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October 12, 2016
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Revision 0

Tennessee Valley Authority
1101 Market Street
Chattanooga, Tennessee 37402

**RE: Initial Structural Stability Assessment
Stilling Pond (including Retention Pond)
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Cumberland Fossil Plant
Cumberland City, Tennessee**

1.0 PURPOSE

This letter documents Stantec's certification of the initial structural stability assessment for the TVA Cumberland Fossil Plant's (CUF) Stilling Pond (including Retention Pond). Based on this assessment, the Stilling Pond (including Retention Pond) is in compliance with the structural stability requirements in the EPA Final CCR Rule at 40 CFR 257.73(d).

2.0 INITIAL STRUCTURAL STABILITY ASSESSMENT

As described in 40 CFR 257.73(d), documentation is required on how the Stilling Pond (including Retention Pond) has been designed, constructed, operated, and maintained according to the structural stability requirements listed in the section. The combined capacity of all spillways must also be designed, constructed, operated, and maintained to adequately manage flow from the 1000-year storm event based upon a hazard potential classification of "significant."

3.0 SUMMARY OF FINDINGS

The attached report presents the initial structural stability assessment of the Stilling Pond (including Retention Pond). The results show that the impoundment meets the structural stability requirements set forth in 40 CFR 257.73(d)(1)-(2).

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stephen H. Bickel, being a Professional Engineer in good standing in the State of Tennessee, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;
2. that the information contained herein is accurate as of the date of my signature below;
and



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Re: **Initial Structural Stability Assessment
Stilling Pond (including Retention Pond)
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Cumberland Fossil Plant
Cumberland City, Tennessee**

3. that the initial structural stability assessment for the TVA Cumberland Fossil Plant's Stilling Pond (including Retention Pond) meets the requirements specified in 40 CFR 257.73(d)(1)-(2).

SIGNATURE

DATE

10/12/2016

ADDRESS:

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Louisville, Kentucky 40223-5308

TELEPHONE:

(502) 212-5075

ATTACHMENTS:

Initial Structural Stability Assessment Report



Initial Structural Stability Assessment

Cumberland Fossil Plant – Stilling
Pond (including Retention Pond)
Stewart County, Tennessee



Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:
Stantec Consulting Services Inc.
Lexington, Kentucky

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INITIAL STRUCTURAL STABILITY ASSESSMENT

Project Background
October 12, 2016

1.0 PROJECT BACKGROUND

On April 17, 2015 the "Disposal of Coal Combustion Residuals (CCR) from Electric Utilities" (EPA Final CCR Rule) was published in the Federal Register. Stantec Consulting Services, Inc. (Stantec) was contracted by the Tennessee Valley Authority (TVA) to analyze the Structural Stability of the Stilling Pond (including retention pond) associated with the Cumberland Fossil Plant (CUF) CCR surface impoundments (SI) and evaluate compliance with §257.73 of the CCR Rule. All further references to Stilling Pond within this report infer the inclusion of the retention pond.

As required by §257.73 of the EPA Final CCR Rule, an initial structural integrity evaluation is required by October 17, 2016 and must include an initial structural stability assessment for each existing CCR surface impoundment that meets the conditions of paragraph (b) as follows:

1. Has a height of five feet or more and a storage volume of 20 acre-feet or more, or
2. Has a height of 20 feet or more.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Unit Description
October 12, 2016

2.0 UNIT DESCRIPTION

The Cumberland Fossil Plant (CUF) is a coal-fired, electric generating plant. The plant is located along the shores of Barkley Reservoir in Stewart County, Tennessee. The plant is located immediately west of Cumberland City, Tennessee approximately 17 miles south of the Kentucky – Tennessee border.

The Stilling Pond is located at the northwest corner of the plant. It is bordered on the north by the Cumberland River and the west by Wells Creek. The Stilling Pond is formed by the Perimeter Dike along the east, north, and west and a Divider Dike to the south that separates it from the fly ash stack. The Stilling Pond encompasses approximately 55 acres. TVA has determined that the Stilling Pond is a CCR Surface Impoundment and therefore subject to the CCR rule.

The subsections under §257.73(d) address conditions of appurtenances categorized as embankments, spillways, or hydraulic structures. Sections 2.1 to 2.3 below provide descriptions of the individual unit elements that fall within these appurtenance categories. Figure 1 provides an overview of the Stilling Pond and appurtenances.

Note that all elevations included in this document and appendices are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29).

2.1 EMBANKMENTS

2.1.1 Perimeter Dike

The Perimeter Dike that forms the Stilling Pond perimeter along the east, west, and north sides is approximately 4,200 feet long. The overall constructed height of the perimeter dike varies from approximately 30 to 35 feet. Dike side slopes range from approximately 2.5H:1V to 3H:1V. The crest of the dike is approximately 20 feet wide and includes a gravel access road.

The dike was originally constructed in 1969 and raised in 1979 to its current height and configuration. The dike is constructed of compacted clay.

2.1.2 Divider Dike

The Divider Dike that forms the Stilling Pond perimeter along the south side is approximately 2,000 feet long. The overall constructed height of the perimeter dike varies from approximately 6 to 22 feet. Dike side slopes range from approximately 1.5H:1V to 2.5H:1V. The crest of the dike is approximately 40 feet wide and includes a gravel access road.



Figure No.
1
Title
Stilling Pond

Client/Project
Tennessee Valley Authority (TVA)
Cumberland Fossil Plant

Project Location
Cumberland City,
Stewart County, Tennessee

175555021
Prepared by WSW on 2016-08-31
Technical Review by TG on 2016-08-31

0 200
Feet
1:2,400 (At original document size of 11x17)

Legend
 Disposal Area Approximate Limits



Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Aerial Imagery provided by client (Dated 2015)



INITIAL STRUCTURAL STABILITY ASSESSMENT

Unit Description
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The dike construction was completed in 1996 and separates the Stilling Pond from the Fly Ash Stack. The dike is constructed of approximately 18 to 30 feet of borrow soil and rock between approximate elevations 353 to 383 feet. Above this elevation the dike was completed using shot rock fill taken from the excavation for the foundation of the FGD scrubbers.

Based on review of the dike configuration and its role in current operations, it appears that failure of the Divider Dike would result in limited impacts to the remainder of the Stilling Pond and would not lead to loss of containment of material off of TVA property. Therefore, no further assessment of the Internal Divider Dike under §257.73 of the EPA Final CCR Rule is included.

2.1.3 Internal Divider Dike

As shown on Figure 2, the Stilling and Retention Ponds are separated by an interior divider dike. The dike is approximately 2,000 feet long with a constructed height of approximately 32 to 36 feet. Dike side slopes are approximately 2H:1V to. The crest of the dike is approximately 20 feet wide.

The dike was constructed in 1977 and separates the Stilling Pond from the Fly Ash Stack. The dike is constructed of bottom ash.

Based on review of the dike configuration and its role in current operations, it appears that failure of the Internal Divider Dike would result in limited impacts to the remainder of the Stilling Pond and would not lead to loss of containment of material off of TVA property. Therefore, no further assessment of the Internal Divider Dike under §257.73 of the EPA Final CCR Rule is included.

2.2 SPILLWAYS

2.2.1 Primary Spillway System

The Primary Spillway System consists of four riser and outlet pipe structures located in the northeast corner of the Stilling Pond.

The risers are 48-inch diameter, reinforced concrete pipe sections stacked vertically to a height of approximately 13 feet. A cured-in-placed pipe (CIPP) liner was installed to increase structural stability, and cover the riser pipe joints. The riser has been further stabilized against lateral movement by the placement of a crushed stone berm that extends to 4-feet below the riser crest.

The outlet pipes are 36-inch-diameter CIPP-lined RCP and approximately 217 feet in length. They extend from the risers through the Perimeter Dike to a headwall at the outlet where they discharge to the Cumberland River via the Condensing Cooling Water Discharge Channel.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Unit Description
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2.2.2 Emergency Spillway

The Emergency Spillway is located in the northwest corner of the Stilling Pond. It consists of a box culvert that extends through the upper portion of the perimeter dike. The culvert discharges into a concrete chute exit channel that was built into the downstream dike slope. Beyond the dike toe, the flows are conveyed to Wells Creek.

2.3 HYDRAULIC STRUCTURES

Other than the spillways described above, no hydraulic structures are located at the Stilling Pond.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Foundations and Abutments (§257.73(d)(1)(i))
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3.0 FOUNDATIONS AND ABUTMENTS (§257.73(D)(1)(I))

Per §257.73(d)(1)(i), the initial structural stability assessment must document whether the unit has been designed, constructed, operated and maintained with stable foundations and abutments. The Stilling Pond has the following features that fall within this requirement:

- Perimeter Dike

Assessment of the foundations and abutments associated with these features was completed considering the following criteria related to the CCR rule:

- Review inspection reports of the facility, considering frequency of inspections, and if the inspections included review and/or assessment of features including cracking, settlement, deformation or erosion of the foundations/abutments. Inspections should indicate that there are no significant signs of tension cracking, settlement, depressions, erosion, and/or deformations at the crest, slope and toe of the structure.
- Confirm that an assessment of seepage conditions of the foundation, with considerations of heave and vertical exit gradient, has been performed. Verify that the seepage assessment follows appropriate methodologies (such as USACE EM 1110-2-1901) and that the foundations exhibit acceptable performance (e.g. FS for piping greater than or equal to 3.0).

3.1 PERIMETER DIKE

3.1.1 Background

The Stilling Pond is contained within a perimeter dike that was completely built above the existing, natural ground line; therefore, there are no natural abutments. Based on previous geotechnical studies ((Stantec, 2010), (Geocomp, 2016) and (Stantec, 2016a)), the foundation of the perimeter dike generally consists of alluvial clay and alluvial sand deposits that vary in thickness from 20 to 70 feet. The alluvial deposits are underlain by bedrock consisting of Ordovician age Mannie Shale, Fernvale Limestone, and Heritage/Carters/Lebanon/Ridley/Pierce and Murfreesboro Limestone Formations.

3.1.2 Assessment

Annual site inspections for the Stilling Pond were conducted and documented regularly from 1972 to 2015. These inspections include observations related to foundation conditions with respect to observable cracking, settlement, depressions, erosion and deformation. No signs of tension cracking, settlement, depressions, erosion, and/or deformations at the crest, slope and toe of the structure were documented.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Foundations and Abutments (§257.73(d)(1)(ii))
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Seepage analysis for the original dike construction is not available. Following construction of the Spillway Improvement Project in 2013, seepage analyses were performed to reflect the lower normal pool level within the pond (Stantec, 2013). The updated analyses indicated that the factor of safety for piping/heave was 4.0 or greater for the Perimeter Dike.

3.1.3 Conclusion

Based on the assessment of the foundation and abutments for the Perimeter Dike, the CCR Rule-related criteria listed above have been met.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Slope Protection (§257.73(d)(1)(ii))
October 12, 2016

4.0 SLOPE PROTECTION (§257.73(D)(1)(II))

Per §257.73(d)(1)(ii), the initial structural stability assessment must document whether the unit has been designed, constructed, operated and maintained with adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown. The Stilling Pond has the following features that fall within this requirement:

- Perimeter Dike

Assessment of the slope protection associated with these features was completed considering the following criteria related to the CCR rule:

1. *Regular (weekly) inspections for erosion. Inspections should show there are no significant signs of deterioration in the slope protection configuration of the Item.*
2. *Appropriate slope protection shall be provided based on anticipated flow velocities. [Hydrologic / hydraulic calculations of flow velocities on the slope of the Item for the appropriate erosive forces. Some common slope protection measures include: Riprap, Gabions, Paving (concrete or asphalt), or appropriate vegetative cover.]*
3. *If slope protection is Riprap, filter layer(s) under the riprap shall be designed according to established filter criteria. However, existing Riprap cover may be evaluated based on performance and observations during inspections.*

4.1 PERIMETER DIKE

4.1.1 Background

Slope protection for the Perimeter Dike consists of grass or rip rap. In addition, the interior slope of the dike has a rip rap wave wash protection layer that was installed as part of the 2012 Spillway Improvement Project. Below the spillway outlets rip rap and grouted rip rap have been placed to protect these areas from concentrated flows.

4.1.2 Assessment

As reported by the EPA (Dewberry, 2013) daily, weekly, monthly, and quarterly inspections of the Perimeter Dike are conducted by qualified TVA personnel, and areas of erosion are prioritized for appropriate repairs. Annual site inspections are conducted by TVA. Site inspection reports from 1972 to 2015 generally indicate appropriate maintenance of slope protection features of the dike, in accordance with the procedures outlined in TVA's Operations Support Document (TVA, July, 2011).

INITIAL STRUCTURAL STABILITY ASSESSMENT

Slope Protection (§257.73(d)(1)(ii))
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The use of rip rap as wave wash protection along the interior of the dike appears appropriate to address concerns of erosive wave action. Documentation of the design of the wave wash protection, including a filter layer underneath the rip rap, is included in the Basis of Design Report prepared by Stantec (Stantec, 2012b).

As part of a March 2016 site visit, Stantec personnel observed the rip rap protection along the slopes. The rip rap was located along the interior slopes of the perimeter dike and divider dike and the exterior slopes near the primary spillway system and emergency spillway. The rip rap above the water surface was continuous and performing well.

4.1.3 Conclusion

Based on the assessment of the slope protection for the Perimeter Dike, the CCR Rule-related criteria listed above have been met.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Embankment Dike Compaction (§257.73(d)(1)(iii))
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5.0 EMBANKMENT DIKE COMPACTION (§257.73(D)(1)(III))

Per §257.73(d)(1)(iii), the initial structural stability assessment must document whether the unit has been designed, constructed, operated and maintained with dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit. The Stilling Pond has the following features that fall within this requirement:

- Perimeter Dike

Assessment of the dike compaction associated with these features was completed considering the following criteria related to the CCR rule:

1. Documentation showing the dike was mechanically compacted. Acceptable documentation may include construction drawings, field notes, construction photographs, correspondences, or any evidence showing the dike was mechanically compacted during construction.
2. If no construction documentation is available specific data from geotechnical explorations of dike may be used. Geotechnical borings with continuous SPTs may be used to assess compaction of the dike. Appropriate methodology correlating blow counts and compaction (Density) should be used.

5.1 PERIMETER DIKE

5.1.1 Background

Construction records related to the dike material placement and compaction for the initial perimeter dike were not available during this review. Certain TVA design drawings provide proposed dike construction and compaction methods and were referenced in the assessment discussed below. Subsurface explorations of the dike were also available that provided SPT data used in the assessment.

5.1.2 Assessment

TVA Drawings 10N212 and 10N213 provide documentation of compaction requirements related to the construction of the Perimeter Dike. Construction criteria related to dike embankment materials and dike compaction as noted on these drawings include:

- Embankments were to be constructed from earth fill from approved borrow sources in accordance with standard TVA construction specifications,

INITIAL STRUCTURAL STABILITY ASSESSMENT

Embankment Dike Compaction (§257.73(d)(1)(iii))
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- Dike embankments were to be compacted with sheepsfoot rollers. Construction monitoring was to include two field moisture-density tests per day to achieve a minimum 95 percent of Standard Proctor maximum density as determined by TVA Materials Laboratory. The earth fill moisture content was not to exceed 3 percent above optimum moisture content.

Two previous geotechnical explorations were available to review as part of this assessment, including a study by Stantec Consulting Services Inc. (Stantec, 2010) and Law Engineering (Law, 1992). Stantec completed a geotechnical exploration and slope stability evaluation of the Ash Pond in March 2010. Their subsurface exploration program included drilling and sampling locations around the Perimeter Dike of the Stilling Pond. Continuous Standard Penetration (SP) Testing was performed at each boring location. Law also completed a geotechnical exploration and stability analysis of the Ash Pond in January 1992. Their exploration included drilling and sampling locations around the Perimeter Dike. SP testing was also performed at each boring location. The SP data from these studies were used to estimate relative density of dike embankment materials, referencing NAVFAC DM-7.1

The SP test data reviewed shows average N-values ranging from 11 to 14 for the dike embankment materials. Correlating these results using NAVFAC DM-7.1 indicate that appropriate compaction exists within the embankment of the Perimeter Dike.

5.1.3 Conclusion

Based on the assessment of the embankment dike compaction for the Perimeter Dike, the CCR Rule-related criteria listed above have been met.

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Vegetated Slopes (§257.73(d)(1)(iv))
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6.0 VEGETATED SLOPES (§257.73(D)(1)(IV))

Per §257.73(d)(1)(iv), the initial structural stability assessment must document whether the unit has been designed, constructed, operated and maintained with vegetated slopes of dikes and surrounding areas, except for slopes which have an alternate form or forms of slope protection. The Stilling Pond has the following features that fall within this requirement:

- Perimeter Dike

Assessment of the vegetated slopes associated with these features was completed considering the following criteria related to the CCR rule:

1. Regular inspection records showing vegetative cover sufficient to prevent surface erosion while allowing an unobstructed view to visually inspect the slope.

6.1 BACKGROUND

The Perimeter Dike is vegetated along the exterior slope excluding the area immediately around the emergency spillway which is armored with rip rap. The interior slope is vegetated above the riprap armoring for wave protection located along the length of the Perimeter Dike excluding areas of rip rap armoring near the Primary and Emergency Spillways.

6.1.1 Assessment

Annual site inspections were conducted and documented regularly following construction of the perimeter dike.

In March 2016, Stantec personnel visited the site to observe existing conditions. The vegetation along the slopes of the perimeter dike of the Stilling Pond did not exceed 6 inches in height.

6.1.2 Conclusion

Based on the assessment of the vegetated slopes for the Stilling Pond, the CCR Rule-related criteria listed above have been met.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Spillway Condition and Capacity (§257.73(d)(1)(v))
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7.0 SPILLWAY CONDITION AND CAPACITY (§257.73(D)(1)(V))

Per §257.73(d)(1)(v), the initial structural stability assessment must document whether the unit has been designed, constructed, operated and maintained with a single spillway or combination of spillways that meet the condition and capacity requirements as outlined in this section of the CCR Rule. The combined capacity of all spillways are to be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in this section. The Stilling Pond has the following features that fall within this requirement:

- Primary Spillway System
- Emergency Spillway

Assessment of the spillway condition and capacity associated with these features was completed considering the following criteria related to the CCR rule:

1. Outlet channel must be of non-erodible material designed to carry sustained flow velocities based on the required flood events. [Estimate flow velocities and select appropriate material using hydraulic analysis for the following flood events: PMF (high hazard potential unit), 1000-year flood (Significant hazard unit), 100-year flood (low hazard potential unit).]
2. Must adequately manage flow during and following the peak discharge. [Estimate size of outlet structure based of hydraulic analysis for the following flood events: PMF (High hazard potential unit), 1000-year flood (Significant hazard potential unit), and 100-year flood (low hazard potential unit).]
3. Must be structurally stable. [Assess stability of structure using stability and stress analyses according to an appropriate methodology. Some acceptable methodologies may include: EM 1110-2-2400, EM 1110-2-2100, ACI 350, etc.]
4. Must maintain structural integrity. [Structural integrity may be warranted by periodic inspections of existing conduits. Inspections must show no significant presence of deformation, distortions, cracks, joint separation, etc.]
5. Must be free from significant amounts of obstruction and anomaly which may affect the operation of the hydraulic structure [Perform periodic pipe inspections to detect deterioration, deformation, distortion, bedding deficiencies, and sediment, and debris accumulations.]

INITIAL STRUCTURAL STABILITY ASSESSMENT

Spillway Condition and Capacity (§257.73(d)(1)(v))
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7.1 PRIMARY SPILLWAY SYSTEM

7.1.1 Background

The Stilling Pond is classified as a significant hazard structure requiring the combined capacity of all spillways be adequate to manage the flow during and following the peak discharge from a 1000-year flood.

Improvements to the Primary Spillway System were constructed in 2011 and 2012. The work included retrofitting the existing steel skimmers mounted on the risers and replacing them with new galvanized steel skimmers. The height of the risers was reduced by 6 feet by removing riser sections and the remaining riser sections were CIPP-lined. No. 57 and No. 4 stone was placed in a 10-foot radius around the risers to provide lateral support. The side slopes of the placed stone to the bottom of the Stilling Pond were approximately 1.5 horizontal to 1 vertical (1.5H:1V).

7.1.2 Assessment

7.1.2.1 Spillway Capacity

The Inflow Design Flood Control System Plan for the Stilling Pond demonstrates the Stilling Pond meets the capacity requirements outlined in §257.73(d)(1)(v) of the CCR Rule. During the March 2016 site visit by Stantec personnel, the barrels were freely discharging with no observed deficiencies or blockages.

7.1.2.2 Structural Stability

7.1.2.2.1 Material Properties

The following properties were used in this analysis for determining weight, strength, and other required parameters:

INITIAL STRUCTURAL STABILITY ASSESSMENT

Spillway Condition and Capacity (§257.73(d)(1)(v))
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Table 1 Material Properties Used in Analysis

Material	Property	Reference
Concrete	$f'_c = 4,000$ psi, $\gamma_c = 150$ pcf, $\epsilon_c = 0.003$	Assumed values based on available concrete during era of construction
Reinforcing Steel	$f_y = 60$ ksi, E_s (Elastic Modulus) $= 29,000$ ksi	Assumed values based on available reinforcing steel during era of construction
Soil below and around structure	$\gamma_{sat} = 119$ pcf, Friction Angle $= 22^\circ$, Bearing Pressure $= 6,767$ psf	02-Soil Parameters (See supporting calculations)

7.1.2.2.2 Geometry

In order to determine the geometry of the riser structures for analysis, the original as-built plans were used in conjunction with revised plans provided in Stantec (2012b) which document the change in riser heights.

The four evaluated risers have identical geometry.

7.1.2.2.3 Analysis Methodology

The four risers are identical in configuration. For this reason, Stantec performed one structural stability analysis. The calculations and results for the riser are included in Appendix B.

To determine the structural stability of the riser, the following "worst case" loading conditions were assumed for each failure limit state.

The failure limit states evaluated for the riser are shown in Table 2.

Table 2 Loading Conditions for Different Failure Limit States

Failure Limit State	Load Condition
Floatation	Water level is at the crest of the riser. Structure is empty. Weight of the trash filter is excluded in the event that it is removed.
Foundation Bearing	Case 1: Water level is at the crest of the riser and the structure is filled. Produces maximum weight, but considerable uplift. Includes weight of the trash filter. Case 2: Water elevation in pond is below riser slab. Riser structure is empty. Produces minimum weight, but no uplift
Strength of Riser Walls	Structure is fully submerged so as to produce maximum lateral pressure on the walls.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Spillway Condition and Capacity (§257.73(d)(1)(v))
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When determining the force effects in the walls of the riser due to the maximum soil and hydrostatic pressures, the walls were assumed to behave as plates fixed on three sides. Engineering Monograph 27 was referenced in the determination of the maximum force effects in the walls. For the capacity of the concrete walls, all tension reinforcing steel was assumed to yield. A stress block approach was used to determine the flexural capacity. Shear and flexure capacities for both directions were evaluated in accordance with ACI 350-06.

7.1.2.2.4 Acceptance Criteria

The following recommended factors of safety were obtained from the indicated references:

Table 3 Minimum Recommended Factors of Safety for Stability

Limit State	Minimum Recommended Factor of Safety	Reference
Floatation	FS = 1.3	USACE (2005)
Foundation Bearing	FS = 3.0	USACE (1992)

For the reinforced concrete strength limit states, the analysis was performed in accordance with ACI 350-06. Appendix C in ACI 350-06 was not used to modify the load factors and resistance reductions. A performance ratio greater than 1 indicates the limit state is satisfied.

The following results were obtained by the calculation in Appendix B of this report:

Table 4 Results for Different Limit States

Limit State	Recommended	Results
Floatation	FS = 1.3	FS = 1.9
Foundation Bearing	FS = 3.0	FS = 6.6 for riser fully submerged FS = 4.7 for riser in drained pond
Strength of Riser Walls	Performance Ratio ≥ 1.0	P.R. = 1.6 for flexure at corner P.R. = 1.4 for shear at corner P.R. = 1.1 for flexure at footing P.R. = 2.1 for shear at footing

The structure complies with the stability and strength limits listed above.

7.1.3 Conclusion

Based on the assessment of the Primary Spillway System condition and capacity for the Stilling Pond, the CCR Rule-related criteria listed above have been met.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Spillway Condition and Capacity (§257.73(d)(1)(v))
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7.2 EMERGENCY SPILLWAY

7.2.1 Background

The Emergency Spillway System provides additional hydraulic capacity for the Stilling Pond for storm events that exceed the capacity of the Primary Spillway System. The outlet of the spillway is armored with reinforced concrete or rip rap to the point it discharges to Wells Creek.

7.2.2 Assessment

7.2.2.1 Spillway Capacity

The Inflow Design Flood Control System Plan for the Stilling Pond demonstrates the Stilling Pond meets the capacity requirements outlined in §257.73(d)(1)(v) of the CCR Rule.

7.2.2.2 Structural Stability

It was determined that the only condition state necessary to check for the spillway chute was moment capacity of the reinforced concrete walls. Balanced loading and absence of groundwater meant the structure would not experience lateral forces to cause sliding or uplift forces to cause floatation under normal load conditions.

Based on the 2011 plan set (sheet 10W286-12), steel yield stress used was 60,000 psi, concrete compressive stress used was 4,000 psi. Soil weight was assumed to be 110 pcf.

The maximum moment induced by the lateral load of the soil backfill was compared to the reinforced concrete side wall's moment capacity using ACI 350-06. A performance ratio greater than 1.0 is necessary. It was concluded that the performance ratio of the walls at the critical location is 1.1.

Structural considerations for the design of the box culvert are documented in Stantec (2012a). The emergency spillway culvert was designed per AASHTO Load and Resistance Factor Design (LRFD). Based on direction from TVA, the emergency spillway culvert was designed to support a fully loaded CAT 740 articulated truck. The fully loaded weight was assumed as 160,055 lb based on machine specifications, with a 54,234 lb front axle, a 53,683 lb center axle and a 52,139 lb rear axle at 13.9 ft and 6.4 ft axle spacing, respectively. The live load was distributed per AASHTO LRFD Article 3.6.1.2.6. The top wall thickness was set at 13 inches with two feet of cover added above the emergency spillway. The culvert walls and bottom slab are 12 inches thick.

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Spillway Condition and Capacity (§257.73(d)(1)(v))
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The culvert was designed for a concrete compressive strength of 4,000 psi and a reinforcing steel strength of 60,000 psi. The concrete and soil fill density were assumed to be 150 pounds per cubic foot (pcf) and 120 pcf respectively.

7.2.3 Conclusion

Based on the assessment of the Emergency Spillway condition and capacity for the Stilling Pond, the CCR Rule-related criteria listed above have been met.

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Sudden Drawdown Assessment (§257.73(d)(1)(vii))
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8.0 SUDDEN DRAWDOWN ASSESSMENT (§257.73(D)(1)(VII))

Per §257.73(d)(1)(vii), the initial structural stability assessment must document whether the unit has been designed, constructed, operated, and maintained with downstream slopes that can be inundated by an adjacent water body (such as a river, stream, or lake) to determine if structural stability is maintained during low pool or sudden drawdown of the adjacent water body. The Stilling Pond has the following feature that falls within this requirement:

- Perimeter Dike

Assessment of the sudden drawdown associated with these features was completed considering the following criteria related to the CCR rule:

- Maintain slope stability during sudden drawdown of adjacent water body.

Guidance provided by the USEPA (2015) described the basis of the CCR Rule's factor of safety criteria and methodology as EM 1110-2-1902 (USACE, 2003) or other appropriate methodologies. Table 3-1 of EM 1110-2-1902 (USACE, 2003) recommends a required minimum factor of safety of 1.1 for maximum surcharge pool under rapid drawdown conditions.

8.1 PERIMETER DIKE

8.1.1 Background

The Stilling Pond has a potential sudden drawdown loading from Wells Creek to the north and west and the outlet channel to the east along the toe of its perimeter dike. A sudden drawdown slope stability analysis of the downstream slope is required under the CCR Rule §257.73(d)(1)(vii). The sudden drawdown slope stability analysis was performed in conjunction with the static safety factor assessment discussed in Stantec (2016b).

8.1.2 Assessment

8.1.2.1 Material Properties

An overview of the subsurface conditions of the perimeter dike at the Stilling Pond is summarized in Table 5. A more in-depth review is found in Stantec (2010).

INITIAL STRUCTURAL STABILITY ASSESSMENT

Sudden Drawdown Assessment (§257.73(d)(1)(vii))

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Table 5 Generalized Subsurface Conditions – Stilling Pond Perimeter Dike

Approximate Elevation (feet)	Materials	General Consistency/Density
Top of dike El. 380	Dike 1 fill – original perimeter dike, lean clay (CL), just above natural ground	Very soft to very stiff
Top of dike El. 395	Dike 2 fill – raised dike uphill of original perimeter dike, lean clay/lean clay with gravel (CL) and fat clay/fat clay with gravel (CH)	Soft to very stiff
Various	Alluvial clay – lean clay (CL)	Soft to very stiff
Various	Alluvial granular – silty sand with gravel (SM), gravel with clay to silt and sand (GP-GC or GM)	Loose to very dense
Various	Fly ash (sluiced) – silt or silt with sand/silty sand (ML)	Soft to very stiff
Various	Bedrock – interbedded limestone and shale	Hard to moderately hard

During the 2009 geotechnical explorations (Stantec, 2010), Stantec performed a laboratory testing program consisting of natural moisture content determinations, sieve and hydrometer analyses, Atterberg limits, specific gravity determinations, unit weight, moisture-density (Proctor), consolidated-undrained triaxial compression tests, and permeability tests. The strength parameters derived using the laboratory data and used in this sudden drawdown slope stability evaluation are presented in Table 6. The results of the laboratory testing and derivation of the strength parameters can be found in Stantec (2010 and 2011).

Table 6 Strength Parameters for Stability Analysis – Stilling Pond Perimeter Dike

Soil Horizon	Unit Weight (pcf)	Effective Stress Strength Parameters		Total Stress Strength Parameters	
		c' (psf)	ϕ' (degrees)	c (psf)	ϕ (degrees)
Dike 1 (Lean Clay)	123	200	22	800	20
Dike 2 (Lean Clay)	123	200	32	500	21
Dike 2 (Fat Clay)	119	200	29	200	18
Fly Ash (Sluiced)	100	0	22	140	11
Alluvial Clay	124	200	33	450	20
Alluvial Granular	130	0	32	100	20
Bedrock	Impenetrable				

INITIAL STRUCTURAL STABILITY ASSESSMENT

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8.1.2.2 Critical Cross Section Selection

Slope stability analyses were available from Stantec (2010) and Stantec and URS (2014). Eight cross sections from the Stilling Pond were analyzed under static, long-term, steady-state conditions. The eight sections that were analyzed were P-P', Q-Q', R-R', S-S', T-T', U-U', V-V', and W-W' and are shown below in Figure 2.

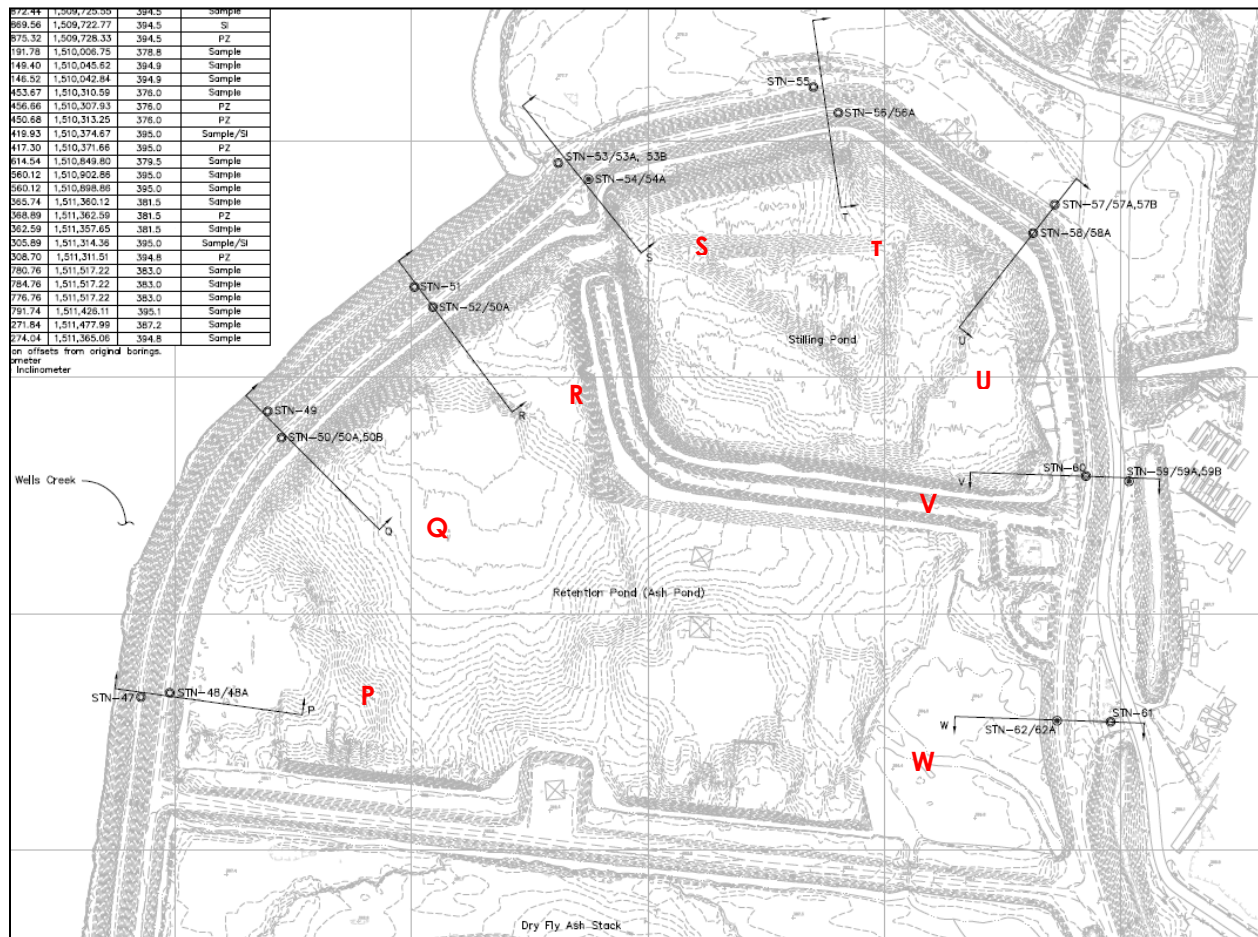


Figure 2 CUF Stilling Pond – Plan View of Cross Sections
(Stantec, 2010)

To determine if these cross sections along the perimeter dike of the Stilling Pond were still representative of field conditions, a review of recent construction activities, topographic, and bathymetric information was performed. The following modifications were made since the 2009 geotechnical exploration:

- The Stilling Pond pool level was lowered from the Spillway Improvements Project (Work Plan 7) completed in March of 2012 (Stantec, 2012b).

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- Additional geotechnical exploration was performed near Section P-P' in October of 2012 (Stantec, 2013).

The additional geotechnical exploration performed in October of 2012 modified the known soil geometry in Section P-P', confining the alluvial granular layer between alluvial clay. The threshold analysis performed in Stantec and URS (2014) reflects this change in geometry, and contains the current geometry for each of the sections. Recent topographic data (Tuck Mapping Solutions, 2015) and bathymetric data (The RLS Group, 2015) indicate negligible changes in the cross section geometry. The model surface geometry from Stantec and URS (2014) and material properties (Stantec 2010) will be the basis of this analysis representing current conditions.

The summary of the historic slope stability results are listed in Table 7. For Stantec (2010), the headwater elevation was set at 384.23 feet. The tailwater elevation was set at 359.5 feet (Wells Creek) for sections P-P' through U-U' and 375 feet (outlet channel) for Sections V-V' and W-W'. For Stantec and URS (2014), the headwater elevation was set at 378.0 feet with tailwater elevations ranging from 359.0 to 365.7 feet.

Table 7 Historic Static Slope Stability Results

Cross-Section	Sudden Drawdown Factor of Safety	Reference
P-P'	1.7	Stantec (2010)
Q-Q'	1.9	Stantec (2010)
Q-Q'	1.7	(Stantec and URS, 2014)
R-R'	2.0	Stantec (2010)
S-S'	2.5	Stantec (2010)
S-S'	2.5	(Stantec and URS, 2014)
T-T'	2.9	Stantec (2010)
U-U'	2.6	Stantec (2010)
U-U'	2.8	(Stantec and URS, 2014)
V-V'	2.8	Stantec (2010)
W-W'	7.2	Stantec (2010)

Section P-P' produced the lowest factor of safety in Stantec (2010). However, this does not reflect the change in geometry from the additional geotechnical explorations in 2012 (Stantec, 2013). Section Q-Q' was selected as another critical cross section. Sudden drawdown stability analyses were performed for both sections P-P' and Q-Q' based on the proposed water levels discussed in Section 8.1.2.3 to determine the critical cross section.

INITIAL STRUCTURAL STABILITY ASSESSMENT

Sudden Drawdown Assessment (§257.73(d)(1)(vii))
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8.1.2.3 Water Levels

The sudden drawdown slope stability analyses require assessment of changes in headwater and tailwater levels. In Stantec (2016a), the water elevations for the Stilling Pond were redefined to meet the requirements of the EPA CCR Rule inflow design flood cases.

The maximum surcharge pool elevation was selected as the high water level within the Stilling Pond. The 1000-year flood elevation was used for the flood pool elevation of the Stilling Pond (Stantec, 2016a).

Normal pool or the maximum storage pool elevation was selected as the low water level for the facility. Headwater elevations are listed in Table 4.

The tailwater corresponds to Wells Creek, which is a tributary of the Cumberland River. The Cumberland River level in this area is controlled by nearby Lake Barkley. The 100-year flood level for Lake Barkley was used for the tailwater flood pool elevation (Stantec, 2016a). Normal pool for the Lake Barkley was used as tailwater for long-term maximum storage conditions (Stantec, 2012b and 2016a). Table 8 lists the headwater and tailwater elevations used for analysis.

Table 8 CUF Water Elevations for Stability Modeling

CCR Rule Criteria	Headwater Stilling Pond Elevation (feet, NGVD29)	Tailwater Wells Creek Elevation (feet, NGVD29)
Maximum surcharge pool loading condition	385.1	381.0
Long-term maximum storage pool loading condition	378.0	359.0

8.1.2.4 Analysis Methodology

Stantec performed the sudden drawdown slope stability analyses using the GeoStudio 2007, Version 7.23 software package developed by GEO-SLOPE International, Ltd. of Calgary, Alberta, Canada (GEO-SLOPE International, Ltd., 2007). This package includes the SLOPE/W module for slope stability analysis. The analyses were performed in accordance with the recommendations and criteria outlined in the USACE Design Manuals EM 1110-2-1902 "Slope Stability" (USACE, 2003) and in the Stantec Engineer's Certification of Safety Factor Assessment Report (Stantec, 2015).

8.1.2.5 Acceptance Criteria

A minimum factor of safety is not explicitly specified within the EPA Final CCR Rule §257.73(d)(1)(vii). In the CCR Rule discussion, USACE (2003) is considered the basis for the slope stability analyses. Table 3-1, Minimum Required Factors of Safety: New Earth and Rock-Fill Dams, requires a factor of safety of 1.1 for a rapid drawdown condition from maximum surcharge pool (USACE, 2003).

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8.1.2.6 Analysis Results

The slope stability assessments presented in this report are focused on the potential for slope failures of significant mass, which could directly impact potential release of water and CCR materials from the Stilling Pond. The search for a critical slip surface in the slope stability assessments is thus restricted to consider only potential surfaces where the depth (measured at the base of at least one slice) is more than ten feet vertically below the ground surface. Table 9 summarizes the sudden drawdown safety factor evaluation results at the Stilling Pond.

Table 9 Factor of Safety Assessment Results

Plant	Facility	Critical Cross Section	EPA Criteria	Recommended Factor of Safety Criteria	Calculated Factor of Safety
CUF	Stilling Pond	P-P'	Sudden Drawdown	1.1	1.8
CUF	Stilling Pond	Q-Q'	Sudden Drawdown	1.1	1.8

8.1.3 Conclusion

Based on the assessment of the sudden drawdown for the Stilling Pond Perimeter Dike, the CCR Rule-related criteria listed above have been met.

INITIAL STRUCTURAL STABILITY ASSESSMENT

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9.0 REFERENCES

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INITIAL STRUCTURAL STABILITY ASSESSMENT

References

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APPENDIX A

SPILLWAY CONDITION AND CAPACITY

**PLANS FOR CONSTRUCTION
SPILLWAY IMPROVEMENT PROJECT
ASH POND COMPLEX
ASH STILLING POND
WORK PLAN 7 (CUF-110311-WP-7)
CUMBERLAND FOSSIL PLANT
CUMBERLAND CITY, STEWART COUNTY, TENNESSEE**

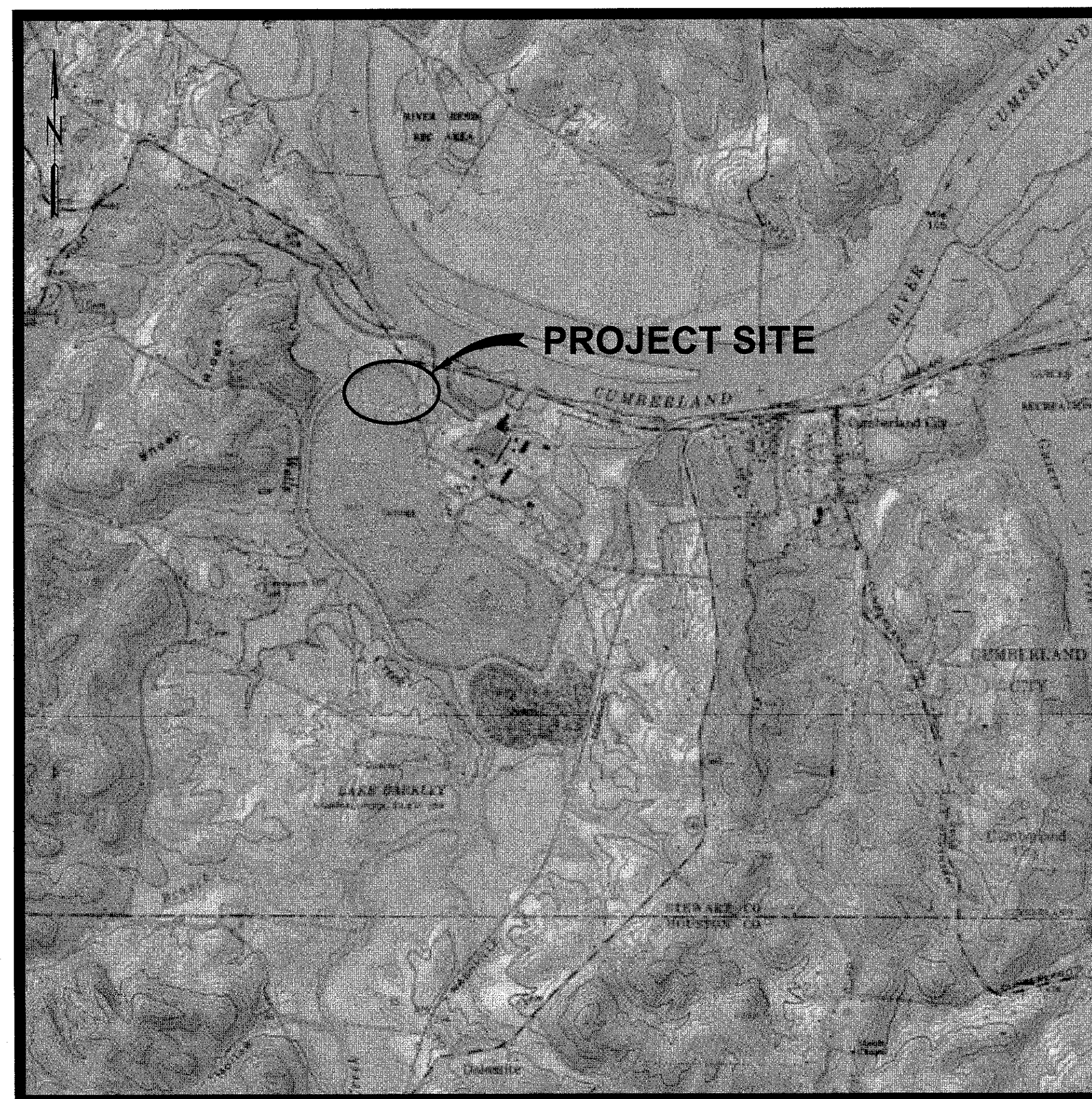
PREPARED FOR

TENNESSEE VALLEY AUTHORITY

PREPARED BY



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Fax 636.343.3554
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RECORD DRAWING NOTES:

1. THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
2. ITEMS SHOWN ON THE "RECORD DRAWING" WITH CLOUDED NOTATION ARE ITEMS FOR WHICH AS-BUILT INFORMATION WAS AVAILABLE. ALL OTHER ITEMS ARE SHOWN FOR REFERENCE AS THEY WERE IN THE "ISSUED FOR CONSTRUCTION" PLAN SET.

INDEX OF SHEETS

10W286-01	COVER SHEET
10W286-02	GENERAL NOTES
10W286-03	EXISTING CONDITIONS & BASELINES
10W286-04	PLAN - SPILLWAY IMPROVEMENTS
10W286-05	PLAN - SPILLWAY RETROFITS
10W286-06	DETAILS - SIPHON SPILLWAYS
10W286-07	DETAILS - ROADS & CHANNEL
10W286-08	DETAILS - SIPHON HEADWALL
10W286-09	DETAILS - SPILLWAY RETROFITS
10W286-10	DETAILS - SKIMMER & WALKWAY
10W286-11	PLAN - EMERGENCY SPILLWAY
10W286-12	DETAILS - EMERGENCY SPILLWAY
10W286-13	DETAILS - EMERGENCY SPILLWAY
10W286-14	EROSION PREVENTION & SEDIMENT CONTROL (EPSC)
10W286-15	GEOTECHNICAL EXPLORATION
10W286-16	LOGS OF BORINGS
10W286-17	PLAN - GRADED FILTER
10W286-18	DETAILS - GRADED FILTER
10W286-19	DETAILS - OUTLET HEADWALL

RECORD DRAWING

R 1	01/20/12	TWW	TMM	MAH	SHB	SEB	MST	JCK			
ISSUED FOR CONSTRUCTION											

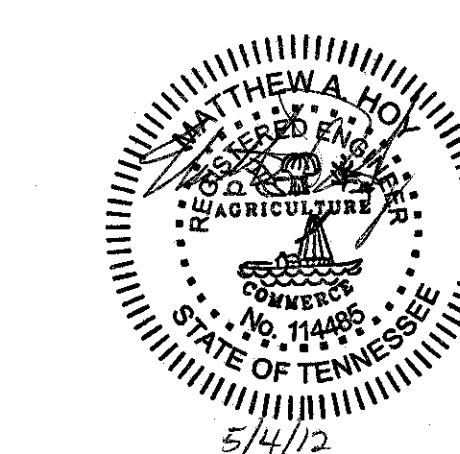
R 2	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK	-	-	-
ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7)											

NS	R 0	03/11/11	LJP	TMM	MAH	MAH	SEB	MST	JCK	-	-	-
	ISSUED FOR CONSTRUCTION											

REV. NO.	DATE	DSGN	DRWN	CHKD	SLIPV	RWMD	APPD	ISSD	PROJECT ID	AS CONST	REV GD
SCALE: NONE										EXCEPT AS NOTED	

SCALE: NONE	EXCEPT AS NOTED
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YARD ASH STILLING POND
SPILLWAY IMPROVEMENT PROJECT COVER SHEET WORK PLAN 7 (CUF-110311-WP-7)



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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 03/11/11	46	C	10W286-01	R 2
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PLOT FACTOR:1
W TVA

C.A.D. DRAWING
NOT ALTER MANUALLY

GENERAL NOTES

SUMMARY OF WORK

THE WORK DESCRIBED IN THIS DRAWING SET CONSISTS OF IMPROVEMENTS TO THE EXISTING SPILLWAY STRUCTURES LOCATED IN THE ASH STILLING POND AT THE TENNESSEE VALLEY AUTHORITY (TVA) CUMBERLAND FOSSIL PLANT (CUF). WORK INCLUDES INSTALLATION OF SIPHON STRUCTURES TO TEMPORARILY DRAW THE POOL DOWN TO ALLOW FOR PLACEMENT OF MATERIAL AROUND THE BASE OF THE EXISTING TALL, UNSUPPORTED RISERS TO PROVIDE LATERAL SUPPORT. THE RISERS WILL THEN BE CLEANED, INSPECTED, AND SLIP-LINED. DURING RETROFITTING, THE EXISTING STEEL SKIMMERS WILL BE REMOVED AND REPLACED WITH NEW GALVANIZED STEEL SKIMMERS, AND THE HEIGHT OF THE RISERS WILL BE REDUCED BY REMOVING THE TOP 6 FEET OF THE RISERS. FOLLOWING RISER LOWERING, THE RISER STRUCTURES AND OUTLET PIPES WILL BE LINED USING CURED-IN-PLACE PIPE (CIPP) LINING. ONCE EXISTING SPILLWAY RETROFITS ARE COMPLETE, THE POOL WILL BE RAISED TO A PERMANENT ELEVATION OF APPROXIMATELY 378.2 FT. ALSO INCLUDED ARE PLANS TO CONSTRUCT AN EMERGENCY SPILLWAY TO PROVIDE DISCHARGE CAPACITY TO CONVEY THE 6-HR PMP STORM EVENT. THE EMERGENCY SPILLWAY WILL CONSIST OF THREE (3) 8 FT BY 8 FT CAST-IN-PLACE CONCRETE BOX CULVERTS.

1.0 GENERAL PROVISIONS

- 1.1 THE ATTACHED PLANS, TECHNICAL SPECIFICATIONS AND QUALITY CONTROL PLAN WERE PREPARED BY STANTEC CONSULTING SERVICES INC. (STANTEC). FOR THE CONSTRUCTION ASPECTS SHOWN HEREIN THE TENNESSEE VALLEY AUTHORITY (TVA) IS THE OWNER AND STANTEC IS THE ENGINEER. THE CONTRACTOR SHALL BE RETAINED UNDER CONTRACT BY THE OWNER.
- 1.2 THE CONTRACTOR SHALL CONFINE ALL SPECIFIC WORK ACTIVITIES TO THE AREA DEFINED BY THE PLANS OR APPROVED BY THE OWNER. ACCESS INTO THE WORK AREA FOR DELIVERY OF EQUIPMENT, MATERIALS AND WORKFORCE SHALL BE REVIEWED DAILY BY THE CONTRACTOR, AND CONTROLLED AS NEEDED TO PREVENT ANY DAMAGE TO THE CREST AND SLOPES OF THE DIKES SURROUNDING THE ASH POND.
- 1.3 THE CONTRACTOR SHALL COORDINATE WITH THE OWNER TO DETERMINE THE LOCATION AND AREA FOR EQUIPMENT OR MATERIAL STORAGE AND FOR OTHER CONSTRUCTION LAY DOWN ACTIVITY.
- 1.4 WHENEVER REFERENCE IS MADE TO TENNESSEE DEPARTMENT OF TRANSPORTATION (TDOT) STANDARD SPECIFICATIONS, AMERICAN CONCRETE INSTITUTE (ACI), AMERICAN WELDING SOCIETY (AWS), AMERICAN WATER WORKS ASSOCIATION (AWWA), AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM) AND OTHER PUBLISHED STANDARDS OR SPECIFICATIONS, IT SHALL MEAN THE LATEST VERSION IN ITS ENTIRETY.
- 1.5 ACCEPTABLE CONSTRUCTION TOLERANCES FROM PLAN DIMENSIONS, ELEVATIONS, AND GRADES SHALL BE AS FOLLOWS:
-EXCAVATIONS AND FINAL GRADES FOR EARTH SURFACES AND SLOPES: ± 0.25 FEET
-RIPRAP: FINAL GRADE ±0.5 FEET, THICKNESS ZERO TO +0.5 FEET
-FINAL GRADE TOP OF DAM: ZERO TO +0.25 FEET
-OUTLET HEADWALL: ±0.10 FEET, AND ALL STRUCTURES WITHIN 0.5 INCHES
-MEASUREMENTS WITHIN 0.5 INCHES OF PLAN DIMENSIONS
-PIPES AND APPURTENANCES: ±0.10 FEET OF PLAN ELEVATION
- 1.6 NO DEVIATIONS FROM THE PLANS OR APPROVED SHOP DRAWINGS SHALL BE MADE WITHOUT PRIOR APPROVAL FROM THE ENGINEER. THE CONTRACTOR SHALL MAINTAIN A RECORD OF ALL DEVIATIONS IN LOCATION OR ELEVATION OF ANY INSTALLATION FROM THAT SHOWN ON THE PLANS, AND ANY DEVIATIONS IN INSTALLATIONS FROM APPROVED SHOP DRAWINGS. AT COMPLETION OF THE PROJECT A SET OF RECORD DRAWINGS WILL BE PREPARED BY THE ENGINEER BASED ON THE AS-BUILT RECORD PROVIDED BY THE CONTRACTOR. THE CONTRACTOR SHALL COOPERATE FULLY AND ASSIST WITH PREPARATION OF THE FINAL RECORD DRAWINGS.
- 1.7 THE GEOTECHNICAL INFORMATION AND DATA FURNISHED HEREIN ARE NOT INTENDED AS REPRESENTATION OR WARRANTIES BUT ARE FURNISHED FOR INFORMATION ONLY. IT SHALL BE DISTINCTLY UNDERSTOOD THAT THE OWNER OR ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DETECTION, INTERPRETATION OR CONCLUSION DRAWN THEREFROM. THE INFORMATION IS MADE AVAILABLE IN ORDER THAT THE CONTRACTOR MAY HAVE READY ACCESS TO THE SAME INFORMATION AVAILABLE TO THE OWNER AND THE ENGINEER AND IS NOT PART OF THIS CONTRACT.
- 1.8 THE CONTRACTOR SHALL NOTIFY CUF PLANT PERSONNEL 48 HOURS IN ADVANCE OF ACCESS ROAD CUTTING TO ALLOW FOR COORDINATION OF ALTERNATIVE TRAFFIC ROUTES.
- 1.9 VEHICULAR ACCESS TO THE SITE SHALL BE DETERMINED BY TVA. NO CONSTRUCTION ACTIVITIES SHALL BE PERFORMED THAT CAUSES AN INTERFERENCE WITH THROUGH TRAFFIC DURING CONSTRUCTION. CONTRACTOR SHALL PROVIDE APPROVED SIGNAGE, BARRIERS AND TRAFFIC SAFETY PERSONNEL RESPONSIBLE FOR DIRECTING CONSTRUCTION AND PLANT TRAFFIC AT ALL POINTS OF INGRESS AND EGRESS.
- 1.10 UTILITIES AND INSTRUMENTATION SHOWN ON THE ATTACHED PLANS SHALL BE CONSIDERED APPROXIMATE AND DO NOT COVER ALL EXISTING UTILITIES IN THE AREA. CONTRACTOR SHALL EXERCISE EXTREME CAUTION DURING EXCAVATION. SHOULD PIPING OR OTHER UTILITIES THAT ARE NOT SHOWN ON THE DRAWINGS BE ENCOUNTERED, CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY, WHO WILL IN TURN NOTIFY TVA PLANT PERSONNEL IMMEDIATELY. WHERE APPLICABLE, THE CONTRACTOR SHALL PROVIDE NECESSARY MEASURES TO PROTECT UTILITIES FROM DAMAGE DUE TO CONTRACTORS WORK.
- 1.11 CONTRACTOR SHALL BE RESPONSIBLE FOR THE HEALTH AND SAFETY OF ITS PERSONNEL AND SHALL MEET ALL APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS INCLUDING BUT NOT LIMITED TO OSHA STANDARDS AND TVA SAFETY REQUIREMENTS.

2.0 SURVEY

- 2.1 TOPOGRAPHIC INFORMATION:
UNLESS OTHERWISE INDICATED, THESE DRAWINGS WERE COMPILED USING SURVEY INFORMATION PROVIDED BY TVA. TOPOGRAPHIC SURVEY POINT FILE PCF572.XYZ DATED 11/30/2009, HYDROGRAPHIC SURVEY POINT FILE PCF572.SND DATED 09/29/2009, AND HYDROGRAPHIC SURVEY POINT FILE JSR631.SND DATED 09/22/2008 WERE UTILIZED. TOPOGRAPHIC DATA FROM AN AERIAL SURVEY FLOWN IN APRIL OF 2009 WAS USED IN AREAS SHOWN OUTSIDE OF THE ABOVE REFERENCED SURVEY EXTENTS. HORIZONTAL COORDINATES ARE REFERENCED TO TENNESSEE STATE PLANE COORDINATE SYSTEM, NAD 27. ELEVATIONS ARE BASED ON NGVD 29. TOPOGRAPHIC INFORMATION SHOWN IN THE DRAWINGS IS DATED AND DOES NOT REFLECT CHANGES SINCE THE TIME OF AERIAL PHOTOGRAPHY. AREAS OF HYDROGRAPHIC SURVEYING MAY NOT REFLECT CURRENT CONDITIONS AS THE UNDERWATER SURFACE CONSTANTLY CHANGES.
 - 2.2 STAKING:
THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SURVEYING AND STAKING NECESSARY FOR LAYOUT AND CONSTRUCTION OF THE PROJECT. STAKING SHALL BE PERFORMED BY OR UNDER THE DIRECTION OF A LICENSED LAND SURVEYOR.
 - 2.3 CONTROL:
A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.
 - 2.4 CONTRACTOR SHALL EMPLOY A COMPETENT SURVEYOR LICENSED IN THE STATE OF TENNESSEE TO ESTABLISH OR CONFIRM ALL LINES, ELEVATIONS, REFERENCE MARKS, ETC. NEEDED BY THE CONTRACTOR OR ENGINEER DURING CONSTRUCTION. THE QUANTITIES OF MATERIALS PRESENTED HERE SHALL BE CONSIDERED APPROXIMATE AND ARE SUBJECT TO CHANGE BASED ON FIELD CONDITIONS.
- ## 3.0 EROSION PREVENTION AND SEDIMENT CONTROL (EPSC)
- 3.1 THE CONTRACTOR SHALL EXERCISE EVERY REASONABLE PRECAUTION AT ALL TIMES TO MINIMIZE SOIL EROSION AND PREVENT WATER POLLUTION BY DEPOSITION OF SEDIMENT INTO THE SPILLWAY DISCHARGE CHANNEL. EROSION PREVENTION AND SEDIMENT CONTROL MEASURES SHALL BE IMPLEMENTED AND MAINTAINED IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
 - 3.2 PRIOR TO BEGINNING CLEARING, GRUBBING, AND TOPSOIL STRIPPING ACTIVITIES, EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) BEST MANAGEMENT PRACTICES (BMP'S) SHALL BE INSTALLED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. ANY MODIFICATIONS OF EPSC MEASUREMENTS MUST BE REVIEWED AND APPROVED BY THE ENGINEER. IF DEEMED NECESSARY BY THE ENGINEER, ADDITIONAL EPSC BMP'S SHALL BE INSTALLED.
 - 3.3 EPSC BMP'S SHALL BE MAINTAINED AT ALL TIMES IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. ANY DEFICIENCIES IDENTIFIED BY THE ENGINEER DURING INSPECTIONS SHALL BE REMEDIED IMMEDIATELY.
 - 3.4 ACTIONS SHALL BE TAKEN TO MINIMIZE THE TRACKING OF MUD AND SOIL FROM THE PROJECT AREA ONTO THE EXISTING PLANT ACCESS ROAD. SOIL TRACKED ONTO THE ROADWAY SHALL BE REMOVED DAILY.
 - 3.5 WHERE CONSTRUCTION OR LAND-DISTURBING ACTIVITIES HAVE TEMPORARILY CEASED ON ANY PORTION OF THE PROJECT SITE, TEMPORARY SITE STABILIZATION MEASURES SHALL BE IMPLEMENTED AS SOON AS PRACTICABLE, BUT NO LATER THAN 15 CALENDAR DAYS AFTER THE ACTIVITY HAS CEASED.
 - 3.6 SEEDING, MULCHING, EROSION CONTROL BLANKET, AND FERTILIZATION OF DISTURBED AREAS SHALL BE IMPLEMENTED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS.

4.0 EARTHWORK

- 4.1 MATERIAL SPECIFICATIONS FOR STRUCTURAL FILL, AGGREGATE, PIPE, CONCRETE AND OTHER CONSTRUCTION MATERIALS ARE DEFINED IN THE TECHNICAL SPECIFICATIONS UNLESS NOTED OTHERWISE.
- 4.2 TEMPORARY EXCAVATIONS SHALL BE PREPARED IN ACCORDANCE WITH OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) STANDARDS. STABILITY OF EXCAVATION SLOPES IS THE RESPONSIBILITY OF THE CONTRACTOR.
- 4.3 NO MATERIAL SHALL BE PLACED IN ANY SECTION OF THE EMBANKMENT UNTIL THE FOUNDATION FOR THAT SECTION HAS BEEN APPROVED BY THE ENGINEER. THE CONTRACTOR SHALL KEEP THE FOUNDATION AND SUBGRADE FREE FROM WATER OR UNACCEPTABLE MATERIALS AFTER FILL OPERATIONS HAVE STARTED.

5.0 SIPHON SPILLWAY OPERATION

- 5.1 THE SIPHON SYSTEM SHALL BE INSTALLED AND OPERATED TO LOWER THE EXISTING POOL DURING CLEANING, CLOSED-CIRCUIT TELEVISION (CCTV) INSPECTION, AND RETROFITS TO THE EXISTING SPILLWAYS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING, PERIODICALLY PRIMING (INCLUDING RENTAL OR PURCHASE OF A GODWIN DRI-PRIME PUMP, OR APPROVED EQUAL), MAINTAINING AND REGULATING THE FLOW OF THE SIPHON IN A MANNER THAT ENSURES SAFETY AND STABILITY OF THE ASH POND DIKES AT ALL TIMES DURING CONSTRUCTION. THE CONTRACTOR SHALL NOT REDUCE THE POOL LEVEL MORE THAN 1 FOOT PER DAY DURING DRAWDOWN AND SHALL IMMEDIATELY HALT POOL LOWERING IF ANY SIGN OF INTERIOR PERIMETER SLOPE INSTABILITY IS NOTED.
- 5.2 THE CONTRACTOR SHALL INSTALL A STAFF GAGE WITH ALTERNATING MARKS AT 0.1' INCREMENTS AND WHOLE FOOT CALL-OUTS. THE CONTRACTOR SHALL MONITOR THE GAGE AND REGULATE THE SIPHON FLOWS TO MAINTAIN THE POND ELEVATION DURING BACKFILL AROUND RISERS, CLEANING, AND INSPECTION.
- 5.3 POOL DRAWDOWN (USING SIPHONS) WILL RESULT IN A DECREASED POND SURFACE AREA DURING CONSTRUCTION. THIS DECREASED SURFACE AREA MAY AFFECT SETTLING TIMES. THE ENGINEER OR A DESIGNATED REPRESENTATIVE SHALL MEASURE TURBIDITY DAILY AND PRIOR TO EVERY 1-FOOT LOWERING OF THE POOL LEVEL TO EVALUATE TRENDS DURING DRAWDOWN.
- 5.4 THE OUTLETS OF THE EXISTING SPILLWAYS ARE A PERMITTED DISCHARGE, "OUTFALL 001", FOR NPDES PERMIT TN0005789. DURING CONSTRUCTION, WORK IN THE ASH POND MAY CAUSE CHANGES IN PERMITTED EFFLUENT CHARACTERISTICS. THE OWNER SHALL BE RESPONSIBLE FOR MITIGATING EFFECTS OF POOL DRAWDOWN ON PH, TOTAL SUSPENDED SOLIDS (TSS), AND DIKE STABILITY.
- 5.5 ROUTINE HANDLING AND OPERATIONS (RHO&M) PROGRAM MANAGER MUST BE NOTIFIED BEFORE CHANGES IN POOL LEVEL OCCUR.
- 5.6 CONTRACTOR TO VERIFY NO CENOSPHERES ARE PRESENT NEAR SIPHONS PRIOR TO ACTIVATION.

6.0 DIVERSION OF STORMWATER

- 6.1 THE CONTRACTOR IS RESPONSIBLE FOR SITE DRAINAGE THROUGHOUT CONSTRUCTION AND SHALL INSTALL TEMPORARY DRAINAGE STRUCTURES OR PUMP WATER AS NECESSARY TO PREVENT INTERFERENCE WITH THE WORK.
- ## 7.0 OUTLET HEADWALL WALKWAY
- 7.1 THE CONTRACTOR SHALL EXTEND THE EXISTING DISCHARGE CHANNEL WALKWAY AS INDICATED ON THE ATTACHED CONSTRUCTION PLANS. THE WALKWAY SHALL BE CONSTRUCTED OF WOOD AND SHALL CONSIST OF LANDING, STEPS, AND PLATFORMS ALONG WITH ASSOCIATE FOUNDATION(S), RAILING(S), STRINGER(S), RISER(S), TREAD(S), POST(S), JOIST(S), AND DECKING IN ACCORDANCE WITH OSHA SECTION 1926.052. ALL WALKWAYS INCLUDING LANDINGS, STEPS, AND PLATFORMS SHALL HAVE RAILINGS. ALL WALKWAYS SHALL BE A MINIMUM OF 4 FEET WIDE (CLEAR DISTANCE BETWEEN SIDE RAILS).
 - 7.2 SHOP DRAWINGS OF THE DISCHARGE CHANNEL WALKWAY EXTENSION SHALL BE PROVIDED TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

8.0 CONSTRUCTION ACCESS ROADS

- 8.1 CONTRACTOR SHALL CONSTRUCT TEMPORARY ACCESS ROADS AS NEEDED TO ACCOMPLISH WORK. ACCESS ROADS SHALL BE SURFACED WITH SIX (6) INCHES OF TDOT TYPE A AGGREGATE FOR SURFACE COURSES IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
- ## 9.0 CONSTRUCTION OBSERVATION AND TESTING
- 9.1 THE ENGINEER WILL PROVIDE QUALITY ASSURANCE CONTROL TESTING AND WILL OBSERVE CONSTRUCTION ACTIVITIES.

10.0 CONSTRUCTION DOCUMENTATION

- 10.1 DAILY REPORT:
THE CONTRACTOR SITE FOREMAN OR SUPERVISOR SHALL COMPLETE A DAILY ACTIVITIES REPORT FOR EACH DAY IN WHICH ANY CONSTRUCTION ACTIVITY OCCURS. THIS REPORT SHALL DOCUMENT THE EQUIPMENT AND PERSONNEL ACTIVE ON SITE (WITH RELEVANT TIMES NOTED) AND IT SHALL PROVIDE A GENERAL DESCRIPTION OF THE CONSTRUCTION ACTIVITIES PERFORMED DURING THE DAY. IT SHALL ALSO INCLUDE A DESCRIPTION OF ONGOING CONSTRUCTION PROGRESS. THE CONSTRUCTION PROGRESS DESCRIPTION SHALL INCLUDE SUCH ITEMS AS THE STATION LIMITS OF INSTALLED SURFACE DITCHES, AND LOCATION OF INSTALLED STRUCTURES, IF APPLICABLE. DISCUSSIONS OF INCLEMENT WEATHER, EQUIPMENT BREAKDOWNS AND ANY DAMAGE, SAFETY, ENVIRONMENTAL, ETC. INCIDENTS WHICH OCCUR SHALL BE PROVIDED. THE CONTRACTOR SHALL PROVIDE HIS OWN FORMAT FOR THIS REPORT, SUBJECT TO ENGINEER APPROVAL. IT IS EXPECTED THAT THIS REPORT SHALL BE SUBMITTED BY THE CONTRACTOR TO THE ENGINEER BY NOON ON THE NEXT BUSINESS DAY FOLLOWING THE DAY WITHIN WHICH THE REPORT COVERS.

RECORD DRAWING NOTES:

1. THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
2. ITEMS SHOWN ON THE "RECORD DRAWING" WITH CLOUDED NOTATION ARE ITEMS FOR WHICH AS-BUILT INFORMATION WAS AVAILABLE. ALL OTHER ITEMS ARE SHOWN FOR REFERENCE AS THEY WERE IN THE "ISSUED FOR CONSTRUCTION" PLAN SET.

10.2 AS-CONSTRUCTED DRAWINGS

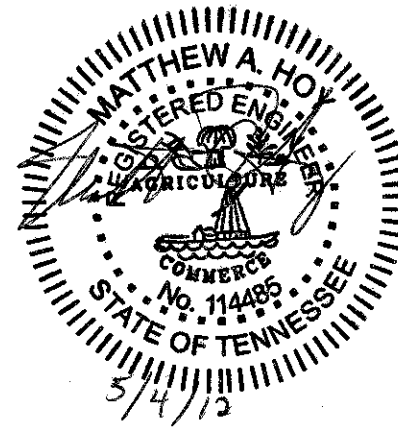
THE CONTRACTOR SHALL MAINTAIN A CLEAN SET OF CONSTRUCTION PLANS AT THE PROJECT SITE. THIS SET OF PLANS SHALL BE USED ONLY FOR RECORDING CONSTRUCTION ACTIVITY AS IT OCCURS. ALL ITEMS INSTALLED INTO THE WORK SHALL BE NOTED AND ANY VARIATION IN MATERIAL SPECIFICATIONS, DETAILS, ELEVATIONS, OR HORIZONTAL LOCATIONS SHALL BE NOTED ON THE PLAN SET WITH RED MARKINGS. TO THE EXTENT NECESSARY, THE CONTRACTOR SHALL ENGAGE A QUALIFIED SURVEYOR TO ESTABLISH THE "AS-BUILT" LOCATION OF ALL PIPES, DRAINS, STRUCTURES, EMBANKMENT ZONE LIMITS, ETC. EACH ITEM'S POSITION SHALL BE DULY NOTED ON THIS "RED-LINE" PLAN SET. THE INFORMATION SHALL BE RECORDED WITH SUFFICIENT ACCURACY AND CLARITY TO BE UNDERSTOOD AND RELIED UPON. AT THE COMPLETION OF THE CONSTRUCTION PROCESS, THIS "RED-LINE" PLAN SET SHALL BE PROVIDED TO THE ENGINEER FOR USE IN DEVELOPING THE RECORD DRAWINGS FOR THE PROJECT. THE INFORMATION ON THE "RED-LINE" DRAWING SET SHALL BE KEPT CURRENT AT ALL TIMES AND SHALL BE AVAILABLE BY THE OWNER OR ENGINEER AT ANY TIME. THE CONTRACTOR SHALL SUBMIT THE "RED-LINE" AS-BUILT SET OF DRAWINGS TO THE ENGINEER WITHIN FIVE WORKING DAYS OF COMPLETION AND ACCEPTANCE OF THE WORK DESCRIBED IN THIS WORK PACKAGE.

CONSTRUCTION QUALITY CONTROL PRODUCT SUBMITTALS						
MATERIAL	SPECIFICATION	REQUIREMENTS	F10/(EA)	MINIMUM FREQUENCY	SUBMITTAL DATE	APPROVAL DATE
CONCRETE			F10	1/SUPPLIER/SOURCE	08/18/11	08/23/11
CONCRETE FORMWORK	03 10 00	MANUFACTURER'S LITERATURE FOR PLYWOOD, FORM ACCESSORIES, PREFABRICATED FORMS AND FORM COATING FOR REVIEW OF TYPE, SHAPE, SIZE, QUALITY AND STRENGTH. SHOP DRAWINGS FOR ENGINEER APPROVAL PRIOR TO CONSTRUCTION.	EA	1/SUPPLIER	08/12/11	N/A
CONCRETE REINFORCEMENT	03 20 00	SUPPLIER CERTIFICATION VERIFYING MATERIAL MEETS SPECIFICATIONS	F10	1/SUPPLIER	08/10/11	N/A
		RESULTS OF PASSING MILL TESTS	F10	15 DAYS PRIOR TO BEGINNING WORK	08/12/11	N/A
CAST-IN-PLACE CONCRETE	03 30 00	COMPLETE LIST OF MATERIALS SHOWING MANUFACTURER'S NAME AND CATALOG NUMBER OF ALL ITEMS INCLUDING ADMIXTURES, CURING COMPOUNDS, CEMENT. DESIGN MIX SUBMITTAL AND SUPPLIER CERTIFICATION VERIFYING MIX MEETS SPECIFICATIONS.	EA	1/SUPPLIER	08/18/11	08/23/11
		DELIVERY SLIPS CERTIFYING CONTENTS OF EACH BATCH NOTING TIME OF DELIVERY.	F10	1/BATCH	VARIES	VARIES
NON-SHRINK (EXPANSIVE) GROUT	03 60 00	CERTIFIED TEST RESULTS FROM MANUFACTURER SHOWING THAT GROUT MEETS OR EXCEEDS ALL SPECIFICATIONS VERIFYING MIX MEETS SPECIFICATIONS (IF NON-COMMERCIAL GROUT MIX IS USED)	EA	1/SUPPLIER	08/18/11	08/23/11
		DELIVERY SLIPS CERTIFYING CONTENTS OF EACH BATCH NOTING TIME OF DELIVERY.	F10	1/BATCH	VARIES	VARIES
METALS						
SITE MISCELLANEOUS METALS	05 50 00	SHOP DRAWINGS FOR ENGINEER APPROVAL PRIOR TO CONSTRUCTION	EA	1/SUPPLIER	N/A	N/A
		AWS CERTIFICATION (WITHIN THE PAST 12 MONTHS)	F10	1/WELDER	N/A	N/A
EARTHWORK						
SITE PREPARATION	31 10 00	SITE SAFETY PLAN FOR APPROVAL BY TVA SAFETY PROFESSIONAL	F10	PRIOR TO BEGINNING WORK	01/11/12	01/12/12
BACKFILL AND EMBANKMENT	31 23 00	MATERIAL CLASSIFICATION OR SAMPLES FOR TESTING FROM EACH REPRESENTATIVE BORROW SOURCE.	EA	1/SUPPLIER/SOURCE	01/31/12	02/01/12
FLEXITERRA HP FGM	31 25 13	MANUFACTURER'S WRITTEN CERTIFICATION STATING THAT THE FURNISHED FGM MEETS OR EXCEEDS ALL SPECIFICATIONS. INSTALLATION INSTRUCTIONS, LIST OF MATERIALS AND APPLICATION RATE.	F10	1/SUPPLIER	N/A	N/A
		CERTIFICATION INDICATING THE SOURCE OF STONE SURFACING IS AN "APPROVED SOURCE" (APL) PER TDOT SECTION 709.	F10	1/SUPPLIER/SOURCE	N/A	N/A
STONE AND RIPRAP	31 37 00	GRADATION CURVE FOR THE MATERIAL AND CERTIFICATION THAT THE MATERIAL MEETS THE SPECIFICATIONS IN THE TECHNICAL SPECIFICATIONS.	F10	1/SUPPLIER/SOURCE	N/A	N/A
		CERTIFICATION INDICATING THE SOURCE OF STONE SURFACING IS AN "APPROVED SOURCE" (APL) PER TDOT SECTION 709.	F10	1/SUPPLIER/SOURCE	N/A	N/A
GROUTED RIPRAP	31 38 00	GRADATION CURVE FOR THE MATERIAL AND CERTIFICATION THAT THE MATERIAL MEETS THE SPECIFICATIONS IN THE TECHNICAL SPECIFICATIONS.	F10	1/SUPPLIER/SOURCE	N/A	N/A
		GROUT MIX DESIGN	F10	15 DAYS PRIOR TO BEGINNING WORK	08/19/11	08/23/11
GEOTEXTILE	31 40 00	SUPPLIER CERTIFICATION AND ALL OTHER AVAILABLE DOCUMENTATION TO DEMONSTRATE THAT SUPPLIED MATERIAL MEETS SPECIFICATIONS	F10	1/SUPPLIER	09/28/11	10/05/11
EROSION CONTROL BLANKET	31 60 00	MANUFACTURER'S WRITTEN CERTIFICATION STATING THAT THE FURNISHED RECP MEETS OR EXCEEDS ALL SPECIFICATIONS	F10	1/SUPPLIER	09/28/11	10/05/11
RISER LATERAL SUPPORT MATERIAL	31 70 00	GRADATION CURVES OR REPRESENTATIVE SAMPLE FOR ENGINEER APPROVAL	EA	1/SUPPLIER/SOURCE	N/A	N/A
EXTERIOR IMPROVEMENTS						
TURF AND GRASSES	32 92 00	CERTIFICATION OF GRASS SEED	F10	1/SUPPLIER	N/A	N/A
		MATERIAL TEST REPORTS FOR STANDARDIZED ASTM D 5268 TOPSOIL	F10	1/SUPPLIER	N/A	N/A
		MAINTENANCE INSTRUCTIONS	F10		N/A	N/A
UTILITIES						
CLOSED CIRCUIT TELEVISION (CCTV)	33 01 30 p18	MPEG FILES OF TV INSPECTION DEMONSTRATING CLEANED PIPE	F10	1/PIPE	01/11/12	N/A
		PROOF OF TRUCK, CAMERA AND SOFTWARE CERTIFICATION IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS	F10		02/01/12	N/A
SIPHON SPILLWAYS	33 10 00	SUPPLIER SPECIFICATIONS FOR THE VALVES AND FLOAT BALLS	F10	1/SUPPLIER	06/17/11	N/A
		RESULTS OF PASSING PRESSURE TEST FOR EACH PIPE RUN	F10	1/PIPE RUN	09/21/11	09/21/11
		DETAILED WORK PLAN AS DESCRIBED IN TECHNICAL SPECIFICATIONS	EA	15 DAYS PRIOR TO BEGINNING WORK	N/A	N/A
EXISTING SPILLWAY RETROFITS	33 20 00	SUPPLIER CERTIFICATION VERIFYING PIPE PLUG MEETS SPECIFICATIONS AND MANUFACTURER'S INSTALLATION INSTRUCTIONS.	F10	1/SUPPLIER	N/A	N/A
		PRI- AND POST-RETROFIT SURVEY ELEVATIONS	F10	1/SPILLWAY RISER	01/25/11	N/A
		DETAILED WORK PLAN AS DESCRIBED IN TECHNICAL SPECIFICATIONS	EA	15 DAYS PRIOR TO BEGINNING WORK	N/A	N/A
CIPP LINING	33 30 00	SUPPLIER CERTIFICATION THAT MATERIAL MEETS OR EXCEEDS SPECIFICATIONS	F10	1/SUPPLIER	01/18/11	N/A
HDPE PIPE	33 40 00	MANUFACTURER CERTIFICATION THAT THE PIPE AND EACH FITTING COMPLIES WITH THE TECHNICAL SPECIFICATIONS	F10	1/SUPPLIER	06/17/11	N/A
FLOATING WALKWAYS	SHEET 02	SHOP DRAWING SUBMITTAL FOR ENGINEER APPROVAL	EA	PRIOR TO BEGINNING WORK	N/A	N/A
VALVE ACCESS WALKWAY	SHEET 02	SHOP DRAWING SUBMITTAL FOR ENGINEER APPROVAL	EA	PRIOR TO BEGINNING WORK	03/14/12	03/15/12

(1) F10 = FOR INFORMATION ONLY; EA = ENGINEER APPROVAL

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE: FPGCUFFESC000000020100008		R 1 05/04/12 PRV TMM MAH SHB SEB MST JCK - - - ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7) R 01 03/11/11 LWP TMM MAH SHB SEB MST JCK - - - - ISSUED FOR CONSTRUCTION											
REV. NO.	DATE	DSN	DRN	CRD	SUPV	RWD	APPD	ISSD	PROJECT ID	AS CONST	REV	DATE	
SCALE: NONE EXCEPT AS NOTED													
YARD ASH STILLING POND													
SPILLWAY IMPROVEMENT PROJECT GENERAL NOTES WORK PLAN 7 (CUF-110311-WP-7)													
DESIGNED BY:	DRN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:							
L.J. PERKINS	T.M. MYERS	M.A. HOY	S.H. BICKEL	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER							
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING													
AUTOCAD R 2000	DATE 03/11/11	46	C	10W286-02				R 1					



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TABLE OF BASELINE COORDINATES			
STATION	BASELINE	NORTHING	EASTING
10+00	BASELINE A	733,085.35	1,511,215.25
14+45	BASELINE A	733,010.29	1,511,653.88
20+00	BASELINE B	732,975.84	1,511,215.83
24+10	BASELINE B	733,012.73	1,511,624.73
30+00	BASELINE C	733,418.39	1,510,409.11
33+05	BASELINE C	733,461.91	1,510,173.83

BASELINE "C" CURVE DATA

①
 P.I. STA. = 31+43.71
 NORTHING = 733,543.51
 EASTING = 1,510,322.80
 $\Delta = 84^{\circ}05'08''$
 $D = 114^{\circ}35'30''$
 $T = 45.09'$
 $L = 73.38'$
 $R = 50.00'$
 $E = 17.33'$
 P.C. STA. = 31+07.02
 P.T. STA. = 31+80.40

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

MAPPING NOTE:

THESE DRAWINGS WERE COMPILED USING SURVEY INFORMATION PROVIDED BY TVA. TOPOGRAPHIC SURVEY POINT FILE PCF572.XYZ DATED 11/30/2009 (OUTLINED AREA ON PLANVIEW), HYDROGRAPHIC SURVEY POINT FILE PCF572.SND DATED 09/29/2009 (ASH STILLING POND CONTOURS), AND HYDROGRAPHIC SURVEY POINT FILE JSR631.SND DATED 09/22/2008 (ASH POND CONTOURS) WERE UTILIZED. TOPOGRAPHIC DATA FROM AN AERIAL SURVEY FLOWN IN APRIL OF 2009 WAS USED IN AREAS SHOWN OUTSIDE OF THE ABOVE REFERENCED SURVEY EXTENTS. HORIZONTAL COORDINATES ARE REFERENCED TO TENNESSEE STATE PLANE COORDINATE SYSTEM, NAD 27. ELEVATIONS ARE BASED ON NGVD 29.

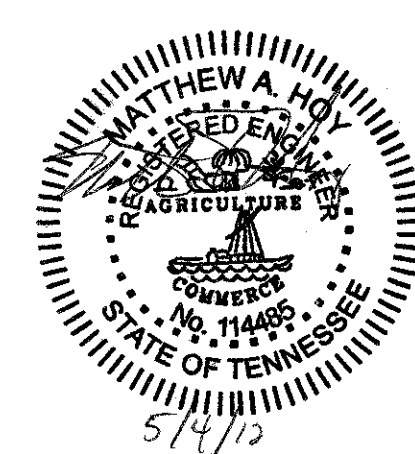
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LEGEND

- 390 ——— EXISTING CONTOURS
- 350 - - - EXISTING HYDROGRAPHIC CONTOURS
- BASELINE
- - - - - EXISTING WATER SURFACE
- APPROXIMATE SURVEY EXTENTS

FOR SUPPORTING DESIGN CALCULATIONS
 SEE FPGCUFFESC0X00000020100008



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R 1	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK	-	-	-
R 01	03/11/11	LJP	TMM	MAH	SHB	SEB	MST	JCK	-	-	-
ISSUED FOR CONSTRUCTION											
REV	NO.	DATE	DSGN	DRWN	CHWD	SUPV	RYND	APPR	ISSD	PROJECT	AS CONST
SCALE: 1" = 50'											
EXCEPT AS NOTED											

YARD
 ASH STILLING POND
**SPILLWAY IMPROVEMENT PROJECT
 EXISTING CONDITIONS & BASELINES
 WORK PLAN 7 (CUF-110311-WP-7)**

DESIGNED BY: L.J. PERKINS	DRAWN BY: T.M. MYERS	CHECKED BY: M.A. HOY	SUPERVISED BY: S.H. BICKEL	REVIEWED BY: S.E. BENNETT	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING						
AUTOCAD R 2000	DATE 03/11/11	46	C	10W286-03	R 1	

PLOT FACTOR:50
 W_TVA

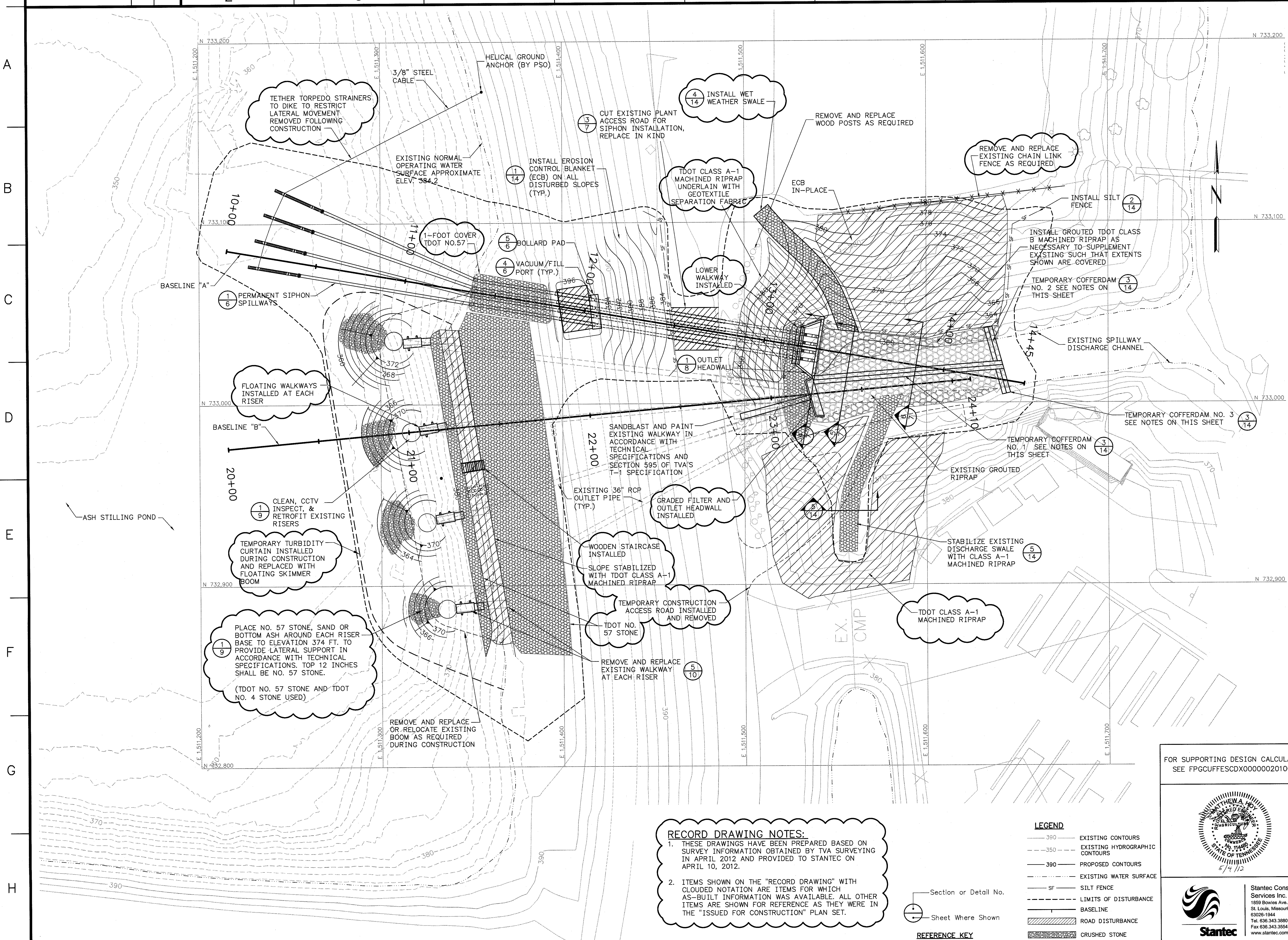
C.A.D. DRAWING
 DO NOT ALTER MANUALLY

PLOT DATE: 05/04/2012 USER: WORKS, TONY
 U:\174000\ENVIRONMENTAL\DRAWINGS\REV1_RECORD\DWG05-03-R1.DWG

STANTEC	1
TASK COMPLETED BY:	REV NO.



PLOT DATE: 05/04/2012 USER: MYERS, TONY
U:\175609014\ENVIRONMENTAL\DRAWING\REV1_RECORD\10W286-04-R1.DWG



- PHASING AND SEQUENCING:**
1. INSTALL SEDIMENT CONTROLS PRIOR TO EARTH-MOVING ACTIVITIES. SILT FENCE AND OTHER CONTROLS SHALL BE INSTALLED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS.
 2. INSTALL CONSTRUCTION ACCESS ROAD TO DISCHARGE CHANNEL. GRADE AREA NORTH OF CHANNEL TO APPROPRIATE FINISH ELEVATIONS, INSTALL CRUSHED STONE FOR ACCESS ROAD, AND STABILIZE DISTURBED AREAS WITH EROSION CONTROL BLANKET OR SOD.
 3. INSTALL TEMPORARY COFFERDAM NO. 1 BETWEEN THE EXISTING SPILLWAY OUTLETS AND THE PROPOSED SIPHON OUTLET HEADWALL AND TEMPORARY COFFERDAM NO. 2 PERPENDICULAR TO THE SPILLWAY DISCHARGE CHANNEL TO ALLOW FOR DEWATERING AND GROUTED RIPRAP INSTALLATION. DEWATER AND GRADE TO APPROPRIATE ELEVATIONS. CONTRACTOR SHALL PREPARE AND SUBMIT DEWATERING PLAN TO ENGINEER FOR REVIEW.
 4. INSTALL GROUTED RIPRAP ON NORTH BANK OF DISCHARGE CHANNEL TO SUPPLEMENT EXISTING RIPRAP AS NECESSARY TO CONVEY FLOW FROM SIPHONS. CONSTRUCT SIPHON OUTLET HEADWALL IN ACCORDANCE WITH THE PLANS AND TECHNICAL SPECIFICATIONS.
 5. INSTALL SIPHON SPILLWAYS. PLANT SHALL BE GIVEN 48 HOUR NOTICE PRIOR TO DISTURBANCE OF ACCESS ROAD. SILT FENCE SHALL BE USED TO CONTROL SEDIMENT DISPLACED DURING EARTHMOVING ACTIVITIES. FOLLOWING INSTALLATION, GRADE TO APPROPRIATE FINISH ELEVATIONS AND STABILIZE DISTURBED AREAS IMMEDIATELY. INSTALL STAFF GAGE IN STILLING POND.
 6. REMOVE TEMPORARY COFFERDAM NO. 2 AND ACTIVATE SIPHONS TO DRAW DOWN POOL LEVEL TO APPROXIMATE ELEVATION 383 FT (SUCH THAT EXISTING SPILLWAYS CARRY NO FLOW). CONTRACTOR SHALL STOCKPILE AND INSTALL CLASS A-1 RIPRAP IN ANY AREAS OF HEADCUTTING OBSERVED IN THE ASH POND COMPLEX DURING DRAWDOWN.
 7. INSTALL TEMPORARY COFFERDAM NO. 3 TO ISOLATE THE EXISTING OUTLETS AND CONTROL SEDIMENT FROM PIPE CLEANING. CLEAN AND INSPECT RISERS AND OUTLET PIPES IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
 8. INSTALL BOTTOM ASH OR NO. 57 STONE AROUND RISERS AS SHOWN ON PLANS AND IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
 9. REMOVE EXISTING STEEL SKIMMERS, ATTACHED WALKWAYS, AND TOP 6 FT FROM EACH SPILLWAY RISER IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS TO ALLOW FOR PERMANENT LOWERING OF THE POOL TO APPROXIMATE ELEVATION 378.2 FT. REFER TO SHEET 09 FOR ADDITIONAL SEQUENCING DETAILS. CONTRACTOR TO SUBMIT DETAILED WORKPLAN TO ENGINEER FOR APPROVAL PRIOR TO BEGINNING WORK.
 10. SLIP-LINE THE RISERS AND OUTLET PIPES USING CURED-IN-PLACE PIPE (CIPP) LINING IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS. INSTALL NEW SKIMMER STRUCTURES AND FLOATING ACCESS WALKWAYS AS SHOWN ON SHEETS 09 AND 10.
 11. REMOVE TEMPORARY COFFERDAMS NO. 1 AND NO. 3 FOLLOWING CURING OF LINER. STABILIZE REMAINING DISTURBED AREAS NEAR SIPHON INSTALLATION WITH EROSION CONTROL BLANKET OR SOD.
 12. ADJUST SIPHON VALVES TO RAISE THE POOL LEVEL AT NO MORE THAN 1 FT PER DAY UNTIL WATER FLOWS OVER THE NEW RISER CRESTS.

SURVEY CONTROL NOTE:
A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

RECORD DRAWING NOTES:

1. THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
2. ITEMS SHOWN ON THE "RECORD DRAWING" WITH CLOUDED NOTATION ARE ITEMS FOR WHICH AS-BUILT INFORMATION WAS AVAILABLE. ALL OTHER ITEMS ARE SHOWN FOR REFERENCE AS THEY WERE IN THE "ISSUED FOR CONSTRUCTION" PLAN SET.

LEGEND

---	EXISTING CONTOURS
---	EXISTING HYDROGRAPHIC CONTOURS
---	PROPOSED CONTOURS
---	EXISTING WATER SURFACE
---	SILT FENCE
---	LIMITS OF DISTURBANCE
---	BASELINE
---	ROAD DISTURBANCE
---	CRUSHED STONE

REFERENCE KEY

Section or Detail No.	
Sheet Where Shown	

FOR SUPPORTING DESIGN CALCULATIONS
SEE FPGCUFFESCDX00000020100008

RECORD DRAWING

YARD ASH STILLING POND

SPILLWAY IMPROVEMENT PROJECT
PLAN - SPILLWAY RETROFITS
WORK PLAN 7 (CUF-110311-WP-7)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L.J. PERKINS	T.M. MYERS	M.A. HOY	S.H. BICKEL	S.E. BENNETT	M.S. TURNBOW	J.C. KEMMEYER

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 DATE 03/11/11 46 C 10W286-05 R 1

STANTEC 1
TASK COMPLETED BY: REV NO.

PLOT FACTOR:20
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

A

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A

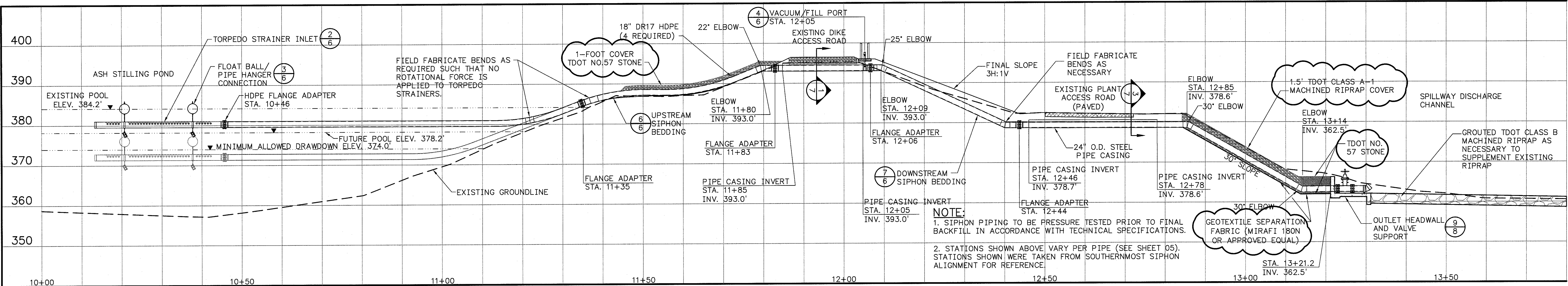
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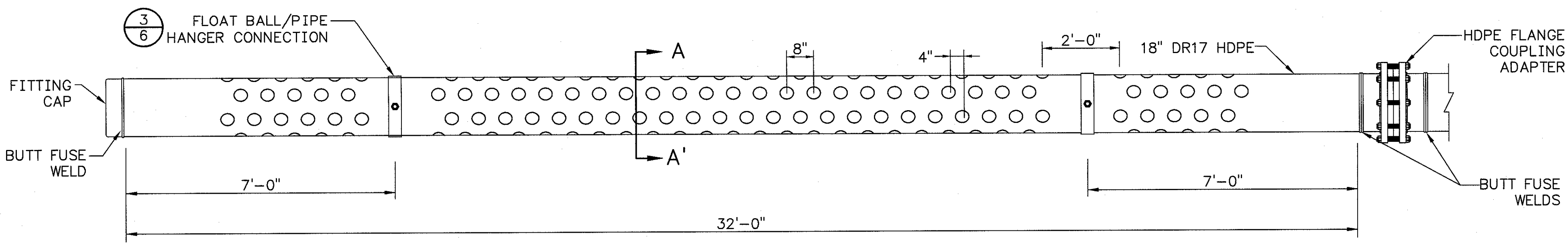
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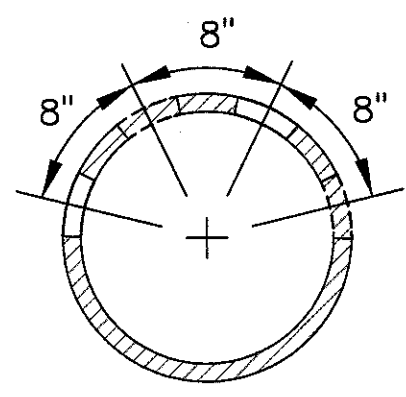


1 PROFILE - BASELINE A
SCALE: 1"=10'



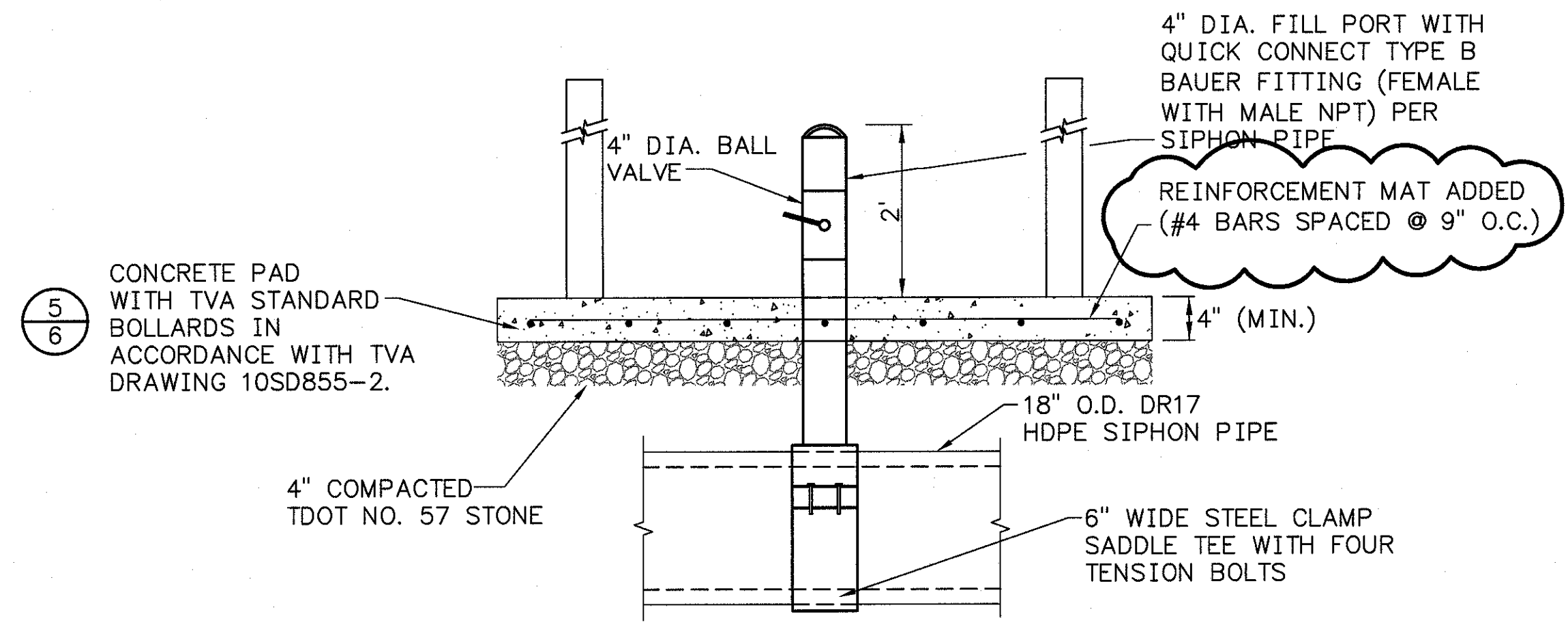
PLAN

2 DETAIL - TORPEDO STRAINER INLET
SCALE: 1/2"=1'-0"

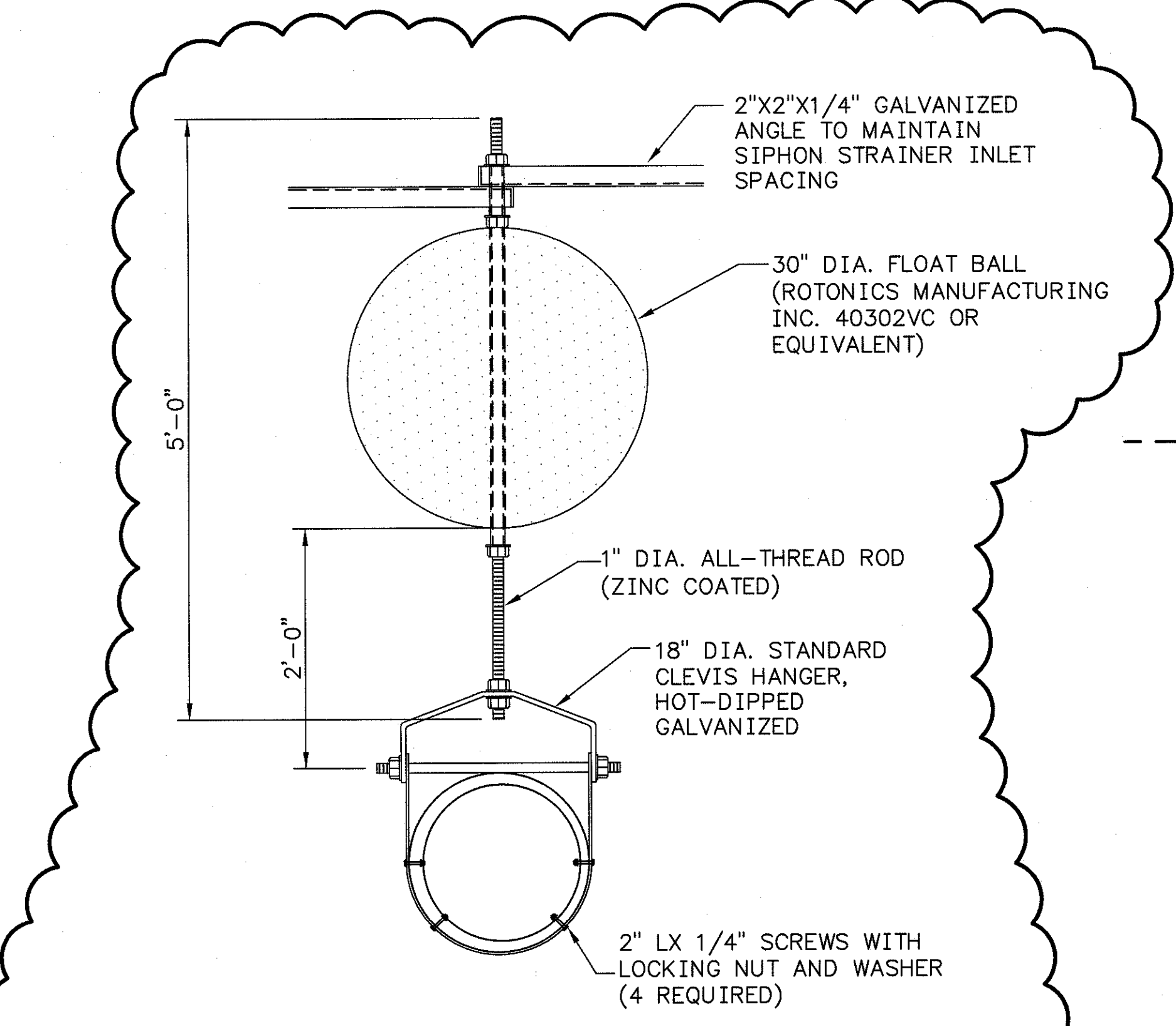


SECTION A-A'

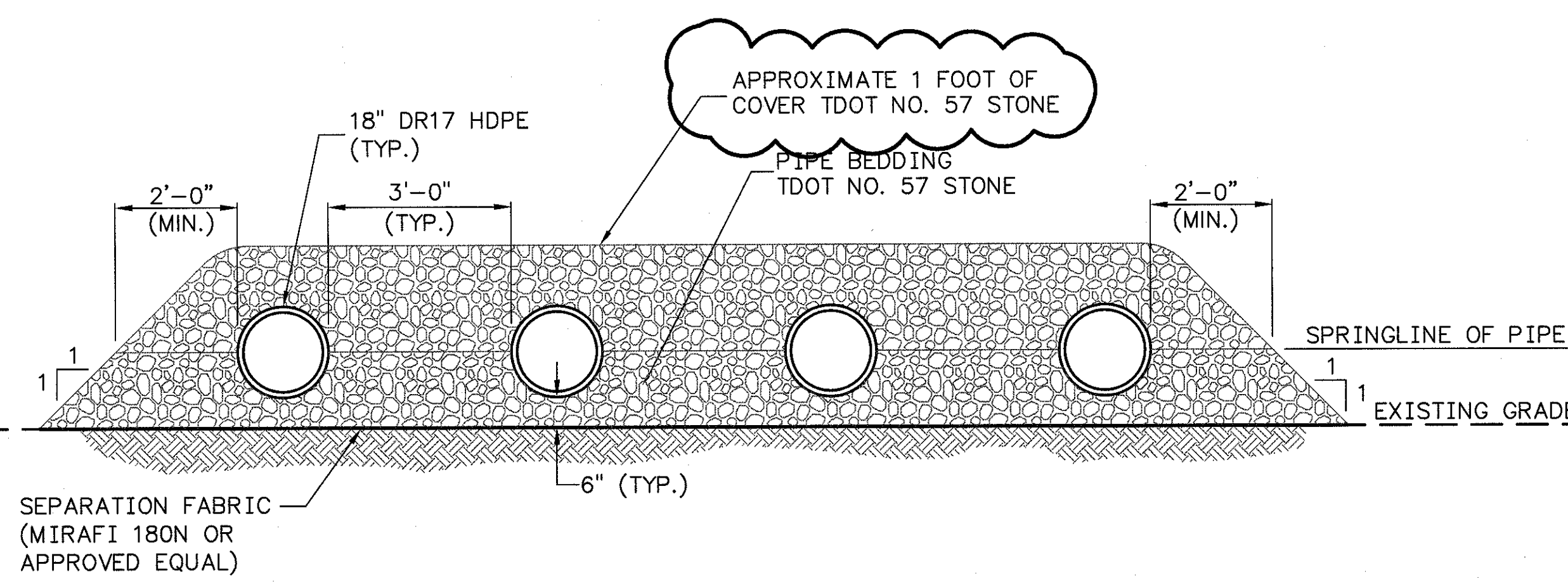
- NOTES:
- HOLES WILL BE ON TOP HALF OF PIPE ONLY.
 - 4" DIA. HOLES AT 8" CENTER TO CENTER.
 - 140 HOLES PER STRAINER (4 ROWS WITH 35 HOLES EACH).
 - ROWS ARE TO BE 8" APART CENTER TO CENTER, AND THE HOLES WILL BE OFFSET BY 4".
 - PROVIDE 2 FOOT LENGTH WITHOUT HOLES AT 7 FEET FROM EACH END FOR FLOAT BALL HANGERS.



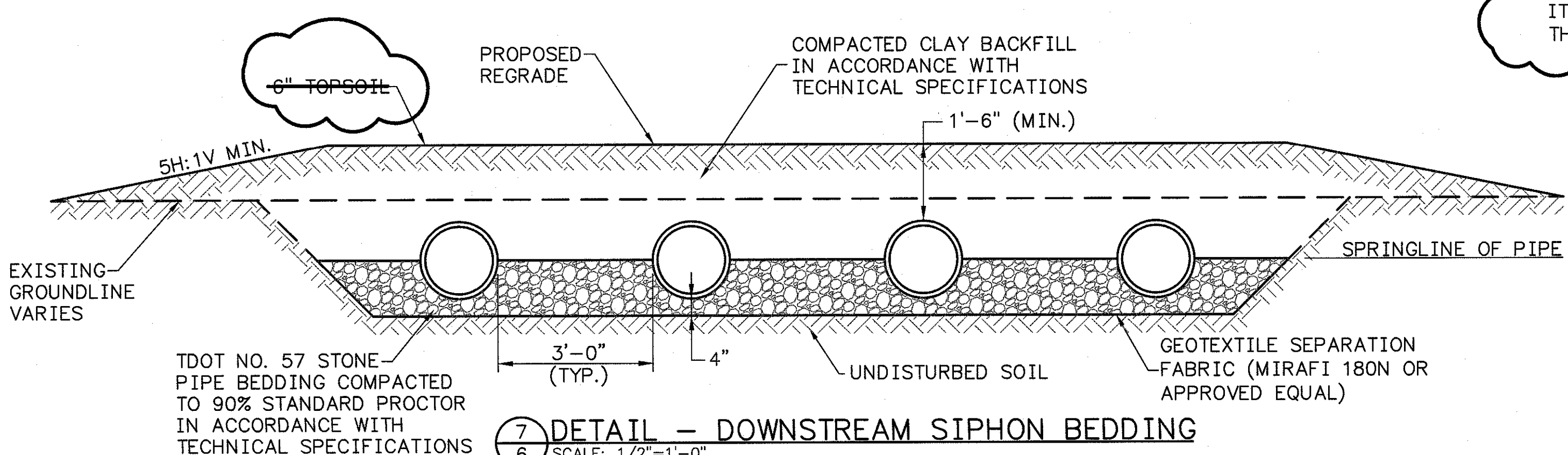
4 DETAIL - VACUUM/FILL PORT
NOT TO SCALE



3 DETAIL - FLOAT BALL/PIPE HANGER CONNECTION
SCALE: 1"=1'-0"



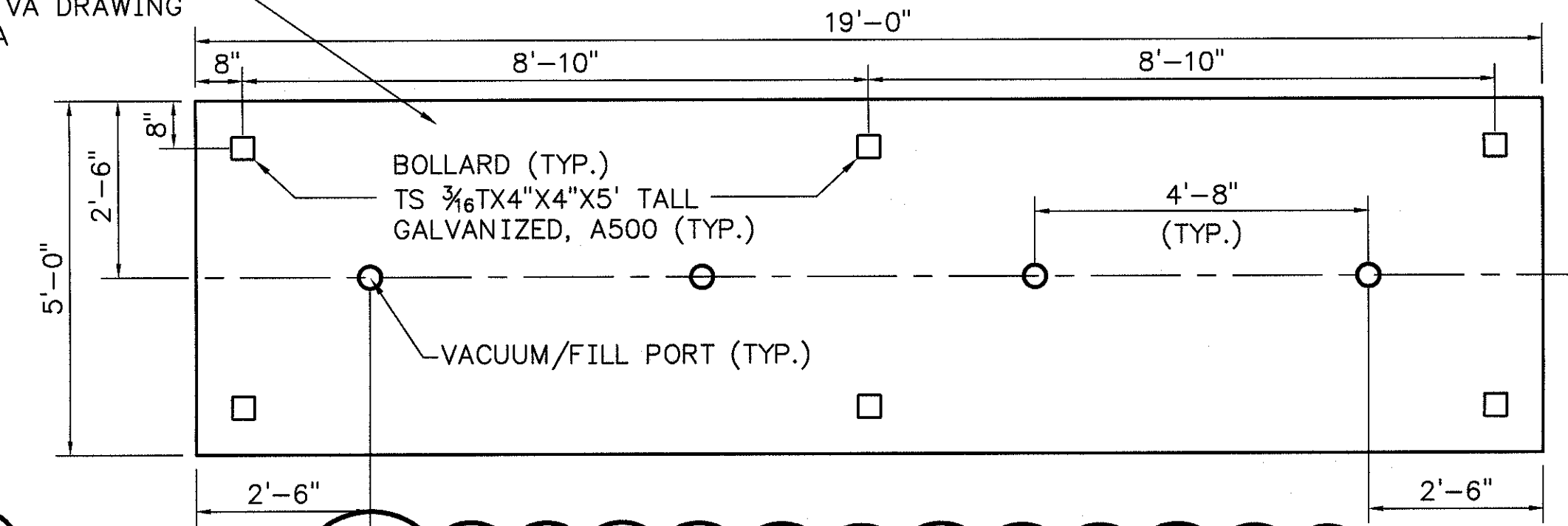
6 SECTION - UPSTREAM SIPHON BEDDING (APPROX. STA 11+50 TO 11+80)
SCALE: 1/2"=1'-0"



7 DETAIL - DOWNSTREAM SIPHON BEDDING
SCALE: 1/2"=1'-0"

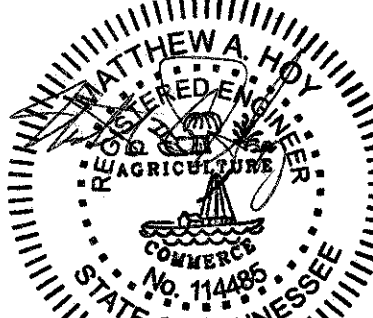
- RECORD DRAWING NOTES:
- THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
 - ITEMS SHOWN ON THE "RECORD DRAWING" WITH CLOUDED NOTATION ARE ITEMS FOR WHICH AS-BUILT INFORMATION WAS AVAILABLE. ALL OTHER ITEMS ARE SHOWN FOR REFERENCE AS THEY WERE IN THE "ISSUED FOR CONSTRUCTION" PLAN SET.

TVA BOLLARD PAD AND BOLLARDS IN ACCORDANCE WITH REINFORCEMENT AND MATERIALS IN TVA DRAWING 10SD855-2, DETAIL A



5 PLAN VIEW - VACUUM/FILL PORT CONCRETE PAD
SCALE: 1/2"=1'-0"
NOTE: REINFORCEMENT MAT NOT SHOWN FOR CLARITY

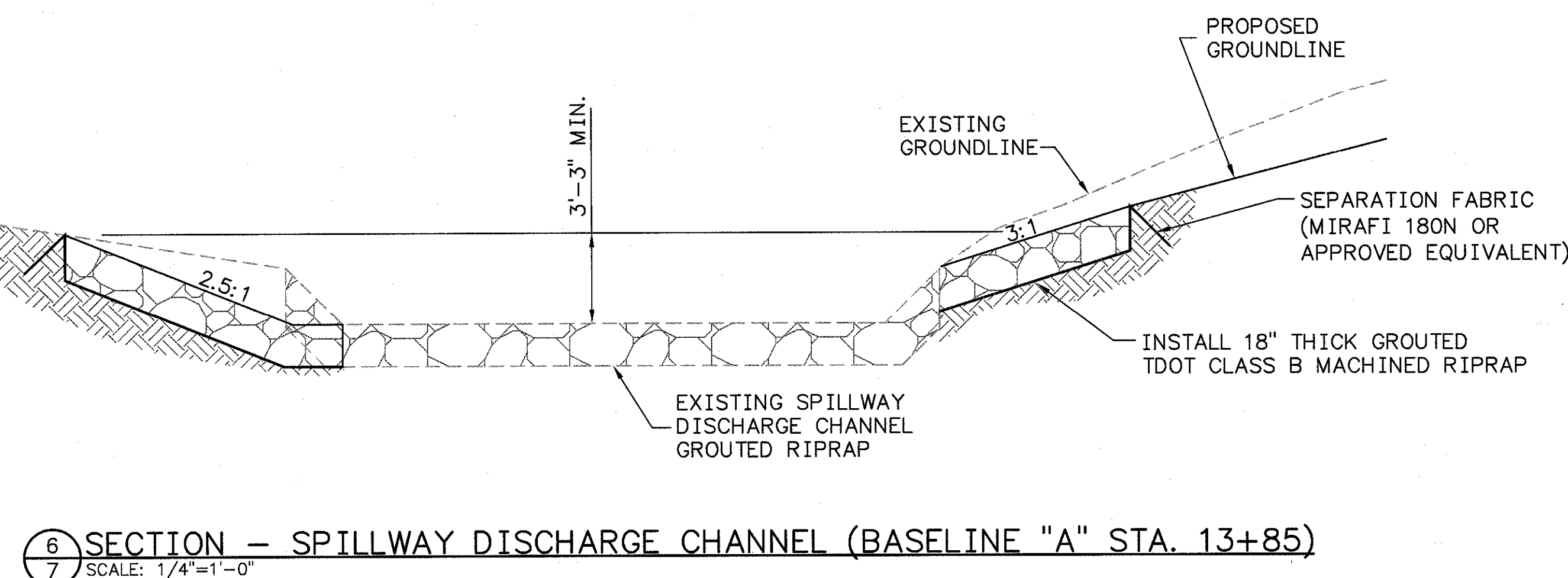
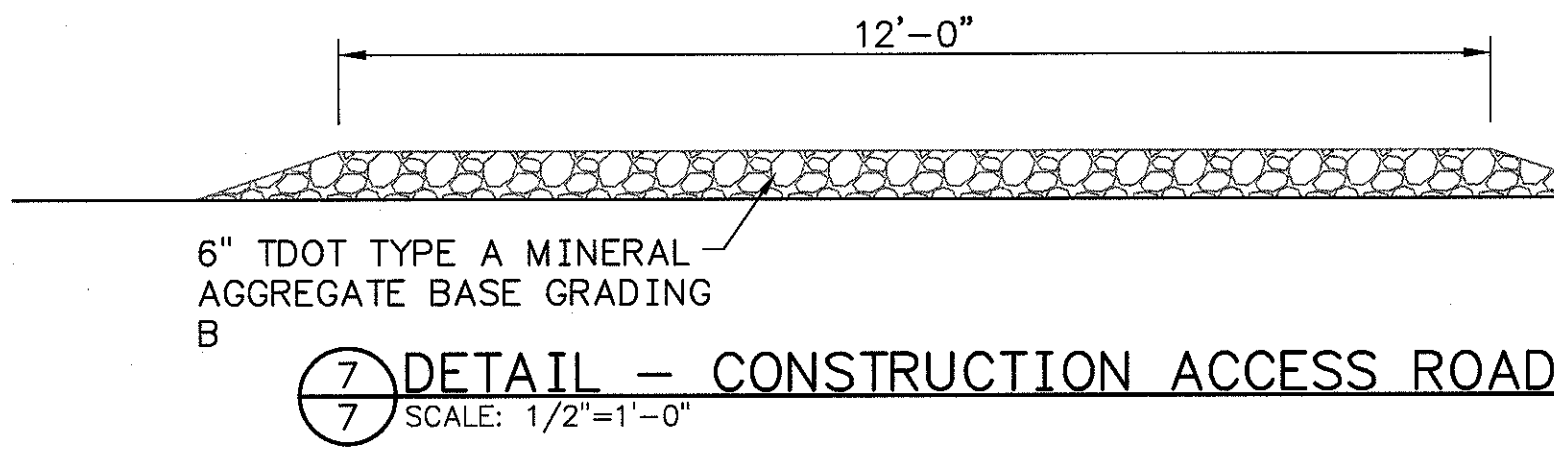
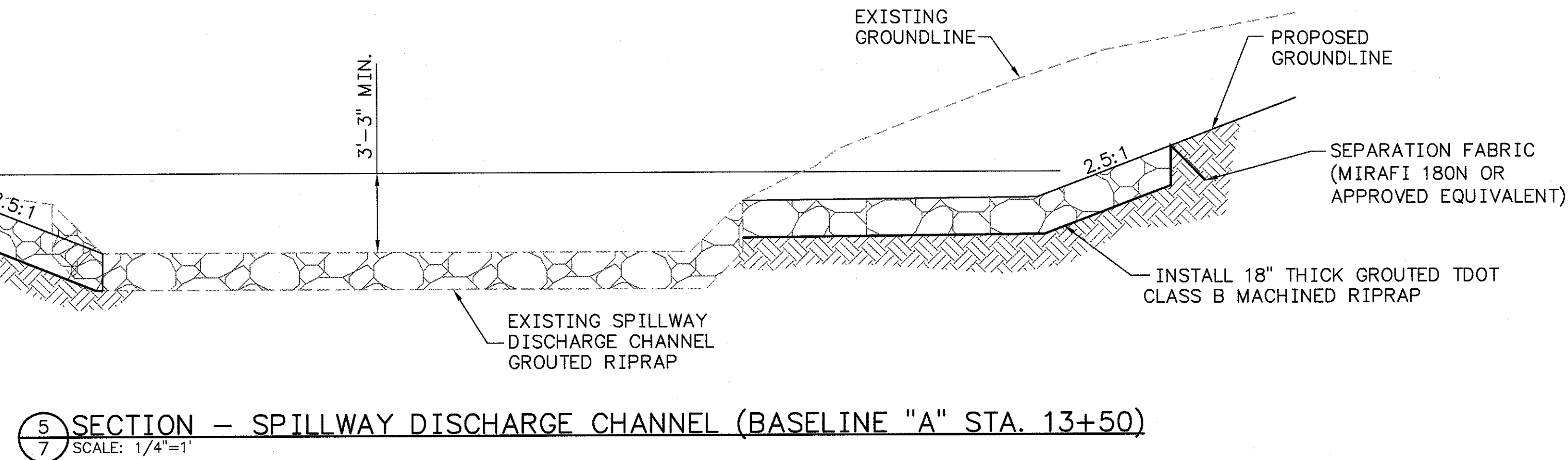
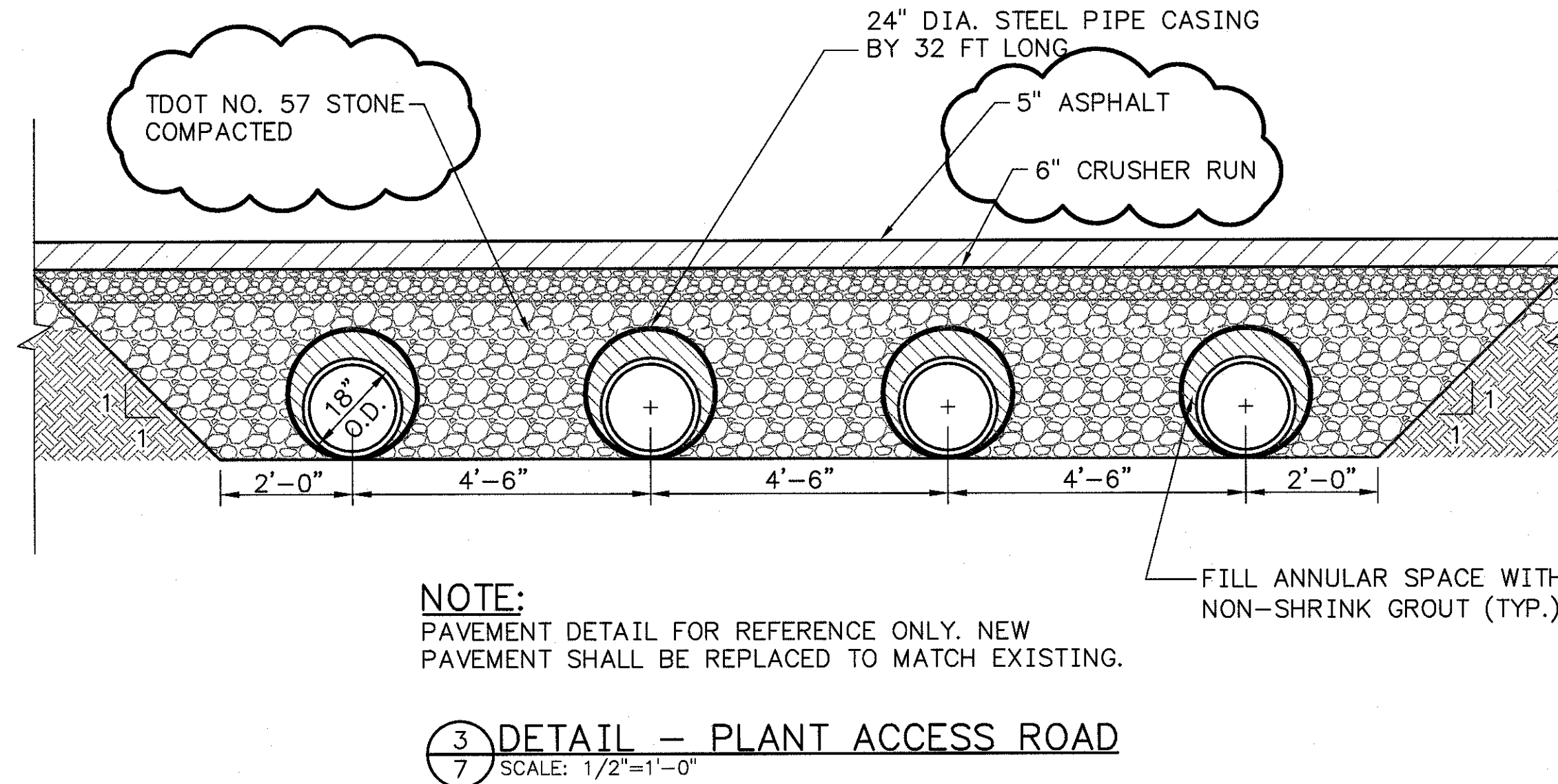
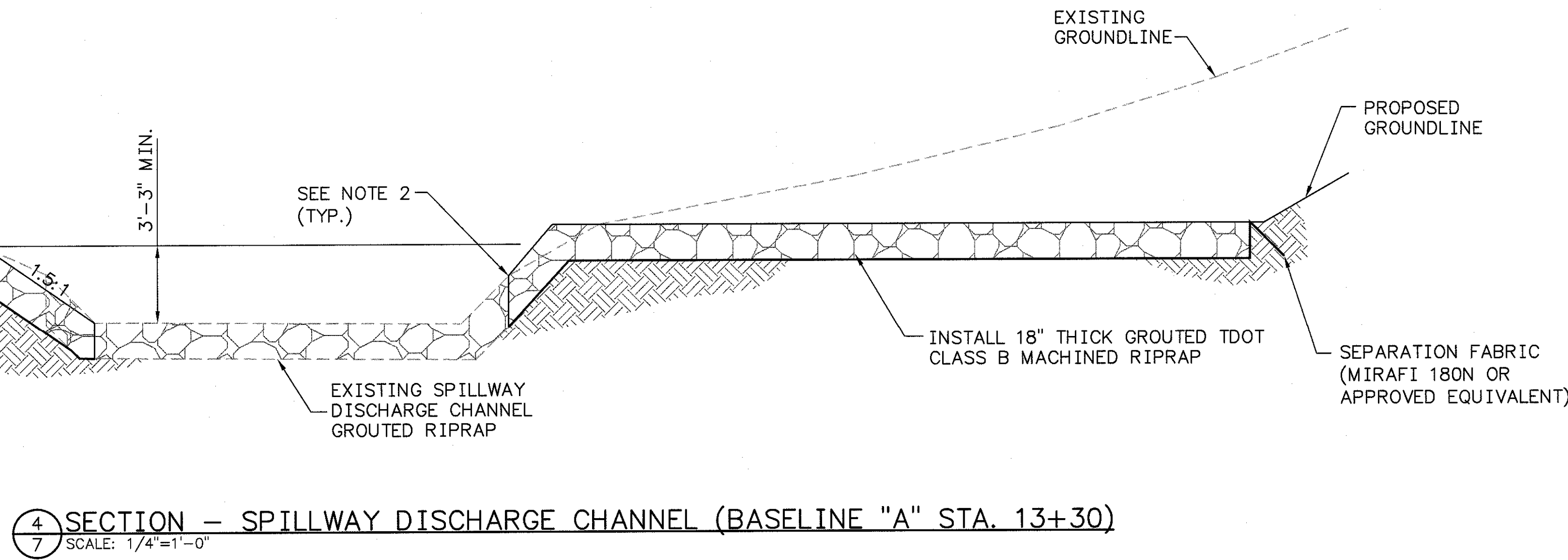
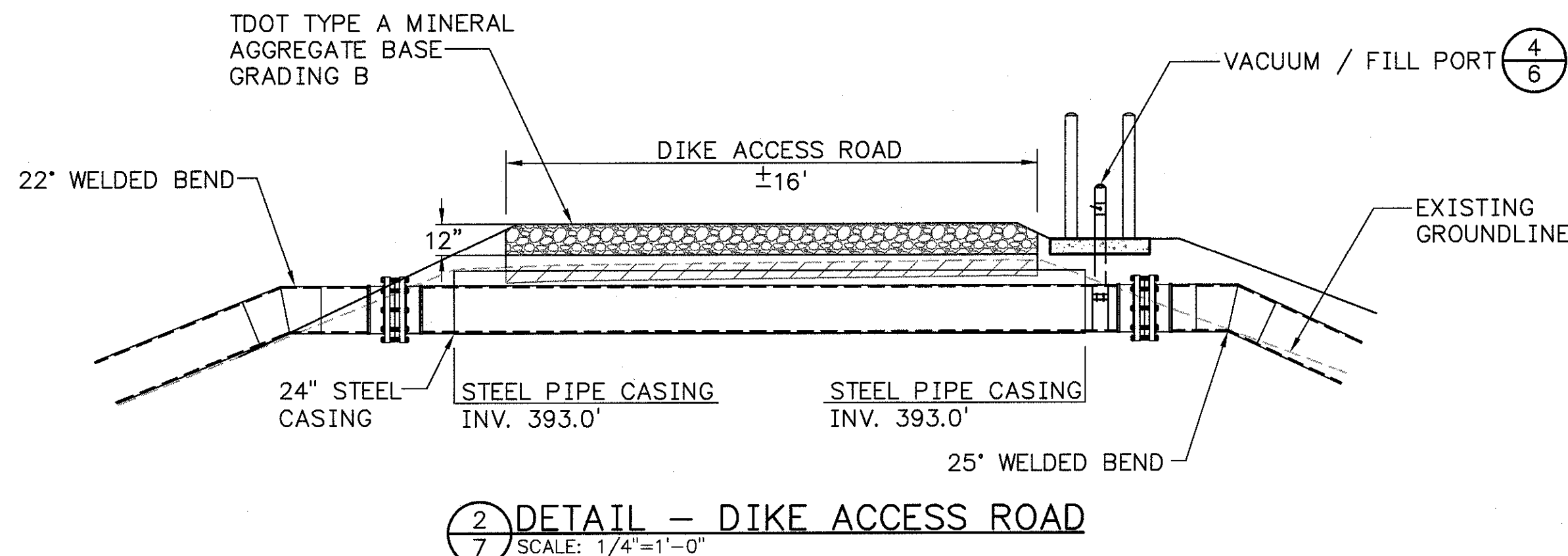
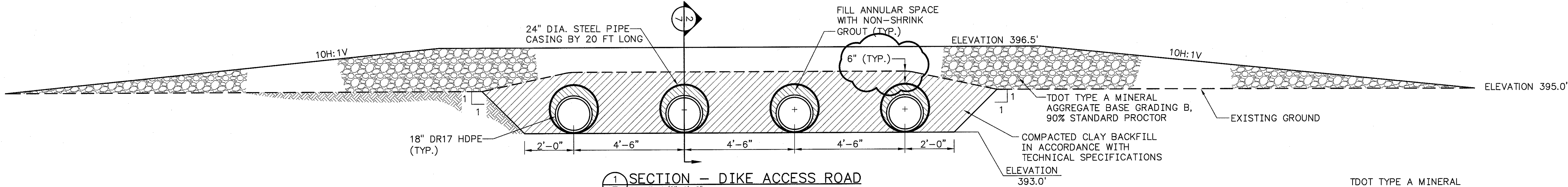
RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGCUFFESCDX00000020100008	<table><tr><td>REV.</td><td>NO.</td><td>DATE</td><td>DSN</td><td>DRWN</td><td>CHKD</td><td>SUPV</td><td>RVNG</td><td>APPD</td><td>ISSD</td><td>PROJECT ID</td><td>AS CONST</td><td>REV. CD</td><td>DISCIPLINE INTERFACE</td></tr><tr><td>R 1</td><td>05/04/12</td><td>PRV</td><td>TMM</td><td>MAH</td><td>SHB</td><td>SEB</td><td>MST</td><td>JCK</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>R 0</td><td>03/11/11</td><td>LJP</td><td>TMM</td><td>MAH</td><td>SHB</td><td>SEB</td><td>MST</td><td>JCK</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table>										REV.	NO.	DATE	DSN	DRWN	CHKD	SUPV	RVNG	APPD	ISSD	PROJECT ID	AS CONST	REV. CD	DISCIPLINE INTERFACE	R 1	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	-	-	R 0	03/11/11	LJP	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	-	-		
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NOTES:

- 3'-3" MIN. DEPTH REQUIRED TO CONVEY PEAK DISCHARGE DURING 6-HR PMP STORM EVENT
- AT INTERFACE BETWEEN NEW AND EXISTING RIPRAP, EXCAVATE AND REMOVE LOOSE RIPRAP. PRESSURE WASH TO REMOVE LOOSE SOIL, AND FILL VOIDS UNDER EDGE WITH GROUT.

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGCUFFESCDX00000020100008		<table><tr><td>R 1</td><td>05/04/12</td><td>PRV</td><td>TMM</td><td>MAH</td><td>SHB</td><td>SEB</td><td>MST</td><td>JCK</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td colspan="14">ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7)</td></tr><tr><td>R 01</td><td>03/11/11</td><td>LJP</td><td>TMM</td><td>MAH</td><td>SHB</td><td>SEB</td><td>MST</td><td>JCK</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td colspan="14">ISSUED FOR CONSTRUCTION</td></tr><tr><td>REV.</td><td>NO.</td><td>DATE</td><td>DSGN</td><td>CHKD</td><td>DRWN</td><td>CHGD</td><td>SUPV</td><td>RWED</td><td>APPR</td><td>ISSD</td><td>PROJECT</td><td>AS CONST</td><td>REV</td></tr><tr><td colspan="12">SCALE: AS SHOWN</td><td colspan="2">EXCEPT AS NOTED</td></tr></table>												R 1	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	-	-	ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7)														R 01	03/11/11	LJP	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	-	-	ISSUED FOR CONSTRUCTION														REV.	NO.	DATE	DSGN	CHKD	DRWN	CHGD	SUPV	RWED	APPR	ISSD	PROJECT	AS CONST	REV	SCALE: AS SHOWN												EXCEPT AS NOTED	
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 Stantec Consulting Services Inc. 1859 Bowles Ave., Ste 250 St. Louis, Missouri 63026-1944 Tel. 636.343.3880 Fax 636.343.3554 www.stantec.com		<table><tr><td>DESIGNED BY:</td><td>DRWN BY:</td><td>CHECKED BY:</td><td>SUPERVISED BY:</td><td>REVIEWED BY:</td><td>APPROVED BY:</td><td>ISSUED BY:</td></tr><tr><td>L.J. PERKINS</td><td>T.M. MYERS</td><td>M.A. HOY</td><td>S.H. BICKEL</td><td>S.E. BENNETT</td><td>M.S. TURNBOW</td><td>J.C. KAMMEYER</td></tr></table> CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING												DESIGNED BY:	DRWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:	L.J. PERKINS	T.M. MYERS	M.A. HOY	S.H. BICKEL	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER																																																																						
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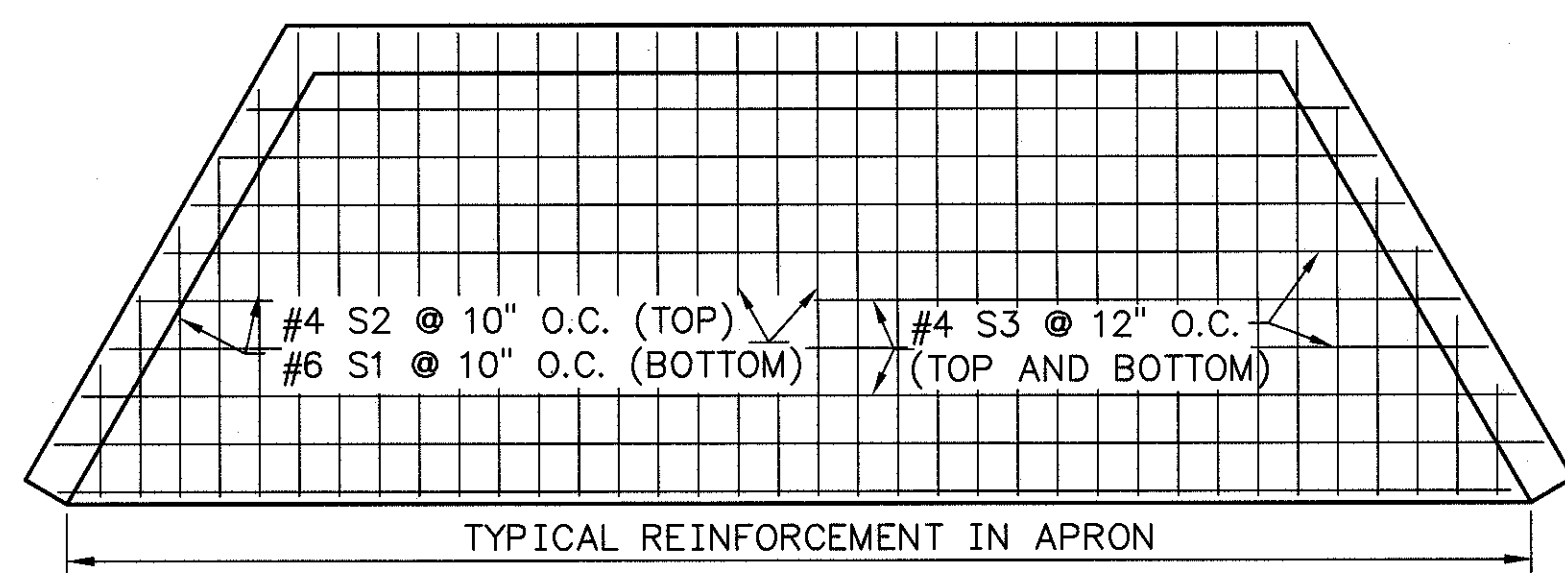
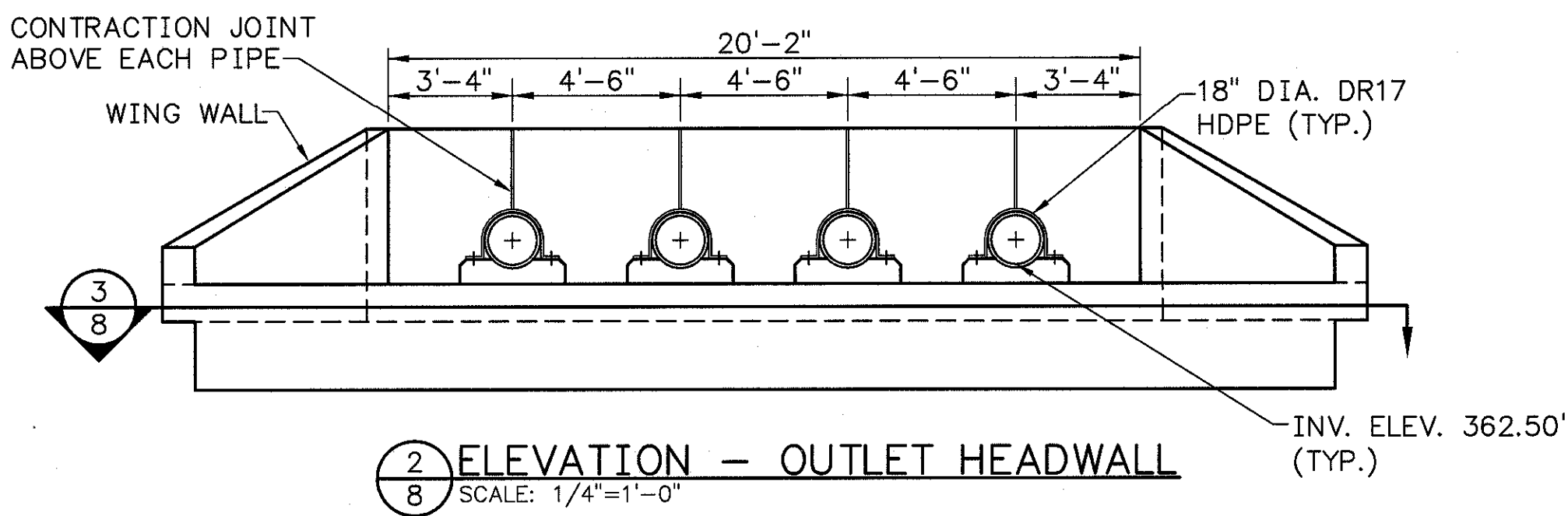
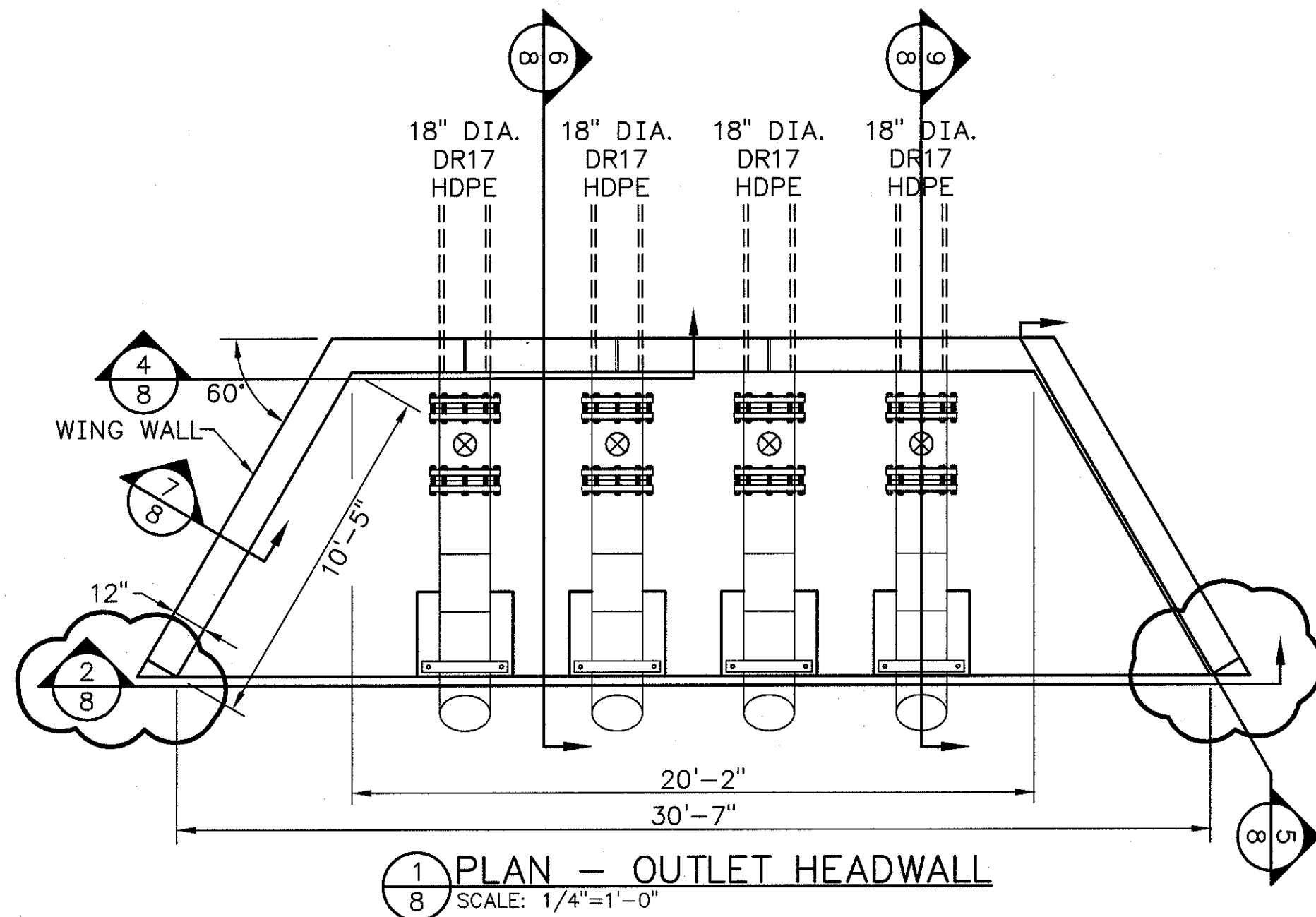
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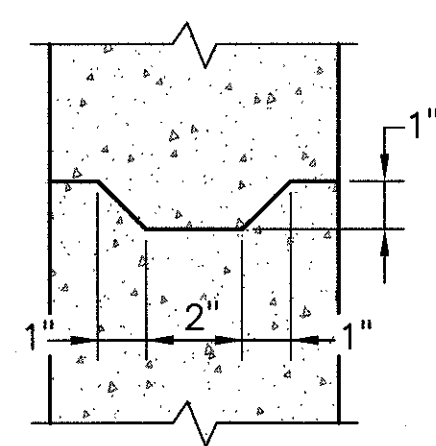
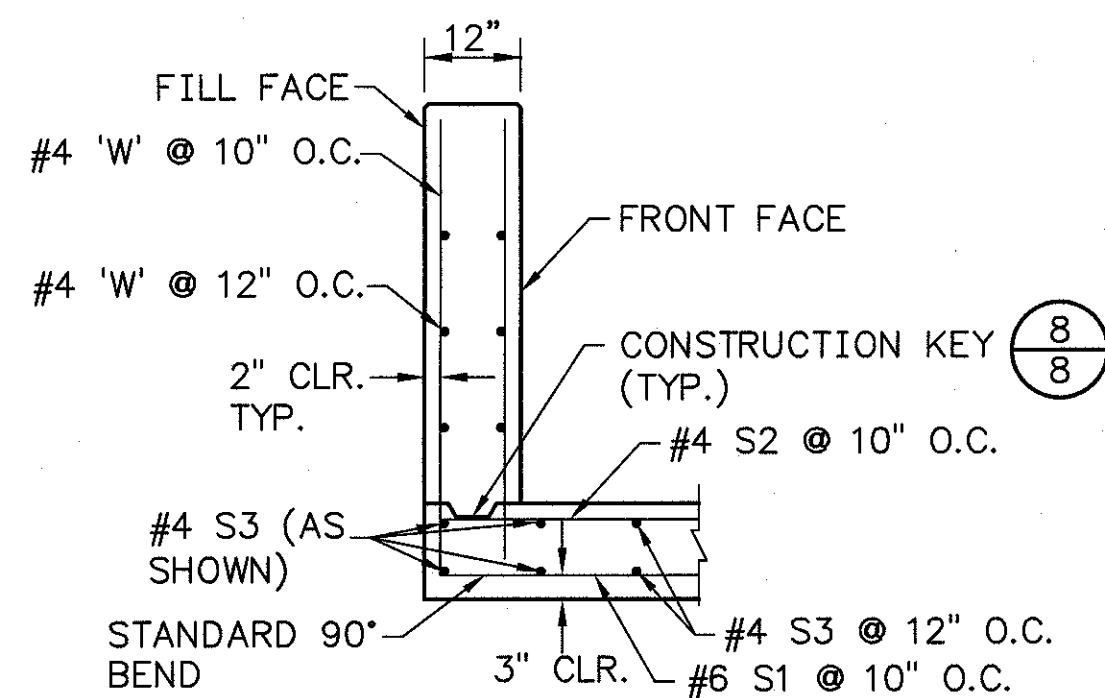
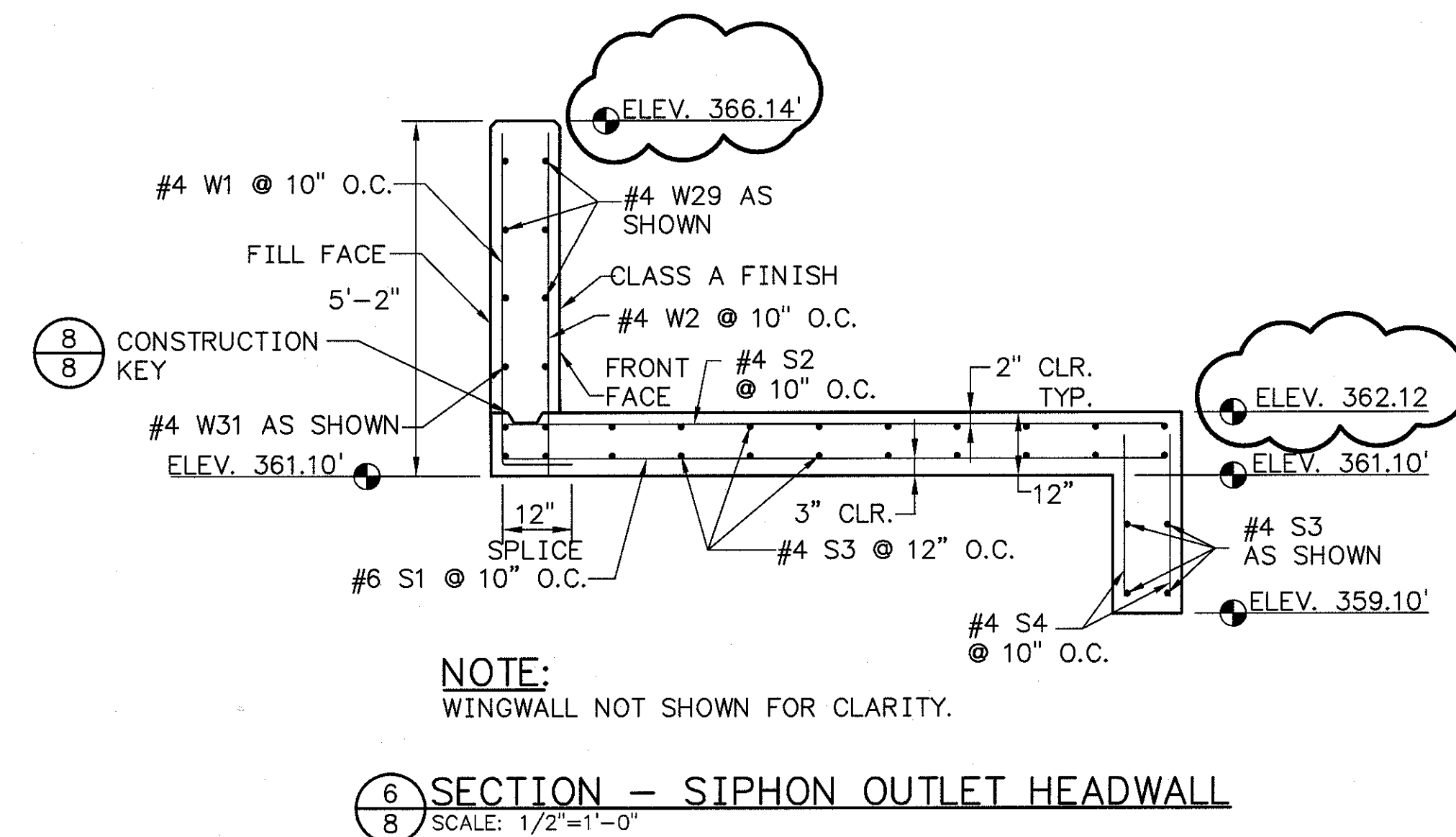
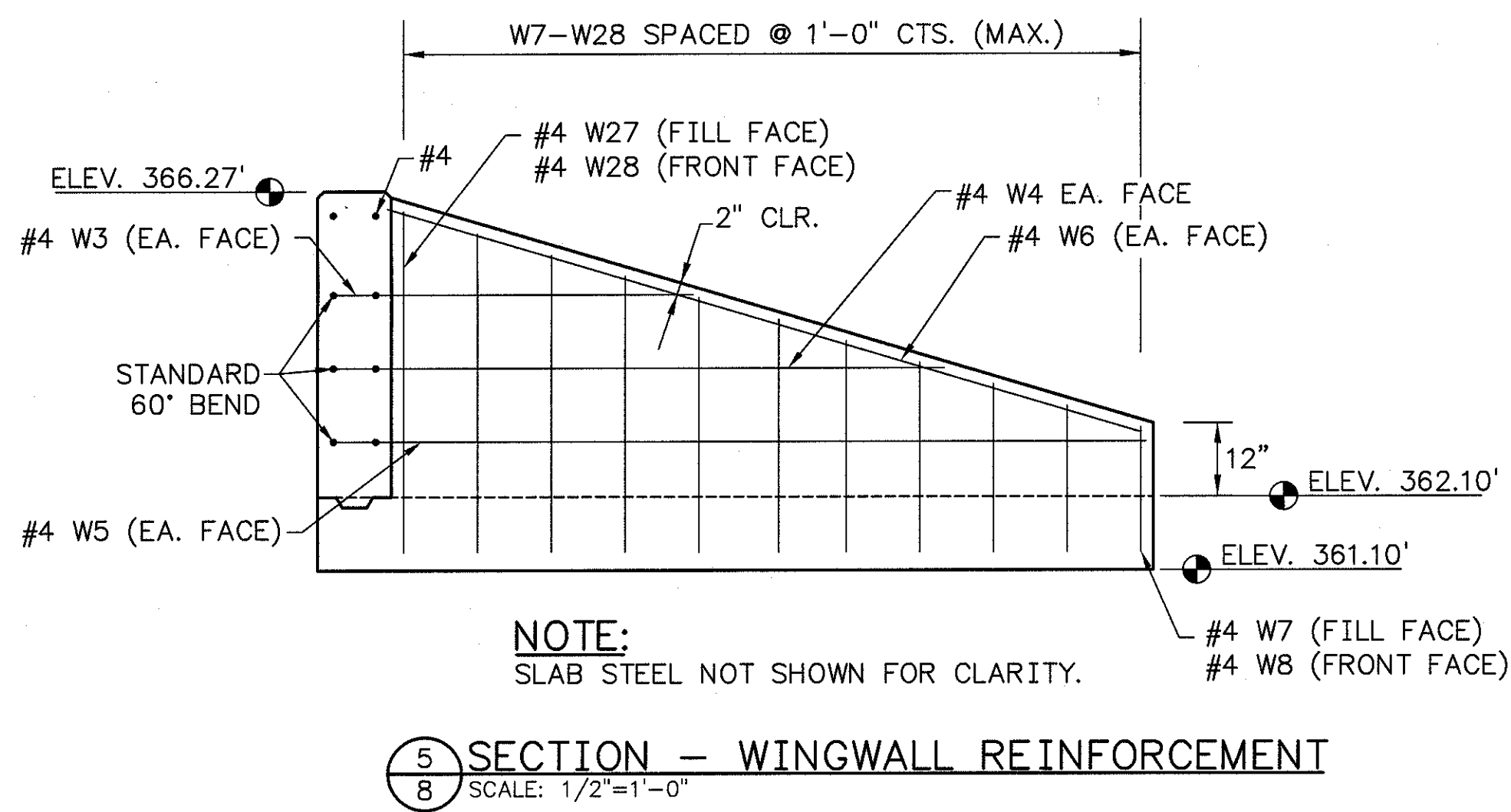
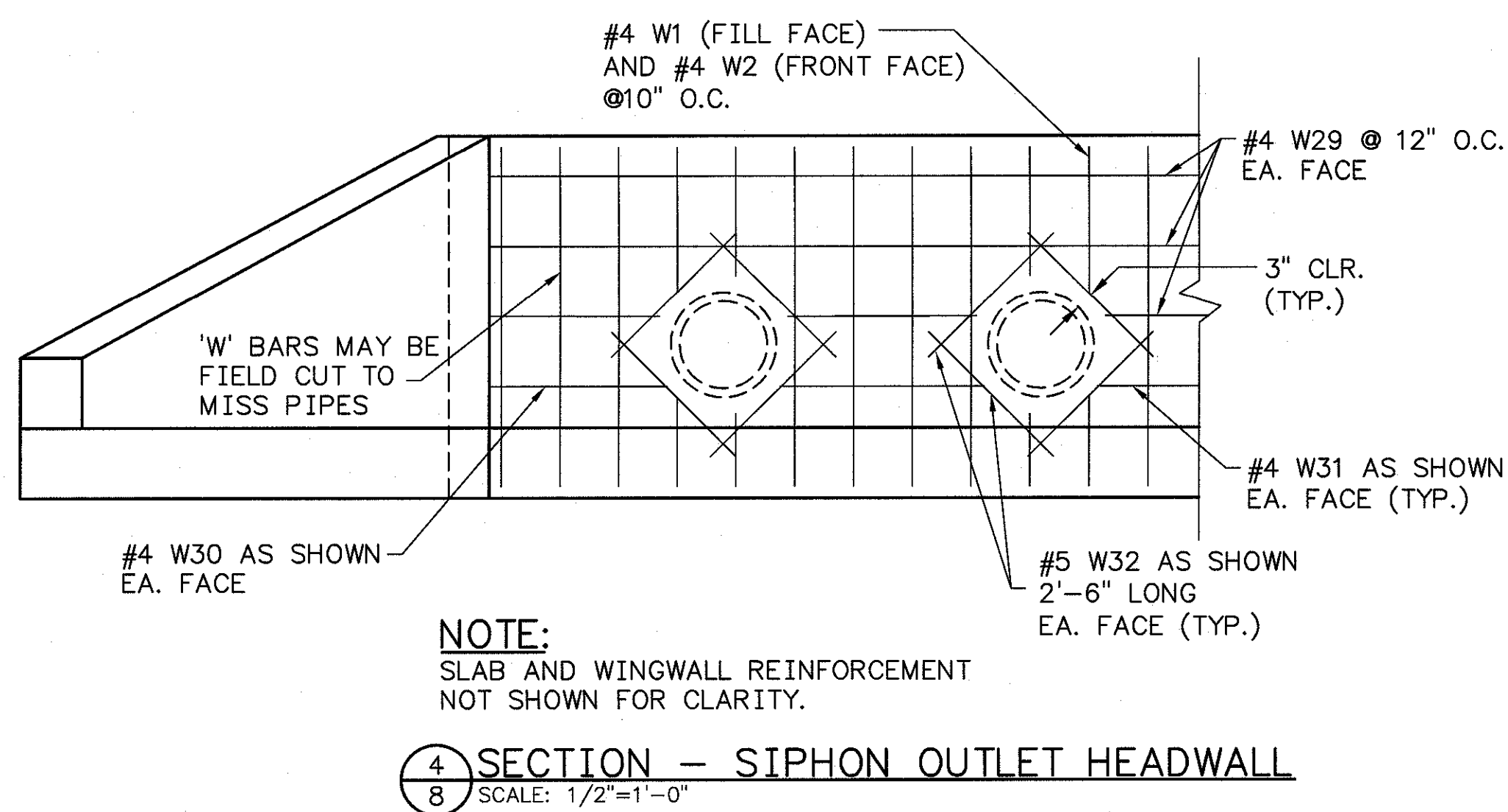
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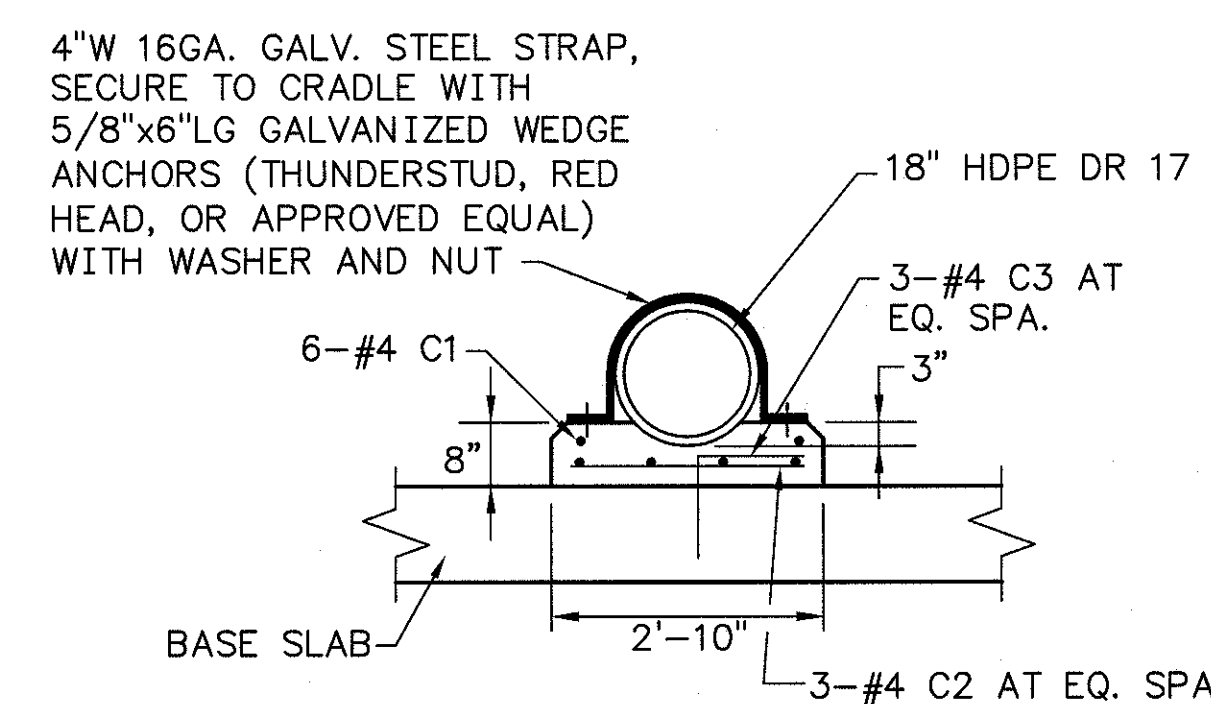
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PLOT DATE: 05/04/12 USER: MERS, TONY
U:\PROJECTS\SPILLWAY REPLACEMENT\DRAWING\10W286-08-01.DWG

- NOTES:
- WALL REINFORCEMENT NOT SHOWN FOR CLARITY.
 - SLAB REINFORCEMENT MAY BE CUT TO FIT.

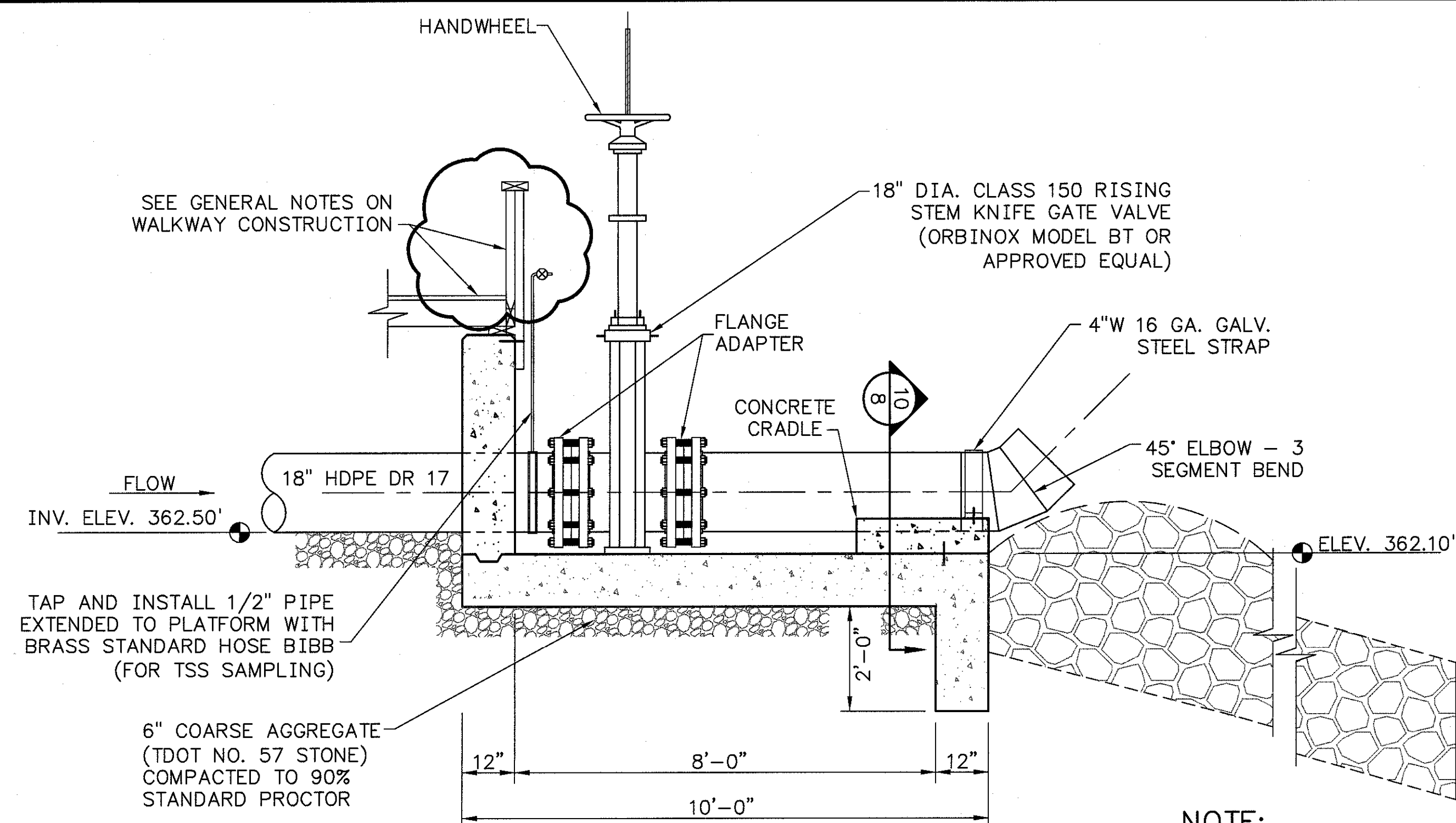


8 DETAIL - CONSTRUCTION KEY
SCALE: 3"=1'-0"

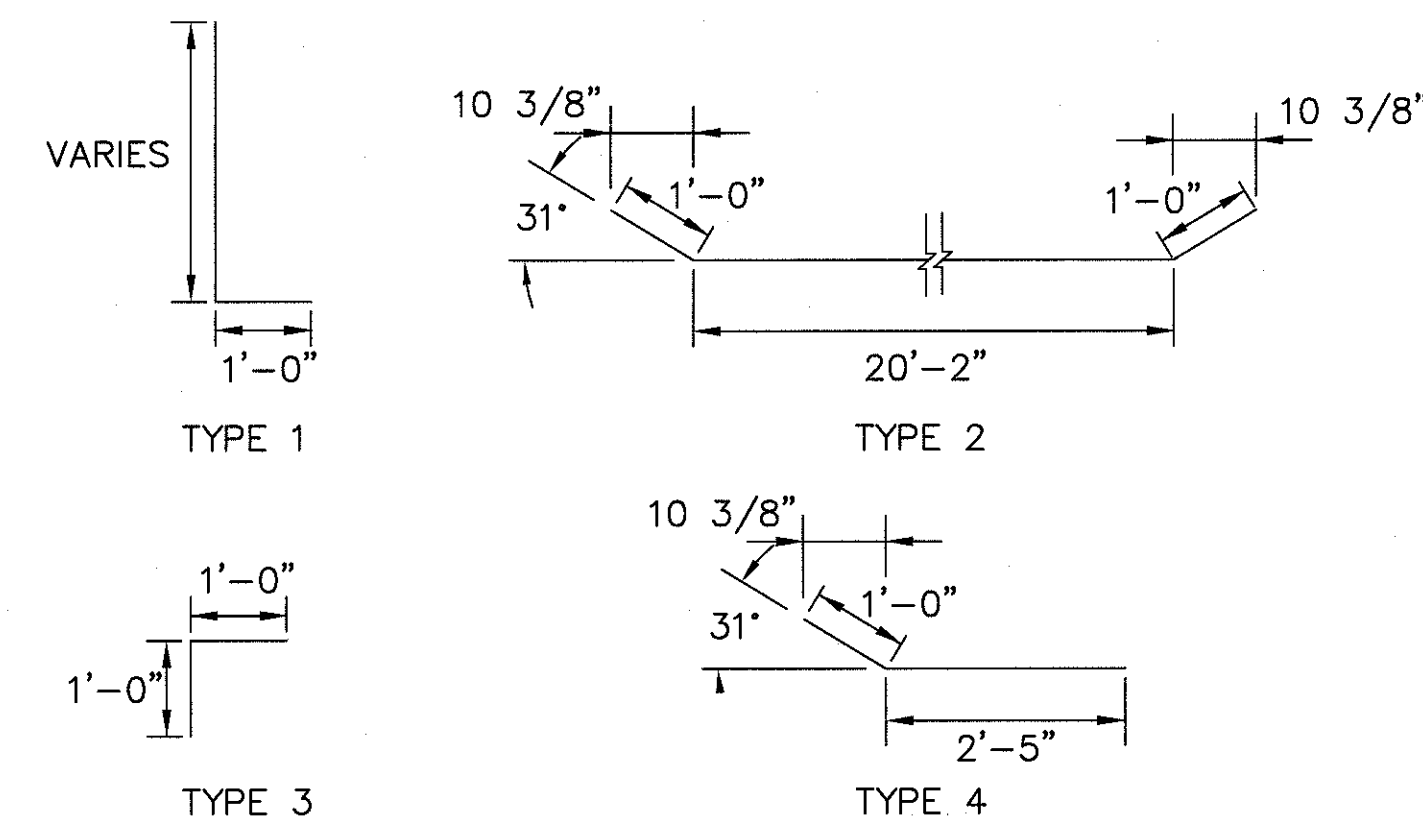


- NOTES:
- TOTAL LENGTHS SHOWN FOR REFERENCE ONLY; COMPLETE STEEL REINFORCEMENT AND BENT BAR LIST TO BE PROVIDED BY SUPPLIER PRIOR TO FABRICATION.
 - REINFORCING STEEL SHALL BE 2" CLR. UNLESS OTHERWISE SPECIFIED.
 - CONCRETE, REINFORCEMENT, AND FORM-WORK SHALL BE IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
 - 3/4" CHAMFER ALL EXPOSED EDGES UNLESS OTHERWISE INDICATED.

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY



NOTE: REINFORCEMENT NOT SHOWN FOR CLARITY.



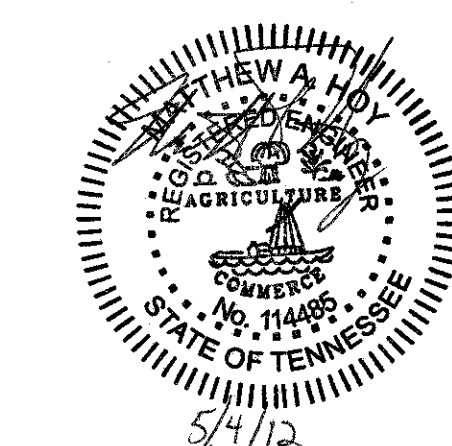
OUTLET HEADWALL - BILL OF REINFORCEMENT					
BAR	NO	SIZE	TYPE	LENGTH	WEIGHT
S1	39	6	STR	9'-8"	566
S2	39	4	STR	9'-8"	252
S3	26	4	STR	32'-3"	560
S4	78	4	STR	2'-8"	135
W1	25	4	1	5'-9"	96
W2	25	4	STR	4'-9"	79
W3	4	4	STR	3'-5"	9
W4	4	4	STR	6'-9"	18
W5	4	4	STR	10'-1"	27
W6	4	4	STR	10'-6"	28
W7	2	4	1	2'-7"	3
W8	2	4	STR	1'-7"	2
W9	2	4	1	2'-11"	4
W10	2	4	STR	1'-11"	2
W11	2	4	1	3'-3"	4
W12	2	4	STR	2'-3"	3
W13	2	4	1	3'-6"	5
W14	2	4	STR	2'-6"	3
W15	2	4	1	3'-10"	5
W16	2	4	STR	2'-10"	4
W17	2	4	1	4'-2"	5
W18	2	4	STR	3'-2"	4
W19	2	4	1	4'-6"	4
W20	2	4	STR	3'-6"	5
W21	2	4	1	4'-10"	6
W22	2	4	STR	3'-10"	5
W23	2	4	1	5'-1"	7
W24	2	4	STR	4'-1"	5
W25	2	4	1	5'-5"	7
W26	2	4	STR	4'-5"	6
W27	2	4	1	5'-9"	8
W28	2	4	STR	4'-9"	6
W29	6	4	2	22'-2"	89
W30	4	4	4	3'-5"	6
W31	6	4	STR	2'-8"	10
W32	32	5	STR	2'-6"	83
C1	24	4	STR	2'-2"	33
C2	12	4	STR	2'-6"	20
C3	12	4	3	2'-0"	16

RECORD DRAWING NOTES:

- THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGCUFFESCDX00000020100008		R 1 05/04/12 PRV TMM TRD MAH SEB MST JCK - - - ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7) R 0 03/11/11 BJE TMM TRD MAH SEB MST JCK - - - ISSUED FOR CONSTRUCTION										DISCIPLINE INTERFACE
REV. NO.	DATE	DSGN	CHGN	CHKD	SUPV	RVNG	APPD	ISSD	PROJECT NO.	AS CONST	BY	
SCALE: AS SHOWN EXCEPT AS NOTED												
YARD ASH STILLING POND												
SPILLWAY REPLACEMENT PROJECT DETAILS - SIPHON HEADWALL WORK PLAN 7 (CUF-110311-WP-7)												
DESIGNED BY: B.J. ELLIOT	DRAWN BY: T.M. MYERS	CHECKED BY: T.R. DUDECK	SUPERVISED BY: M.A. HOY	REVIEWED BY: S.E. BENNETT	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER						
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING												
AUTOCAD R 2000		DATE 03/11/11	46	C	10W286-08			R 1				



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STANTEC
TASK COMPLETED BY: REV NO.

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

C

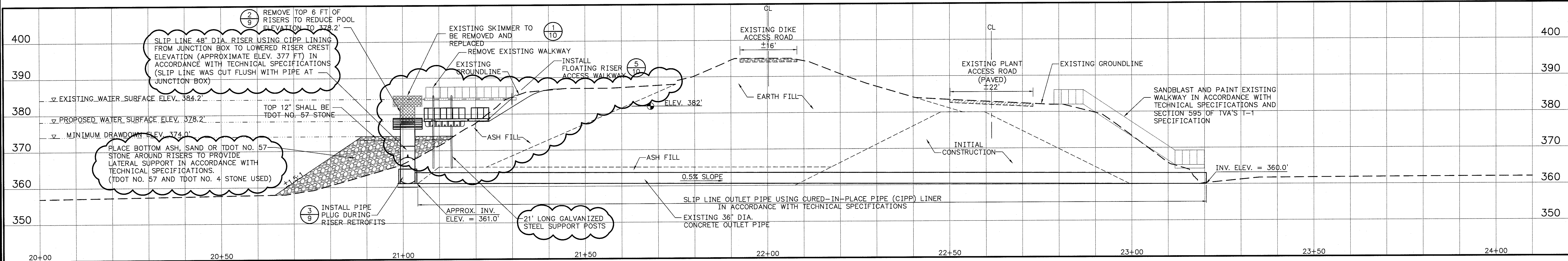
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E

F

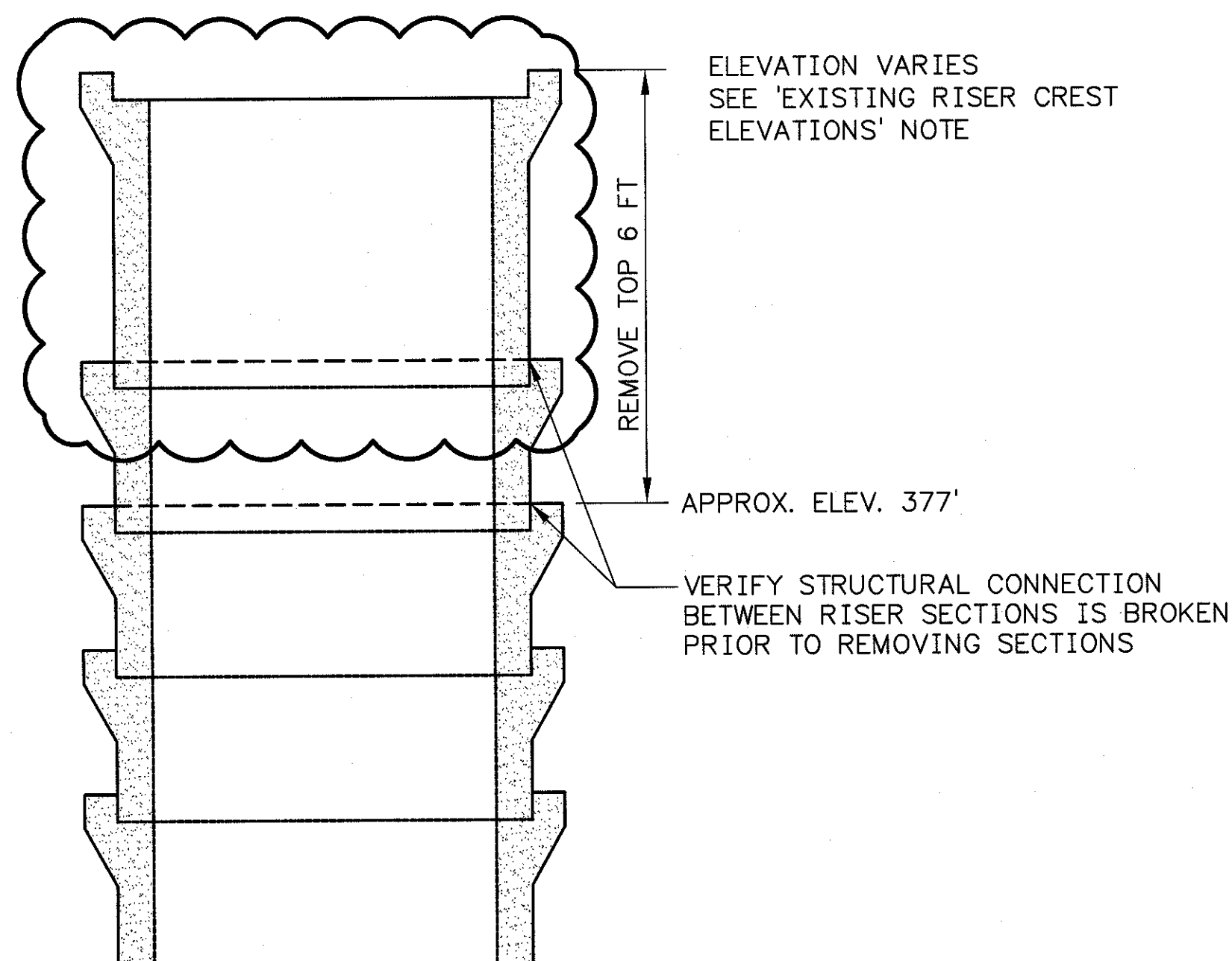
G

H

1
9 PROFILE - BASELINE B
SCALE: 1"=10'

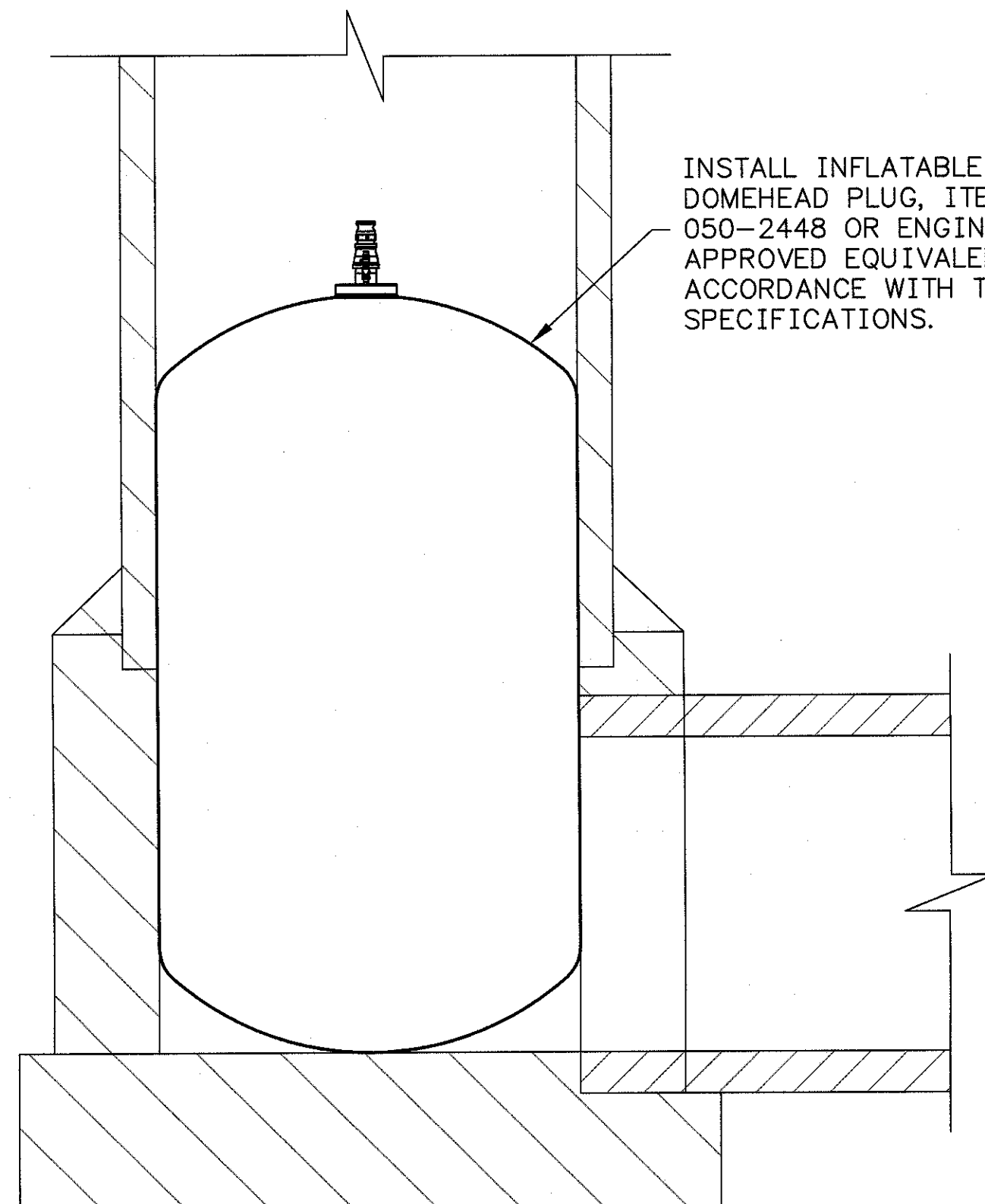
EXISTING RISER CREST ELEVATIONS (STEEL PLATE CREST)

SPILLWAY ID (SEE SHEET 3)	ELEV.
CUF-AP-MG-001-A	383.99'
CUF-AP-MG-002-A	383.92'
CUF-AP-MG-003-A	383.95'
CUF-AP-MG-004-A	383.83'

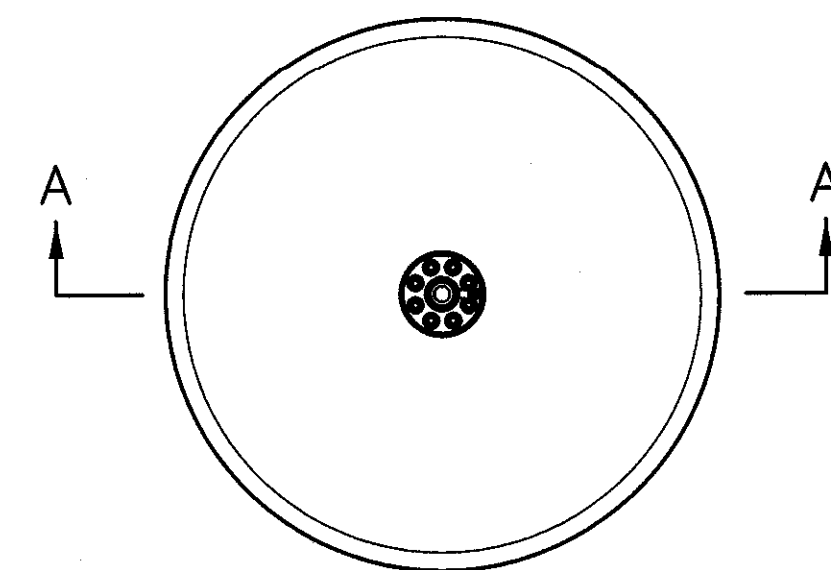
2
9 DETAIL - EXISTING RISER RETROFITS
NOT TO SCALE

PHASING AND SEQUENCING:

1. LOWER POOL ELEVATION APPROXIMATELY 1 FT BELOW EXISTING RISER CREST USING SIPHONS.
2. INSTALL TEMPORARY COFFERDAM OR SILT FENCE DOWNSTREAM OF EXISTING SPILLWAY OUTLETS TO CONTROL SEDIMENT AND WASTE FROM PIPE CLEANING.
3. CLEAN EACH SPILLWAY OUTLET PIPE IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
4. INSPECT EACH SPILLWAY OUTLET PIPE AND RISER USING CLOSED-CIRCUIT TELEVISION (CCTV) IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
5. INSTALL PIPE PLUG IN EACH RISER AND VERIFY TIGHTNESS AND ABILITY TO HOLD PRESSURE.
6. LOWER POOL ELEVATION USING SIPHONS AND REMOVE TOP 6 FT OF EACH RISER. EACH 2 FT RISER SECTION SHALL BE REMOVED INDIVIDUALLY. CONTRACTOR SHALL SUBMIT DETAILED WORKPLAN FOR REMOVING RISER SECTIONS TO ENGINEER FOR APPROVAL PRIOR TO BEGINNING WORK. WORKPLAN SHALL DETAIL POOL DRAWDOWN ELEVATION FOR EACH INCREMENTAL SECTION REMOVAL AS WELL AS MEANS TO ENSURE THAT ONLY THE TOP RISER SECTION WILL BE REMOVED AND NO LOWER JOINTS WILL BE IMPACTED.
7. MAINTAIN POOL LEVEL BELOW NEW RISER CREST ELEVATION USING SIPHONS AND SLIP LINE THE RISERS AND OUTLET PIPES USING CURED-IN-PLACE PIPE (CIPP) LINING IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
8. INSTALL NEW SKIMMER STRUCTURES IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
9. INSTALL NEW FLOATING WALKWAYS.

3
9 DETAIL - INSTALLATION OF PIPE PLUG
NOT TO SCALE

INSTALL INFLATABLE LANSAS DOMEHEAD PLUG, ITEM NO. 050-2448 OR ENGINEER APPROVED EQUIVALENT IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.

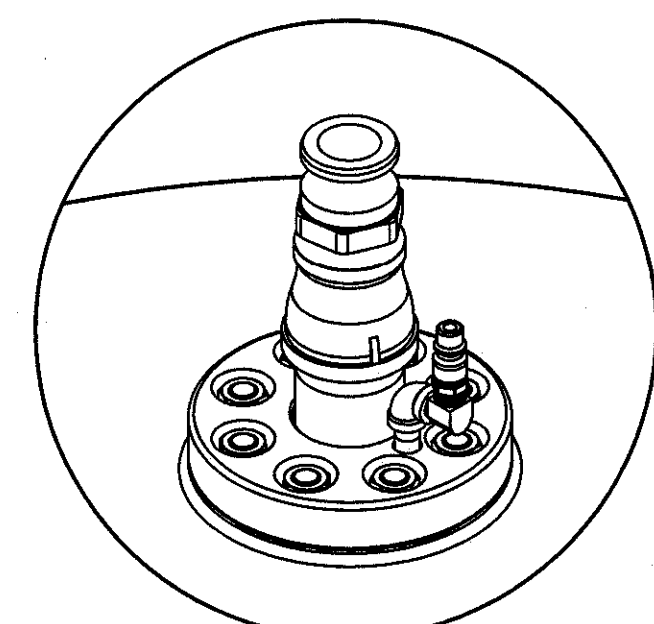
4
9

1.5" MALE CAM & GROOVE CONNECTION FOR WATER INFLATION/DEFLATION

1/2" MALE QUICK CONNECTION FOR AIR INFLATION OR PRESSURE MONITORING

INTERNAL WATER HOSE FOR DEFLATION

SECTION A-A



DETAIL B

POSITIONING LOOPS ON INFLATION END FOR PLACING AND RETRIEVING PLUG.

DETAIL B

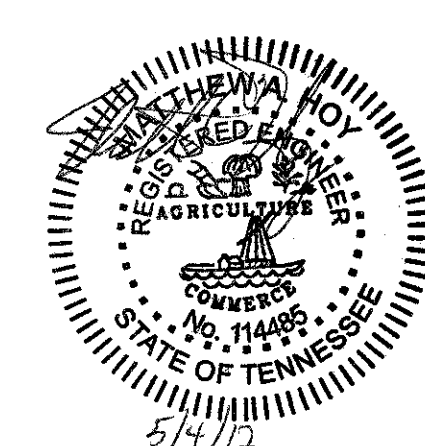
120" APPROXIMATE OVERALL LENGTH

96" APPROXIMATE CONTACT LENGTH

BALLISTIC NYLON-REINFORCED POLYURETHANE OUTER PLY

4
9 DETAIL - INFLATABLE PIPE PLUG
NOT TO SCALE

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS
SEE FPGCUFFESCDX0000020100008

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CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING						
AUTOCAD R 2000		DATE: 03/11/11	46	C	10W286-09	
PLOT FACTOR:10 W-TVA		C.A.D. DRAWING DO NOT ALTER MANUALLY		R 1		

RECORD DRAWING NOTES:

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SECTION OR DETAIL NO.

SHEET WHERE SHOWN

REFERENCE KEY

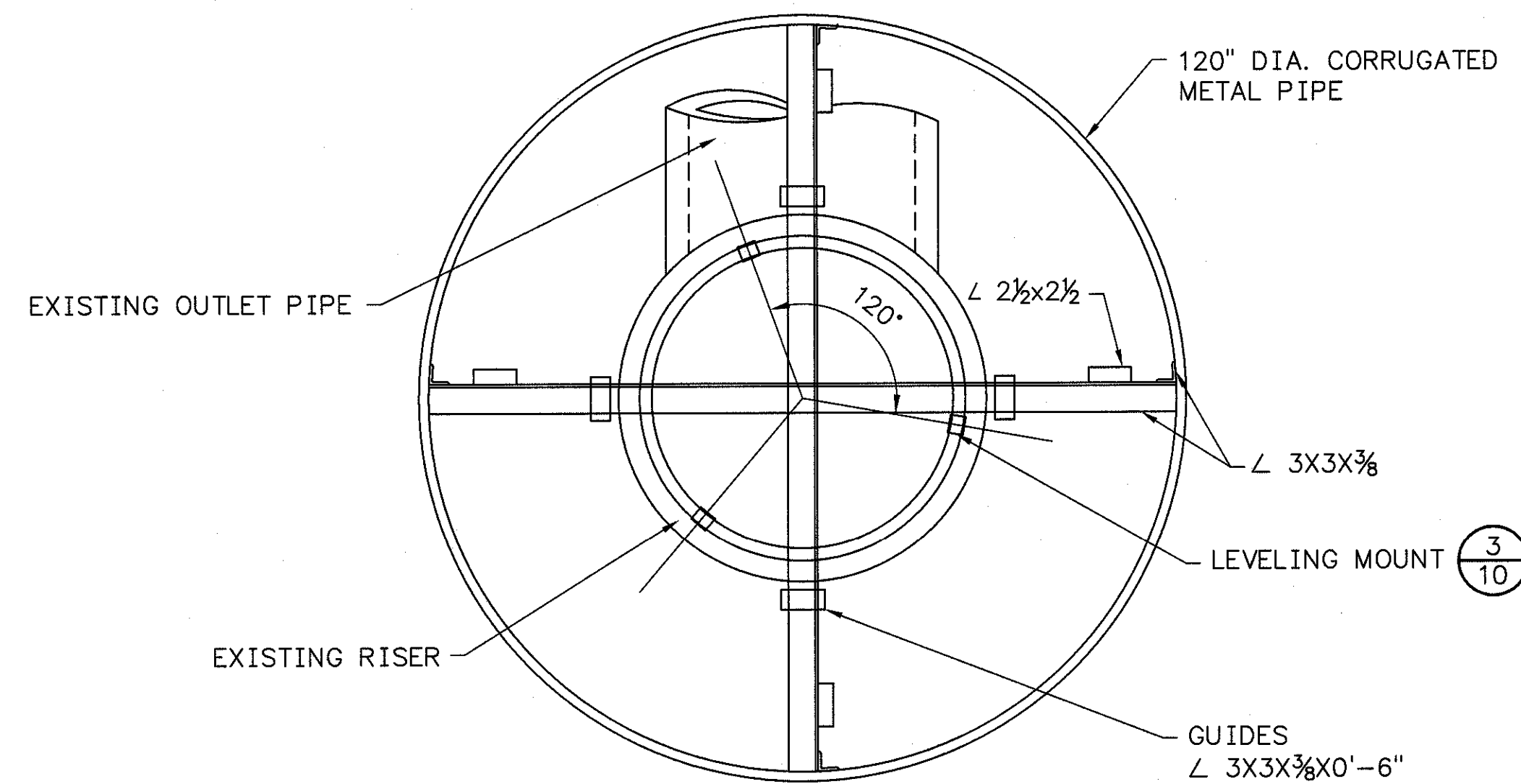
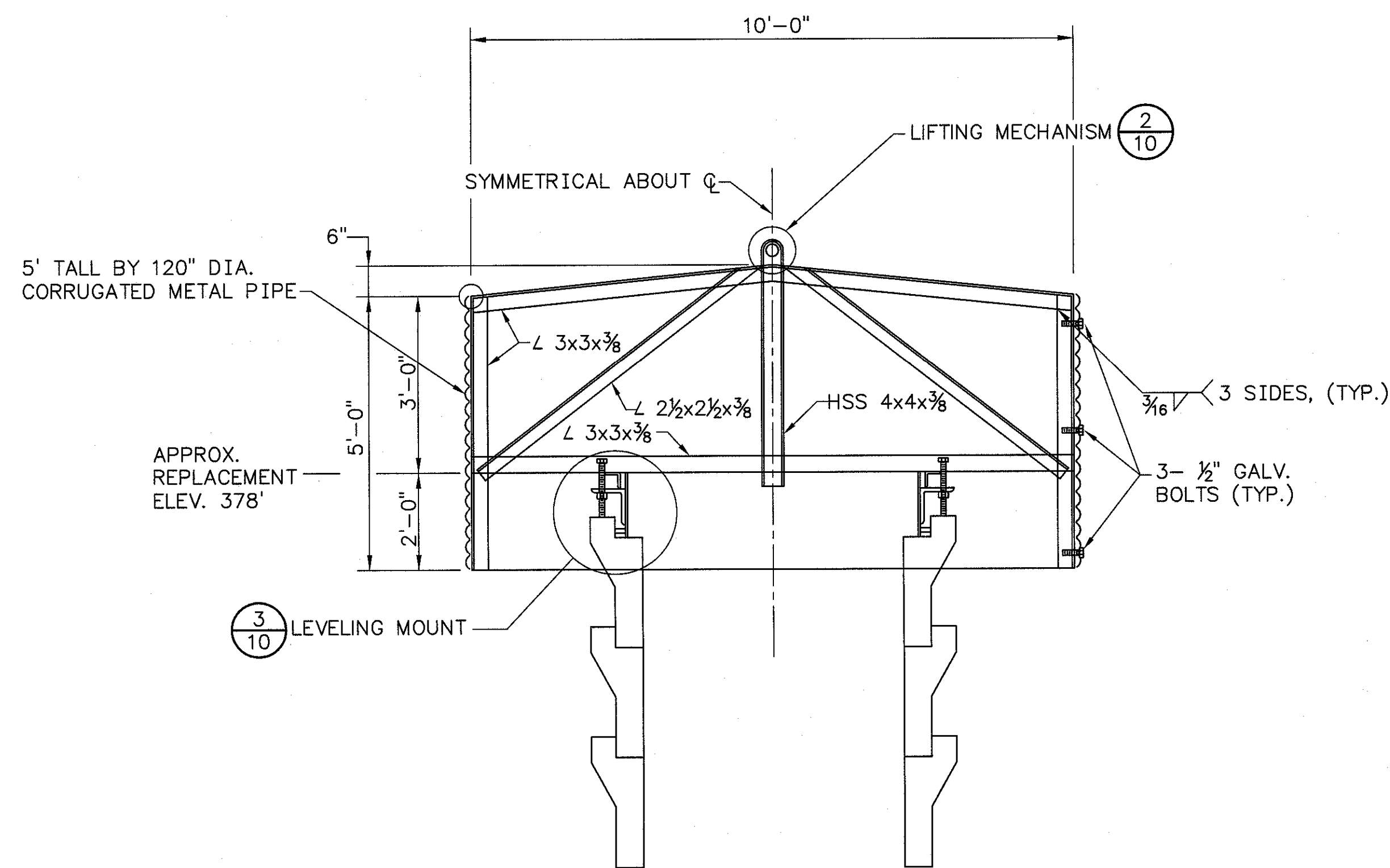
STANTEC

1

TASK COMPLETED BY:

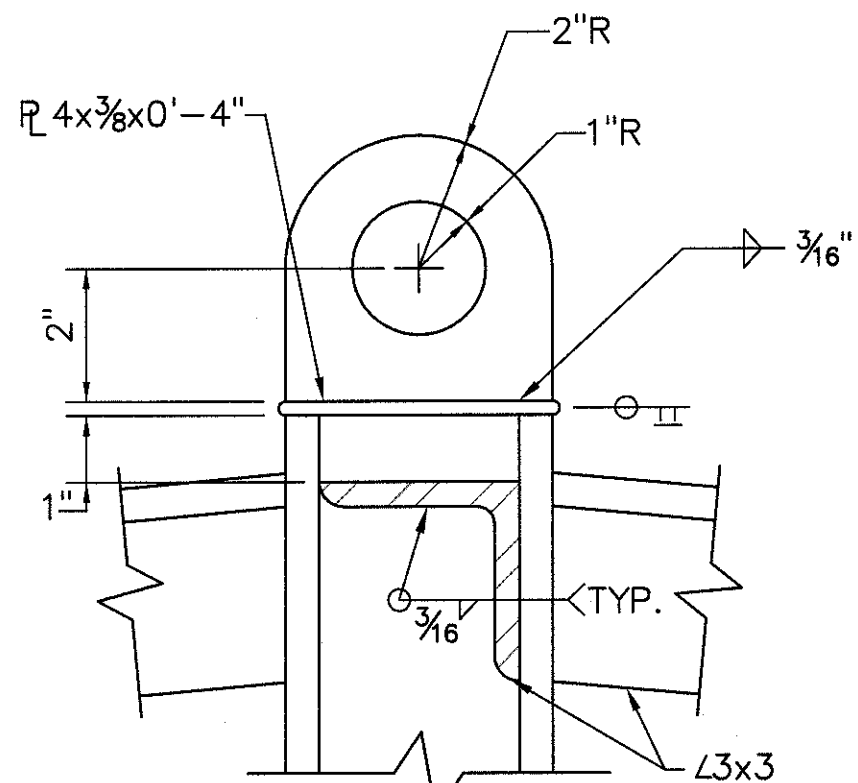
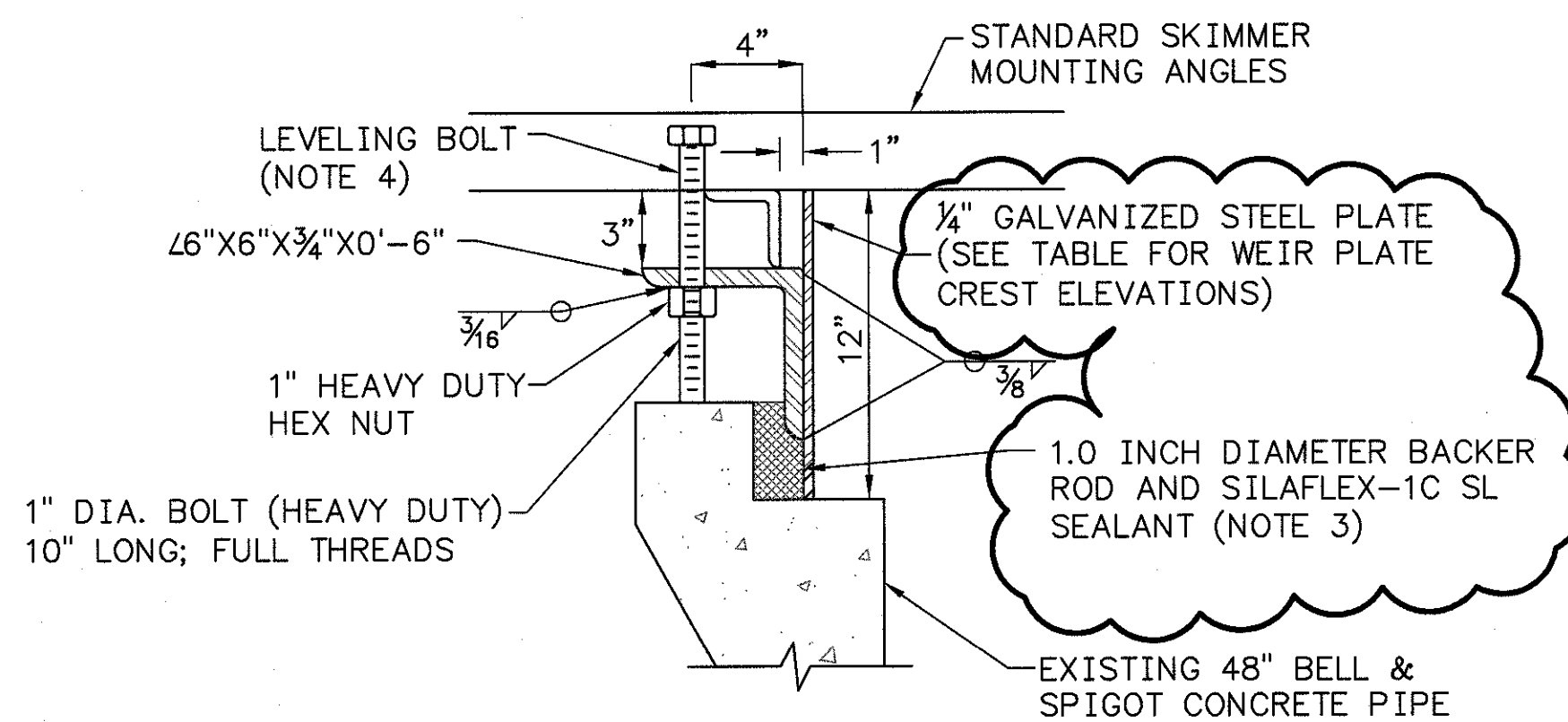
REV NO.

PLOT FACTOR:10
W-TVAC.A.D. DRAWING
DO NOT ALTER MANUALLY

TOP VIEW OF SKIMMER
NOT TO SCALESECTION VIEW OF SKIMMER
NOT TO SCALE1
10
DETAIL - SKIMMER
NOT TO SCALE

NOTES:

- ALL STRUCTURAL STEEL COMPONENTS SHALL BE GALVANIZED IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
- A SECTION OF 120" CORRUGATED METAL PIPE IS RECOMMENDED FOR SKIMMER. IF STRUCTURAL PLATES OR OTHER METAL SHAPES ARE USED FOR FABRICATION, SPECIAL CARE SHALL BE TAKEN TO SEAL ALL JOINTS BY WELDING OR WITH ASPHALT PAINT.
- DETAILS SHOWN ON THESE PLANS WERE OBTAINED FROM TVA STANDARD DRAWINGS 10N214, 10N229-1, AND 10N229-2.
- DETAILS SHOWN ON THESE PLANS FOR CONSTRUCTION ARE FOR REFERENCE PURPOSES. SKIMMER STRUCTURES TO BE IN ACCORDANCE WITH TVA DRAWINGS 10N229-1 AND 10N229-2.

2
10
DETAIL - LIFTING MECHANISM
NOT TO SCALE3
10
DETAIL - LEVELING MOUNT
NOT TO SCALE

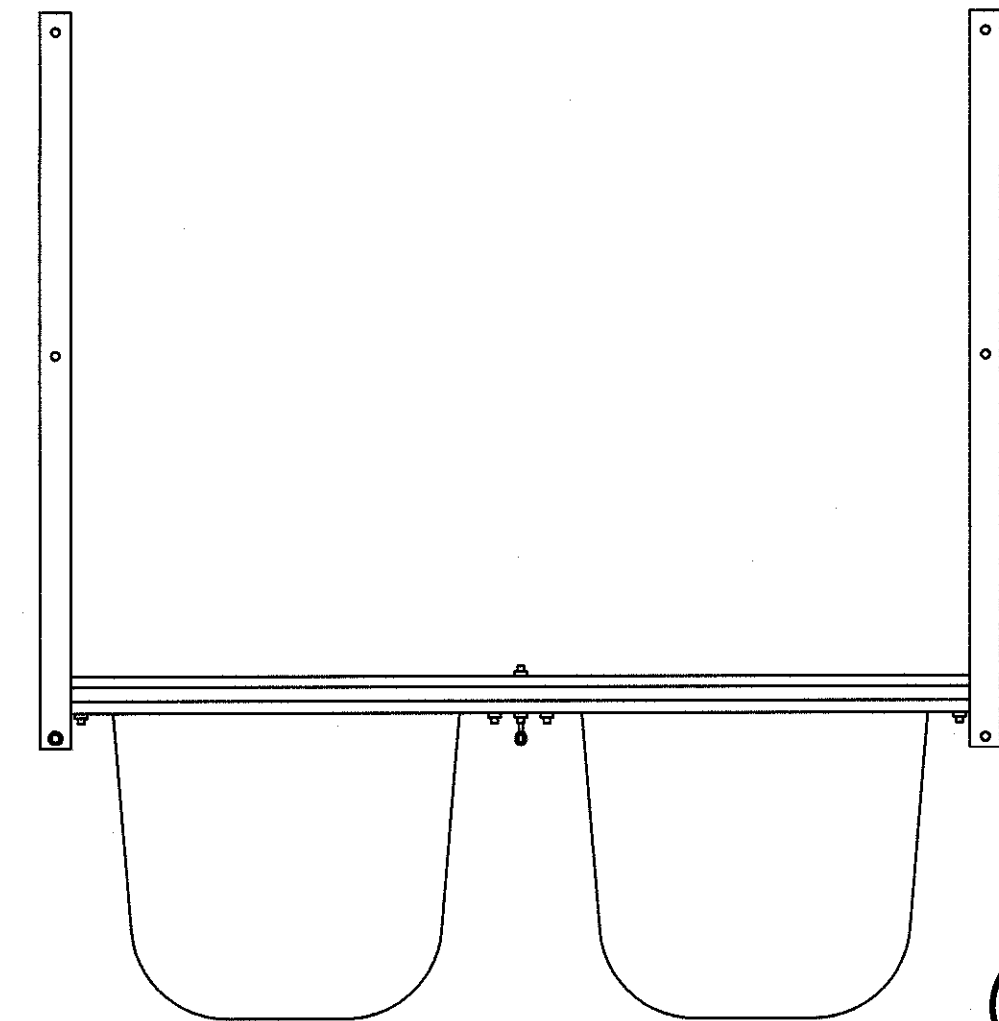
NOTES:

- ALL CONNECTIONS TO BE WELDED.
- FOR SKIMMER AND SPILLWAY DETAILS, REFER TO TVA DRAWING 10N229-2.
- CAULKING SHALL EXTEND COMPLETELY AROUND THE WEIR AND FORM A WATER TIGHT SEAL.
- WHEN THE WEIR IS INSTALLED, THE TOP SHALL BE LEVELED WITH THE USE OF LEVELING BOLTS.

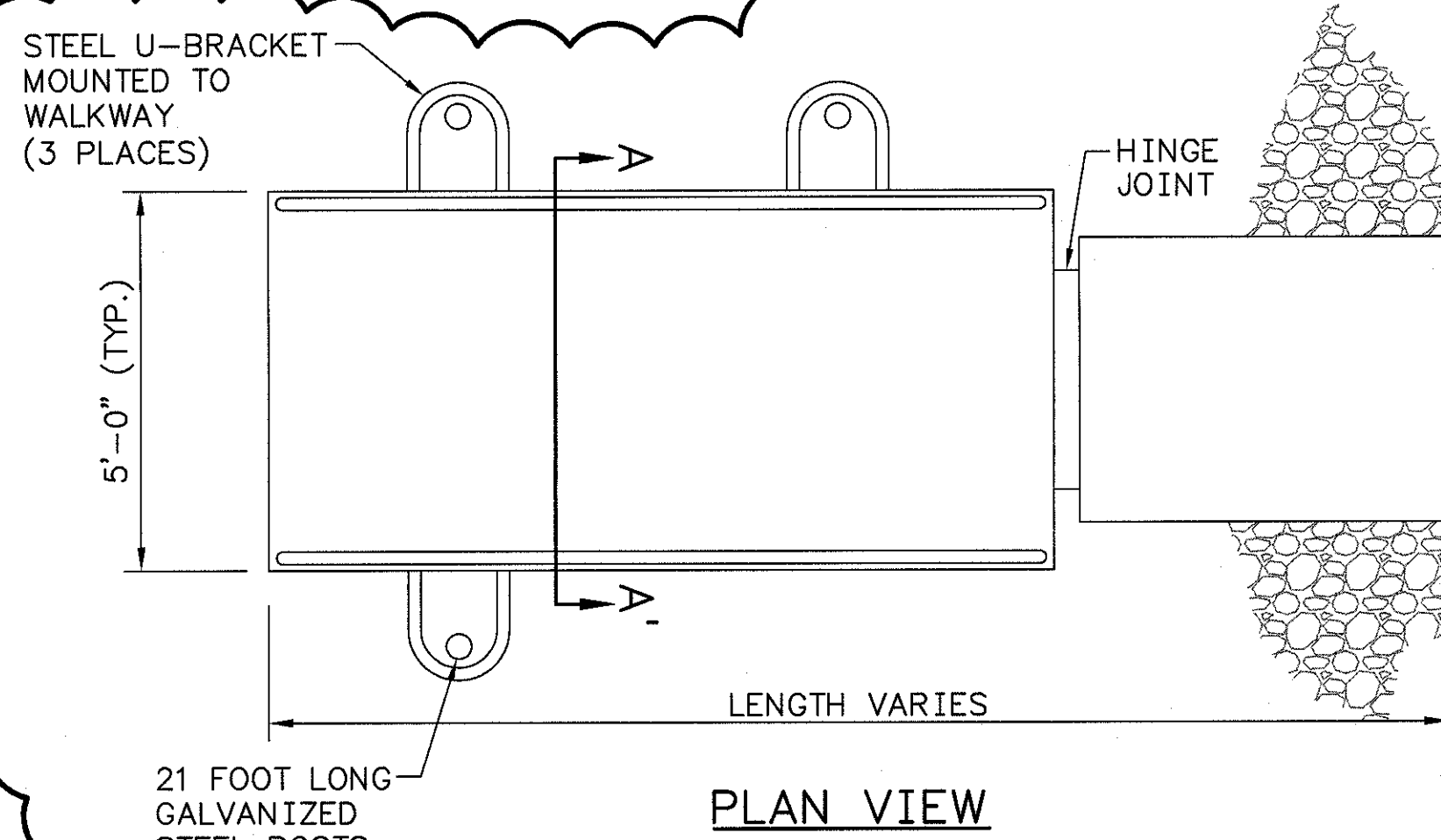
WEIR PLATE CREST ELEVATIONS

SPILLWAY	EL. 1	EL. 2	EL. 3	EL. 4	EL. 5	EL. 6	EL. 7	EL. 8
CUF-AP-MG-001-A	378.00	378.00	378.00	377.99	377.98	378.00	378.00	378.00
CUF-AP-MG-002-A	378.00	378.01	377.99	378.00	379.99	377.98	377.99	378.00
CUF-AP-MG-003-A	378.01	378.01	378.01	378.01	378.00	378.00	378.01	378.01
CUF-AP-MG-004-A	378.02	378.01	378.02	378.02	378.02	378.03	378.03	378.02

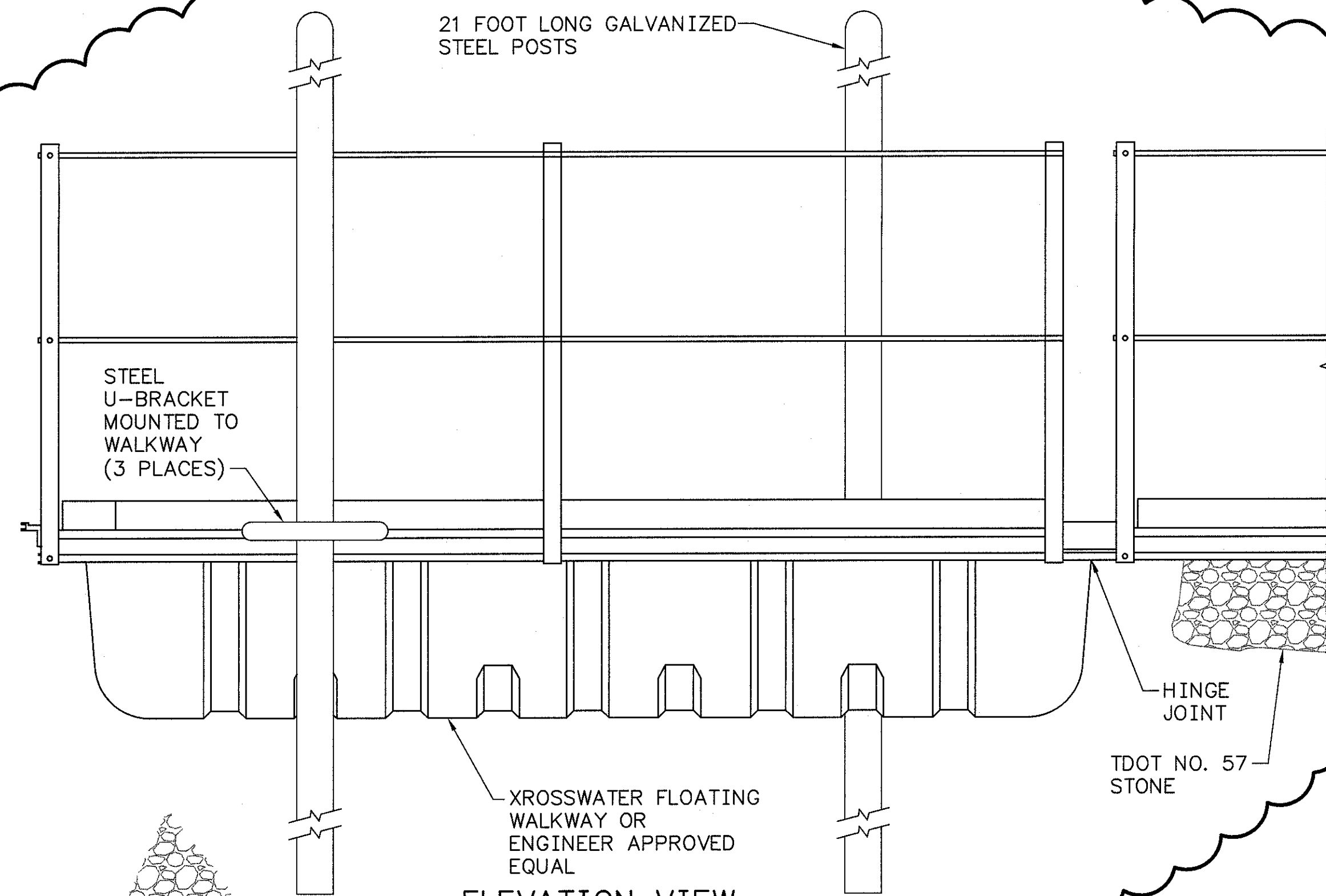
NOTE: 8 POINTS SURVEYED ON WEIR PLATE CIRCUMFERENCE. POINT ELEVATIONS LISTED STARTING WITH THE NORTHERN MOST POINT AND CONTINUING CLOCKWISE AROUND THE WEIR PLATE.



SECTION A-A'



PLAN VIEW

5
10
DETAIL - FLOATING ACCESS WALKWAY
NOT TO SCALE

ELEVATION VIEW

NOTES:

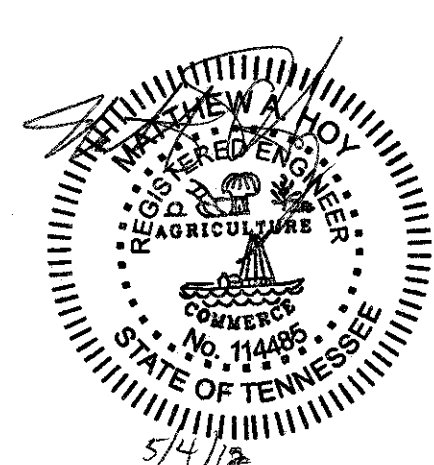
- DETAILS SHOWN ARE CONCEPTUAL ONLY. SHOP DRAWINGS TO BE SUBMITTED TO ENGINEER PRIOR TO FABRICATION.
- FLOATING ACCESS WALKWAY TO BE CROSSWATER FLOATING WALKWAY OR ENGINEER APPROVED EQUAL.
- CROSSWATER WALKWAY SHALL HAVE ALUMINUM HANDRAILS WITH KNEE RAIL AT 3.28 FT HIGH, HDPE/HMWPE THERMOFORMED FLOAT UNIT, AND LAMINATED TOP DECK WITH ALUMINUM COMPONENT FRAME. THE WALKWAY WILL BE SUPPLIED IN COMPONENT FORM WHICH WILL ASSEMBLE INTO A 10 FT x 5 FT SECTION. BUOYANCY IS 2200 LBS MAX PER SECTION.
- WALKWAY SHALL BE ANCHORED TO RESIST LATERAL MOVEMENT. CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR ANCHORING WALKWAYS TO BANK TO RESTRICT LATERAL MOVEMENT.
- WALKWAYS SHALL NOT BE RIGIDLY CONNECTED TO RISERS.

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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS
SEE FPGCUFFESCDX000000020100008



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REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVMD	APPD	ISSD	PROJECT	AS CONST	BY
R 1	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK			
R 0	03/11/11	LJP	TMM	MAH	SHB	SEB	MST	JCK			

SCALE: AS SHOWN
EXCEPT AS NOTED

YARD
ASH STILLING POND
SPILLWAY IMPROVEMENT PROJECT
DETAILS - SKIMMER & WALKWAY
WORK PLAN 7 (CUF-110311-WP-7)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
L.J. PERKINS	T.M. MYERS	M.A. HOY	S.H. BICKEL	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

AUTOCAD R 2000 DATE 03/11/11 46 C 10W286-10 R 1

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

STANTEC
TASK COMPLETED BY: REV NO.

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE AND/OR AFTER THE SURVEYING WORK IS COMMENCED. USE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

PHASING AND SEQUENCING:

1. CLEAR VEGETATION FROM PROPOSED EMERGENCY SPILLWAY LOCATION AND INSTALL SEDIMENT CONTROL MEASURES.
2. INSTALL EMERGENCY SPILLWAY DISCHARGE CHANNEL AND CHUTE SECTION AS SHOWN ON PLANS.
3. EXCAVATE AND INSTALL CAST-IN-PLACE EMERGENCY SPILLWAY BOX CULVERTS ALONG DIKE CREST. PLANT SHALL BE GIVEN 48 HOUR NOTICE PRIOR TO EXCAVATION ALONG DIKE CREST. FOLLOWING INSTALLATION, GRADE TO FINISH ELEVATIONS OVER BOX CULVERT AS SHOWN ON PLANS.
4. GRADE REMAINING DISTURBED AREAS TO APPROPRIATE FINISH ELEVATIONS AND STABILIZE WITH EROSION CONTROL BLANKET OR SOD.
5. REMOVE ALL TEMPORARY SEDIMENT CONTROLS.

RECORD DRAWING NOTES:

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SECTION OR DETAIL NO.

 SHEET WHERE SHOWN

REFERENCE KEY

LEGEND

-

- ◎ SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS
- ◎ SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS AND ROCK CORE

RECORD DRAWING

R 1	08/25/11	RC	TMM	MAH	SHB	SEB	MST	JCK			
RECORD DRAWING											

R 2	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK	-	-	-
ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7)											

REV.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT	AS CONST	REVISION
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YARD
ASH STILLING POND

SPILLWAY IMPROVEMENT PROJECT PLAN – EMERGENCY SPILLWAY WORK PLAN 7 (CUF-110311-WP-7)

DESIGNED BY: R. CORSA	DRAWN BY: T.M. MYERS	CHECKED BY: M.A. HOY	SUPERVISED BY: S.H. BICKEL	REVIEWED BY: S.E. BENNETT	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER
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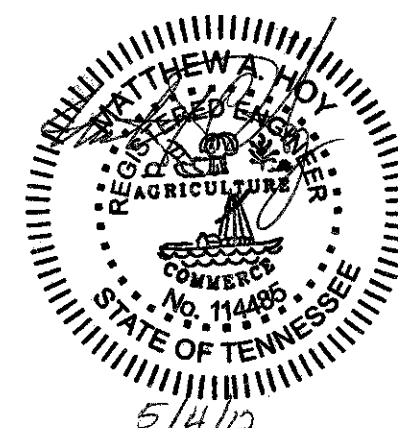
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 03/11/11	46	C	10W286-11	R 2
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PLOT FACTOR:10
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

FOR SUPPORTING DESIGN CALCULATIONS
SEE EPGCUEFFSCDX00000020100008



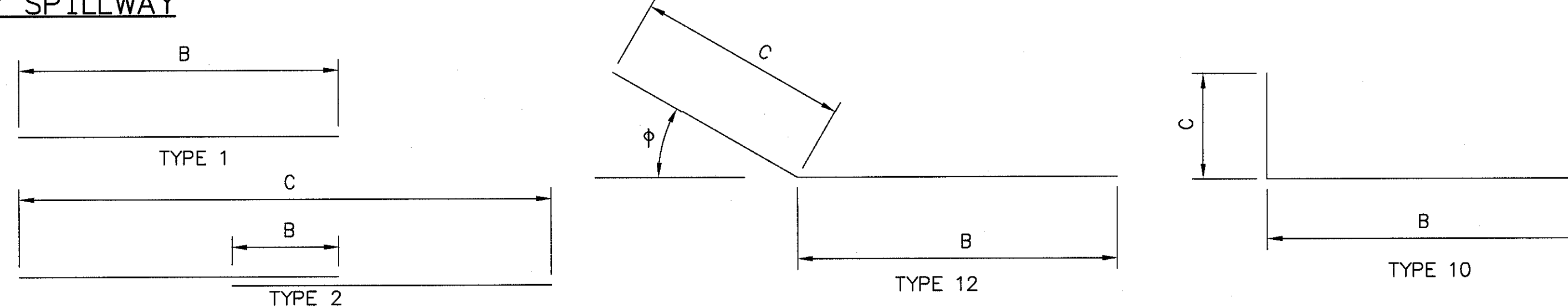
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STANTEC	2
WORK COMPLETED BY:	REV NO

STANTEC	2
WORK COMPLETED BY:	REV NO



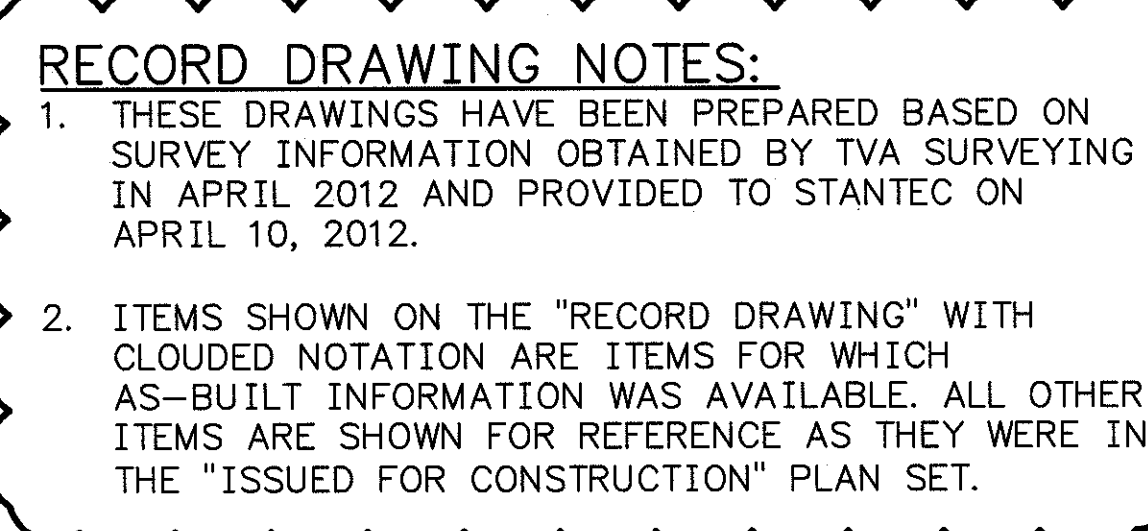
12 PROFILE
SCALE: 1"=10'



12 SECTION
SCALE: 1/2"=1'-0"



12 SCALE: 2"=1'

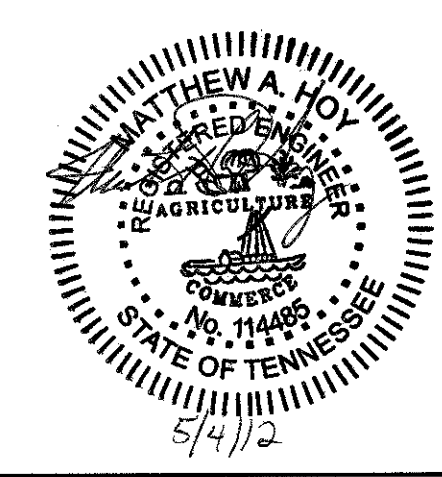


4 SECTION
12 SCALE: 1/2"=1'-0"

* VARYING LENGTHS TO MATCH WINGWALL HEIGHT

1. CONCRETE, REINFORCEMENT AND FORMWORK SHALL BE IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS. CONCRETE SHALL BE CLASS A, $F'_C=4,000$ PSI.
2. REINFORCING STEEL SHALL HAVE A MINIMUM YIELD STRENGTH, $F_Y=60,000$ PSI
3. ALL #4 BARS SHALL HAVE 1'-9" SPLICE (MIN.).
ALL #5 BARS SHALL HAVE 2'-2" SPLICE (MIN.).
ALL #6 BARS SHALL HAVE 2'-7" SPLICE (MIN.).
4. MAINTAIN 2" CLR. UNLESS OTHERWISE SHOWN.
5. ALL EXPOSED CORNERS SHALL HAVE 3" CHAMFER.
6. TOOLED JOINTS SHALL BE PLACED EVERY 20 FEET ALONG TRANSITION, CHUTE, AND APRON SECTIONS.
7. BROOM FINISH FLOOR SURFACES PERPENDICULAR TO FLOW.

RECORD DRAWING

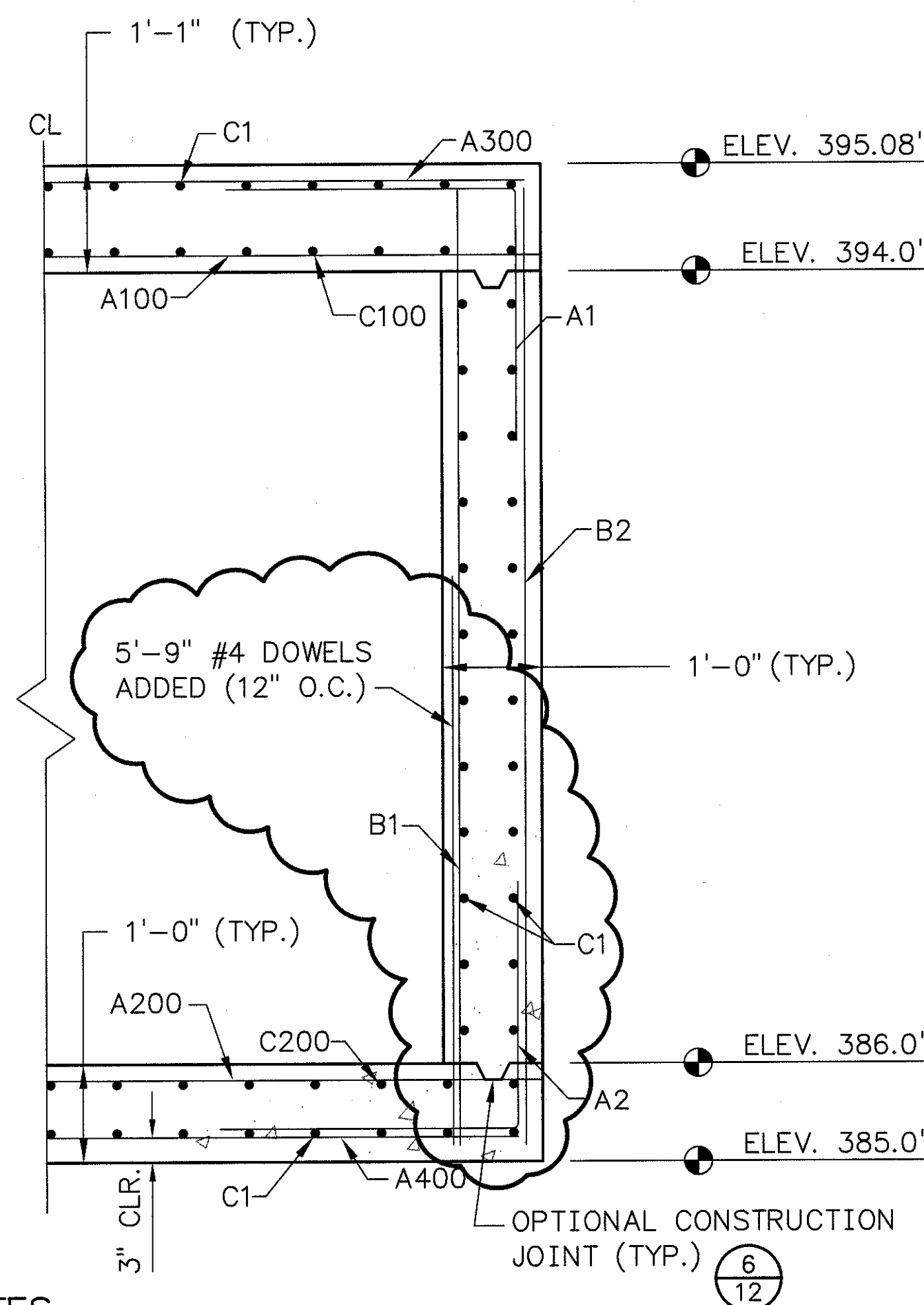
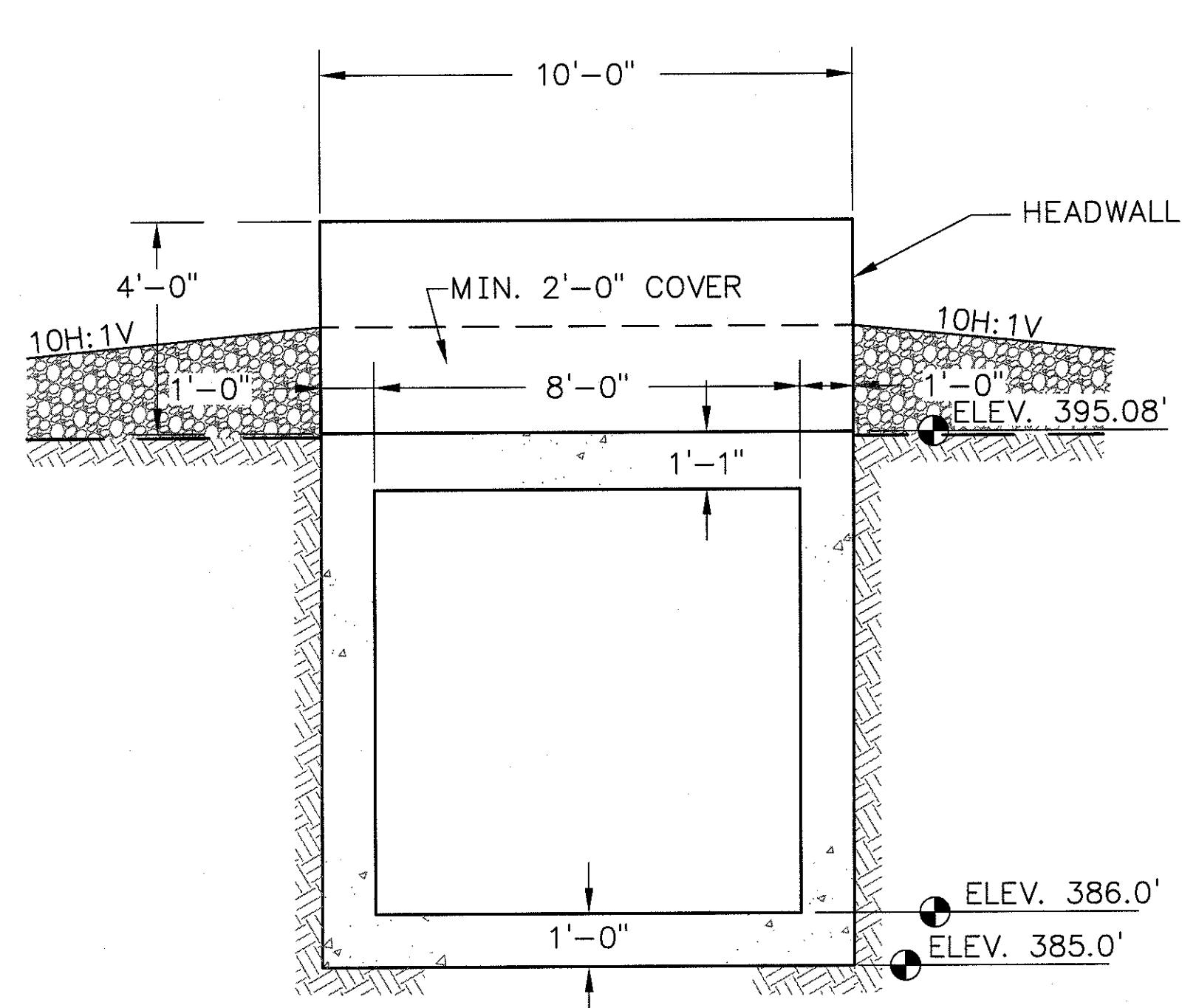
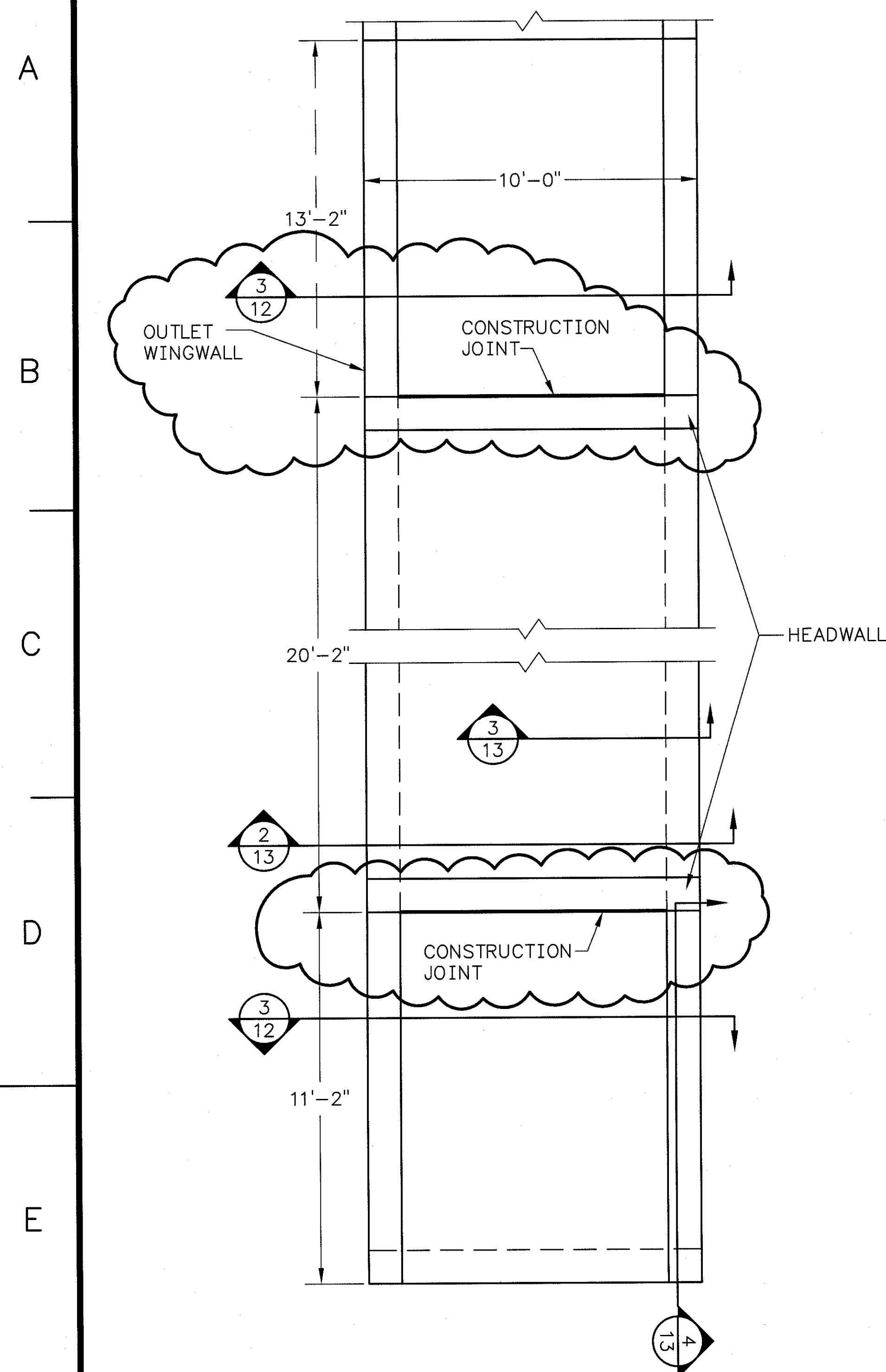


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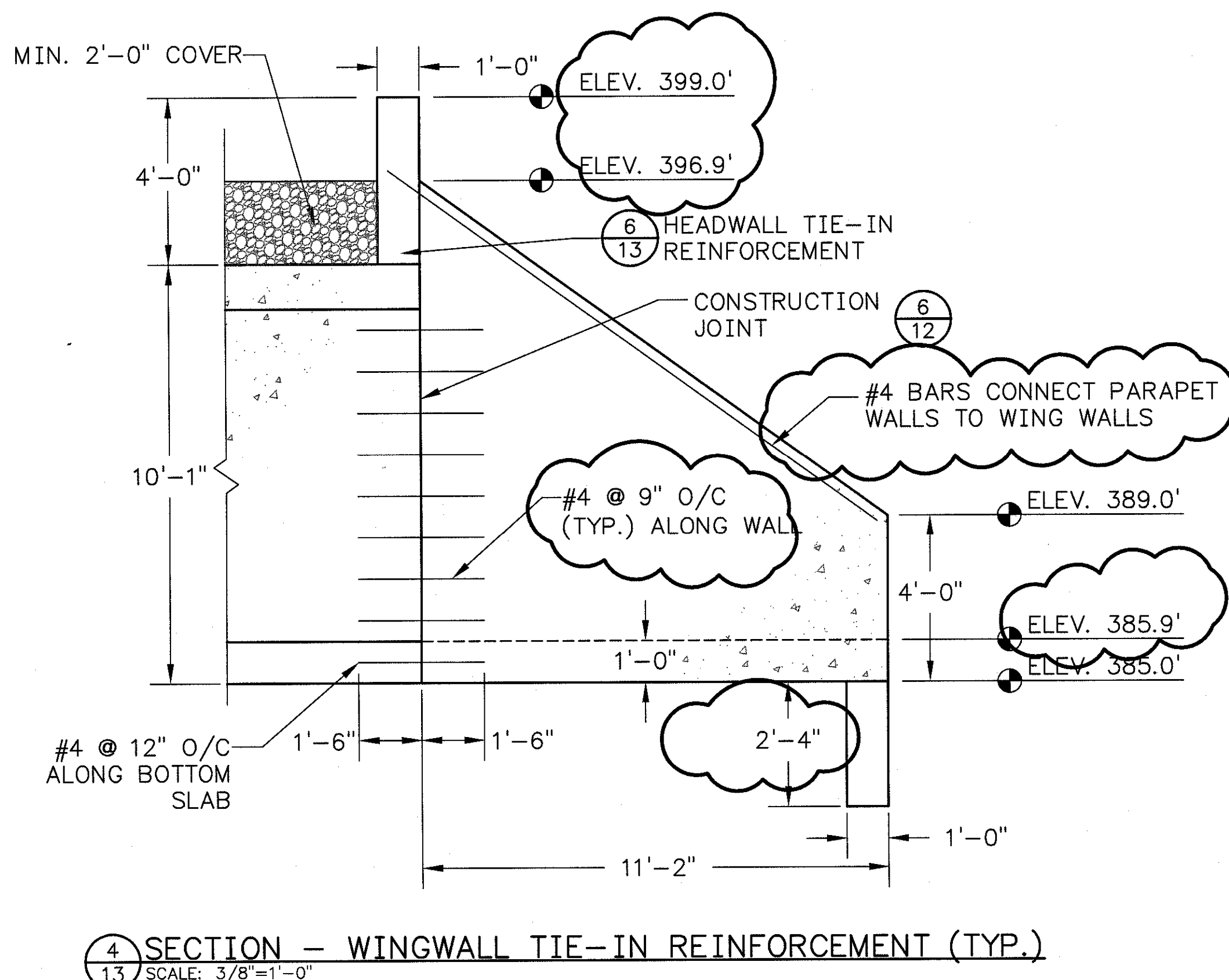
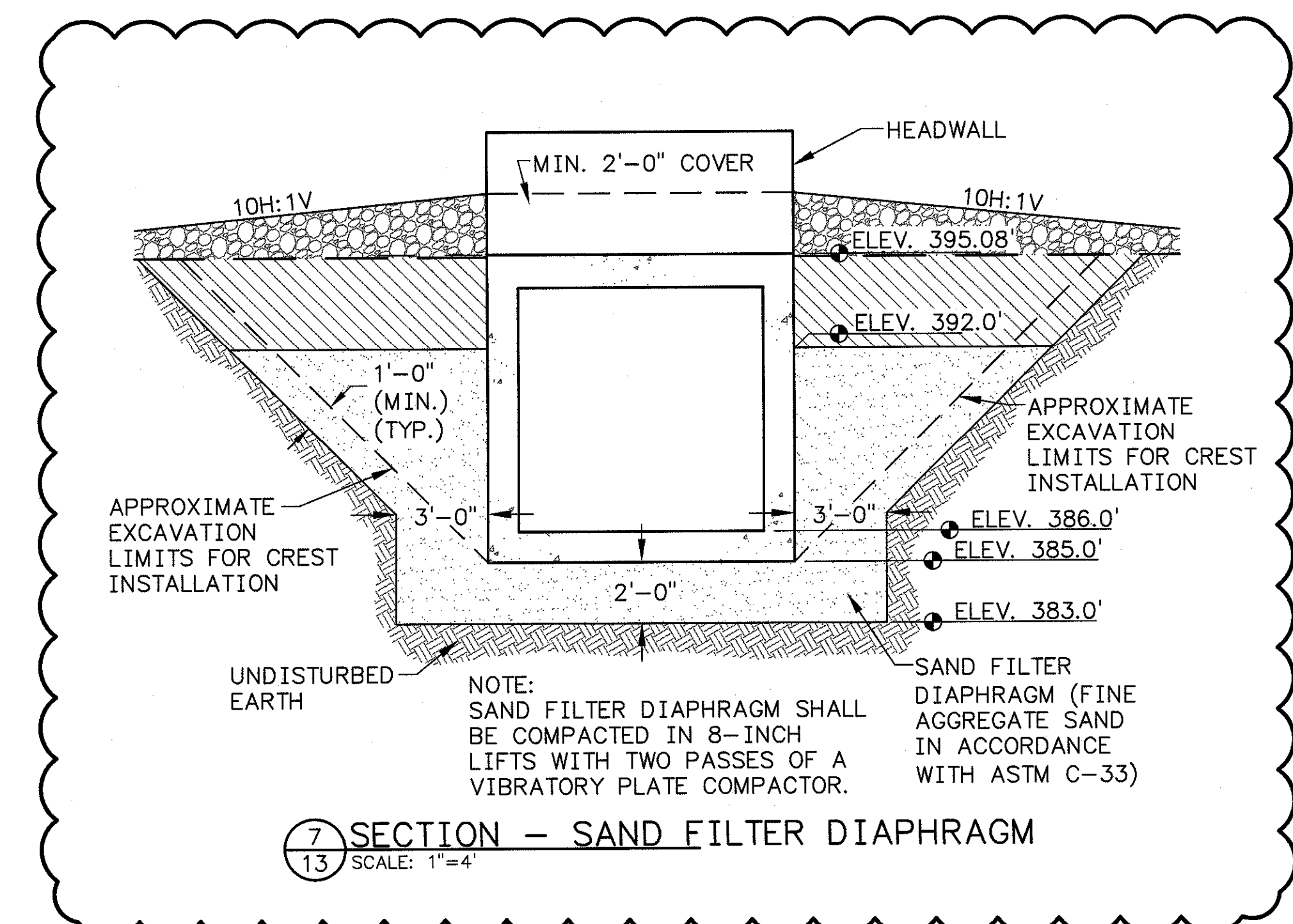
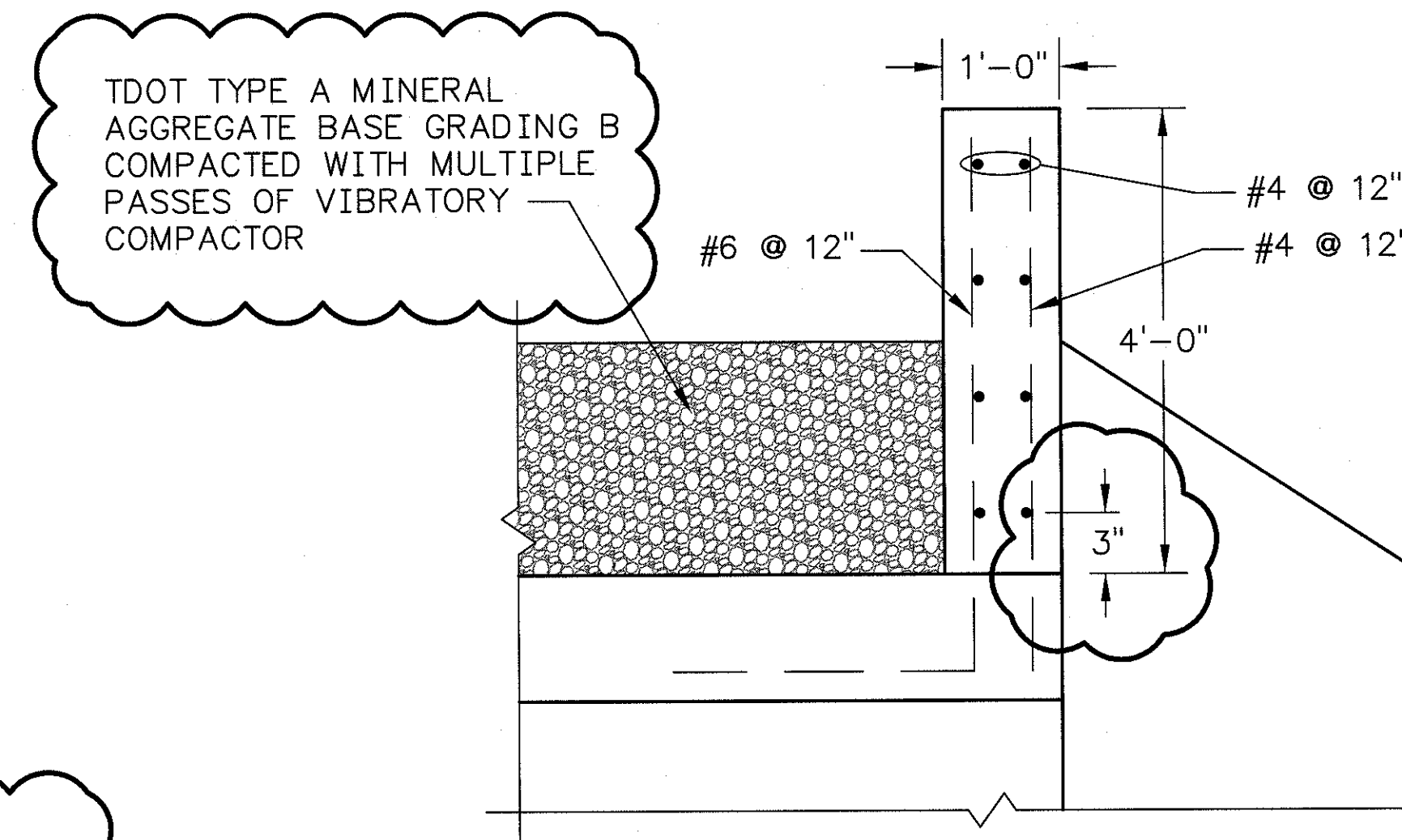
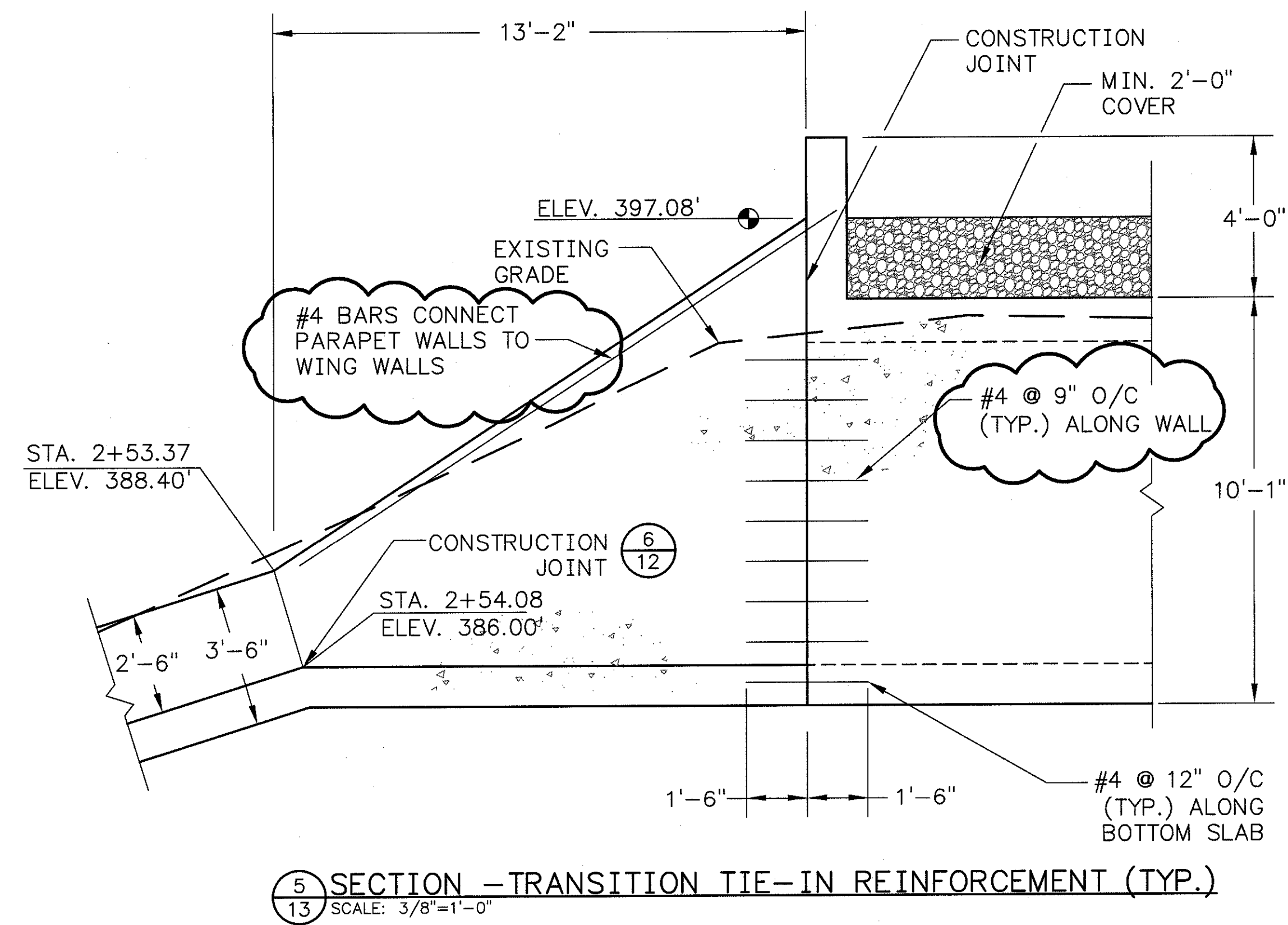
YARD ASH STILLING POND
SPILLWAY REPLACEMENT PROJECT DETAILS – EMERGENCY SPILLWAY WORK PLAN 7 (CUF-110311-WP-7)

DESIGNED BY: R. CORSA	DRAWN BY: T.M. MYERS	CHECKED BY: R. VERRASTRO	SUPERVISED BY: M.A. HOY	REVIEWED BY: S.E. BENNETT	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING						
AUTOCAD R 2000	DATE 03/11/11	46	C	10W286-12		R 2



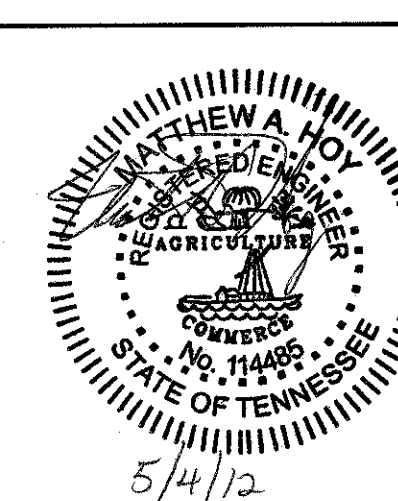
- NOTES:
1. REINFORCEMENT SYMMETRICAL ABOUT CENTERLINE.
 2. 2" CLEAR UNLESS NOTED OTHERWISE.

BOX CULVERT REINFORCEMENT										
CURTAIN WALLS										
MARK	QTY	SIZE	SPACING (INCHES)	TYPE	LENGTH (FEET)	WT. (LBS)	A (INCHES)	B (INCHES)	C (INCHES)	G (INCHES)
A100	41	5	6	1	9'-8"	414		116		
A200	35	6	7	1	9'-8"	508		116		
A300	28	4	9	1	9'-8"	181				
A400	28	4	9	1	9'-8"	181				
A1	70	4	7	10	5'-3"	245		32	31	
A2	70	6	7	10	6'-6"	683		45	33	
B1	42	4	12	1	8'-6"	238		102		
B2	70	4	7	1	8'-0"	374		96		
C1	54	4	9	1	19'-11"	719		239		
C100	9	4	9	1	19'-11"	120		239		
C200	9	4	9	1	19'-11"	120		239		



- RECORD DRAWING NOTES:
1. THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
 2. ITEMS SHOWN ON THE "RECORD DRAWING" WITH CLOUDED NOTATION ARE ITEMS FOR WHICH AS-BUILT INFORMATION WAS AVAILABLE. ALL OTHER ITEMS ARE SHOWN FOR REFERENCE AS THEY WERE IN THE "ISSUED FOR CONSTRUCTION" PLAN SET.

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS
SEE FPGCUFFESCDX00000020100008

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www.stantec.com

REV.	NO.	DATE	BY	CHKD.	SUPV.	BY	APPD.	ISSD.	PROJECT	AS CONST.	REV.
R 1	06/25/11	RC	TMM	RV	MAH	SEB	MST	JCK			
R 2	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK			
R 3	03/11/11	RC	TMM	RV	MAH	SEB	MST	JCK			

SCALE: AS SHOWN
EXCEPT AS NOTED

YARD
ASH STILLING POND
SPILLWAY REPLACEMENT PROJECT
DETAILS - EMERGENCY SPILLWAY
WORK PLAN 7 (CUF-110311-WP-7)

DESIGNED BY: R. CORSA	DRAWN BY: T.M. MYERS	CHECKED BY: R. VERRASTRO	SUPERVISED BY: M.A. HOY	REVIEWED BY: S.E. BENNETT	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING						
AUTOCAD R 2000	DATE 03/11/11	46	C	10W286-13	R 2	

STANTEC
TASK COMPLETED BY:
REV. NO.PLOT FACTOR:1
W-TVAC.A.D. DRAWING
DO NOT ALTER MANUALLY

A

B

C

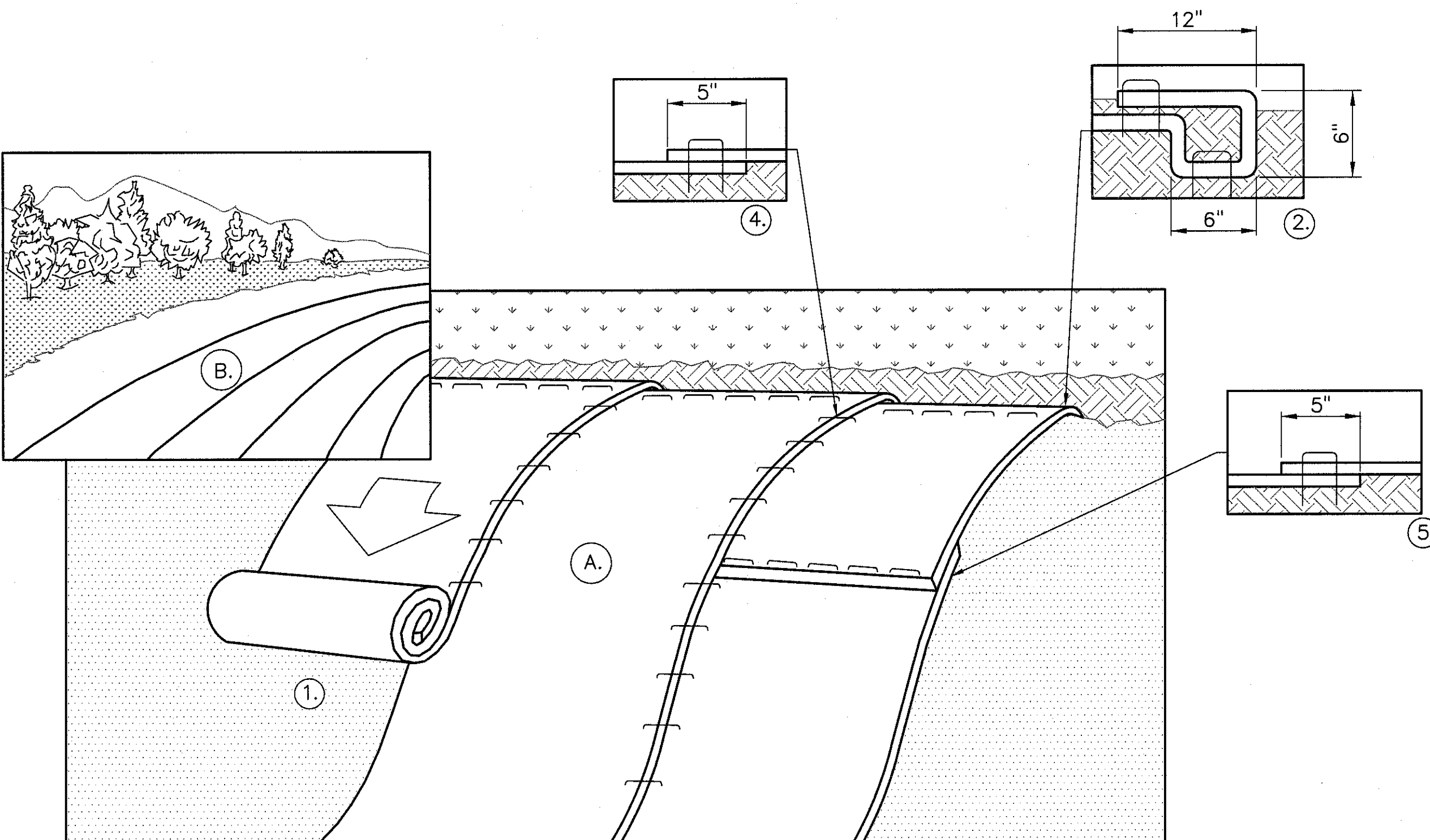
D

E

F

G

H



- NOTES:**
1. INSTALL ROLLED EROSION CONTROL PRODUCTS (RECPs) IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
 2. PREPARE SOIL BEFORE INSTALLING RECP'S, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER AND SEED.
 3. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECP'S IN A 6" DEEP BY 6" WIDE TRENCH WITH A MINIMUM OF 12" OF RECP'S EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP'S WITH A ROW OF STAPLES/STAKES AT A MAXIMUM OF 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF RECP'S BACK OVER SEED AND COMPACTED SOIL. SECURE RECP'S OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED AT A MAXIMUM OF 12" APART ACROSS THE WIDTH OF THE RECP'S.
 4. ROLL THE RECP'S (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. RECP'S WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP'S MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE.
 5. THE EDGES OF PARALLEL RECP'S MUST BE STAPLED WITH A MINIMUM OF 5" OVERLAP.
 6. CONSECUTIVE RECP'S SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH A MINIMUM OF 5" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, AT A MAXIMUM OF 12" APART ACROSS ENTIRE RECP'S WIDTH.

1 DETAIL — EROSION CONTROL BLANKET

14 NOT TO SCALE

NOTES:

1. INSTALL SILT FENCE IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
2. THE BOTTOM 12 INCHES OF THE FABRIC SHALL BE BURIED IN A 6-INCH TRENCH CUT INTO THE GROUND TO PREVENT SEDIMENT FROM ESCAPING UNDER THE FENCE. ALL EARTHWORK SHALL BE ON THE UPSTREAM SIDE OF THE FENCE.
3. GEOTEXTILE FABRIC SHALL MEET THE FOLLOWING SPECIFICATIONS: TENSILE STRENGTH (ASTM D 4632) — 100 LBS. MIN., WIDTH — 36" MIN., APPARENT OPENING SIZE (ASTM D4751) NO. 30. ULTRAVIOLET DEGRADATION (ASTM D 4355) 80% STRENGTH RETAINED. ELONGATION OF 40% MAX. (ASTM D 4632).

2 DETAIL — SILT FENCE

14 NOT TO SCALE

EROSION PREVENTION AND SEDIMENT CONTROL NOTES:

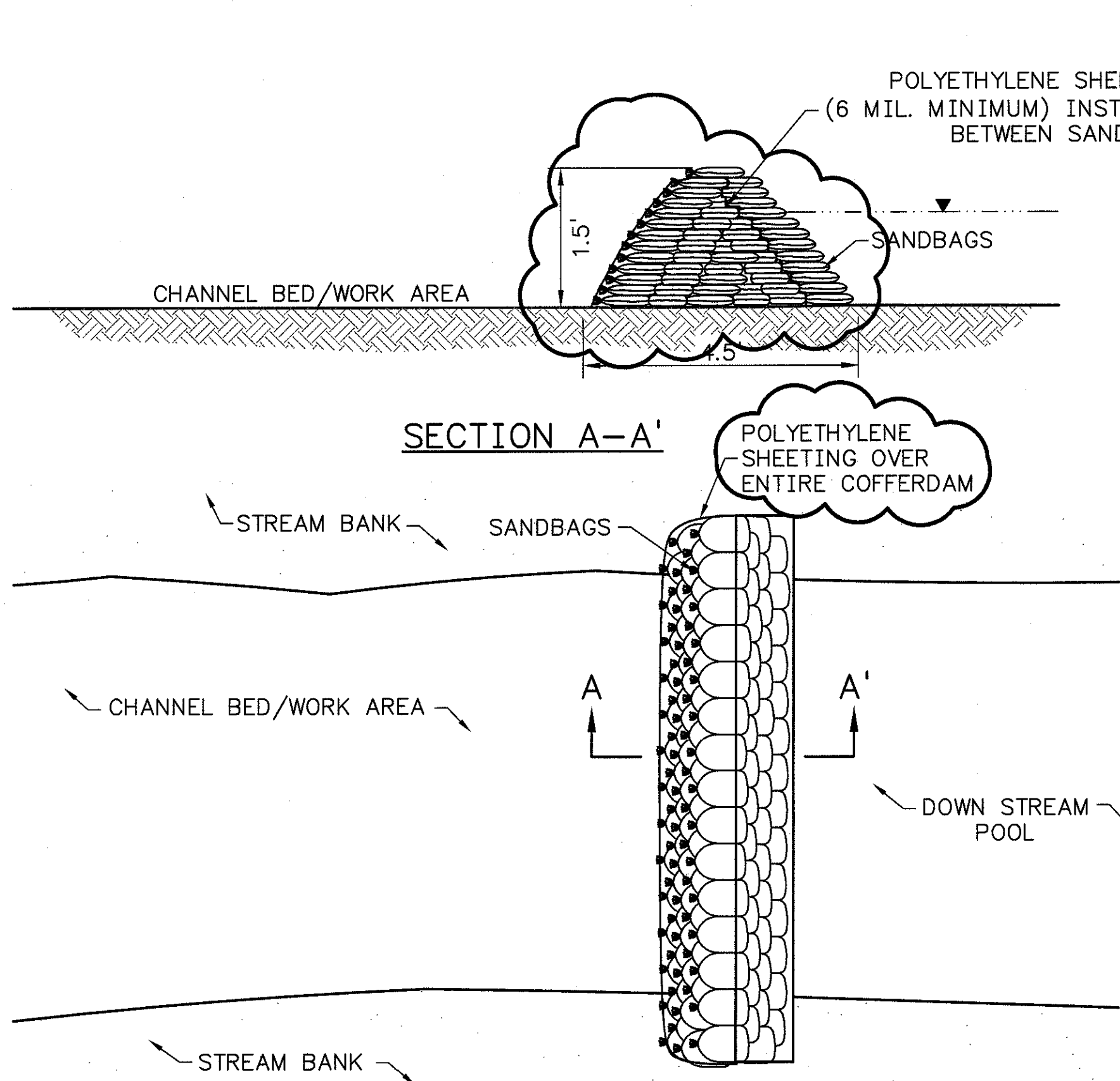
1. PRIOR TO BEGINNING CLEARING, GRUBBING, AND TOPSOIL STRIPPING ACTIVITIES, EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) BEST MANAGEMENT PRACTICES (BMP'S) SHALL BE INSTALLED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. ANY MODIFICATIONS OF EPSC MEASUREMENTS MUST BE REVIEWED AND APPROVED BY THE ENGINEER. IF DEEMED NECESSARY BY THE ENGINEER, ADDITIONAL EPSC BMP'S SHALL BE INSTALLED.
2. EPSC BMP'S SHALL BE MAINTAINED AT ALL TIMES IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. ANY DEFICIENCIES IDENTIFIED BY THE ENGINEER DURING INSPECTIONS SHALL BE REMEDIED IMMEDIATELY.
3. ACTIONS SHALL BE TAKEN TO MINIMIZE THE TRACKING OF MUD AND SOIL FROM THE PROJECT AREA ONTO THE EXISTING PLANT ACCESS ROAD. SOIL TRACKED ONTO THE ROADWAY SHALL BE REMOVED DAILY.
4. WHERE CONSTRUCTION OR LAND-DISTURBING ACTIVITIES HAVE TEMPORARILY CEASED ON ANY PORTION OF THE PROJECT SITE, TEMPORARY SITE STABILIZATION MEASURES SHALL BE IMPLEMENTED AS SOON AS PRACTICABLE, BUT NO LATER THAN 15 CALENDAR DAYS AFTER THE ACTIVITY HAS CEASED.
5. SEEDING, MULCHING, EROSION CONTROL BLANKET, AND FERTILIZATION OF DISTURBED AREAS SHALL BE IMPLEMENTED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS.

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

RECORD DRAWING NOTES:

1. THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
2. ITEMS SHOWN ON THE "RECORD DRAWING" WITH CLOUDED NOTATION ARE ITEMS FOR WHICH AS-BUILT INFORMATION WAS AVAILABLE. ALL OTHER ITEMS ARE SHOWN FOR REFERENCE AS THEY WERE IN THE "ISSUED FOR CONSTRUCTION" PLAN SET.

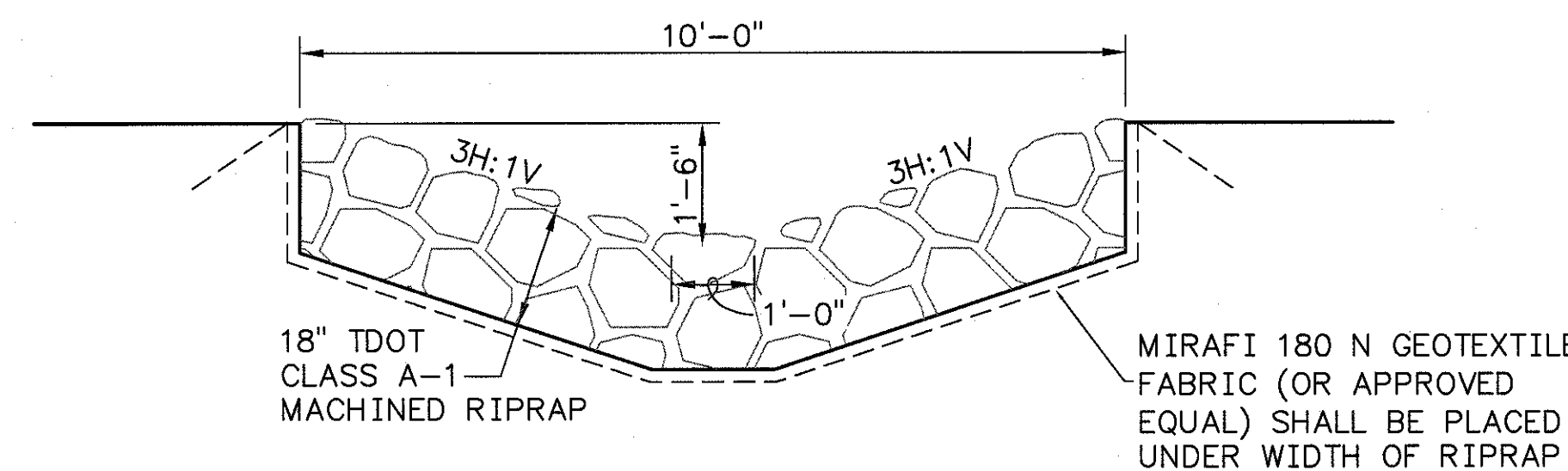


SECTION A-A'

PLAN

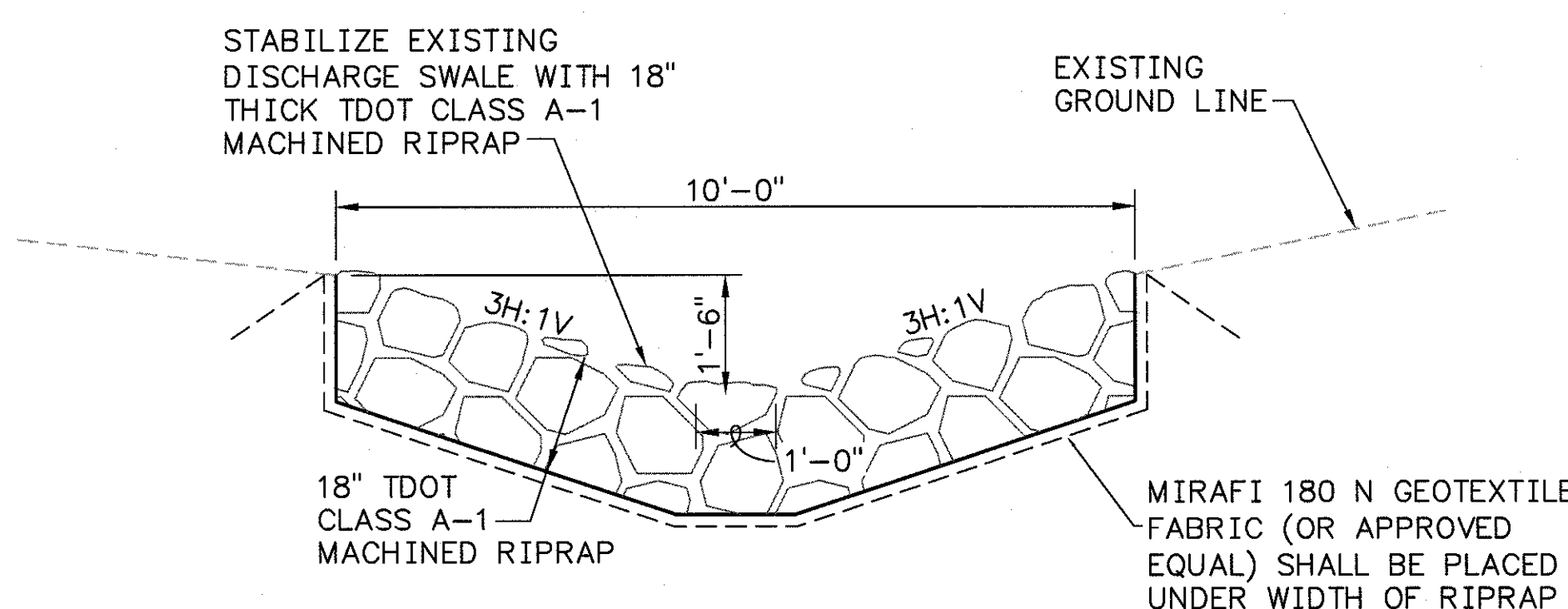
3 DETAIL — TEMPORARY COFFERDAM

14 NOT TO SCALE



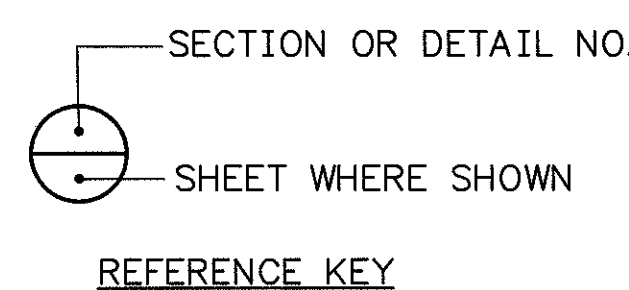
4 DETAIL — WET WEATHER SWALE

14 SCALE: 1/2"=1'-0"

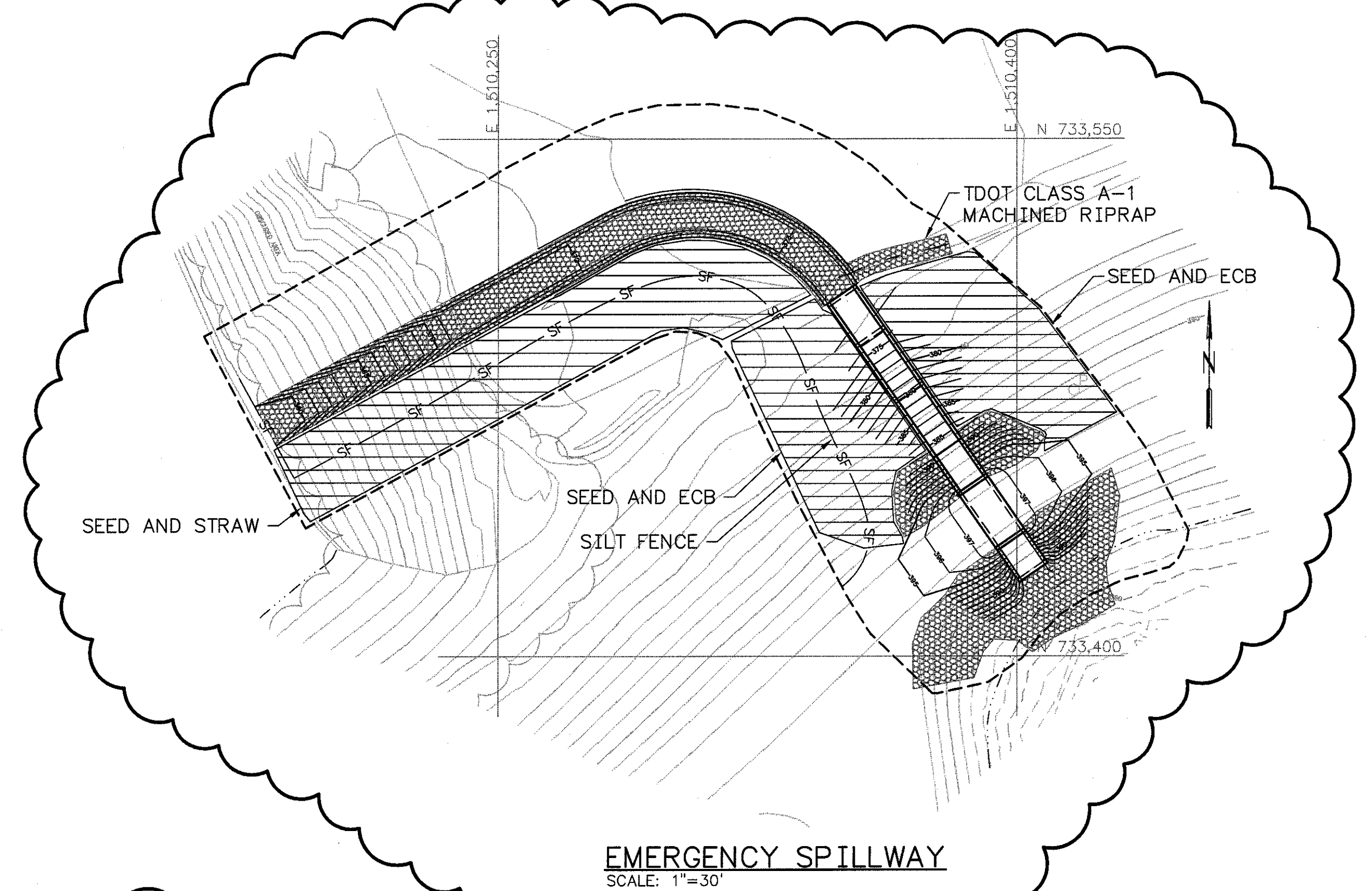


5 DETAIL — DISCHARGE SWALE

14 SCALE: 1/2"=1'-0"

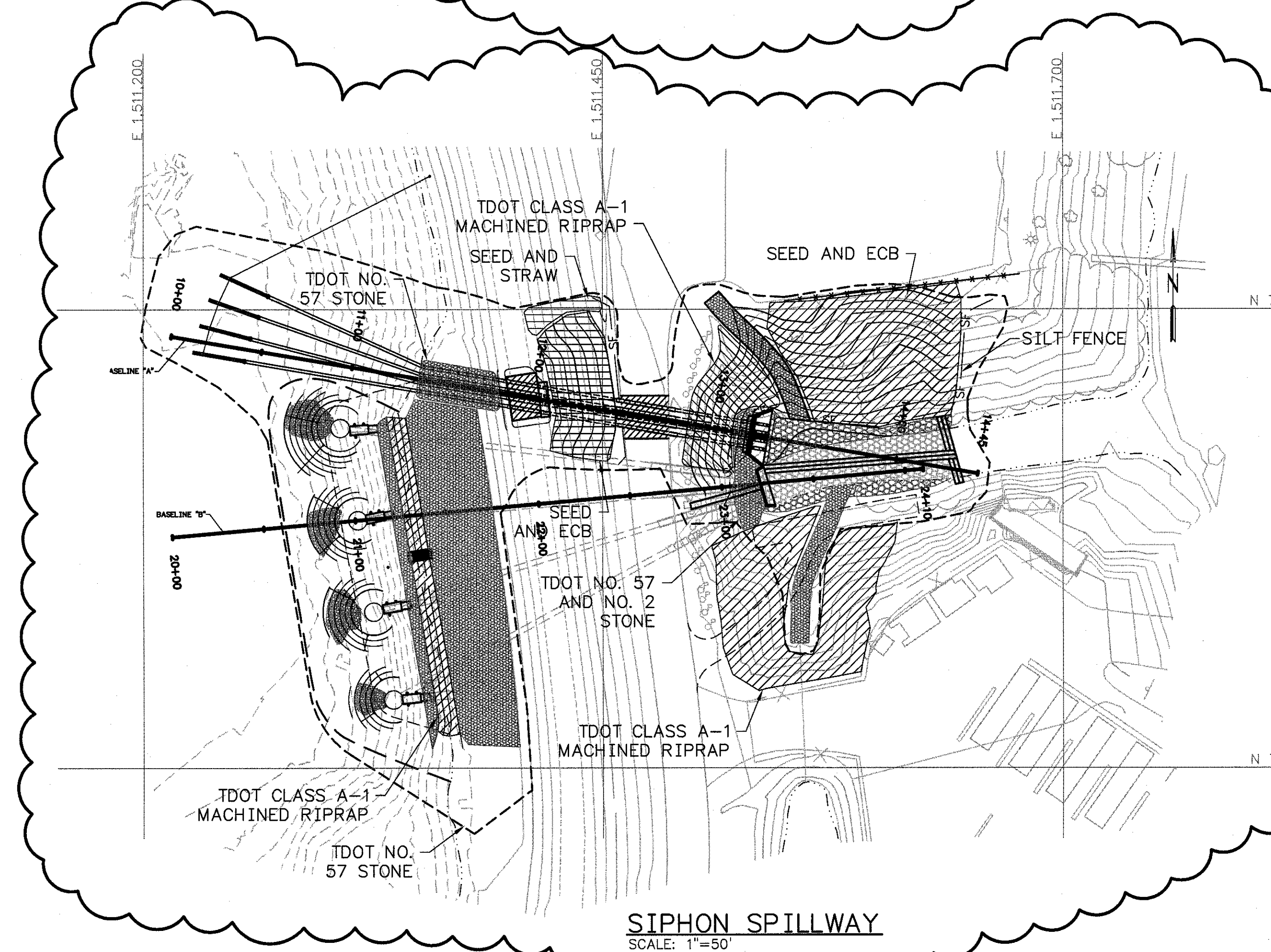


REFERENCE KEY



EMERGENCY SPILLWAY

SCALE: 1"=30'



SIPHON SPILLWAY

SCALE: 1"=50'

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGCUFFESCDX00000020100008	 5/4/12	R 1	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	-	DISCIPLIN INTERFACIN	
		ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7)														
 Stantec Services Inc. 1859 Bowles Ave., Ste 250 St. Louis, Missouri 63102-1044 Tel. 636.343.3880 Fax 636.343.3554 www.stantec.com	 Stantec	R 0	03/11/11	LJP	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	-	DISCIPLIN INTERFACIN	
		ISSUED FOR CONSTRUCTION														
		REV. NO.	DATE	DESIGN	DRAWN	CHECK	SUPPLY	REVIEW	APPRO	ISSD	PROJECT CUST	AS CONST	REV. NO.			
		SCALE: AS SHOWN											EXCEPT AS NOTED			
		YARD ASH STILLING POND														
SPILLWAY IMPROVEMENT PROJECT																
EPSC																
WORK PLAN 7 (CUF-110311-WP-7)																
 Stantec		DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:		REVIEWED BY:		APPROVED BY:		ISSUED BY:					
		L.J. PERKINS	T.M. MYERS	M.A. HOY	S.H. BICKEL		S.E. BENNETT		M.S. TURNBOW		J.C. KAMMEYER					
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING																
AUTOCAD R 2000		DATE	03/11/11	46	C	10W286-14						R 1				

STANTEC

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TASK COMPLETED BY: REV NO.

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

RECORD DRAWING NOTES:

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STN-53/53A, 53B

STN-54/54A

PIEZOMETER PAD
ADDED

STN-51

STN-52/52A

APPROXIMATE
LOCATION

SB-1

SB-2

SB-3

STN-61

STN-59/59A, 59B/60

APPROXIMATE
SURVEY EXTENTS
(SEE MAPPING
NOTE)

BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEV. (FT.)	BORING TYPE
**SB-1	733,043.82	1,511,354.49	386.0	SAMPLE
**SB-2	732,895.08	1,511,375.22	386.0	SAMPLE
**SB-3	732,830.36	1,511,382.57	386.0	SAMPLE
STN-51	733,191.78	1,510,006.75	378.8	SAMPLE
STN-52	733,149.40	1,510,045.62	394.9	SAMPLE
STN-52A	733,146.52	1,510,042.84	394.9	SAMPLE
STN-53	733,453.67	1,510,310.59	376.0	SAMPLE
*STN-53A	733,456.66	1,510,307.93	376.0	PZ
*STN-53B	733,450.68	1,510,313.25	376.0	PZ
STN-54	733,419.93	1,510,374.67	395.0	SAMPLE/SI
*STN-54A	733,417.30	1,510,371.66	395.0	PZ
STN-59	732,780.76	1,511,517.22	383.0	SAMPLE
*STN-59A	732,784.76	1,511,517.22	383.0	SAMPLE
*STN-59B	732,776.76	1,511,517.22	383.0	SAMPLE
STN-60	732,776.76	1,511,517.22	383.0	SAMPLE
STN-61	732,791.74	1,511,462.11	383.0	SAMPLE

*ESTIMATED BASED ON OFFSETS FROM ORIGINAL BORINGS.

**APPROXIMATE LOCATION

"PZ" DENOTES PIEZOMETER

"SI" DENOTES SLOPE INCLINOMETER

GEOTECHNICAL NOTE:

1. THE BORING LOGS AND RELATED INFORMATION SHOWN ON THIS DRAWING DEPICT GENERAL AND APPROXIMATE SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC BORING LOCATIONS NOTED AND AT THE TIME OF DRILLING. CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM THOSE OCCURRING AT THE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE SUBSURFACE CONDITIONS AT THE BORING LOCATIONS. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE GENERALLY BASED ON STRAIGHT LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.

2. THE GEOTECHNICAL INFORMATION AND DATA FURNISHED HEREIN ARE NOT INTENDED AS REPRESENTATION OR WARRANTIES BUT ARE FURNISHED FOR INFORMATION ONLY. IT SHALL BE DISTINCTLY UNDERSTOOD THAT THE OWNER OR ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DEDUCTION, INTERPRETATION, OR CONCLUSION DRAWN THEREFROM. THE INFORMATION IS MADE AVAILABLE IN ORDER THAT THE CONTRACTOR MAY HAVE READY ACCESS TO THE SAME INFORMATION AVAILABLE TO THE OWNER AND THE ENGINEER AND IS NOT PART OF THIS CONTRACT.

MAPPING NOTE:

THESE DRAWINGS WERE COMPILED USING SURVEY INFORMATION PROVIDED BY TVA. TOPOGRAPHIC SURVEY POINT FILE PCF572.XYZ DATED 11/30/2009 (OUTLINED AREA ON PLANVIEW), HYDROGRAPHIC SURVEY POINT FILE PCF572.SND DATED 09/29/2009 (ASH STILLING POND CONTOURS), AND HYDROGRAPHIC SURVEY POINT FILE JSR631.SND DATED 09/22/2008 (ASH POND CONTOURS) WERE UTILIZED. TOPOGRAPHIC DATA FROM AN AERIAL SURVEY FLOWN IN APRIL OF 2009 WAS USED IN AREAS SHOWN OUTSIDE OF THE ABOVE REFERENCED SURVEY EXTENTS. HORIZONTAL COORDINATES ARE REFERENCED TO TENNESSEE STATE PLANE COORDINATE SYSTEM, NAD 27. ELEVATIONS ARE BASED ON NGVD 29.

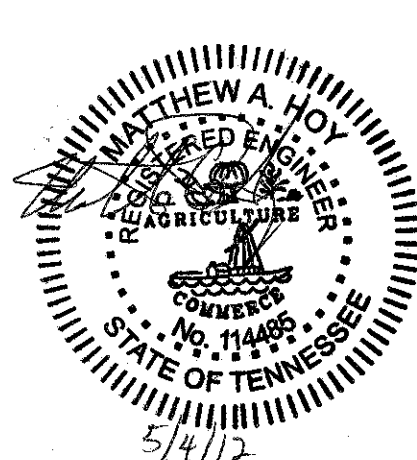
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LEGEND

- SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS
- SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS AND ROCK CORE
- EXISTING CONTOURS
- EXISTING HYDROGRAPHIC CONTOURS
- PROPOSED CONTOURS
- EXISTING WATER SURFACE
- LIMITS OF DISTURBANCE
- APPROXIMATE SURVEY EXTENTS

FOR SUPPORTING DESIGN CALCULATIONS
SEE FPGCUFFESC0X00000020100008



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ISSUED	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	DISCIPLINE INTERFACE
R 01	03/11/11	LJP	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	
ISSUED FOR CONSTRUCTION												
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RWMD	APPR	ISSD	PROJECT ID	AS CONST	REV. NO.	
SCALE: 1"=50'												
EXCEPT AS NOTED												
YARD ASH STILLING POND												
SPILLWAY IMPROVEMENT PROJECT GEOTECHNICAL EXPLORATION WORK PLAN 7 (CUF-110311-WP-7)												
DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:						
L.J. PERKINS	T.M. MYERS	M.A. HOY	S.H. BICKEL	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER						
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING												
AUTOCAD R 2000	DATE	03/11/11	46	C	10W286-15	R 1						

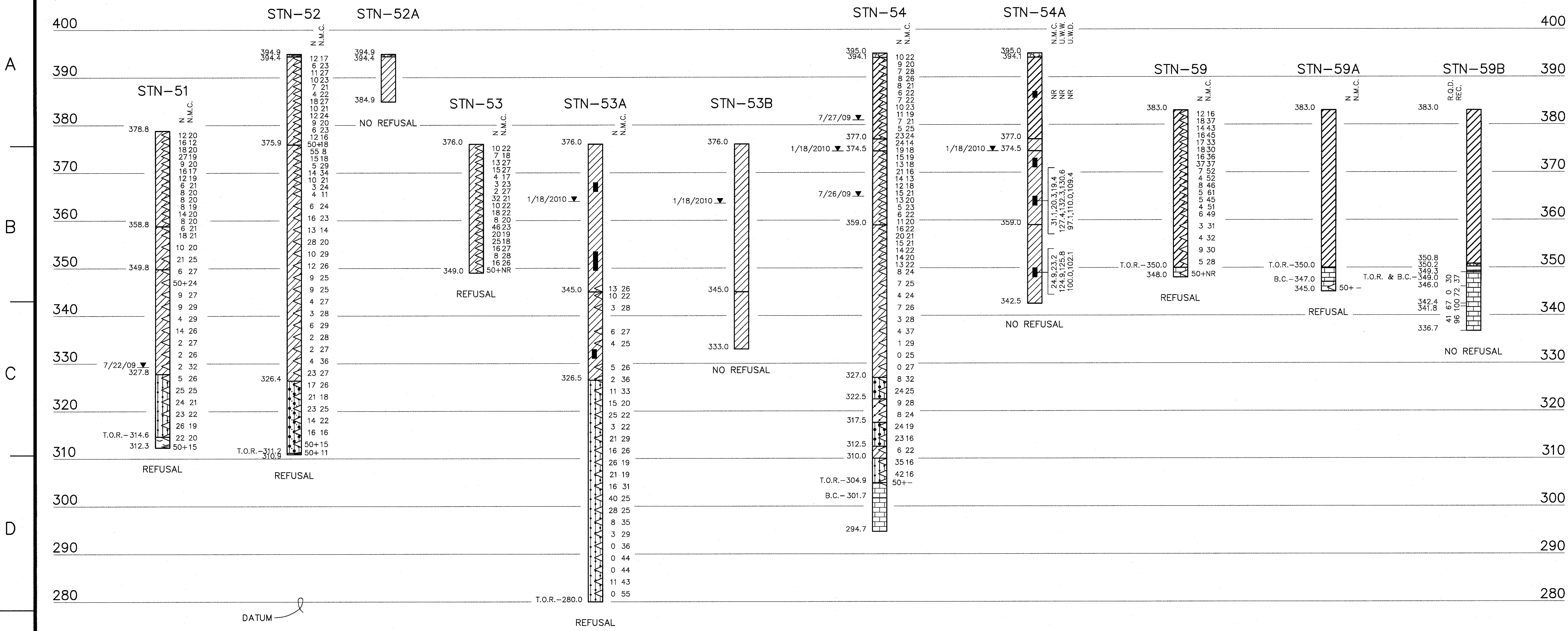
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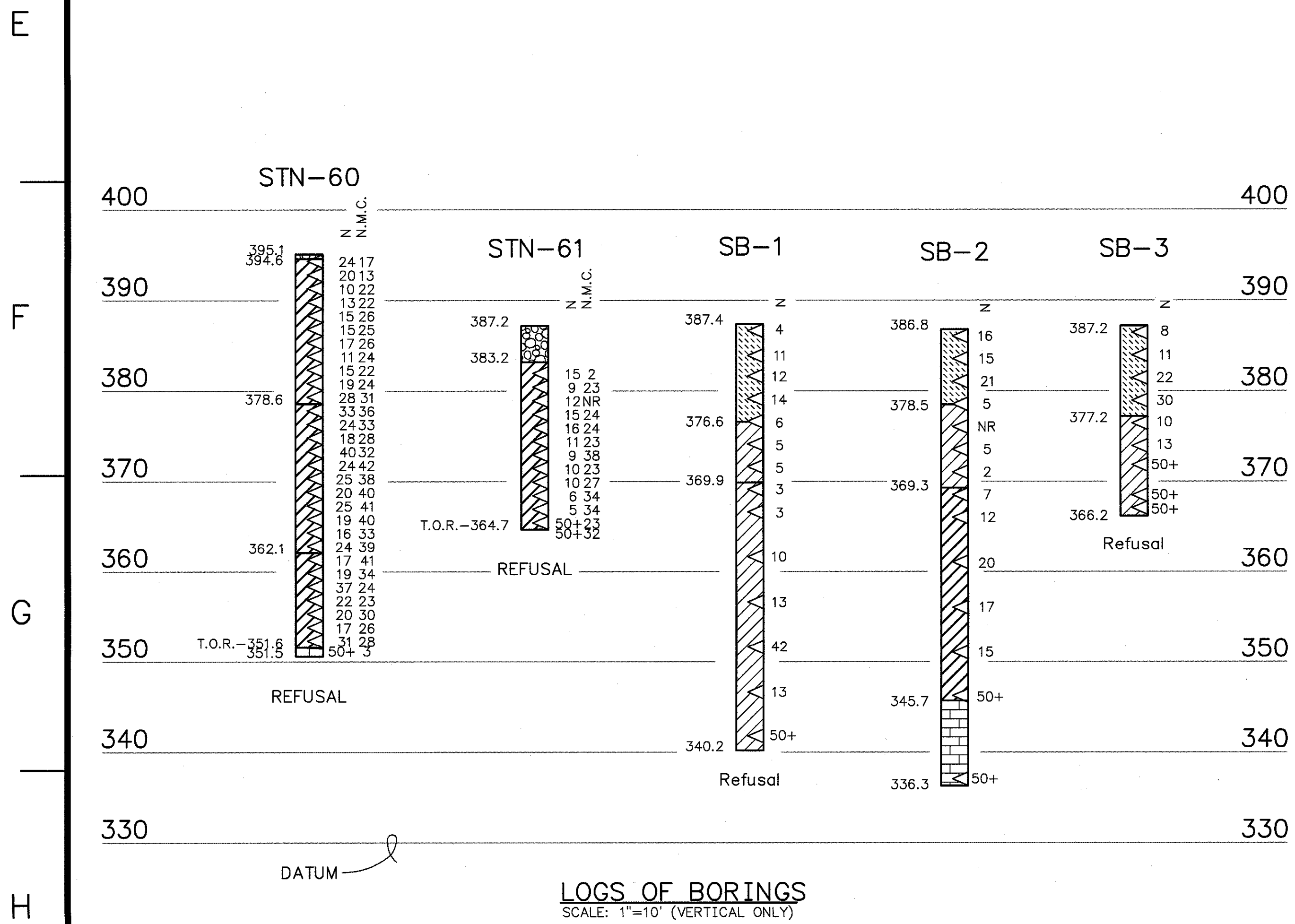
TASK COMPLETED BY: REV NO.

PLOT FACTOR:50
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



- LEGEND**
- FLY ASH, GRAY TO DARK GRAY, DAMP TO WET, SOFT.
 - LEAN CLAY, LIGHT BROWN, RED-BROWN AND GRAY (VARIES), DAMP TO WET, VERY SOFT TO VERY STIFF, SOMETIMES MOTTLED.
 - FAT CLAY, DARK TO REDDISH BROWN, LITTLE TO SOME SAND, DAMP TO WET, SOFT TO VERY STIFF.
 - SILTY SAND, BROWN, WET, LOOSE TO VERY DENSE.
 - CLAYEY SAND, DARK GRAY TO GRAY-BROWN, SOME GRAVEL, DAMP TO WET, LOOSE TO VERY DENSE.
 - SILTY GRAVEL, BROWN, WET, LOOSE TO DENSE.
 - CLAYEY GRAVEL, DARK GRAY TO OLIVE-BROWN, DAMP TO WET, LOOSE TO MEDIUM DENSE.
 - SHALE, GRAY TO DARK GRAY, SOFT, HIGHLY TO COMPLETELY WEATHERED.
 - LIMESTONE, VERY LIGHT GRAY TO GRAY, WEATHERED, HARD.
 - ROCK/GRAVEL
 - TOPSOIL
 - STANDARD PENETRATION TEST INTERVAL
 - UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
 - STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB SAFETY HAMMER (BLOWS/FT)
 - NATURAL MOISTURE CONTENT (%)
 - DAMAGED TUBE, NO SPECIMEN
 - LITTLE TO NO RECOVERY
 - WATER LEVEL AND DATE RECORDED
 - TOP OF ROCK (INDICATES THE BEGINNING OF ROCK-LIKE RESISTANCE TO THE ADVANCEMENT OF THE AUGERS. THIS MAY INDICATE THE BEGINNING OF WEATHERED BEDROCK, BOULDERS OR ROCK REMNANTS. AN EXACT DETERMINATION CANNOT BE MADE WITHOUT PERFORMING ROCK CORING.)
 - BEGIN ROCK CORE
 - ROCK QUALITY DESIGNATION (%)
 - RECOVERY (%)
 - AUGER REFUSAL USING A CARBIDE-TIPPED TOOTH AUGER BIT
 - NO REFUSAL ENCOUNTERED
- LEGEND**
- SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS
 - SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS AND ROCK CORE



GEOTECHNICAL NOTE:

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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGCUFFESCDX00000020100008		R 1 05/04/12 PRV TMM MAH SHB SEB MST JCK - - - ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7) R 0 03/11/11 LUP TMM MAH SHB SEB MST JCK - - - ISSUED FOR CONSTRUCTION												
SCALE: 1"=10'		EXCEPT AS NOTED												
YARD ASH STILLING POND														
SPILLWAY IMPROVEMENT PROJECT LOGS OF BORINGS WORK PLAN 7 (CUF-110311-WP-7)														
DESIGNED BY: L. PERKINS DRAWN BY: T. MYERS CHECKED BY: M. HOY SUPERVISED BY: S.H. BICKEL REVIEWED BY: S.E. BENNETT PROJECT ID: M.S. TURNBOW ISSUED BY: J.C. KAMMEYER														
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING														
AUTOCAD R 2000		DATE: 03/11/11	46	C	10W286-16					R 1				

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GENERAL PROVISIONS:

1. THE PROPOSED PROJECT SHOWN ON REVISION SHEETS 10W286-17, 10W286-18, AND 10W286-19 INCLUDES THE INSTALLATION OF A GRADED FILTER ON THE DOWNSTREAM END OF THE EXISTING STILLING POND SPILLWAY OUTLET PIPES TO ADDRESS CONCERNS WITH INTERNAL EROSION DUE TO SEEPAGE OBSERVED ALONG THE EXTERIOR OF THE OUTLET PIPES.
2. REFER TO THE TECHNICAL SPECIFICATIONS THAT ARE PART OF THE CUF-110311-WP-7 REVISION 0 SUBMITTAL.
3. CONTRACTOR SHALL PROVIDE SHOP DRAWINGS OF PROPOSED WALKWAY PRIOR TO FABRICATION.
4. MATERIAL CERTIFICATIONS STATING THAT THE MATERIALS MEET THE SPECIFICATION REQUIREMENTS FOR ALL GRADED FILTER MATERIALS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION OF THE GRADED FILTER. SAMPLES OF EACH FILTER LAYER SHALL BE PROVIDED TO THE ENGINEER FOR CONFORMANCE TESTING DURING INSTALLATION.

COORDINATE TABLE:

1. COORDINATE LOCATIONS ARE APPROXIMATE, CONTRACTOR TO ADJUST LOCATIONS AS NECESSARY TO MATCH FIELD CONDITIONS.

COORDINATE TABLE				
COORDINATE REFERENCE	DESCRIPTION	NORTHING	EASTING	ELEV.
C1A	OUTLET HEADWALL	1511533.14	733012.01	363.74'
C1B	OUTLET HEADWALL	1511538.83	732992.51	363.88'
C1C	PIPE FLOW-LINE	1511538.83	732994.95	359.89'
C1D	PIPE FLOW-LINE	1511537.28	733000.14	359.86'
C1E	PIPE FLOW-LINE	1511535.89	733005.03	359.85'
C1F	PIPE FLOW-LINE	1511534.52	733009.94	359.82'

LEGEND

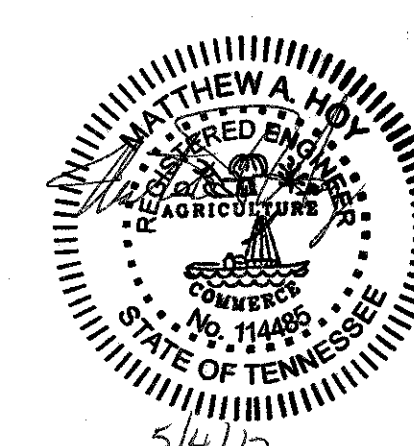
- 390 EXISTING CONTOURS
- 350 EXISTING HYDROGRAPHIC CONTOURS
- 390 PROPOSED CONTOURS
- EXISTING WATER SURFACE
- PROPOSED PIEZOMETER

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS
SEE FPGCUFFESC00000020100008



Stantec Consulting
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DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
T.W. WARD	T.M. MYERS	M.A. HOY	S.H. BICKEL	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE	01/20/12	46	C	10W286-17	R 1
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PLOT FACTOR:2
W-TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

RECORD DRAWING NOTES:

1. THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
2. ITEMS SHOWN ON THE "RECORD DRAWING" WITH CLOUDED NOTATION ARE ITEMS FOR WHICH AS-BUILT INFORMATION WAS AVAILABLE. ALL OTHER ITEMS ARE SHOWN FOR REFERENCE AS THEY WERE IN THE "ISSUED FOR CONSTRUCTION" PLAN SET.

PLAN - GRADED FILTER
SCALE: 1" = 2'

GRAPHIC SCALE: 1" = 2'
CONTOUR INTERVAL = 2'

STANTEC	1
TASK COMPLETED BY:	REV NO.

A

B

C

D

E

F

G

H

A

B

C

D

E

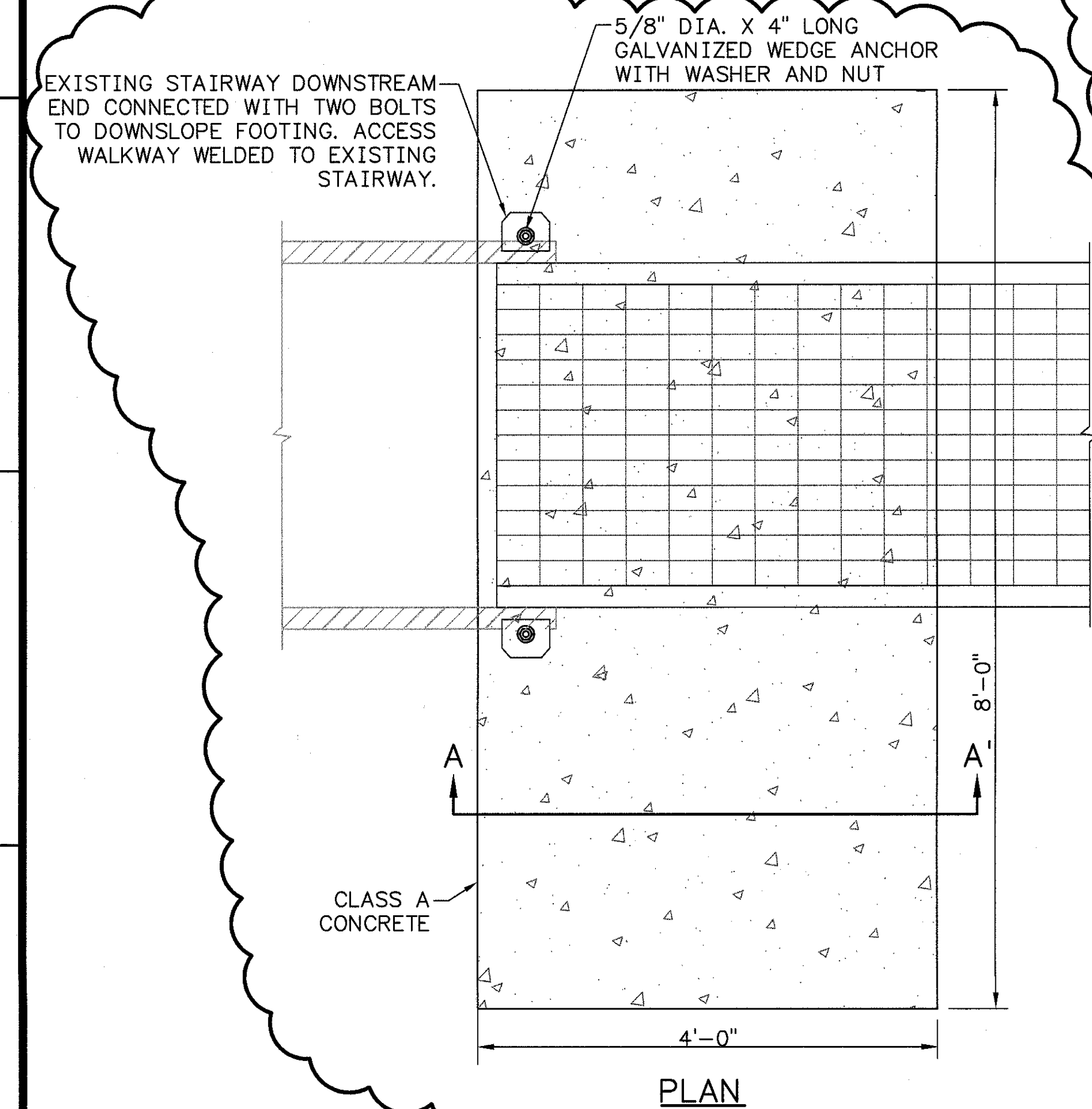
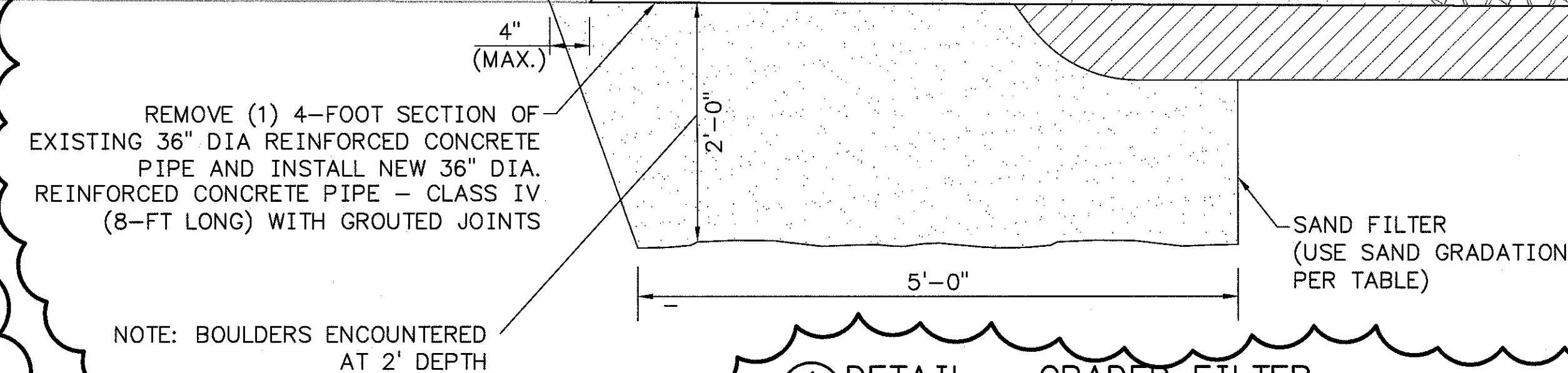
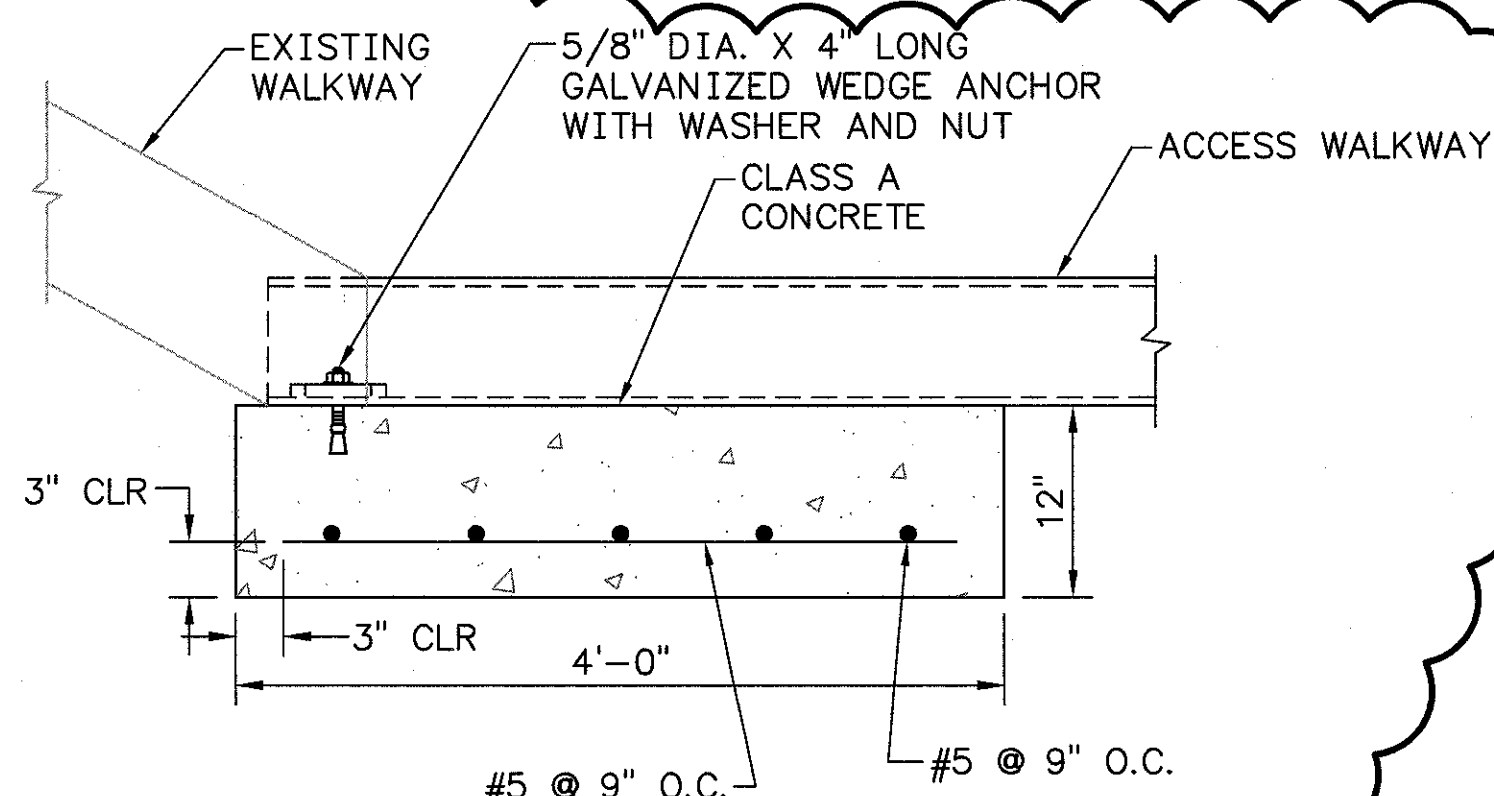
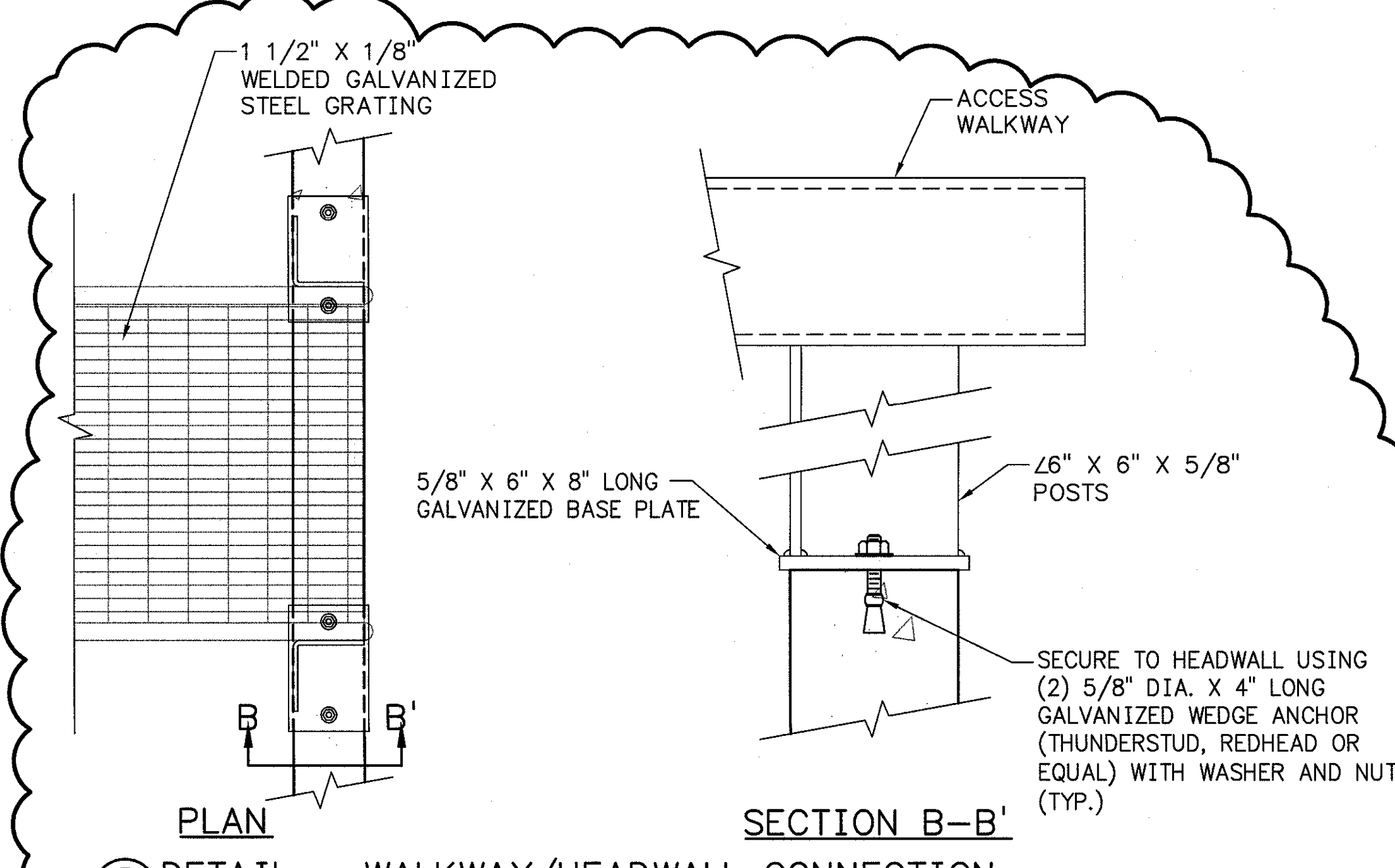
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GRADED FILTER:

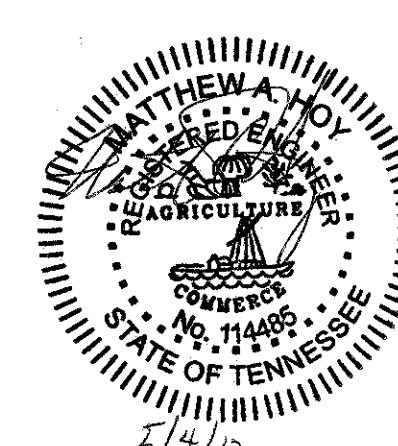
1. COMPACT SAND IN 12-INCH LIFTS USING 3 PASSES WITH A VIBRATING PLATE COMPACTOR. HAND TAMPER IS ACCEPTABLE IN CONFINED ZONE BETWEEN PIPES.
2. SAND FILTER SHALL EXTEND MINIMUM 3' Laterally BEYOND PIPE WALLS.
3. SAND FILTER SHALL HAVE A GRADATION CONSISTENT WITH THE SAND GRADATION TABLE BELOW.

SAND GRADATION

PARTICLE SIZE	PERCENT PASSING
1"	100
1/2"	90-100
1/4"	80-100
NO. 4 SIEVE	75-100
NO. 8 SIEVE	60-95
NO. 16 SIEVE	40-75
NO. 30 SIEVE	20-60
NO. 50 SIEVE	5-45
NO. 100 SIEVE	0-25
NO. 200 SIEVE	0-5

**2 DETAIL - WALKWAY FOOTING**
SCALE: 1"=1'**1 DETAIL - GRADED FILTER**
SCALE: 1"=2'**SECTION A-A****3 DETAIL - WALKWAY/HEADWALL CONNECTION**
SCALE: N.T.S.**RECORD DRAWING NOTES:**

1. THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION OBTAINED BY TVA SURVEYING IN APRIL 2012 AND PROVIDED TO STANTEC ON APRIL 10, 2012.
2. ITEMS SHOWN ON THE "RECORD DRAWING" WITH CLOUDED NOTATION ARE ITEMS FOR WHICH AS-BUILT INFORMATION WAS AVAILABLE. ALL OTHER ITEMS ARE SHOWN FOR REFERENCE AS THEY WERE IN THE "ISSUED FOR CONSTRUCTION" PLAN SET.

RECORD DRAWINGFOR SUPPORTING DESIGN CALCULATIONS
SEE FPGCUFFESCDX00000020100008

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R 1	05/04/12	PRV	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	-	DISCIPLIN INTERFACIN	
ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7)														
R 0	01/20/12	TWW	TMM	MAH	SHB	SEB	MST	JCK	-	-	-	-		
ISSUED FOR CONSTRUCTION														
REV	NO.	DATE	ISSN	DRWN	CHKD	SUPV	RVND	APPD	ISSD	PROJECT ID	AS CONST	DATE		
SCALE: AS SHOWN												EXCEPT AS NOTED		
YARD ASH STILLING POND														
SPILLWAY IMPROVEMENT PROJECT DETAILS - GRADED FILTER WORK PLAN 7 (CUF-110311-WP-7)														
DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:								
T.W. WARD	T.M. MYERS	M.A. HOY	S.H. BICKEL	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER								
CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING														
AUTOCAD R 2000		DATE	01/20/12	46	C	10W286-18						R 1		

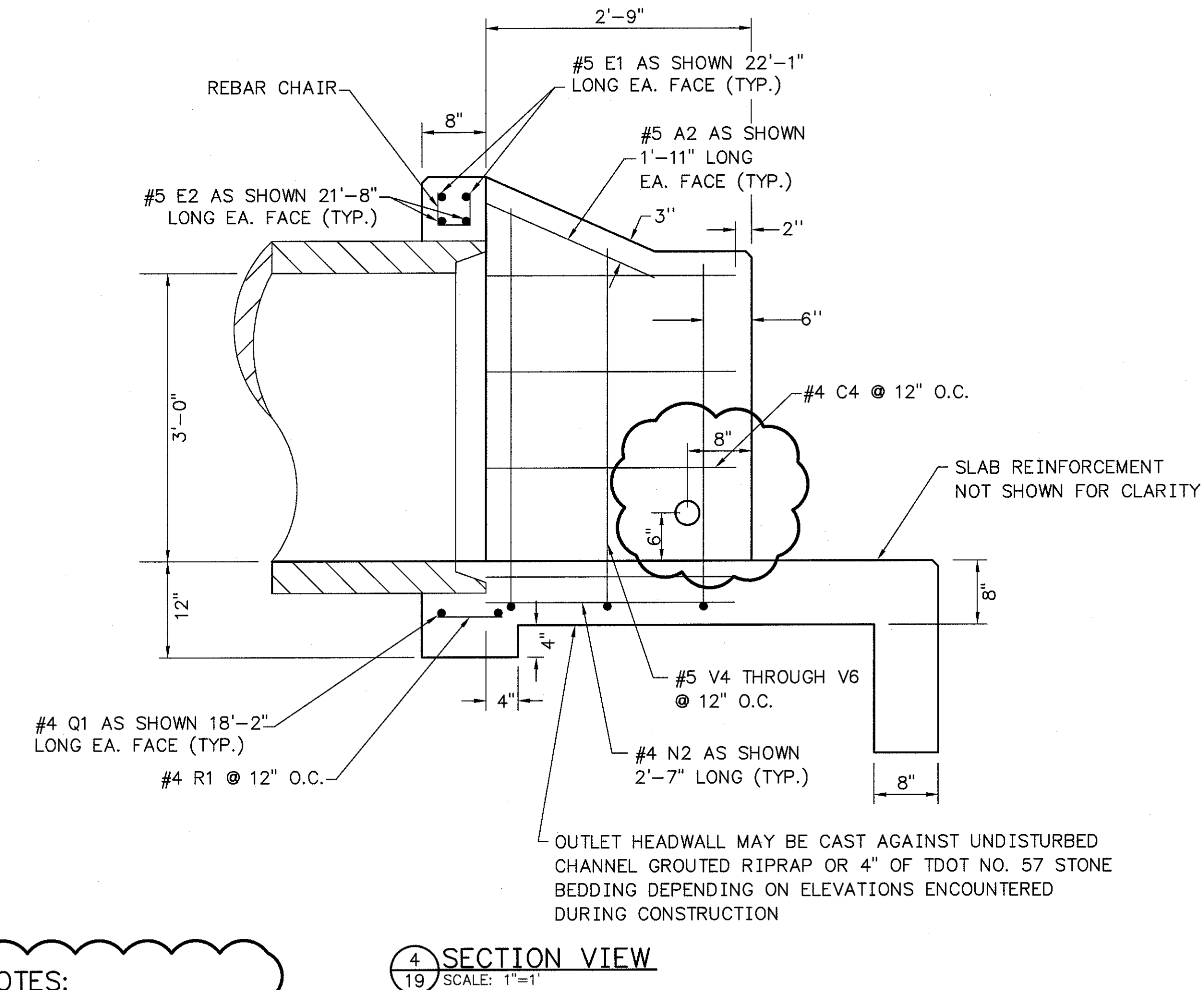
STANTEC

1

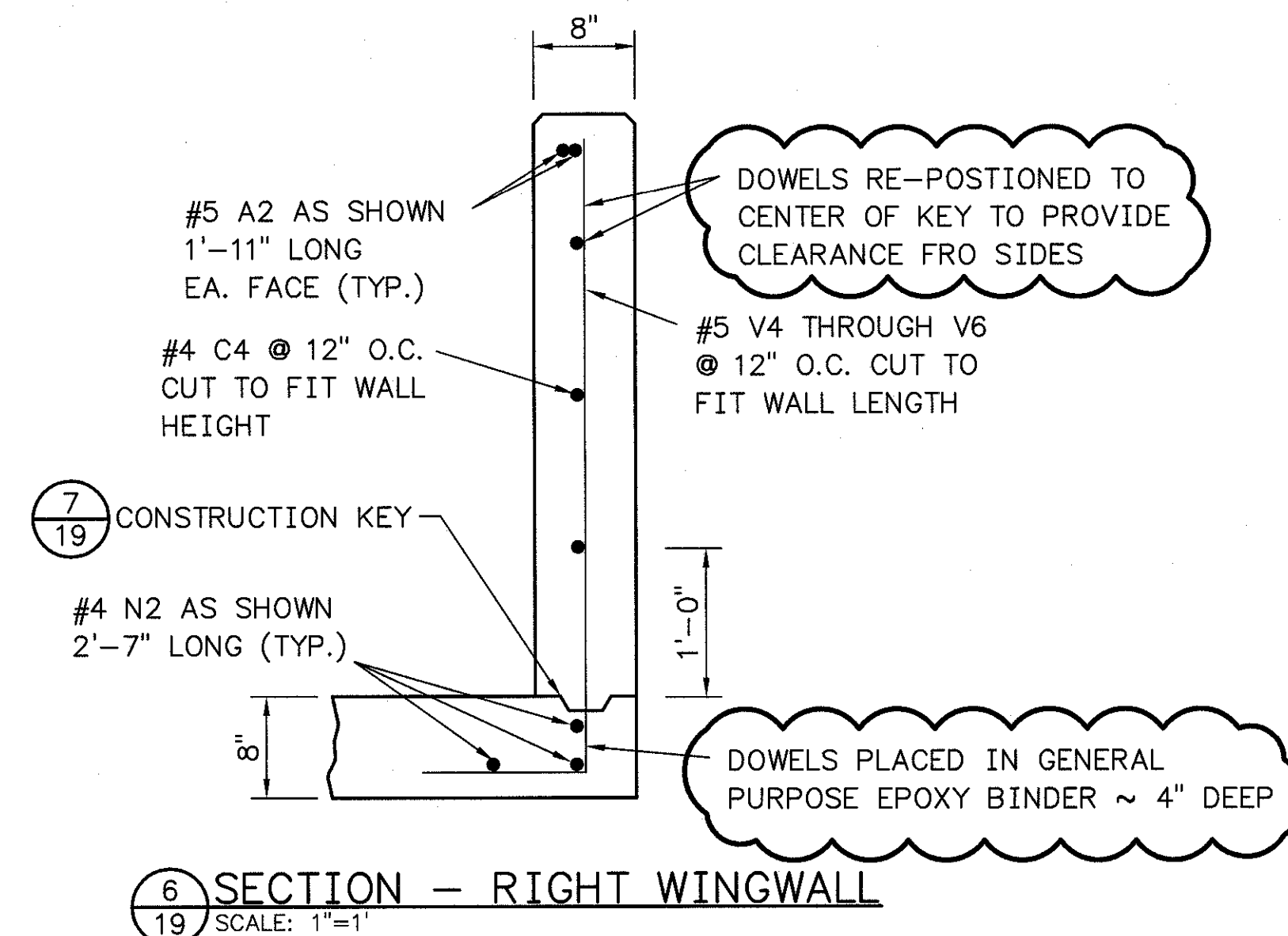
TASK COMPLETED BY:

REV NO.

PLOT FACTOR:1
W_TVAC.A.D. DRAWING
DO NOT ALTER MANUALLY

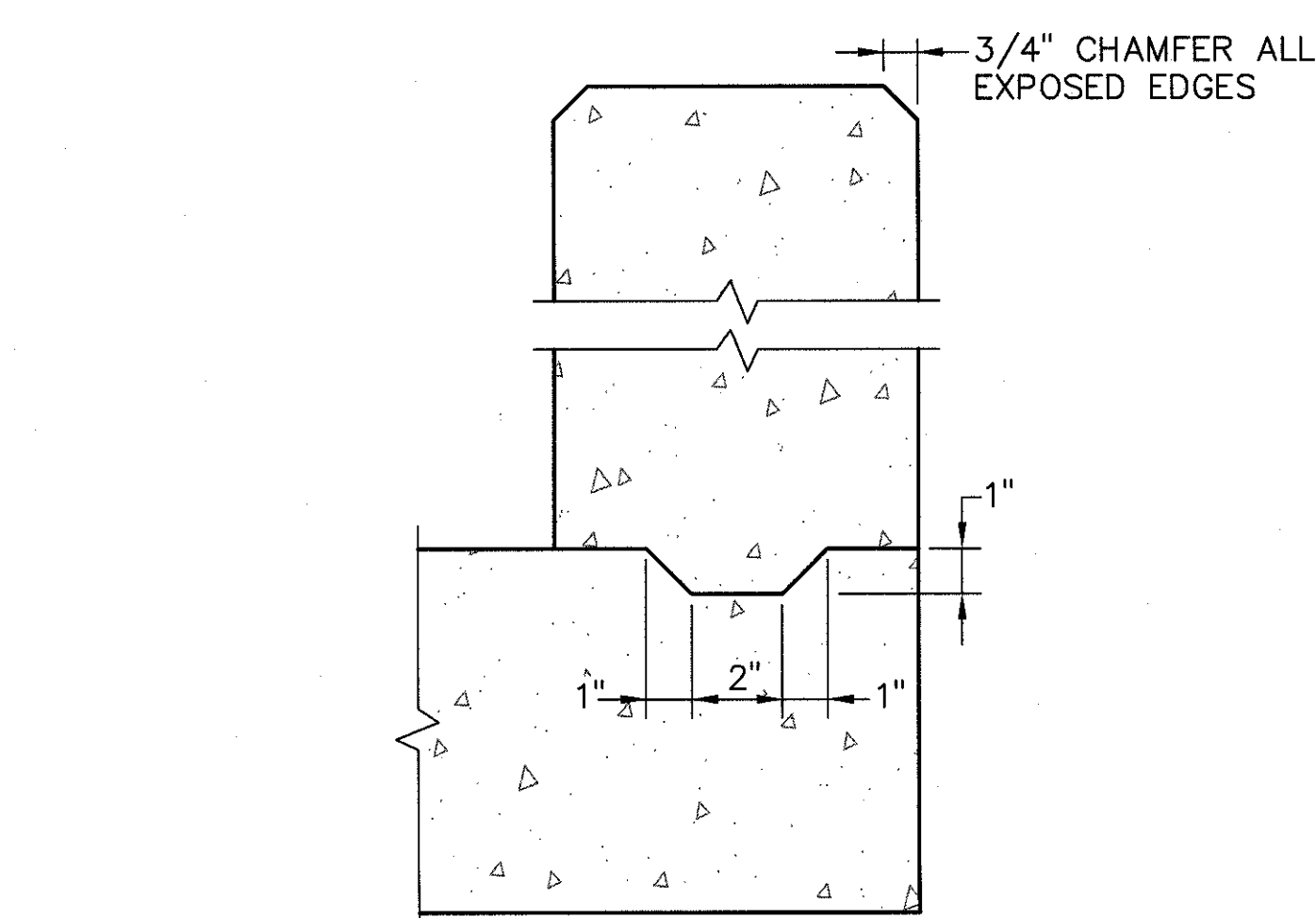
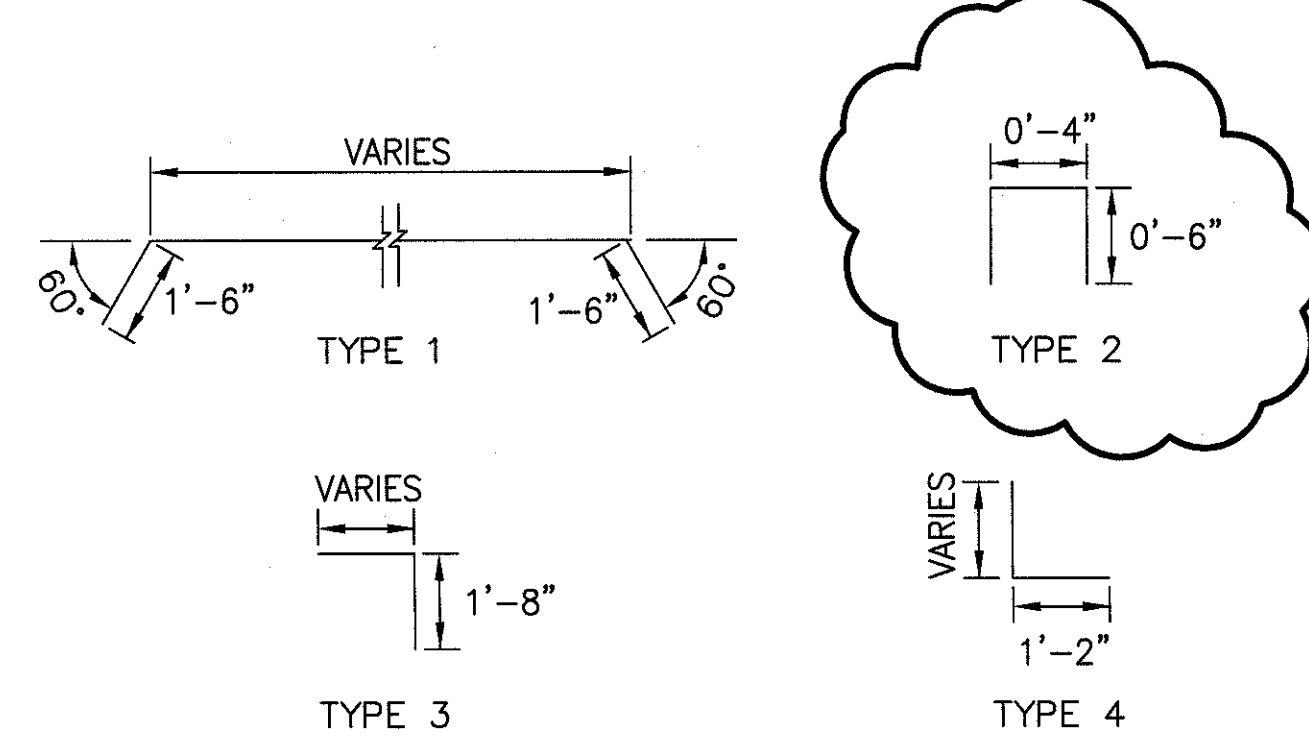


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NOTES:

1. BARS V1 THROUGH V6 ARE PLACED IN ORDER OF INCREASING LENGTHS, BEGINNING AT THE END OF EACH WING.
2. BARS C2 THROUGH C6 ARE PLACED IN ORDER OF INCREASING LENGTHS, BEGINNING AT THE TOP OF EACH WING.
3. APRON BETWEEN WINGS SHALL BE SLOPED IN DIRECTION OF FLOW EQUAL TO SLOPE OF PIPE. FRONT FACE OF HEADWALL AND ENDS OF WINGS SHALL REMAIN VERTICAL.
4. DIMENSIONS FROM FACE OF CONCRETE TO STEEL SHALL BE 2" CLEAR DISTANCE.
5. ALL CONCRETE AND REINFORCING STEEL SHALL BE IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.

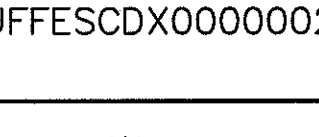


SECTION OR DETAIL NO.

SHEET WHERE SHOWN

REFERENCE KEY

RECORD DRAWING

 5/4/12		FOR SUPPORTING DESIGN CALCULATIONS SEE FPGCUFFSCDX00000020100008 R 1 05/04/12 PRV TMM MAH SHB SEB MST JCK - - - - ISSUED AS-BUILT AS PER WORK PLAN 7 (CUF-110311-WP-7) R 0 01/20/12 TWW TMM MAH SHB SEB MST JCK - - - - ISSUED FOR CONSTRUCTION DISCIPLINE INTERVIEW											
		REV NO. DATE DESIGN DRAWN CHECKED SUPPLY REVISED APPROVED ISSUED PROJECT ID AS CONST. SCALE: AS SHOWN EXCEPT AS NOTED											
		YARD ASH STILLING POND SPILLWAY REPLACEMENT PROJECT DETAILS – OUTLET HEADWALL WORK PLAN 7 (CUF-110311-WP-7)											
 Stantec Consulting Services Inc. 1850 Bowles Ave., Ste 250 St. Louis, Missouri 63025-1944 Tel: 636.343.3880 Fax: 636.343.3554 www.stantec.com		DESIGNED BY: T.W. WARD DRAWN BY: T.M. MYERS CHECKED BY: M.A. HOY SUPERVISED BY: S.H. BICKEL REVIEWED BY: S.E. BENNETT APPROVED BY: M.S. TURNBOY ISSUED BY: J.C. KAMMEYER CUMBERLAND FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING											
		REV AUTOCAD R 2000 DATE 01/20/12 46 C 10W286-19 R 1											

Cumberland Fossil Plant Pizer Structures at settling Pond Bearing Capacity Calculation.

April 25, 2016

Performed by: Arunay Chakravarty (ARU)

Checked by:

Summary

<u>Allowable Bearing Capacity.</u>		
Vesic Method (using ϕ & c)	3600 psf	(see page 3.)
Vesic method. (using only c)	2250 psf (2256 Roud to 2250 psf.)	← USP Fig. 3. (see Page 4)
Hand Calculation - Method 1 (using ϕ & c)	3835 psf	(See Page 5)
Hand Calculation - Method 2 (Classical)	2650 psf.	(See Page 6)

Soil Properties.

$$\gamma_{sat} = 119 \text{ psf} \quad (\text{see page 15})$$

$$\phi_f = 22^\circ \quad (\text{see page 15})$$

$$\delta = 18 \quad (\text{see Page 8})$$

$$P_b = 2250 \text{ psf.} \quad (\text{see Page 4})$$

BEARING CAPACITY BY VESIC'S METHOD

Reference: Das, "Fundamentals of Geotechnical Engineering," Section 12.2

Name TVA/CUF Still Pond Riser Structures
 Date 04/25/16
 Identification CUF Stilling Pond Riser Structures

Input

Units of Measurement

E SI or E

$\gamma_w = 62.40$ lb/ft³

Foundation Information

Loading

Shape SQ SQ, CI, CO, or RE

B = 6.00 ft

L = 6.00 ft

$D_f = 14.00$ ft

$e_B = 0.00$

$e_L = 0.00$

$\beta(\text{deg}) = 20.00$

Soil Information

c = 200.00 lb/ft²

$\phi = 22.00$ deg

$\gamma_1 =$

$\gamma_{1\text{sat}} = 119.0$ lb/ft³

Soil Above Foundation Base

$\gamma_2 =$

$\gamma_{2\text{sat}} = 119.0$ lb/ft³

Soil Below Foundation Base

$D_w = 0.00$ ft

Depth of Water Below Ground Surface

Factor of Safety

F = 3.00

Calculations

$\phi(\text{deg}) = 22.00$	$N_c = 16.88$	B = 6.00	$e_B = 0.00$	$B' = 6.00$
$\phi(\text{rad}) = 0.38$	$N_q = 7.82$	L = 6.00	$e_L = 0.00$	$L' = 6.00$
$\beta(\text{deg}) = 20.00$	$N_\gamma = 7.13$	A = 36.00	$D_f/B = 2.33$	$A' = 36.00$

c	N_c	Fcs	Fcd	Fci	q_u	Q_u
200.00	16.88	1.46	1.47	0.60	4383 lb/ft ²	158 k
q	N_q	Fqs	Fqd	Fqi		
792.40	7.82	1.40	1.37	0.60	7203 lb/ft ²	259.3 k
γ	B	N_γ	Fys	Fyd	Fyi	
56.60	6.00	7.13	0.60	1.00	0.01	6 lb/ft ² 0.2 k
FS = 3.00		Gross Ultimate = 11592 lb/ft ² 417.3 k				
		Net Ultimate = 10800 lb/ft ² 388.8 k				
		Gross Allowable = 3864 lb/ft ² 139.1 k				
		Net Allowable = 3600 lb/ft ² 129.6 k				

BEARING CAPACITY BY VESIC'S METHOD

Reference: Das, "Fundamentals of Geotechnical Engineering," Section 12.2

Name TVA/CUF Still Pond Riser Structures
 Date 04/25/16
 Identification CUF Stilling Pond Riser Structures

Input

Units of Measurement

E SI or E

$\gamma_w = 62.40$ lb/ft³

Foundation Information

Shape SQ SQ, CI, CO, or RE

B = 6.00 ft

L = 6.00 ft

$D_f = 14.00$ ft

Soil Information

c = 1300.00 lb/ft²

$\phi =$ deg

$\gamma_1 =$

$\gamma_2 =$

$D_w = 0.00$ ft

Leave γ_{sat} blank if no water.

$\gamma_{1sat} = 119.0$ lb/ft³ Soil Above Foundation Base

$\gamma_{2sat} = 119.0$ lb/ft³ Soil Below Foundation Base

Depth of Water Below Ground Surface

Factor of Safety

F = 3.00

Loading

$e_B = 0.00$

$e_L = 0.00$

$\beta(\text{deg}) = 20.00$

Calculations

$\phi(\text{deg}) = 0.00$	$N_c = 5.14$	B = 6.00	$e_B = 0.00$	B' = 6.00
$\phi(\text{rad}) = 0.00$	$N_q = 1.00$	L = 6.00	$e_L = 0.00$	L' = 6.00
$\beta(\text{deg}) = 20.00$	$N_\gamma = 0.00$	A = 36.00	$D_f/B = 2.33$	A' = 36.00

c	N_c	Fcs	Fcd	Fci	q_u	Q_u
1300.00	5.14	1.19	1.47	0.60	7081 lb/ft ²	255 k
q	N_q	Fqs	Fqd	Fqi		
792.40	1.00	1.00	1.00	0.60	479 lb/ft ²	17.3 k
γ	B	N_γ	Fys	Fyd	Fyi	
56.60	6.00	0.00	0.60	1.00	0.00	0 lb/ft ² 0.0 k
FS = 3.00		Gross Ultimate = 7560 lb/ft ² 272.2 k				
		Net Ultimate = 6767 lb/ft ² 243.6 k				
		Gross Allowable = 2520 lb/ft ² 90.7 k				
		Net Allowable = 2256 lb/ft ² 81.2 k				



Stantec

Hand Calculation

Method 1 (Using ϕ & c values obtained from lab Triaxial testing)

$$D_f = 14'$$

$$\gamma = 119 \text{ lb/ft}^3 \text{ (Saturated)}$$

$$c = 200$$

$$\phi = 21^\circ$$

Effective Stress
Strength Parameter

Footing Size: 6' x 6'

i.e. Square Footing.

$$N_c = 19.5$$

$$N_q = 9$$

$$N_r = 6$$

$$\begin{aligned} q &= \gamma \times D_f \\ &= (119 - 62.4) \times 14 \\ &= 566 \times 14 \\ &= 7924 \end{aligned}$$

B.M. Das, 1997

$$q_u = N_c + q N_q + q_r$$

$$= c N_c + q N_q + \frac{1}{2} \gamma B N_r$$

$$= (200 \times 19.5) + (7924 \times 9) + \left(\frac{1}{2} \times 119 \times 6 \times 6\right)$$

$$= 3900 + 7131 + 2142$$

$$= 13,173$$

$$q_{\text{net-ultimate}} = q_u - \gamma D$$

$$= 13,173 - (119 \times 14)$$

$$= 13,173 - 1,666$$

$$= 11,507 \text{ psf}$$

$$q_{\text{net-Allowable}} = \frac{11,507}{F.S. = 3}$$

$$= 3,835 \text{ psf}$$

Hand Calculation

Method 2. (Using C only & using NAUFAE Fig. 4 to obtain S_u)

$$N_{\text{assumed}} = 10 \quad (\text{Field SPT Value, uncorrected})$$

$$q_{\text{ref}} = (N_c \times (SF))$$

SF = Shape Factors.

$$= 1300 \times 5.14 \times 1.19$$

$$SF = 1 + \frac{B}{L} \left(\frac{N_{60}}{N_c} \right)$$

$$= 1 + \frac{6'}{6'} \left(\frac{1}{5.14} \right)$$

$$= 7951 \text{ psf}$$

$$\text{For } n = 10$$

Using NAUFAE, 7-1-88

Figure 4,

$$q_{\text{allowable}} = \frac{7951 \text{ psf}}{3}$$

$$= 2650 \text{ psf}$$

$$C = S_u = \frac{1}{2} q_{\text{ref}}$$

$$= \left(\frac{1}{2} \times 1.3 \right) \text{TSF}$$

$$= \frac{1}{2} \times 1.3 \times 2000 \text{ psf}$$

$$= 1300 \text{ psf}$$

$$\text{For } \phi = 0$$

$$N_c = 5.14$$

B.M. Das, 1997

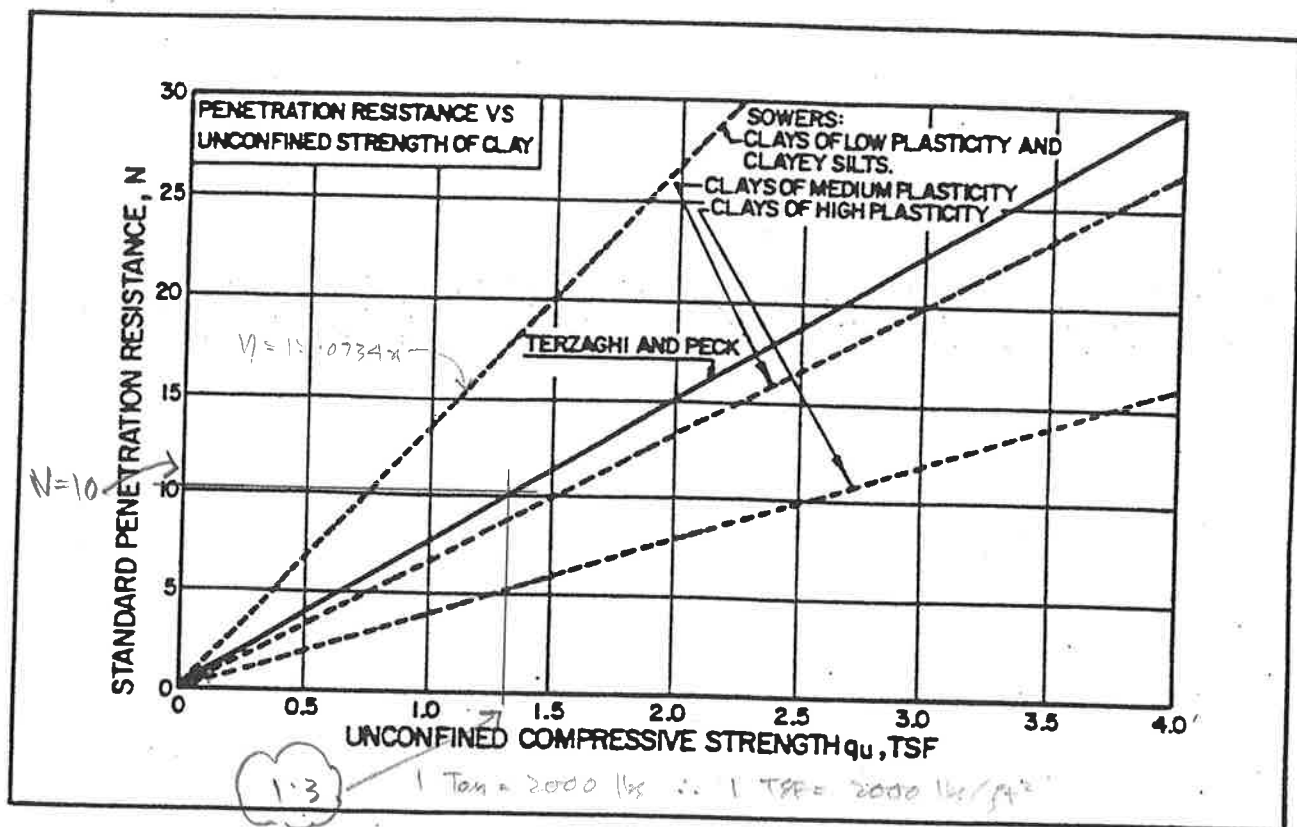
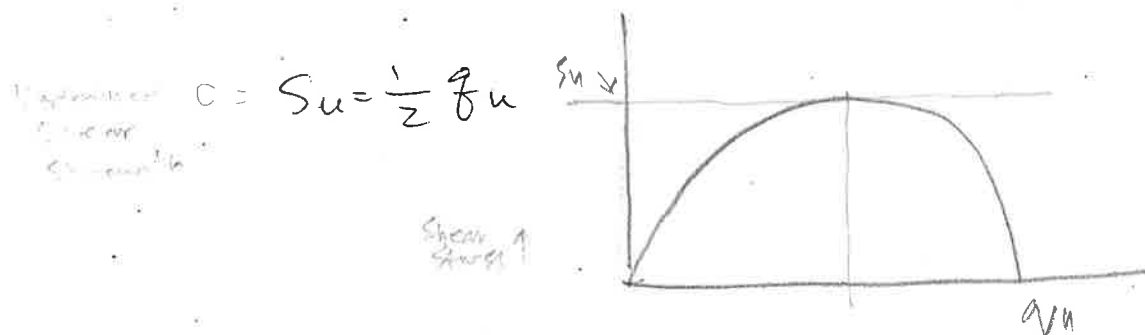


FIGURE 4
Correlations of Standard Penetration Resistance



$$\sigma_n = 1.3 \text{ TSF}$$

$$S_u = \frac{1}{2} \sigma_n = \frac{1}{2} (1.3 \text{ TSF}) = \frac{1}{2} \cdot (1.3 \times 2000) \text{ psf}$$

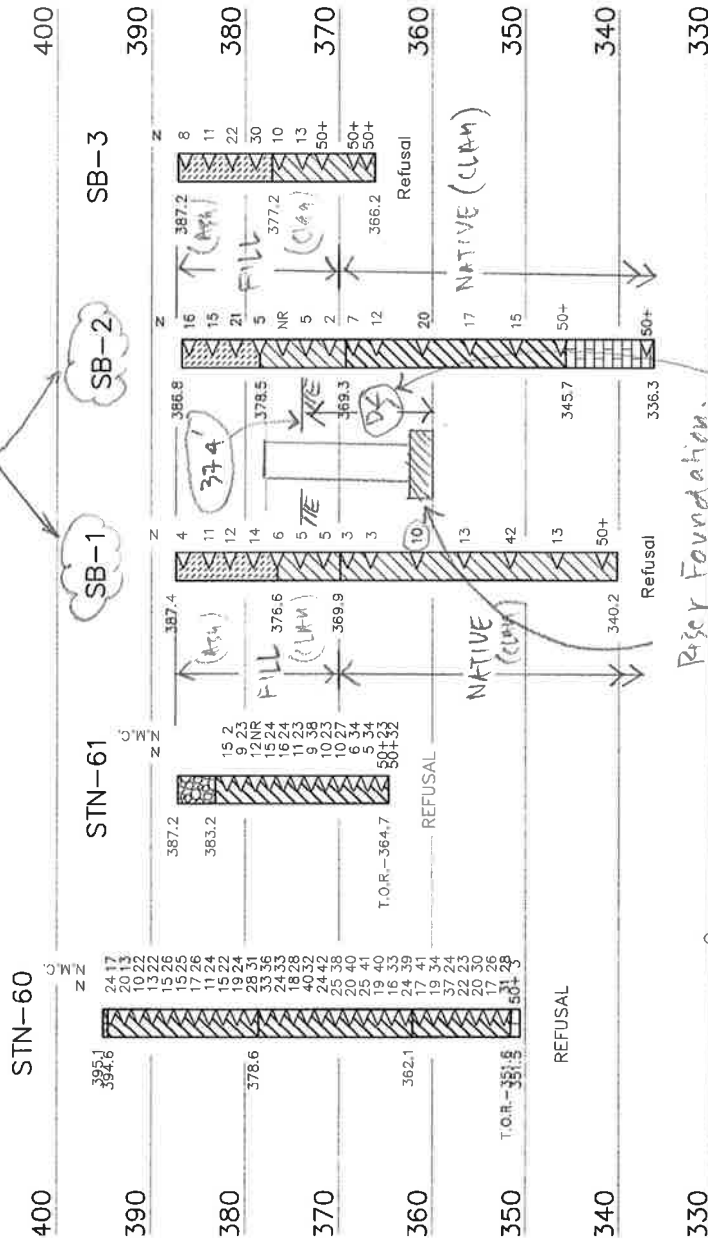
$$S_u = 1300 \text{ psf}$$

←
NAVFAC Manual.

TABLE 1
Ultimate Friction Factors and Adhesion for Dissimilar Materials

Interface Materials	Friction factor, $\tan \delta$	Friction angle, δ degrees
Mass concrete on the following foundation materials:		
Clean sound rock.....	0.70	35
Clean gravel, gravel-sand mixtures, coarse sand...	0.55 to 0.60	29 to 31
Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel.....	0.45 to 0.55	24 to 29
Clean fine sand, silty or clayey fine to medium sand.....	0.35 to 0.45	19 to 24
Fine sandy silt, nonplastic silt.....	0.30 to 0.35	17 to 19
Very stiff and hard residual or preconsolidated clay.....	0.40 to 0.50	22 to 26
Medium stiff and stiff clay and silty clay..... (Masonry on foundation materials has same friction factors.)	0.30 to 0.35	17 to 19 → 18
Steel sheet piles against the following soils:		
Clean gravel, gravel-sand mixtures, well-graded rock fill with spalls.....	0.40	22
Clean sand, silty sand-gravel mixture, single size hard rock fill.....	0.30	17
Silty sand, gravel or sand mixed with silt or clay	0.25	14
Fine sandy silt, nonplastic silt.....	0.20	11
Formed concrete or concrete sheet piling against the following soils:		
Clean gravel, gravel-sand mixture, well-graded rock fill with spalls.....	0.40 to 0.50	22 to 26
Clean sand, silty sand-gravel mixture, single size hard rock fill.....	0.30 to 0.40	17 to 22
Silty sand, gravel or sand mixed with silt or clay	0.30	17
Fine sandy silt, nonplastic silt.....	0.25	14
Various structural materials:		
Masonry on masonry, igneous and metamorphic rocks:		
Dressed soft rock on dressed soft rock.....	0.70	35
Dressed hard rock on dressed soft rock.....	0.65	33
Dressed hard rock on dressed hard rock.....	0.55	29
Masonry on wood (cross grain).....	0.50	26
Steel on steel at sheet pile interlocks.....	0.30	17
Interface Materials (Cohesion)	Adhesion C_a (psf)	
Very soft cohesive soil (0 - 250 psf)	0 - 250	
Soft cohesive soil (250 - 500 psf)	250 - 500	
Medium stiff cohesive soil (500 - 1000 psf)	500 - 750	
Stiff cohesive soil (1000 - 2000 psf)	750 - 950	
Very stiff cohesive soil (2000 - 4000 psf)	950 - 1,300	

see page 17 for location



LOGS OF BORINGS
 SCALE: 1"=10' (VERTICAL ONLY)

$DS = 374 - 360 = 14'$

GEOTECHNICAL NOTE:

1. THE BORING LOGS AND RELATED INFORMATION SHOWN ON THIS DRAWING DEPICT GENERAL AND APPROXIMATE SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC BORING LOCATIONS NOTED AND AT THE TIME OF DRILLING. CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM THOSE OCCURRING AT THE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE SUBSURFACE CONDITIONS AT THE BORING LOCATIONS. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE GENERALLY BASED ON STRAIGHT LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.
2. THE GEOTECHNICAL INFORMATION AND DATA FURNISHED HEREIN ARE NOT INTENDED AS REPRESENTATION OR WARRANTIES BUT ARE FURNISHED FOR INFORMATION ONLY. IT SHALL BE DISTINCTLY UNDERSTOOD THAT THE OWNER OR ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DEDUCTION, INTERPRETATION, OR CONCLUSION DRAWN THEREFROM. THE INFORMATION IS MADE AVAILABLE IN ORDER THAT THE CONTRACTOR MAY HAVE READY ACCESS TO THE SAME INFORMATION AVAILABLE TO THE OWNER AND THE ENGINEER AND IS NOT PART OF THIS CONTRACT.

Project Number		175609014		Location							
Project Name		CUF - Spillway		Boring No.		CUF-SB-2		Total Depth		50.5 ft	
County		Stewart County		Surface Elevation		386.8 ft					
Project Type		Geotechnical Exploration		Date Started		2/24/10		Completed		2/25/10	
Supervisor		R. Riker Driller J. Felts		Depth to Water		2.5 ft		Date/Time		2/24/10	
Logged By		R. Riker		Depth to Water		N/A		Date/Time		N/A	

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mols. Cont. %	Remarks
Elevation	Depth		Rock Core						
386.8	0.0	Top of Excavation							
386		FILL, BOTTOM ASH, dark gray, moist to wet, medium to coarse grained, medium dense.		SPT-1	0.0 - 1.5	1.3	2-4-12 16	--	Top cover bottom ash roadway
				SPT-2	2.5 - 4.0	1.1	6-7-8 15	--	Wet below 2.5
380				SPT-3	5.0 - 6.5	1.2	5-9-12 21	--	
379				SPT-4	7.5 - 9.0	0.7	1-2-3 5	-	
378.5	8.3	FILL, LEAN CLAY (CL) with Sand, brown to red brown, moist, very soft to medium stiff, with few gravels, and possible manganese concretions, with bottom ash to 11.5 feet		SPT-5	10.0 - 11.5	0.4	1-WOH-1	--	
375				SPT-6	12.5 - 14.0	0.0	1-2-3 5	-	
				SPT-7	15.0 - 16.5	0.9	1-1-1 2	--	
370				SPT-8	17.5 - 19.0	1.3	1-3-4 7	--	Rock fragments in tip
369.3	17.5	FAT CLAY (CH) with sand, gravel and chert pieces, brown to reddish brown, moist, medium stiff to stiff (Native)		SPT-9	20.0 - 21.5	1.4	6-8-4 12	--	
365									
362									



Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois. Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
360		FAT CLAY (CH) with sand, gravel and chert pieces, brown to reddish brown, moist, medium stiff to stiff (Native) (Continued)		SPT-10	25.0 - 26.5	1.4	6-8-12 20	—	← (see detail) X
		Bottom of Footing							
355				SPT-11	30.0 - 31.5	1.5	6-7-10 17	—	
350				SPT-12	35.0 - 36.5	0.9	5-7-8 15	—	
345.7	41.1			SPT-13	40.0 - 41.1	1.1	5-8-50+	—	Rock fragments in tip @ 40.0 Began Core
		LIMESTONE, gray to light gray, thin bedded, Hard, Numerous Shale partings and Sandy zones.					50+		
									Backfilled 4 bags of portland cement, 2 bags Bentonite grout, 1/2 bag bentonite
336.3	50.5			97	9.4	9.4	100	50.5	
Bottom of Hole									
Top of Rock ≈ 41.1 Elevation (345.7)									

Project Number <u>175609014</u>				Location _____			
Project Name <u>CUF - Spillway</u>				Boring No. <u>CUF-SB-1</u>		Total Depth <u>47.2 ft</u>	
County <u>Stewart County</u>				Surface Elevation <u>387.4 ft</u>			
Project Type <u>Geotechnical Exploration</u>				Date Started <u>2/19/10</u>		Completed <u>2/23/10</u>	
Supervisor <u>R. Riker</u> Driller <u>J. Felts</u>				Depth to Water <u>2.5 ft</u>		Date/Time <u>2/19/10</u>	
Logged By <u>R. Riker</u>				Depth to Water <u>N/A</u>		Date/Time <u>N/A</u>	

Lithology		Description	Overburden Rock Core	Sample # ROD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois. Cont. % Run Depth	Remarks
Elevation	Depth								
387.4	0.0	Top of Excavation							
386		FILL, BOTTOM ASH, dark gray, moist to wet, medium to coarse grained, loose to medium dense.		SPT-1	0.0 - 1.5	1.0	1-2-2 4	--	Wet below 2.5'
385				SPT-2	2.5 - 4.0	1.4	3-5-6 11	-	
384									
383				SPT-3	5.0 - 6.5	1.5	6-5-7 12	--	
382									
381				SPT-4	7.5 - 9.0	1.5	3-7-7 14	-	
380									
379				SPT-5	10.0 - 11.5	1.4	2-3-3 6	--	Drilling fluid added to boring
378									
377				SPT-6	12.5 - 14.0	0.6	6-2-3 5	-	
376.6	10.8	FILL, LEAN CLAY (CL) with sand and trace gravel, brown to red brown, moist to wet, medium stiff to soft.							
375				SPT-7	15.0 - 16.5	0.9	1-2-3 5	-	
370									
369.9	17.5	LEAN CLAY (CL) with sand and trace gravel, brown to red brown, moist to wet, soft to very stiff. (Native)		SPT-8	17.5 - 19.0	0.5	1-1-2 3	-	
369									
368									
367				SPT-9	20.0 - 21.5	1.0	1-1-2 3	-	
366									
365									
364									
363									
362									



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Chakravarty, Arumoy

From: Chakravarty, Arumoy
Sent: Friday, April 22, 2016 5:00 PM
To: Harmon, Jacqueline; Chakravarty, Arumoy
Subject: Conversation with Harmon, Jacqueline

Chakravarty, Arumoy 4:33 PM:

Hi Jacqueline

Harmon, Jacqueline 4:34 PM:

Hi, Arumoy.

What's up?

Chakravarty, Arumoy 4:34 PM:

Apologies for reaching out to you late on Friday, wanted to ask you a couple of questions about soil parameters you may have considered in your analysis

Harmon, Jacqueline 4:35 PM:

no problem. My brain is tired, but still here :)

Chakravarty, Arumoy 4:35 PM:

I am just trying to see if you have those nos. readily available instead of me calculating over again

Harmon, Jacqueline 4:35 PM:

Which plant/facility?

CUF?

Chakravarty, Arumoy 4:35 PM:

cumberland

yeah... you read my mind

I am working with Victor Fraga on static analysis of riser structures at the stilling basin

he wants to know, what the soil density (moist or wet), phi angle, cohesion and a good bearing capacity would be for these riser structure foundations

question: did you have to do analysis involving these riser structures as part of what you are doing?

Chakravarty, Arumoy 4:40 PM:

what he is asking is really simple. the tougher part is to pull existing boring exploration in the area, and finding soil parameters suitable for the soils that underlie these existing structures.

Harmon, Jacqueline 4:42 PM:

Oops, sorry. Someone walked in. We have properties for the Stilling Pond (and Retention Basin). I'm not sure where the riser structures are.

The properties are generalized for the unit.

I would have densities, phi, and cohesion. Bearing isn't something we need.

The CUF team might have it. It should be calculable using the soil data we have.

Hold on.

4:44 PM Harmon, Jacqueline asked to send you "L_FB28.tmp.PNG".

4:44 PM L_FB28.tmp.PNG was saved to C:\Users\achakravarty\Documents\My Received Files. It's a good idea to scan the file for viruses before you open it.

Harmon, Jacqueline 4:44 PM:

Let me know if one of the cross sections is near his risers.

Chakravarty, Arumoy 4:46 PM:

the riser structures are located between cross-sections U and V adjacent to the embankment, located within the pool area

These riser structures collect water from the stilling basin and pass through the embankment spillway

Harmon, Jacqueline 4:48 PM:

Table 3. Strength Parameters for Stability Analysis – Stilling Pond (including Retention Pond) Perimeter Dike

Soil Horizon	Unit Weight (pcf)	Effective Stress Strength Parameters		Total Stress Strength Parameters	
		c' (psf)	ϕ' (degrees)	c (psf)	ϕ (degrees)
Dike 1 (Lean Clay)	123	200	22	800	20
Dike 2 (Lean Clay)	123	200	32	500	21
Dike 2 (Fat Clay)	119	200	29	200	18
Fly Ash (Sluiced)	100	0	22	140	11
Alluvial Clay	124	200	33	450	20
Alluvial Granular	130	0	32	100	20
Bedrock	Impenetrable				

Let me find the U and V sections to help with elevations.

[ftp://projftp.stantec.com/CUF\(Cumberland\)/Retention%20Pond%20\(Ash%20Pond\)/Work%20Plan/Study%20Phase/Correspondence%20&%20Reports/CUF-GE-100329/Report/](ftp://projftp.stantec.com/CUF(Cumberland)/Retention%20Pond%20(Ash%20Pond)/Work%20Plan/Study%20Phase/Correspondence%20&%20Reports/CUF-GE-100329/Report/)

Chakravarty, Arumoy 4:49 PM:

thanks

4:52 PM Harmon, Jacqueline asked to send you "**Pages from CUF-GE-100329_(175539016R01)[1].pdf**".

Harmon, Jacqueline 4:53 PM:

Daniel Rogers (who did the early work) sits next to me. He doesn't remember needing bearing capacity. The report with the link will have the logs for the borings shown on the figure.

Do you have an elevation for the bottom of the risers?

(Apologies. I feel like I flooded you with info. I hope it's helpful.)

Chakravarty, Arumoy 4:55 PM:

you did not overwhelm me

thanks for the info you provided

let me look at it, and if I need to, will get back to you on Monday

Harmon, Jacqueline 4:57 PM:

Sounds good. Have a fun weekend!

4:57 PM You can't receive "**Pages from CUF-GE-100329_(175539016R01)[1].pdf**" from Harmon, Jacqueline.

STATIC ANALYSIS OF RISER STRUCTURES
SQUARE RISER WITH CIRCULAR INLET PIPE
Structural Stability Assessment for Coal Combustion Residual
CUF - East Ash Disposal Area - CUF RISERS
Tennessee Valley Authority

1 Objective

The purpose of this calculation is to demonstrate that under usual static loading conditions, a particular riser structure, the geometric and material properties of which have been entered by the user, will be stable considering floatation, soil bearing pressure, and strength of the reinforced concrete walls due to hydrostatic and earth pressures acting along the height of the structure.

Note: Blue text denotes an equation. Boxed text denotes a user input.

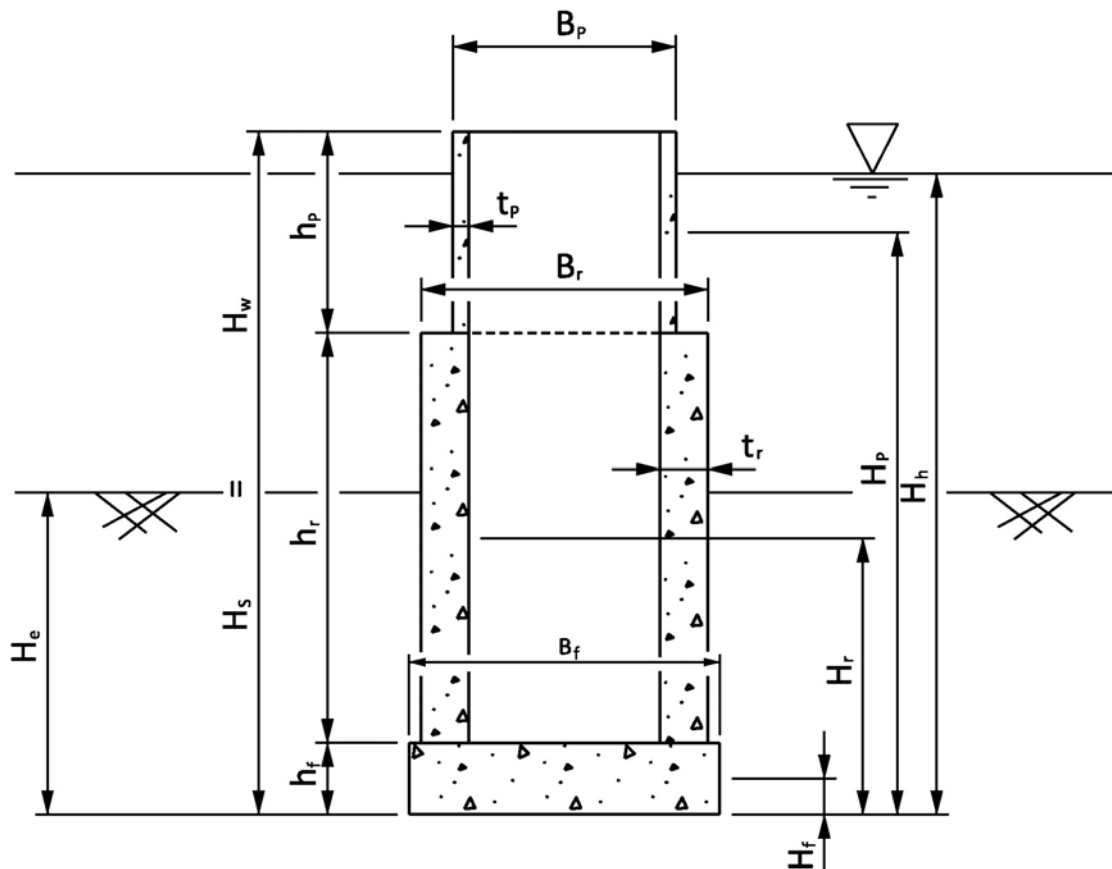


Figure 1 - Explanation of Geometric Parameters

2 Riser Geometry and Material Definitions

2.1 Riser Geometry *See original TVA Design Drawings for dimensions.*

Width of Footing
(Square): $B_f := 6.5\text{ft}$

Height of Footing: $h_f := 1.5\text{ft}$

Top of Footing Elevation: $EL_{tf} := 361.0\text{ft}$ *Also reported as "Invert Elevation"*

Bottom of Footing Elevation: $EL_{bf} := EL_{tf} - h_f = 359.5\text{ft}$

Width of Square Riser: $B_r := 6\text{ft}$ *Out to out*

Height of Square Riser: $h_r := 4\text{ft}$

Thickness of Square
Riser Walls: $t_r := 12\text{in}$

Top of Rectangular Section
Elevation: $EL_{tr} := EL_{tf} + h_r = 365.0\text{ft}$

Diameter of Circular Inlet: $B_p := 4\text{ft} + 8\text{in}$ *Out to out*

Top of Structure Elevation: $EL_{ts} := 378.0\text{ft}$

Height of Circular Inlet: $h_p := EL_{ts} - EL_{tr} = 13\text{ft}$

Thickness of Circular Inlet
Walls: $t_p := 4\text{in}$

Soil Embedment Elevation: $EL_e := 374.0\text{ft}$

Soil Embedment Height: $H_e := EL_e - EL_{bf} = 14.50\text{ft}$

Estimated Weight of
Trash Filter on Top: $W_{\text{trash}} := 1.3\text{kip}$

Approximated using original design plan bill of material. See TVA drawings. Weight per foot of angles taken from AISC Steel Construction Manual. Weight per foot of corrugated metal pipe taken from Contech (R) Corrugated Metal Pipe Design Guide (page 10). Extra 50 lbs added for bolts and other miscellaneous items.

2.2 Material Properties

Unit Weight of Water:

$$\gamma_w := 62.4 \text{pcf}$$

2.2.1 Soil Materials

Saturated Unit Weight of Fill:

$$\gamma_{\text{sat}} := 119 \text{pcf}$$

See TVA Static Slope Stability Analysis Report.

Angle of Internal Friction:

$$\phi_f := 22 \text{deg}$$

See TVA Static Slope Stability Analysis Report.

Friction Angle:

$$\delta := 18 \text{deg}$$

U.S. Department of the Navy, 1982a.

Angle of face of wall to horizontal:

$$\theta := 90 \text{deg}$$

Assumes vertical wall.

Angle of fill to horizontal:

$$\beta := 0 \text{deg}$$

Assumes level fill.

Gamma:

$$\Gamma := \left(1 + \sqrt{\frac{\sin(\phi_f + \delta) \sin(\phi_f - \beta)}{\sin(\theta - \delta) \sin(\theta + \beta)}} \right)^2 = 2.26$$

U.S. Department of the Navy, 1982a.

Active Lateral Earth Pressure Ratio:

$$K_a := \frac{\sin(\theta + \phi_f)^2}{\Gamma \cdot \sin(\theta)^2 \sin(\theta - \delta)} = 0.4$$

U.S. Department of the Navy, 1982a.

Ultimate Bearing Pressure:

$$P_b := 6767 \text{psf}$$

See geotechnical bearing pressure calculation.

2.2.2 Reinforced Concrete Parameters

Unit Weight of Concrete:

$$\gamma_c := 150 \text{pcf}$$

Normal weight concrete.

Concrete Compressive Strength:

$$f_c := 4 \text{ksi}$$

Class A concrete. See original TVA design plans.

Assumed max. concrete compressive strain:

$$\epsilon_c := 0.003$$

Steel yield stress: $f_y := 60\text{ksi}$ See TVA original design plans.

Steel Modulus of Elasticity: $E_s := 29000\text{ksi}$ Assumed

Area of Horizontal Reinforcing Bar: $A_{\text{horiz}} := 0.2\text{in}^2$ Area of one bar

Horizontal Reinforcement Spacing: $s_{\text{horiz}} := 12\text{in}$ #4 @ 12 - Single Layer

Area of Vertical Reinforcing Bar: $A_{\text{vert}} := 0.2\text{in}^2$ 6-#4 Single Layer

No. of Vertical Bars: $n_{\text{vert}} := 6$

Depth from concrete surface to steel: $d := 6\text{in} - \frac{9}{16}\text{in} = 5.437\text{in}$ Assume for both vertical and horizontal steel. This value is half of the wall thickness minus half the diameter of vertical steel minus half the diameter of horizontal steel.

3 Floatation Factor of Safety

3.1 Assumptions

- (a) Riser structure is fully submerged.
- (b) Buoyant unit weight of soil to be used for embedment fill.
- (c) Structure is completely drained. That is to say, there is no water inside so that the uplift force from buoyancy is maximum.

3.2 Area and Weight Computations

Area of Footing: $A_f := B_f^2 = 42.25 \text{ ft}^2$

Weight of Footing: $W_f := A_f \cdot h_f \cdot \gamma_c = 9.51 \text{ kip}$

Area of Rectangular Section: $A_r := B_r^2 - (B_r - 2 \cdot t_r)^2 = 20 \text{ ft}^2$

Weight of Rectangular Section: $W_r := A_r \cdot \gamma_c \cdot h_r = 12.00 \text{ kip}$

Area of Circular Inlet: $A_p := \frac{\pi}{4} \cdot B_p^2 - \frac{\pi}{4} \cdot (B_p - 2 \cdot t_p)^2 = 4.54 \text{ ft}^2$

Weight of Circular Inlet: $W_p := A_p \cdot \gamma_c \cdot h_p = 8.85 \text{ kip}$

Total Dry Weight of Riser: $W_T := W_f + W_r + W_p = 30.36 \text{ kip}$

Does not include trash filter in the event that it has fallen over (since the trash filter is not anchored).

3.3 Hydrostatic and Soil Fill Forces

Hydrostatic pressure at base: $P_h := \gamma_w \cdot (EL_{ts} - EL_{bf}) = 8.017 \text{ psi}$

Hydrostatic uplift force: $U_h := P_h \cdot A_f = 48.77 \text{ kip}$

Weight of water around riser and above footing: $W_{wext} := \left[h_p \cdot \left(B_f^2 - \frac{\pi}{4} \cdot B_p^2 \right) + (h_r - H_e) \cdot (B_f^2 - B_r^2) \right] \cdot \gamma_w = 16.303 \text{ kip}$

Weight of Fill:

$$W_F := \left[(H_e - h_f) \cdot (B_f^2 - B_r^2) + (H_e - h_f - h_r) \left(B_r^2 - \frac{\pi}{4} B_p^2 \right) \right] \cdot \gamma_{\text{sat}} = 29.91 \text{ kip}$$

3.4 Conclusion of Floatation Factor of Safety *Factor of Safety Limits Governed by TVA CCR Rule*

Factor of Safety:

$$FS_f := \frac{W_T + W_F}{U_h - W_{\text{wext}}} = 1.86$$

Usual Load Combination:

$$U_f := \begin{cases} \text{"Satisfactory"} & \text{if } FS_f \geq 1.3 \\ \text{"Unsatisfactory"} & \text{otherwise} \end{cases} = \text{"Satisfactory"}$$

4 Computation of Foundation Bearing Safety Factor

4.1 Assumptions

- (a) Structure is submerged in water.
- (b) Entire Structure is filled with water.

4.2 Weight of Water Inside Riser

Volume of Rectangular
Section Void:

$$v_r := (B_r - 2t_r)^2 \cdot h_r = 64 \text{ ft}^3$$

Volume of Circular Inlet
Pipe Void:

$$v_p := \frac{\pi}{4} (B_p - 2t_p)^2 \cdot h_p = 163.36 \text{ ft}^3$$

Total Volume of Void:

$$v_v := v_r + v_p = 227.36 \text{ ft}^3$$

Total Weight of Water Inside
Riser:

$$W_{wint} := v_v \cdot \gamma_w = 14.19 \text{ kip}$$

4.3 Bearing Factor of Safety

Pressure on Foundation (Riser
Fully Submerged and Filled):

$$P_{fsub} := \frac{W_T - U_h + W_F + W_{wext} + W_{wint} + W_{trash}}{B_f^2} = 1024.34 \cdot \text{psf}$$

Pressure on Foundation (Riser
in Air and Empty):

$$P_{fair} := \frac{W_T + W_F}{B_f^2} = 1.43 \times 10^3 \cdot \text{psf}$$

Usual Load Factor of Safety:

$$FS_{UB} := \frac{P_b}{P_{fsub}} = 6.606$$

Unusual Load Factor of Safety:

$$FS_{UNB} := \frac{P_b}{P_{fair}} = 4.74$$

4.4 Conclusion of Foundation Bearing Capacity *Factor of Safety Limits Governed by TVA CCR Rule*

Usual Load Combination: $U_B := \begin{cases} \text{"Satisfactory"} & \text{if } FS_{UB} \geq 3.0 \\ \text{"Unsatisfactory"} & \text{otherwise} \end{cases} = \text{"Satisfactory"}$

Unusual Load Combination: $UN_B := \begin{cases} \text{"Satisfactory"} & \text{if } FS_{UNB} \geq 2.6 \\ \text{"Unsatisfactory"} & \text{otherwise} \end{cases} = \text{"Satisfactory"}$

5 Determination of Maximum Force Effects in Wall Using Plate Reactions and Moments Tables

5.1 Depths

Depth to Top of Rectangular Section:

$$z_1 := EL_{ts} - EL_{tr} = 13 \text{ ft}$$

Depth to Bottom of Rectangular Section:

$$z_2 := EL_{ts} - EL_{tf} = 17 \text{ ft}$$

5.2 Water Pressure

Factored Pressure at Top of Rectangular Section:

$$P_{w1} := \gamma_w \cdot z_1 = 811.20 \cdot \text{psf}$$

Factored Pressure at Bottom of Rectangular Section:

$$P_{w2} := \gamma_w \cdot z_2 = 1.061 \times 10^3 \cdot \text{psf}$$

5.3 Soil Pressure

Factored Pressure at top of Rectangular Section:

$$P_{s1} := \begin{cases} K_a \cdot (EL_e - EL_{tr}) \cdot \gamma_{sat} & \text{if } EL_e > EL_{tr} \\ 0 \cdot \text{psf} & \text{otherwise} \end{cases} = 428.446 \cdot \text{psf}$$

Factored Pressure at Bottom of Rectangular Section:

$$P_{s2} := K_a \cdot (EL_e - EL_{tf}) \cdot \gamma_{sat} = 618.867 \cdot \text{psf}$$

5.4 Factored Line Loads

Load Factor:

$$F := 1.4 \quad \text{ACI 350-06, (9-1)}$$

Factored Line Load at top:

$$w_{top} := F \cdot (P_{w1} + P_{s1}) \cdot B_r = 10.413 \text{ klf}$$

Factored Line Load at bottom:

$$w_{bott} := F \cdot (P_{w2} + P_{s2}) \cdot B_r = 14.109 \text{ klf}$$

5.5 Moment and Shear Coefficients from Engineering Monograph 27 Table
5.5.1 Uniform Load

Moment about vertical axis:

$$C_{mxu} := 0.1788$$

Moment about horizontal axis:

$$C_{myu} := 0.1212$$

Shear at corner of wall:

$$C_{rxu} := 0.8592$$

Shear at base of wall:

$$C_{ryu} := 0.6725$$

These values were taken from Engineering Monograph 27 figure 1 and figure 4 for a uniform load and a triangular load, respectively.

5.5.2 Triangular Load

Moment about vertical axis:

$$C_{mxt} := 0.0433$$

Moment about horizontal axis:

$$C_{myt} := 0.0584$$

Shear at corner of wall:

$$C_{rxt} := 0.2542$$

Shear at base of wall:

$$C_{ryt} := 0.4055$$

5.6 Maximum Applied Moment and Shear

Maximum Moment about vertical axis:

$$M_{u1} := C_{mxu} \cdot w_{top} \cdot h_r^2 + C_{mxt} \cdot (w_{bott} - w_{top}) \cdot h_r^2 = 32.35 \text{ ft} \cdot \text{kip}$$

Maximum Moment about horizontal axis:

$$M_{u2} := C_{myu} \cdot w_{top} \cdot h_r^2 + C_{myt} \cdot (w_{bott} - w_{top}) \cdot h_r^2 = 23.647 \text{ ft} \cdot \text{kip}$$

Maximum Shear at corner:

$$V_{u1} := C_{rxu} \cdot w_{top} \cdot h_r + C_{rxt} \cdot (w_{bott} - w_{top}) \cdot h_r = 39.546 \text{ kip}$$

Maximum Shear at base:

$$V_{u2} := C_{ryu} \cdot w_{top} \cdot h_r + C_{ryt} \cdot (w_{bott} - w_{top}) \cdot h_r = 34.006 \text{ kip}$$

6 Capacity of Wall for Flexure About Vertical Axis

6.1 Material Parameters

Total area of steel:

$$A_s := A_{\text{horiz}} \left(\frac{h_r}{s_{\text{horiz}}} \right) = 0.8 \cdot \text{in}^2$$

6.2 Nominal Moment Capacity Using the Equivalent Stress Block Approach

See ACI 350-06, 10.2

Concrete stress block:

$$a := \frac{A_s f_y + 2 \cdot V_{u1}}{0.85 \cdot f_c \cdot h_r} = 0.779 \cdot \text{in}$$

Concrete stress block reduction factor:

$$\beta_1 := \begin{cases} 0.85 & \text{if } f_c \leq 4000 \text{ psi} \\ \left[0.85 - 0.05 \left(\frac{f_c - 4000 \text{ psi}}{1000 \text{ psi}} \right) \right] & \text{otherwise} \end{cases} = 0.85 \quad \text{ACI 350-06, R10.2.7}$$

Concrete Compression Zone:

$$c := \frac{a}{\beta_1} = 0.916 \cdot \text{in}$$

Strain in steel:

$$\epsilon_s := \epsilon_c \cdot \left(\frac{d - c}{c} \right) = 0.015$$

Yield strain:

$$\epsilon_y := \frac{f_y}{E_s} = 0.0021$$

Reduction Factor:

$$\phi_{ff} := \begin{cases} 0.9 & \text{if } \epsilon_s \geq 0.005 \\ \left[0.65 + (\epsilon_s - \epsilon_y) \cdot \frac{0.25}{0.005 - \epsilon_y} \right] & \text{otherwise} \end{cases} = 0.9 \quad \text{ACI 350-06, 9.3.2.1, 9.3.2.2}$$

Steel Yielding?:

$$\text{yield} := \begin{cases} \text{"TRUE"} & \text{if } \epsilon_s \geq \epsilon_y \\ \text{"FALSE"} & \text{otherwise} \end{cases} = \text{"TRUE"}$$

Nominal moment capacity:

$$M_c := A_s \cdot f_y \cdot \left(d - \frac{a}{2} \right) + 2 \cdot V_{u1} \left(\frac{t_r}{2} - \frac{a}{2} \right) = 57.172 \cdot \text{kip} \cdot \text{ft}$$

Moment Capacity:

$$\phi M_n := \phi_{ff} \cdot M_c = 51.455 \text{ ft} \cdot \text{kip}$$

6.3 Shear Capacity

6.3.1 Material Parameters

Concrete shear stress:

$$f_v := 2 \cdot \sqrt{f_c \cdot \frac{1000}{\text{ksi}} \cdot \frac{\text{ksi}}{1000}} = 0.1265 \text{ ksi} \quad \text{ACI 350-06, (11-3)}$$

6.3.2 Computation of Shear Strength

Concrete Shear Strength:

$$V_c := f_v \cdot h_f \cdot t_r = 72.859 \text{ kip}$$

Reduction Factor:

$$\phi_{vv} := 0.75 \quad \text{ACI 350-06, 9.3.2.3}$$

Total Shear Strength:

$$\phi V_n := \phi_{vv} \cdot V_c = 54.644 \text{ kip}$$

6.4 Conclusion on Strength of Rectangular Section for Flexure About Vertical Axis

Factor of Safety for Flexure at corner:

$$FS_f := \frac{\phi M_n}{M_{u1}} = 1.591$$

Factor of Safety for Shear:

$$FS_v := \frac{\phi V_n}{V_{u1}} = 1.382$$

7 Capacity of Wall For Flexure About Horizontal Axis

7.1 Material Parameters

Total area of steel:

$$A_s := A_{\text{vert}} n_{\text{vert}} = 1.2 \cdot \text{in}^2$$

7.2 Nominal Moment Capacity Using the Equivalent Stress Block Approach See ACI 350-06, 10.2

Concrete stress block:

$$a := \frac{A_s f_y}{0.85 \cdot f_c \cdot B_r} = 0.294 \cdot \text{in}$$

Concrete stress block reduction factor:

$$\beta_1 := \begin{cases} 0.85 & \text{if } f_c \leq 4000 \text{ psi} \\ \left[0.85 - 0.05 \left(\frac{f_c - 4000 \text{ psi}}{1000 \text{ psi}} \right) \right] & \text{otherwise} \end{cases} = 0.85 \quad \text{ACI 350-06, R10.2.7}$$

Concrete Compression Zone:

$$c := \frac{a}{\beta_1} = 0.346 \cdot \text{in}$$

Strain in steel:

$$\epsilon_s := \epsilon_c \cdot \left(\frac{d - c}{c} \right) = 0.044$$

Yield strain:

$$\epsilon_y := \frac{f_y}{E_s} = 0.0021$$

Reduction Factor:

$$\phi_{ff} := \begin{cases} 0.9 & \text{if } \epsilon_s \geq 0.005 \\ \left[0.65 + (\epsilon_s - \epsilon_y) \cdot \frac{0.25}{0.005 - \epsilon_y} \right] & \text{otherwise} \end{cases} = 0.9 \quad \text{ACI 350-06, 9.3.2.1, 9.3.2.2}$$

Steel Yielding?:

$$\text{yield} := \begin{cases} \text{"TRUE"} & \text{if } \epsilon_s \geq \epsilon_y \\ \text{"FALSE"} & \text{otherwise} \end{cases} = \text{"TRUE"}$$

Nominal moment capacity:

$$M_c := A_s \cdot f_y \cdot \left(d - \frac{a}{2} \right) = 31.743 \text{ ft} \cdot \text{kip}$$

Moment Capacity:

$$\phi M_n := \phi_{ff} \cdot M_c = 28.568 \text{ ft} \cdot \text{kip}$$

7.3 Shear Capacity

7.3.1 Material Parameters

Concrete shear stress:

$$f_v := 2 \cdot \sqrt{f_c} \cdot \frac{1000}{\text{ksi}} \cdot \frac{\text{ksi}}{1000} = 0.1265 \text{ ksi} \quad \text{ACI 350-06, (11-3)}$$

7.3.2 Computation of Shear Strength

Concrete Shear Strength:

$$V_c := f_v \cdot B_f \cdot t_r = 109.288 \text{ kip}$$

Reduction Factor:

$$\phi_{vv} := 0.75 \quad \text{ACI 350-06, 9.3.2.3}$$

Total Shear Strength:

$$\phi V_n := \phi_{vv} \cdot V_c = 81.966 \text{ kip}$$

7.4 Conclusion on Strength of Rectangular Section for Flexure About Horizontal Axis

Factor of Safety for Flexure at footing:

$$FS_f := \frac{\phi M_n}{M_{u2}} = 1.208$$

Factor of Safety for Shear:

$$FS_v := \frac{\phi V_n}{V_{u2}} = 2.41$$

8 References

Engineer Manual 1110-2-2400: Structural Design and Evaluation of Outlet Works. 2003. U.S. Army Corps of Engineers.

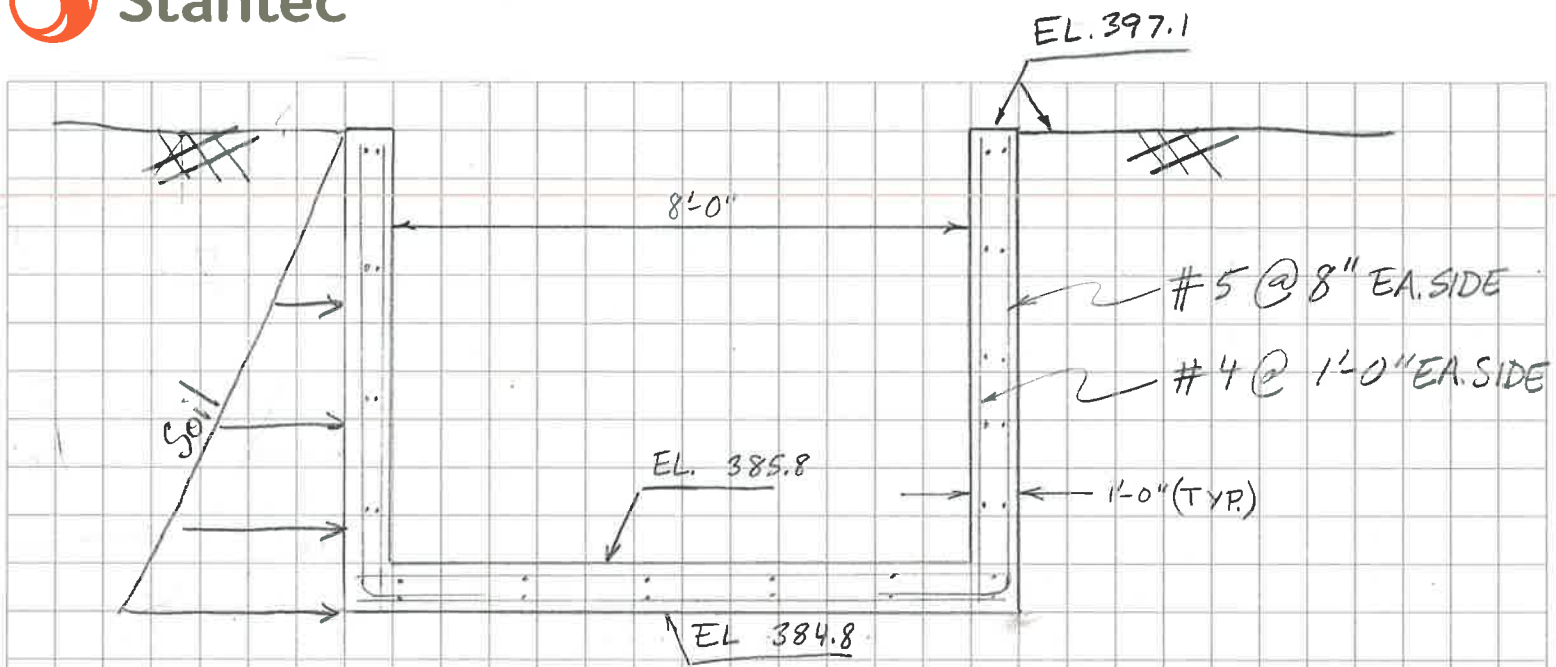
TVA-CCR Rule. 2015. TVA.

ACI 350-06: Environmental Structures Code/Commentary. 2006. American Concrete Institute.

U.S. Department of the Navy. 1982. *Foundations and Earth Structures*. Technical Report NAVFAC DM-7.1 and DM-7.2. Naval Facilities Command, U.S. Department of Defense, Washington, DC, p. 244.

Engineering Monograph No. 27. *Moments and Reactions for Rectangular Plates*. United States Department of the Interior, Bureau of Reclamation. pp.7-10.

Corrugated Metal Pipe Design Guide. *Approximate Weight (Pounds/Foot) Contech Corrugated Steel Pipe*. p.10. CONTECH.



$$f_y = 60,000 \text{ psi} \quad f'_c = 4000 \text{ psi} \quad A_s = \#5 @ 8" = \frac{0.465 \text{ in}^2}{\text{ft}}$$

Soil Load:

$$\gamma_{\text{soil}} = 110 \text{ pcf (Assumed)}$$

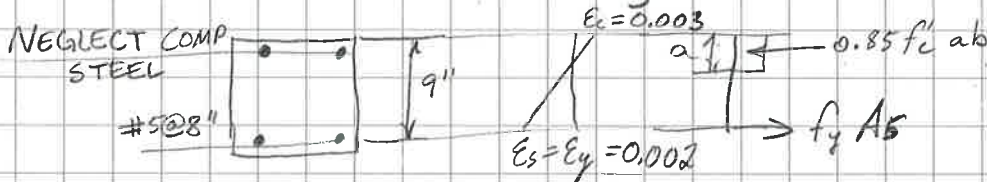
$$K_a = 0.4$$

$$h = (397.1 - 384.8) = 12.3 \text{ ft}$$

$$P_{\text{max}} = K_a \gamma_{\text{soil}} h = (0.4)(110 \text{ pcf})(12.3 \text{ ft}) = 541 \text{ psf}$$

$$F_E = (541 \text{ psf})(1 \text{ ft width})(12.3 \text{ ft})(\frac{1}{2}) = 3327 \text{ lb}$$

$$M_{\text{max}} = F_E \left(\frac{12.3 \text{ ft}}{3} - 1 \text{ ft} \right) = 10.314 \text{ k-ft}$$



$$a = \frac{f_y A_s}{0.85 f'_c b} = \frac{(60,000)(0.465)}{(0.85)(4000)(12)} = 0.684 \text{ in}$$

CUF Chute Spillway Check for Max Bending

$$M_n = \frac{(f_y A_s) \left[d - \frac{a}{2} \right]}{1000 \#/k \times 12 \text{ in/ft}} = \underline{20.13 \text{ k-ft}}$$

$$\epsilon_s = -0.003 \frac{(9'' - \frac{a}{0.85})}{- \frac{a}{0.85}}$$

$$\epsilon_s = 0.0306 \Rightarrow \epsilon_y = 0.002 \quad \text{OK}$$

$$\Rightarrow 0.005 \quad \therefore \phi = 0.9$$

$$\boxed{\phi M_n = 18.12 \text{ k-ft} > 1.6 (M_{max}) = 16.5 \text{ k-ft} \quad \text{OK}}$$

$$PR = \frac{\phi M_n}{1.6 M_{max}} = 1.10$$

APPENDIX B

SUDDEN DRAWDOWN ASSESSMENT



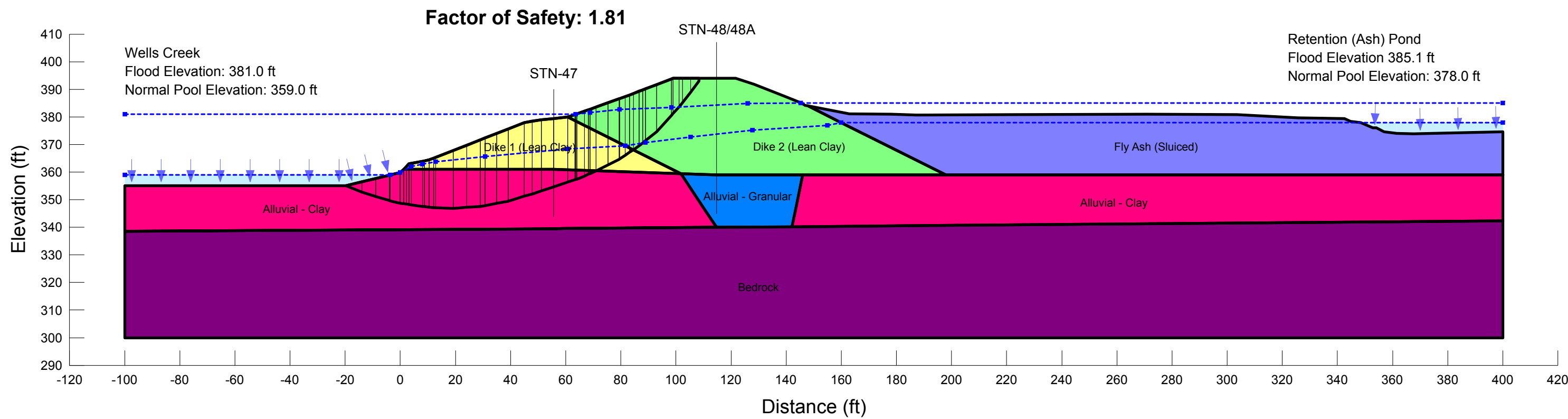
Tennessee Valley Authority
Cumberland Fossil Plant
Stilling Pond (including Retention Pond)
Cumberland City, Tennessee
Section P-P'

Sudden Drawdown

Existing Geometry
Sudden Drawdown
Undrained, SDD Strengths

Material Type	Unit Wt.	Effective - c'	Effective - phi'	Total - c	Total - phi
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °	800 psf	20 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °	500 psf	21 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °	140 psf	11 °
Alluvial - Clay	124 pcf	200 psf	33 °	450 psf	20 °
Alluvial - Granular	130 pcf	0 psf	32 °	100 psf	20 °
Bedrock	Impenetrable				

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions between the borings.





Tennessee Valley Authority
Cumberland Fossil Plant
Stilling Pond (including Retention Pond)
Cumberland City, Tennessee
Section Q-Q'

Sudden Drawdown

Existing Geometry
Sudden Drawdown
Undrained, SDD Strengths

Material Type	Unit Wt.	Effective - c'	Effective - phi'	Total - c	Total - phi
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °	800 psf	20 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °	500 psf	21 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °	200 psf	18 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °	140 psf	11 °
Alluvial Clay	124 pcf	200 psf	33 °	450 psf	20 °
Alluvial Granular	130 pcf	0 psf	32 °	100 psf	20 °
Bedrock	Impenetrable				

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions between the borings.

