Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
Ash Pond Outlet Structure
RDP-0114-G

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Design Summary

The new structures will be AgriDrain stoplog structures as requested by TVA. The design lifespan of these structures is no greater than 5 years. The structures convey flow over PVC stoplogs in the upstream face through 27-inch (nominal outside diameter) DR-17 HDPE pipes installed through the embankment. Eight structures will be installed in the south corner of the Ash Pond. Riprap will be placed on the upstream divider dike slope behind the structures to limit surface erosion around the structures.

The structures are being installed in the location of the former cenosphere collection pond. Test pits were excavated to determine the bearing material below the structures. The material at the bearing elevation is primarily wet bottom ash. The bearing elevation is also approximately 6 ft below the existing Ash Pond water surface elevation (currently controlled by 5 morning-glory spillways in the northeast corner of the Ash Pond). A significant area of settled ash is present upstream of the proposed structure location (i.e. between the Ash Pond and the excavation) and will serve to partially restrict flow into the excavation. However, due to the potential for underseepage into the excavation a temporary cofferdam will likely be required to further protect the construction area. Further, since a detailed geotechnical investigation was not conducted as part of this project, a concrete mud slab will be installed beneath the inlet structures to bridge any soft materials. The AgriDrain structures will be bolted to the mud slab to minimize tipping potential of the structures.

When initially installed, stoplogs will be inserted to a crest elevation of 760.0 ft and will regulate the pool elevation at the approximate existing elevation of 761 ft. Immediately following installation, the stoplogs will be incrementally removed to draw down the pool in the Ash Pond. The pool elevation is being permanently lowered in preparation for installation of the Perimeter Wall Stabilization (PWS). The Construction Documents contain details regarding limitations on the allowable pool drawdown rate to minimize potential rapid drawdown failures.

The outlet pipes will be installed through the existing divider dike. The dike is constructed primarily of bottom ash. Due to the concerns with compaction of ash or soil backfill around the HDPE outlet pipes, flowable fill (CLSM) will be used as backfill around and above the outlet pipes to minimize seepage potential. Immediately following installation, approximately 6 ft of hydraulic head will be present above the outlet pipe inverts. A sand filter diaphragm will be installed downstream of the divider dike crest to intercept any potential seepage along the outlet pipes. The outlet pipes will project through the embankment and discharge onto TDOT Class A-1 Riprap. The riprap will act as scour protection to minimize disturbance of settled ash and will extend over 3 ft upstream of the pipe outlets to minimize undermining potential.

The exhibits described below have been prepared as part of the calculation package for the Ash Pond Outlet Structures proposed at the southern corner of the Ash Pond at Kingston Fossil Plant (KIF).

Report of Hydrologic and Hydraulic Analysis & Risk Analysis - Exhibit 01

This report is an excerpt of a report documenting the on-going Ash Pond hydrologic and hydraulic (H&H) analysis. The report includes information on the hydrologic and hydraulic model created to

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represent existing conditions at the Kingston Fossil Plant. The included report details existing hydrologic conditions for areas draining to the Ash Pond complex and evaluates the hydraulic capacity of the new Ash Pond Outlet Structures.

The Ash Pond Outlet Structures were designed to convey a daily plant process flow of 75 cubic feet per second (cfs) from the Ash Pond to the Stilling Pond. This value was provided by TVA. The rating curve developed for the structures indicates an Ash Pond elevation of 761.1 feet with stoplogs in-place to elevation 760.0 ft. The rating curve also indicates an elevation of 756.3 feet with all stoplogs removed. Under this condition flow through the structures is controlled by the pipe inlets. These structures will also convey stormwater flow to the Stilling Pond during rain events. The hydrologic routing model indicates the Ash Pond can convey the 33-inch, 24-hour storm (SCS Type II distribution) without overtopping the divider dike (assumed crest elevation 765.0 ft) with all stoplogs removed.

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Geotechnical Calculations and Test Pit Logs - Exhibit 02

Net Unloading Calculation

A net loading calculation was completed to determine if a settlement analysis was necessary. The purpose was to determine if the existing overburden pressure exceeds the proposed loading at the outlet structure location. This calculation assumes the re-compression settlement is minimal and the any soft soils at the bearing surface will be repair or replaced. The analysis concluded that the proposed applied pressure is less than the existing overburden pressure; therefore, no settlement analysis is required.

Mud Mat Reinforcement Calculation

A reinforcement calculation was completed to determine the amount of reinforcement necessary in the mud mat. This calculation assumes the reinforcement is only required for shrinkage control, not structural support. The standard ACI 318-08 7.12.2.1b was used to determine the minimum reinforcement ratio required.

Ash Pond Outlet Structure Test Pit Logs

On July 7, 2011, Stantec observed the excavation of two (2) test pits, designated APOS-1 and APOS-2. The test pit locations were surveyed by TVA Survey and excavation by TVA Civil Projects using a trackhoe. The purposed of this work was to determine the bearing conditions at the location of the outlet structures. The test pits were excavated to depth of 7.5 to 8.0 feet below the existing ground surface, or 0.5 to 1.0 feet below the base of the mud mat. The materials encountered consisted of fly ash and bottom ash with some clay and cenosphere deposits. The material at the mud mat elevation consisted of bottom ash and fly ash for APOS-1 and APOS-2, respectively. Groundwater was encountered in APOS-2 during the excavation at a depth of 7 feet.

Exhibit 01

Report of Hydrologic and Hydraulic Analysis & Risk Analysis

Report of Hydrologic and Hydraulic Analysis & Risk Analysis

Ash Pond and Stilling Pond
TVA Kingston Fossil Plant
Roane County, Tennessee

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Report of Hydrologic and Hydraulic Analysis and Risk Analysis

Ash Pond and Stilling Pond
TVA Kingston Fossil Plant
Roane County, Tennessee

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Executive Summary

This draft report includes information on the hydrologic and hydraulic (H&H) model created to represent existing conditions at the Kingston Fossil Plant. Information pertaining to additional model scenarios will be added to this draft report once these models are completed.

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Report of Hydrologic and Hydraulic Analysis and Risk Analysis

Ash Pond and Stilling Pond
TVA Kingston Fossil Plant
Roane County, Tennessee

1. Introduction

The purpose of this project is to determine risk associated with pond overtopping (Ash Pond and Stilling Pond) during various stages of construction at the TVA Kingston Fossil Plant. As part of this effort, a hydrologic and hydraulic (H&H) model created previously as a screening-level tool to assess freeboard and capacity in support of the report entitled "Report of Hydrologic and Hydraulic Analysis – Ash Pond and Stilling Pond" dated September 30, 2010 was refined and updated to model four different scenarios including:

- Existing Conditions (as of late January, 2011)
- Scenario 1 (assumed maximum inflow to ash pond and potential overtopping of Divider Dike) – North and Central Dredge Cell stacking complete (infill not yet placed), Lateral Expansion complete;
- Scenario 2 (assumed maximum inflow to Stilling Pond and potential Dike C overtopping) – All Stacking complete (infill area complete, ash pond filled), revegetation not established;
- Final Configuration.

For each scenario the results of the new H&H model were used to:

1) Assess the impacts of the changes in site drainage on peak inflow to the ash and stilling ponds;
2) Estimate the storm event that causes overtopping of the perimeter embankment;
3) Estimate the approximate dimensions of the emergency spillway required to convey flow from the ash and stilling ponds without overtopping the perimeter embankment for one selected storm event (generally the 6-hour Probable Maximum Precipitation (PMP) event).

This report summarizes the calculations and results for each of the four scenarios.

2. Existing Conditions Model

The existing conditions model was created to represent conditions on the site as of late January, 2011. The following sections summarize the assumptions, methodology, and results associated with the existing conditions model.

2.1. Modeling Assumptions

a. Pipes are assumed to be flowing freely and are not clogged or leaking. Some of the pipes may, in actuality, be clogged and some of the older pipes may be leaking (especially older corrugated metal pipes). Elevations and flows determined for this analysis may not be applicable in those situations.

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b. Wave action is not considered in this analysis. Overtopping is assumed to occur only when the modeled water surface elevation of the pond rises above the minimum crest elevation. In reality, wave action may play a role in the overtopping of the ponds. Compensating for wave action is beyond this scope of work.

c. The model takes into account the tailwater effect of the downstream water surface elevation (WSEL) of the Stilling Pond on the upstream outfall structures in the Ash Pond. A rating curve was developed for each storm event for the Ash Pond utilizing an expected downstream WSEL for the Stilling Pond. The expected WSEL of the Stilling Pond was generated using the HEC-HMS model as if the outfall structures of the Ash Pond were free flowing. This generated a maximum WSEL for the Stilling Pond. This WSEL was then used to generate a new rating curve for the Ash Pond. This results in the Ash Pond rating curves being slightly conservative since only the maximum WSEL of the downstream Stilling Pond was used. All rating curves are shown in Appendix C.

d. During the initial run for the 6-HR PMP event, the model run ends when the WSEL rises to the top of the Ash Pond at an elevation of 765.00 feet (ft). This elevation is the top of embankment elevation depicted in available survey data. This result suggested that the water in the Ash Pond would overtop the existing dike during the 6-HR PMP event. To estimate the amount of flow overtopping the dike and entering the downstream Stilling Pond, weir flow over the top of the dike was modeled. In reality, not all of the overtopping flow would enter the Stilling Pond as some of the flow would leave the Ash Pond and flow directly into the river. For the purposes of this model it was assumed that all of the overtopping flow would enter the Stilling Pond.

e. For modeling purposes the overtopping spillway was conservatively estimated to be the length of the dike separating the two ponds at 2070 LF. In reality, a localized low area would serve as the primary flow path. To facilitate modeling, the highest elevation in the ash pond storage table was extended to 766.00 ft. The surface area of the pond at both the 766.00 ft and 765.00 ft elevations was estimated to be 83.58 acres. Using these values, a new stage-discharge rating curve and a stage-volume curve were generated for the 6-HR PMP event. The 6-HR PMP Ash Pond rating curve can be reviewed in Appendix C.

f. Wherever ash existed in the drainage area, it was assumed to behave as a Hydrologic Group C soil. The water surface of the ponds was considered to be impervious so that 100% of the rainfall was assumed to flow directly into the pond as runoff.

g. This model was not calibrated as sufficient data from actual storms was not available.

2.2. Methodology

2.2.1. Watershed Description

For the updated existing conditions analysis, general flow characteristics were verified during a field visit on January 31, 2011. Watershed boundaries were delineated to reflect

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topographic data dated December, 2010. The invert elevations of several pipes connecting the watersheds were surveyed in January, 2011 and the December, 2010 topographic data was used to reflect storage upstream of several of these outlet pipes. A schematic showing the watersheds and connectivity used to update the H&H model is attached as Appendix A. Drainage Areas for each watershed are summarized in Table 1.

2.2.2. SCS Parameters

SCS methodologies were applied to predict runoff and were computed using Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) software. Composite curve numbers for each of the watersheds were calculated based on aerial imagery dated November 22, 2010. A curve number of 87 was assumed for ash covered areas and a curve number of 79 was assumed for grass covered areas. The impervious area percentage, including ponded areas, was calculated for each watershed. Curve numbers are shown in Table 1.

SCS TR-55 methodologies were used to calculate a time of concentration and a lag time for each watershed. For the Stilling Pond and the Ash Pond, a lag time of 5 minutes was assumed. Lag times for each watershed are summarized in Table 1.

Table 1. Watershed Parameters

Pond Name	Drainage Area (acres)	Composite Curve Number	Percent Impervious Area	Lag Time (minutes)
Ash Pond	65.1	87	45.9	5
Ball Field East	22.0	87	0.0	9
Ball Field South	8.7	87	0.0	7
French Drain	12.6	81	0.0	5
Lateral Expansion	29.2	87	3.9	13
Relic Area	24.7	87	0.0	7
Sluice Trenches	30.3	87	11.7	6
Stilling Pond	28.3	87	85.9	5
Test Embankment	11.1	87	0.0	8

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2.2.3. Stage-Storage

Elevation-Area curves were developed for the Ash Pond and the Stilling Pond. The Elevation-Area curve developed for the Stilling Pond was computed based on topographic data dated February 27, 2010 and hydrographic survey data dated August 20, 2009. Elevation-Area relationships were re-calculated using the above-water December, 2010 contour data. For the Stilling Pond, these calculations closely matched the previous calculations. However, for the Ash Pond the areas calculated based on the December, 2010 data were reduced in some cases by as much as 8 acres. Therefore, the new area calculations were used for the above-water elevations. A summary of the elevation-area data can be found in Appendix B.

Additional storage was modeled behind the Sluice Trenches, Relic Area, Ball Field East, and Ball Field South watersheds. Elevation-area curves were calculated based on the

December, 2010 topographic data. A culvert analysis was performed using the January, 2011 surveyed pipe invert elevations and pipe sizes to establish a rating curve for these storage areas. These elevation-area curves and spillway rating curves can be found in Appendix D.

For all modeled storage areas an initial water surface elevation was defined within the model. For the Ash Pond and the Stilling Pond the base flow was run through the model to come up with starting water surface elevations of 760.5 and 754.9 feet, respectively. For the Relic Area the pipe invert elevation from the January 2011 survey was used. For the Ball Field East, Ball Field South, and Sluice Trenches storage areas, elevations from the topographic data that corresponded with approximate water surface elevations depicted on the aerial imagery were chosen as the starting water surface elevations.

2.2.4. Spillway Rating Curves

Spillway rating curves were developed based on the configuration and elevations of the five risers for the Ash Pond shown in TVA drawings 10W425-24, 10W425-70, 10W425-77, 10W425-78, 10W425-79, and 10W425-80 and for the Stilling Pond shown in TVA drawings 10W421, 10N422, and 10N423. An Excel file provided by TVA entitled "TVA Spillway Concrete Top Survey"; dated January 23, 2009 lists multiple plants with surveyed riser elevations and approximate riser invert elevations. The approximate riser invert elevations match the data from TVA drawing 10W421. The data gathered from these files were compiled for the rating curves and is shown in Table 2.

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Table 2. Existing Spillway Data

Pond	Weir/Orifice Structure	Weir Length (ft)	Weir Elevation (ft)	Orifice Opening (ft^2)	Orifice Invert (ft)	Data Source
Ash Pond	1	48	760.00	36	752.00	TVA drawings 10W425-70, 10W425-79, 10N425-80
Ash Pond	2	48	760.00	36	752.00	TVA drawings 10W425-70, 10W425-79, 10N425-80
Ash Pond	3	48	760.00	36	752.00	TVA drawings 10W425-70, 10W425-79, 10N425-80
Ash Pond	4	48	760.00	36	752.00	TVA drawings 10W425-70, 10W425-79, 10N425-80
Ash Pond	5	48	760.00	36	752.00	TVA drawings 10W425-70, 10W425-79, 10N425-80

Table 2. Existing Spillway Data

Pond	Weir/Orifice Structure	Weir Length (ft)	Weir Elevation (ft)	Orifice Opening (ft^2)	Orifice Invert (ft)	Data Source
Stilling Pond	A	48	756.54	36	746.00	"TVA Spillway Concrete Top Survey", 1-23-09
Stilling Pond	B	48	754.48	36	746.00	"TVA Spillway Concrete Top Survey", 1-23-09
Stilling Pond	C	48	754.44	36	746.00	"TVA Spillway Concrete Top Survey", 1-23-09
Stilling Pond	D	48	754.43	36	746.00	"TVA Spillway Concrete Top Survey", 1-23-09
Stilling Pond	E	48	754.45	36	746.00	"TVA Spillway Concrete Top Survey", 1-23-09
Stilling Pond	F	48	754.42	36	746.00	"TVA Spillway Concrete Top Survey", 1-23-09

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Standard hydraulic equations were used to develop a rating curve for the existing spillways and level-pool routing methodology was used in HEC-HMS to route the design storm through the outlets. The spillway rating curves can be found in Appendix C.

Flow just above the riser crest behaves as weir flow and can be computed using:

$$Q = C_w L H^{\frac{3}{2}} \qquad \textbf{Eqn. 2.1}$$

where: Q = discharge (cubic feet per second); Cw = weir coefficient; L = weir length (ft); and H = head above the riser crest (ft). The weir has been assumed to behave as a sharp-crested weir and therefore a weir coefficient of 3.27 (Chow 1959) was selected.

As head develops above the riser crest, orifice flow in the riser may limit flow through the spillway system. Orifice flow in the riser can be computed as:

$$Q = C_0 A \left(2gH\right)^{0.5} \qquad \textbf{Eqn. 2.2}$$

where C_0 = orifice discharge coefficient, A = cross sectional area of the riser, g = gravitational constant, and H = head above the riser crest. An orifice discharge coefficient of 0.6 (Brater

and King 1976) was selected. Weir and orifice flow through the riser crest were compared at each water surface elevation and the minimum was used as the controlling discharge.

Orifice flow in the outlet pipe was also computed for the range of conditions using:

$$Q = C_0 A \left[2g \left(H_C \right) \right]^{0.5} \qquad \textbf{Eqn. 2.3}$$

where H_c = head above the centroid of the outlet pipe, A = cross sectional area of the outlet pipe. This equation reflects that the head acts on the centroid of flow in the outlet pipe. This flow was compared to the controlling flow in the riser section and the limiting flow was used in the rating curve.

Flow over the dike crest for overtopping calculations was assumed to act as broad-crested weir flow. Broad-crested weir flow was assumed using the equation:

$$Q = C_w L H^{3/2} \qquad \textbf{Eqn. 2.4}$$

where H = head above the weir crest, L = cross-sectional length of the weir crest rectangular section, C_w = weir coefficient (assumption of 3.087).

Tailwater effects from the Emory River were considered in the Stilling Pond rating curve calculation and tailwater effects from the Stilling Pond were considered in the Ash Pond rating curve calculation. For the Stilling Pond, the 100-year elevation of the Emory River (based on FEMA floodplain mapping) was used as the tailwater elevation (747.1 ft NGVD29). A figure showing the FEMA mapping is shown in Appendix D. For the Ash Pond, the expected elevation of the Stilling Pond during each storm event was used as the tailwater elevation.

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2.2.5. Diversions

Diversions were also added into the model to represent different flowpaths as storage areas fill. A diversion was created in the HEC-HMS model for the Ball Field East area and the Ball Field South area. The December, 2010 topographic data, suggests that once the Ball Field East storage area is inundated above elevation 767 ft, the flow is directed to the storage area associated with the Sluice Trenches. When the Ball Field South storage area fills above elevation 768 ft, flow is diverted to a small low-lying area outside of the watershed. To compute overflow rates, an approximate weir length was estimated along the low portion of the embankment and weir equations were used to determine the overflow. The inflow-diversion data can be found in Appendix F.

For the Ash Pond and the Stilling Pond, the minimum crest elevation was assumed to be 765.0 ft based on the December 2010, topographic data. Once water surface elevations exceeded this value the pond was assumed to be overtopping. All flow from the Ash Pond overtopping was assumed to flow into the Stilling Pond. While it is likely that some of the flow may drain into the Emory River, this assumption results in a conservative estimate for the Stilling Pond peak pool elevations.

2.2.6. Precipitation Data

Rainfall events simulated in the HEC-HMS model included the 1-, 10-, 25-, 50-, and 100-year 24-hour SCS Type II storms as well as the 6-hour PMP. SCS Type II rainfall depths were taken from NOAA Atlas 14 for Kingston, TN. Rainfall depth for the 6-hour PMP event was taken from NOAA HMR-56. Rainfall depths are summarized in Table 3.

Table 3. Rainfall Depths

Storm Event	Rainfall Depth (inches)
1-year 24-hour	2.84
10-year 24-hour	4.72
25-year 24-hour	5.53
50-year 24-hour	6.17
100-year 24-hour	6.80
6-hour PMP	36.3

A summary of the HEC-HMS inputs and outputs can be found in Appendix G.

Plant process flows were considered in this analysis. Plant process flows were based on email correspondence from Jason T. Weaver and assumed to be a constant flow of 75 cfs (33,650 gpm). Slightly varying process flows were reported from TVA ranging from 40.79 MGD to 48.46 MGD (See Appendix H). The most conservative value of 48.46 MGD (75 cfs) was used in the analysis.

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2.3. Existing Conditions Results

The updated existing conditions model reflects an additional area of runoff (approximately 30 acres), in comparison to the previous study, that drains to the Ash Pond (The Relic Area and Test Embankment areas shown on the attached schematic). Without the additional areas, the Ash Pond was able to pass a 100-year event but overtopped for a 6-hour PMP while the Stilling Pond was able to pass both the 100-year event and 6-hour PMP. The current analysis shows that the additional runoff does not impact the Ash Pond enough to cause it to overtop for a 100-year event and does not cause the Stilling Pond to overtop during the 6-hour PMP. Peak pond elevations for these events are summarized in Table 4.

Table 4. H&H Analysis Results

		Peak Water Surface Elevations					
Pond Name	Drainage Area (acres)	1-year 24-hour rainfall event	10-year 24-hour rainfall event	25-year 24-hour rainfall event	50-year 24-hour rainfall event	100-year 24-hour rainfall event	6-hour PMP rainfall event)
Ash Pond	204.2	760.9	761.2	761.3	761.4	761.5	**765.7***
Stilling Pond	232.3	755.3	755.5	755.6	755.7	755.8	763.9

*Pond overtops

Additional rainfall events were modeled in order to determine the rainfall events that would cause the Ash Pond and the Stilling Pond to overtop. Based on the current analysis, it appears that the Ash Pond can handle approximately 26.0 inches of rain (SCS Type II 24-hour rainfall event) before it begins to overtop. The Stilling Pond can handle the 6-hour PMP event without overtopping. The 1000-year rainfall in the Kingston area is approximately 9 inches. Therefore, the probability of an event occurring that would overtop the Ash Pond or the Stilling Pond is rare, with a less than a 0.1% chance of occurring annually.

Based on an Ash Pond closure date of May 13, 2014, the risk of an event occurring before then that would overtop the Ash Pond or the Stilling Pond is less than 0.3%. It should be noted that this risk calculation does not consider potential for wave action to cause overtopping and assumes normal operating conditions (i.e. plant inflows are typical and spillways are not blocked) in addition to the modeled storm event.

In order to prevent the Ash Pond overtopping during a PMP event, a spillway could be constructed between the Ash Pond and the Stilling Pond. For the purposes of this study, an open-channel rectangular spillway was assumed with a crest elevation of 761'. At this elevation, the spillway would need to be approximately 150' wide for the Ash Pond in order to pass the PMP. The additional inflow into the Stilling Pond from the emergency spillway during a PMP event would cause the Stilling Pond to overtop. Therefore, an additional spillway would also need to be added between the Stilling Pond and the River. A 100' spillway at elevation 761' would be sufficient pass the PMP event for the Stilling Pond.

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2.4. Additional Modeling – Siphon Analysis

The existing conditions model was also used to support the siphon design. The rating curves calculated during the siphon design were input into the HEC-HMS model. Based on these rating curves, the 10-year and 100-year peak pool elevations for the Stilling Pond would be approximately 756.1' and 757.4' respectively. The amount of rainfall that would cause the spillway risers to begin to overtop is approximately 2.8", which is approximately a 1-year rainfall event.

2.5. Additional Modeling – Drawdown Analysis

The existing conditions model was also utilized to support the drawdown plan and identify how many pipes would need to be placed through the embankment between the Ash Pond and the Stilling Pond in order to convey the flow. Assuming a downstream invert of 755.0', an upstream invert of 755.5', eight Agridrain structures with all stoplogs in place would be sufficient to pass 22 inches of rainfall (SCS Type II 24-hour storm) without overtopping the divider dike. The normal pool elevation is expected to be approximately 761.1' with all stoplogs in place. Once all stoplogs are removed, the expected normal pool elevation is 756.3'. Assuming the capacity of the Ash Pond does not change, the Agridrain structures should be able to pass up to 33 inches of rainfall (SCS Type II 24-hour storm) without overtopping the divider dike once all stoplogs are removed. The tailwater in the Stilling Pond was assumed to be 754.7' for this analysis.

3. Scenario 1 Model

To be added.

4. Scenario 2 Model

To be added.

5. Final Configuration model

To be added.

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Appendix A

Watershed Schematic

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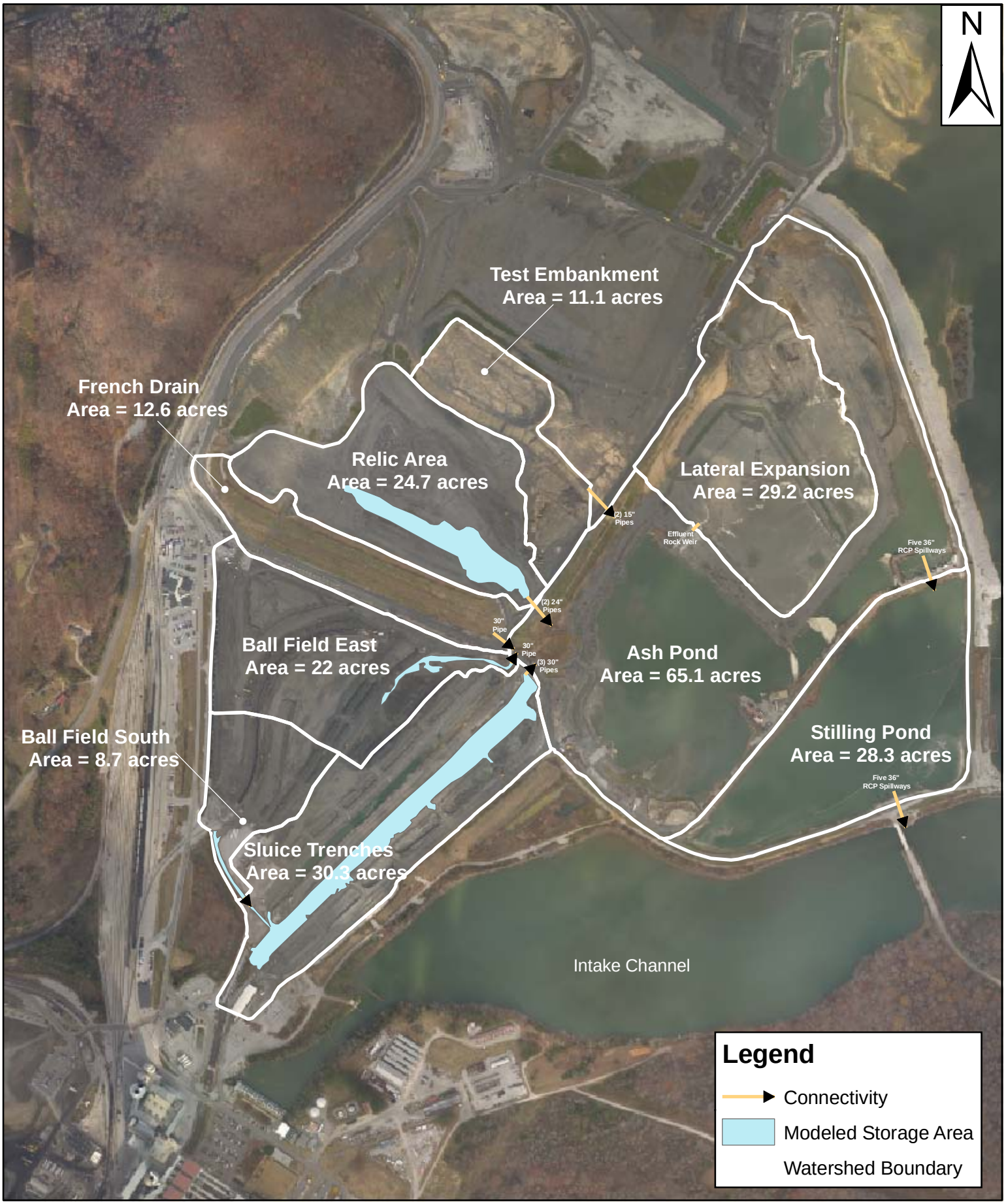


Kingston H&H Schematic (Existing Conditions)

0 600 1,200 Feet

Appendix B

Stage-Storage Data

DRAFT

Existing Conditions

Ash Pond Stage-Storage	
Pond Elev. (ft)	Pond Area (ac)
742	0.21
743	3.74
744	5.13
745	9.39
746	10.91
747	11.89
748	12.98
749	13.97
750	14.96
751	15.91
752	17.43
753	18.27
754	19.13
755	20.03
756	21.01
757	22.58
758	24.76
759	26.18
760	25.38
761	31.56
762	39.00
763	42.67
764	48.30
765	83.58
766	83.58

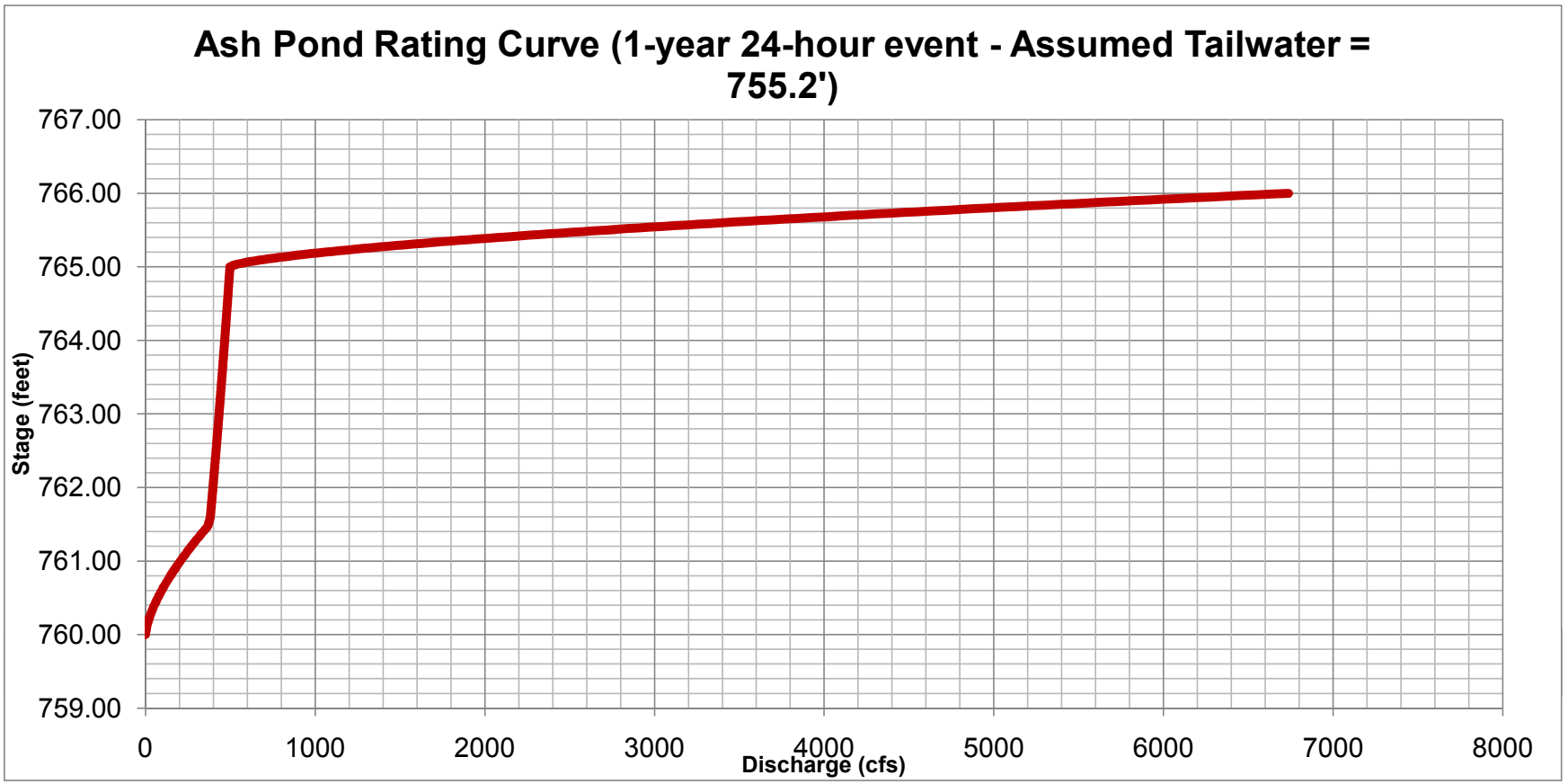
Stilling Pond Stage-Storage	
Pond Elev(ft)	Pond Area(ac)
740	0.05
741	0.33
742	0.53
743	0.91
744	1.55
745	2.7
746	3.18
747	3.83
748	12.34
749	19.42
750	20.98
751	22.01
752	22.67
753	23.23
754	23.79
754.42	23.99
755	24.27
756	24.69
757	25
758	25.27
759	25.5
760	25.72
761	25.95
762	26.21
763	26.45
764	26.76
765	27.48

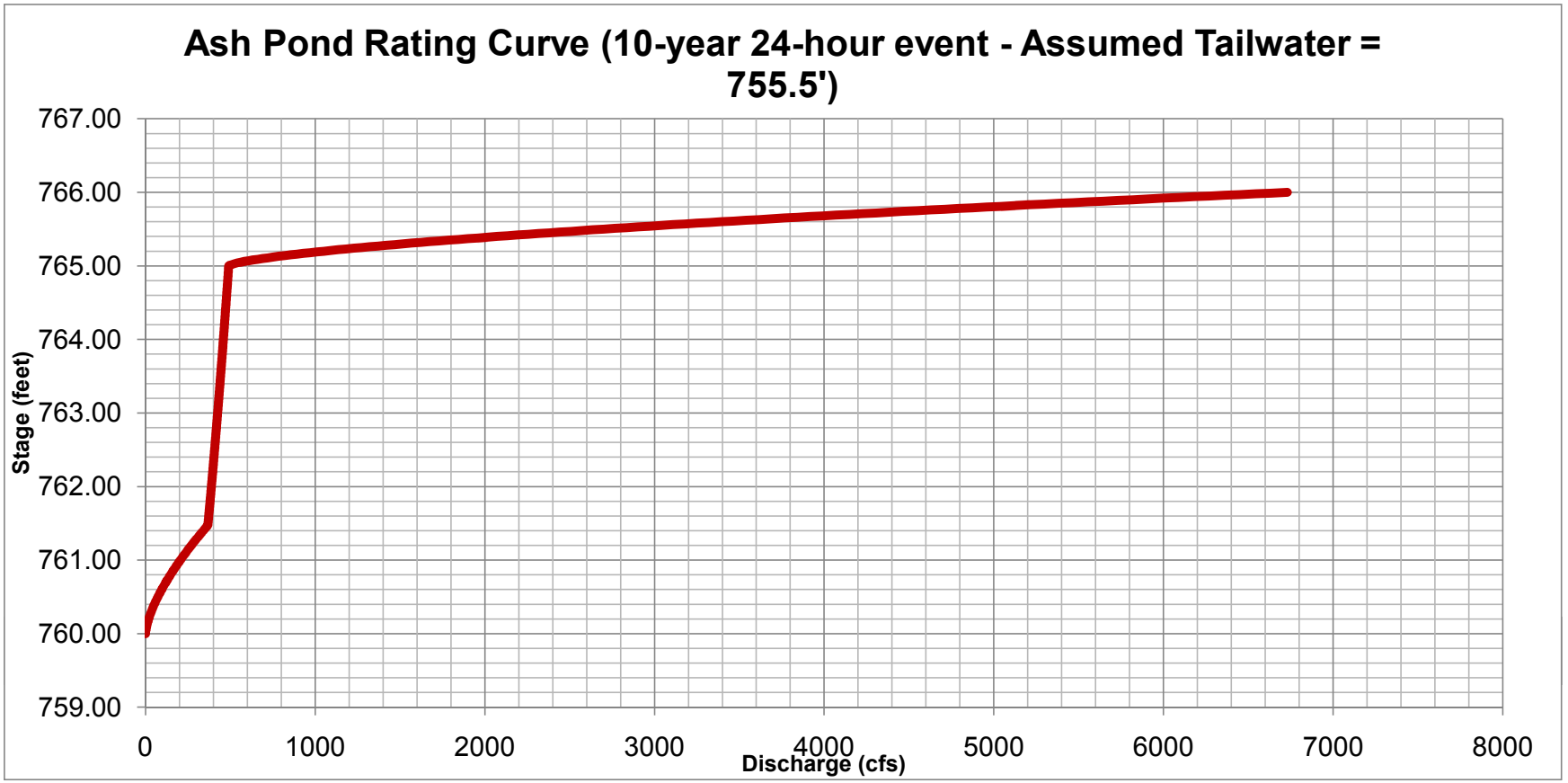
Water Surface Elevation (Normal Pool)
Lowest Elev. at Top of Dike
Used for routing overtopping

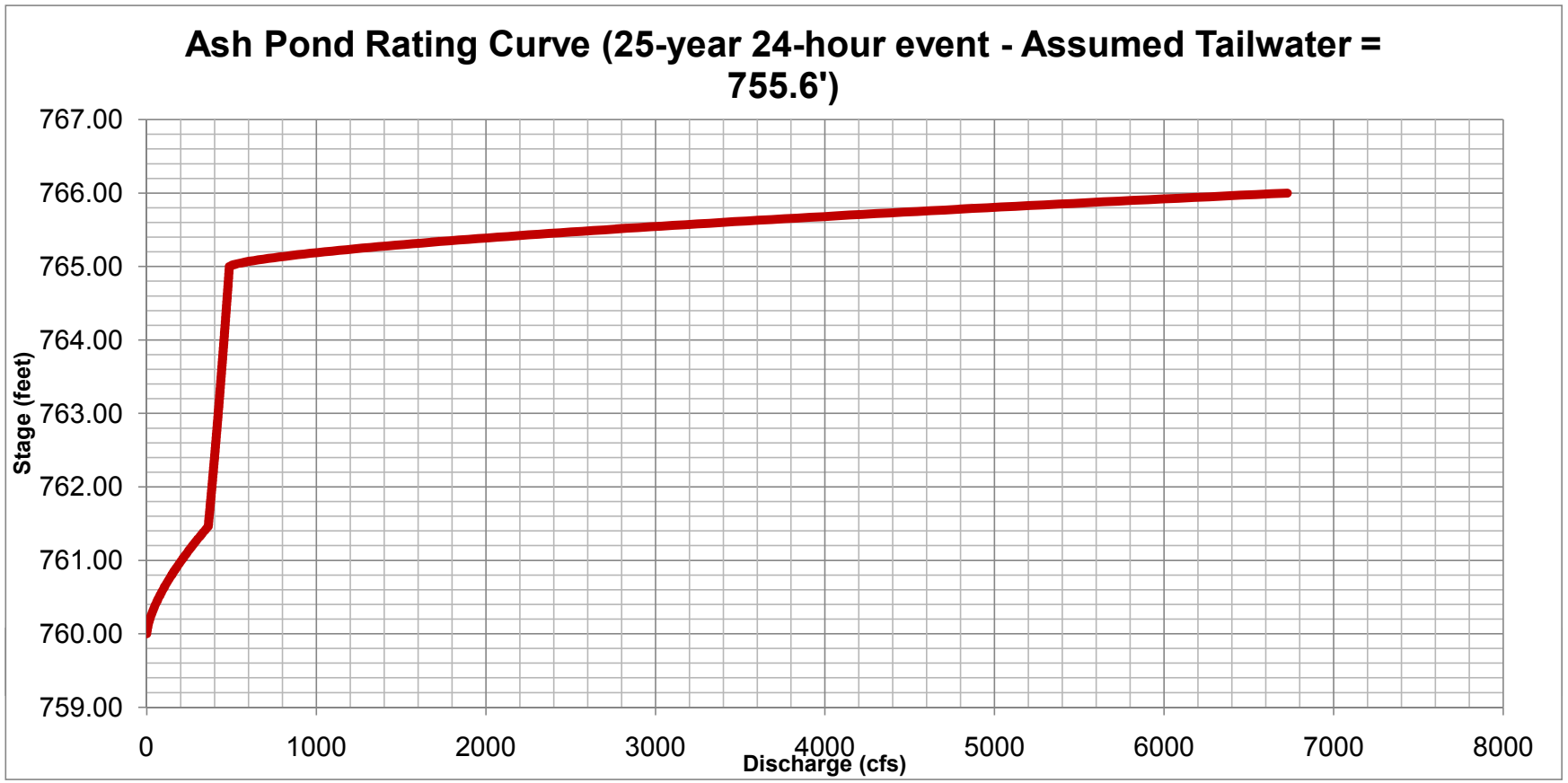
Appendix C

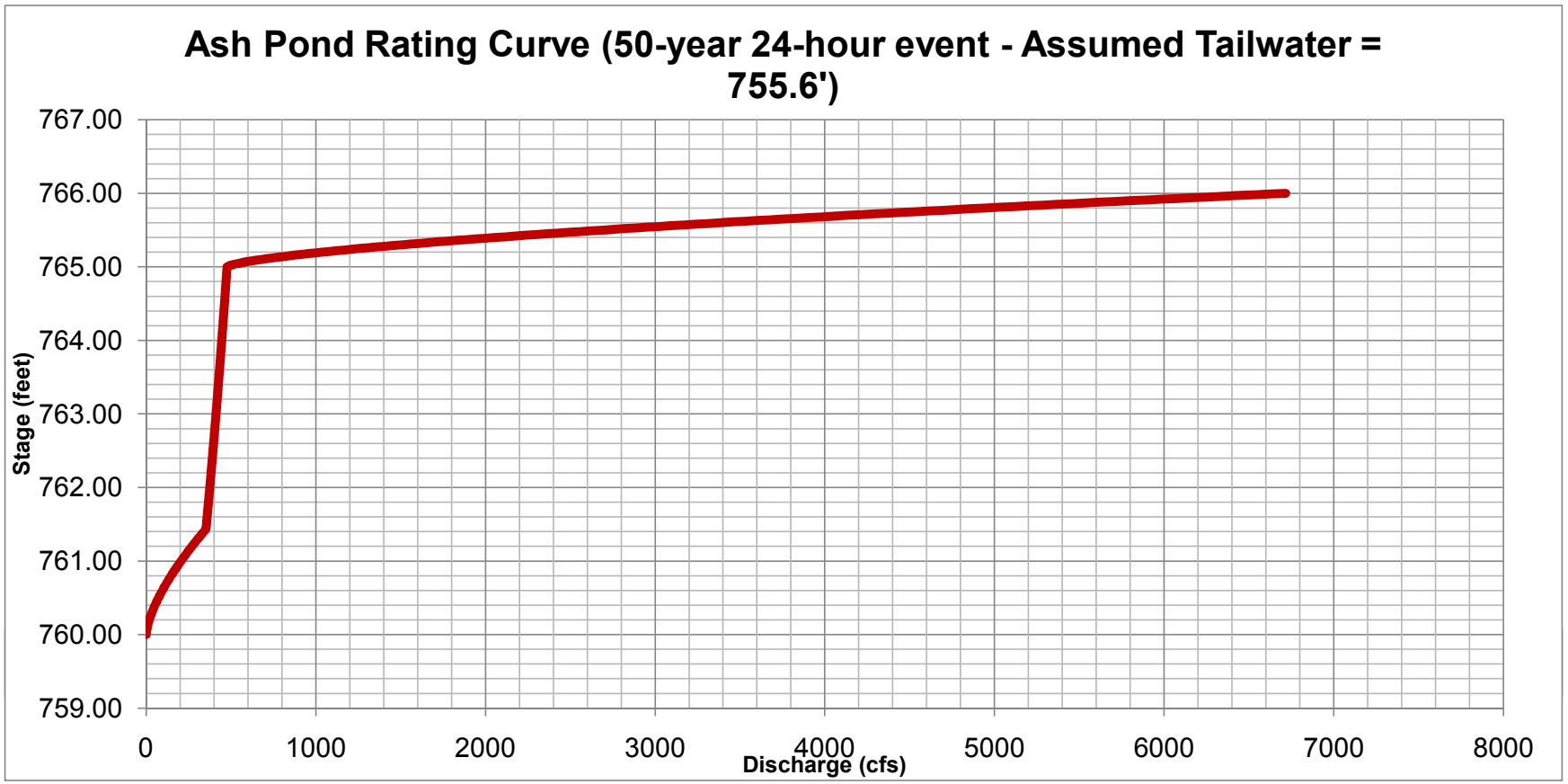
Spillway Rating Curves

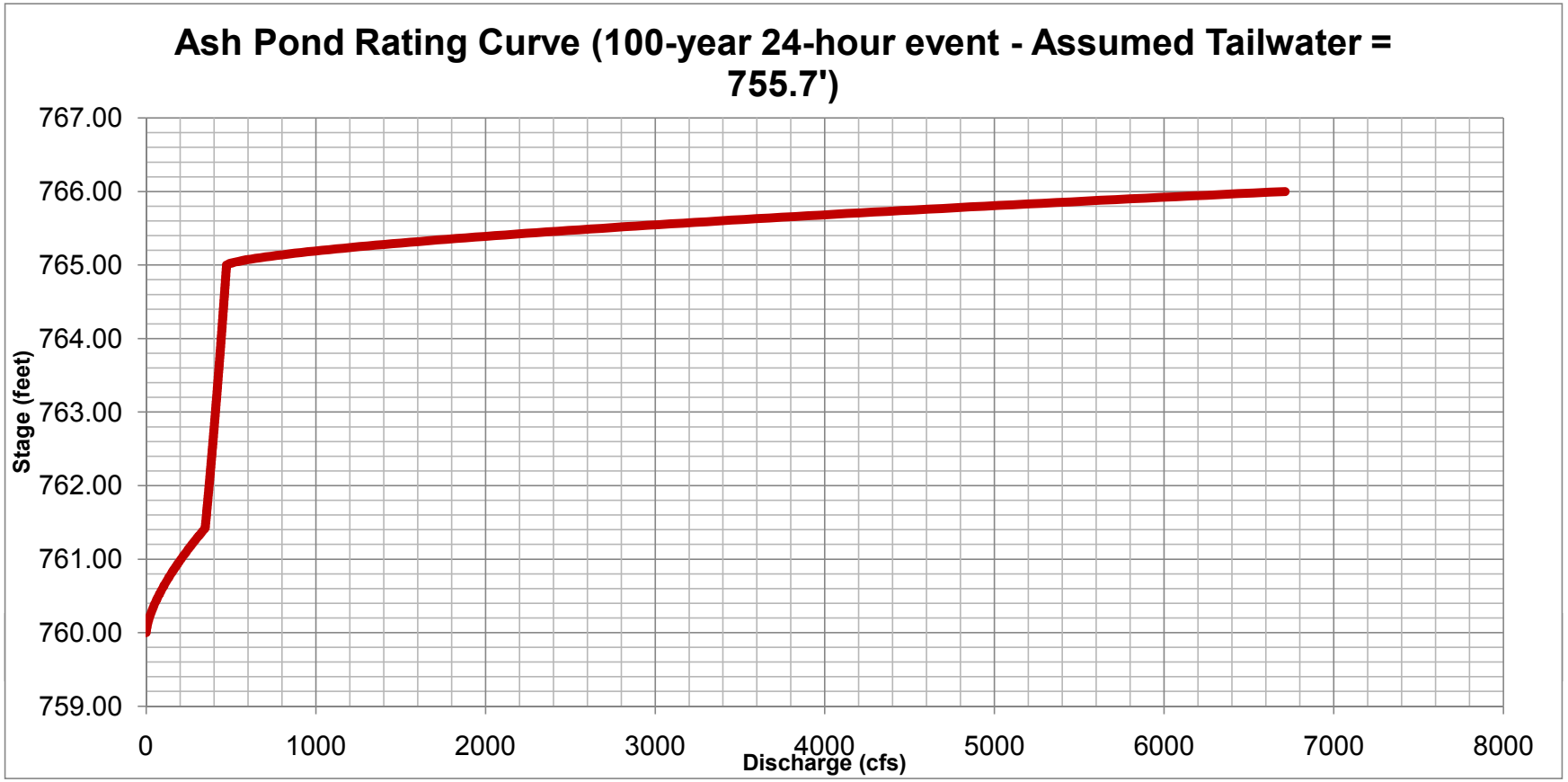
DRAFT

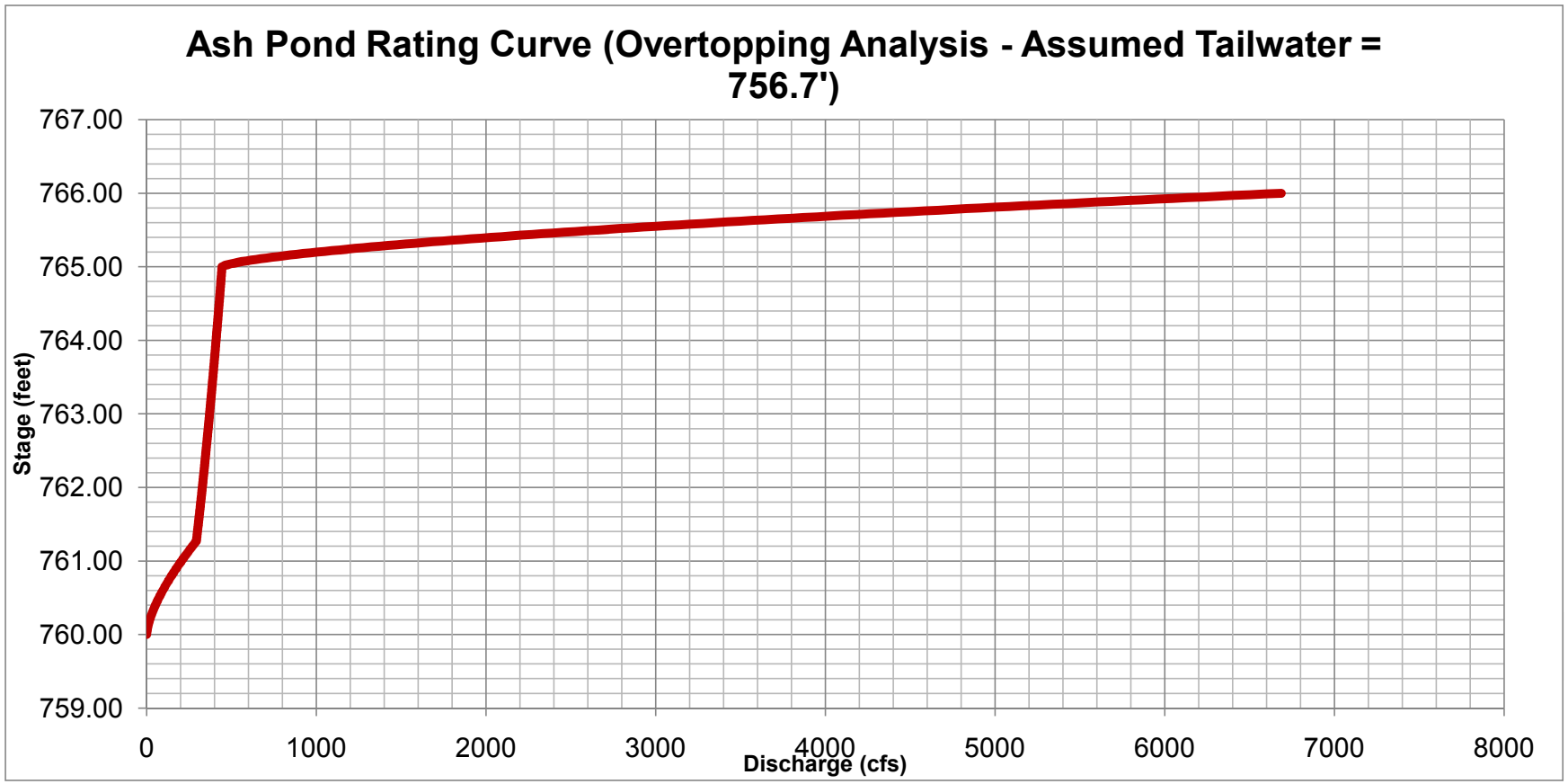

Ash Pond Rating Curve (1-year 24-hour event - Assumed Tailwater = 755.2')
767.00
766.00
765.00
764.00
763.00
762.00
761.00
760.00
759.00
Stage (feet)
0
1000
2000
3000
4000
5000
6000
7000
8000
Discharge (cfs)

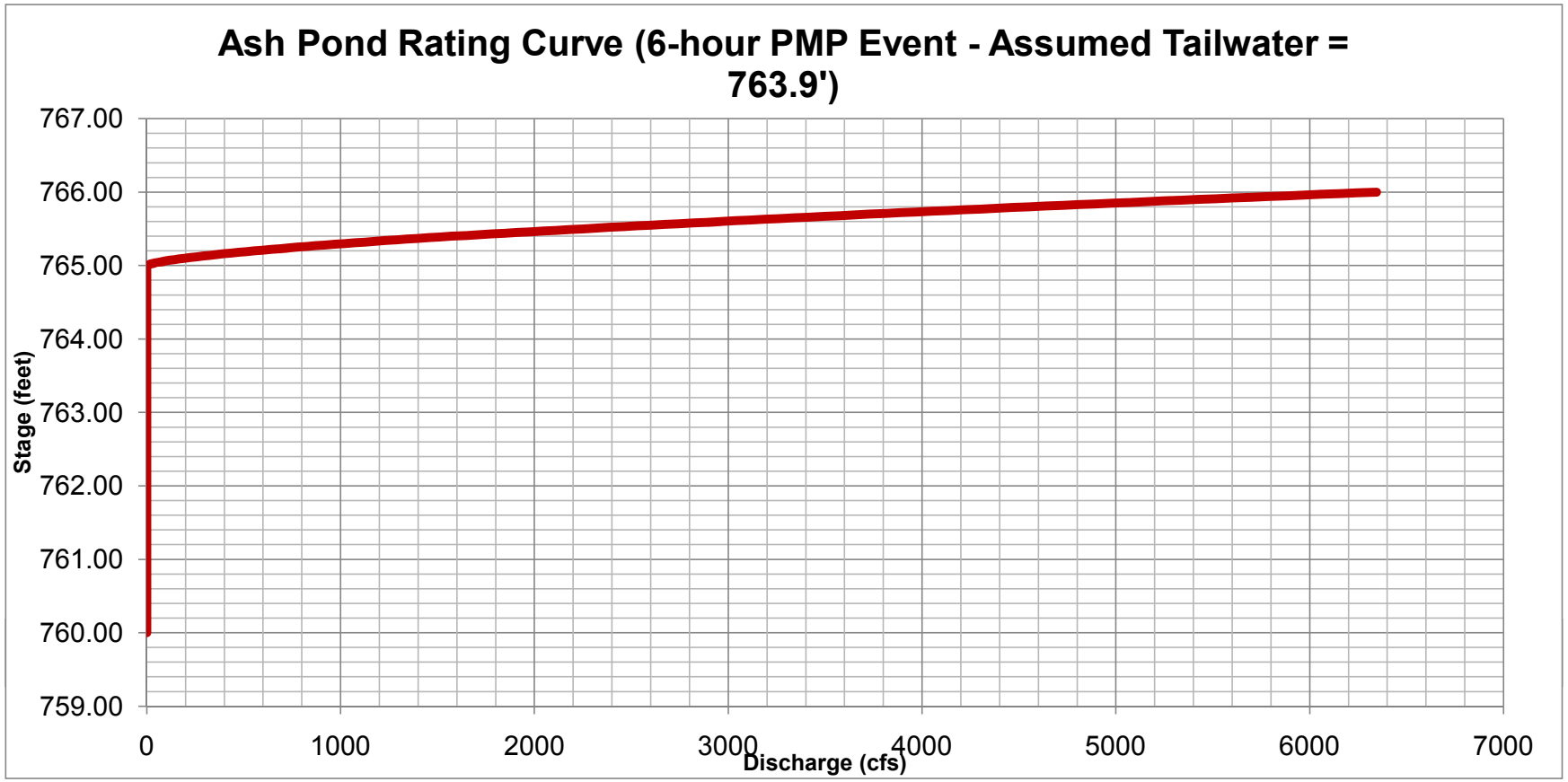

Ash Pond Rating Curve (10-year 24-hour event - Assumed Tailwater = 755.5')
767.00
766.00
765.00
764.00
763.00
762.00
761.00
760.00
759.00
Stage (feet)
0
1000
2000
3000
4000
5000
6000
7000
8000
Discharge (cfs)

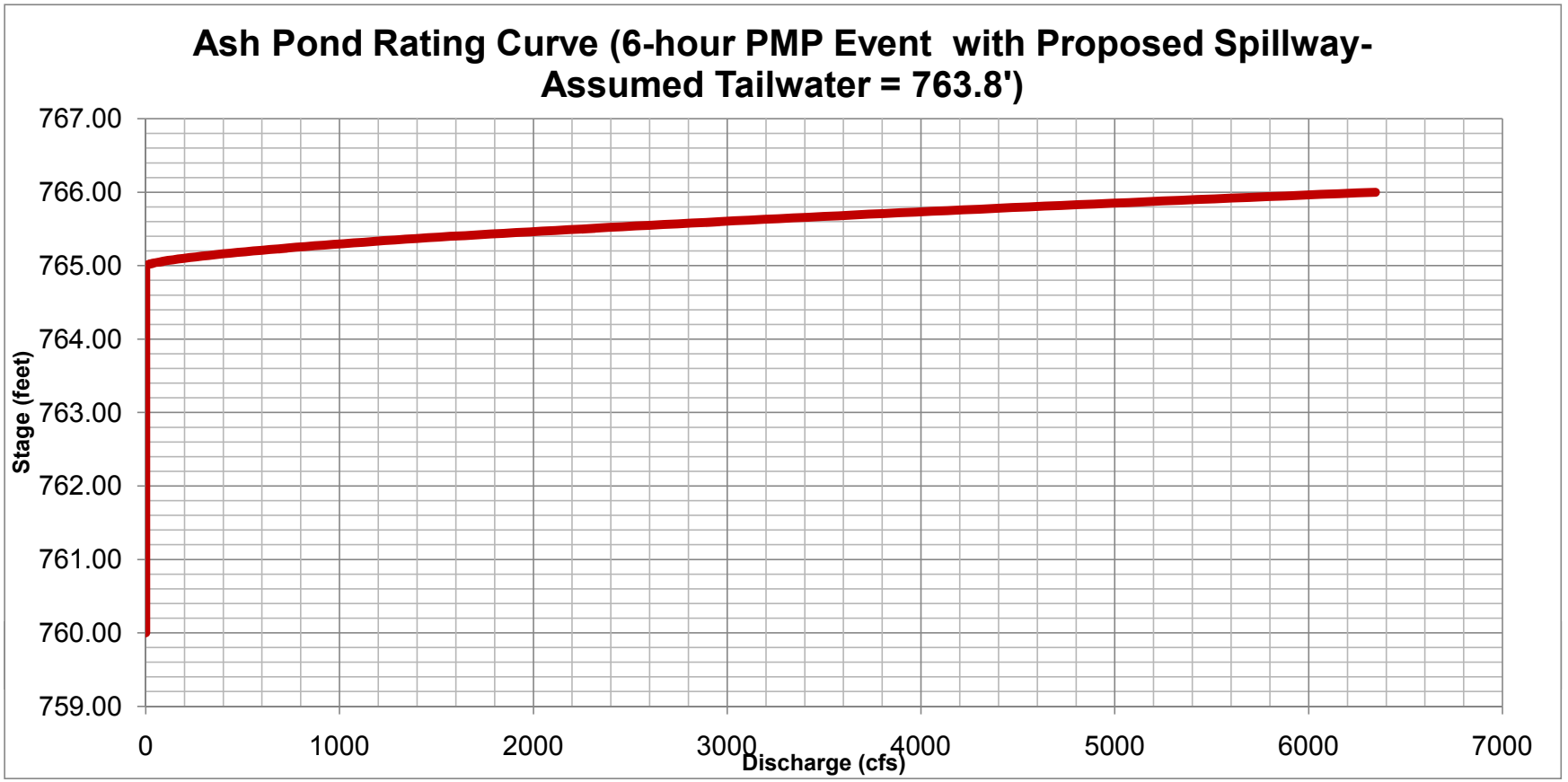

Ash Pond Rating Curve (25-year 24-hour event - Assumed Tailwater = 755.6')
767.00
766.00
765.00
764.00
763.00
762.00
761.00
760.00
759.00
Stage (feet)
0
1000
2000
3000
4000
5000
6000
7000
8000
Discharge (cfs)

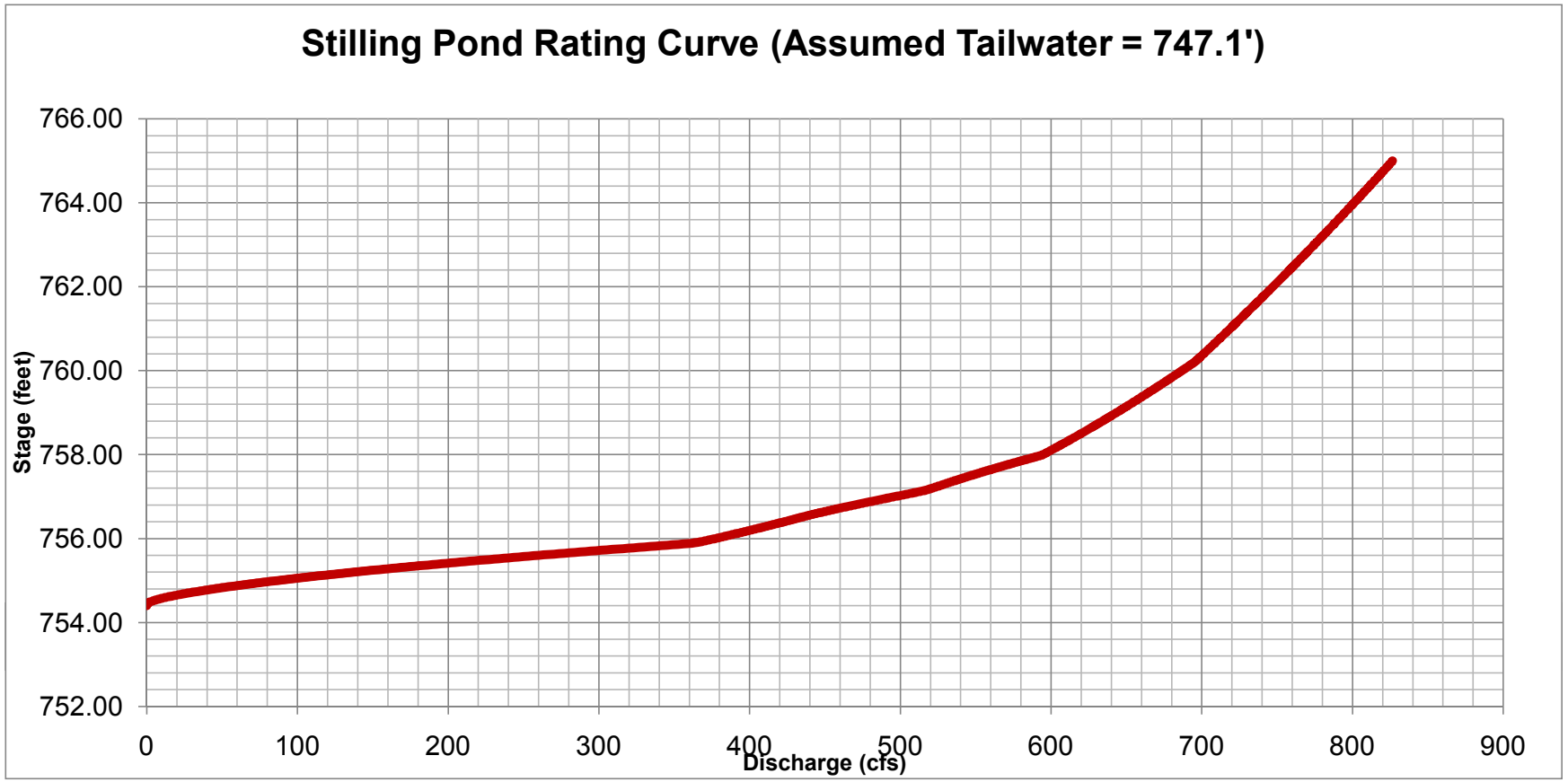

Ash Pond Rating Curve (50-year 24-hour event - Assumed Tailwater = 755.6')
767.00
766.00
765.00
764.00
763.00
762.00
761.00
760.00
759.00
Stage (feet)
0
1000
2000
3000
4000
5000
6000
7000
8000
Discharge (cfs)

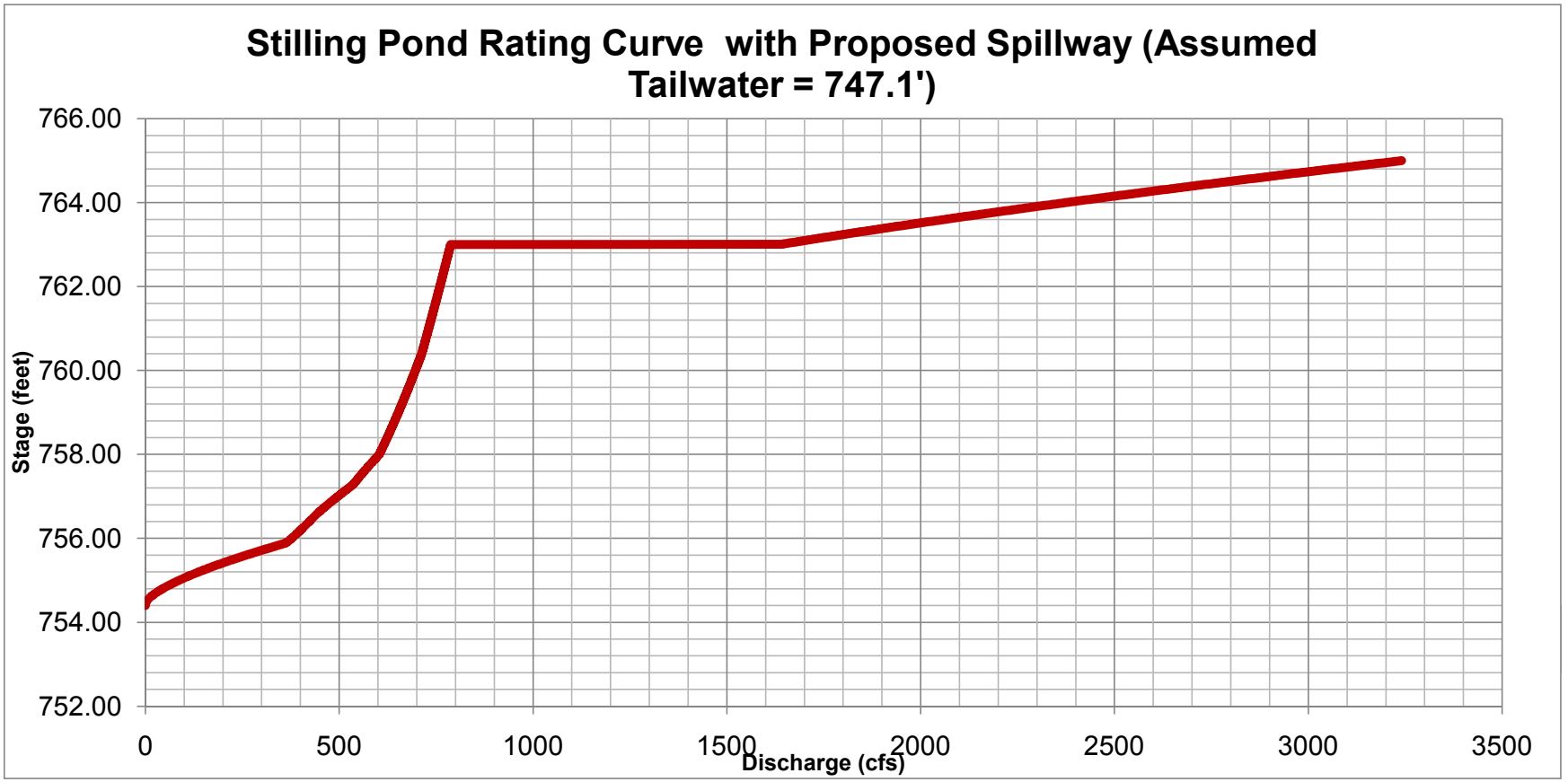

Ash Pond Rating Curve (100-year 24-hour event - Assumed Tailwater = 755.7')
767.00
766.00
765.00
764.00
763.00
762.00
761.00
760.00
759.00
Stage (feet)
0
1000
2000
3000
4000
5000
6000
7000
8000
Discharge (cfs)


Ash Pond Rating Curve (Overtopping Analysis - Assumed Tailwater = 756.7')
Stage (feet)
767.00
766.00
765.00
764.00
763.00
762.00
761.00
760.00
759.00
0
1000
2000
3000
4000
5000
6000
7000
8000
Discharge (cfs)


Ash Pond Rating Curve (6-hour PMP Event - Assumed Tailwater = 763.9')
767.00
766.00
765.00
764.00
763.00
762.00
761.00
760.00
759.00
Stage (feet)
0
1000
2000
3000
4000
5000
6000
7000
Discharge (cfs)


Ash Pond Rating Curve (6-hour PMP Event with Proposed Spillway-
Assumed Tailwater = 763.8')
767.00
766.00
765.00
764.00
763.00
762.00
761.00
760.00
759.00
Stage (feet)
0
1000
2000
3000
4000
5000
6000
7000
Discharge (cfs)


Stilling Pond Rating Curve (Assumed Tailwater = 747.1')
766.00
764.00
762.00
760.00
758.00
756.00
754.00
752.00
Stage (feet)
0
100
200
300
400
500
600
700
800
900
Discharge (cfs)


Stilling Pond Rating Curve with Proposed Spillway (Assumed Tailwater = 747.1')
Stage (feet)
766.00
764.00
762.00
760.00
758.00
756.00
754.00
752.00
0
500
1000
1500
2000
2500
3000
3500
Discharge (cfs)

No. of Structures	8
Top of Structure Elev. (ft.)	761.2
Top of Stop Log Elev. (ft.)	760
US Invert (ft.)	755.5
DS Invert (ft.)	755
DS WSEL (ft.)	754.7
Width (ft.)	2.60
Stoplog Width (ft.)	2.56
Depth (ft.)	1.6
Outlet Pipe Diameter (ft.)	2
Outlet Pipe Area (sq. ft.)	3.14
Top of Dike (ft.)	765
Dike Length (ft.)	1000

Normal Pool	761.10
Rainfall to Overtop (in.)	22.00

Proposed Spillway Rating Curves with 8 Agridrain Structures Installed (all stoplogs in place)

				Weir Flow			Orifice Flow	Pipe Flow	Overtopping Flow	Total Flow	Total Flow
				Over Stop Log	Over Structure	Total				(per structure)	
Water Surface Elevation	H_{SL}[1]	H_S[2]	H_c[3]	$Q = C_wLH_{SL}^{(3/2)}$	$Q = C_wLH_S^{(3/2)}$	$Q = C_wLH_{SL}^{(3/2)} + C_wLH_S^{(3/2)}$	$Q = C_0A(2gH_{SL})^{0.5}$	$Q = C_0A[2g(H_C)]^{0.5}$	$Q = C_wLH^{(3/2)}$		
755	--	--	--	--	--	--	--	--	0	--	--
755.5	--	--	--	--	--	--	--	--	0	--	--
756	--	--	--	--	--	--	--	--	0	--	--
756.5	--	--	--	--	--	--	--	--	0	--	--
757	--	--	--	--	--	--	--	--	0	--	--
757.5	--	--	--	--	--	--	--	--	0	--	--
758	--	--	--	--	--	--	--	--	0	--	--
758.5	--	--	--	--	--	--	--	--	0	--	--
759	--	--	--	--	--	--	--	--	0	--	--
759.5	--	--	--	--	--	--	--	--	0	--	--
760	0	--	--	0.00	0.00	0.00	--	--	0	0.00	0.00
760.5	0.5	--	5.8	2.96	0.00	2.96	14.19	36.41	0	2.96	23.70
761	1	0	6.3	8.38	0.00	8.38	20.06	37.95	0	8.38	67.04
761.5	1.5	0.3	6.8	15.39	3.66	19.05	24.57	39.43	0	19.05	152.42
762	2	0.8	7.3	23.70	15.93	39.63	28.37	40.85	0	28.37	226.98
762.5	2.5	1.3	7.8	33.12	33.00	66.12	31.72	42.23	0	31.72	253.77
763	3	1.8	8.3	43.54	53.76	97.31	34.75	43.56	0	34.75	277.99
763.5	3.5	2.3	8.8	54.87	77.66	132.52	37.53	44.85	0	37.53	300.27
764	4	2.8	9.3	67.04	104.31	171.34	40.12	46.11	0	40.12	321.00
764.5	4.5	3.3	9.8	79.99	133.46	213.45	42.56	47.33	0	42.56	340.47
765	5	3.8	10.3	93.68	164.92	258.60	44.86	48.52	0	44.86	358.89
765.5	5.5	4.3	10.8	108.08	198.51	306.60	47.05	49.69	1091.42	47.05	1467.82
766	6	4.8	11.3	123.15	234.13	357.28	49.14	50.82	3087.00	49.14	3480.14

[1] Height above Top of Stop Log

[2] Height above Top of Structure

[3] Height above the downstream WSEL

No. of Structures	8
Top of Structure Elev. (ft.)	761.2
Top of Stop Log Elev. (ft.)	755.5
US Invert (ft.)	755.5
DS Invert (ft.)	755
DS WSEL (ft.)	754.7
Width (ft.)	2.60
Stoplog Width (ft.)	2.56
Depth (ft.)	1.625
Outlet Pipe Diameter (ft.)	2
Outlet Pipe Area (sq. ft.)	3.14
Top of Dike (ft.)	765
Dike Length (ft.)	1000

Normal Pool	756.30
Rainfall to Overtop (in.)	33.00

Proposed Spillway Rating Curves with 8 Agridrain Structures Installed (all stoplogs removed)

		Weir Flow			Orifice Flow	Pipe Flow	Pipe Flow	Overtopping Flow	Total Flow	Total Flow
		Over Stop Log	Over Structure	Total			HY-8		(per structure)	
Water Surface Elevation	**H_c[1]**	$Q = C_wLH_{SL}^{(3/2)}$	$Q = C_wLH_S^{(3/2)}$	$Q = C_wLH_{SL}^{(3/2)} + C_wLH_S^{(3/2)}$	$Q = C_0A(2gH_{SL})^{0.5}$	$Q = C_0A[2g(H_c)]^{0.5}$	(Inlet Control)	$Q = C_wLH^{(3/2)}$		
742	--	--	--	--	--	--		--	--	--
754.8		--	--	--	--			0		
755		--	--	--	--			0		
755.1		--	--	--	--			0		
755.2		--	--	--	--			0		
755.3		--	--	--	--			0		
755.4		--	--	--	--			0		
755.5	0.8	--	--	--	--			0		
756	1.3	--	--	--	--	17.24	6.73	0	6.73	53.82
756.5	1.8	--	--	--	--	20.28	11.80	0	11.80	94.40
757	2.3	--	--	--	--	22.93	16.91	0	16.91	135.27
757.5	2.8	--	--	--	--	25.30	21.08	0	21.08	168.62
758	3.3	--	--	--	--	27.47	24.53	0	24.53	196.27
758.5	3.8	--	--	--	--	29.47	27.50	0	27.50	220.00
759	4.3	--	--	--	--	31.35	30.15	0	30.15	241.17
759.5	4.8	--	--	--	--	33.12	32.56	0	32.56	260.47
760	5.3	--	--	--	--	34.81	34.84	0	34.81	278.45
760.5	5.8	--	--	--	--	36.41	37.00	0	36.41	291.29
761	6.3	--	--	--	--	37.95	38.95	0	37.95	303.59
761.5	6.8	--	--	--	--	39.43	40.74	0	39.43	315.40
762	7.3	--	--	--	--	40.85	42.47	0	40.85	326.79
762.5	7.8	--	--	--	--	42.23	44.13	0	42.23	337.80
763	8.3	--	--	--	--	43.56	45.71	0	43.56	348.46
763.5	8.8	--	--	--	--	44.85	47.24	0	44.85	358.80
764	9.3	--	--	--	--	46.11	48.74	0	46.11	368.85
764.5	9.8	--	--	--	--	47.33	48.74	0	47.33	378.64
765	10.3	--	--	--	--	48.52	48.74	0	48.52	388.18
765.5	10.8	--	--	--	--	49.69	48.74	1091.42	48.74	1481.33
766	11.3	--	--	--	--	50.82	48.74	3087.00	48.74	3476.91

[1] Height above the downstream tailwater elevation

Appendix D

Additional Storage Area Data

DRAFT

TVA Kingston Fossil Plant - Storage/Discharge relationships

Stantec Project #: 175601004

Sluice Trenches

Stage - Storage Data

Elevation	Area (acres)
760	0
761	0
762	0
763	0.01
764	3.70
765	4.82
766	7.66
767	10.06

Stage - Discharge Rating Curve

Discharge			
3 30" Corrugated HDPE Pipes; L = 80', US inv. 760, DS inv. Assumed 759			
H	$Q = 3.087LH^{1.5}$ weir (L = 65)	Q (Hydrocalc)	Q total
0		0	0
1		15	15
2		51	51
3		93	93
4		126	126
5		150	150
6	2949	171	3120
7	3716	192	3908

If this storage area overtops, the flow goes to the Ash Pond

Relic Area

Stage - Storage Data

Elevation	Area (acres)
790	0
791	0.00
792	0.01
793	0.27
794	0.84
795	1.41
796	1.86
797	2.64
798	2.83
799	3.29

Stage - Discharge Rating Curve

Discharge			
2 24" Corrugated HDPE Pipes; L = 220', S = 0.11			
H	$Q = 3.087LH^{1.5}$ weir (L = 20)	Q (Hydrocalc)	Q total
0		0	0
0.4		2	2
1.4		18	18
2.4		38	38
3.4		52.0	52
4.4		62.0	62
5.4		72.0	72
6.4		80.0	80
7.4	1243	87	1329.8
8.4	1503	94	1597.1

If this storage area overtops, the flow goes to the Test Embankment then to the ash pond

Ball Field East

Stage - Storage Data

Elevation	Area (acres)
765	0
766	0.00
767	0.16
768	0.32
769	0.48
770	0.64

Stage - Discharge Rating Curve

Discharge			
1 30" Corrugated HDPE Pipes; L = 62', S = 0.01			
H	$Q = 3.087LH^{1.5}$ weir (L = 90)	Q (Hydrocalc)	Q total
0		0	0
0.6		2	2
1.6		12	12.0
2.6	1165	25	1189.8
3.6	1898	38	1935.7
4.6	2741	47	2788.0

If this storage area overtops, the flow goes to the sluice trenches area

Ball Field South

Stage - Storage Data

Elevation	Area (acres)
763	0
764	0.00
765	0.02
766	0.09
767	0.13
768	0.18
769	0.23
770	0.28

Stage - Discharge Rating Curve

Discharge			
3 18" Corrugated HDPE Pipes; L = 62, S= 0.01			
H	$Q = 3.087LH^{1.5}$ weir (L = 210)	Q (Hydrocalc)	Q total
0		0	0
0.7		6	6
1.7		24	24.0
2.7		39	39.0
3.7		48.0	48.0
4.7		57.0	57.0
5.7	8822	63	8885.0
6.7	11243	72	11314.6

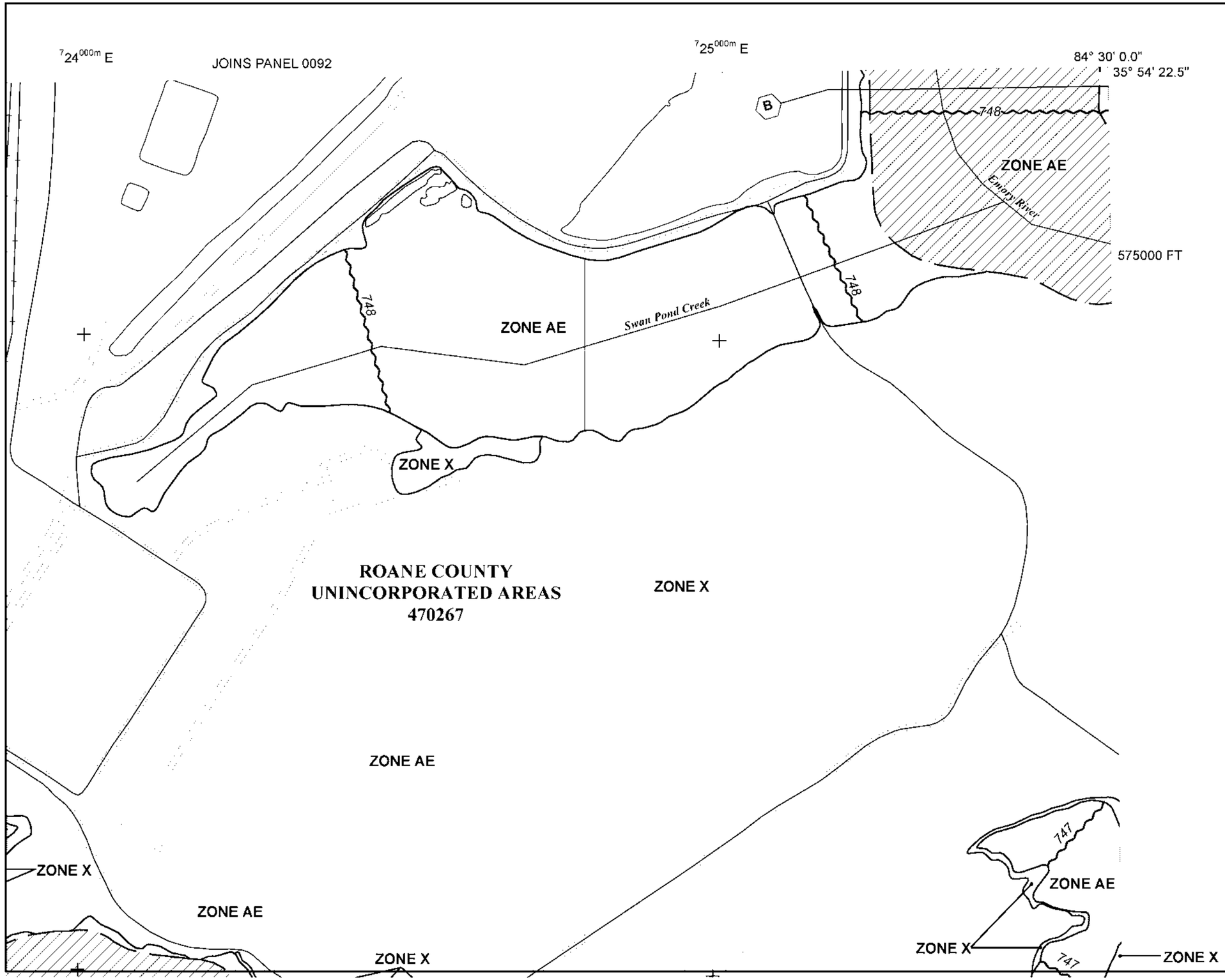
If this storage area overtops, the flow goes to a small pond/ditch outside the watershed

extrapolated value

Appendix E

FEMA Firmette

DRAFT



MAP SCALE 1" = 500'

250 0 500 1000 FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0094G

FIRM

FLOOD INSURANCE RATE MAP

ROANE COUNTY, TENNESSEE

AND INCORPORATED AREAS

PANEL 94 OF 335

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KINGSTON, CITY OF	470274	0094	G
ROANE COUNTY	470267	0094	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
47145C0094G
MAP REVISED
NOVEMBER 18, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix F

Inflow-Diversion Data

DRAFT

Inflow-Diversion Data

Stantec Project #: 175601004

Ball Field East

Inflow-Diversion Data

Total inflow (cfs)	Discharge to Ash Pond (cfs)	Discharge to Sluice Trenches Storage Area (cfs)
0	0	0
2	2	0
12	12	0
1190	25	1165
1936	38	1898

Ball Field South

Inflow-Diversion Data

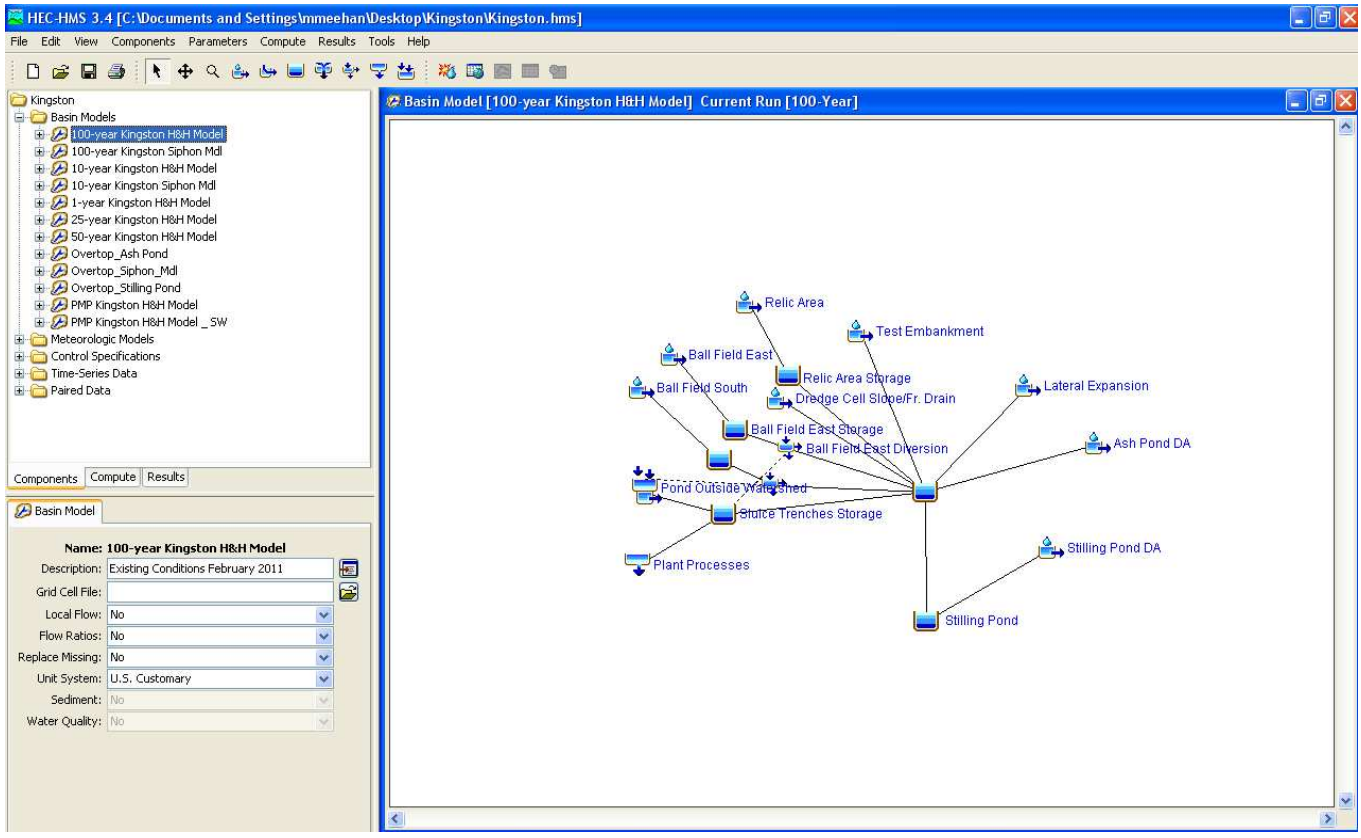
Total inflow (cfs)	Discharge to Ash Pond (cfs)	Discharge outside watershed (cfs)
0	0	0
6	6	0
24	24	0
39	39	0
48	48	0
57	57	0
8885	63	8822
11315	72	11243

Appendix G

HEC-HMS Input and Output

DRAFT

HEC-HMS Input Files



Basin Models

1-year Existing Conditions

Basin: 1-year Kingston H&H Model
    Description: Existing Conditions February 2011
    Last Modified Date: 14 April 2011
    Last Modified Time: 14:04:55
    Version: 3.4
    Unit System: English
    Missing Flow To Zero: No
    Enable Flow Ratio: No
    Allow Blending: No
    Compute Local Flow At Junctions: No

    Enable Sediment Routing: No

    Enable Quality Routing: No
End:

Subbasin: Ash Pond DA
    Description: Drainage area surrounding Ash Pond
    Canvas X: 4630.681818181818
    Canvas Y: 738.636363636364
    Area: 0.102
    Downstream: Ash Pond

    Canopy: None

    Surface: None

```
    LossRate: SCS
    Percent Impervious Area: 45.9
    Curve Number: 87

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Sluice Trenches
    Description: Sluice Channel Area
    Canvas X: -7193.0479032751755
    Canvas Y: -572.2323051182293
    Area: 0.047
    Downstream: Sluice Trenches Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 11.7
    Curve Number: 87

    Transform: SCS
    Lag: 6
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Source: Plant Processes
    Description: Flows from Plant Processes
    Canvas X: -7490.530303030303
    Canvas Y: -2443.181818181818
    Area: 0.0
    Downstream: Sluice Trenches Storage

    Flow Method: CONSTANT_FLOW
    Constant Flow: 75
    End Flow Method:
End:

Reservoir: Sluice Trenches Storage
    Description: Storage behind 3 30" Corrugated HDPE Pipes
    Canvas X: -5222.426283032342
    Canvas Y: -1103.321819793603
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 763
    Elevation-Area Table: Sluice Trenches
    Elevation-Outflow Table: Sluice Trenches
    Primary Table: Elevation-Outflow
End:

Subbasin: Lateral Expansion
    Canvas X: 2784.09090909091
    Canvas Y: 2234.848484848485
    Area: 0.046
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
```

```
    Percent Impervious Area: 3.9
    Curve Number: 87

    Transform: SCS
    Lag: 13
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Relic Area
    Canvas X: -4551.576369758188
    Canvas Y: 4431.189964718182
    Area: 0.039
    Downstream: Relic Area Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Relic Area Storage
    Description: Storage area  behind 2 24" Corrugated HDPE Pipes
    Canvas X: -3349.636941808658
    Canvas Y: 2446.592304615471
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 790.6
    Elevation-Area Table: Relic Area
    Elevation-Outflow Table: Relic Area
    Primary Table: Elevation-Outflow
End:

Subbasin: Ball Field East
    Canvas X: -6550.150069720776
    Canvas Y: 3061.5380584501136
    From Canvas X: 153.7364384586608
    From Canvas Y: 852.5384314525727
    Label X: -1.0
    Label Y: 0.0
    Area: 0.034
    Downstream: Ball Field East Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 9
    Unitgraph Type: STANDARD

    Baseflow: None
End:
```

```
Reservoir: Ball Field East Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -4914.953406115022
    Canvas Y: 1104.8924780671596
    From Canvas X: 377.3530762167129
    From Canvas Y: 796.6342720130597
    Downstream: Ball Field East Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 766
    Elevation-Area Table: Ball Field East
    Elevation-Outflow Table: Ball Field East
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field East Diversion
    Description: When water overtops the ball field east storage area it flows to the sluice trences storage area
    Canvas X: -3475.421300547562
    Canvas Y: 580.7909833217254
    Downstream: Ash Pond
    Divert To: Sluice Trenches Storage

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field East Diversion
    End Diverter:
End:

Subbasin: Dredge Cell Slope/Fr. Drain
    Description: French Drain
    Canvas X: -3736.382078964274
    Canvas Y: 1894.893509293437
    Area: 0.020
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 81

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Test Embankment
    Canvas X: -1637.572058973572
    Canvas Y: 3655.519752494939
    Area: 0.017
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 8
    Unitgraph Type: STANDARD

    Baseflow: None
End:
```

Subbasin: Ball Field South
    Canvas X: -7374.736421453592
    Canvas Y: 2181.0475472777844
    Label X: -1.0
    Label Y: 0.0
    Area: 0.014
    Downstream: Ball Field South Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Ball Field South Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -5348.2106417712475
    Canvas Y: 315.2462259840386
    Downstream: Ball Field South Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 765
    Elevation-Area Table: Ball Field South
    Elevation-Outflow Table: Ball Field South
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field South Diversion
    Description: When the storage area for the south ball field overtops it flows to a small pond outside of the watershed area
    Canvas X: -3880.7264564840316
    Canvas Y: -355.6036872901177
    Downstream: Ash Pond
    Divert To: Pond Outside Watershed

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field South Diversion
    End Diverter:
End:

Reservoir: Ash Pond
    Description: Ash Pond
    Canvas X: 116.42094344114594
    Canvas Y: -600.1843848379867
    Label X: -1.0
    Label Y: 0.0
    Downstream: Stilling Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 760.5
    Elevation-Area Table: Ash Pond EL-AREA
    Elevation-Outflow Table: 1-YR Ash Pond EL-Q
    Primary Table: Elevation-Outflow
End:

Subbasin: Stilling Pond DA
    Description: DA to Stilling Pond
    Canvas X: 3416.815742397138

Canvas Y: -2012.5223613595708
Area: 0.044
Downstream: Stilling Pond

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 85.9
Curve Number: 87

Transform: SCS
Lag: 5
Unitgraph Type: STANDARD

Baseflow: None
End:

Reservoir: Stilling Pond
Description: Stilling Pond
Canvas X: 118.57707509881402
Canvas Y: -3893.280632411068
Label X: 3.0
Label Y: 0.0

Route: Modified Puls
Routing Curve: Elevation-Area-Outflow
Initial Elevation: 754.9
Elevation-Area Table: Stilling Pond EL-AREA
Elevation-Outflow Table: Stilling Pond El-Q
Primary Table: Elevation-Outflow
End:

Sink: Pond Outside Watershed
Canvas X: -7304.8562221542015
Canvas Y: -173.91516911170038
End:

Basin Schematic Properties:
Last View N: 4356.060606060606
Last View S: -3893.280632411068
Last View W: -7821.969696969696
Last View E: 4630.681818181818
Maximum View N: 4356.060606060606
Maximum View S: -3893.280632411068
Maximum View W: -7821.969696969696
Maximum View E: 4630.681818181818
Extent Method: Elements
Buffer: 0
Draw Icons: Yes
Draw Icon Labels: Yes
Draw Map Objects: No
Draw Gridlines: No
Draw Flow Direction: Yes
Fix Element Locations: No
Fix Hydrologic Order: No
Map: hec.map.aishape.AiShapeMap
Map File Name: C:\Documents and Settings\mmeehan\My Documents\Projects\KingstonHH\existing_feb_2011.shp
Map Shown: Yes
End:

10-year Existing Conditions

Basin: 10-year Kingston H&H Model
Description: Existing Conditions February 2011
Last Modified Date: 14 April 2011
Last Modified Time: 14:04:35
Version: 3.4
Unit System: English
Missing Flow To Zero: No

```
    Enable Flow Ratio: No
    Allow Blending: No
    Compute Local Flow At Junctions: No

    Enable Sediment Routing: No

    Enable Quality Routing: No
End:

Subbasin: Ash Pond DA
    Description: Drainage area surrounding Ash Pond
    Canvas X: 4630.681818181818
    Canvas Y: 738.636363636364
    Area: 0.102
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 45.9
    Curve Number: 87

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Sluice Trenches
    Description: Sluice Channel Area
    Canvas X: -7193.0479032751755
    Canvas Y: -572.2323051182293
    Area: 0.047
    Downstream: Sluice Trenches Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 11.7
    Curve Number: 87

    Transform: SCS
    Lag: 6
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Source: Plant Processes
    Description: Flows from Plant Processes
    Canvas X: -7490.530303030303
    Canvas Y: -2443.181818181818
    Area: 0.0
    Downstream: Sluice Trenches Storage

    Flow Method: CONSTANT_FLOW
    Constant Flow: 75
    End Flow Method:
End:

Reservoir: Sluice Trenches Storage
    Description: Storage behind 3 30" Corrugated HDPE Pipes
    Canvas X: -5222.426283032342
    Canvas Y: -1103.321819793603
    Downstream: Ash Pond
```

```
    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 763
    Elevation-Area Table: Sluice Trenches
    Elevation-Outflow Table: Sluice Trenches
    Primary Table: Elevation-Outflow
End:

Subbasin: Lateral Expansion
    Canvas X: 2784.09090909091
    Canvas Y: 2234.848484848485
    Area: 0.046
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 3.9
    Curve Number: 87

    Transform: SCS
    Lag: 13
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Relic Area
    Canvas X: -4551.576369758188
    Canvas Y: 4431.189964718182
    Area: 0.039
    Downstream: Relic Area Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Relic Area Storage
    Description: Storage area  behind 2 24" Corrugated HDPE Pipes
    Canvas X: -3349.636941808658
    Canvas Y: 2446.592304615471
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 790.6
    Elevation-Area Table: Relic Area
    Elevation-Outflow Table: Relic Area
    Primary Table: Elevation-Outflow
End:

Subbasin: Ball Field East
    Canvas X: -6550.150069720776
    Canvas Y: 3061.5380584501136
    From Canvas X: 153.7364384586608
    From Canvas Y: 852.5384314525727
```

```
    Label X: -1.0
    Label Y: 0.0
    Area: 0.034
    Downstream: Ball Field East Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 9
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Ball Field East Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -4914.953406115022
    Canvas Y: 1104.8924780671596
    From Canvas X: 377.3530762167129
    From Canvas Y: 796.6342720130597
    Downstream: Ball Field East Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 766
    Elevation-Area Table: Ball Field East
    Elevation-Outflow Table: Ball Field East
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field East Diversion
    Description: When water overtops the ball field east storage area it flows to the sluice trences storage area
    Canvas X: -3475.421300547562
    Canvas Y: 580.7909833217254
    Downstream: Ash Pond
    Divert To: Sluice Trenches Storage

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field East Diversion
    End Diverter:
End:

Subbasin: Dredge Cell Slope/Fr. Drain
    Description: French Drain
    Canvas X: -3736.382078964274
    Canvas Y: 1894.893509293437
    Area: 0.020
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 81

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:
```

```
Subbasin: Test Embankment
    Canvas X: -1637.572058973572
    Canvas Y: 3655.519752494939
    Area: 0.017
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 8
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Ball Field South
    Canvas X: -7374.736421453592
    Canvas Y: 2181.0475472777844
    Label X: -1.0
    Label Y: 0.0
    Area: 0.014
    Downstream: Ball Field South Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Ball Field South Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -5348.2106417712475
    Canvas Y: 315.2462259840386
    Downstream: Ball Field South Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 765
    Elevation-Area Table: Ball Field South
    Elevation-Outflow Table: Ball Field South
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field South Diversion
    Description: When the storage area for the south ball field overtops it flows to a small pond outside of the watershed
area
    Canvas X: -3880.7264564840316
    Canvas Y: -355.6036872901177
    Downstream: Ash Pond
    Divert To: Pond Outside Watershed

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field South Diversion
    End Diverter:
End:
```

Reservoir: Ash Pond
    Description: Ash Pond
    Canvas X: 86.65511265164696
    Canvas Y: -528.5961871750433
    Label X: -1.0
    Label Y: 0.0
    Downstream: Stilling Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 760.5
    Elevation-Area Table: Ash Pond EL-AREA
    Elevation-Outflow Table: 10-YR Ash Pond EL-Q
    Primary Table: Elevation-Outflow
End:

Subbasin: Stilling Pond DA
    Description: DA to Stilling Pond
    Canvas X: 3416.815742397138
    Canvas Y: -2012.5223613595708
    Area: 0.044
    Downstream: Stilling Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 85.9
    Curve Number: 87

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Stilling Pond
    Description: Stilling Pond
    Canvas X: 118.57707509881402
    Canvas Y: -3893.280632411068
    Label X: 3.0
    Label Y: 0.0

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 754.9
    Elevation-Area Table: Stilling Pond EL-AREA
    Elevation-Outflow Table: Stilling Pond El-Q
    Primary Table: Elevation-Outflow
End:

Sink: Pond Outside Watershed
    Canvas X: -7304.8562221542015
    Canvas Y: -173.91516911170038
End:

Basin Schematic Properties:
    Last View N: 4356.060606060606
    Last View S: -3893.280632411068
    Last View W: -7821.969696969696
    Last View E: 4630.681818181818
    Maximum View N: 4356.060606060606
    Maximum View S: -3893.280632411068
    Maximum View W: -7821.969696969696
    Maximum View E: 4630.681818181818
    Extent Method: Elements
    Buffer: 0

Draw Icons: Yes
Draw Icon Labels: Yes
Draw Map Objects: No
Draw Gridlines: No
Draw Flow Direction: Yes
Fix Element Locations: No
Fix Hydrologic Order: No
Map: hec.map.aishape.AiShapeMap
Map File Name: C:\Documents and Settings\mmeehan\My Documents\Projects\KingstonHH\existing_feb_2011.shp
Map Shown: Yes
End:

25-year Existing Conditions

Basin: 25-year Kingston H&H Model
Description: Existing Conditions February 2011
Last Modified Date: 14 April 2011
Last Modified Time: 14:05:09
Version: 3.4
Unit System: English
Missing Flow To Zero: No
Enable Flow Ratio: No
Allow Blending: No
Compute Local Flow At Junctions: No

Enable Sediment Routing: No

Enable Quality Routing: No
End:

Subbasin: Ash Pond DA
Description: Drainage area surrounding Ash Pond
Canvas X: 4630.681818181818
Canvas Y: 738.636363636364
Area: 0.102
Downstream: Ash Pond

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 45.9
Curve Number: 87

Transform: SCS
Lag: 5
Unitgraph Type: STANDARD

Baseflow: None
End:

Subbasin: Sluice Trenches
Description: Sluice Channel Area
Canvas X: -7193.0479032751755
Canvas Y: -572.2323051182293
Area: 0.047
Downstream: Sluice Trenches Storage

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 11.7
Curve Number: 87

Transform: SCS
Lag: 6
Unitgraph Type: STANDARD

```
    Baseflow: None
End:

Source: Plant Processes
    Description: Flows from Plant Processes
    Canvas X: -7490.530303030303
    Canvas Y: -2443.181818181818
    Area: 0.0
    Downstream: Sluice Trenches Storage

    Flow Method: CONSTANT_FLOW
    Constant Flow: 75
    End Flow Method:
End:

Reservoir: Sluice Trenches Storage
    Description: Storage behind 3 30" Corrugated HDPE Pipes
    Canvas X: -5222.426283032342
    Canvas Y: -1103.321819793603
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 763
    Elevation-Area Table: Sluice Trenches
    Elevation-Outflow Table: Sluice Trenches
    Primary Table: Elevation-Outflow
End:

Subbasin: Lateral Expansion
    Canvas X: 2784.09090909091
    Canvas Y: 2234.848484848485
    Area: 0.046
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 3.9
    Curve Number: 87

    Transform: SCS
    Lag: 13
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Relic Area
    Canvas X: -4551.576369758188
    Canvas Y: 4431.189964718182
    Area: 0.039
    Downstream: Relic Area Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:
```

```
Reservoir: Relic Area Storage
    Description: Storage area  behind 2 24" Corrugated HDPE Pipes
    Canvas X: -3349.636941808658
    Canvas Y: 2446.592304615471
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 790.6
    Elevation-Area Table: Relic Area
    Elevation-Outflow Table: Relic Area
    Primary Table: Elevation-Outflow
End:

Subbasin: Ball Field East
    Canvas X: -6550.150069720776
    Canvas Y: 3061.5380584501136
    From Canvas X: 153.7364384586608
    From Canvas Y: 852.5384314525727
    Label X: -1.0
    Label Y: 0.0
    Area: 0.034
    Downstream: Ball Field East Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 9
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Ball Field East Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -4914.953406115022
    Canvas Y: 1104.8924780671596
    From Canvas X: 377.3530762167129
    From Canvas Y: 796.6342720130597
    Downstream: Ball Field East Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 766
    Elevation-Area Table: Ball Field East
    Elevation-Outflow Table: Ball Field East
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field East Diversion
    Description: When water overtops the ball field east storage area it flows to the sluice trences storage area
    Canvas X: -3475.421300547562
    Canvas Y: 580.7909833217254
    Downstream: Ash Pond
    Divert To: Sluice Trenches Storage

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field East Diversion
    End Diverter:
End:

Subbasin: Dredge Cell Slope/Fr. Drain
    Description: French Drain
```

Canvas X: -3736.382078964274
Canvas Y: 1894.893509293437
Area: 0.020
Downstream: Ash Pond

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 0.0
Curve Number: 81

Transform: SCS
Lag: 5
Unitgraph Type: STANDARD

Baseflow: None
End:

Subbasin: Test Embankment
Canvas X: -1637.572058973572
Canvas Y: 3655.519752494939
Area: 0.017
Downstream: Ash Pond

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 0.0
Curve Number: 87

Transform: SCS
Lag: 8
Unitgraph Type: STANDARD

Baseflow: None
End:

Subbasin: Ball Field South
Canvas X: -7374.736421453592
Canvas Y: 2181.0475472777844
Label X: -1.0
Label Y: 0.0
Area: 0.014
Downstream: Ball Field South Storage

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 0.0
Curve Number: 87

Transform: SCS
Lag: 7
Unitgraph Type: STANDARD

Baseflow: None
End:

Reservoir: Ball Field South Storage
Description: Storage behind 3 18" Corrugated HDPE Pipes
Canvas X: -5348.2106417712475
Canvas Y: 315.2462259840386
Downstream: Ball Field South Diversion

```
    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 765
    Elevation-Area Table: Ball Field South
    Elevation-Outflow Table: Ball Field South
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field South Diversion
    Description: When the storage area for the south ball field overtops it flows to a small pond outside of the watershed
area
    Canvas X: -3880.7264564840316
    Canvas Y: -355.6036872901177
    Downstream: Ash Pond
    Divert To: Pond Outside Watershed

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field South Diversion
    End Diverter:
End:

Reservoir: Ash Pond
    Description: Ash Pond
    Canvas X: 86.65511265164696
    Canvas Y: -528.5961871750433
    Label X: -1.0
    Label Y: 0.0
    Downstream: Stilling Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 760.5
    Elevation-Area Table: Ash Pond EL-AREA
    Elevation-Outflow Table: 25YR Ash Pond EL-Q
    Primary Table: Elevation-Outflow
End:

Subbasin: Stilling Pond DA
    Description: DA to Stilling Pond
    Canvas X: 3416.815742397138
    Canvas Y: -2012.5223613595708
    Area: 0.044
    Downstream: Stilling Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 85.9
    Curve Number: 87

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Stilling Pond
    Description: Stilling Pond
    Canvas X: 118.57707509881402
    Canvas Y: -3893.280632411068
    Label X: 3.0
    Label Y: 0.0

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 754.9
    Elevation-Area Table: Stilling Pond EL-AREA
```

Elevation-Outflow Table: Stilling Pond El-Q
Primary Table: Elevation-Outflow
End:

Sink: Pond Outside Watershed
Canvas X: -7304.8562221542015
Canvas Y: -173.91516911170038
End:

Basin Schematic Properties:
Last View N: 4356.060606060606
Last View S: -3893.280632411068
Last View W: -7821.969696969696
Last View E: 4630.681818181818
Maximum View N: 4356.060606060606
Maximum View S: -3893.280632411068
Maximum View W: -7821.969696969696
Maximum View E: 4630.681818181818
Extent Method: Elements
Buffer: 0
Draw Icons: Yes
Draw Icon Labels: Yes
Draw Map Objects: No
Draw Gridlines: No
Draw Flow Direction: Yes
Fix Element Locations: No
Fix Hydrologic Order: No
Map: hec.map.aishape.AiShapeMap
Map File Name: C:\Documents and Settings\mmeehan\My Documents\Projects\KingstonHH\existing_feb_2011.shp
Map Shown: Yes
End:

50-year Existing Conditions

Basin: 50-year Kingston H&H Model
Description: Existing Conditions February 2011
Last Modified Date: 14 April 2011
Last Modified Time: 14:05:30
Version: 3.4
Unit System: English
Missing Flow To Zero: No
Enable Flow Ratio: No
Allow Blending: No
Compute Local Flow At Junctions: No

Enable Sediment Routing: No

Enable Quality Routing: No
End:

Subbasin: Ash Pond DA
Description: Drainage area surrounding Ash Pond
Canvas X: 4630.681818181818
Canvas Y: 738.636363636364
Area: 0.102
Downstream: Ash Pond

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 45.9
Curve Number: 87

Transform: SCS
Lag: 5
Unitgraph Type: STANDARD

Baseflow: None
End:

```
Subbasin: Sluice Trenches
    Description: Sluice Channel Area
    Canvas X: -7193.0479032751755
    Canvas Y: -572.2323051182293
    Area: 0.047
    Downstream: Sluice Trenches Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 11.7
    Curve Number: 87

    Transform: SCS
    Lag: 6
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Source: Plant Processes
    Description: Flows from Plant Processes
    Canvas X: -7490.530303030303
    Canvas Y: -2443.181818181818
    Area: 0.0
    Downstream: Sluice Trenches Storage

    Flow Method: CONSTANT_FLOW
    Constant Flow: 75
    End Flow Method:
End:

Reservoir: Sluice Trenches Storage
    Description: Storage behind 3 30" Corrugated HDPE Pipes
    Canvas X: -5222.426283032342
    Canvas Y: -1103.321819793603
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 763
    Elevation-Area Table: Sluice Trenches
    Elevation-Outflow Table: Sluice Trenches
    Primary Table: Elevation-Outflow
End:

Subbasin: Lateral Expansion
    Canvas X: 2784.09090909091
    Canvas Y: 2234.848484848485
    Area: 0.046
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 3.9
    Curve Number: 87

    Transform: SCS
    Lag: 13
    Unitgraph Type: STANDARD

    Baseflow: None
End:
```

Subbasin: Relic Area
    Canvas X: -4551.576369758188
    Canvas Y: 4431.189964718182
    Area: 0.039
    Downstream: Relic Area Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Relic Area Storage
    Description: Storage area behind 2 24" Corrugated HDPE Pipes
    Canvas X: -3349.636941808658
    Canvas Y: 2446.592304615471
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 790.6
    Elevation-Area Table: Relic Area
    Elevation-Outflow Table: Relic Area
    Primary Table: Elevation-Outflow
End:

Subbasin: Ball Field East
    Canvas X: -6550.150069720776
    Canvas Y: 3061.5380584501136
    From Canvas X: 153.7364384586608
    From Canvas Y: 852.5384314525727
    Label X: -1.0
    Label Y: 0.0
    Area: 0.034
    Downstream: Ball Field East Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 9
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Ball Field East Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -4914.953406115022
    Canvas Y: 1104.8924780671596
    From Canvas X: 377.3530762167129
    From Canvas Y: 796.6342720130597
    Downstream: Ball Field East Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow

```
    Initial Elevation: 766
    Elevation-Area Table: Ball Field East
    Elevation-Outflow Table: Ball Field East
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field East Diversion
    Description: When water overtops the ball field east storage area it flows to the sluice trences storage area
    Canvas X: -3475.421300547562
    Canvas Y: 580.7909833217254
    Downstream: Ash Pond
    Divert To: Sluice Trenches Storage

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field East Diversion
    End Diverter:
End:

Subbasin: Dredge Cell Slope/Fr. Drain
    Description: French Drain
    Canvas X: -3736.382078964274
    Canvas Y: 1894.893509293437
    Area: 0.020
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 81

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Test Embankment
    Canvas X: -1637.572058973572
    Canvas Y: 3655.519752494939
    Area: 0.017
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 8
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Ball Field South
    Canvas X: -7374.736421453592
    Canvas Y: 2181.0475472777844
    Label X: -1.0
    Label Y: 0.0
    Area: 0.014
    Downstream: Ball Field South Storage

    Canopy: None
```

Surface: None

LossRate: SCS
Percent Impervious Area: 0.0
Curve Number: 87

Transform: SCS
Lag: 7
Unitgraph Type: STANDARD

Baseflow: None
End:

Reservoir: Ball Field South Storage
Description: Storage behind 3 18" Corrugated HDPE Pipes
Canvas X: -5348.2106417712475
Canvas Y: 315.2462259840386
Downstream: Ball Field South Diversion

Route: Modified Puls
Routing Curve: Elevation-Area-Outflow
Initial Elevation: 765
Elevation-Area Table: Ball Field South
Elevation-Outflow Table: Ball Field South
Primary Table: Elevation-Outflow
End:

Diversion: Ball Field South Diversion
Description: When the storage area for the south ball field overtops it flows to a small pond outside of the watershed area
Canvas X: -3880.7264564840316
Canvas Y: -355.6036872901177
Downstream: Ash Pond
Divert To: Pond Outside Watershed

Diverter: Inflow-Diversion Table
Inflow Diversion Table Name: Ball Field South Diversion
End Diverter:
End:

Reservoir: Ash Pond
Description: Ash Pond
Canvas X: 86.65511265164696
Canvas Y: -528.5961871750433
Label X: -1.0
Label Y: 0.0
Downstream: Stilling Pond

Route: Modified Puls
Routing Curve: Elevation-Area-Outflow
Initial Elevation: 760.5
Elevation-Area Table: Ash Pond EL-AREA
Elevation-Outflow Table: 50YR Ash Pond EL-Q
Primary Table: Elevation-Outflow
End:

Subbasin: Stilling Pond DA
Description: DA to Stilling Pond
Canvas X: 3416.815742397138
Canvas Y: -2012.5223613595708
Area: 0.044
Downstream: Stilling Pond

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 85.9

Curve Number: 87

Transform: SCS
Lag: 5
Unitgraph Type: STANDARD

Baseflow: None
End:

Reservoir: Stilling Pond
Description: Stilling Pond
Canvas X: 118.57707509881402
Canvas Y: -3893.280632411068
Label X: 3.0
Label Y: 0.0

Route: Modified Puls
Routing Curve: Elevation-Area-Outflow
Initial Elevation: 754.9
Elevation-Area Table: Stilling Pond EL-AREA
Elevation-Outflow Table: Stilling Pond El-Q
Primary Table: Elevation-Outflow
End:

Sink: Pond Outside Watershed
Canvas X: -7304.8562221542015
Canvas Y: -173.91516911170038
End:

Basin Schematic Properties:
Last View N: 4356.060606060606
Last View S: -3893.280632411068
Last View W: -7821.969696969696
Last View E: 4630.681818181818
Maximum View N: 4356.060606060606
Maximum View S: -3893.280632411068
Maximum View W: -7821.969696969696
Maximum View E: 4630.681818181818
Extent Method: Elements
Buffer: 0
Draw Icons: Yes
Draw Icon Labels: Yes
Draw Map Objects: No
Draw Gridlines: No
Draw Flow Direction: Yes
Fix Element Locations: No
Fix Hydrologic Order: No
Map: hec.map.aishape.AiShapeMap
Map File Name: C:\Documents and Settings\mmeehan\My Documents\Projects\KingstonHH\existing_feb_2011.shp
Map Shown: Yes
End:

100-year Existing Conditions

Basin: 100-year Kingston H&H Model
Description: Existing Conditions February 2011
Last Modified Date: 14 April 2011
Last Modified Time: 14:04:12
Version: 3.4
Unit System: English
Missing Flow To Zero: No
Enable Flow Ratio: No
Allow Blending: No
Compute Local Flow At Junctions: No

Enable Sediment Routing: No

Enable Quality Routing: No
End:

Subbasin: Ash Pond DA

```
    Description: Drainage area surrounding Ash Pond
    Canvas X: 4630.681818181818
    Canvas Y: 738.636363636364
    Area: 0.102
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 45.9
    Curve Number: 87

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Sluice Trenches
    Description: Sluice Channel Area
    Canvas X: -7193.0479032751755
    Canvas Y: -572.2323051182293
    Area: 0.047
    Downstream: Sluice Trenches Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 11.7
    Curve Number: 87

    Transform: SCS
    Lag: 6
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Source: Plant Processes
    Description: Flows from Plant Processes
    Canvas X: -7490.530303030303
    Canvas Y: -2443.181818181818
    Area: 0.0
    Downstream: Sluice Trenches Storage

    Flow Method: CONSTANT_FLOW
    Constant Flow: 75
    End Flow Method:
End:

Reservoir: Sluice Trenches Storage
    Description: Storage behind 3 30" Corrugated HDPE Pipes
    Canvas X: -5222.426283032342
    Canvas Y: -1103.321819793603
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 763
    Elevation-Area Table: Sluice Trenches
    Elevation-Outflow Table: Sluice Trenches
    Primary Table: Elevation-Outflow
End:

Subbasin: Lateral Expansion
```

```
    Canvas X: 2784.09090909091
    Canvas Y: 2234.848484848485
    Area: 0.046
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 3.9
    Curve Number: 87

    Transform: SCS
    Lag: 13
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Relic Area
    Canvas X: -4551.576369758188
    Canvas Y: 4431.189964718182
    Area: 0.039
    Downstream: Relic Area Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Relic Area Storage
    Description: Storage area  behind 2 24" Corrugated HDPE Pipes
    Canvas X: -3513.616820710902
    Canvas Y: 2517.8404167691288
    Label X: -1.0
    Label Y: -3.0
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 790.6
    Elevation-Area Table: Relic Area
    Elevation-Outflow Table: Relic Area
    Primary Table: Elevation-Outflow
End:

Subbasin: Ball Field East
    Canvas X: -6550.150069720776
    Canvas Y: 3061.5380584501136
    From Canvas X: 153.7364384586608
    From Canvas Y: 852.5384314525727
    Label X: -1.0
    Label Y: 0.0
    Area: 0.034
    Downstream: Ball Field East Storage

    Canopy: None

    Surface: None
```

```
    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 9
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Ball Field East Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -4914.953406115022
    Canvas Y: 1104.8924780671596
    From Canvas X: 377.3530762167129
    From Canvas Y: 796.6342720130597
    Downstream: Ball Field East Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 766
    Elevation-Area Table: Ball Field East
    Elevation-Outflow Table: Ball Field East
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field East Diversion
    Description: When water overtops the ball field east storage area it flows to the sluice trences storage area
    Canvas X: -3475.421300547562
    Canvas Y: 580.7909833217254
    Downstream: Ash Pond
    Divert To: Sluice Trenches Storage

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field East Diversion
    End Diverter:
End:

Subbasin: Dredge Cell Slope/Fr. Drain
    Description: French Drain
    Canvas X: -3736.382078964274
    Canvas Y: 1894.893509293437
    Area: 0.020
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 81

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Test Embankment
    Canvas X: -1637.572058973572
    Canvas Y: 3655.519752494939
    Area: 0.017
    Downstream: Ash Pond

    Canopy: None
```

Surface: None

LossRate: SCS
Percent Impervious Area: 0.0
Curve Number: 87

Transform: SCS
Lag: 8
Unitgraph Type: STANDARD

Baseflow: None
End:

Subbasin: Ball Field South
Canvas X: -7374.736421453592
Canvas Y: 2181.0475472777844
Label X: -1.0
Label Y: 0.0
Area: 0.014
Downstream: Ball Field South Storage

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 0.0
Curve Number: 87

Transform: SCS
Lag: 7
Unitgraph Type: STANDARD

Baseflow: None
End:

Reservoir: Ball Field South Storage
Description: Storage behind 3 18" Corrugated HDPE Pipes
Canvas X: -5348.2106417712475
Canvas Y: 315.2462259840386
Downstream: Ball Field South Diversion

Route: Modified Puls
Routing Curve: Elevation-Area-Outflow
Initial Elevation: 765
Elevation-Area Table: Ball Field South
Elevation-Outflow Table: Ball Field South
Primary Table: Elevation-Outflow
End:

Diversion: Ball Field South Diversion
Description: When the storage area for the south ball field overtops it flows to a small pond outside of the watershed area
Canvas X: -3880.7264564840316
Canvas Y: -355.6036872901177
Downstream: Ash Pond
Divert To: Pond Outside Watershed

Diverter: Inflow-Diversion Table
Inflow Diversion Table Name: Ball Field South Diversion
End Diverter:
End:

Reservoir: Ash Pond
Description: Ash Pond
Canvas X: 86.65511265164696
Canvas Y: -528.5961871750433
Label X: -1.0
Label Y: 0.0
Downstream: Stilling Pond

Route: Modified Puls
Routing Curve: Elevation-Area-Outflow
Initial Elevation: 760.5
Elevation-Area Table: Ash Pond EL-AREA
Elevation-Outflow Table: 100YR Ash Pond EL-Q
Primary Table: Elevation-Outflow
End:

Subbasin: Stilling Pond DA
Description: DA to Stilling Pond
Canvas X: 3416.815742397138
Canvas Y: -2012.5223613595708
Area: 0.044
Downstream: Stilling Pond

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 85.9
Curve Number: 87

Transform: SCS
Lag: 5
Unitgraph Type: STANDARD

Baseflow: None
End:

Reservoir: Stilling Pond
Description: Stilling Pond
Canvas X: 284.53637283303397
Canvas Y: -3963.585182164057
Label X: 3.0
Label Y: 0.0

Route: Modified Puls
Routing Curve: Elevation-Area-Outflow
Initial Elevation: 754.9
Elevation-Area Table: Stilling Pond EL-AREA
Elevation-Outflow Table: Stilling Pond El-Q
Primary Table: Elevation-Outflow
End:

Sink: Pond Outside Watershed
Canvas X: -7304.8562221542015
Canvas Y: -173.91516911170038
Label X: 0.0
Label Y: -9.0
End:

Basin Schematic Properties:
Last View N: 4356.060606060606
Last View S: -3893.280632411068
Last View W: -7821.969696969696
Last View E: 4630.681818181818
Maximum View N: 4356.060606060606
Maximum View S: -3893.280632411068
Maximum View W: -7821.969696969696
Maximum View E: 4630.681818181818
Extent Method: Elements
Buffer: 0
Draw Icons: Yes
Draw Icon Labels: Yes
Draw Map Objects: No
Draw Gridlines: No
Draw Flow Direction: Yes
Fix Element Locations: No

Fix Hydrologic Order: No
Map: hec.map.aishape.AiShapeMap
Map File Name: C:\Documents and Settings\mmeehan\My Documents\Projects\KingstonHH\existing_feb_2011.shp
Map Shown: Yes
End:

6-hour PMP

Basin: PMP Kingston H&H Model
Description: Existing Conditions February 2011
Last Modified Date: 14 April 2011
Last Modified Time: 14:06:30
Version: 3.4
Unit System: English
Missing Flow To Zero: No
Enable Flow Ratio: No
Allow Blending: No
Compute Local Flow At Junctions: No

Enable Sediment Routing: No

Enable Quality Routing: No
End:

Subbasin: Ash Pond DA
Description: Drainage area surrounding Ash Pond
Canvas X: 4630.681818181818
Canvas Y: 738.636363636364
Area: 0.102
Downstream: Ash Pond

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 45.9
Curve Number: 87

Transform: SCS
Lag: 5
Unitgraph Type: STANDARD

Baseflow: None
End:

Subbasin: Sluice Trenches
Description: Sluice Channel Area
Canvas X: -7193.0479032751755
Canvas Y: -572.2323051182293
Area: 0.047
Downstream: Sluice Trenches Storage

Canopy: None

Surface: None

LossRate: SCS
Percent Impervious Area: 11.7
Curve Number: 87

Transform: SCS
Lag: 6
Unitgraph Type: STANDARD

Baseflow: None
End:

Source: Plant Processes
Description: Flows from Plant Processes
Canvas X: -7490.530303030303

```
    Canvas Y: -2443.181818181818
    Area: 0.0
    Downstream: Sluice Trenches Storage

    Flow Method: CONSTANT_FLOW
    Constant Flow: 75
    End Flow Method:
End:

Reservoir: Sluice Trenches Storage
    Description: Storage behind 3 30" Corrugated HDPE Pipes
    Canvas X: -5222.426283032342
    Canvas Y: -1103.321819793603
    Downstream: Ash Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 763
    Elevation-Area Table: Sluice Trenches
    Elevation-Outflow Table: Sluice Trenches
    Primary Table: Elevation-Outflow
End:

Subbasin: Lateral Expansion
    Canvas X: 2784.09090909091
    Canvas Y: 2234.848484848485
    Area: 0.046
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 3.9
    Curve Number: 87

    Transform: SCS
    Lag: 13
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Relic Area
    Canvas X: -4551.576369758188
    Canvas Y: 4431.189964718182
    Area: 0.039
    Downstream: Relic Area Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Relic Area Storage
    Description: Storage area  behind 2 24" Corrugated HDPE Pipes
    Canvas X: -3349.636941808658
    Canvas Y: 2446.592304615471
    Downstream: Ash Pond
```

```
    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 790.6
    Elevation-Area Table: Relic Area
    Elevation-Outflow Table: Relic Area
    Primary Table: Elevation-Outflow
End:

Subbasin: Ball Field East
    Canvas X: -6550.150069720776
    Canvas Y: 3061.5380584501136
    From Canvas X: 153.7364384586608
    From Canvas Y: 852.5384314525727
    Label X: -1.0
    Label Y: 0.0
    Area: 0.034
    Downstream: Ball Field East Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 9
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Ball Field East Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -4914.953406115022
    Canvas Y: 1104.8924780671596
    From Canvas X: 377.3530762167129
    From Canvas Y: 796.6342720130597
    Downstream: Ball Field East Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 766
    Elevation-Area Table: Ball Field East
    Elevation-Outflow Table: Ball Field East
    Primary Table: Elevation-Outflow
End:

Diversion: Ball Field East Diversion
    Description: When water overtops the ball field east storage area it flows to the sluice trences storage area
    Canvas X: -3475.421300547562
    Canvas Y: 580.7909833217254
    Downstream: Ash Pond
    Divert To: Sluice Trenches Storage

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field East Diversion
    End Diverter:
End:

Subbasin: Dredge Cell Slope/Fr. Drain
    Description: French Drain
    Canvas X: -3736.382078964274
    Canvas Y: 1894.893509293437
    Area: 0.020
    Downstream: Ash Pond

    Canopy: None
```

```
    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 81

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Test Embankment
    Canvas X: -1637.572058973572
    Canvas Y: 3655.519752494939
    Area: 0.017
    Downstream: Ash Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 8
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: Ball Field South
    Canvas X: -7374.736421453592
    Canvas Y: 2181.0475472777844
    Label X: -1.0
    Label Y: 0.0
    Area: 0.014
    Downstream: Ball Field South Storage

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 87

    Transform: SCS
    Lag: 7
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Ball Field South Storage
    Description: Storage behind 3 18" Corrugated HDPE Pipes
    Canvas X: -5348.2106417712475
    Canvas Y: 315.2462259840386
    Downstream: Ball Field South Diversion

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 765
    Elevation-Area Table: Ball Field South
    Elevation-Outflow Table: Ball Field South
    Primary Table: Elevation-Outflow
```

```
End:

Diversion: Ball Field South Diversion
    Description: When the storage area for the south ball field overtops it flows to a small pond outside of the watershed
area
    Canvas X: -3880.7264564840316
    Canvas Y: -355.6036872901177
    Downstream: Ash Pond
    Divert To: Pond Outside Watershed

    Diverter: Inflow-Diversion Table
    Inflow Diversion Table Name: Ball Field South Diversion
    End Diverter:
End:

Reservoir: Ash Pond
    Description: Ash Pond
    Canvas X: 86.65511265164696
    Canvas Y: -528.5961871750433
    Label X: -1.0
    Label Y: 0.0
    Downstream: Stilling Pond

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 760.5
    Elevation-Area Table: Ash Pond EL-AREA
    Elevation-Outflow Table: 6-HR PMP Ash Pond EL-Q
    Primary Table: Elevation-Outflow
End:

Subbasin: Stilling Pond DA
    Description: DA to Stilling Pond
    Canvas X: 3416.815742397138
    Canvas Y: -2012.5223613595708
    Area: 0.044
    Downstream: Stilling Pond

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 85.9
    Curve Number: 87

    Transform: SCS
    Lag: 5
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Reservoir: Stilling Pond
    Description: Stilling Pond
    Canvas X: 118.57707509881402
    Canvas Y: -3893.280632411068
    Label X: 3.0
    Label Y: 0.0

    Route: Modified Puls
    Routing Curve: Elevation-Area-Outflow
    Initial Elevation: 754.9
    Elevation-Area Table: Stilling Pond EL-AREA
    Elevation-Outflow Table: Stilling Pond El-Q
    Primary Table: Elevation-Outflow
End:

Sink: Pond Outside Watershed
    Canvas X: -7304.8562221542015
```

Canvas Y: -173.91516911170038
End:

Basin Schematic Properties:
Last View N: 4356.060606060606
Last View S: -3893.280632411068
Last View W: -7821.969696969696
Last View E: 4630.681818181818
Maximum View N: 4356.060606060606
Maximum View S: -3893.280632411068
Maximum View W: -7821.969696969696
Maximum View E: 4630.681818181818
Extent Method: Elements
Buffer: 0
Draw Icons: Yes
Draw Icon Labels: Yes
Draw Map Objects: No
Draw Gridlines: No
Draw Flow Direction: Yes
Fix Element Locations: No
Fix Hydrologic Order: No
End:

Meteorologic Models

Meteorology: SCS 1-year, 24-hour
Description: 1-year, 24-hour
Last Modified Date: 10 May 2011
Last Modified Time: 15:33:41
Version: 3.4
Unit System: English
Precipitation Method: SCS Storm
Radiation Method: None
Snowmelt Method: None
Evapotranspiration Method: No Evapotranspiration
Use Basin Model: 1-year Kingston H&H Model
End:

Precip Method Parameters: SCS Storm
Storm Depth: 2.84
Storm Type: Type II
End:

Subbasin: Stilling Pond DA
End:

Subbasin: Ash Pond DA
End:

Subbasin: Sluice Trenches
End:

Subbasin: Dredge Cell Slope/Fr. Drain
End:

Subbasin: Ball Field East
End:

Subbasin: Test Embankment
End:

Subbasin: Relic Area
End:

Subbasin: Lateral Expansion
End:

Subbasin: Ball Field South
End:

Meteorology: SCS 10-year, 24-hour
    Last Modified Date: 8 February 2011
    Last Modified Time: 20:33:04
    Version: 3.4
    Unit System: English
    Precipitation Method: SCS Storm
    Radiation Method: None
    Snowmelt Method: None
    Evapotranspiration Method: No Evapotranspiration
    Use Basin Model: Kingston H&H Model
End:

Meteorology: SCS 10-year, 24-hour
    Last Modified Date: 8 February 2011
    Last Modified Time: 20:33:04
    Version: 3.4
    Unit System: English
    Precipitation Method: SCS Storm
    Radiation Method: None
    Snowmelt Method: None
    Evapotranspiration Method: No Evapotranspiration
    Use Basin Model: Kingston H&H Model
End:

Precip Method Parameters: SCS Storm
    Storm Depth: 4.72
    Storm Type: Type II
End:

Subbasin: Ash Pond DA
End:

Subbasin: Stilling Pond DA
End:

Subbasin: Sluice Trenches
End:

Subbasin: Dredge Cell Slope/Fr. Drain
End:

Subbasin: Ball Field East
End:

Subbasin: Test Embankment
End:

Subbasin: Relic Area
End:

Subbasin: Lateral Expansion
End:

Subbasin: Ball Field South
End:

Meteorology: SCS 25-year, 24-hour
    Last Modified Date: 10 February 2011
    Last Modified Time: 20:38:43
    Version: 3.4
    Unit System: English
    Precipitation Method: SCS Storm
    Radiation Method: None
    Snowmelt Method: None
    Evapotranspiration Method: No Evapotranspiration
    Use Basin Model: 25-year Kingston H&H Model
End:

Precip Method Parameters: SCS Storm
    Storm Depth: 5.53

Storm Type: Type II
End:

Subbasin: Ash Pond DA
End:

Subbasin: Stilling Pond DA
End:

Subbasin: Sluice Trenches
End:

Subbasin: Dredge Cell Slope/Fr. Drain
End:

Subbasin: Ball Field East
End:

Subbasin: Test Embankment
End:

Subbasin: Relic Area
End:

Subbasin: Lateral Expansion
End:

Subbasin: Ball Field South
End:

Meteorology: SCS 50-year, 24-hour
Last Modified Date: 10 February 2011
Last Modified Time: 20:38:36
Version: 3.4
Unit System: English
Precipitation Method: SCS Storm
Radiation Method: None
Snowmelt Method: None
Evapotranspiration Method: No Evapotranspiration
Use Basin Model: 50-year Kingston H&H Model
End:

Precip Method Parameters: SCS Storm
Storm Depth: 6.17
Storm Type: Type II
End:

Subbasin: Ash Pond DA
End:

Subbasin: Stilling Pond DA
End:

Subbasin: Sluice Trenches
End:

Subbasin: Dredge Cell Slope/Fr. Drain
End:

Subbasin: Ball Field East
End:

Subbasin: Test Embankment
End:

Subbasin: Relic Area
End:

Subbasin: Lateral Expansion
End:

Subbasin: Ball Field South
End:

Meteorology: SCS 100-year, 24-hour
    Last Modified Date: 15 February 2011
    Last Modified Time: 14:31:04
    Version: 3.4
    Unit System: English
    Precipitation Method: SCS Storm
    Radiation Method: None
    Snowmelt Method: None
    Evapotranspiration Method: No Evapotranspiration
    Use Basin Model: 100-year Kingston H&H Model
    Use Basin Model: 100-year Kingston Siphon Mdl
End:

Precip Method Parameters: SCS Storm
    Storm Depth: 6.80
    Storm Type: Type II
End:

Subbasin: Stilling Pond DA
End:

Subbasin: Ash Pond DA
End:

Subbasin: Sluice Trenches
End:

Subbasin: Dredge Cell Slope/Fr. Drain
End:

Subbasin: Ball Field East
End:

Subbasin: Test Embankment
End:

Subbasin: Relic Area
End:

Subbasin: Lateral Expansion
End:

Subbasin: Ball Field South
End:

Meteorology: SCS 500-year, 24-hour
    Last Modified Date: 10 May 2011
    Last Modified Time: 15:33:21
    Version: 3.4
    Unit System: English
    Precipitation Method: SCS Storm
    Radiation Method: None
    Snowmelt Method: None
    Evapotranspiration Method: No Evapotranspiration
End:

Precip Method Parameters: SCS Storm
    Storm Depth: 8.4
    Storm Type: Type II
End:

Control Specifications

Control: 48-hour run
    Description: 24-hour run

Last Modified Date: 9 August 2010
Last Modified Time: 16:35:08
Start Date: 31 December 2009
Start Time: 24:00
End Date: 2 January 2010
End Time: 24:00
Time Interval: 1
End:

Paired Data

Existing Conditions

Storage-Discharge

(see Appendix B for stage-storage and storage-discharge data)

Time-Series Data

Precipitation Gages: 6-Hour PMP

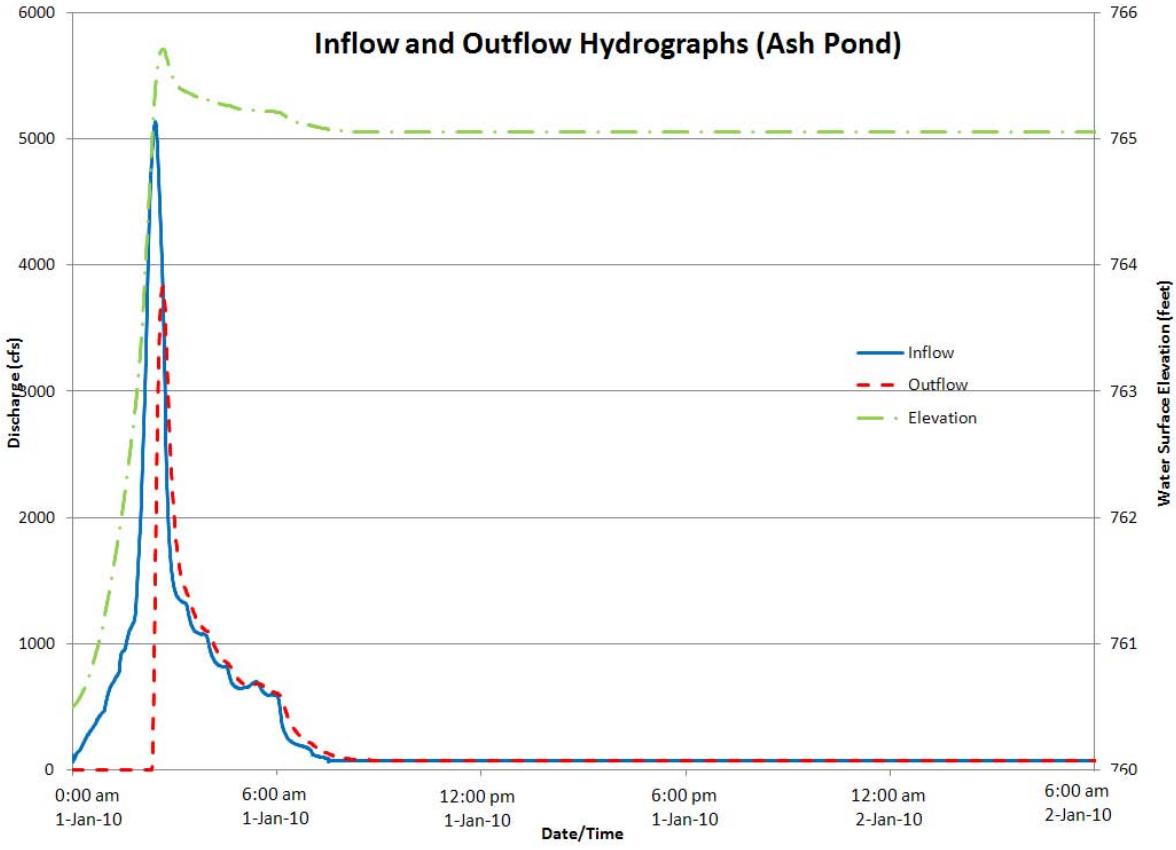
01Jan2010, 00:00	*0*
01Jan2010, 00:06	*0.24*
01Jan2010, 00:12	*0.48*
01Jan2010, 00:18	*0.73*
01Jan2010, 00:24	*0.97*
01Jan2010, 00:30	*1.21*
01Jan2010, 00:36	*1.45*
01Jan2010, 00:42	*1.73*
01Jan2010, 00:48	*2.01*
01Jan2010, 00:54	*2.29*
01Jan2010, 01:00	*2.73*
01Jan2010, 01:06	*3.18*
01Jan2010, 01:12	*3.63*
01Jan2010, 01:18	*4.11*
01Jan2010, 01:24	*4.6*
01Jan2010, 01:30	*5.08*
01Jan2010, 01:36	*5.69*
01Jan2010, 01:42	*6.29*
01Jan2010, 01:48	*6.9*
01Jan2010, 01:54	*8.04*
01Jan2010, 02:00	*9.4*
01Jan2010, 02:06	*11.25*
01Jan2010, 02:12	*13.92*
01Jan2010, 02:18	*16.58*
01Jan2010, 02:24	*19.24*

01Jan2010, 02:30	21.22
01Jan2010, 02:36	22.89
01Jan2010, 02:42	23.6
01Jan2010, 02:48	24.2
01Jan2010, 02:54	24.81
01Jan2010, 03:00	25.41
01Jan2010, 03:06	26.02
01Jan2010, 03:12	26.62
01Jan2010, 03:18	27.23
01Jan2010, 03:24	27.71
01Jan2010, 03:30	28.19
01Jan2010, 03:36	28.68
01Jan2010, 03:42	29.16
01Jan2010, 03:48	29.65
01Jan2010, 03:54	30.13
01Jan2010, 04:00	30.49
01Jan2010, 04:06	30.86
01Jan2010, 04:12	31.22
01Jan2010, 04:18	31.58
01Jan2010, 04:24	31.94
01Jan2010, 04:30	32.31
01Jan2010, 04:36	32.57
01Jan2010, 04:42	32.84
01Jan2010, 04:48	33.11
01Jan2010, 04:54	33.38
01Jan2010, 05:00	33.66
01Jan2010, 05:06	33.94
01Jan2010, 05:12	34.24
01Jan2010, 05:18	34.55
01Jan2010, 05:24	34.85
01Jan2010, 05:30	35.09
01Jan2010, 05:36	35.33
01Jan2010, 05:42	35.57
01Jan2010, 05:48	35.82
01Jan2010, 05:54	36.06
01Jan2010, 06:00	36.3

HEC-HMS Output Files

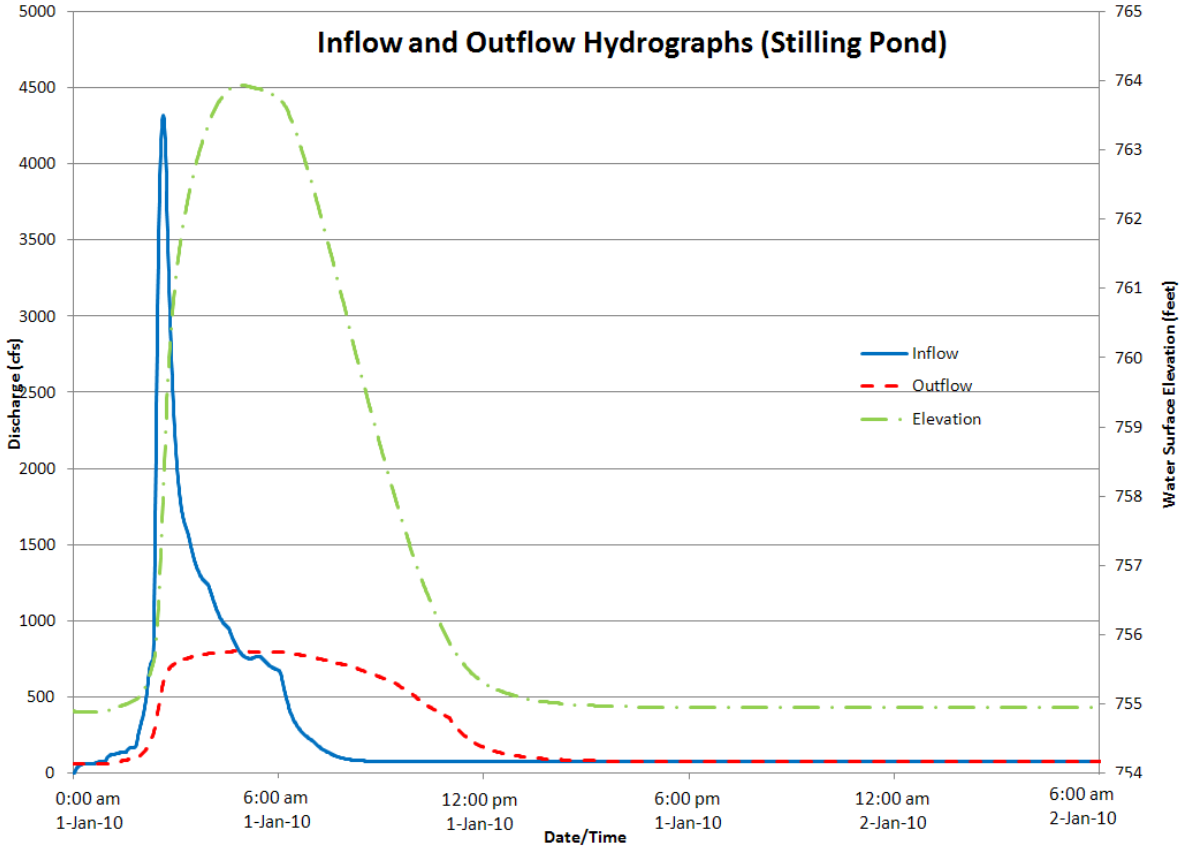
Existing Conditions - Ash Pond Routing

6-hr PMP



Existing Conditions - Stilling Pond Routing

6-hr PMP



Appendix H

Plant Process Flows

DRAFT

From: Weaver, Jason T
Sent: Thursday, August 20, 2009 7:27 PM
To: Russ, Timothy A
Subject: Pumps in service and discharge to trench and ash pond

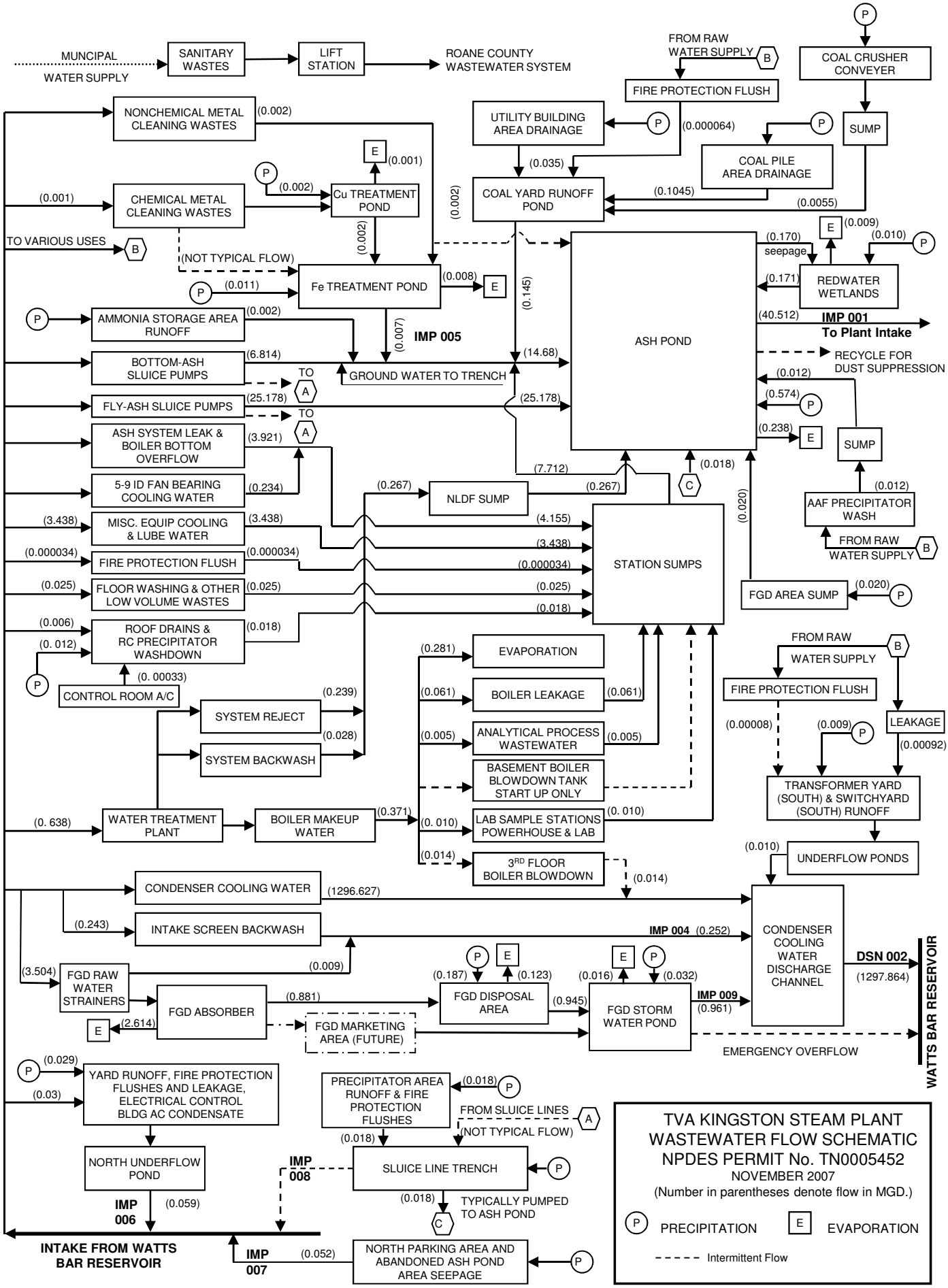
KIF Plant Water Flows to Ash Pond Area

Station sump pump flow increases approx 50% with units online if lined up correctly(Approx. 6k gpm now, and 10k gpm with all units online). We have 9 Fly Ash pumps(4@1925gpm and 5@4800gpm) and 4 Bottom Ash Pumps(2600gpm each). The bottom ash pumps are turned on when sluicing the bottoms of the boilers which occurs once per shift at 1 hour per unit. At least 3 fly ash pumps are on all the time to support the fire protection and hydrovactors at the precipitators. As the units are started, more fly ash pumps are required to run to support the hydrovactor operation at the precipitators.

With all nine units running, we normally have 6 fly ash pumps on @ 18,250 gpm, 2 bottom ash pumps running @ 5,200 gpm, 5 station sumps running at 10,000 gpm, and smaller auxiliary pumps running that may total 200 gpm....Total: 33,650 gpm

With 2-3 units running, we normally have 3 fly ash pumps on @ 8,650 gpm, 2 bottom ash pumps on intermittently @ 5,200 gpm, 3 station sumps running at 6,000 gpm, and the smaller auxiliary pumps running at 200 gpm.....Total: 20,050 gpm.

These are all rough numbers, but it gives you an idea of the flow that you are seeing. Please remember that the station sump pump discharge(and auxiliary pumps) is currently being pumped directly into the ash pond. The fly ash and bottom ash pumps are being pumped to the trench.


MUNCIPAL WATER SUPPLY
SANITARY WASTES
LIFT STATION
ROANE COUNTY WASTEWATER SYSTEM
FROM RAW WATER SUPPLY
COAL CRUSHER CONVEYER
FIRE PROTECTION FLUSH
NONCHEMICAL METAL CLEANING WASTES
(0.002)
UTILITY BUILDING AREA DRAINAGE
(0.000064)
SUMP
COAL PILE AREA DRAINAGE
(0.001)
(0.002)
Cu TREATMENT POND
(0.035)
COAL YARD RUNOFF POND
(0.1045)
(0.0055)
CHEMICAL METAL CLEANING WASTES
(0.001)
TO VARIOUS USES
(NOT TYPICAL FLOW)
Fe TREATMENT POND
(0.008)
(0.011)
(0.170)
seepage
(0.009)
(0.010)
REDWATER WETLANDS
(0.171)
AMMONIA STORAGE AREA RUNOFF
(0.002)
IMP 005
(0.007)
(0.145)
ASH POND
(40.512)
IMP 001
To Plant Intake
RECYCLE FOR DUST SUPPRESSION
BOTTOM-ASH SLUICE PUMPS
(6.814)
GROUND WATER TO TRENCH
(14.68)
(0.012)
FLY-ASH SLUICE PUMPS
(25.178)
(0.574)
ASH SYSTEM LEAK & BOILER BOTTOM OVERFLOW
(3.921)
(0.238)
SUMP
(7.712)
(0.018)
5-9 ID FAN BEARING COOLING WATER
(0.234)
(0.267)
NLDF SUMP
(0.012)
AAF PRECIPITATOR WASH
(3.438)
MISC. EQUIP COOLING & LUBE WATER
(4.155)
(0.020)
FROM RAW WATER SUPPLY
(0.000034)
FIRE PROTECTION FLUSH
STATION SUMPS
(0.025)
FLOOR WASHING & OTHER LOW VOLUME WASTES
FGD AREA SUMP
(0.020)
(0.006)
ROOF DRAINS & RC PRECIPITATOR WASHDOWN
(0.018)
(0.012)
(0.281)
EVAPORATION
FROM RAW WATER SUPPLY
(0.00033)
CONTROL ROOM A/C
(0.061)
BOILER LEAKAGE
FIRE PROTECTION FLUSH
(0.239)
SYSTEM REJECT
(0.005)
ANALYTICAL PROCESS WASTEWATER
(0.00008)
(0.009)
LEAKAGE
(0.028)
SYSTEM BACKWASH
(0.00092)
BASEMENT BOILER BLOWDOWN TANK START UP ONLY
TRANSFORMER YARD (SOUTH) & SWITCHYARD (SOUTH) RUNOFF
(0. 638)
WATER TREATMENT PLANT
BOILER MAKEUP WATER
(0.371)
(0. 010)
LAB SAMPLE STATIONS POWERHOUSE & LAB
(0.010)
UNDERFLOW PONDS
(0.014)
3RD FLOOR BOILER BLOWDOWN
CONDENSER COOLING WATER
(1296.627)
(0.243)
INTAKE SCREEN BACKWASH
IMP 004
(0.252)
CONDENSER COOLING WATER DISCHARGE CHANNEL
DSN 002
(1297.864)
WATTS BAR RESERVOIR
(3.504)
FGD RAW WATER STRAINERS
(0.009)
(0.187)
(0.123)
(0.016)
(0.032)
FGD ABSORBER
(0.881)
FGD DISPOSAL AREA
(0.945)
FGD STORM WATER POND
IMP 009
(0.961)
(2.614)
FGD MARKETING AREA (FUTURE)
EMERGENCY OVERFLOW
(0.029)
YARD RUNOFF, FIRE PROTECTION FLUSHES AND LEAKAGE, ELECTRICAL CONTROL BLDG AC CONDENSATE
(0.03)
PRECIPITATOR AREA RUNOFF & FIRE PROTECTION FLUSHES
(0.018)
FROM SLUICE LINES
(NOT TYPICAL FLOW)
NORTH UNDERFLOW POND
IMP 008
SLUICE LINE TRENCH
(0.018)
TYPICALLY PUMPED TO ASH POND
IMP 006
(0.059)
INTAKE FROM WATTS BAR RESERVOIR
IMP 007
(0.052)
NORTH PARKING AREA AND ABANDONED ASH POND AREA SEEPAGE
TVA KINGSTON STEAM PLANT
WASTEWATER FLOW SCHEMATIC
NPDES PERMIT No. TN0005452
NOVEMBER 2007
(Number in parentheses denote flow in MGD.)
PRECIPITATION
EVAPORATION
Intermittent Flow

KIF Generated Flow Reference Chart									
	Sluice Trench(MGD)			Sluice Trench Total(MGD)	Ash Pond(MGD)			Ash Pond Total(MGD)	Total Daily Flow(MGD)
	AAF Hydrovactor	SCR Hydrovactor	Sluice		Station Sumps	Filter Plant Sumps	AAF Sumps		
All Units Offline	0	0	0	0.00	0.4	0.09	0.2	0.69	0.69
1 Unit in Service	1.98	1.49	0.125	3.60	1.26	0.09	0.2	1.55	5.145
2 Unit in Service	3.96	2.98	0.25	7.19	2.12	0.09	0.2	2.41	9.6
3 Unit in Service	5.94	4.47	0.375	10.79	2.98	0.09	0.2	3.27	14.055
4 Units in Service	7.92	5.96	0.5	14.38	3.84	0.09	0.2	4.13	18.51
5 Units in Service	9.9	7.45	0.625	17.98	4.7	0.09	0.2	4.99	22.965
6 Units in Service	11.88	8.94	0.75	21.57	5.56	0.09	0.2	5.85	27.42
7 Unit in Service	13.86	10.43	0.875	25.17	6.42	0.09	0.2	6.71	31.875
8 Units in Service	15.84	11.92	1	28.76	7.28	0.09	0.2	7.57	36.33
9 Units in Service	17.82	13.41	1.125	32.36	8.14	0.09	0.2	8.43	40.785

Assumptions:

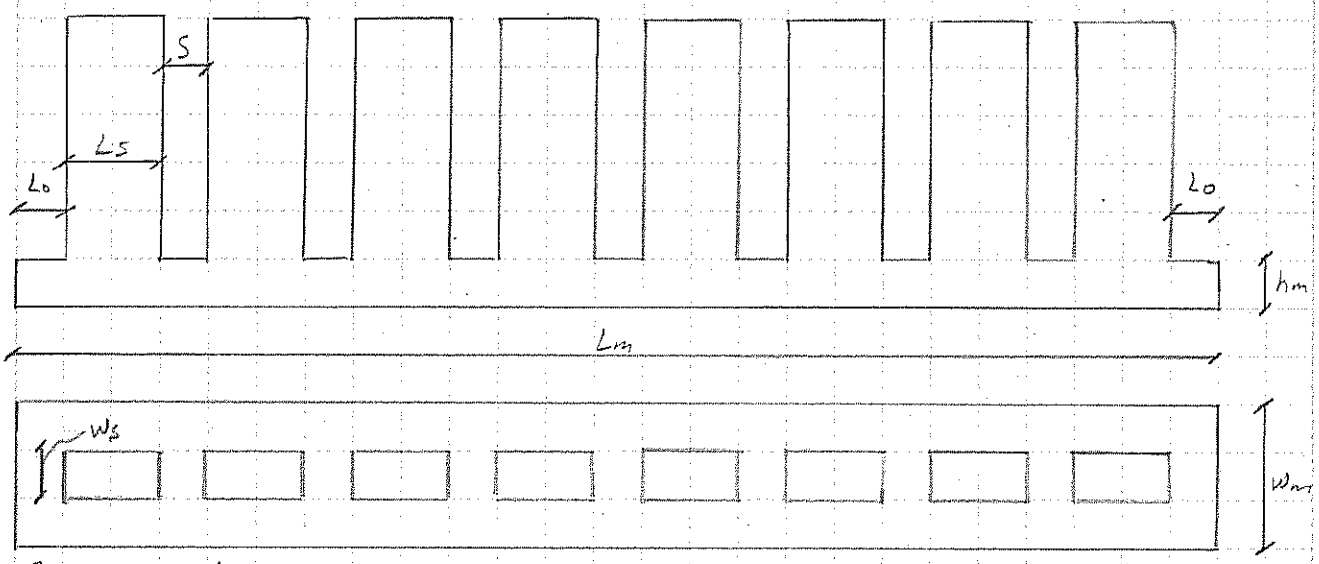
- Sluice Boiler Bottoms on unit for 2 hours per day when online
- AAF sump pumps operate No More Than 2.5 hours per day
- Filter Plant sump pump operates No More Than 2.5 hours per day
- Each unit generates 600 gpm of supply to the station sumps

Exhibit 02

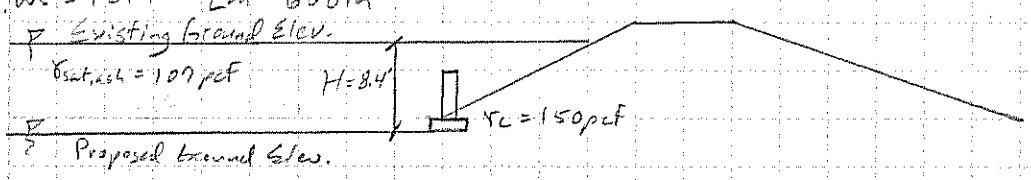
Geotechnical Calculations and Test Pit Logs

KIF Ash Pond Structure
Existing overburned loads vs. loads of proposed structures
175601118 6/13/11 Page 2 of 2

Structure and Mat Layout



S = 48 in hm = 6 in Lo = 12 in
Ls = 31 in Wm = 412 in
Ws = 18 in Lm = 608 in



Check: Determine if existing overburden pressure exceeds the proposed loading at outlet structures.

Assume settlement due to re-compression is minimal.
Assumes soft soils at bearing surface will be repaired/replaced.
Overburden Pressure:

$$\sigma'_{ov} = H \times (\gamma_{sat,ash} - \gamma_w) = 8.4\,ft \times (107\,pcf - 62.4\,pcf)$$

$$\boxed{\sigma'_{ov} = 374.6\ psf}$$

Designed by: Thomas Ward, PE Checked by: YW 06/15/11

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Stantec

Applied Pressure:

Mud mat weight -

$A_m = L_m \times W_m = 60\frac{3}{12}\,ft \times \frac{4\frac{1}{2}}{12}\,ft$
$A_m = 177.5\,ft^2$

$Wt_c = A_m \times h_m \times \gamma_c = 177.5\,ft^2 \times \frac{6}{12}\,ft \times 150\,pcf$
$Wt_c = 13{,}312.5\,lb$

Structures Weight -

$Wt_s = 352\,lb \times 8$ (supplied by manufacturer)
$Wt_s = 2{,}816\,lb$

Applied Pressure - (assume water level has been dropped to the bottom of the mud mat)

$\sigma_s' = \frac{Wt_c + Wt_s}{A_m} = \frac{13{,}312.5\,lb + 2{,}816\,lb}{177.5\,ft^2}$

$\boxed{\sigma_s' = 90.9\,psf}$

$\Delta\sigma' = \sigma_s' - \sigma_{ov}' = 90.9\,psf - 374.6\,psf$
$\boxed{\Delta\sigma' = -283.7\,psf}$

∴ Since the applied pressure is less than the removed overburden pressure, no settlement analysis is required.

Designed by: Thomas Ward, PE Checked by: YW 06/15/11

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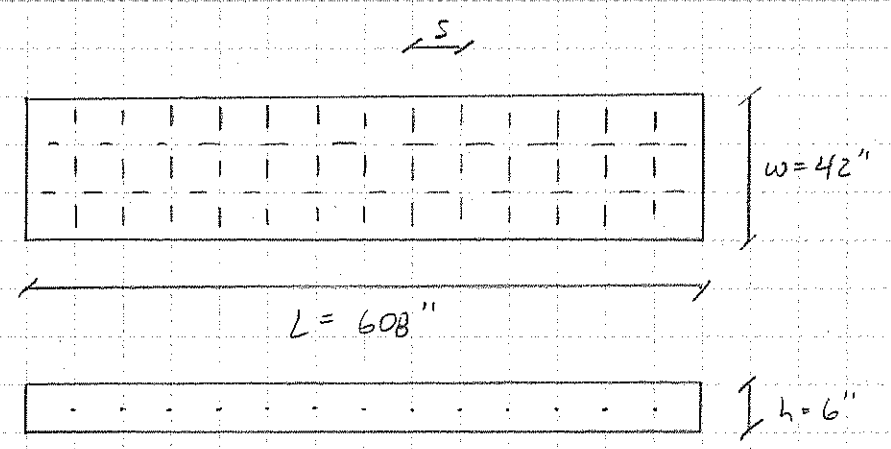

Determine the size of wire and spacing required for shrinkage control

Assumptions

Reinforcement is only required for shrinkage control.

Cross sectional Areas

By width -

$A_w = h \times w = 6in \times 42in$
$A_w = 252 in^2$

By length -

$A_l = h \times L = 6in \times 608in$
$A_l = 3,648 in^2$

Minimum Area of Reinforcement

ACI 318-08 7.12.2.1b – Slabs where Grade 60 deformed bars or welded wire reinforcement area used, use a minimum reinforcement ratio of $\rho_{s,min} = 0.0018$

$A_{s,w} = \rho_{s,min} \times A_w = 0.0018 \times 252 in^2$
$A_{s,w} = 0.45 in^2$

$A_{s,l} = \rho_{s,min} \times A_l = 0.0018 \times 3,648 in^2$
$A_{s,l} = 6.57 in^2$

Designed by: T. Ward, PE Checked by: M. Hay 6/20/11

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Stantec

Check 2x2 W2.9/2.9

$A_c = 2.9/100\ in^2$
$A_c = 0.029\ in^2$

$S = 2\ in$

$A_{s,w\,Total} = A_c \times w/s = 0.029\ in^2 \times \frac{42\ in}{2\ in}$
$A_{s,w\,Total} = 0.61\ in^2$

$A_{s,w\,Total} > A_{s,w}$
$0.61\ in^2 > 0.45\ in^2$ Check

$A_{s,l\,Total} = A_c \times L/s = 0.029\ in^2 \times \frac{608\ in}{2\ in}$
$A_{s,l\,Total} = 8.82\ in^2$

$A_{s,l\,Total} > A_{s,l}$
$8.82\ in^2 > 6.57\ in^2$ Check

$\therefore$ A 2x2 W2.9/2.9 wire mesh is acceptable.

Designed by: T. Ward, PE Checked by: M. Hoy 6/20/11

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Printed on FSC®-certified and 100 percent recycled postconsumer waste paper.

SUBSURFACE LOG (DRAFT)

Project No.	175660044	Location	N 553872.98, E 2441372.88 (NAD27)
Project Name	Ash Pond Outlet Structure	Boring No.	**TP-1** Total Depth 7.5 ft
Location	Roane County, Tennessee	Surface Elevation	761.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/7/11 Completed 7/7/11
Supervisor	T. Ward Operator TVA CP	Depth to Water	N/A Date/Time N/A
Logged By	T. Ward	Automatic Hammer ☐	Safety Hammer ☐ N/A ☒

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
761.0'	0.0'	Top of Hole							
		FLY ASH, gray, moist, loose, cenospheres, some clay							Test pit conducted with trackhoe.
755.5'	5.5'								
753.5'	7.5'	BOTTOM ASH, brown and gray, wet, loose, coarse material, some coal particles							
		No Refusal/ Bottom of Hole							

FMSM_LEGACY 175601118 TEST PIT LOGS.GPJ FMSM.GDT 7/26/11

SUBSURFACE LOG (DRAFT)

Project No.	175660044	Location	N 553852.29, E 2441351.25 (NAD27)
Project Name	Ash Pond Outlet Structure	Boring No.	**TP-2** Total Depth 8.0 ft
Location	Roane County, Tennessee	Surface Elevation	761.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/7/11 Completed 7/7/11
Supervisor	T. Ward Operator TVA CP	Depth to Water	7.0 ft Date/Time 7/7/11
Logged By	T. Ward	Automatic Hammer ☐	Safety Hammer ☐ N/A ☒

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
761.3'	0.0'	Top of Hole							
760.3'	1.0'	FLY ASH, gray, moist, loose, cenospheres, filter fabric, clay and chert							Test pit conducted with trackhoe.
758.3'	3.0'	CENOSPHERES, white, moist, some fly ash							
		FLY ASH, gray, moist, loose		BAG-1	6.0 - 6.5			--	
753.3'	8.0'	-6-inch layer of Bottom Ash							
		No Refusal/ Bottom of Hole							

FMSM_LEGACY 175601118 TEST PIT LOGS.GPJ FMSM.GDT 7/26/11

Construction Quality Control (CQC) Plan

Ash Pond Outlet Structure

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Kingston Fossil Plant
Roane County, Tennessee

DRAFT FOR REVIEW

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Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

July 26, 2011

Construction Quality Control (CQC) Plan
Ash Pond Outlet Structure
Kingston Fossil Plant
Roane County, Tennessee

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Appendix A Material Testing Schedule

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Construction Quality Control (CQC) Plan
Ash Pond Outlet Structure

Kingston Fossil Plant
Roane County, Tennessee

1. Purpose and Scope

This document is a site specific Construction Quality Control (CQC) plan that addresses construction of the outlet structures in the Ash Pond to allow for pool lowering.

The CQC plan defines acceptable construction materials and methods along with responsibilities and authority of the Owner, Contractor and designated QC personnel. This plan should be considered to represent minimum QC requirements and shall serve as an outline for use in developing site specific QC protocols based on conditions encountered during construction and operation of the facility. It is noted that a detailed construction package, also referred to as RDP-0114-G, consisting of construction drawings, notes and Technical Specifications is an integral part of this project. The construction drawings and specifications are the official documents controlling the project requirements. Where there is a conflict between this QC Plan and the construction documents, the construction documents take precedence.

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2. Limitations

The QC plan does not include any facility element outside the limits of construction designated on the Construction Plans.

3. Responsibility and Authority

3.1. Engineer

A qualified professional engineer licensed in the State of Tennessee shall be designated as the Engineer of Record (Engineer). The Engineer shall be responsible preparing the construction documents, approving required “Engineer Approved” submittals, and responding to requests for information (RFI’s) during construction. The Engineer for this project is Stantec Consulting Services Inc. (Stantec). The Engineer of Record is Mr. Matthew A. Hoy, P.E (636-343-3880).

3.2. Quality Control Manager and Team

A qualified professional engineer licensed in the State of Tennessee shall be designated as the Quality Control Manager (QC Manager). The QC Manager shall be responsible for management of construction monitoring, testing and related documentation as outlined herein. The QC Manager shall assign appropriate test standards and methods for field observations and/or laboratory testing designated in the project requirements and is responsible for review of all QC data to assess conformance with project requirements. The QC Manager shall also perform random observations of personnel and activities (to include final constructed elements) working and/or performed under his direct supervision as needed

in order to complete the required certification during the course of the project. The Quality Control Team (QC Team) shall consist of qualified personnel working under the direct supervision of the QC Manager. The QC Team shall be familiar with facility operations as it affects the project, proper material placement protocols and the functional intent of the respective design components.

Personnel assignments are subject to change provided qualification requirements are met.

3.3. Owner and Operator

The plant and its ancillary functions are owned and operated by Tennessee Valley Authority (Owner). The Owner shall be responsible for the overall management of project activities to include but not limited to contracting, administration, and retaining the services of qualified consultants as required during the project. In addition, the Owner shall approve any design and/or QC revisions and administer related permit modifications.

The Owner shall also designate one representative to serve as the Construction Representative to be responsible for construction activities to include but not be limited to the character and sequence of work, coordination, scheduling, and management of cost, time and contract administration as related to the execution of the project. The owner shall be responsible for providing qualified professionals to establish and enforce safety protocols related to the project.

3.4. Contractor

The Contractor for this project is To Be Determined. The Contractor shall be responsible for all construction activities associated with this project including meeting all of the requirements for project quality as defined in the construction drawings and specifications.

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4. Project Setting

This project will take place at the Kingston Fossil Plant (KIF) Ash Pond.

4.1. Project Description

The purpose of this project is to install new outlet structures in the Ash Pond to allow for lowering of the Ash Pond pool elevation. The new spillway structures are prefabricated stoplog spillway structures installed through the divider dike in the southwest corner of the Ash Pond. The structures will be installed such that the top stoplog elevation controls the pool at its approximate existing elevation of 760.7 ft. Stoplogs will be incrementally removed to slowly lower the water surface elevation to its ultimate drawdown elevation. A concrete cradle will be poured around a portion of the outlet pipes through the embankment and clay backfill will be compacted around the outlet pipes, replacing the existing bottom ash material in the Divider Dike. A temporary cofferdam will be installed in the Ash Pond to isolate the construction area.

4.2. Key Design and Construction Elements

Key project design and construction elements are defined in the following sections. It is noted that in all cases proper construction sequence and methodology along, with compliance to established project requirements, is critical to the project.

4.2.1. Ash Pond Water Quality

The existing Stilling Pond spillway outlets are a NPDES permitted discharge point. Following Ash Pond pool lowering, the decreased surface area may affect particle settling times. One of the permit effluent requirements is total suspended solids (TSS). As highlighted in the Construction Plans, the Owner is responsible for mitigating effects of TSS levels. Modifications may encompass addition of polymer to aid in settling, installation of turbidity curtain around the siphon inlets, or installation of curtain booms in the Stilling Pond to increase flow travel time through the pond. Installation of these items shall be the responsibility of the Owner.

4.2.2. Earthwork

Compacted backfill shall be placed as indicated in the Construction Plans. Proper construction techniques and materials are critical as backfill is used to reconstruct the embankment around and above the siphon spillway pipes. Material and placement specifications are included in the Technical Specifications.

4.3. Erosion and Sediment Control

General locations of sediment and erosion control features are shown on the Construction Plans. All construction activities shall be conducted in accordance with applicable permit requirements, including the erosion prevention and sediment control (EPSC) notes in the Construction Plans.

4.4. Outlet Structures

The outlet will consist of prefabricated stop log structures and 27-inch O.D. DR17 HDPE pipe in accordance with the Construction Plans and Technical Specifications to be used to drawdown the pool and to maintain the typical daily process flow from the plant. The stop logs at the prefabricated outlet structures will be used to regulate flow from the outlet structures. The HDPE pipe shall be pressure tested prior to backfill to verify that there are no leaks.

4.5. Pool Lowering

Following installation of the outlet structure, the stoplogs will be removed such that the ash pond elevation is lowered no more than 6 inches per day or 2 feet every 2 weeks.

4.6. Record Surveys

Field surveys shall be conducted in association with construction activities to verify elevations and dimensions specified in the Construction Plans or as directed by the Contractor or QC Manager. These surveys shall document earthwork element elevations to one-tenth (0.1) foot and drainage control structure invert elevations to five-one hundredths (0.05) foot. The Owner or its designee shall conduct these surveys.

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5. Quality Control Activities

5.1. Project Meetings

Project meetings shall be coordinated and conducted by the Project Manager.

5.2. Modifications

General construction and QC modifications may be executed following approval of the Engineer and the Owner. Proposed construction modifications shall be developed by the Contractor using the attached RFI form, submitted to the Engineer for review and comment, and then submitted to the Owner for review and comment prior to incorporation into the facility design. Modifications that require an added cost will also require submittal of a Project Change Request (PCR) form.

5.3. Field Observations – QC Team

The QC Team shall perform minimum daily observations of the facility. Daily observations are to be documented on the Daily Field Report Form included in the QA requirements for the project. In addition, weekly observations shall be made of embankment outslopes for indications of slope instability to include but not be limited to tension cracks, sloughs, and seepage. The QC Team shall observe all constructed sediment control structures as well as overall site drainage conditions. These observations shall be documented on the Weekly Field Observation Form.

The Noncompliance Report Form shall be used as needed to immediately report deficiencies, remediation required and resolution to the Contractor and the Owner.

Any suspect facility conditions shall be promptly reported to both the Owner and the Engineer. Copies of observation forms that may be adapted for use in this project are provided in the QA requirements for the project. Each observation shall be documented for inclusion with the project records.

In addition to the daily and weekly activities documented above, the QC Team will perform additional inspections during pool drawdown. During pool drawdown, the QC Team will sample turbidity in addition to performing daily dike observations to monitor for slope instabilities. Any slope instabilities or sloughing on the interior of the dikes, which could result in increased TSS levels, will be reported to the Contractor and repaired or armored immediately.

5.4. Contractor Submittals

Contractor submittals shall be reviewed and approved by the QC Manager prior to procurement, delivery and/or use of the respective construction materials. Copies of all submittals shall be included with the project records. A list of required submittals is included in on the Construction Plans.

5.5. Conformance Testing

Conformance testing shall consist of periodic testing of materials and/or constructed products. Conformance testing shall be conducted at frequencies as specified in the

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Technical Specifications and listed in Appendix A and documented by the QC Team. Results of testing shall be reviewed by the QC Manager to assess conformance with project requirements. Copies of all conformance testing results shall be included with the project records.

5.6. Stop Work Authority

The Contractor or QC Manager may exercise Stop Work Authority where personnel safety is concerned and, after approval by the Project Manager, in extreme deviations from design, significant cost or schedule impact, or stability concerns.

5.7. Mandatory QC Hold Points

Work may not proceed beyond the following hold points until a QC Team Member has completed the applicable QC test or confirmation and has so notified the Contractor.

Hold Point	Test or Confirmation
Outlet Structures	Confirm structures are installed at grade specified on construction plans and stoplogs are installed as shown on plans.
Pipe Installation	Confirm bedding material suitable for installation Confirm that pipe installation is consistent with design grade and alignment prior to covering Confirm that pipe pressure testing has passed for each run prior to covering
Concrete Placement	Confirm bedding material placement Confirm form dimensions comply with construction plans
Backfill	QC Team approval of fill material Confirm passing compaction test result for each lift Confirm elevations and slopes consistent with design
Lowering Pool Level	Verify that pool is lowered no more than 6 inches per day or a maximum of 2 ft every 2 weeks. Prior to every 6 inch drop in pool elevation, QC Team shall assess perimeter and interior dikes for any sign of slope instability.

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6. Project Submittals and Material Testing

6.1. Cast-In-Place Concrete

Cast-in-place concrete shall comply with the Technical Specifications. Strength requirements for the concrete are specified in the Technical Specifications. The QC Team shall conduct conformance testing during placement to verify the acceptability of supplied materials at prescribed intervals provided in the testing schedule present in Appendix A of this plan.

Submittals shall be reviewed and approved by the Engineer. The QC Team shall observe all cast-in-place concrete construction. Any reinforcing steel showing signs of non-conformance to design or project specifications shall be replaced by the Contractor. A batch mix design shall be submitted to the QC Team 15 working days prior to beginning of concrete work, and the Contractor shall supply the QC Team with delivery slips.

6.2. Concrete Reinforcement

Placement and use of reinforcing steel shall comply with the Technical Specifications and Construction Plans.

Submittals shall be reviewed and approved by the Engineer. The QC Team shall observe reinforcing steel placement prior to pouring. Any reinforcing steel showing signs of non-conformance to specifications shall be replaced by the Contractor. Complete shop drawings in accordance with the Technical Specifications shall be submitted at least 15 days prior to beginning work. The Contractor shall not allow delivery of the reinforcing steel to the job site until review of the shop drawings has been completed by the Engineer.

6.3. Flowable Fill

Flowable fill shall comply with the Technical Specifications. Strength requirements for the flowable fill are specified in the Technical Specifications. The QC Team shall conduct conformance testing during placement to verify the acceptability of supplied materials at prescribed intervals provided in the testing schedule present in Appendix A of this plan.

Submittals shall be reviewed and approved by the Engineer. The QC Team shall observe all flowable fill placement. A material list and batch mix design shall be submitted to the QC Team 15 working days prior to beginning of concrete work, and the Contractor shall supply the QC Team with delivery slips.

6.4. Earthwork

Site preparation work shall be performed in accordance with the Technical Specifications and shall not commence until erosion and sediment control measures are in place.

The QC Team shall observe all pertinent earth-moving activities and verify that erosion and sediment control measures are in place prior to commencement of work. The Contractor shall prepare and present a Site Safety Plan to be reviewed and approved by a TVA Safety Professional. No work will be allowed prior to submittal of the plan and approval of the document.

6.4.1. Excavation

Excavation shall be consistent with the Construction Plans and Technical Specifications and shall not commence until erosion and sediment control measures are in place.

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During excavation, the Contractor is responsible for verifying all grades and lines as shown on the Construction Plans. Excavations carried below the indicated depths shall be replaced with material satisfactory to the Engineer. The QC Team shall verify that the Plant has been notified prior to excavation in the dike.

6.4.2. Backfill and Embankment

Compacted backfill shall be placed as indicated in the construction drawings above the CLSM placed around the outlet pipes. Material and placement specifications are included in the Technical Specifications.

Backfill material shall be tested for classification, standard proctor density and optimum moisture content by the QC Team for each borrow source or when a change in the supplied material is noted. Classification shall be approved by the QC Manager prior to being placed as fill by the Contractor. The QC Team shall observe placed backfill for rutting, quaking or heaving. If observed, QC Team shall notify the Engineer and the Contractor.

Material and placement requirements for the compacted backfill are specified in the construction documents. The QC Team will verify subgrade has been properly prepared for fill placement prior to placement of each lift.

Each lift of structural fill shall be compacted with appropriate heavy equipment as approved by the QC Team to the minimum requirements established in the testing schedule presented in Appendix A of this plan. The QC Team shall observe the prepared foundation and direct the Contractor to maintain proper moisture control.

Field conformance testing shall include periodic in-place density and device calibration testing to provide documentation of the compaction operations at prescribed intervals provided in the testing schedule presented in Appendix A of this plan. Compaction testing of each lift shall be conducted by the responsible QC Team Member or testing personnel assigned by a QC Team Member. Compacted materials shall be tested at the minimum frequency specified in Appendix A. Materials for subsequent lifts shall not be placed by the Contractor until testing results on the previous lift meet project specifications.

Prior to construction of subsequent backfill lifts, the QC Team shall verify the following:

- Confirm the material is properly compacted and uniform and is suitable to support further construction;
- Observe and report that placement and compaction meets project specifications;
- Confirm and document that materials used meet the specifications.

6.4.3. Dewatering

Dewatering is needed to maintain the working areas in the excavation area as needed to perform the construction operations specified.

Prior to beginning work, the Contractor shall submit to the Engineer a plan for dewatering the excavated area and maintaining the dewatered state in the working area prior to beginning work. This plan shall include details on slope movement and signs of distress, discuss the

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equipment to be used for dewatering, intake point, discharge point and means of controlling scour at the discharge point. The plan shall include hours of operation and any special actions needed to be taken by the Owner and/or others.

The Contractor shall submit information detailing the number type and manufacturer of pumping units to be utilized. Contractor submittals are included on the Construction Plans.

The QC Team shall perform reviews of these dewatering features. Appropriate maintenance and adjustments to dewatering the excavated area shall be made by the Contractor as deemed necessary by the Engineer.

6.4.4. Temporary Cofferdams

Should the existing berm around the cenosphere pond not be sufficient to prevent infiltration of water from the Ash Pond, the Contractor shall install a temporary cofferdam.

The type of cofferdam shall be an AquaDam or Engineer approved equivalent. The Contractor shall submit to the Engineer a detailed plan covering the installation, operation and maintenance of the AquaDam during construction. This plan shall include any special actions necessary by the Owner and/or others.

6.4.5. Erosion and Sediment Control

Basic sediment and erosion control structures are shown on the Construction Plans. Primary erosion and sediment control features include the installation of silt fencing around the construction area.

The QC Team shall perform reviews of these erosion control features as well as overall site drainage conditions in accordance with the Technical Specifications. Appropriate maintenance and adjustments to site drainage and related sediment control structures shall be made by the Contractor as deemed necessary by the QC Team.

6.4.6. Geotextile Fabric

The geosynthetic materials shall include geotextile fabric specified in the Technical Specifications. Alternative materials must be approved by the QC Manager. Geotextile fabric shall be used for silt fence and separation applications and geogrid shall be used for stabilization of the base of the mud mat.

The Contractor shall submit certified material specifications, delivery tickets and all other documentation provided by the supplier to demonstrate that the supplied material meets the requirements of the Technical Specifications. Contractor submittals are included on the Construction Plans.

6.4.7. Stone and Riprap

Durable stone aggregate materials designated for use in this project shall meet the requirements listed in the Technical Specifications.

Prior to delivery, the Contractor shall submit supplier certification, including gradation analyses, to the QC Manager that all materials meet or exceed the minimum established

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properties. Required submittals are summarized in the testing schedule presented in Appendix A of this plan. Additional conformance documentation shall be required at any time a significant change in the supplied material is noted.

6.5. Utilities

6.5.1. Stoplog Outlet Structures

The Contractor shall submit to the Engineer a detailed work plan 15 days prior to beginning work. This work plan shall detail the methodology and sequence used to install the prefabricated outlet structures.

The QC Team shall verify the type, size and condition of the outlet structures prior to installation. During installation, the QC Team shall verify that the Contractor installed outlet structures are level.

6.5.2. HDPE Pipe

Installation of HDPE pipe shall be performed in accordance with the Construction Plans and with the project requirements established in the Technical Specifications.

Following fabrication of outlet structure pipe runs, each run shall be pressure tested by the Contractor in accordance with the Technical Specifications. Any pipe runs not meeting test requirements will be repaired or re-fabricated until a passing test result is achieved. Test results shall be submitted to the QC Team.

Pipe suppliers shall submit certified material specifications, delivery tickets and all other available documentation to show that the supplied material meets the project specifications. The QC Team shall verify pipe runs have passed a pressure air test prior to backfilling. During pipe trench backfill operations, the QC Team shall document that these operations are performed in accordance with the project requirements and manufacturer recommendations.

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6.6. Record Surveys

Field surveys shall be conducted in association with facility construction and phased operations as directed by the QC Manager. These surveys shall document earthwork element structure elevations as shown on the Construction Plans. The Owner or its designee shall conduct these surveys.

7. Project Documentation

Project documentation shall be obtained and maintained by the QC Manager (copied to the Owner) during all phases of construction. This documentation shall include:

- Construction field reports;
- Observation reports;
- Contractor submittals;

- Material conformance data;
- Photographic documentation;
- Construction issue and resolution reports;
- Request for Information (RFI) forms;
- Design and/or specification modifications; and
- Meeting minutes.

The QC Manager shall prepare a Construction Certification Report (CCR) at the completion of this project in accordance with TVA Programmatic Documents. This report shall include construction observations, evaluations performed and results obtained. This report shall also contain a statement that indicates that the construction was performed in general accordance with the plans and specifications. The QC Team shall also prepare Record Drawings based on as-built drawings and surveys provided by the Contractor and Owner. The following statement shall be used in the CCR:

I,_____, hereby certify that I am a licensed engineer in the State of Tennessee. To the best of my knowledge, information, and belief the documentation submitted in this report indicates construction operations were performed in general conformance with the intent of the approved plans and specifications and in my professional opinion, is in compliance with applicable regulations as required by Rule 1200-1-7-.04 (9)(c)19.

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Appendix A

Material Testing Schedule

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Construction Quality Control Plan
Material Testing Schedule
Ash Pond Outlet Structure
Kingston Fossil Plant
Roane County, Tennessee

MATERIAL	PROPERTY / TEST	RESPONSIBLE PERSONNEL	METHOD	Value	Minimum Frequency (1)
Backfill	Classification	Engineer	ASTM D-2487	CL, CL-ML, CL-CH, CH	1/ supplier / source
	Density	Engineer	ASTM D-698	Determine max dry density 98% max dry density	1/ supplier / source 1/ 4-inch or 8-inch lift (per plans)
	Moisture	Engineer	ASTM D-698	Optimum moisture content +2 / -2 % optimum moisture	1/ supplier / source 1/ 4-inch or 8-inch lift (per plans)
HDPE Pipe	Low Pressure Air Test	Contractor	ASTM F-1417	Passing Test Result	1/ pipe run
Concrete	Compressive Strength	Engineer	ASTM C-31 / C-39	3,000 psi	1/ 50 cy / day 4 samples / test; 1 broken at 7 days for information ; 2 broken at 28 days for acceptance; 1 reserve
	Air Content	Engineer	ASTM C-231	4% +/- 2%	1/ compressive strength test specimen
	Slump	Engineer	ASTM C-143	3 -5"	1/ compressive strength test specimen
CLSM	Compressive Strength	Engineer	ASTM C-31 / C-39	50 psi	1/ 50 cy / day 4 samples / test; 1 broken at 7 days for information ; 2 broken at 28 days for acceptance; 1 reserve
Graded Filter No. 57	Gradation	Engineer	ASTM D-75 ASTM C-136	per KYTC 805.15	1/ 100 tons
Sand	Gradation	Engineer	ASTM D-75 ASTM C-136	per KYTC 805.15	1/ 100 tons

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Technical Specifications

Kingston Fossil Plant
Ash Pond Outlet Structure
RDP-114-G
Roane County, Tennessee

ISSUED FOR REVIEW – 90%

Prepared for

Tennessee Valley Authority
Chattanooga, Tennessee

July 26, 2011

Stantec Consulting Services Inc.
One Team. Infinite Solutions

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TECHNICAL SPECIFICATIONS
DIVISION 03 – CONCRETE
SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1. DESCRIPTION

This Specification covers the furnishing of all material, equipment, labor and plant, and performing all operations specified herein for concrete used in the inlet structure mud mat.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Division 31 – Earthwork
- Division 03 – Concrete

1.3. REFERENCE

In addition to complying with all pertinent codes and regulations, the Contractor shall comply with all pertinent recommendations of the following standards:

1. American Concrete Institute, ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete".

2. American Concrete Institute, ACI 308, "Recommended Practice for Curing Concrete".

3. American Concrete Institute, ACI 311, "Recommended Practice for Concrete Inspection".

4. American Concrete Institute, ACI 318, "Building Code Requirements for Reinforced Concrete".

PART 2 - SUBMITTALS

2.1. MATERIAL TESTING

See Part 8.

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PART 3 - PRODUCTS

3.1. CONCRETE

Concrete shall be composed of Portland cement, water, fine aggregate, coarse aggregate, and when specified or approved in writing by the Engineer, admixtures for entraining air or retarding agents to slow concrete curing. The design of the concrete mixture will be based on the water-cement ratio necessary to secure (1) a plastic workable mixture suitable for the specific conditions of placement and (2) when properly cured, a product having durability, impermeability and strength in accordance with all the requirements set forth by these Technical Specifications. The concrete mixture shall be designed so that the concrete placed according to Construction Plans shall produce a minimum laboratory cylinder compressive strength equal to the strength designated in Part 4.

3.2. STEEL REINFORCEMENT

Steel Reinforcement shall consist of 2x2 W2.9/2.9 welded wire mesh. Unless otherwise noted, reinforcing steel placement and cover shall conform to ACI 318.

All steel reinforcement shall be handled and stored in such a manner as to avoid damage or corrosion. If corrosion or damage is observed, replacement materials may be required.

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PART 4 - DESIGN REQUIREMENTS

All cast-in place concrete shall meet the following minimum design requirements:

Minimum 28-Day Strength (psi)	Air Entraining (%)	Minimum Cement Content (lbs./cu.yd.)	Maximum Water/Cement Ratio
3,000	4 (min.)	564	0.45

PART 5 - CONSISTENCY

5.1. GENERAL

The consistency of concrete shall be such that it can be worked readily into corners and angles of forms and around reinforcement without permitting the materials to segregate or excess water to collect on the surface. The extreme limits of allowable slump when tested in accordance with ASTM Designation C-143 shall be 1 to 3 inches. Where vibrators are used, the QC Manager may allow a slightly lower slump than the specified minimum.

5.2. MIXING WATER

Mixing water shall be potable water. The ratio of mixing water to cement shall not be changed without prior approval from the Engineer.

5.3. READY-MIX DELIVERY SLIPS

Contractor shall:

1. Keep a record at the job site showing time and place of each batch of concrete, together with ready-mix delivery slips certifying contents of each batch.

2. Make records available to the QC Manager for his inspection upon request.

3. Upon completion of this portion of the work, deliver the record and delivery slips to the QC Manager.

PART 6 - DESIGN MIXES

6.1. GENERAL

Contractor shall be responsible for the design of the concrete mixtures and the quality of the concrete, including ready-mix batches. He shall use an independent testing laboratory, approved by the Engineer, for preparing and reporting proposed mix designs.

6.2. PROPORTIONING AND REPORTS

Design mixes shall be proportioned by weight, complying with ACI-211 "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete."

6.3. DESIGN CRITERIA

The concrete mixes shall be designed so that the compressive strength of laboratory-cured cylinders, for each required strength, will be at least 15 percent greater than the minimum specified compressive strength; and such that not more than one test, of any ten consecutive tests for strength, will have a value of less than 90 percent of the required strength.

PART 7 - CONCRETE MATERIALS

7.1. GENERAL

All batching of concrete shall be in accordance with this Technical Specification.

7.2. CEMENT

7.2.1. Portland Cement

Portland cement shall meet the requirements of ASTM Designation C-150 for the type of cement specified. The cement shall be either Type II or Type IIA cement unless otherwise directed by the Engineer.

7.2.2. Air-Entraining Portland Cement

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Air-entraining Portland cement shall meet the requirements of ASTM Designation C-150 for the type of cement specified.

7.2.3. Storage of Cement on the Site

Cement shall be properly stored and protected from weather, dampness or other destructive agents. Any cement which is damaged will be rejected and not permitted to be used in the work.

7.2.4. Sampling and Testing

Portland cement shall be subject to sampling and testing in accordance with ASTM Designation C-150.

7.3. AGGREGATES

7.3.1. Fine Aggregate

Fine aggregate shall be sand having clean, hard, durable, and well-graded particles free from deleterious substances and shall conform to the provisions of ASTM Designations C-33 and C-136.

7.3.2. Coarse Aggregate

Coarse aggregate shall be crushed limestone of hard, clean, durable particles free from deleterious substances and shall conform to the provisions of ASTM Designations C-33 and C-136. Maximum particle size of coarse aggregate shall be one inch.

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7.4. WATER

Water used in mixing concrete shall be fresh, clean and free of injurious amounts of sewage, oil, acid, alkali, salts, or organic matter and its source shall be subject to approval of the QC Manager.

7.5. ADMIXTURES

7.5.1. Air-Entrainment

Air-entraining admixtures shall fully meet the requirements of ASTM Designation C-260 and shall be subject to tests in accordance with ASTM Designation C-233. Air-entraining admixtures shall be added to the concrete mixture in the form of solutions rather than solids. The manufacturer's storage recommendations shall be followed.

PART 8 - CONCRETE SAMPLING AND TESTING

8.1. GENERAL

Standard tests of the material and concrete shall be made by TVA's testing service, as required by these specifications. Retests required due to non-conformity of the materials shall also be made by TVA's testing service as approved by the Engineer. The following tests will be performed by the methods and minimum frequencies indicated.

8.1.1. Fresh Concrete

ASTM C-172; each sample shall be obtained from a different batch of concrete on a random basis.

8.1.2. Compressive Test

ASTM C-31; one set of four (4) standard cylinders for each compressive strength test. One set of specimens shall be cast from a composite sample of concrete placed in one day or each 50 cubic yards placed, whichever is minimum. The QC Manager or his representative will determine and record the batch number for the concrete and the exact location in the work at which each batch represented by test specimens is deposited.

8.1.3. Concrete Temperature

Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compressive test specimens is made.

8.1.4. Compressive Strength

ASTM C-39; for each set of compressive strength test specimens there shall be one test at seven (7) days after placing for information and two (2) tests at twenty-eight (28) days for acceptance. One specimen shall be held in reserve. The acceptance test results shall be the average of the two strengths of the specimens at 28 days. If one specimen in the test manifests evidence of improper sampling, molding, transportation or testing, it shall be discarded and the reserve specimen shall replace it. If two specimens in a test show any defects, the test result shall be the remaining cylinder strength. If more than two specimens show evidence of damage the test shall be discarded, a testing service, selected by the TVA and approved by the Engineer, shall take core samples of in-place concrete when test results are such that there is reasonable doubt that the specified concrete strengths and other characteristics have not been attained in the structure. The testing service shall conduct tests to determine the strength and other characteristics of the in-place concrete by compression tests on cored cylinders complying with ASTM C-42. The TVA shall pay for such tests conducted and any other additional testing that may be required.

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8.1.5. Reports

Test results shall be reported in writing to the QC Manager, TVA and Contractor on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, designate TVA Civil Projects as Contractor, name of concrete supplier and truck number (if applicable), name of concrete testing service, concrete type, location of concrete batch in the structure, design compressive strength at 28 days and the compressive breaking strength for all tests completed for a particular set of cylinders on the day that the reports are submitted.

8.1.6. Storage Facility

Contractor shall provide a stable, insulated storage facility equipped with thermostatically controlled heat for the storage of compression test cylinders in the first 24 hours after molding.

8.2. READY MIX

8.2.1. General

Ready-mixed concrete includes both central-mixed and truck-mixed concrete. When Contractor elects to use ready-mixed concrete he shall make adequate arrangements for preventing delays in delivery and placing concrete.

8.2.2. Central Plant Mix

When a central-mixing plant is used, the concrete shall be mixed in an approved drum-type mixer or pan-type mixer. Mixing time for drum-type mixers having a rated capacity of two cubic yards or less shall be a minimum of 60 seconds. For mixers having capacities greater than two cubic yards, the mixing time shall be a minimum of 90 seconds; however, the minimum mixing time for drum-type mixers may be reduced from 90 to 75 seconds when the concrete ingredients are uniformly blended during the charging of the mixer. In order to attain uniform blending, the batch shall be charged so that the flows of water, coarse aggregate, fine aggregate, and cement are started, continued, and ended simultaneously or nearly simultaneously.

The mixing time for pan-type mixers, having a rated capacity of three cubic yards or less, shall be a minimum of 45 seconds. The mixing time for pan-type mixers having rated capacities greater than three cubic yards shall be increased by 15 seconds for each three cubic yards, or fraction thereof, over that permitted for the three cubic yard mixer.

The QC Manager may increase the minimum mixing time for any type of mixer specified herein, provided the mixer does not produce the desirable quality with respect to uniformity of mixture, slump, and air content, or upon proof by tests that undesirable quality of concrete produced by a given mixer with regard to compressive strength would be prevented by additional mixing. The mixing time shall be measured from the time all cement and aggregates are charged into the mixture until the mixture is ready for discharging.

Concrete for use at points other than the central plant site shall be delivered in approved truck mixers. Each truck mixer shall have attached, in a prominent place, a metal plate on which is stamped its rated capacity in cubic yards of mixed concrete, as certified by the manufacturer for the different uses to which the equipment is adapted and the manufacturer's stated speeds of rotation for both mixing and agitation. Agitating shall start immediately after the batch is introduced and shall continue without interruption until the batch is discharged. Each batch shall be completely discharged before the succeeding batch is introduced. Drums and auxiliary parts for the equipment shall be maintained free from accumulations of hardened materials.

The rates of rotation of the mixer drum for both the mixing and agitation of concrete shall be as designated on the metal plate furnished by the manufacturer of the equipment.

8.2.3. Truck Mix

When concrete is truck-mixed, the truck mixer shall be of an approved revolving drum or revolving blade type, constructed to produce a thoroughly mixed concrete mass with a uniform distribution of materials throughout. The truck mixer shall be equipped with a discharge mechanism which will ensure discharging of the mixed concrete without segregation. Truck mixers that will not discharge concrete within the specified slump and air content ranges will be barred from use unless satisfactory repairs are made. Each truck mixer shall have a metal plate attached on which is stated the manufacturer's capacities in terms of volume of mixed concrete for the various uses to which the equipment is applicable and the manufacturer's stated speeds of rotation for mixing and agitation.

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The rates of rotation of the mixer drum used for mixing and agitation shall be as designated on the metal plate by the manufacturer of the equipment. The mixer drum shall not permit loss of water or concrete during charging, mixing, and agitation, or during transportation.

The truck mixer shall be equipped with an automatic revolution counter which will permit reading of the count at the plant and at the destination. Use of trucks on which the revolution counter is defective will not be permitted. The interior of the mixer drums shall be maintained free from hardened concrete. The tanks containing mixing water on truck mixers shall be equipped with a device for accurately determining the quantity of water added at the job site.

The entire quantity of mixing water shall be accurately measured and controlled to within 1.0 percent accuracy. Each batch shall be mixed no less than 70 revolutions at the plant site, at the rate of rotation specified by the manufacturer for mixing speed. Mixing may be reduced to 50 revolutions when the batch is charged so that all ingredients, including water, are uniformly blended during charging, and a satisfactory mixture is produced. The concrete shall then be mixed an additional ten revolutions at the specified mixing speed at the job site. When the Engineer permits additional water to be added at the job site, the concrete shall be mixed an additional 30 revolutions at the specified mixing speed after water has been added. Any additional mixing shall be done at a lower speed as specified by the mixer manufacturer. Agitation shall be continuous until the batch is discharged.

When deemed necessary, Contractor will be required to provide baffle plates in the chute to avoid segregation in the concrete placed in the work.

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PART 9 - PLACING CONCRETE

9.1. PREPARATION BEFORE PLACING

9.1.1. Clean Equipment

Hardened concrete and foreign materials shall be removed from the inner surfaces of the conveying equipment.

9.1.2. Formwork

Formwork shall be completed and checked to be watertight and to the proper lines. Snow, ice, chips, dirt, and other extraneous materials shall be removed. Thoroughly wet the forms (except in freezing weather), or oil them; and remove all standing water.

9.1.3. Embedded Items

Castings, anchor bolts and other embedded items shall be positioned properly and shall be clean and free of oil or loose coatings of paint, rust or scale.

9.1.4. Inspection

Verification that reinforcement is placed properly with the required clearance and that all reinforcing steel is free of oil or other coatings that might impair bond with the concrete shall be completed before placing any concrete.

9.2. NOTIFICATION

No concrete shall be placed until the QC Manager, or his representative, has given his approval of the forms and reinforcing steel in place. If the reinforcing steel is not placed in accordance with the Construction Plans, the QC Manager will stop Contractor from placing any concrete until the error is corrected. Under no circumstances will an attempt be made to correct errors by inserting additional unscheduled bars. No concrete shall be placed except in the presence of the QC Manager or his representative, and Contractor shall give the QC Manager at least 24 hours advance notice.

9.3. CONVEYING CONCRETE

9.3.1. General

Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. There shall be no vertical drop greater than five (5) feet, except where suitable equipment is provided to prevent segregation and where specifically authorized by the QC Manager.

9.3.2. Exposed Conveying

Belt conveyers, chutes or other similar equipment in which the concrete is delivered to the structure in a thin, continuously exposed flow, will not be permitted, except for very limited or isolated sections of the work and only then if approved in writing by the Engineer. Such equipment shall be arranged to prevent objectionable segregation.

9.3.3. Maximum Concrete Drop

Openings shall be spaced around the perimeter of the formed area so that lateral flow of fresh concrete will be limited to three (3) feet. Drop chutes which may be provided to convey the concrete through wall ports shall have an outside pocket under each form opening to stop the concrete and allow it to flow easily over into the form without separation.

9.3.4. Pumping

Pumping or pneumatic conveying equipment, if used, shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation does not occur in the discharged concrete. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

9.4. PLACING CONCRETE

9.4.1. General

Concrete shall be placed within one and one-half (1 1/2) hours after the introduction of the water to the cement and aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or where the temperature of the concrete is 85°F or above, the time shall be reduced to 45 minutes. The QC Manager may allow a longer time, providing the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding mixture. Concrete shall be deposited as closely as possible to its final position in the forms so that flow within the mass and consequent segregation is reduced to a minimum.

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9.4.2. Use of Vibrators

Use of vibrators to transport concrete within the forms shall not be allowed. Vibrators may be used to aid in the consolidation of the concrete provided they are used under experienced supervision, and the forms designed to withstand their action. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Vibration shall not be applied directly to the steel reinforcement or the forms or to concrete which has hardened to the degree that it becomes plastic when vibrated.

9.4.3. Spading Concrete

When a vibrator is used, Contractor shall also spade the concrete along form surfaces a sufficient amount to prevent excessive size or numbers of air- void pockets in the concrete surface.

9.4.4. Prevention of Additional Water

Unless adequate protection is provided and approval is obtained, concrete shall not be placed in rain, sleet, or snow. Rainwater will not be allowed to increase the mixing water.

9.4.5. Placing Temperature

Concrete shall be mixed and placed only when the temperature is at least 40°F and rising, unless permission to place is obtained from the Engineer, in which event all material shall be heated and otherwise properly prepared so that batching and mixing can proceed in full accord with the provisions of these Technical Specifications. The method proposed for heating the materials and protecting the concrete shall be approved by the QC Manager. Salt, chemicals, or other materials shall not be mixed with the concrete for the purpose of preventing freezing.

9.4.6. Placement Not Permitted

Concrete placement will not be permitted when, in the opinion of the QC Manager, the sun, heat, wind, or humidity prevents proper placement and consolidation.

9.4.7. Cold Weather

When the atmospheric temperature may be expected to drop below 40°F at the time concrete is delivered to the work site, during placement or any time during the curing period, the following provisions also shall apply:

1. The temperature of the concrete at the time of placing shall not be less than 50°F nor more than 90°F. The temperature of neither aggregates nor mixing water shall be more than 100°F just prior to mixing with the cement.

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9.4.8. Hot Weather

When climatic or other conditions are such that the temperature of the concrete may be expected to exceed 85°F at the time of delivery at the work site, during placement, or during the first 24 hours after placement, the following provisions also shall apply:

1. Contractor shall maintain the temperature of the concrete below 85°F during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting," ACI Standard 305.

2. The concrete shall be placed in the work immediately after mixing. Truck mixing shall be delayed until only time enough remains to accomplish it before the concrete is placed.

3. Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected, as directed by the QC Manager, from drying during the time between placement and finishing, and after finishing.

4. Finishing of slabs and other exposed surfaces shall be started as soon as the condition of the concrete allows and shall be completed without delay

5. Concrete surfaces exposed to the air shall be covered as soon as the concrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period and for the entire curing period unless curing compound is applied.

6. Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during and after form removal) or until curing compound is applied.

7. If moist curing is discontinued before the end of the curing period, white pigmented curing compound shall be applied immediately.

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9.5. CURING AND PROTECTING CONCRETE

9.5.1. General

All concrete shall be cured for a period of not less than seven (7) consecutive days by an approved method, or combination of methods. The curing process shall be done so as to prevent loss of moisture from the concrete for the duration of the entire curing period. Unhardened concrete shall be protected from heavy rains and flowing water. All concrete shall be adequately protected from damage.

9.5.2. Moist Curing

Concrete shall be moist cured by maintaining all surfaces continuously (not periodically) wet for the duration of the entire curing period. Water for curing shall be clean and free from any elements which will cause staining or discoloration of the concrete. Where forms of wood are used and left in place during curing, the wood shall be kept wet at all times.

9.6. FINISHING CONCRETE

9.6.1. Formed Surfaces

After removal of forms, tie holes and defects shall be patched and all fins shall be completely removed. No later than the day following form removal, surfaces shall be wetted and rubbed with a carborundum brick or other abrasive material approved by the QC Manager, until a uniform color and smooth texture are produced.

9.6.2. Unformed Surfaces

Following placement, consolidation, and screening, the surface should be darbied or bull-floated to eliminate high and low spots and embed large aggregates. After surface water has disappeared and concrete has hardened sufficiently, the surface shall be floated by power driven or hand floats. The Contractor shall check and level the surface to a tolerance not exceeding one half inches in ten feet when tested with a ten-foot straightedge. After leveling, Contractor shall refloat surface to a uniform granular texture. Care shall be exercised to prevent migration of excess water and fines to the surface during finishing operations. All trafficked surfaces shall receive a broom finish.

END OF SECTION 03 30 00

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TECHNICAL SPECIFICATIONS

DIVISION 05 – METALS

SECTION 05 50 00 – SITE MISCELLANEOUS METALS

PART 1 - GENERAL

1.1. DESCRIPTION

This Specification covers the work necessary to install the outlet structures and other metal accessories such as anchorage items, as shown on the Construction Plans.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Section 33 10 00 – Prefabricated Outlet Structures

PART 2 - SUBMITTALS

Contractor shall make all field measurements necessary to verify all dimensions which may affect installation/fabrication of the metals.

Certifications showing that welders employed in the work have satisfactorily passed AWS Qualification Test within the previous 12 months shall be provided to the Engineer prior to beginning such work.

PART 3 - PRODUCTS

3.1. ANCHORAGE ITEMS

Contractor shall furnish all bolts, nuts, plates, shims, pins, screws, straps, nails and other anchors which may be required by the Construction Plans or job conditions, to secure all items permanently in place, whether or not specifically called for or shown on the Construction Plans.

All anchor bolts, nuts, and other anchors which may be required shall be constructed from ASTM A-36 steel, and shall conform to the requirements of ASTM A325 or A490 for bolts, ASTM A194 or A563 for nuts, and ASTM A307 for anchor bolts. All bolt holes drilled into the structures shall be filled with non-shrink grout, following the manufacturer's recommendations and specifications. Tar mastic, or other watertight sealants, shall be used in all bolt holes to ensure a watertight seal at all outlet structure connections.

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PART 4 - EXECUTION

4.1. INSTALLATION

All items shall be installed to the lines, grades, elevations and sections as shown in the Construction Plans.

4.2. FABRICATION

All metal items shall be accurately fabricated and erected with exposed joints close fitting. All joints shall be of such character and so assembled that they will be as strong and rigid as adjoining sections. Joints shall be located where least conspicuous. Items shall have smooth finished surfaces except where otherwise shown or specified.

Where welding is required or permitted, it shall conform to the requirements for shielding metal arc welding (SMAW) of the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society (AWS). Shop drawings shall show welding and shall indicate the size, length, spacing and type of welds. Joints required to be welded shall be continuously welded or spot welded as specified and face of welds dressed flush and smooth where exposed to view.

4.3. COMPATIBILITY

All attachments and couplings shall be made as per the manufacturer's recommendations and in accordance with applicable codes or standards. Contractor shall ensure that all couplings are compatible and watertight.

4.4. EQUIVALENCY

Alternate or equivalent products will be considered by the QC Manager. Contractor shall ensure that substitute items are compatible with one another and will function properly.

END OF SECTION 05 50 00

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TECHNICAL SPECIFICATIONS
DIVISION 31 – EARTHWORK
SECTION 31 10 00 – SITE PREPARATION

PART 1 - GENERAL

1.1. DESCRIPTION

The Work shall consist of site preparation including:

- Clearing and grubbing.
- Stockpiling and protection of materials to be incorporated in the work.
- Removal of organic materials and debris.
- Construction staking.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Division 03 – Concrete
- Division 31 – Earthwork
- Division 33 – Utilities

1.3. MATERIAL OWNERSHIP

Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

PART 2 - SUBMITTALS

2.1. CERTIFICATIONS

Certification statements shall be provided by each supplier that the products conform to these specifications. In addition all materials shall meet the testing schedules noted in the CQC Plan.

Contractor shall prepare and present a Site Safety Plan that has been reviewed and approved by a TVA Safety Professional. No excavation or embankment work is allowed prior to submittal of the plan and the approval document.

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PART 3 - PRODUCTS

3.1. CONSTRUCTION STAKING

Construction staking and as-built surveys shall be performed by Contractor. As a minimum construction staking shall identify location of drainage facilities, cut/fill limits, alignment, elevation, and grades of features to be installed. As-built surveys shall be performed to verify alignment and grades of outlet structures and piping. The as-built data shall be provided to the Quality Control Representative daily for review.

3.2. UTILITY VERIFICATION

Contractor shall locate and verify all utilities prior to construction activities to ensure there is no conflict with the construction improvements.

3.3. EROSION CONTROL MEASURES

Site clearing operations are not to commence until erosion and sediment control measures are in place. Stabilization of disturbed areas shall be in accordance with section 31 25 00 of these specifications.

PART 4 - EXECUTION

4.1. PREPARATION

4.1.1. Protect and maintain benchmarks, survey control points, and geotechnical instrumentation (piezometers and slope inclinometers) from disturbance during construction.

4.2. TEMPORARY EROSION AND SEDIMENTATION CONTROL

4.2.1. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or fugitive dust. Install measures according to erosion- and sedimentation-control details shown on Construction Plans.

4.2.2. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction. Erosion and sediment controls are detailed in Section 31 25 00 of these Specifications.

4.2.3. Work shall be performed in segments and disturbance shall be limited as practicable to limit exposure of exposed soils to rainfall events and subsequent erosion.

4.2.4. Silt fencing or other sediment control devices that must be removed to allow work to be performed shall be removed immediately before work occurs and re-installed as soon as practicable afterward.

END OF SECTION 31 10 00

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TECHNICAL SPECIFICATIONS
DIVISION 31 – EARTHWORK
SECTION 31 20 00 – EXCAVATION

PART 1 - GENERAL

1.1. DESCRIPTION

The Work shall consist of excavating and grading for the outlet structure, pipe installation, and divider dike access roadway; trimming and shaping of all slopes; and disposing of all excavated material all in accordance with these Specifications and in reasonably close conformity with the lines, grades and typical cross sections shown on the Construction Plans or established by the Engineer.

The Engineer reserves the right to increase or decrease the excavation widths and depths or make such other changes in sections as may be deemed necessary.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Section 31 10 00 – Site Preparation
- Section 31 23 00 – Backfill and Embankment
- Section 31 25 00 – Erosion and Sediment Control

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1.3. CLASSIFICATION

Without regard to the materials encountered, all excavation shall be unclassified, unless noted otherwise.

1.4. TYPES OF EXCAVATION

1.4.1. General

Excavation shall include excavating to the designated depths/elevations, and the shaping and finishing of all excavation to the required lines and grades as shown on the Construction Plans. Contractor shall utilize excavated material and stockpile the same until ready to use within the appropriate zone of embankment.

Excavations carried below the indicated depths, except when directed by the QC Manager, shall be replaced with material satisfactory to the QC Manager.

Excavation includes the removal of all materials encountered or involved in the excavation at the location shown on the Construction Plans or as directed by the QC Manager as well as the proper utilization of such excavated materials. In cases where the proper utilization of the materials is not readily discernable, the determination of the material type shall be made by the QC Manager.

1.4.2. Common Excavation

Common Excavation shall consist of and include the removal of all materials encountered or involved in the construction of drains, trimming and shaping of slopes, or shaping of subgrade at the locations shown on the Construction Plans or as directed by the QC Manager. In cases where the proper utilization of the materials is not readily discernable, the determination of the material type shall be made by the QC Manager.

1.4.3. Outlet Structure Excavation

Outlet Structure Excavation includes excavation for the outlet structure and concrete encased piping as shown in the Construction Plans or as directed by the Engineer.

PART 2 - EXECUTION

All excavations shall be prepared in accordance with Occupational Safety and Health Administration (OSHA) standards. Stability of excavation slopes is the responsibility of the Contractor.

2.1. UTILIZATION OF EXCAVATED MATERIALS

Excavation shall include excavation to the designated depths or elevations, and the shaping and finishing of all excavation to the required lines and grades as shown on the Construction Plans. Excavated materials shall be removed in such a manner that the slopes may be neatly trimmed to the lines given.

QC Manager shall designate as unsuitable those soils that cannot be properly compacted in embankments. All unsuitable soil shall be disposed of as directed at no additional cost.

2.2. REMOVAL OF WATER

Contractor shall furnish, install, maintain, and operate all pumping and other equipment for dewatering and maintaining the Work free from water as required. After having served their purpose, temporary protective works shall be removed, or leveled, to give a sightly appearance and so as not to interfere in any way with the operation, usefulness or stability of the permanent structures. Dewatering shall be in accordance with section 31 23 00 of these specifications.

END OF SECTION 31 20 00

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TECHNICAL SPECIFICATIONS
DIVISION 31 – EARTHWORK
SECTION 31 23 00 – BACKFILL AND EMBANKMENT

PART 1 - GENERAL

1.1. DESCRIPTION

The Work shall consist of performing all operations in connection with construction of subgrade and structural fill adjacent to and above the outlet structure and concrete encased pipes. The Work also includes the transportation and placement of all materials in embankment areas to include spreading, moisture control, compaction and preparation of bonding surfaces, to the lines and grades shown on the Construction Plans.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Section 31 20 00 – Excavation
- Section 33 40 00 – HDPE Pipe

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1.3. LINES AND GRADES

Embankments and subgrade shall be constructed to the lines, grades and cross sections indicated on the Construction Plans, unless otherwise directed by the Engineer.

1.4. CONDUCT OF THE WORK

Contractor shall maintain and protect embankment and subgrade in a satisfactory condition at all times until final acceptance of the Work. If, in the opinion of the QC Manager, equipment causes horizontal shears or slickensides, rutting, quaking, heaving, cracking or excessive deformation of the embankment, Contractor shall limit the type, load or travel speed of the equipment on the subgrade or embankment. Any approved embankment material which is lost in transit or rendered unsuitable after being placed in the embankment and before final acceptance of the Work, shall be replaced by the Contractor in a satisfactory manner. Contractor shall excavate and remove from the embankment any material which the QC Manager considers objectionable and shall dispose of such material in accordance with these Specifications and refill the excavated areas as directed.

1.5. STOCKPILING

When the excavation from various areas of the subgrade progresses at a faster rate than fill placement is being accomplished, such excavated material shall be stockpiled at approved locations adjacent to the Work until its use is authorized by the QC Manager.

PART 2 - SUBMITTALS

2.1. SAMPLES FOR TESTING

For each borrow site, the Contractor shall provide a representative sample of the borrow soil to the QC Manager.

PART 3 - PRODUCTS

3.1. SOIL MATERIALS

Excavated materials from offsite borrow sources that will be placed as embankment material against either the outside slope of the dike or to backfill excavations within the dike shall consist primarily of soils that, in the opinion of the Engineer, are suitable for dam construction. Unless otherwise permitted, soil embankment materials shall exhibit a classification of CL, CL-ML, CL-CH, or CH in accordance with ASTM D-2487. The material shall be free of organic matter, topsoil, rubbish, debris, waste material, and rock pieces greater than 3 inches (maximum dimension) in size, and shall be at a moisture content that is suitable for acceptable compaction.

Final embankment surfaces shall be finished to a relatively smooth and compact surface. Seedbed preparation, fertilizing, seeding and mulching shall be in accordance with TVA's T-1 construction specifications.

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3.2. WATER

Water used in controlling moisture shall consist of water obtained from sources approved by the Owner.

PART 4 - EXECUTION

4.1. GENERAL

All embankment work is to be performed per TDOT Section 205.

Areas which will be excavated or used for embankment shall be cleared of trees, stumps, brush, projecting roots, weeds, logs and other protruding obstructions. All trees, stumps, brush, projecting roots, weeds, logs, and protruding obstructions shall be cut to within 3 inches of existing ground. The area shall be grubbed to a depth of at least 6 inches to remove grass, roots and other organic material. If encountered, topsoil shall be stripped. All cleared and grubbed material shall be removed from the site and disposed of at an approved disposal site and in accordance with applicable local landfill regulations. Topsoil shall be stored at a designated location on the site to be used for final topdressing.

4.2. PLACEMENT

Prior to placing embankment against the outside slope of the dike, the bottom shall be benched to provide a level surface to begin the embankment. Sloping surfaces against which embankment or backfill material will be placed shall be destroyed by stepping or serrating as directed by the QC Manager to enhance bonding and prevent wedging action during compaction.

No material shall be placed in any section of the embankment until the foundation for that section has been approved by the QC Manager. The surface shall be stripped and free of organic, vegetative and deleterious materials. The Contractor shall keep the foundation and subgrade free from water or unacceptable materials after fill operations have started.

The subgrade surface shall be proof rolled using loaded equipment as directed by the QC Manager and shall be uniform prior to the placement of the material. Soft materials shall be reinforced by working stone or other approved materials into the surface to achieve a surface that will accommodate construction equipment and meet the specified compaction requirements.

Contractor shall construct embankment in horizontal lifts.

All depressions or holes below the natural ground surface, whether caused by grubbing or otherwise, shall be filled with suitable material and compacted to ground surface before embankment construction is started.

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4.3. SPREADING

4.3.1. General

The original ground surface, or the surface of any embankment layer in place, shall not be in frozen condition, and shall be free from quantities of snow, ice, and mud when a subsequent layer is placed thereon.

Rock shall be placed in maximum 12-inch loose lifts and compacted with at least three passes of a vibratory tamping foot roller.

Material shall be placed in maximum eight-inch loose lifts for bulk fill applications and four-inch loose lifts for applications requiring hand or remotely operated compacting equipment.

No material placed by dumping in piles or windrows shall be incorporated in a layer in that position, but shall be moved and spread by blading or similar approved methods.

Material coming from required excavation in the form of large lumps or masses shall be pulverized by disking, harrowing or by the use of mechanical pulverizers prior to compacting. All lumps or masses, whose largest dimension exceeds four (4) inches, shall be broken down prior to compacting.

No fill shall be placed upon a frozen surface, nor shall snow, ice or frozen materials be incorporated in the fill.

4.4. MOISTURE CONTROL

4.4.1. Structural Fill

During compaction operations the materials being placed shall be maintained within two percent below optimum and two percent above optimum moisture content as determined by ASTM D-698. The moisture content shall be controlled in the following manner:

1) Water may be added to the fill materials at the source or after the material has been brought onto the embankment, whichever is the most practical. When material deposited on the embankment is too dry, Contractor shall be required to water each layer and obtain uniform moisture distribution in the layer by disking, blading or other approved methods. The amount of water applied shall be accurately controlled so that free water will not appear on the surface during or subsequent to compaction operations.

2) Material deposited on the fill that is too wet shall be removed or spread and permitted to dry, assisted by disking or blading, if necessary, until the moisture content is reduced to the specified limits.

3) When the top surface of a layer becomes too dry or too smooth to permit suitable bonding with the subsequent layer, Contractor shall loosen the material by scarifying or disking. Traversing the fill surface with tamping foot compactor or track equipment may not achieve adequate scarification. Contractor shall then moisten the loosened material to an acceptable moisture content and re-compact the material to the specified density.

4) Adjustments of moisture content shall be made on the basis of determination of moisture by field tests as construction progresses.

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4.5. PREPARATION OF SURFACES

4.5.1. General

If, in the opinion of the QC Manager, the surface of the prepared foundation is too dry or smooth to bond properly with the layer of material to be placed thereon, it shall be moistened and/or worked with harrow, scarifier, or other suitable equipment, in an approved manner to a sufficient depth to provide a satisfactory bonding surface before the next succeeding layer of material is placed. If, in the opinion of the QC Manager, the surface of the fill in place is too wet for proper compaction of the layer of material to be placed thereon, it shall be allowed to dry; or be worked with a harrow, scarifier or other suitable equipment to reduce the water content to an acceptable amount; and then it shall be recompacted before the next succeeding layer of material is placed.

During placement operations, the top surface of the fill layer will be crowned with grades of not less than two percent or otherwise graded to maintain positive drainage.

4.6. COMPACTION

4.6.1. Compaction Requirements

4.6.1.1. Structural Fill

After each layer of structural fill has been placed, spread, and contains the required moisture, it shall be compacted by passing compaction equipment over the entire surface of the layer a sufficient number of times to obtain the specified density. Compaction equipment shall consist of tamping foot, sheepsfoot, steel drum or pneumatic tire rollers as appropriate for the material being placed or as specified by the QC Manager. Structural fill within 5 feet of the prefabricated outlet structures shall be hand tamped. Compaction equipment shall consist of Adjustments in the compactive effort shall be made on the basis of field density determinations made as the construction progresses.

Structural fill shall be compacted to 98 percent of its maximum dry density as determined by ASTM D-698. In-place moisture shall be –2% to +2% of optimum moisture as determined by ASTM D-698.

4.6.1.2. Subgrade Surface

Subgrade material shall be compacted as directed by the QC Manager. The QC Manager will observe the response of the constructed surface to passes made by loaded hauling equipment and adjust compaction requirements accordingly.

4.6.2. Compaction Around Structures and Piping

To the extent practical considering size of equipment and loads, compaction around structures and piping shall be accomplished using the requirements of the appropriate Sections of this Specification.

No fill or other load shall be placed on, or against cast-in-place concrete structures until a minimum of 14 calendar days has elapsed after the concrete is placed, or until the compressive strength tests demonstrate a minimum 100% of the required 28 day compressive strength outlined in Section 03 30 00 of these Specifications.

Material that is placed adjacent to and less than 2 feet above the top of pipes shall be compacted using hand-directed compactors ("Jumping Jack" type compactor/rammer).

4.6.2.1. Backfilling Pipe in Trenches

After the pipe has been properly bedded, the materials as shown on the Construction Plans shall be placed around the pipe. Materials shall be placed along both sides of pipe in layers not exceeding four (4) inches in uncompacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. Care shall be taken to insure placement of the fill under the haunches of the pipe. Each layer shall be lightly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached the design elevation.

4.6.2.2. Backfilling Pipe in Embankment Conditions

For pipe placed in embankments, backfill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 4 inches in compacted depth, and shall be compacted by light mechanical tamping or ramming.

END OF SECTION 31 23 00

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TECHNICAL SPECIFICATIONS

DIVISION 31 – EARTHWORK

SECTION 31 23 19 – DEWATERING

PART 1 - GENERAL

1.1. DESCRIPTION

This Specification covers the work necessary to furnish and install materials and equipment needed to dewater and maintain the working areas in the excavation area as needed to perform the construction operations specified. This work includes proper planning and staging of the work, coordination with backfill, installation of a temporary cofferdam, grading the excavation area floor to construct the outlet structure as shown on the drawings and the provision and operation of equipment as needed to dewater the excavation area and maintain a dewatered state during staged construction. Work also includes control of water at the discharge end of lines to meet National Pollutant Discharge Elimination System (NPDES) discharge parameters.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.3. DEFINITIONS

When the term "pump" is used, it shall be deemed to mean a pump, complete with, but not limited to, drive motor, accessories, power source, appurtenances, discharge lines and all associated equipment.

1.4. SUBMITTALS

1.4.1. Water Management Plan

The Contractor shall submit to the Engineer a plan for dewatering the excavated area and maintaining the dewatered state in the working area prior to beginning of work. This plan shall include details on slope movement and signs of distress, discuss the equipment to be used for dewatering, intake point, discharge point and means of controlling scour at the discharge point. The plan shall include hours of operation and any special actions needed to be taken by the Owner and/or others.

1.4.2. Pumping Units

The Contractor shall submit information detailing the number, type and manufacturer of pumping units to be utilized.

1.4.3. Discharge Line

The Contractor shall supply information on the discharge lines proposed including material, pressure rating, diameter, manufacturer, length and number of lines.

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PART 2 – SITE REQUIREMENTS AND CONDUCT OF WORK

2.1. PUMPING SCOPE

The required pump(s) shall have sufficient capacity to dewater the excavation area plus maintain a dewatered state in the area in which work is being performed. The Contractor shall be aware that in addition to direct precipitation, runoff impacts surface water control. The amount of runoff entering the excavation area will be dependent on measures taken by the Contractor as well as rainfall amount, intensity, amount of disturbance and the time of year. Seepage may also report to the excavation area as water levels are drawn down. The Contractor shall make every reasonable attempt to divert water from the excavation area to limit pumping.

2.2. DISCHARGE POINT AND WATER QUALITY

Excavation area discharge shall be routed through one of the Owner's NPDES discharge points. The Contractor shall be responsible for the effluent meeting the permit discharge conditions.

2.3. INTAKE POINT AND DISCHARGE LINE LOCATION

The intake point will vary from time to time throughout construction but in general it should be chosen in an area where it will not interfere with work operations yet be placed in sufficiently deep water to prevent scour. A screen or other device should be provided at the intake end. The discharge line shall be routed in such a manner as to not interfere with construction operations, use of public roads or the Owner's activities. The discharge line should be able to accommodate relocation.

2.4. ACCESSORIES

The Contractor shall provide all necessary pipe fittings and accessories to perform the work.

2.5. TEMPORARY COFFERDAM

Should existing material at the site not be sufficient to prevent infiltration of water from the Ash Pond, the Contractor shall install a temporary cofferdam. The type of cofferdam shall be an Aqua Dam. The Contractor shall submit to the Engineer a detailed plan covering the installation, operation and maintenance of the AquaDam during construction. This plan shall include any special actions needed to be taken by the Owner and/or others.

PART 3 – EXECUTION

3.1. GENERAL

If required, the cofferdam shall be of sufficient size to prevent the Ash Pond water from accessing the construction site in order to maintain a dewatered state in the area in which work is being performed. The Contractor shall be aware that in addition to direct precipitation, runoff impacts surface water control. The amount of runoff entering the excavation area will be dependent on measures taken by the Contractor as well as rainfall amount, intensity, amount of disturbance and the time of year. Seepage may also report to the excavation area as water levels are drawn down. The Contractor shall make every reasonable attempt to divert water from the excavation area to limit pumping.

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3.2. INSTALLATION

The Contractor shall install the AquaDam utilizing the safe practices and procedures as provided by the Manufacturer. Manpower may include, but is not limited to rope assisted installation. The Contractor shall clear all debris including sharp, angular objects from the ground surface prior to AquaDam installation to ensure that a good seal is created with minimized leakage and damage to the AquaDam.

END OF SECTION 31 23 19

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TECHNICAL SPECIFICATIONS
DIVISION 31 – EARTHWORK
SECTION 31 23 23.33 – CLSM (FLOWABLE FILL)

PART 1 - GENERAL

1.1. DESCRIPTION

The Section shall consist of performing all operations in connection with placement of controlled low strength material (CLSM) (flowable fill) above the outlet structure. The Work also includes the transportation and placement of all materials to the lines and grades shown on the Construction Plans.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Section 31 20 00 – Excavation
- Section 33 40 00 – HDPE Pipe

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PART 2 - DESIGN REQUIREMENTS

2.1. STRENGTH

All sampling and testing shall be conducted in accordance with Paragraph 6. All CLSM shall meet the following requirements:

1. Minimum 28-day strength of 50 pounds per square inch (psi).
2. Maximum ultimate strength of 100 psi.

2.2. PERMEABILITY

The permeability of the CLSM shall not exceed $1x10^{-7}$ centimeters per second (cm/s).

PART 3 - MATERIALS

3.1. GENERAL

CLSM shall be composed of a mixture of cement, fine aggregate, coarse aggregate, water, and possibly fly ash. The design of the mixture will be based on the water-cement ratio necessary to secure a plastic workable mixture suitable for the specific conditions of placement and when properly cured, a product

having durability, impermeability and strength in accordance with all the requirements set forth by these Technical Specifications.

3.2. CEMENT

Portland cement shall meet the requirements of ASTM Designation C-150 for the type of cement specified. The cement shall be either Type II or Type IIA cement unless otherwise directed by the Engineer.

3.3. FLY ASH

Fly ash may be either Class C or Class F and shall conform to ASTM C 618.

3.4. AGGREGATES

Fine and coarse aggregate shall conform to the provisions of ASTM Designations C-33 and C-136.

3.5. WATER

Water used in mixing CLSM shall conform to the requirements of ASTM C 94.

3.6. ADMIXTURES

Air-entraining admixtures shall fully meet the requirements of ASTM Designation C-260 and shall be subject to tests in accordance with ASTM Designation C-233. Air-entraining admixtures shall be added to the CLSM mixture in the form of solutions rather than solids. The manufacturer's storage recommendations shall be followed.

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PART 4 - SAMPLING AND TESTING

4.1. COMPRESSIVE STRENGTH

ASTM C-31; one set of four (4) standard cylinders for each compressive strength test. One set of specimens shall be cast from a composite sample placed in one day or each 50 cubic yards placed, whichever is minimum. The QC Manager or his representative will determine and record the batch number for the CLSM and the exact location in the work at which each batch represented by test specimens is deposited.

ASTM C-39; for each set of compressive strength test specimens there shall be one test at seven (7) days after placing for information and two (2) tests at twenty-eight (28) days for acceptance. One specimen shall be held in reserve. The acceptance test results shall be the average of the two strengths of the specimens at 28 days. If one specimen in the test manifests evidence of improper sampling, molding, transportation or testing, it shall be discarded and the reserve specimen shall replace it. If two specimens in a test show any defects, the test result shall be the remaining cylinder strength.

4.2. SLUMP

ASTM C-143; one test for each set of compressive strength test specimens, and whenever consistency of CLSM appears to vary.

4.3. AIR CONTENT

ASTM C-231, pressure method; one for each set of compressive strength test specimens.

4.4. REPORTS

Test results shall be reported in writing to the QC Manager, TVA and Contractor on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of CLSM placement, designate TVA Civil Projects as Contractor, name of the supplier and truck number (if applicable), name of the testing service, type, location of batch in the structure, design compressive strength at 28 days and the compressive breaking strength for all tests completed for a particular set of cylinders on the day that the reports are submitted.

PART 5 - EXECUTION

5.1. NOTIFICATION

No CLSM shall be placed until the QC Manager, or his representative, has given his approval of the forms. No CLSM shall be placed except in the presence of the QC Manager or his representative, and Contractor shall give the QC Manager at least 24 hours advance notice.

5.2. PLACEMENT

5.2.1. Placement Around Pipes

Pipe shall be placed on two sandbags and leveled to the proper grade. Precast or other types of rigid pads that constitute a point load are unacceptable. CLSM shall be placed as closely behind pipe laying operations as possible.

CLSM shall be placed under the pipe from one side so that it flows under the pipe until it appears on the other side. CLSM shall then be added to both sides of the pipe until it completely fills the space between the pipe and the sides of the trench, to the depths shown in the Construction Plans. Rodding, mechanical vibration, and compaction of CLSM shall be performed to assist in consolidation the CLSM.

To prevent uplift, the CLSM shall be placed in multiple lifts. Each lift shall have sufficient time to set prior to placing the next lift. The pipes may need to be weighed down to prevent flotation during the setting process. The lift spacing is listed below:

- 1st lift to be placed to a height of 1/4 OD up the pipe.
- 2nd lift to be placed to an additional 1/3 OD above the first lift.

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- 3rd lift to be placed to the top of the pipe.
- The remaining lifts shall be placed with a thickness of no more than 12 inches.

CLSM shall be deposited as nearly as practical in its final position and in no way disturb the pipe trench or cause foreign material to become mixed with the CLSM.

5.2.2. Soil Backfill

Soil backfill shall not be placed until the CLSM has reached the initial set. If backfill is not to be placed over the CLSM within 8 hours, a 6-inch cover of moist earth shall be placed over the CLSM surface.

5.2.3. Temperature

CLSM shall not be placed while the air temperature is less than 45° F. If the air temperature is between 45° F and 50° F, CLSM shall only be placed if the temperature is rising and the moist earth cover is at least 18-inches thick.

5.2.4. Unsuitable Weather

The QC Manager shall determine if weather conditions are unsuitable for placement of CLSM.

5.2.5. Unsuitable Subgrade

The QC Manager shall determine if the subgrade or excavation walls are frozen. CLSM shall not be placed on or against frozen material.

END OF SECTION 31 23 23.33

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TECHNICAL SPECIFICATIONS
DIVISION 31 – EARTHWORK
SECTION 31 25 00 – EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1. DESCRIPTION

This Section includes provisions for erosion control and stabilization. All construction activities shall be conducted in accordance with applicable environmental requirements. Install sediment and erosion control measures prior to disturbance where applicable.

Contractor shall become familiar with the Site Wide Storm Water Management Plan (SWMP), as well as the Erosion and Sediment Control Details in the Construction Documents, and Best Management Practices (BMP) on file with the plant and shall anticipate, and therefore plan in advance, for each construction activity.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Section 31 10 00 – Site Preparation
- Section 31 20 00 – Excavation
- Section 31 23 00 – Backfill and Embankment

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PART 2 - MATERIALS

Refer to the SWMP, the BMP Plan at the end of this Specification, the Sediment and Erosion Control Details, and Sediment and Erosion Control features noted on the various Plans for products and materials to be employed in erosion control and stabilization efforts.

PART 3 - EXECUTION

3.1. CONSTRUCTION PHASE OPERATIONS

Contractor shall evaluate the progress of work on the project and plan to minimize the surface area disturbed at any one time. Stabilization of disturbed areas shall include stone cover or sod installation. Sediment and Erosion Control Measures shall be in place to the extent practicable prior to commencement of excavation activities.

Perform excavation or grading in stages in order to route sediment laden runoff through installed sediment control measures. Excavate material during dry weather when possible.

Establish final grade in a given area as quickly as possible.

Contractor shall control fugitive dust emissions.

Control dust generation by covering disturbed areas by achieving final grade, installing the final cover and by wetting haul roads or applying approved (by Owner or Engineer) chemical soil binders, as needed.

Contractor shall not discharge raw silt and sediment laden water from the site without providing for removal of soil particles.

Maintain all best management devices by removing accumulated silt, repairing or replacing damaged devices and by cleaning up any excess discharges or mud on gravel roads.

3.2. SEDIMENT BARRIERS

Contractor shall install silt fences in the locations shown on the Construction Plans. Silt fence may also be required at other locations based upon field conditions.

3.2.1. Silt Fences

Silt fences shall conform to the requirements of the Tennessee Erosion and Sediment Control Handbook for Type C Silt Fence. Install below proposed disturbed areas in accordance with the plans and details and as needed in other areas. Embed silt fence as shown on the Construction Plans. Turn ends of silt fence slightly toward the uphill side to help reduce bypassing by runoff around the fence ends.

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3.3. INSPECTION AND MAINTENANCE

3.3.1. General

Contractor is responsible for inspection and maintenance of the construction site and all best management practices.

3.3.2. Inspection

Contractor shall provide inspection and maintenance of best management practices at minimum two days per calendar week. Inspections shall be at least 72 hours apart. This includes checking areas downstream of the work area. In addition, inspect all best management practices after any rainfall event greater than 0.5 inches. Keep records of inspection observations and actions taken, and file with other erosion and sediment control plan paperwork.

3.3.3. Maintenance

Remove sediment before it reaches ⅓ the height of the silt fence or erosion control measure. Reinstall sections of fence which have washed out underneath the fence. Replace broken, torn or

worn fences. Repair gullied areas and any upslope areas contributing large volumes of sediment. Install berms, fiber coils or other measures as needed. Make repairs within three days of discovery.

END OF SECTION 31 25 00

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TECHNICAL SPECIFICATIONS
DIVISION 31 – EARTHWORK
SECTION 31 25 13 – GEOSYNTHETICS

PART 1 - GENERAL

1.1. DESCRIPTION

This Specification covers furnishing and placement of geosynthetics. Geotextile fabric is to be inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids. Geogrid will be placed beneath the mud mat to provide additional reinforcement to the prefabricated outlet structures.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Section 31 10 00 – Site Preparation
- Section 31 00 00 – Earthwork
- Section 33 10 00 – Siphon Spillways

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PART 2 - SUBMITTALS

The Contractor shall provide a manufacturer's written certification stating that the product meets or exceeds all requirements of this specification. The certification, upon request, shall be accompanied by the manufacturer's quality control program and supporting data.

PART 3 - PRODUCTS

3.1. MINIMUM PHYSICAL PROPERTIES

3.1.1. Geotextile Fabric (Separation Application)

Separation geotextile fabric shall be a non-woven, polyester or polypropylene fabric meeting the following minimum physical properties:

Property	Test Method	Units	Value
Mechanical			
Grab Tensile Strength	ASTM D 4632	lbs	160
Burst Strength	ASTM D 3786	lbs	300
Puncture Strength	ASTMD 4833	lbs	45
Apparent Opening Size (AOS)[1]	ASTM D 4751	mm	0.21-0.15
Permeability	ASTM D 4491	gal/min/ft2	95
Fabric Weight		Oz./SY	8

1. AOS is a maximum value

An acceptable product is Mirafi 180N.

3.1.2. Geogrid

The geogrid installed below the mud mat shall be Tensar TX140 (or Engineer approved equivalent) and conform to the following property values.

Property	Test Method	Units	Value
Mechanical			
Radial Stiffness at 0.5% strain	ASTM D6637-01	lbs/ft	15,430
Junction Efficiency	GRI-GG2-87 and GRI-GG1-87	%	93
Aperture Stability at 5.0 kg-cm	[1]	kg-cm/deg	3.0
UV Resistance	ASTM D 4355-05	% strength retained	100
Chemical Degradation Resistance	EPA 9090 Immersion Testing	% strength retained	100
Mid-rib Width		inches	0.04 Diagonal and 0.04 Transverse
Mid-rib Depth		inches	0.04 Diagonal and 0.05 Transverse
Rib pitch		inches	1.60 Longitudinal and 1.60 Diagonal

1. In-plane torsional rigidity measured by applying a moment to the central junction of a 225mm x 225mm specimen restrained at its perimeter in accordance with U.S. Army Corps of Engineers Methodology for measurement of Torsional Rigidity, (Kinney, T.C. Aperture stability Modulus ref 3, 3.1.2000)

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PART 4 - EXECUTION

4.1. SHIPMENT AND STORAGE

During all periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultra-violet rays, temperature greater than 140 degrees Fahrenheit, mud, dirt, dust and debris. To the extent possible, the geotextile shall be maintained wrapped in a heavy duty protective covering.

4.2. GEOTEXTILE INSTALLATION

The Contractor shall adhere to the Manufacturer's recommendations and these specifications during installation of the geotextile.

At the time of installation, the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation, or storage.

All stitches shall be Class 401 with a minimum of five stitches per inch. Thread used in sewing shall be the same material as the geotextile. All seam strengths shall be equal to or greater than 90 percent of the grab tensile strength of the geotextile or reinforcing fabric as determined by ASTM D-4632.

4.3. GEOGRID INSTALLATION

Place geogrid at the proper elevation and alignment, in continuous strips without joints, seams, or connections according to the manufacturer's recommendations. Verify the geogrid orientation (roll direction). Geogrid may be temporarily secured in place with staples, pins, sand bags or backfill as required by fill properties, fill placement procedures, or weather conditions as the QC Manager directs.

Place aggregate over the geogrid according to the Construction Plans. Place, spread, and compact the aggregate in such a manner that minimizes the development of wrinkles and movement in the geogrid. A minimum loose fill thickness of 6 inches shall be placed prior to operation of tracked vehicles over the geogrid. Keep the turning of tracked vehicles to a minimum to prevent displacement of the fill and damage to the geogrid.

END OF SECTION 31 25 13

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TECHNICAL SPECIFICATIONS
DIVISION 31 – EARTHWORK
SECTION 31 37 00 – STONE AND RIP-RAP

PART 1 – GENERAL

1.1. DESCRIPTION

The Work covered by this specification consists of furnishing all materials, equipment, and labor for the installation of surfacing stone, pipe bedding stone and riprap as shown on the Construction Plans, and at other locations as directed by the Engineer.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

PART 2 - SUBMTTALS

2.1. PRODUCT CERTIFICATION

The Contractor must supply the Engineer with a gradation curve for the material and certification that the material meets the Specifications in this document.

These certifications shall be supplied prior to any material arriving at the job site.

PART 3 - PRODUCTS

3.1. MATERIALS

3.1.1. Crushed Stone

No 57 crushed stone crushed stone shall consist of quarried stone meeting the requirements of Section 903 of the Tennessee Department of Transportation (TDOT) “Standard Specifications for Road and Bridge Construction” (Standard Specifications) latest edition. The gradation shall conform to Table 1 (AASHTO M43) in Section 903.22 of the TDOT Standard Specifications.

3.1.2. Riprap (Class B)

Riprap shall consist of quarry stone meeting the requirements of Section 709 of TDOT “Standard Specifications for Road and Bridge Construction” latest edition.

Machined Riprap shall be clean shot rock essentially free of sand, dust or organic materials and shall be the size designated for the class specified. The stone shall be uniformly distributed throughout the size

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range. The thickness of the stone layer shall be that designated for the specified class herein unless otherwise noted on the Construction Plans.

Machined Riprap (Class A-1) shall vary in size 2 in. to 1.25 ft. (from 50 to 375 mm) with no more than 20% by weight being less than 4 in. (100 mm). The thickness of the layer shall be 1.5 ft. (450 mm) with a tolerance of 3 in. (75 mm). Stones of smaller sizes shall be permissible for use in filling voids in the upper surface and dressing to the proper slope.

Machined Riprap (Class B) shall vary in size 3 in. to 2.25 ft. (from 75 to 675 mm) with no more than 20% by weight being less than 6 in. (150 mm). The thickness of the layer shall be 2.5 ft. (750 mm) with a tolerance of 4 in. (100 mm). Stones of smaller sizes shall be permissible for use in filling voids in the upper surface and dressing to the proper slope.

3.1.3. Sand

Manufactured sand product is a durable quarry produced material free of deleterious amounts of shale conforming to Rogers Group Inc., Roane County, Quarry Manufactured Sand Product, Tennessee Department of Transportation Concrete Sand or QC Manager approved equivalent. The gradation shall conform to the following:

Sieve/Screen Size	Percent Passing
3/8	100
No. 4	70-100
No. 8	50-100
No. 16	35-85
No. 30	15-60
No. 50	10-45
No. 100	2-25
No. 200	0-5

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PART 4 - EXECUTION

4.1. STONE SURFACING

Stone surfacing shall be constructed to the lines and grades shown on the Plans. Prior to stone surfacing, the subgrade shall be proof rolled a minimum of two passes with a tamping foot roller or loaded hauling equipment as directed by the QC Manager. Any areas of pumping soil shall be removed or stabilized as directed by the QC Manager.

After preparing the subgrade, 6 inches of stone shall be placed and compacted with at least two passes of a steel drum or rubber tired roller.

4.2. RIPRAP PLACEMENT

Riprap shall be placed by mechanical means using an excavator or loader. The maximum allowable drop height for riprap placement is 2 feet. The lining shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that lining in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Riprap shall be placed on a layer of separation geotextile fabric.

4.3. PLACEMENT OF STONE AND RIPRAP ADJACENT TO AND ABOVE HDPE PIPING

The Contractor shall place material adjacent to and above HDPE piping using mechanical means so as not to damage the piping. Any sections of piping damaged during installation shall be replaced by the Contractor.

END OF SECTION 31 37 00

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TECHNICAL SPECIFICATIONS

DIVISION 33 – UTILITIES

SECTION 33 10 00 – PREFABRICATED OUTLET STRUCTURES

PART 1 - GENERAL

1.1. DESCRIPTION

This Specification covers the Work necessary to furnish and install materials and equipment needed to perform the construction of the prefabricated outlet structures specified. The Work includes proper planning and staging of the installation of the prefabricated outlet structures.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Division 31 – Earthwork
- Division 03 – Concrete
- Division 33 – Utilities

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PART 2 - SUBMITTALS

The Contractor shall submit to the Engineer a detailed work plan 15 days prior to beginning of work. This work plan shall detail the methodology and sequence used to install the prefabricated outlet structures.

PART 3 - PRODUCTS

The prefabricated outlet structures shall be AgriDrain Inlet Water Level Control Structure Model INLET06X24P. These structures shall be capable of being attached to 27” Nominal Diameter DR17 smooth-walled HDPE outlet piping.

PART 4 – EXECUTION

4.1. INSTALLATION

The structures shall be installed on a cast-in-place mud mat that can provide a solid, level, and stable base in accordance with Section 33 00 00. The Contractor shall ensure that the structure base meets these requirements prior to anchoring the prefabricated outlet structures. The structures shall be anchored to the base using galvanized hardware. Connections from the inlet structure to HDPE outlet pipe shall be in accordance with Manufacturer recommendations and shall form a watertight seal such that no leakage occurs.

The Contractor shall prevent damage to the structures during backfill by applying the appropriate backfill techniques discussed in Section 31 23 00 in addition to manufacturer recommendations.

END OF SECTION 33 10 00

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TECHNICAL SPECIFICATIONS

DIVISION 33 – UTILITIES

SECTION 33 40 00 – HDPE PIPE

PART 1 - GENERAL

1.1. DESCRIPTION

This Specification covers installing HDPE outlet piping at the locations shown in the Construction Plans.

1.2. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Specifications, Construction Plans, and the Construction Quality Control (CQC) Plan apply to this Section.

1.2.1. Related Sections

- Section 05 50 00 – Site Miscellaneous Metals
- Section 31 10 00 – Site Preparation
- Section 31 20 00 – Excavation
- Section 31 23 00 – Backfill and Embankment

1.2.2. Referenced Documents

- ASTM F1417 – 92: Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

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PART 2 - SUBMITTALS

Contractor shall submit to the QC Manager an affidavit from the pipe Manufacturer certifying that the pipes and each fitting complies with this Specification. The proof of compliance shall be provided to the QC Manager prior to delivery of any pipe or fitting to the project site. Following fabrication, test results showing compliance with ASTM F1417 shall be submitted to the Engineer.

PART 3 - MATERIALS

3.1. SOLID WALL HDPE PIPE

3.1.1. HDPE Physical Properties

HDPE pipe and fittings shall be manufactured from very high molecular weight high density polyethylene resin recommended by the Plastic Pipe Institute for an 800 pounds per square inch (psi) hydrostatic design stress rating at 140 degrees Fahrenheit, and shall have a Plastic Pipe Institute Material Designation of PE 3408 and a cell classification of PE 34543C as determined by ASTM D-3350. Pressure Class rating shall be 160 psi for water.

3.1.2. SDR Rating

Unless otherwise noted on the Construction Plans, the Standard Dimension Ratio (SDR) rating of individual HDPE pipe and fittings shall conform to SDR 17.

3.1.3. Fittings

All fittings, flanges and other materials necessary to install the Work shall be provided in accordance with the Construction Plans. HDPE fittings installed shall be verified to mate with existing prefabricated outlet structure fittings where required.

PART 4 - EXECUTION

4.1. GENERAL

Care should be exercised by Contractor in all operations such as placing of pipe, jointing, bedding, and backfilling. It shall be Contractor's responsibility to see that pipes are not damaged during transportation, unloading, placement, compaction of backfill, or by any other forces including pipe bursting that may cause damage. All installations shall be in accordance with Manufacturer's recommendations.

4.2. EXCAVATION

Excavation shall be performed in accordance with Section 31 20 00.

Excavation shall conform to the lines and grades shown on the Construction Plans. The lines of excavation of trenches shall be made so there will be a clearance of at least six (6) inches on each side of the barrel on the pipe. Excavations shall not be carried below the established grades and any excavation below the required level shall be backfilled and thoroughly tamped at the Contractors expense.

4.3. JOINING

Pipe shall be laid and jointed in accordance to approved manufacturer's recommendation and the Construction Plans.

4.4. PLACEMENT

Where necessary, proper facilities and equipment shall be provided for lowering the pipe into trenches. The pipe shall not be rolled, dropped, or thrown into the trench. The pipe should not exceed the minimum bending radius of approximately 30 feet. The pipe shall be laid carefully and true to the given lines and grades. Pipe that is not installed in true alignment or which shows abnormal settlement after placement, shall be removed and replaced.

Following butt fusion and fabrication of the outlet structure pipe runs, each run shall be pressure tested by the Contractor in accordance with ASTM F-1417. Any pipe runs not meeting test requirements shall be repaired or refabricated until a passing test result is achieved.

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4.5. BEDDING AND BACKFILL

Shape the bedding to conform to the invert shape throughout the entire width and length of the proposed structure. Place the bedding up to an elevation of 0.3 the pipe diameter.

Pipe excavations shall be backfilled using materials as indicated on the Construction Plans. Compaction shall be accomplished in accordance with the requirements for the applicable zone of material in accordance with Section 31 23 00 – Backfill and Embankment. No heavy equipment shall operate over the pipe until a minimum of 24 inches of compacted cover is in place.

4.6. CLEANING

Prior to installation of the pipe and again prior to demobilizing, Contractor shall visually inspect and clean mud, debris and/or sediment from the pipe.

END OF SECTION 33 40 00

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Contingency Plan (Draft B)

Ash Pond Outlet Structure
RDP-0114-G
Kingston Fossil Plant
Harriman, Roane County,
Tennessee

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ISSUED FOR REVIEW
90% SUBMITTAL

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Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

July 26, 2011

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July 26, 2011

Mr. Jamey Dotson
Senior Program Manager – CCP Engineering
Tennessee Valley Authority
1101 Market Street, LP 5E-C
Chattanooga, Tennessee 37402-2801

Re: Contingency Plan (Draft B)
Ash Pond Outlet Structure
RDP-0114-G
Kingston Fossil Plant
Harriman, Roane County, Tennessee

DRAFT

Dear Mr. Dotson:

Stantec Consulting Services Inc. (Stantec) has reviewed the Ash Pond Outlet Structure, RDP-0114-G, Revision 1 construction drawings and developed a contingency plan for the project. The plan addresses several specific and general hazards that could possibly affect project safety, environmental conditions, or plant operations during construction. This contingency plan is meant to compliment any existing safety, seepage and storm water programs, not replace the programs. All work should be performed as detailed in the Ash Pond Outlet Structure RDP-0114-G plans and specifications, current revision.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Matthew A. Hoy, PE

Senior Project Engineer

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Contingency Plan (Draft B)

Ash Pond Outlet Structure
RDP-0114-G
Kingston Fossil Plant
Harriman, Roane County,
Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

July 26, 2011

Contingency Plan (Draft B)

Ash Pond Outlet Structure
RDP-0114-G
Kingston Fossil Plant
Harriman, Roane County, Tennessee

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Contingency Plan (Draft B)

Ash Pond Outlet Structure
RDP-0114-G
Kingston Fossil Plant
Harriman, Roane County, Tennessee

1. Background

The purpose of this Contingency Plan is to provide guidance to the Contractor in the event that activities related to construction of the outlet structures at Kingston Fossil Plant (KIF) Ash Pond have a negative impact on the ash pond, stilling pond, or surrounding dikes. This document outlines monitoring protocol and mitigation actions for construction elements that have the potential to affect the integrity of the impoundments or compliance with environmental permitting activities.

The contingency plan highlights possible scenarios that could occur during construction as well as methods to address each scenario. This plan shall serve as an outline for use in developing site specific monitoring protocols based on conditions encountered during construction activities. It is noted that a detailed Construction Quality Control Plan, prepared to supplement construction package ##W###, also referred to as RDP-0114-G, is also an integral part of this project and should be adhered to at all times.

For each event listed, 'contingency' actions are described to mitigate the impact to the dike or environmental standards set for the plant. These contingency actions should be implemented immediately upon noticing any of the adverse events described below. However, they are considered temporary and if any of the adverse events described below take place a Stantec engineer should be contacted immediately.

This plan is not intended to supersede any part of TVA's Safety, Seepage and Storm Water programs, only to complement them.

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2. Potential Site Impacts

This plan addresses potential problems that could arise when working in or around the construction area. Several specific concerns are presented herein with associated consequences, preventative measures, and recommended courses of action.

This plan also addresses general project awareness items such as planning, preconstruction field location of existing site improvements, inclement weather measures, oil spill mitigation, fire prevention, heavy equipment safety, and work on slopes along with some safety tips and procedures that should be taken during the course of this project in conjunction with the existing TVA safety program. Implementation of these recommendations should reduce the chance of the occurrence of a catastrophic event.

3. Pre-Construction Precautionary Measures

A pre-construction meeting will be held to review the construction drawings and this contingency plan before any construction commences to decrease the risk of accidents and

lost work time. Prior to construction, proper inspection and maintenance of vehicles and equipment should be performed. It is recommended that the KIF Shift Operation Supervisor (SOS) be notified of daily work activities.

The physical locations of the utility lines and any buried conduit within the limits of construction should be surveyed and marked to ensure they are properly located prior to and during excavation.

All available documentation that includes information on the locations and operations of the sluice lines, under drains, and overhead/buried electrical conduit should be reviewed before any construction commences. These measures will decrease the risk of damaging and/or disrupting daily operations at KIF. It is recommended that the KIF SOS be notified of excavation activities daily while working near and around the sluice lines. The SOS should also be notified daily upon completion of work.

4. Specific Project Concerns and Contingencies

The following paragraphs address several specific project concerns directly related to RDP-0114-G. The activities listed below are discussed because it is believed they are the most likely to have potential adverse impacts to the dike. However, this does not mean that other construction activities cannot cause adverse impacts. The Contractor should always be aware of how their activities are impacting the dike. If they feel uncomfortable about performing a construction activity they should discuss the issue with the Engineer.

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4.1. Dike Cut During Outlet Structure Installation

The Contractor will excavate in the divider dike during installation of the outlet structure piping.

4.1.1. Risk

The primary risk associated with excavation in the divider dike is potential overtopping due to the reduced freeboard. Dike overtopping could occur in the case of a storm event that causes water to rise above the cofferdam being used to isolate the construction area. Dike overtopping could lead to failure of the divider dike and a breach wave could impact the Stilling Pond spillways.

4.1.2. Monitoring

The Contractor and CQC representative should monitor Ash Pond water surface elevations throughout construction. The Contractor and CQC representative should also review weather forecasts prior to each day of work. If heavy rains are forecast, the contractor should prepare to dewater the area inside the cofferdam and be prepared to fill in the divider dike cut if the cofferdam is overtopped.

4.1.3. Mitigation

The Contractor will be responsible for maintaining a stockpile of riprap nearby. In the event that water levels approach within one-foot of the dike cut elevation, this stockpile will be pushed into the cut to impede the flow of water over exposed soil in the dike and provide scour protection in the dike cut.

4.2. Pool Drawdown

The pool will be drawn down by the removal of stoplogs at the outlet structures. Removal of stop logs shall be in accordance with the plans and specifications such that the pool level shall not be lowered more than 6 inches per day. The pool level shall also not be lowered more than 2 feet every 2 weeks to allow porewater pressures in the surrounding dikes to dissipate.

The Routine Handling and Operations (RHO&M) Program Manager must be notified before changes in the pool level occur.

4.2.1. Risk

Potential hazards during pool drawdown include:

- Perimeter and interior dike instability due to the drawn down water elevation.
- Changes in pH levels at due to lowered water surface elevation.
- The potential that the reduced surface area of the ash pond will not provide the detention time required for a sufficient quantity of particles to settle out in order to meet permitted total suspended solids (TSS) levels.

The exterior dikes of the ash pond complex provide retention of water in the pond. The primary concern during the drawdown period is the stability of these perimeter dikes. Pond lowering could potentially result in sloughing on the interior of the dikes in formerly submerged soils. Daily observations of both interior and exterior dikes shall be performed by the CQC representative to check for sloughing or headcutting.

The pond discharges through a National Pollutant Discharge Elimination System (NPDES) permitted outfall. The reduced pool elevation may decrease settling efficiency of the pond and result in elevated TSS levels.

4.2.2. Monitoring

An on-site Construction Quality Control (CQC) representative will perform twice daily visual observations of the ash pond complex to observe any indications of dike and temporary cofferdam instability during construction.

The Owner shall be responsible for TSS monitoring and. It is the responsibility of the Owner to be aware of construction status and verify that TSS measurements are in compliance with the NPDES permit.

The Owner shall be responsible for pH monitoring.

4.2.3. Mitigation Plan

The owner shall be responsible for mitigating effects of pool drawdown on pH, TSS, and dike stability. If sloughs, cracks, or headcuts in the dikes are observed during daily inspections they shall be reported as detailed in Section 5.

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5. Immediate Action Plan

Table 1 below outlines immediate action procedures and the responsible parties.

Table 1. Immediate Action for Response

Responsible Person	Actions
Discoverer	1. Identify material, quantity and personnel involved 2. Clear affected area 3. Call Shift Operations Supervision (SOS)
Shift Operations Supervisor (SOS)	1. Determine if event requires regulatory notification 2. Notify Stantec Engineering (Matthew Hoy – 636-343-3880) 3. If it is a reportable oil spill, notify the TEMA (State EC) 800-424-8802 and the TVA CCP Construction Manager 4. Report spill to Program Administrator – Environmental 5. Notify Roane County Emergency Management, if warranted, 911 6. Contact TVA Environmental Engineering Services through the TVA ODS at 423-751-1700
On Site Spill Responders	1. Develop plan of action 2. Stop product flow release 3. Warn personnel 4. Initiate containment 5. Pump stormwater and/or product back into Ash Retention Pond 6. Clean up spill residue 7. Decontaminate Area and all response equipment
Program Administrator – Environmental	1. Determine root cause and document the indecent 2. Develop lessons learned

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6. Inclement Weather

6.1. Inclement Weather Measures

A TVA key employee, or designee, will always be on-call during non-work days including holidays for an onsite inspection following an adverse weather event. After inspection has been completed and assessments made, the employee will notify the contractor with his or her assessment. If at that time the need for immediate attention is required, a crew will be

mobilized to remedy the situation. If the contractor deems that situation could lead to a plant emergency, the Plants Shift Operation Supervisor will also be notified at that time.

If a severe weather warning is issued during the course of a normal work shift, all employees will be taken to an area within the plant that has been designated for use as a tornado shelter by plant management.

7. Oil Spills

7.1. General

Heavy machinery will be operating adjacent to the Stilling Pond. Therefore, releases of oil or other petroleum products into the ponds are a possibility. The Facility Spill Response Plan includes employee awareness training to ensure that all employees understand about the corrective actions that may need to be implemented for different types of oil spills. Listed below are some basic prevention methods that employees will be trained in and reviewed from time to time during the daily pre-job meetings.

- Good Housekeeping
- Proper Storage Practices
- Secondary Containment
- Spill Cleanup
- Regular Inspections
- Preventive Maintenance
- Contingency Plans
- Training

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7.2. Oil Spill Prevention

Site-specific spill precautions include the following items:

- Collect debris, cover trashcans and dumpsters, keep trash and rubbish away from concentrated storm water runoff.
- Store all petroleum products in approved containers; store all potential pollutants neatly in a covered, secured location unaffected by runoff.
- Keep copies of Material Safety Data Sheets (MSDS) for all materials and chemicals that are stored on-site. Make sure employees are familiar with MSDS sheets and where they are kept.
- Use secondary containment (a minimum 110% capacity) for storage of hazardous materials.

- Have spill clean-up supplies readily available. Clean up, remediate, or dispose of contaminated soils in an approved manner.

- Equipment to be inspected daily for any worn hoses or seals that could pose a leak. (If leaking, equipment will be idled until repaired)

- Storage areas should be inspected daily.

- Worn hoses on equipment should be changed before they rupture causing a spill.

- Port-o-Lets should never be placed near storm water inlets or near waters of the state.

- Contingency Plans for spills shall include but is not limited to: location of approved disposal facility for contaminated soils, location of spill kits and supplies, correct equipment to be used for clean up and to ensure that National Pollutant Discharge Elimination System (NPDES) requirements have been adhered to.

- Employees will be made aware of these requirements though new hire orientation and safety- environmental discussions at the pre-job meetings.

8. Fire Prevention

Fire prevention is covered in the Health and Safety program. Key items include but are not limited to: maintain good housekeeping to reduce fire hazards and to provide safe exit routes, conduct periodic trailer and site inspections to identify fire hazards including accumulation of combustibles and sources of ignition, and properly store combustible materials.

Access to available firefighting equipment should be maintained at all times and the equipment should be inspected monthly to ensure it is in good operating condition. Any defective equipment should immediately be replaced. No open fires shall be permitted on or around the site. Smoking should be prohibited within 50 feet of gas storage facilities and other flammable materials on site. Water trucks should have a 50 foot fire house in case of a fire. Emergency fire and rescue contact information should be posted throughout the project site and in onsite trailers. In the event of a fire proper authorities should be notified.

9. Heavy Equipment

The following items should be considered regarding safe equipment operation:

Equipment Operation

- Only qualified operators of heavy equipment

- Proper training

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- Use equipment only for its intended use
- All personnel on site shall wear bright reflective safety vests
- Do not operate under adverse conditions (weather, under influence, etc.)
- Proper Inspection and maintenance of vehicles/equipment – including rollover protection, and safety measures, oil change, grease, etc.

Develop a Traffic Plan for Haul Routes

- Speed control
- Visual clearance for all vehicles
- Appropriate use of signs, flaggers at two-way traffic intersections, spotters for large equipment traveling on relatively narrow haul routes. etc.

10. Work on Slopes

The project will include embankment construction. All members on-site should be aware of potential dangers associated with work on slopes. The following corrective measures should be considered during construction:

- Roll-over protection
- Equipment must be carefully inspected
- Proper equipment must be used for work performed on slopes.

Extreme care must be exercised on slopes during adverse weather conditions as wind, rain, fog, and darkness create their own hazards inherent in slope work.

11. Site Visitors

All visitors to the site during construction must follow established check-in procedures.

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