Geosyntec consultants

2100 Commonwealth Avenue, Suite 100
Ann Arbor, Michigan 48105
PH 734.332.8004
FAX 3734.332.8063
www.geosyntec.com

October 15, 2021

Via Email

Mr. Nicholas M. Reidenbach, P.E.
Civil/Structural Principal Specialist Engineer
DTE Energy
One Energy Plaza
Detroit, MI 48226

Subject: Five-Year Regulatory Compliance Reporting: Hydrologic and Hydraulic Capacity Assessment
Monroe Power Plant Fly Ash Basin Facility
Monroe, MI

Dear Mr. Reidenbach:

This letter report presents Geosyntec Consultants of Michigan, Inc.'s (Geosyntec's) five-year periodic hydrologic and hydraulic capacity assessment for DTE Electric Company's (DTE's) Monroe Power Plant Fly Ash Basin (FAB). The hydrologic and hydraulic capacity assessments are required under the United States Environmental Protection Agency (USEPA) Coal Combustion Residual (CCR) Rule (CCR Rule) published on 17 April 2015 40 CFR Parts 257 and 261). Under the CCR Rule, the FAB is an "existing surface impoundment" and must meet hydrologic and hydraulic capacity assessment per §257.82[1] of the CCR Rule.

This letter report presents an executive summary followed by details of the hydrologic and hydraulic capacity assessment.

EXECUTIVE SUMMARY

A five-year periodic hydraulic capacity of the facility was completed using the design storm as required under §257.82(a)(3). The results of the analyses indicate that the FAB meets the hydraulic capacity requirements per §257.82. Geosyntec had also performed the initial

[1] §257.82 – Hydrologic and Hydraulic Capacity Requirements for CCR Surface Impoundments.

hydraulic capacity assessment for the FAB and documented it in a letter report dated October 17, 2016 (Geosyntec, 2016)[2].

HYDROLOGIC AND HYDRAULIC CAPACITY ASSESSMENT

Requirements of the CCR Rule

A hydraulic capacity analysis was conducted to assess whether the discharge structure, acting as the spillway, meets the requirements of §257.82 of the CCR Rule. The CCR Rule requires that:

> *"(a)(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood.*
>
> *(a)(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood.*
>
> *…*
>
> *(c)(1) Inflow design flood control system plan. The owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (4) of this section. These plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of this section..."*

Hydraulic Models and Inputs

Geosyntec assigned the FAB a "Significant Hazard Potential" classification per §257.73(a)(2)[3]. Per the CCR Rule, the FAB must adequately manage peak discharge from a 1,000-yr flood event. However, the peak discharge was estimated based on the more conservative Probable Maximum Flood (PMF).

The combination of available storage volume within the FAB and the hydraulic (flow) capacity of the discharge structure must be able to safely convey the expected peak flows during the PMF without overtopping the perimeter embankment. The assessment was conducted using the hydrologic model HEC-HMS (HEC-HMS, 2021) to simulate inflows into the FAB,

---

[2] Geosyntec Consultants (2016), "Hydraulic Capacity Assessment, Monroe Power Plant Fly Ash Basin Facility, Monroe, MI," Chicago, 2016.

[3] A separate letter is provided for the hazard potential classification for the Monroe Fly Ash Basin, which is considered to be a "Significant Hazard Potential".

temporary runoff storage in the FAB, and outflow from the FAB via the discharge structure. HEC-HMS is hydrologic analysis software developed by the U.S. Army Corps of Engineers that is in the public domain and widely used for hydrologic modeling related to flood control and management, drainage, stormwater management, and dam and reservoir management.

The inflow design flood for the FAB was conservatively selected to be the PMF. The volume and peak flow of stormwater runoff during the PMF was calculated from a simulation of the Probable Maximum Precipitation (PMP) storm event.

The PMP data was taken from the PMP Study for Wisconsin and Michigan (EPRI, 1993). A 72-hour duration rainfall period was analyzed. The EPRI study published PMP depths for a range of durations up to 72 hours. The PMP depths for 6-hour and 24-hour periods are nested within the 72-hour PMP. The 72-hour PMP depth is 23.2 inches of rainfall. Most of the rainfall will occur within the peak 24 hours of the rainfall event.

It was assumed that all of the rainfall falling within the FAB will become direct runoff into the FAB meaning that no runoff reduction credit was taken for infiltration into the ground (conservative). It was also assumed that sluiced fly ash continues to be discharged to the FAB during the PMP storm event at a constant rate of 15 million gallons per day, or 23 cubic feet per second (fs). In addition to the constant sluiced fly ash rate, a constant flow of six cubic feet per second (cfs) was included in the simulation to represent the estimated maximum inflow from the stormwater pumping station. Therefore, the total constant inflow rate used per the simulation (in addition to variable stormwater runoff from the PMP) was 29 cfs, which includes a 23 cfs contribution from incoming fly ash slurry and 6 cfs from the stormwater pumping station. These constant inflow rates are the same as the 2016 model (Geosyntec, 2016) because there have not been any changes in these values through our communication with DTE in 2021.

After calculating the inflow, storage and outflow characteristics of the FAB were entered in HEC-HMS. The storage characteristics of the FAB are based on topographic and bathymetric data. A digital terrain model was constructed to calculate the storage data. Sources used in the creation of the digital terrain model include:

- Topographic mapping of existing above-water areas, based on the July 2021 aerial survey.
- Bathymetric mapping of existing below-water areas based on May 2021 bathymetry survey.

To simulate the hydraulic characteristics of the discharge structure, a rating curve or structure geometry must be entered into HEC-HMS. Because of the complexity of the discharge structure, it could not be represented with one simple hydraulic element. The discharge structure hydraulics are evaluated using a combination of three different hydraulic controls:

- First, water must pass through openings cut into the sheet pile wall surrounding the discharge structure. These openings hydraulically function as submerged orifices. If the water level increases above 610.5 ft, it will flow through sheet pile weirs.
- Next, water passes through the stoplog/weir structures. There are three weir openings, with the bottom elevations controlled by raising or lowering the stoplogs.
- Finally, water enters three parallel 36-inch diameter steel pipes encased in concrete and is discharged to the east beyond the FAB.

A HEC-RAS (HEC-RAS, 2021) computer model was developed to simulate the hydraulic interactions and performance of this series of structures. HEC-RAS is widely used to simulate steady-state flow through artificial and natural waterways and structures such as culverts, bridges, channels, spillways, rivers, and gates. A series of different steady-state flows were simulated in HEC-RAS, ranging from 2 cubic feet per second to 250 cubic feet per second, and the pond water elevations corresponding to these flow rates were calculated. The pond water elevation for a specific flow rate corresponds to the hydraulic head necessary to push a specified flow rate through the discharge structure. These data were used to develop a storage-discharge curve for the HEC-HMS routing.

Following the construction of the HEC-HMS model, the model was used to simulate the hydraulic performance of the FAB during the PMF.

The discharge structure was modified in 2016 (prior to initial reporting) to operate more reliably during the PMF event. The drawing provided in Appendix A provides more information on discharge structure construction and modified geometry.

The analysis was conducted based on FAB operating water level of 609.0 ft and the discharge structure geometry.

The analysis considered that 42 linear feet of a section of the sheet pile wall is lowered to an elevation of 610.6 ft. It was assumed that the sheet pile underwater openings are 70% blocked and that the effective diameter of the outlet discharge pipes were reduced by 3.0 inches, to account for the 1.5-inch-thick deposits in the discharge pipes.

A starting water surface elevation of 609.0 ft was used, which is the normal operating elevation.

Analysis Results

The PMF results in a peak water surface elevation of 612.57 ft, which leaves approximately 0.43 feet of freeboard relative to the lowest point on the existing embankment crest, which is at elevation 613.0 ft. This indicates that the PMF will be contained within the FAB. The peak outflow from the FAB would be approximately 169.34 cfs. Figure 1 shows how the water level is changed within the FAB during and after the PMP storm event.

Inflow Design Flood Control System Plan

The FAB is encapsulated by an embankment that is up to 45 ft higher than the surrounding ground surface. The perimeter of the embankment defines the outer limits of the watershed, which is the plan area of rainfall. There is no outer watershed area that directly flows into the FAB. Inflow values have been previously described in the earlier section of this letter under "Hydraulic Models and Inputs".

Stoplogs should be adjusted so that water level in the FAB is kept around elevation 609.0 ft.

QUALIFICATIONS OF LICENSED PROFESSIONAL ENGINEER

John Seymour is a qualified licensed professional engineer with over 40 years of experience in civil and geotechnical engineering associated with earthen structures and dams.

CERTIFICATION

I, John Seymour, am a qualified licensed professional engineer in Michigan have evaluated the FAB and hereby certify that the results of the hydraulic analysis meet the requirements of 40 CFR 257.82 and the FAB manages the design storm leaving 0.43 feet of freeboard.

Certified by:

STATE OF MICHIGAN JOHN P. SEYMOUR ENGINEER No. 33056 LICENSED PROFESSIONAL ENGINEER

Date 10/15/2021

John Seymour, P.E.
Michigan License Number 620103356
Senior Principal

Attachments: Figure 1
Appendix A

Copies to: Mark Green (DTE)
Christopher Scieszka (DTE)
Lisa Lockwood (DTE)

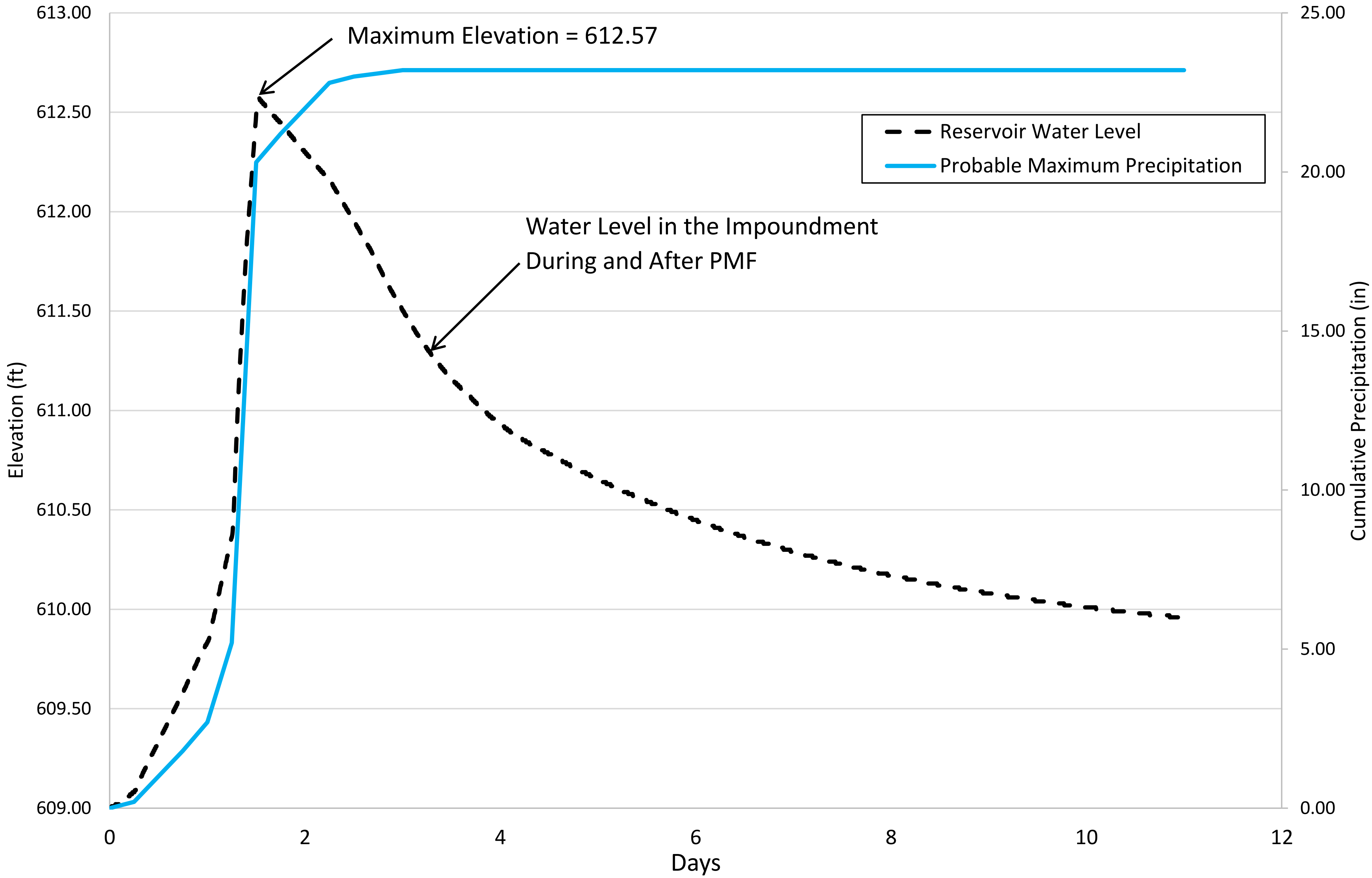
REFERENCES

Geosyntec Consultants (2016), "Hydraulic Capacity Assessment, Monroe Power Plant FAB Facility, Monroe, MI," Chicago, 2016.

Electric Power Research Institute (EPRI) (1993), "Probable Maximum Precipitation Study for Wisconsin and Michigan", EPRI Technical Report TR-101554

HEC-RAS software (2021), Public domain software published by U.S. Army Corps of Engineers, Version 6.0.0, https://www.hec.usace.army.mil/software/hec-ras/

HEC-HMS software (2021), Public domain software published by U.S. Army Corps of Engineers, Version 4.8, https://www.hec.usace.army.mil/software/hec-hms/

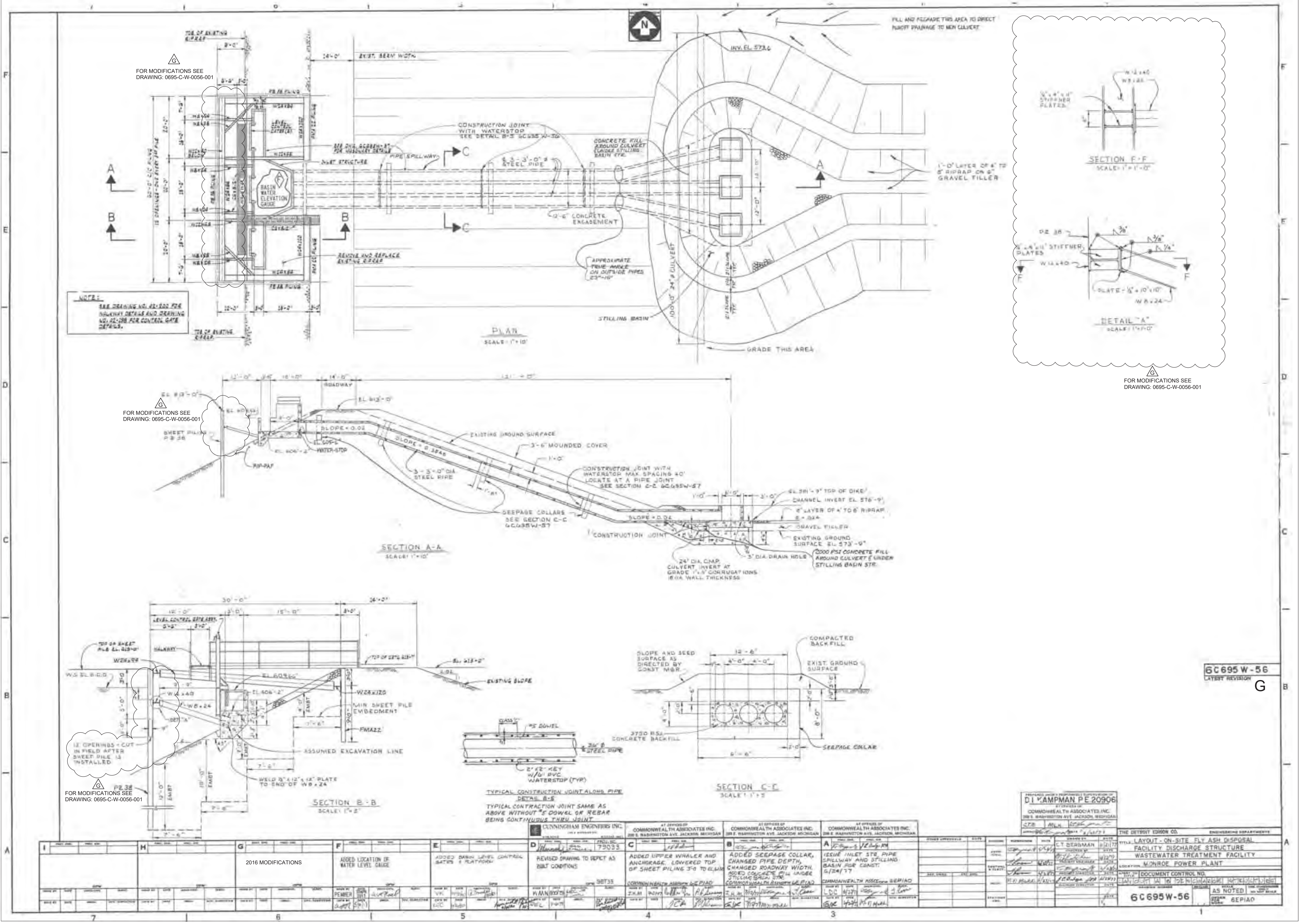


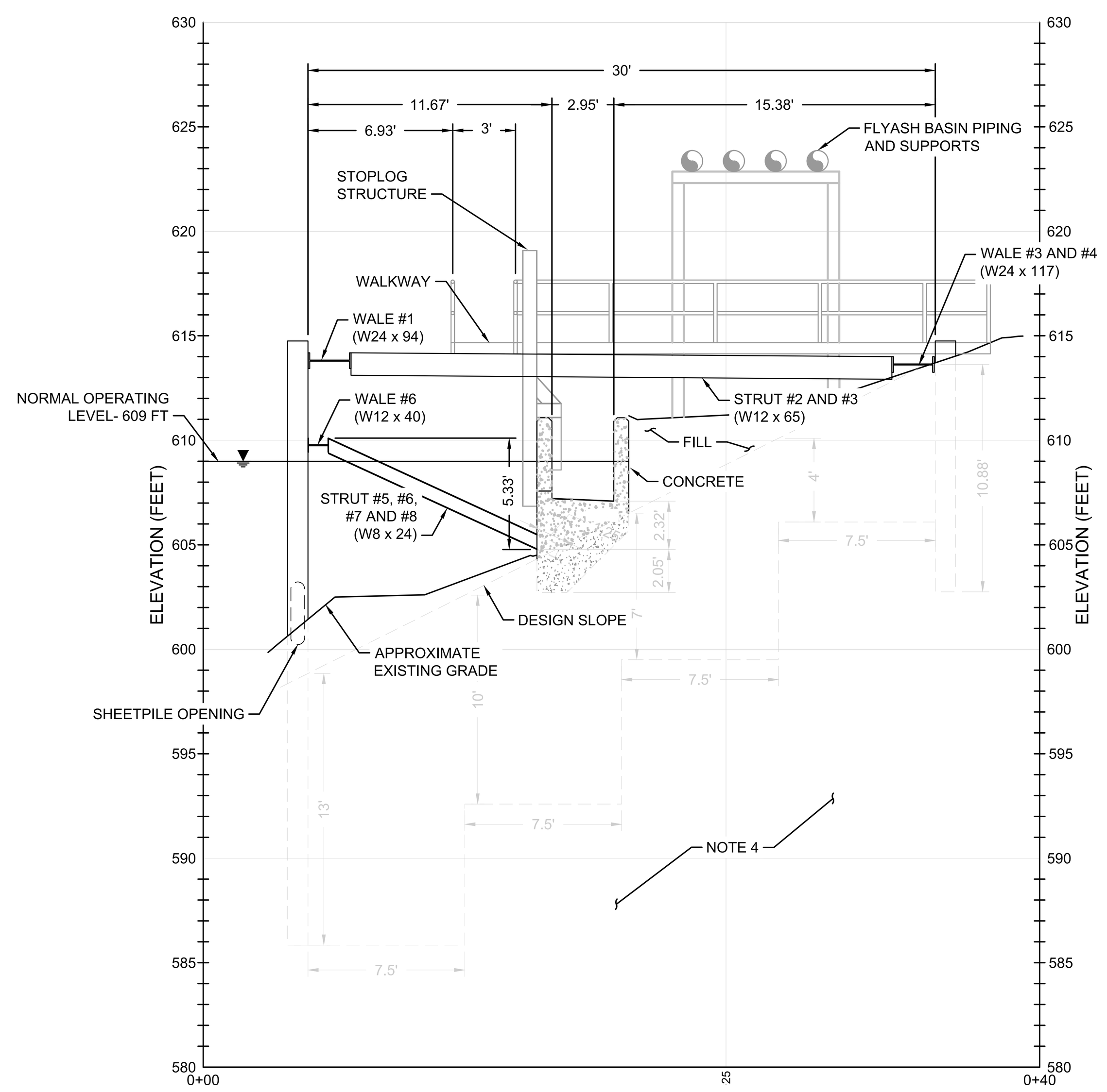
Change in Ash Basin Water Elevation During and After PMF

Monroe Ash Basin Hydraulic Capacity Assessment **(September 2021)**	Geosyntec consultants / DTE	**Figure 1**

Y:\CWP\CHE8242-Detroit Edison\500 - Technical\502 Ash Pond Stability\502-13 Structural Stability & Hydraulics Assessment\Task 2 - Hydraulics Assessment\August 2021

APPENDIX A


FOR MODIFICATIONS SEE DRAWING: 0695-C-W-0056-001
PLAN
SCALE: 1" = 10'
CONSTRUCTION JOINT WITH WATERSTOP SEE DETAIL B-5 6C695 W-56
PIPE SPILLWAY
INLET STRUCTURE
BASIN WATER ELEVATION GAUGE
12'-6" CONCRETE ENCASEMENT
CONCRETE FILL AROUND CULVERT & UNDER STILLING BASIN STR.
APPROXIMATE TRUE ANGLE ON OUTSIDE PIPES 23°-10'
STILLING BASIN
GRADE THIS AREA
INV. EL. 573.6
FILL AND REGRADE THIS AREA TO DIRECT RUNOFF DRAINAGE TO NEW CULVERT
1'-0" LAYER OF 4" TO 8" RIPRAP ON 6" GRAVEL FILLER
REMOVE AND REPLACE EXISTING RIPRAP
TOP OF EXISTING RIPRAP
EXIST. BERM WIDTH
NOTE: SEE DRAWING NO. 42-200 FOR WALKWAY DETAILS AND DRAWING NO. 42-198 FOR CONTROL GATE DETAILS.
SECTION F-F
SCALE: 1" = 1'-0"
DETAIL "A"
SCALE: 1" = 1'-0"
SECTION A-A
SCALE: 1" = 10'
ROADWAY
EXISTING GROUND SURFACE
3'-6" MOUNDED COVER
SLOPE = 0.02
SLOPE = 0.3846
SLOPE = 0.04
3 - 3'-0" DIA. STEEL PIPE
SEEPAGE COLLARS SEE SECTION C-C 6C695W-57
CONSTRUCTION JOINT WITH WATERSTOP MAX SPACING 40' LOCATE AT A PIPE JOINT SEE SECTION C-C 6C695W-57
CONSTRUCTION JOINT
EL. 581'-9" TOP OF DIKE
CHANNEL INVERT EL. 576'-9"
6" LAYER OF 4" TO 8" RIPRAP
GRAVEL FILLER
EXISTING GROUND SURFACE EL. 573'-9"
2000 PSI CONCRETE FILL AROUND CULVERT & UNDER STILLING BASIN STR.
3" DIA. DRAIN HOLE
24" DIA. CMP CULVERT INVERT AT GRADE 1"x4" CORRUGATIONS 16GA WALL THICKNESS
WATER-STOP
RIP-RAP
SECTION B-B
SCALE: 1" = 5'
WALKWAY
EXISTING SLOPE
ASSUMED EXCAVATION LINE
MIN. SHEET PILE EMBEDMENT
WELD 3/4" x 12" x 12" PLATE TO END OF W8 x 24
12 OPENINGS - CUT IN FIELD AFTER SHEET PILE IS INSTALLED
TYPICAL CONSTRUCTION JOINT ALONG PIPE
DETAIL B-5
2" x 2" KEY W/ 6" PVC WATERSTOP (TYP)
TYPICAL CONTRACTION JOINT SAME AS ABOVE WITHOUT #5 DOWEL OR REBAR BEING CONTINUOUS THRU JOINT
SECTION C-C
SCALE: 1" = 5'
SLOPE AND SEED SURFACE AS DIRECTED BY CONST. MGR.
COMPACTED BACKFILL
EXIST. GROUND SURFACE
3750 P.S.I. CONCRETE BACKFILL
SEEPAGE COLLAR
6C695 W-56
LATEST REVISION
G
2016 MODIFICATIONS
ADDED LOCATION OF WATER LEVEL GAUGE
ADDED BASIN LEVEL CONTROL GATES & PLATFORM
REVISED DRAWING TO REFLECT AS BUILT CONDITIONS
ADDED UPPER WHALER AND ANCHORAGE. LOWERED TOP OF SHEET PILING 3'-0 TO EL. 613'
ADDED SEEPAGE COLLAR, CHANGED PIPE DEPTH, CHANGED ROADWAY WIDTH, ADDED CONCRETE FILL UNDER STILLING BASIN STR.
ISSUE INLET STR, PIPE SPILLWAY AND STILLING BASIN FOR CONST. 6/24/77
CUNNINGHAM ENGINEERS INC.
COMMONWEALTH ASSOCIATES INC.
D.I. KAMPMAN P.E. 20906
THE DETROIT EDISON CO.
LAYOUT - ON-SITE FLY ASH DISPOSAL FACILITY DISCHARGE STRUCTURE
WASTEWATER TREATMENT FACILITY
MONROE POWER PLANT
DOCUMENT CONTROL NO.
AS NOTED
6C695W-56

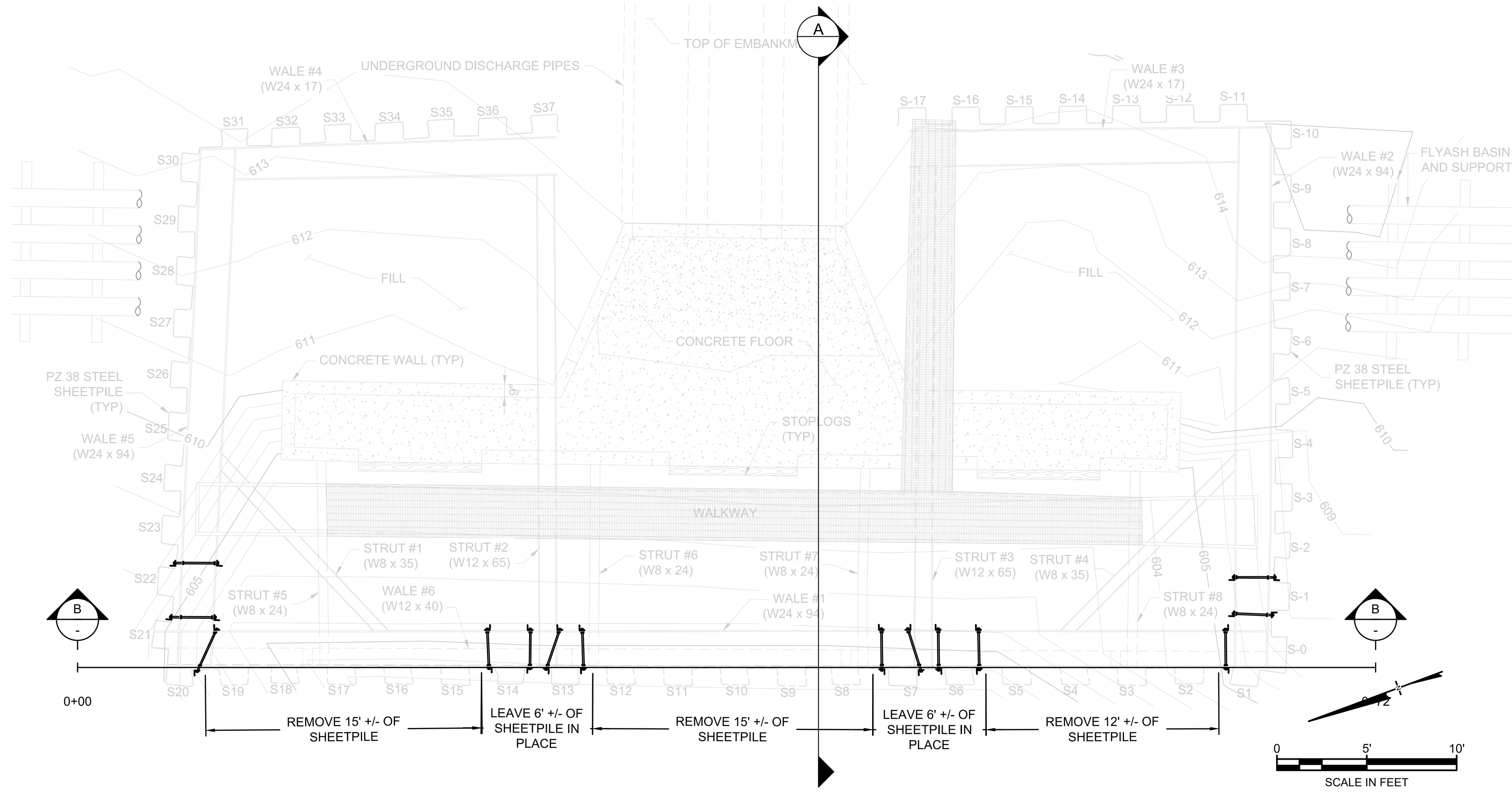


SECTION A

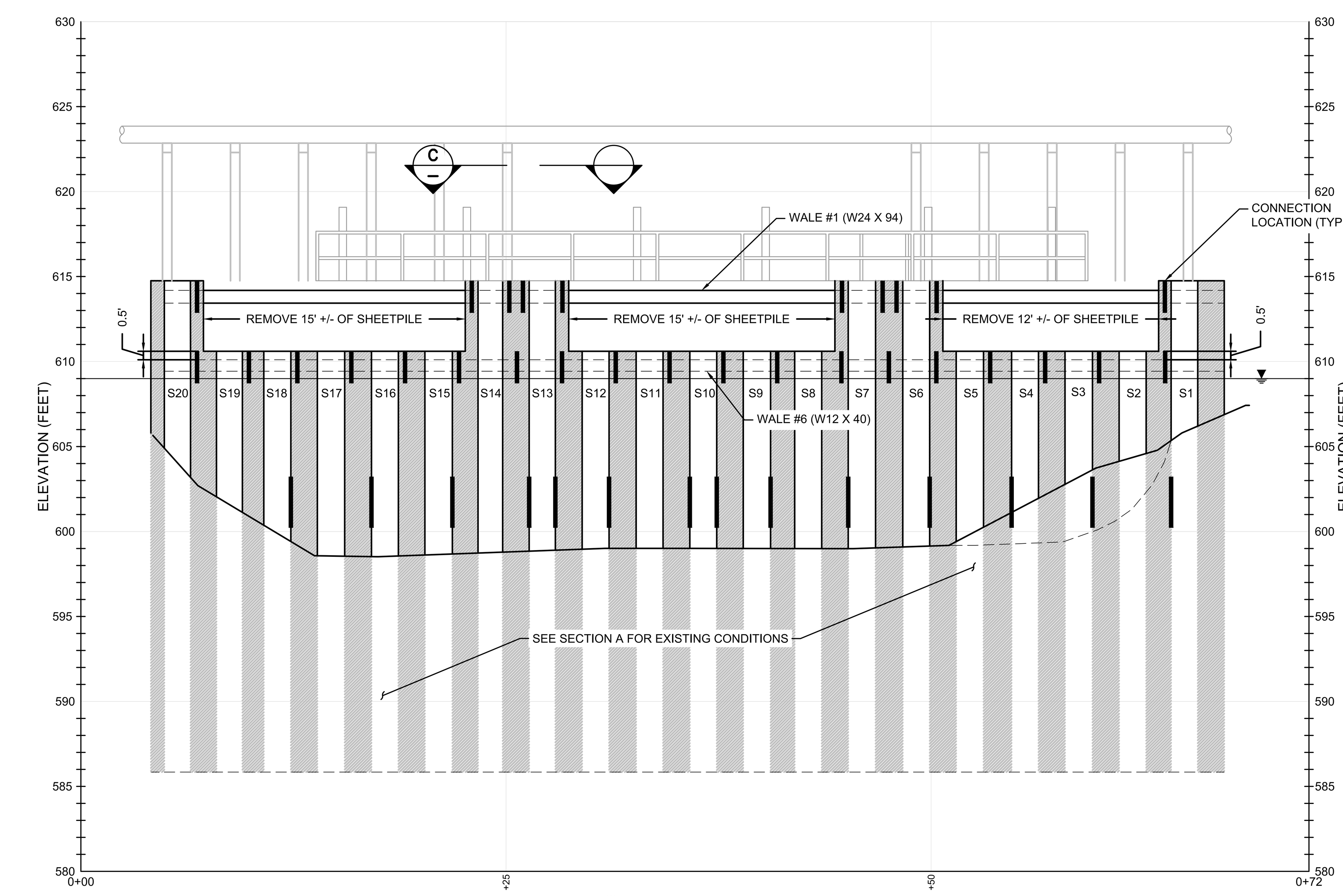
HORIZONTAL SCALE 1"=5'
VERITCAL SCALE 1"=5'

AS–BUILT CONDITION NOTES:

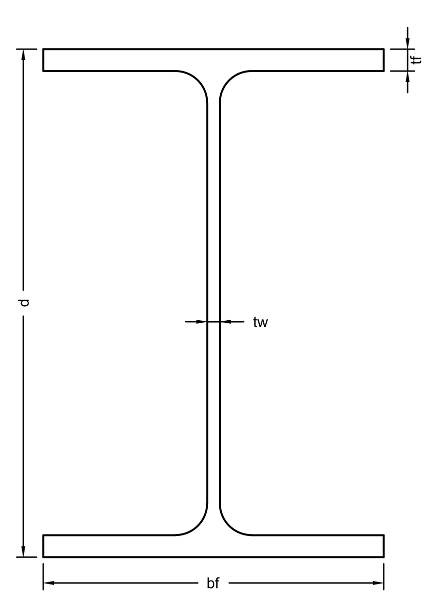
1. SURVEY INFORMATION IS NOT PROVIDED ON THIS DRAWING FOR CLARITY. DETAILED SURVEY INFORMATION IS PROVIDED ON DRAWING 6SE0695–0698.
2. THE ELEVATIONS ARE IN NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929.
3. FEATURES BELOW GRADE AND THOSE ABOVE GRADE SHOWN IN GRAY ARE BASED ON THE INFORMATION PROVIDED IN THE HISTORICAL DRAWINGS LISTED IN NOTE 1.
4. APPROXIMATE EXISTING GRADE WAS ESTABLISHED BASED ON A FEW SURVEY POINTS TAKEN AT THE SOUTHWEST CORNER OF THE DISCHARGE STRUCTURE. THE EXISTING GRADE IN THIS AREA IS MORE LIKELY TO BE AS SHOWN BY THE DASHED LINE.
5. WALE, STRUT AND SHEETPILE SIZES ARE SUMMARIZED IN DETAILS 1 AND 2.
6. STRUCTURE DESIGNATIONS ARE ASSIGNED BASED ON FIELD MEASUREMENTS AND AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) 13TH EDITION. SOME OF THE DIMENSIONS ARE DIFFERENT THAN THOSE PROVIDED IN AISC; THIS IS MAINLY AS A RESULT OF RUSTING.
7. ONLY CERTAIN SHEETPILE SECTIONS WERE SURVEYED. THE SHEETPILE SECTIONS THAT WERE SURVEYED REPRESENT A RANGE OF TYPICAL DIMENSIONS FOR SHEETPILES. S0, S20 AND S21 ARE LOCATED AT CORNERS.
8. SHEETPILES S0 AND S20 WERE FIELD–FIT TO CONSTRUCT THE CORNER. THEREFORE, THERE ARE NO DIMENSIONS FOR "L" AND "M".



PLAN VIEW
AS-BUILT CONDITION

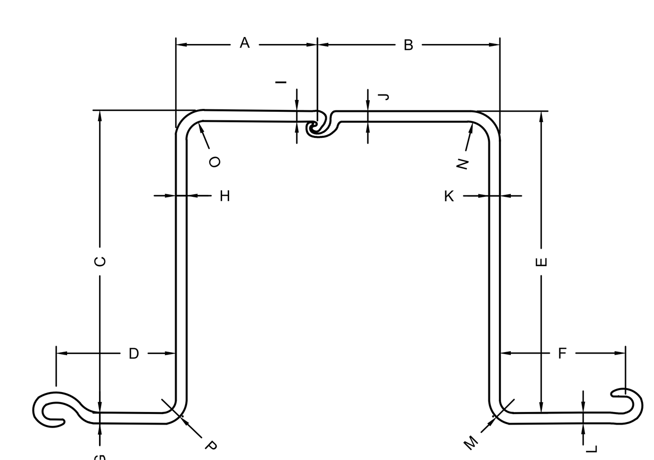


SECTION B - AS-BUILT CONDITION



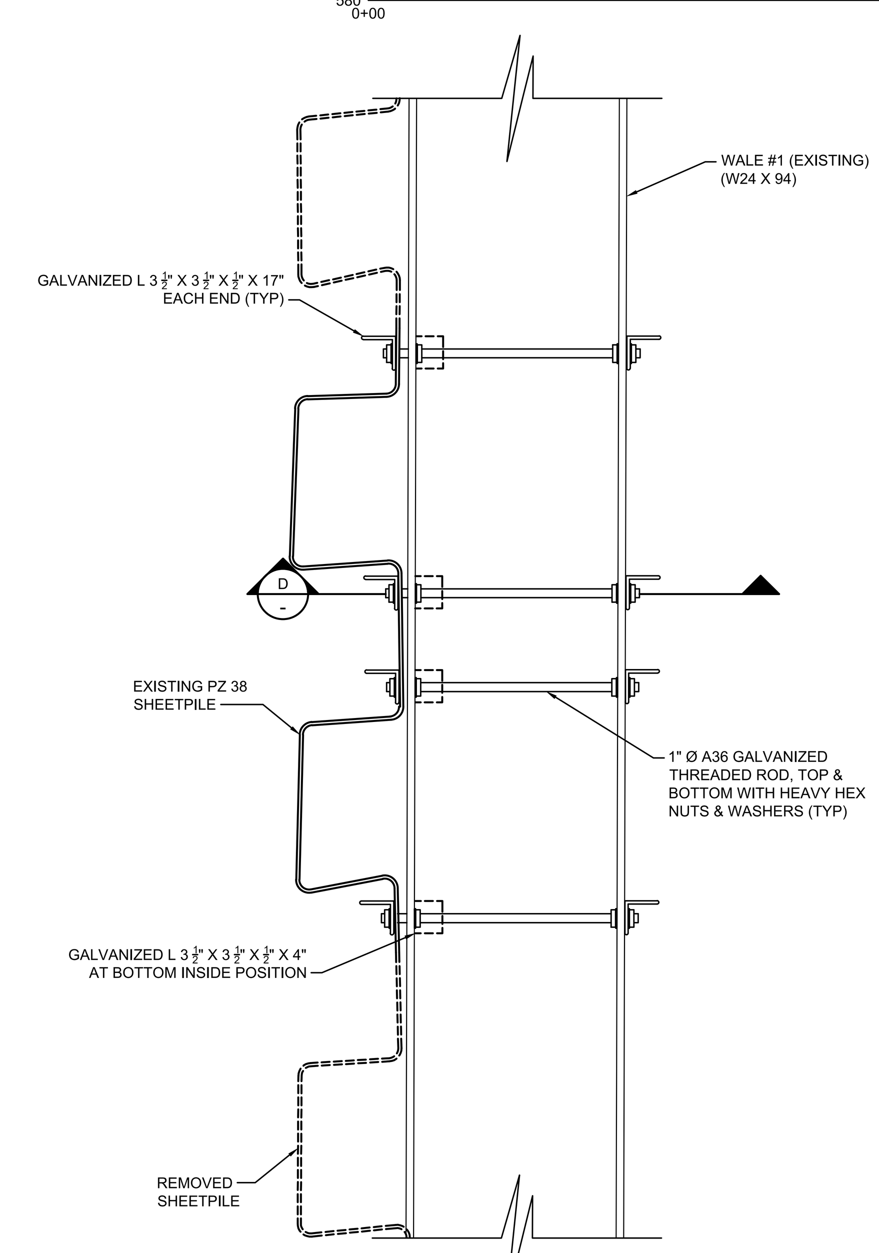
NUMBER	STRUCTURE DESIGNATION (NOTE 7)	bf	d	tf	tw
WALE 1	W24 x 94	9"	24-1/2"	7/8"	1/2"
WALE 2	W24 x 94	8"	24-3/8"	7/8"	1/2"
WALE 3	W24 x 117	12"	24-1/4"	7/8"	1"
WALE 4	W24 x 117	12"	24-1/4"	7/8"	1"
WALE 5	W24 x 94	9"	24-1/2"	7/8"	1/2"
WALE 6	W12 x 40	8"	11-7/8"	3/8"	1/8"
STRUT 1	W8 x 35	8-1/8"	8-3/16"	7/16"	5/8"
STRUT 2	W12 x 65	12-11/16"	12-1/4"	9/16"	9/16"
STRUT 3	W12 x 65	12-1/4"	12-1/4"	5/8"	3/4"
STRUT 4	W8 x 35	8"	8-3/16"	7/16"	1/4"
STRUT 5	W8 x 24	6-9/16"	7-15/16"	3/8"	5/16"
STRUT 6	W8 x 24	6-9/16"	8"	3/8"	3/16"
STRUT 7	W8 x 24	6-9/16"	8"	3/8"	7/16"
STRUT 8	W8 x 24	6-9/16"	8"	3/8"	5/16"

DETAIL (TYP)
WALE/STRUT DIMENSIONS

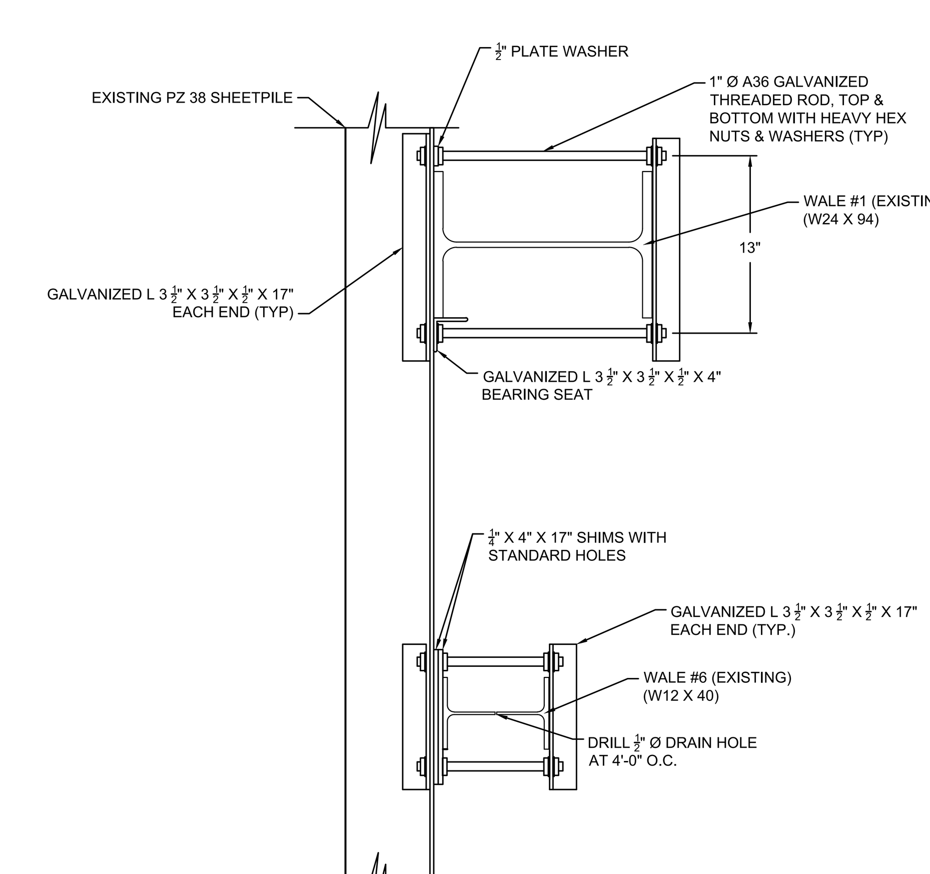


NUMBER	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
S-6	9"	9-3/4"		9-3/8"		8"	1/2"	3/8"	1/2"	1/2"	3/8"	1/2"	1/2"	1/2"	1/2"	1/2"
S0	9-3/8"	15-1/2"	11"	9-3/4"	8-1/2"	0	5/8"	1/2"	5/8"	1/2"	5/8"	NOTE 8	NOTE 8	1/2"	1/2"	1/2"
S1	9"	8"	11-3/8"	9-7/8"	11-3/8"	10"	5/8"	1/2"	3/4"	5/8"	3/8"	5/8"	1/2"	1/2"	1/2"	1/2"
S4	8-7/8"	10"	11-3/8"	9-1/2"	11-3/8"	9-3/4"	5/8"	3/8"	5/8"	5/8"	3/8"	5/8"	1/2"	1/2"	1/2"	1/2"
S20	8-7/8"	10"	11-3/8"	9-1/2"	14-1/2"	0	5/8"	3/8"	5/8"	5/8"	1/2"	NOTE 8	NOTE 8	1/2"	1/2"	1/2"
S21	9"	9-3/4"	11"	9-1/4"	11-3/8"	8-1/4"	5/8"	3/8"	5/8"	5/8"	3/8"	5/8"	1/2"	1/2"	1/2"	1/2"
S22	8-3/4"	10"	11"	9-7/8"	11"	8"	5/8"	3/8"	5/8"	5/8"	3/8"	5/8"	1/2"	1/2"	1/2"	1/2"
S25	8-1/2"	10"	11-3/8"	9-1/4"	11-3/8"	8"	5/8"	3/8"	5/8"	5/8"	3/8"	5/8"	1/2"	1/2"	1/2"	1/2"

DETAIL (TYP)
SHEETPILE DIMENSIONS (NOTE 8)



SECTION (TYP)
SHEETPILE AND UPPER WALE CONNECTION



SECTION D
NOT TO SCALE

THIS IS AN CAD PRODUCED DRAWING. ANY CHANGES OR REVISIONS TO THIS DRAWING MUST BE COMPLETED USING THE CAD SYSTEM

6C695W-0056-001
LATEST REVISION "0"

NO.	DATE	ISSUED FOR	PROJ. ENG.	RESP. ENG.
6				
5				
4				
3				
2				
1	6/20/16	ISSUED FOR CONSTRUCTION	JG	MG

PROJECT ENGINEER: | APPROVALS

PRECONSTRUCTION REVISION BLOCK - REV.

Vendor:

DESIGNED BY: GEOSYNTEC — DATE: 6/20/2016
DRAWN BY: DTE — DATE: 2/12/2016
CHECKED BY: — DATE:
APPROVED BY: G STEPHENS — DATE: 2/17/2016
PROJECT ENGINEER: J GRICE — DATE: 6/20/2016
PROJECT MANAGER: — DATE:

CIVIL: MARK GREEN — 11/2/2016

DTE Electric Company

TITLE
DISCHARGE STRUCTURE – OVERFLOW MODIFICATION & RESUPPORT AS–BUILT
DTE ENERGY
MONROE POWER PLANT ASH SETTLING BASIN

LOCATION NAME: MONROE, POWER PLANT
UNIT NUMBER: N/A
ORIGINATING SOURCE: ENGINEERING SUPPORT ORGANIZATION
SCALE: N/A
USE DIMENSIONS ONLY DO NOT SCALE
DTE ELECTRIC COMPANY DRAWING NUMBER: 6C695W–0056–001