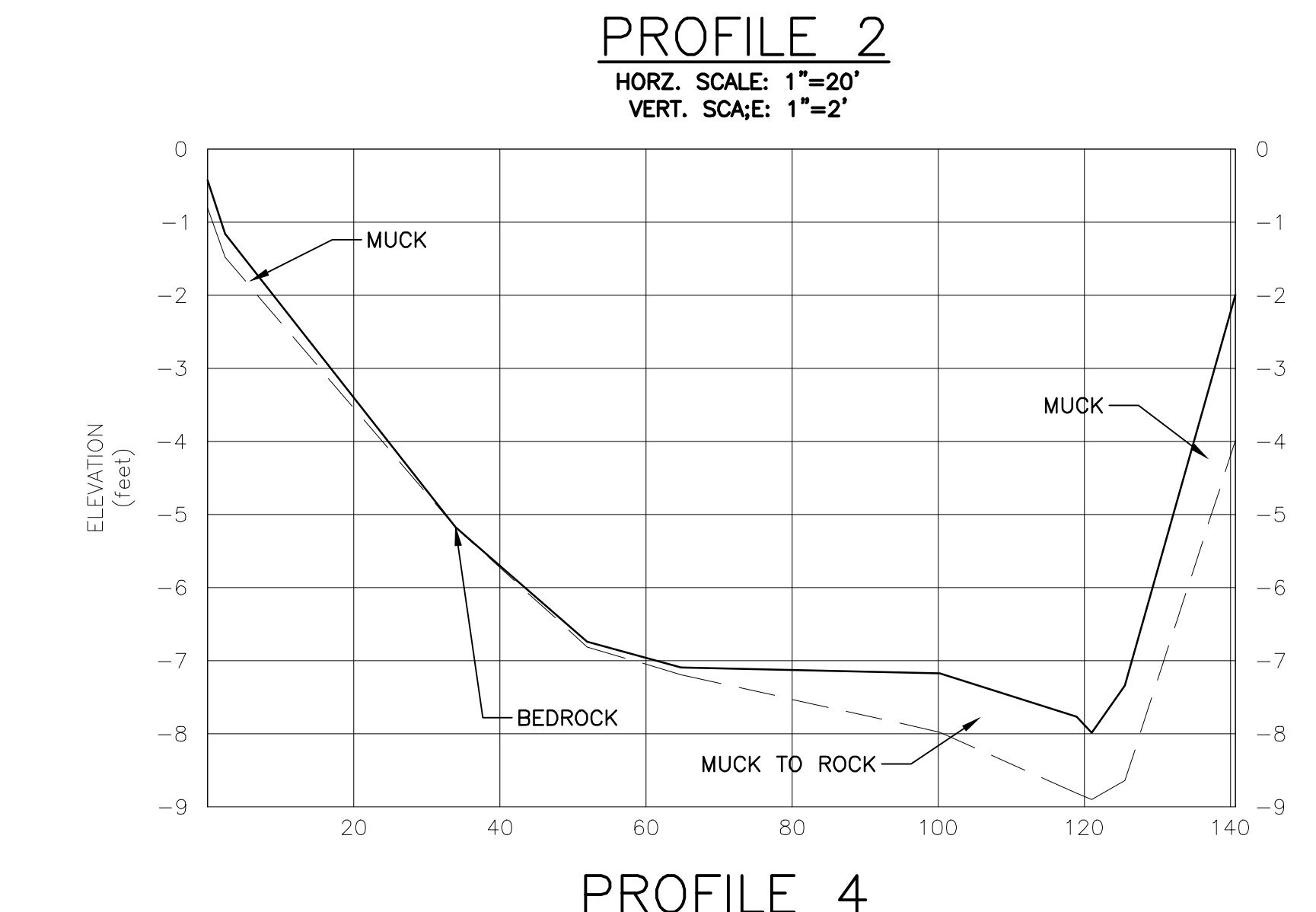
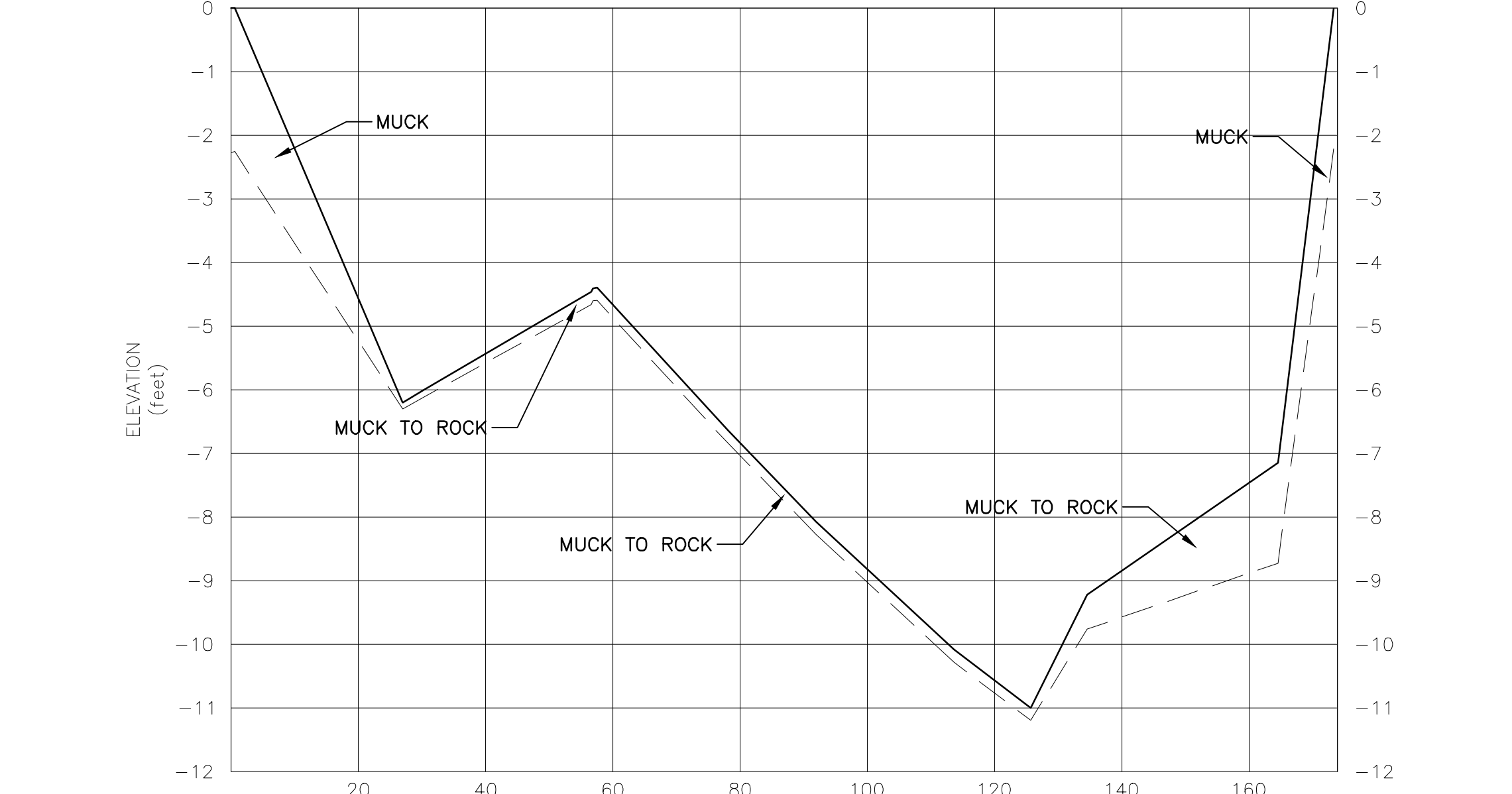
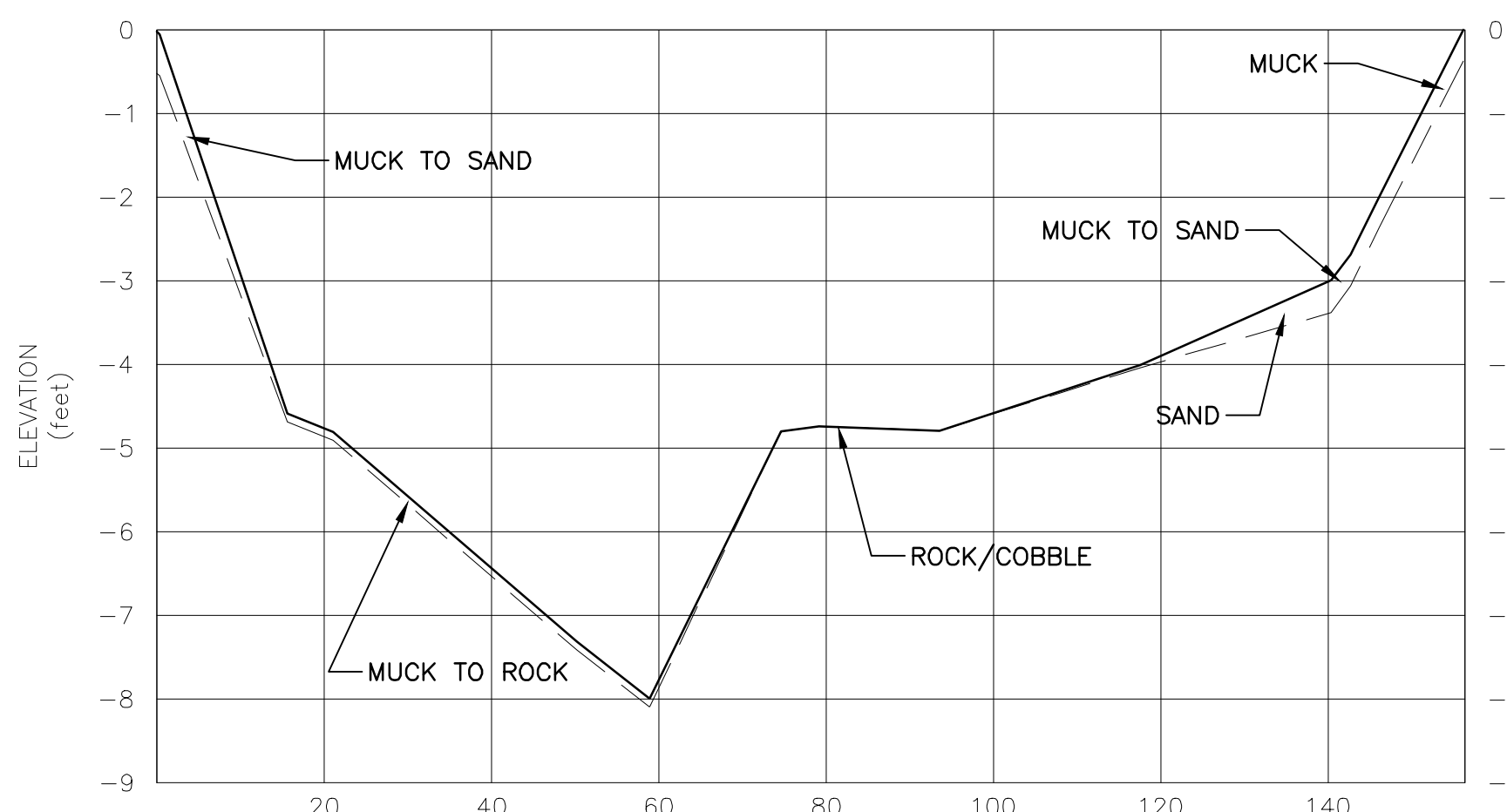
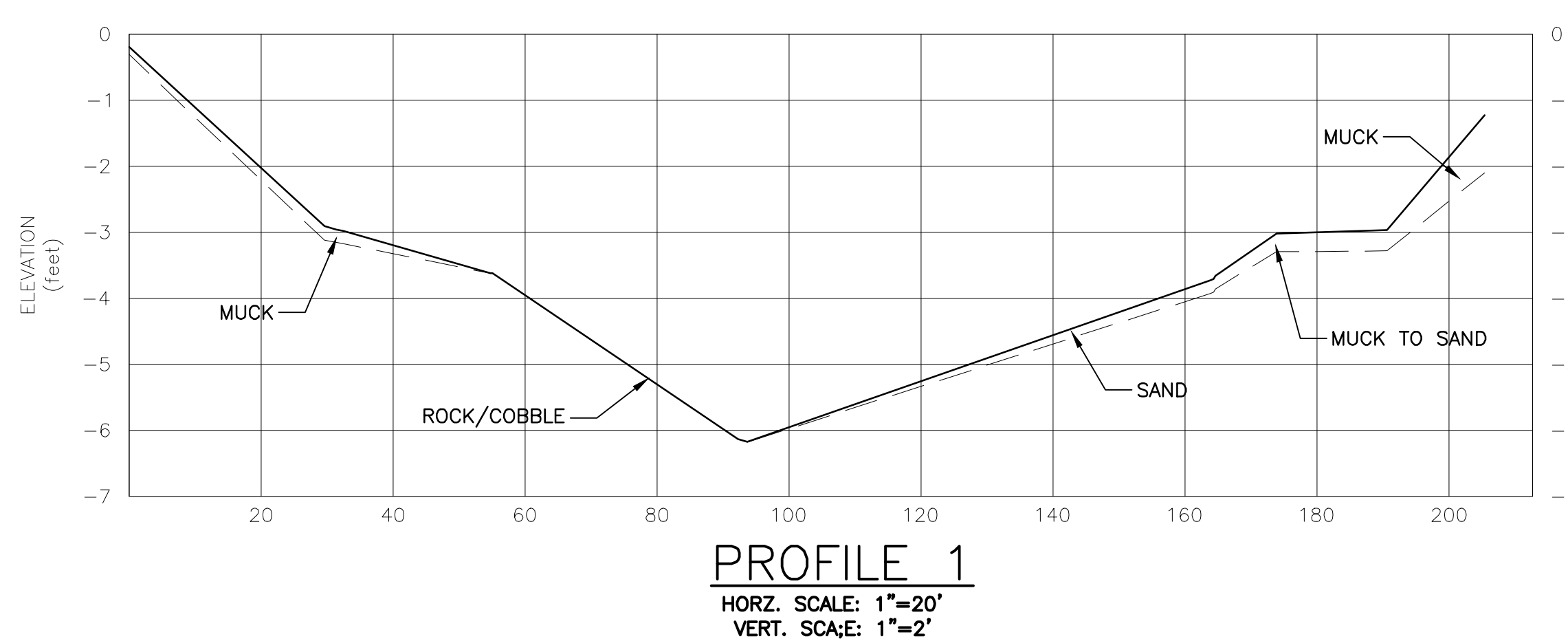
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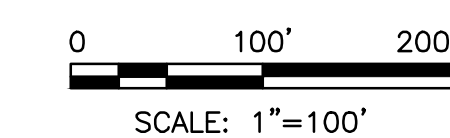
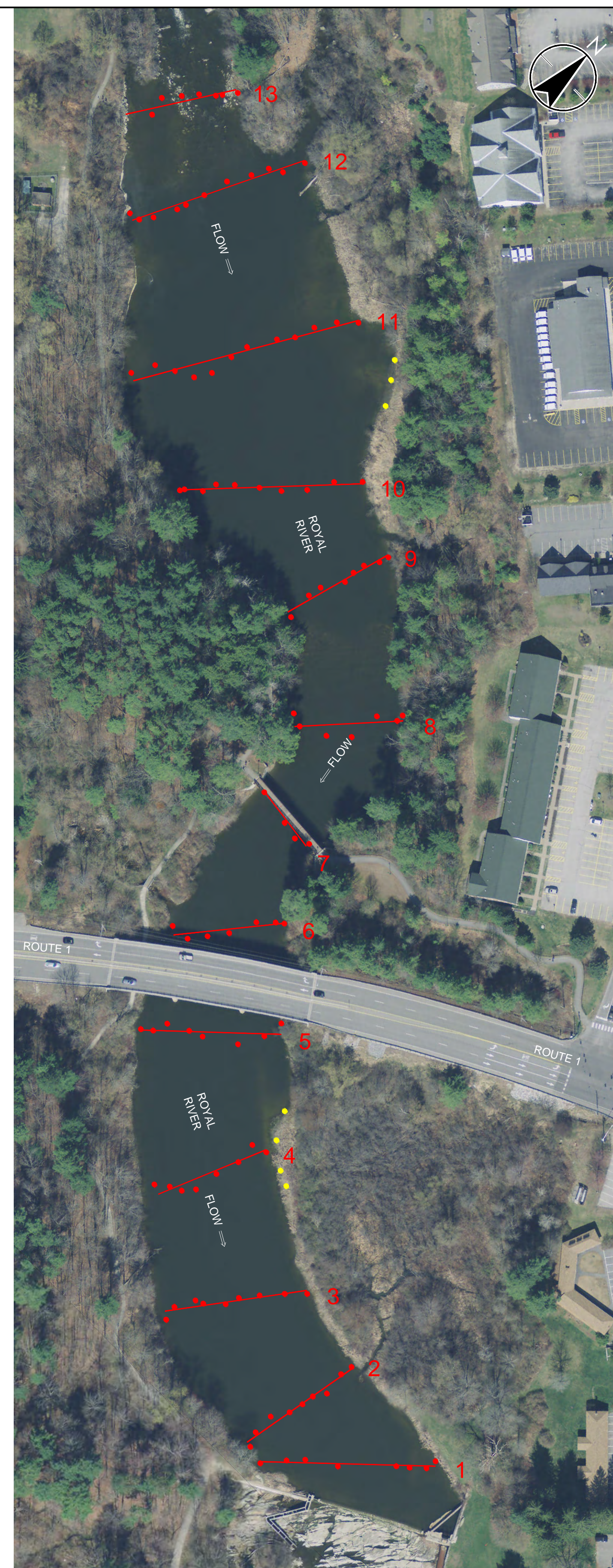
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NOTE: ORIENTATION OF ALL CROSS SECTION VIEWS ARE FACING DOWNSTREAM.



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Consultants

Legend

- 1 CROSS SECTION OF MANUAL PROBING
- TOP OF SEDIMENT
- BOTTOM OF SEDIMENT
- TRANSECT GPS PROBE POINT
- BANK GPS PROBE POINT

Notes

1. CROSS SECTION DATA WAS DEVELOPED FROM MANUAL PROBING COLLECTED BY GPS AND PERFORMED BY STANTEC ON NOVEMBER 12, 2014.
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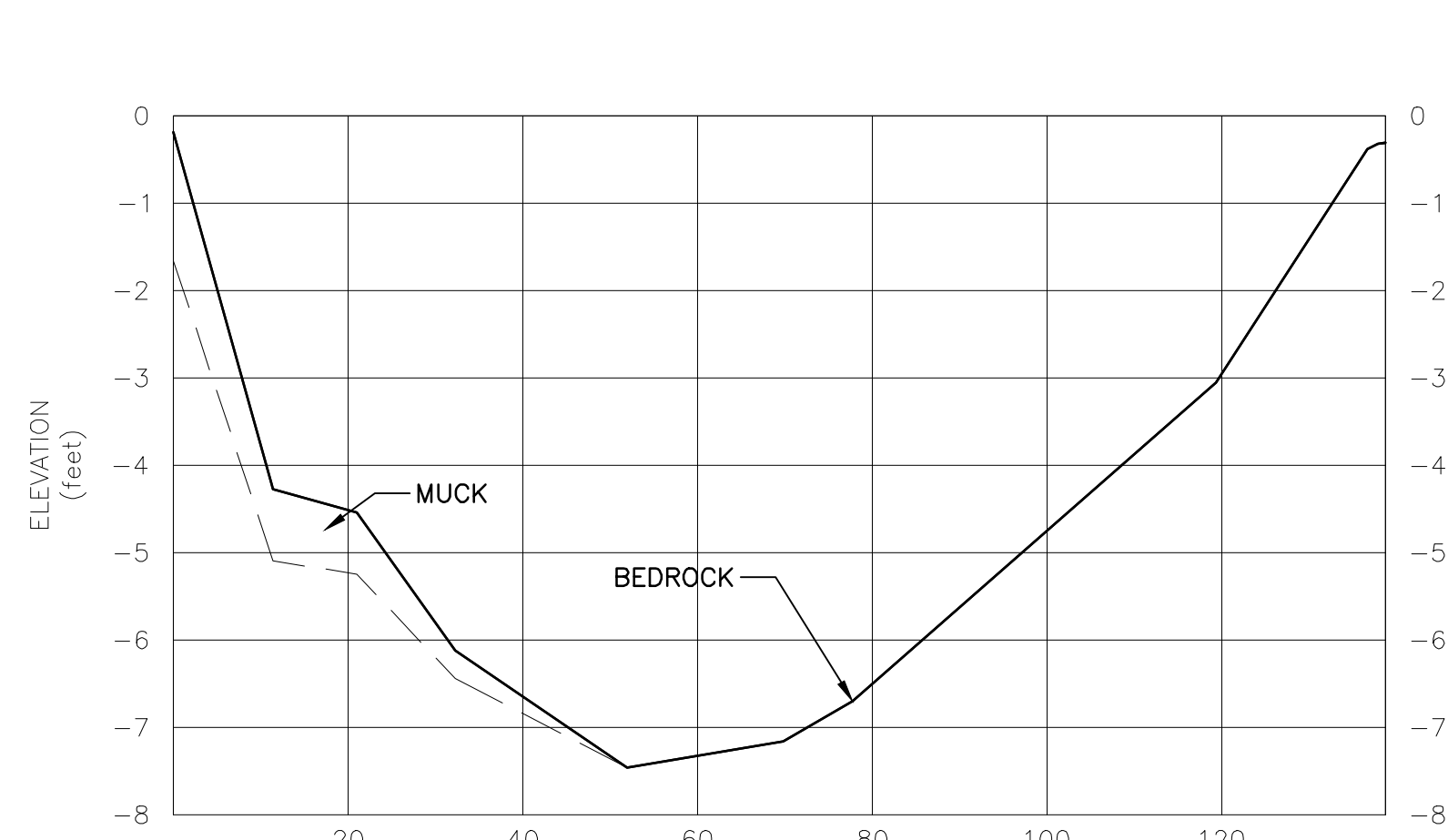
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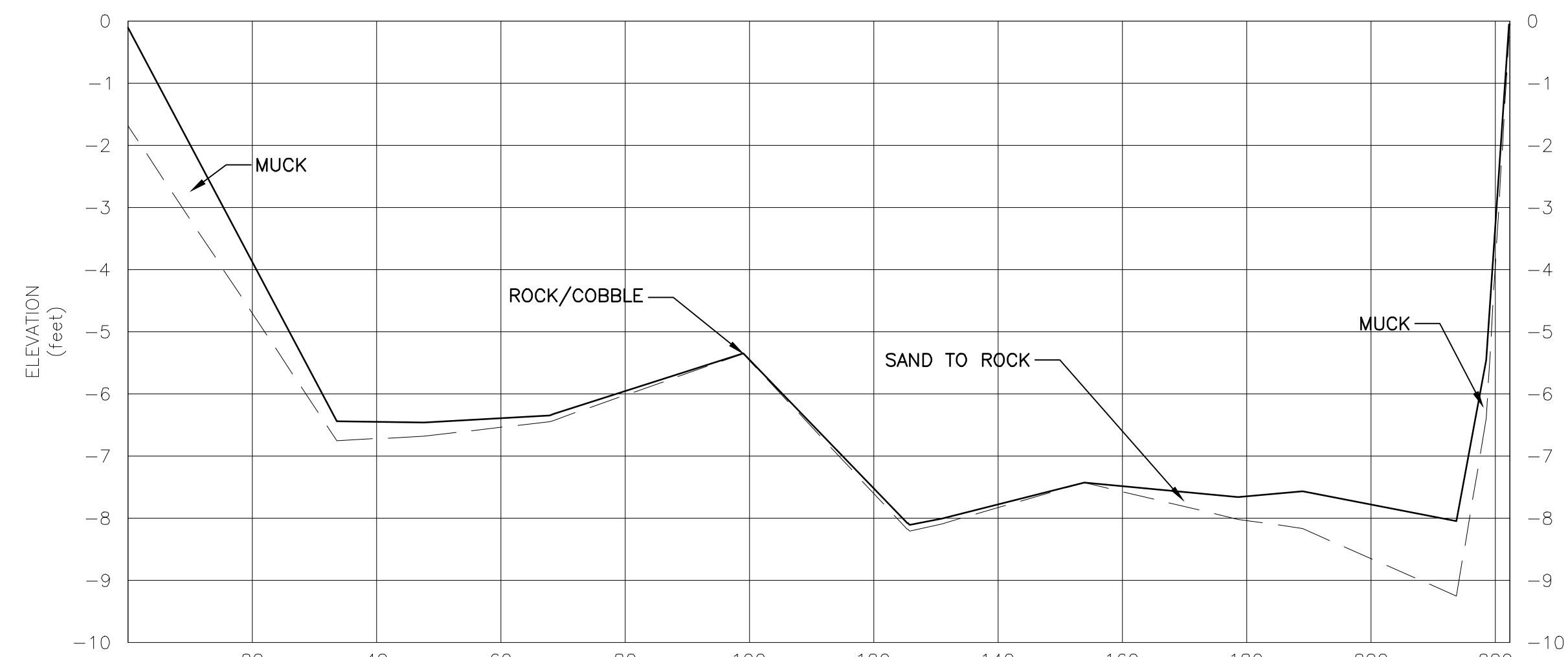
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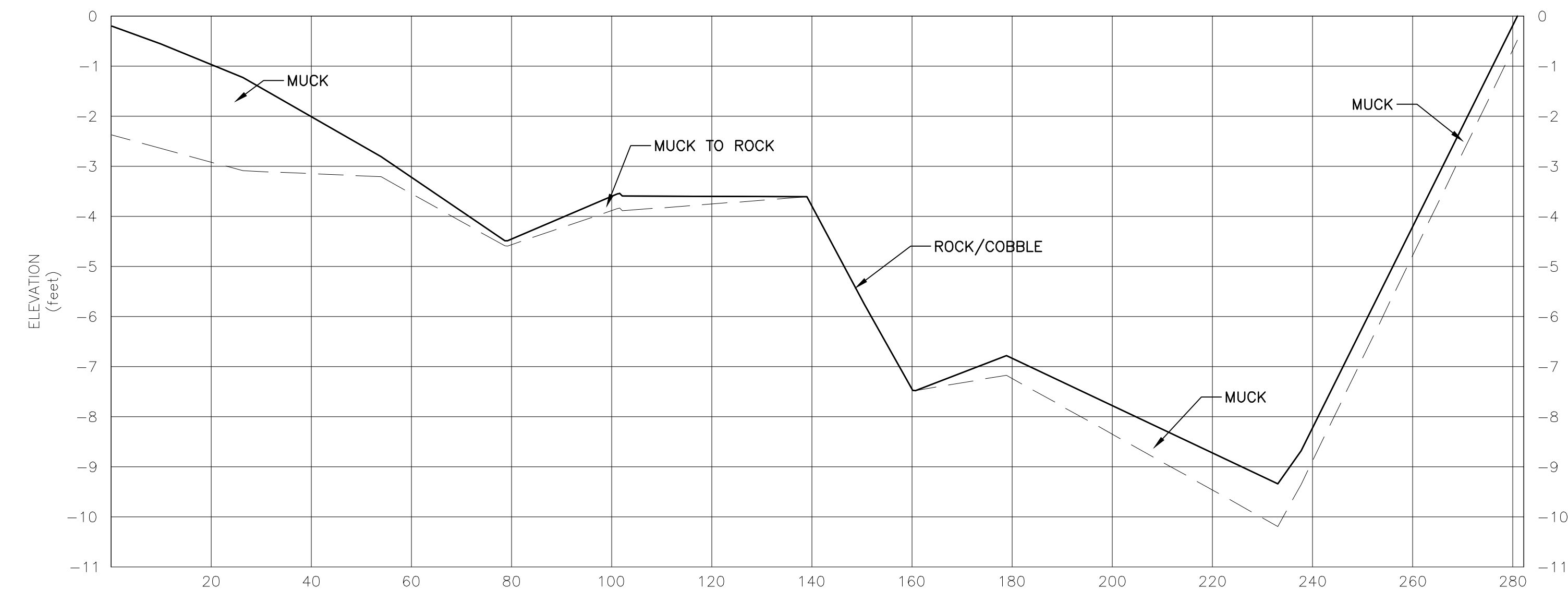
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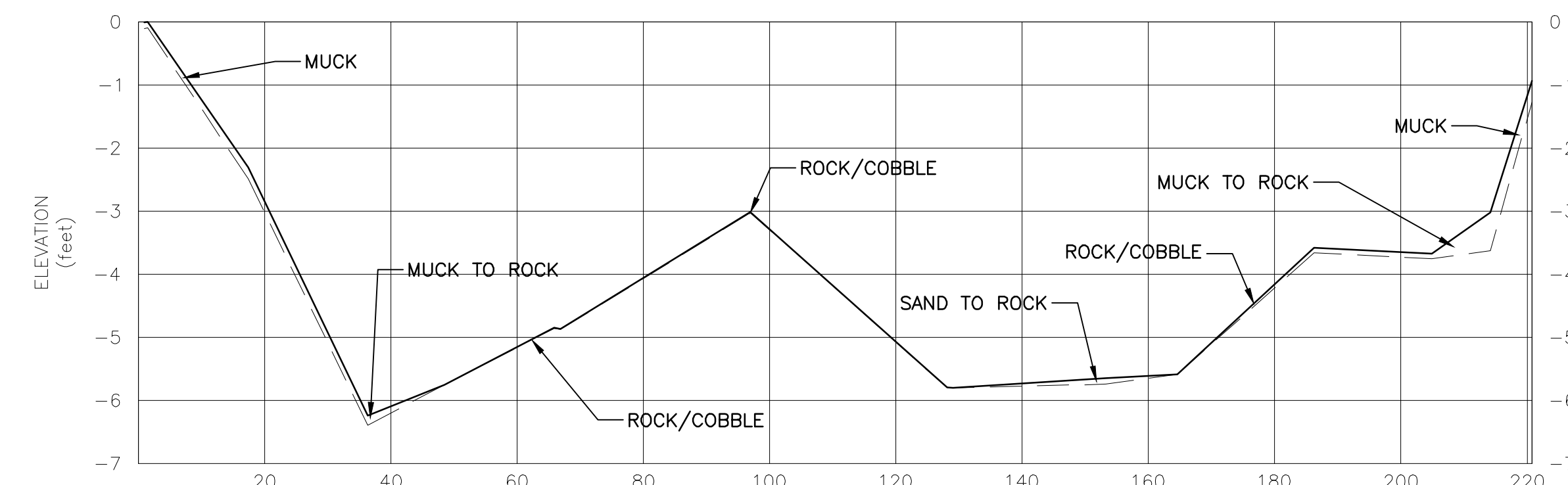
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 VERT. SCALE: 1"=2'



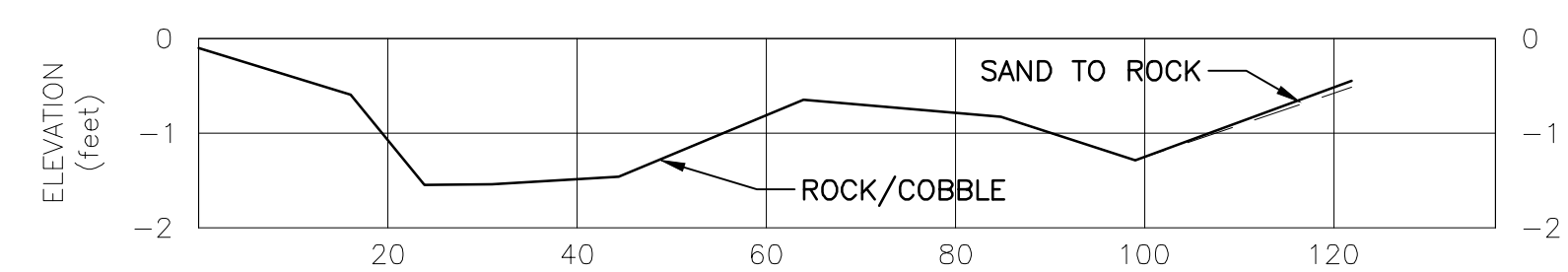
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 VERT. SCALE: 1"=2'



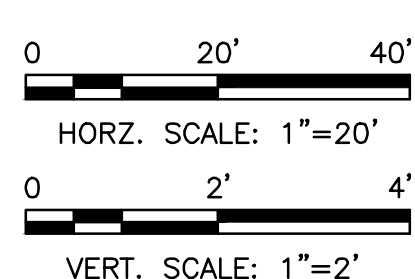
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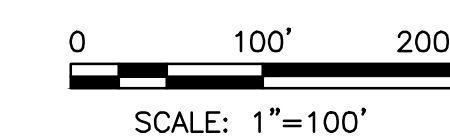
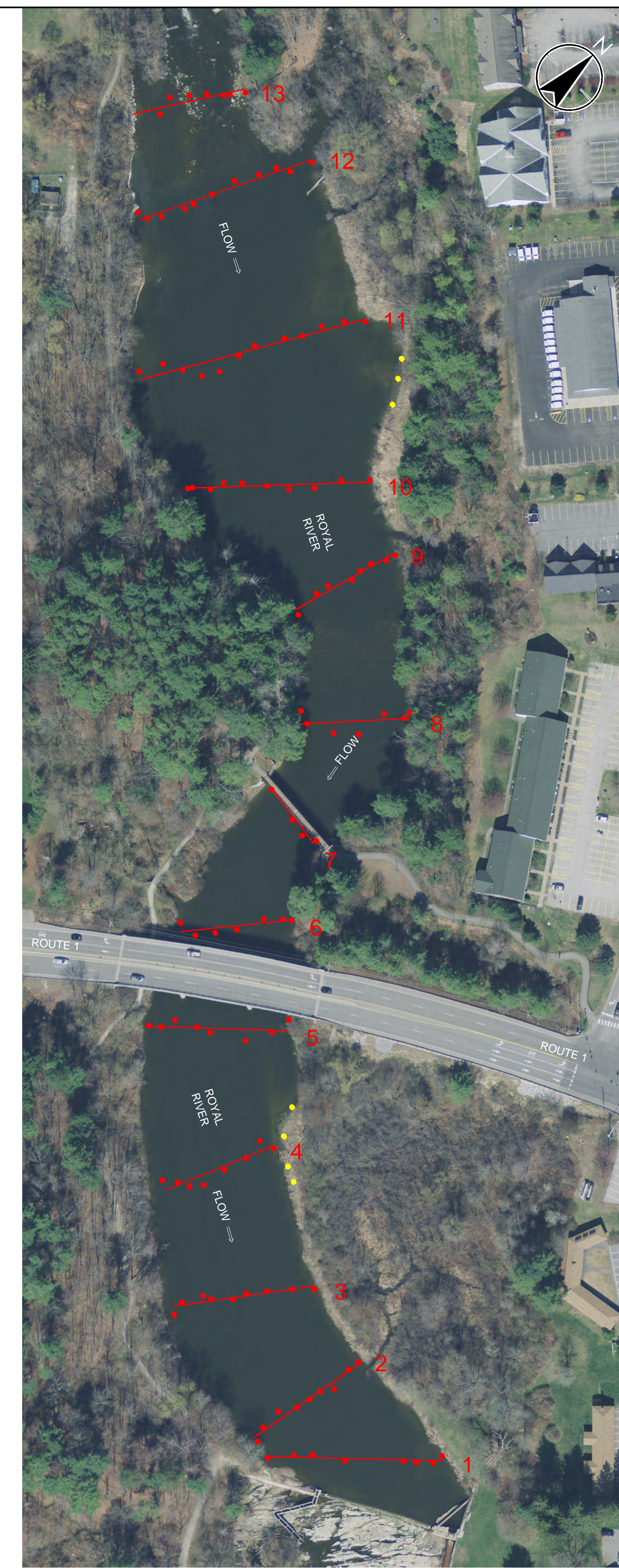
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 VERT. SCALE: 1"=2'



**PROFILE 13**  
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 VERT. SCALE: 1"=2'



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## ESTIMATED SEDIMENT VOLUME: BRIDGE STREET DAM IMPOUNDMENT

Data Analysis  
June 19, 2015

### 3.0 DATA ANALYSIS

The sediment probing data was post-processed to provide graphical depictions of the sediment probing locations in plan and profile along each transect and to estimate the volume of probed sediment. Profiles along the 13 sediment probing transects are depicted in Figure 1 and annotated with the estimated sediment characteristics.

The volume of the probed sediment was calculated using a volumetric surface defined by a triangulated irregular network with horizontal coordinates at each probed location with heights at each measurement location represented by the measured sediment depth. The estimated volume of probed material in this volumetric surface is 4,200 cubic yards (CY), which includes approximately 750 CY between Middle Falls and the exposed ledge upstream from the Beth Condon Memorial Trail footbridge and approximately 3,450 CY between the exposed ledge and the dam. Note that this estimate does not include material located outside of the wetted perimeter of the impoundment, such as those points that are depicted as yellow dots on Figure 1.

#### 3.1 SEDIMENT COMPOSITION

The sediment probing identified muck, sand, gravel/cobble/boulder, and bedrock substrate along the probed transects in the impoundment. Probing in the two areas along the left side of the impoundment in areas that are above the normal water surface elevation of the impoundment indicated that fine material is the dominant sediment in these areas.

The use of manual probes does not allow for penetration through coarse-grained sediments, such as gravel, cobble, or boulder material. It is therefore estimated that most of the probed material is comprised of fine-grained material (sand or smaller).

### 4.0 RESULTS AND DISCUSSION

Information obtained as part of the sediment probing work indicates that accumulated sediment in the Bridge Street Dam impoundment includes muck, sand, gravel/cobble/boulders, and that the bottom is scoured to bedrock in some locations. In general, depths of accumulated sediment are larger along the margins of the impoundment; this finding suggests that high-speed flows during high-flow events limit accumulation of sediment in the impoundment.

As previously noted, the estimated volume of accumulated sediment based on the sediment probing in the impoundment is 4,200 CY. Based on observed localized deposits of fine sediment, it is suggested that a contingency of 20% (840 CY) be added to the estimated volume of accumulate sediment to reflect observed localized sediment deposits, including the observed



## **ESTIMATED SEDIMENT VOLUME: BRIDGE STREET DAM IMPOUNDMENT**

Results and Discussion  
June 19, 2015

material immediately upstream from the Sparhawk Mill hydroelectric facility trashracks and adjacent to stormwater outfalls and coarse-grained sediment that was not probed. The estimated volume of material based on the 20% contingency is therefore 5,040 CY.

The estimated volume of accumulated sediment does not include material located outside of the normal pool limits of the impoundment (i.e., along the margins of the impoundment), including material that was probed and denoted by yellow dots in Figure 1.

Observations of the project reach of the Royal River during high-flow conditions suggest that most of the finer-grained material in the Bridge Street Dam impoundment would be remobilized during a higher flow event (e.g., 10-year return-interval flow) if the dam is removed. However, it is expected that remobilization of this material would occur over multiple high-flow events.

Based on information obtained as part of previous project studies, it is expected that material that is remobilized from the Bridge Street Dam impoundment during high-flow events would be replaced by material that is delivered to the impoundment from the upstream reach of the Royal River.

### **4.1 SEDIMENT COMPOSITION AND DISTRIBUTION**

Most of the probed material in the Bridge Street Dam impoundment was located along the edges of the impoundment and is comprised of fine-grained material (sand or smaller). The apparent dominance of fine-grained material is consistent with the size of material that is expected to be regularly transported downstream at the East Elm Street Dam approximately 1,300 ft upstream from Middle Falls.

It is not expected that the volume of accumulated sediment in the Bridge Street Dam may change in response to high-flow events, but it is expected that the existing volume of sediment is representative of the typical volume of sediment. The basis for this determination is that Bridge Street Dam has been in place for over 100 years. It is not expected that the volume of accumulated sediment varies seasonally.

It is expected that most of the fine-grained sediment could be remobilized following removal of the dam, but the duration of time during which remobilization would occur is indeterminate. Note, however, that the sediment probing did not extend substantially landward from the edge of the impoundment. While some additional sediment along the impoundment margins may be subject to remobilization, sediment in areas which are persistently vegetated, such as the area along the left bank between the U.S Route 1 Bridge and the dam, may not be subject to ready remobilization.



**ESTIMATED SEDIMENT VOLUME:  
BRIDGE STREET DAM IMPOUNDMENT**

Results and Discussion  
June 19, 2015

## **4.2 ACCUMULATION OF SEDIMENT IN YARMOUTH HARBOR**

Approximately 60,000 CY of material was removed from Yarmouth Harbor during dredge work in the fall of 2014, and others have estimated that the average accumulation rate of sediment in the harbor is approximately 10,000 CY per year. Based on these estimates, the estimated volume of sediment in the Bridge Street Dam impoundment constitutes approximately 10% of the volume of the recent dredge or a half-year of the average annual accumulation of sediment.

Coarse grained materials, including gravel, cobble, and boulder-size material, could be remobilized from the Bridge Street Dam impoundment if the dam is removed. However, it is not expected that this material could substantially contribute to sedimentation in the harbor because the larger material is expected to accumulate in the immediate vicinity of the Interstate 295 Bridge.

## Appendices

**ESTIMATED SEDIMENT VOLUME:  
BRIDGE STREET DAM IMPOUNDMENT**

Appendix A Field Notes  
June 19, 2015

**Appendix A FIELD NOTES**

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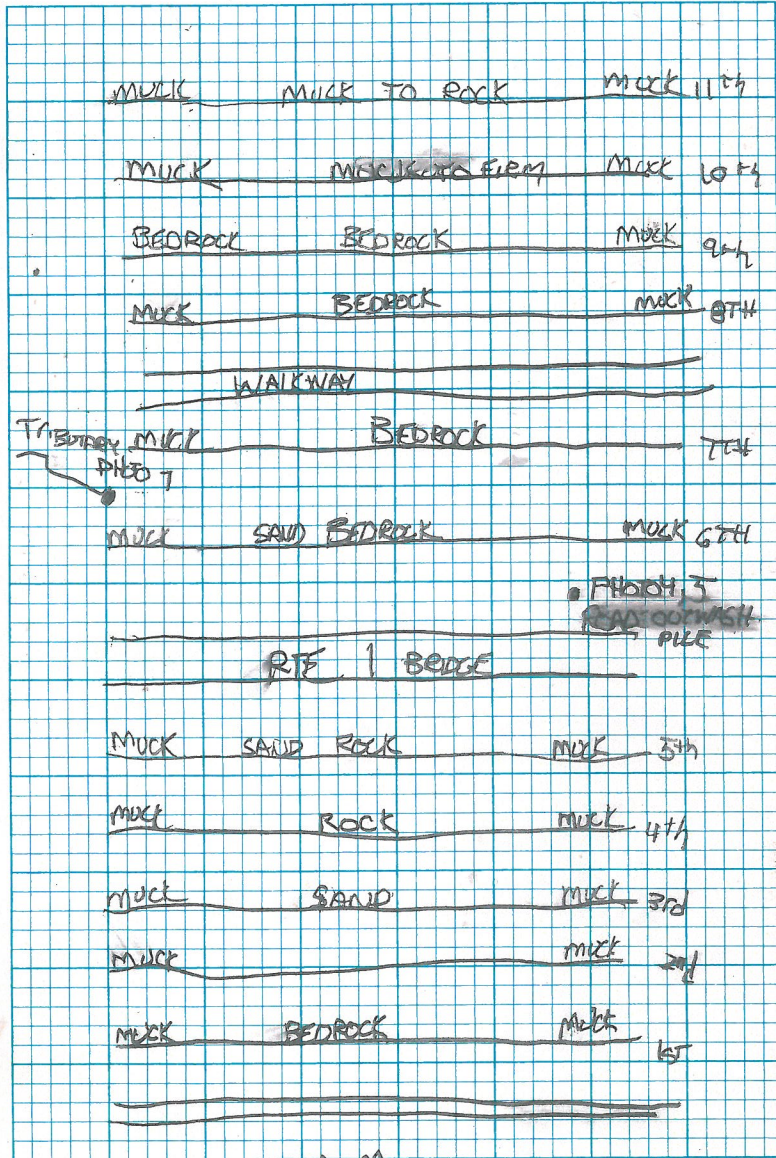
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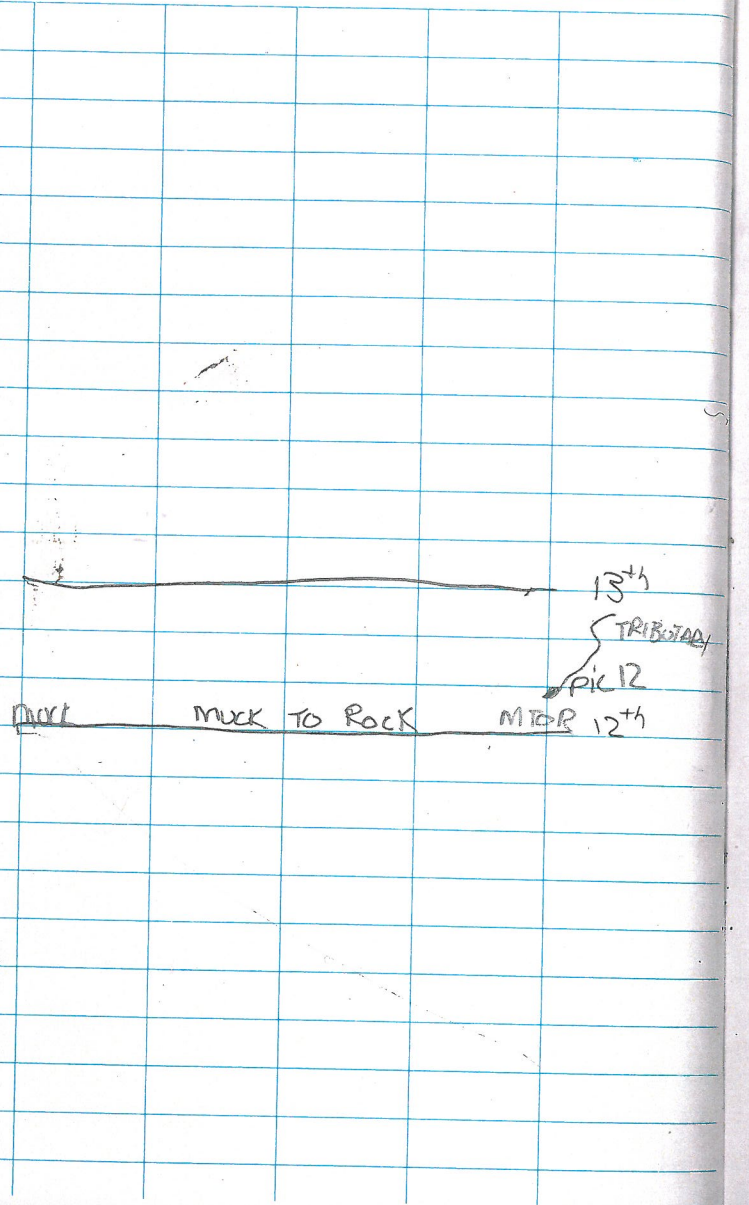


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