COAL COMBUSTION RESIDUAL RULE
GROUNDWATER MONITORING SYSTEM CERTIFICATION

MARTIN LAKE STEAM ELECTRIC STATION
ASH POND AREA
RUSK COUNTY, TEXAS

OCTOBER 16, 2017

Prepared For:

Luminant Generation Company, LLC
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Prepared By:

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Texas Engineering Firm No. 4760

October 16, 2017

PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Pastor, Behling & Wheeler, LLC under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I hereby certify that the groundwater monitoring system installed at the referenced facility has been designed and constructed to meet the requirements of Section 257.91 of the CCR Rule.

Patrick J. Behling, P.E.
Principal Engineer
PASTOR, BEHLING & WHEELER, LLC

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1.0 INTRODUCTION

Luminant Power (Luminant) operates the Martin Lake Steam Electric Station (MLSES) located approximately 5 miles southeast of Tatum, Rusk County, Texas (Figure 1). The MLSES consists of three coal/lignite-fired power generation units. Coal Combustion Residuals (CCRs) including fly ash, bottom ash and gypsum are generated as part of the MLSES unit operations. Currently, CCRs generated at the MLSES are transported off-site for beneficial use by third-parties or are managed by Luminant in surface impoundments located on the MLSES property or the A1 Area Landfill located approximately 2.5 miles east of the MLSES. Three CCR Units have been identified within the MLSES operations, the Ash Pond Area, Permanent Disposal Pond 5 (PDP 5), and A1 Area Landfill. This report discusses the Ash Pond Area (the Site), which includes the West Ash Pond (WAP), East Ash Pond (EAP), and the New Scrubber Pond. The Ash Ponds meet the definition of CCR surface impoundments and are subject to groundwater monitoring system requirements of the CCR Rule.

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by the EPA to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. The final CCR Rule was published in the Federal Register on April 17, 2015. The effective date of the CCR Rule was October 19, 2015.

The CCR Rule establishes national minimum criteria for existing and new CCR landfills, existing and new CCR surface impoundments, and lateral expansions to landfills/impoundments. Pastor, Behling & Wheeler, LLC (PBW) was retained by Luminant to evaluate and certify that the groundwater monitoring system at the Site has been designed and constructed to meet the requirements of Section 257.91 of the CCR Rule.

1.1 Description of the Ash Pond Area

The WAP, EAP, and New Scrubber Pond (collectively referred to as the “Ash Ponds”) are located immediately east of the MLSES power units (Figure 2). The WAP and EAP receive fluids from bottom ash dewatering bins and other MLSES process wastewater sources that typically include bottom ash fines. Solids present in these wastewaters settle within the ponds and are periodically dredged, dewatered, and transported to the A1 Area Landfill for disposal. The WAP and EAP are both provided with some

combination of clay/single or double 60-mil high density polyethylene (HDPE) liners, separated by a geonet with a 4-inch protective revetment mat. The liner systems for the WAP and EAP per the CCR Rule are considered unlined impoundments (BM, 2015).

The New Scrubber Pond is the primary impoundment used for recycling process wastewater from the flue-gas desulfurization (FGD) process at the MLSES. Solids present in the FGD wastewater settle within the pond and are periodically removed and managed similar to the ash solids from the WAP and EAP. The New Scrubber Pond is provided with a double 60-mil HDPE liner, separated by a geonet and a 4-inch protective revetment mat. The liner for the New Scrubber Pond per the CCR Rule is considered an unlined impoundment (BM, 2015).

Several other water management ponds that are not considered CCR units are also located in the vicinity of the Ash Ponds, including two emergency catch basins (Catch Basin 1 and Catch Basin 2) and a storm water pond. Catch Basins 1 and 2 are used for storage of seal water and other fluids from adjacent low pressure ash water pump stations and have historically been unlined (18-inch thick clay liners were installed in the catch basins in April 2015). Water stored in Catch Basins 1 and 2 is transferred to the New Scrubber Pond or used for process make-up water. The storm water pond receives/stores storm water run-off from the lignite/coal storage area run-off at the plant. Water stored in the storm water pond is used for process make-up water (PBW, 2011).

The Process Water Pond, which is also located in the Ash Pond Area, was formerly used to manage process wastewaters similar to the New Scrubber Pond; however, Luminant had CCR within the Process Water Pond removed prior to the effective date of the CCR Rule. As a result, the Process Water Pond is not included as a CCR unit as part of this evaluation.

1.2 CCR Unit Groundwater Monitoring System Requirements

Section 257.91 of the CCR Rule indicates that existing CCR landfills and surface impoundments be provided with a groundwater monitoring system that consists of sufficient wells, installed at appropriate location and depths, to yield groundwater samples from the uppermost aquifer that meet the following criteria:

- Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit; and

- Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary to ensure detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

The specific configuration of the groundwater monitoring system must be determined based on site-specific technical information that must include aquifer thickness, groundwater flow rate, groundwater flow direction (including seasonal and temporal fluctuation in groundwater flow), saturated and unsaturated geologic units and fill materials that overly the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the upmost aquifer, including, but not limited to, thickness, stratigraphy, lithology, hydraulic conductivities, porosities, and effective porosities.

At a minimum, the monitoring system must consist of at least one upgradient and three downgradient monitoring wells, and any additional monitoring wells necessary to accurately represent the quality of the background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit. Multi-unit groundwater monitoring systems are allowed but must be equally as capable of detecting monitored constituents at the waste boundary of a CCR unit as individual groundwater monitoring wells.

Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space above the sampling depth must be sealed to prevent contamination of samples and the groundwater. There must be documentation in the operating record of the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified engineer must have access to and must review this documentation as part of the groundwater monitoring system certification.

2.0 GROUNDWATER MONITORING SYSTEM EVALUATION

2.1 Ash Pond Area Groundwater Monitoring System

The CCR groundwater monitoring well system at the Ash Pond Area consists of seven monitoring wells (H-26, H-27, H-28, H-29, H-31, H-32, and H-33) that are each screened in the uppermost aquifer at the Site. The locations of the CCR monitoring wells are shown on Figure 2. Well construction information and survey data for the CCR wells are summarized in Table 1, CCR monitoring well logs are presented in Appendix A, and photographs of the CCR wells are presented in Appendix B.

2.2 Local Geology and Hydrogeology

The FGD Ponds are located in the outcrop area of the Eocene-aged Wilcox Group (Barnes, 1965). PBW reviewed current and historical soil boring logs, monitoring well completion documentation, and historical reports to describe the geologic and hydrogeologic conditions in the Ash Pond Area. Geologic cross sections were constructed using these data. Cross section locations are presented on Figure 3 and the cross sections are presented on Figures 4, 5, and 6.

The geology of the Site consists of an upper zone composed of an approximately 30 to 40-foot thick low to medium plasticity, lean clay to clayey sand unit. The upper zone is underlain by an intermediate zone composed of poorly-graded fine sand and silty sand unit that is generally about 5 to 20 feet thick. The intermediate zone underlain by a laterally continuous silty to sandy confining clay unit. The uppermost aquifer occurs in the intermediate sand and silty sand unit at the Site.

2.3 Groundwater Potentiometric Surface Elevations

Eight background groundwater monitoring events were performed using the Ash Pond Area CCR monitoring well system from October 2015 to December 2016. Static water levels measured during the background monitoring period indicated water elevations ranging from 302.30 feet above mean sea level (amsl) to 310.04 feet amsl, and depths to water ranging from 9.24 feet bgs to 26.94 feet bgs (Table 2). Groundwater potentiometric surface maps based on data collected during the background monitoring period are presented in Appendix C.

Groundwater elevations were generally highest in the west, with an inferred groundwater flow direction to the east. Based on the inferred groundwater flow direction, the location of each CCR monitoring well relative to the Ash Pond Area is as follows:

Upgradient Wells	Downgradient Wells
H-26	H-28
H-27	H-29
H-33	H-31
	H-32

2.4 Uppermost Aquifer Hydraulic Conductivity Testing

Aquifer tests (slug tests) were conducted in both the upper zone of clayey sand and the intermediate zone of sand and silty sand (see Section 2.2) as part of an Affected Property Assessment Report (APAR) prepared for the Ash Pond Area (PBW, 2011). The APAR was approved by the Texas Commission on Environmental Quality (TCEQ) in December 2011 (TCEQ, 2011). The hydraulic conductivities of upper zone reportedly ranged from 3.5×10^{-6} to 3.8×10^{-4} cm/sec, and hydraulic conductivities of the intermediate zone ranged from 1.2×10^{-4} to 7.5×10^{-3} cm/sec.

2.5 Conclusions

The CCR groundwater monitoring well system at the Ash Pond Area complies with Section 257.91 of the CCR Rule. This conclusion is supported by the following as described in detail in previous sections of this report:

- Seven monitoring wells are included in the CCR groundwater monitoring system – three upgradient monitoring wells and four downgradient monitoring wells.
- Each monitoring well is screened in the uppermost aquifer at the Site. Samples collected from upgradient monitoring wells will be representative of the quality of background groundwater that has not been affected by leakage from the CCR units and samples collected from downgradient wells will ensure detection of groundwater contamination in the uppermost aquifer from the CCR units.
- The monitoring wells are constructed with appropriate well casing to maintain the integrity of the monitoring well borehole and with slotted well screens to enable collection of groundwater samples. In addition, the annular space above the well screen is appropriately sealed to prevent contamination of groundwater samples from surface sources.
- Appropriate documentation exists concerning the design, installation, and development of the monitoring wells.

3.0 REFERENCES

Barnes, Virgil E., 1965. Geologic Atlas of Texas, Tyler Sheet. Texas Bureau of Economic Geology.

Burns & McDonnell Engineering Company, Inc (BM), 2015. CCR Study for Martin Lake Steam Electric Station – Final Draft. June 2015.

Pastor, Behling & Wheeler, LLC (PBW), 2011. Revised Affected Property Assessment Report, Martin Lake Steam Electric Station – Ash Pond Area (TCEQ SWR No. 31277). May 3.

Texas Commission on Environmental Quality (TCEQ), 2011. Approved Addendum to Revised Affected Property Assessment Report for Ash Ponds Area. December 1.

Tables

TABLE 1
WELL CONSTRUCTION SUMMARY
ASH POND AREA
MARTIN LAKE STEAM ELECTRIC STATION

Well ID	Date Installed	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Screen Length (ft)	Total Design Depth (ft bgs)	Casing Diameter (in)
H-26	9/14/15	229020	2907068	320.44	323.70	35	40	5	40	2
H-27	9/15/15	229615	2906851	330.50	330.42	45	50	5	50	2
H-28	9/15/15	230034	2907669	314.04	316.82	27	32	5	32	2
H-29	9/23/15	229428	2907900	329.55	329.26	52	57	5	57	2
H-31	9/24/15	229262	2908597	329.46	329.26	42	52	10	52	2
H-32	9/24/15	228728	2908233	330.15	329.85	42	52	10	52	2
H-33	9/14/15	228609	2907268	320.78	323.85	41	46	5	46	2

Notes:
1. Abbreviations: ft - feet; amsl - above mean sea level; bgs - below ground surface.

TABLE 2
GROUNDWATER ELEVATION SUMMARY
ASH POND AREA
MARTIN LAKE STEAM ELECTRIC STATION

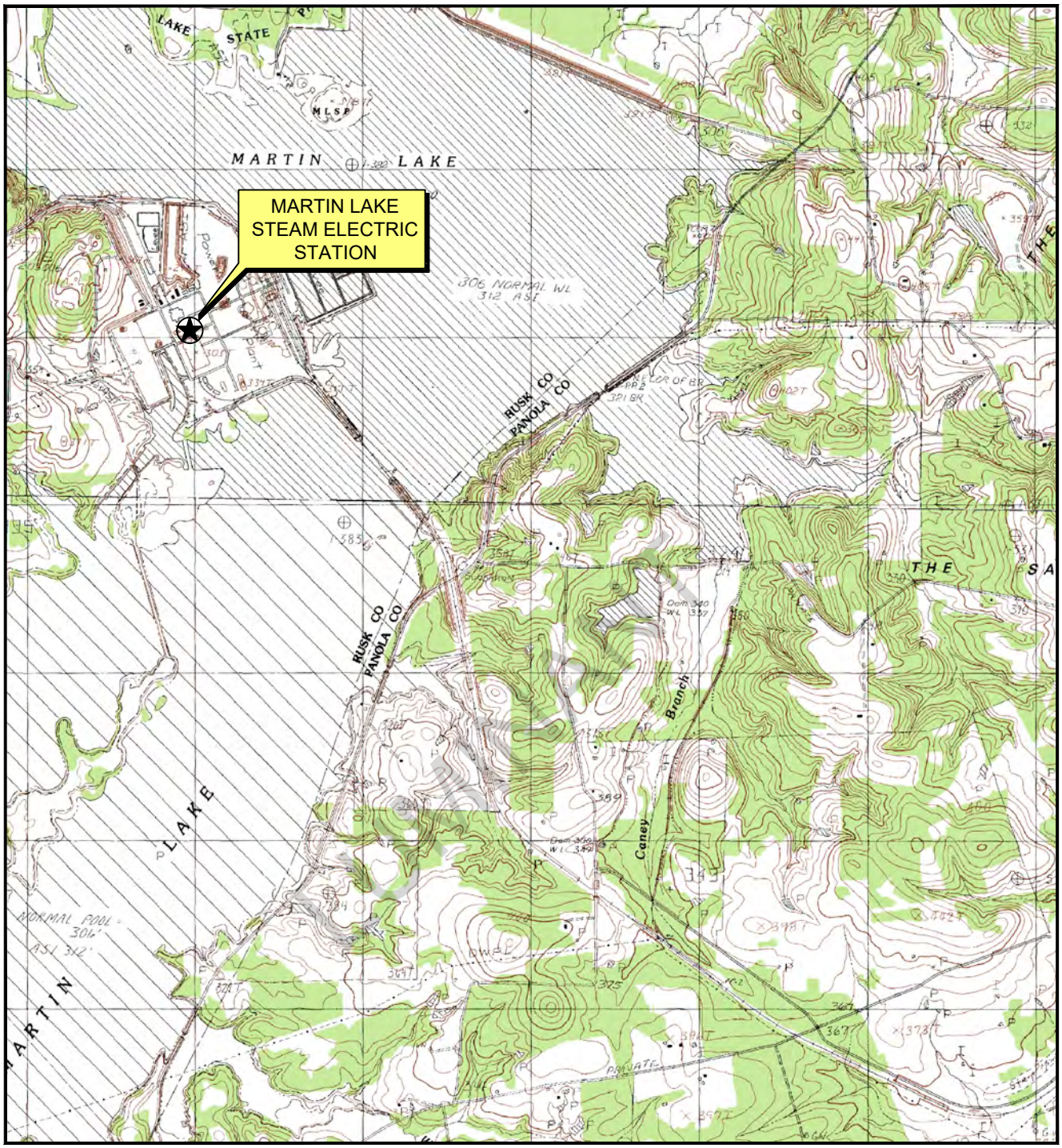
Well ID	TOC Elevation (ft amsl)	Date	Depth to Water (ft bgs)	Water Elevation (ft amsl)
H-26	323.70	10/21/15	16.29	307.41
		12/14/15	15.57	308.13
		02/23/16	14.96	308.74
		04/05/16	15.34	308.36
		06/06/16	14.33	309.37
		08/09/16	15.30	308.40
		10/17/16	15.79	307.91
		12/11/16	17.54	306.16
H-27	330.42	10/21/15	23.66	306.76
		12/14/15	22.49	307.93
		02/23/16	21.95	308.47
		04/05/16	22.54	307.88
		06/06/16	21.70	308.72
		08/09/16	22.62	307.80
		10/17/16	23.12	307.30
		12/11/16	25.42	305.00
H-28	316.82	10/21/15	12.96	303.86
		12/14/15	10.41	306.41
		02/23/16	9.86	306.96
		04/05/16	10.46	306.36
		06/06/16	9.24	307.58
		08/09/16	11.81	305.01
		10/17/16	12.23	304.59
		12/11/16	14.52	302.30
H-29	329.26	10/21/15	24.51	304.75
		12/14/15	22.57	306.69
		02/23/16	22.02	307.24
		04/05/16	22.73	306.53
		06/06/16	22.09	307.17
		08/09/16	23.38	305.88
		10/17/16	23.59	305.67
		12/11/16	25.89	303.37
H-31	329.26	10/20/15	26.44	302.82
		12/14/15	22.99	306.27
		02/23/16	22.79	306.47
		04/05/16	23.34	305.92
		06/06/16	22.62	306.64
		08/09/16	25.15	304.11
		10/17/16	25.26	304.00
		12/11/16	26.88	302.38
H-32	329.85	10/22/15	26.11	303.74
		12/14/15	23.47	306.38
		02/23/16	23.05	306.80
		04/05/16	23.72	306.13
		06/06/16	23.11	306.74
		08/09/16	24.84	305.01
		10/17/16	25.03	304.82
		12/11/16	26.94	302.91

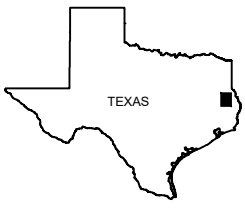
TABLE 2
GROUNDWATER ELEVATION SUMMARY
ASH POND AREA
MARTIN LAKE STEAM ELECTRIC STATION

Well ID	TOC Elevation (ft amsl)	Date	Depth to Water (ft bgs)	Water Elevation (ft amsl)
H-33	323.85	10/22/15	15.91	307.94
		12/14/15	14.78	309.07
		02/23/16	14.79	309.06
		04/05/16	14.82	309.03
		06/06/16	13.81	310.04
		08/09/16	15.00	308.85
		10/17/16	15.34	308.51
		12/11/16	17.52	306.33

Notes:
1. Abbreviations: ft - feet; amsl - above mean sea level; bgs - below ground surface

Figures





QUADRANGLE LOCATION

N

Scale in Feet

0 1500 3000

SOURCE:
Base map from www.tnris.gov, Tatum, TX 7.5 min. USGS quadrangle dated 1983.

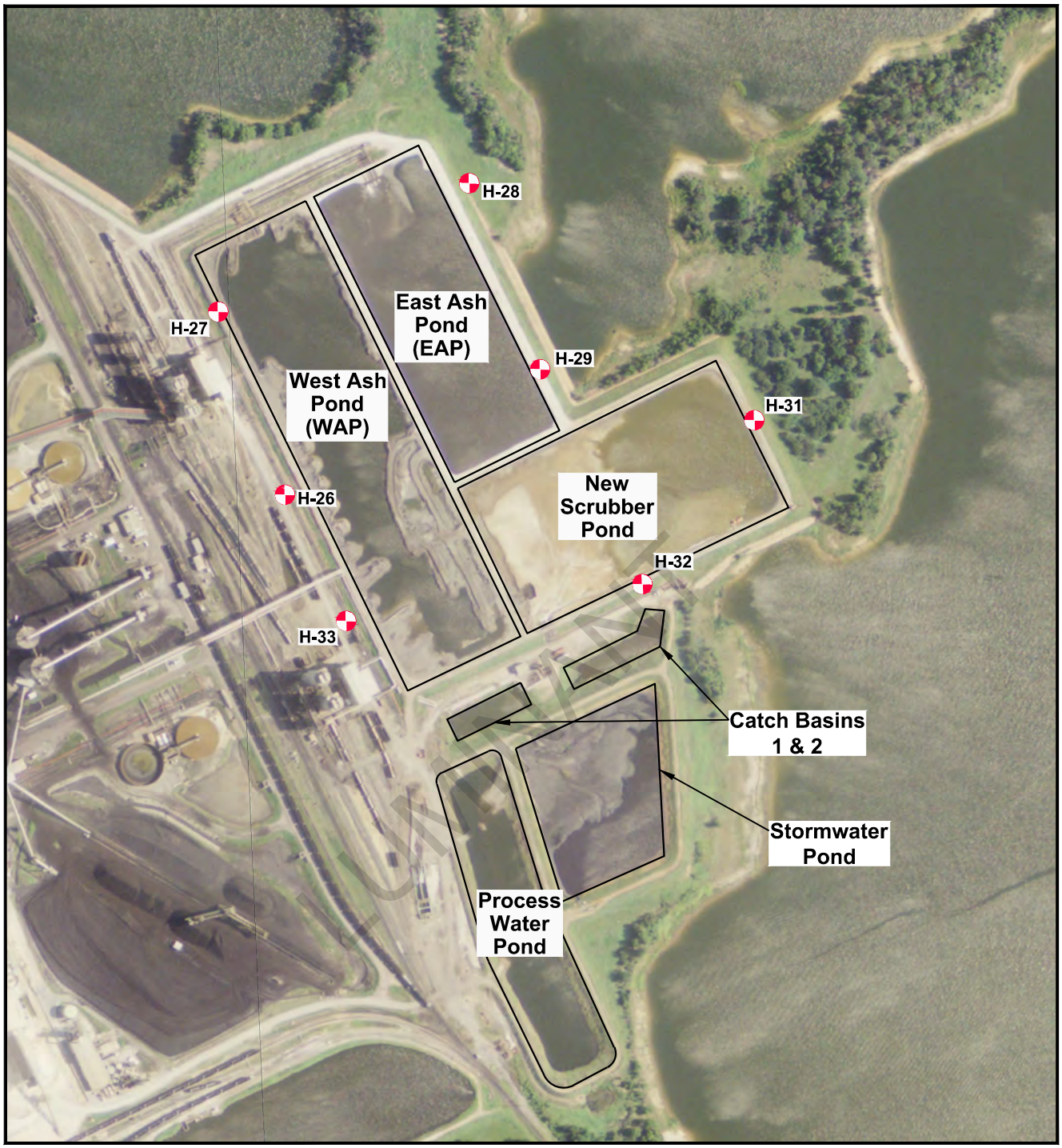
MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 1

ASH POND AREA SITE LOCATION MAP

PROJECT: 5123B	BY: AJD	REVISIONS
DATE: JUNE, 2015	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

CCR Monitoring Well Location

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

MARTIN LAKE STEAM ELECTRIC STATION

TATUM, TEXAS

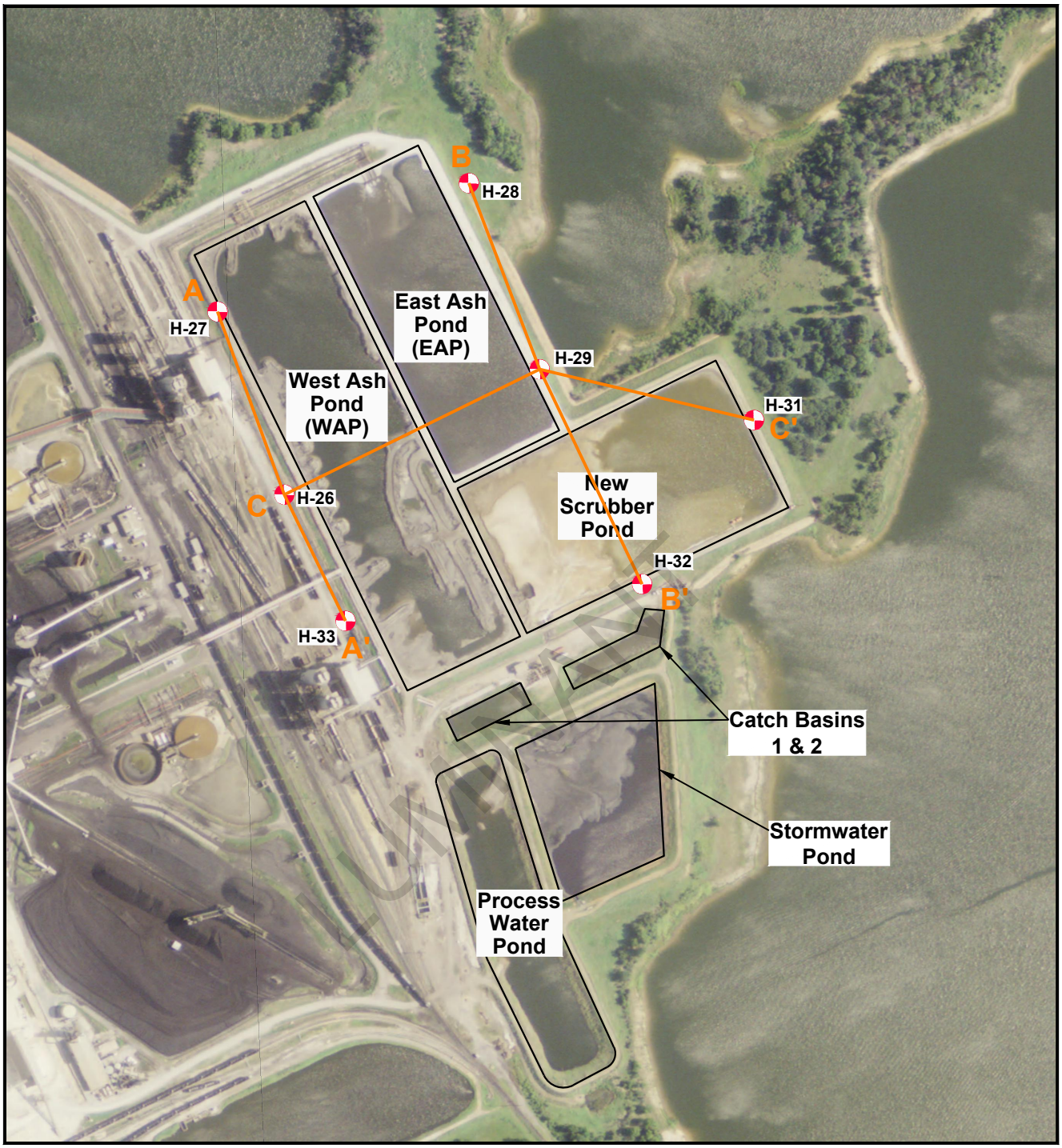
Figure 2

ASH POND AREA DETAILED SITE PLAN

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

CCR Monitoring Well Location

A A' Geologic Cross Section Location Lines

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

MARTIN LAKE STEAM ELECTRIC STATION

TATUM, TEXAS

Figure 3

ASH POND AREA CROSS SECTION LOCATION MAP

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

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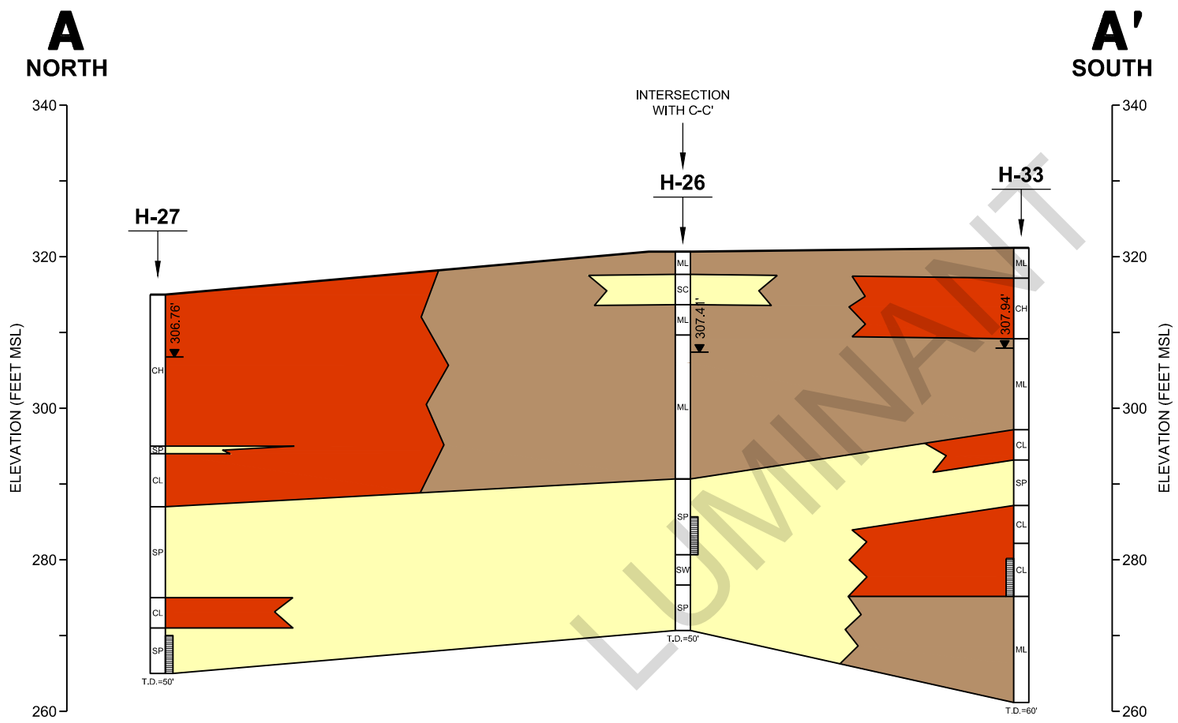
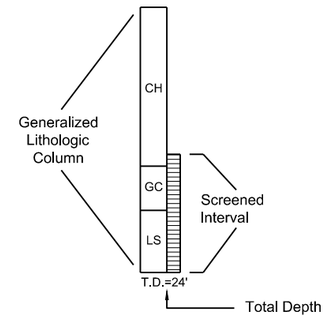


EXPLANATION

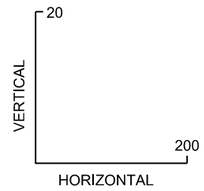
- FILL
- SAND
- CLAY
- SILT

MONITORING WELL CONSTRUCTION



Water Level (Ft MSL)
Measured 10/20/15 - 10/22/15

SCALE IN FEET



10x Vertical Exaggeration

MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 4

ASH POND AREA GEOLOGIC CROSS SECTION A-A' WEST SIDE OF WEST ASH POND THROUGH PROCESS WATER POND

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: OCT., 2017	CHECKED: PJB	

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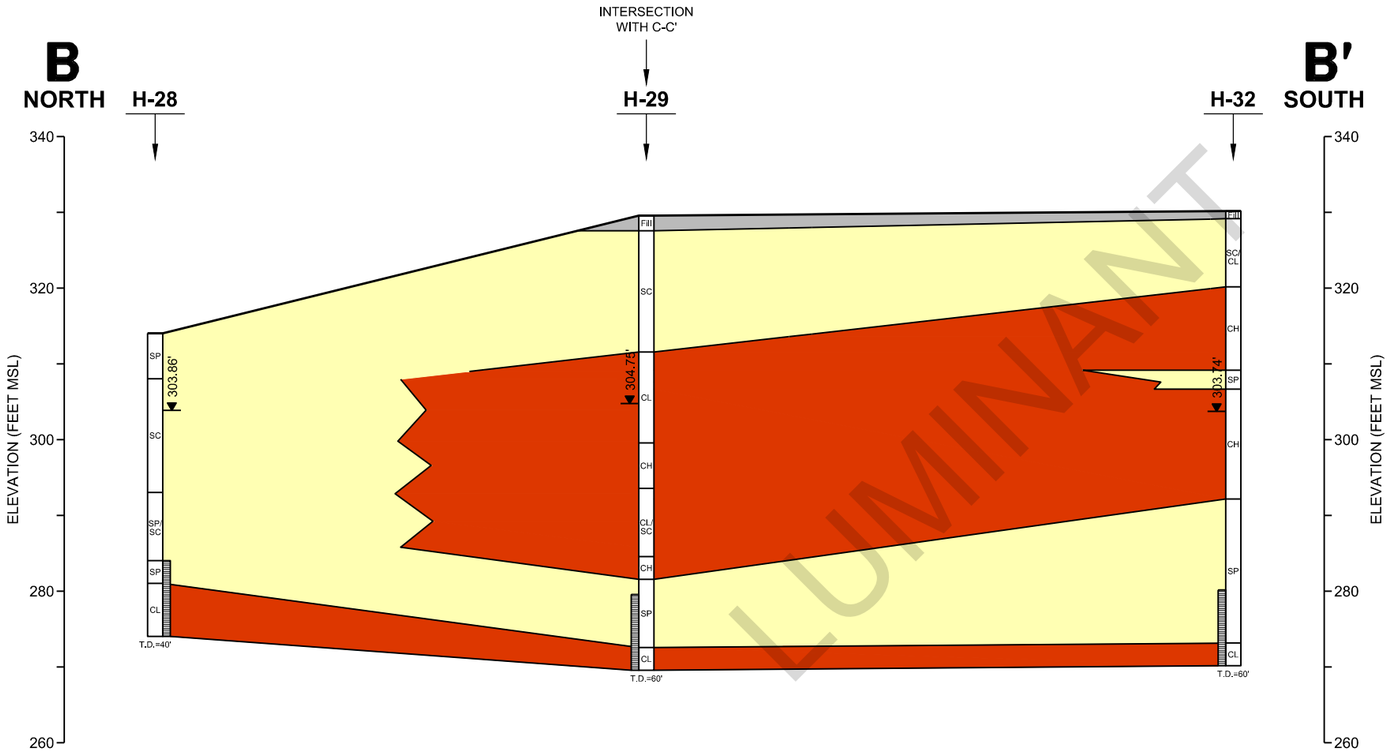
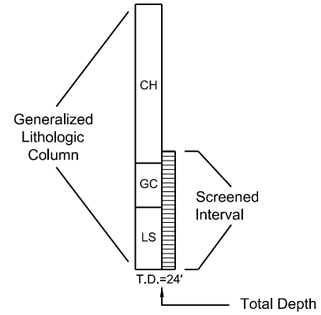


EXPLANATION

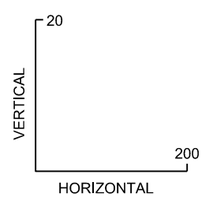
FILL
SAND
CLAY
SILT

MONITORING WELL CONSTRUCTION



Water Level (Ft MSL)
Measured 10/20/15 - 10/22/15

SCALE IN FEET



10x Vertical Exaggeration

MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 5

ASH POND AREA
GEOLOGIC CROSS SECTION B-B'
EAST SIDE OF ASH POND
THROUGH SCRUBBER POND

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: OCT., 2017	CHECKED: PJB	

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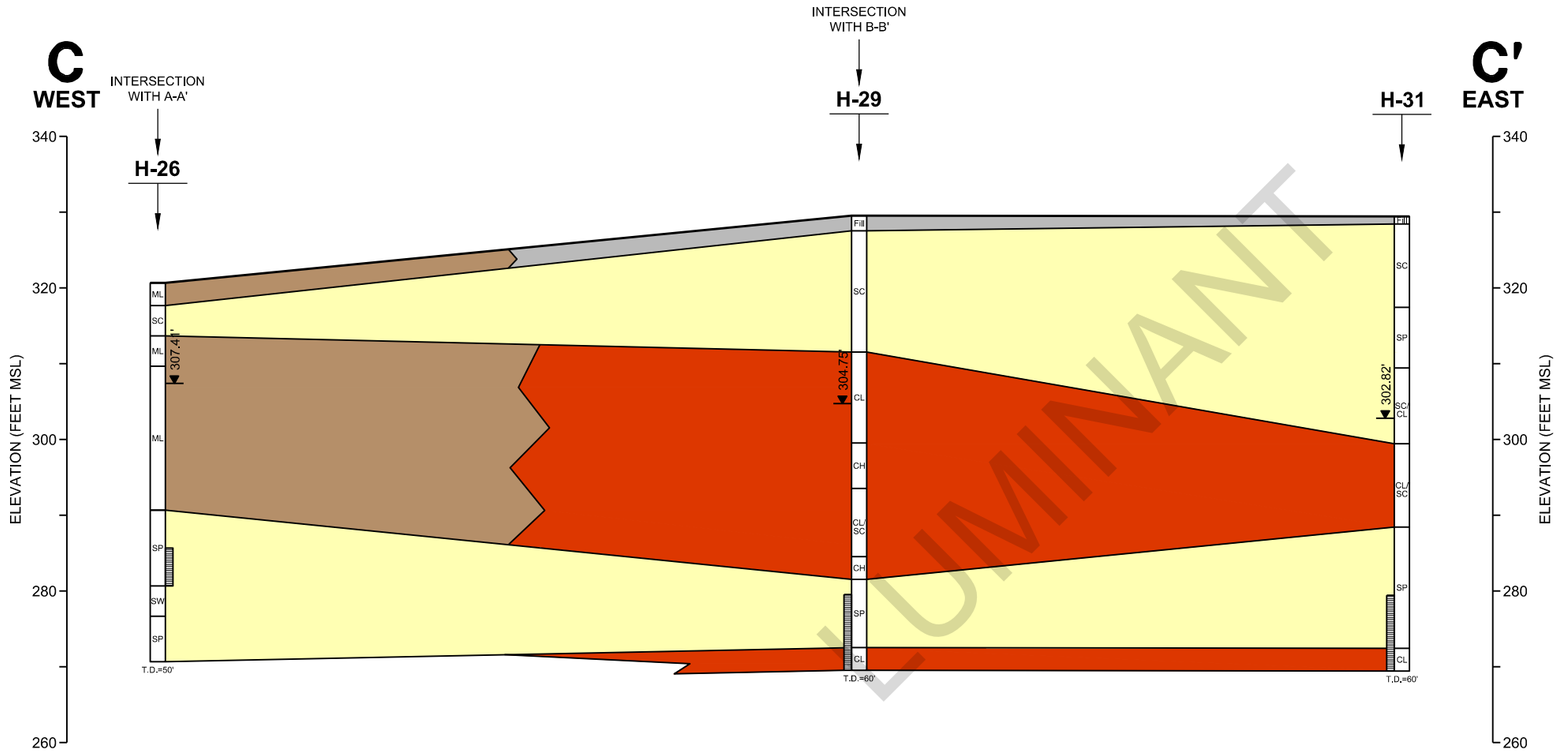


SCALE IN FEET

VERTICAL 20

HORIZONTAL 200

10x Vertical Exaggeration

MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 6

ASH POND AREA GEOLOGIC CROSS SECTION C-C' THROUGH WEST ASH POND AND EAST ASH POND

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: OCT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

Appendix A

CCR Monitoring Well Logs

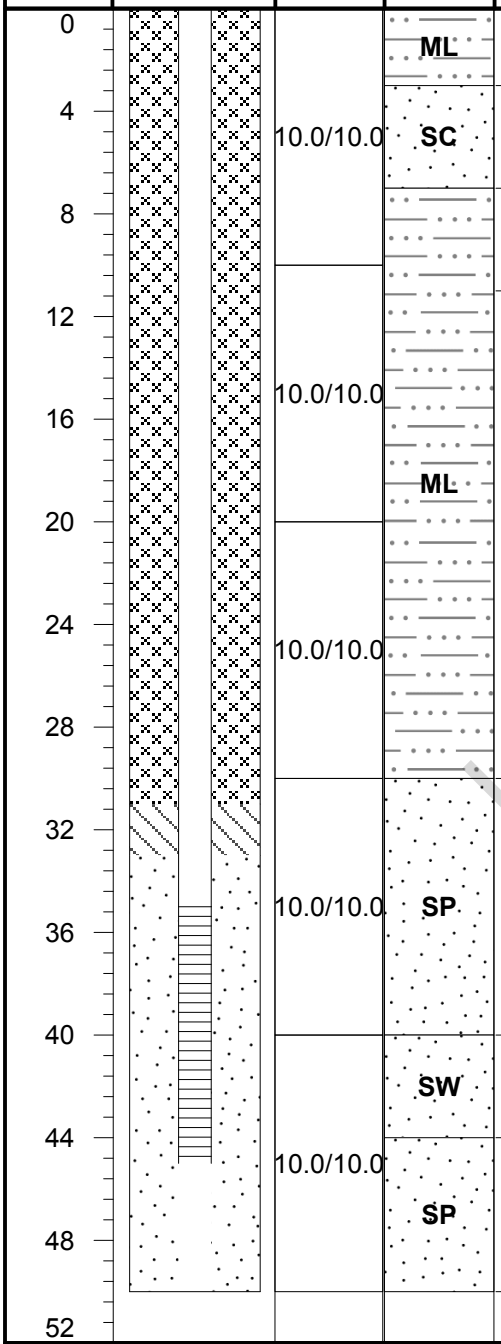
Luminant

Log of Boring: H-26

Martin Lake Steam Electric Station
Tatum, TX

PBW Project No. 5164B

Completion Date:	9/14/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.5
Driller:	Timmy Beach	Total Depth (ft):	50
Driller's License:	5814M	TOC Elevation (ft. AMSL):	
Logged By:	Ryan Francis	Northing:	
Sampling Method:	4"x10' Core barrel	Easting:	



Lithologic Description
(0 - 3) Silty CLAY, dark brown, dry, soft to firm, weak cementation, flat, low plasticity
(3 - 7) Sandy CLAY, red/orange with gray clay ribbons, dry, soft to firm, weak cementation, medium plasticity, minor rounded pebbles
(7 - 11) Silty SAND, gray, dry, soft, weak cementation, subrounded, sharp contact
(11 - 30) Clayey silty SAND, tan with red and gray ribbons, moist to wet, soft, weak cementation, medium plasticity
(30 - 40) SAND, tan and orange, fine grained, higher clay content (31'-34'), wet, very soft to soft, low to medium plasticity
(40 - 44) SAND, red, wet, soft to firm, moderate cementation, heavy iron content, iron concretions ("rocky" texture)
(44 - 50) SAND, red and gray, wet, soft, fine grained, subrounded, gradual color change to dark brown/black (47'-50'), moisture content decreases with depth, hard sand (48'-50')

PBW

Pastor, Behling & Wheeler, LLC
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Round Rock, TX 78664
Tel (512) 671-3434 Fax (512) 671-3446

Notes:
1. This log should not be used separately from the report to which it is attached.

Well Materials
(0-35) Casing, 2" Sch 40 FJT PVC
(35-40) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-31') Grout
(31'-33') Bentonite pellets
(33'-40') 20/40 sand

Luminant

Log of Boring: H-27

Martin Lake Steam Electric Station
Tatum, TX

PBW Project No. 5164B

Completion Date:	9/15/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.5
Driller:	Timmy Beach	Total Depth (ft):	50
Driller's License:	5814M	TOC Elevation (ft. AMSL):	
Logged By:	Ryan Francis	Northing:	
Sampling Method:	4"x10' Core barrel	Easting:	

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0				
4		10.0/10.0	CH	(0 - 20) CLAY, orange and brown mottling, minor black sreaking, blocky, moist, soft to hard, low to high plasticity, dry and variable sand content (5'-7'), wet at 20'
8				
12		10.0/10.0		
16				
20			SP	(20 - 21) SAND, gray, moist, soft, subrounded, sharp contact
24		10.0/10.0	CL	(21 - 28) CLAY, gray and orange, blocky, moist, firm to hard, moderate cementation, low plasticity
28				
32		10.0/10.0	SP	(28 - 40) SAND, light gray to tan/orange, moist to wet, soft, none to low plasticity, minor clay content decreasing with depth
36				
40			CL	(40 - 44) Sandy CLAY, orange and gray, moist, firm, low to medium plasticity, flat, sharp contact, very hard and little to no sand at 43'
44		10.0/10.0	SP	(44 - 50) Clayey SAND, orange and gray, wet, soft, low plasticity, fine grained, decreasing clay content with depth, sharp contact, color change to brown at 48'
48				
52				

PBW

Pastor, Behling & Wheeler, LLC
2201 Double Creek Dr., Suite 4004
Round Rock, TX 78664
Tel (512) 671-3434 Fax (512) 671-3446

Notes:
1. This log should not be used separately from the report to which it is attached.

Well Materials
(0-45) Casing, 2" Sch 40 FJT PVC
(45-50) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-41') Grout
(41'-43') Bentonite pellets
(43'-50') 20/40 sand

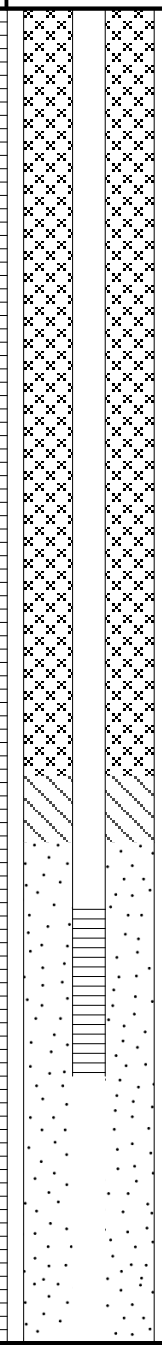
Luminant

Log of Boring: H-28

Martin Lake Steam Electric Station
Tatum, TX

PBW Project No. 5164B

Completion Date:	9/15/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.5
Driller:	Timmy Beach	Total Depth (ft):	40
Driller's License:	5814M	TOC Elevation (ft. AMSL):	
Logged By:	Ryan Francis	Northing:	
Sampling Method:	4"x10' Core barrel	Easting:	

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0 – 6		10.0/10.0	SP	(0 - 6) Soil with SAND, tan, dry, firm, moderate cementation, hard packed
6 – 20		10.0/10.0	SC	(6 - 21) Clayey SAND, moist, soft to firm, weak cementation, none to low plasticity, flat, 6" gray fine to very fine sand lense at 10', gray and orange mottling (11'-21'), fine grained
20 – 30		10.0/10.0	SP/SC	(21 - 30) Clayey SAND, tan and orange, wet, soft to firm, low plasticity, none to weak cementation, variation in clay content with depth, highest clay content at 21', more orange and less clay (29'-30')
30 – 32			SP	(30 - 33) SAND, orange and gray, fine grained, wet, soft, low plasticity, minor clay content, color change from tna to brown to dark gray
32 – 40		10.0/10.0	CL	(33 - 40) Silty CLAY, dark gray, moderate sand, dry, hard, weak cementation, flat

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Well Materials
(0-27) Casing, 2" Sch 40 FJT PVC
(27-32) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-23') Grout
(23'-25') Bentonite pellets
(25'-32') 20/40 sand

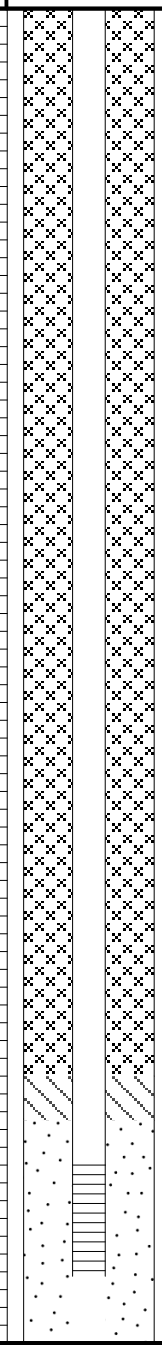
Luminant

Log of Boring: H-29

Martin Lake Steam Electric Station
Tatum, TX

PBW Project No. 5164B

Completion Date:	9/23/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.5
Driller:	Timmy Beach	Total Depth (ft):	60
Driller's License:	5814M	TOC Elevation (ft. AMSL):	
Logged By:	Ryan Francis	Northing:	
Sampling Method:	4"x10' Core barrel	Easting:	

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0			FILL	(0 - 2) Hard rock road bed, dry
4		10.0/10.0	SC	(2 - 18) Clayey SAND, orange and gray mottling, very fine grained, dry to moist, firm, weak cementation, low to medium plasticity, increasing clay content with depth
8				
12		10.0/10.0		
16				
20		10.0/10.0	CL	(18 - 30) CLAY, orange, moist, firm, low to medium plasticity, very little sand or silt, black striping at 22', increasing sand content with depth (28'-30')
24				
28				
32		10.0/10.0	CH	(30 - 36) CLAY, orange, moist, soft, friable, high plasticity, minor silt
36				
40		10.0/10.0	CL/SC	(36 - 45) Sandy CLAY/Clayey SAND, orange/gray/red mottling, friable, wet, soft to firm, low to medium plasticity, increasing clay content with depth
44				
			CH	(45 - 48) CLAY with sand, orange and gray mottling, wet, soft, high plasticity
48				
52		10.0/10.0	SP	(48 - 57) SAND, gray, wet, soft, one to low plasticity, some black roots/ organics, interspersed clay lenses
56				
60			CL	(57 - 60) Silty CLAY, gray/brown, dry, hard, weak cementation, sharp contact

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Well Materials
(0-52) Casing, 2" Sch 40 FJT PVC
(52-57) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-48') Grout
(48'-50') Bentonite pellets
(50'-57') 20/40 sand

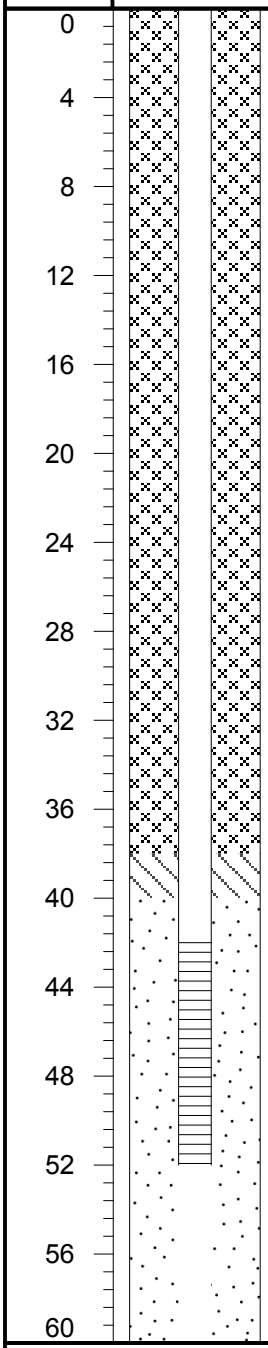
Luminant

Log of Boring: H-31

Martin Lake Steam Electric Station
Tatum, TX

PBW Project No. 5164B

Completion Date:	9/24/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.5
Driller:	Timmy Beach	Total Depth (ft):	60
Driller's License:	5814M	TOC Elevation (ft. AMSL):	
Logged By:	Ryan Francis	Northing:	
Sampling Method:	4"x10' Core barrel	Easting:	



Depth (ft)	Recovery (ft/ft)	USCS	Lithologic Description
0		FILL	(0 - 1) Hard, packed gravel road bed, dry
4	10.0/10.0	SC	(1 - 12) Clayey SAND, orange, dry to moist, soft to firm, low plasticity, fine grained, increasing clay content with depth, gray clay ribbons at 10'
8			
12	5.0/10.0	SP	(12 - 20) SAND, orange with red and gray mottling, dry to moist, soft, none to low plasticity, weak cementation, fine grained, very little clay
16			
20	10.0/10.0	SC/CL	(20 - 30) Sandy CLAY, orange, dry to moist, firm, crumbly, color variation with depth, low plasticity, some gray sand lenses, very fine grained, color change to gray at 29'
24			
28			
32	10.0/10.0	CL/SC	(30 - 41) Sandy CLAY,/ Clayey SAND, gray and tan, moist, soft, fine grained, low plasticity, variations in clay content and firmness with depth, moisture content changes to wet at 35'
36			
40	10.0/10.0	SP	(41 - 57) SAND, orange/tan, wet, very soft, fine grained, subrounded, increasing red color with depth starting at 52', hard iron concretion layer with some black staining at 55'
44			
48			
52	10.0/10.0		
56			
60		CL	(57 - 60) Sandy CLAY, gray, dry to moist, hard, fine grained, weak cementation, low plasticity, flat

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Notes:
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Well Materials
(0-42) Casing, 2" Sch 40 FJT PVC
(42-52) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-38') Grout
(38'-40') Bentonite pellets
(40'-52') 20/40 sand

Luminant

Log of Boring: H-32

Martin Lake Steam Electric Station
Tatum, TX

PBW Project No. 5164B

Completion Date:	9/24/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.5
Driller:	Timmy Beach	Total Depth (ft):	60
Driller's License:	5814M	TOC Elevation (ft. AMSL):	
Logged By:	Ryan Francis	Northing:	
Sampling Method:	4"x10' Core barrel	Easting:	

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0			FILL	(0 - 1) Hard, packed gravel road bed, dry
4		10.0/10.0	SC/CL	(1 - 10) Sandy CLAY/Clayey SAND, orange/tan, dry, firm, fine grained, low plasticity, weak cementation
8				
12		10.0/10.0	CH	(10 - 21) CLAY with minor silt/sand, orange with some black streaks, moist, firm, high plasticity, gradual contact
16				
20			SP	(21 - 23.5) SAND, gray, dry, soft to firm, friable, fine grained
24		10.0/10.0	CH	(23.5 - 38) CLAY, orange/tan/gray, moist, soft to firm, unconsolidated, high plasticity, minor sand at 30', tan and gray with orange stripes (30'-38'), sharp contact
28				
32				
36		10.0/10.0		
40			SP	(38 - 57) SAND, orange/tan, moist to wet, very soft to soft, fine grained, subrounded, minor clay, low plasticity, no clay content at 42', gradual coarsening of sand grains (48'-55'), some gray streakings at 49', color change to reddish brown at 52'
44		10.0/10.0		
48				
52				
56		10.0/10.0		
60			CL	(57 - 60) Sandy CLAY, dark red and brown, wet, soft, low plasticity, layer of dark red concretions at 57', weak cementation, flat

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Notes:
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Well Materials
(0-42) Casing, 2" Sch 40 FJT PVC
(42-52) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-38') Grout
(38'-40') Bentonite pellets
(40'-52') 20/40 sand

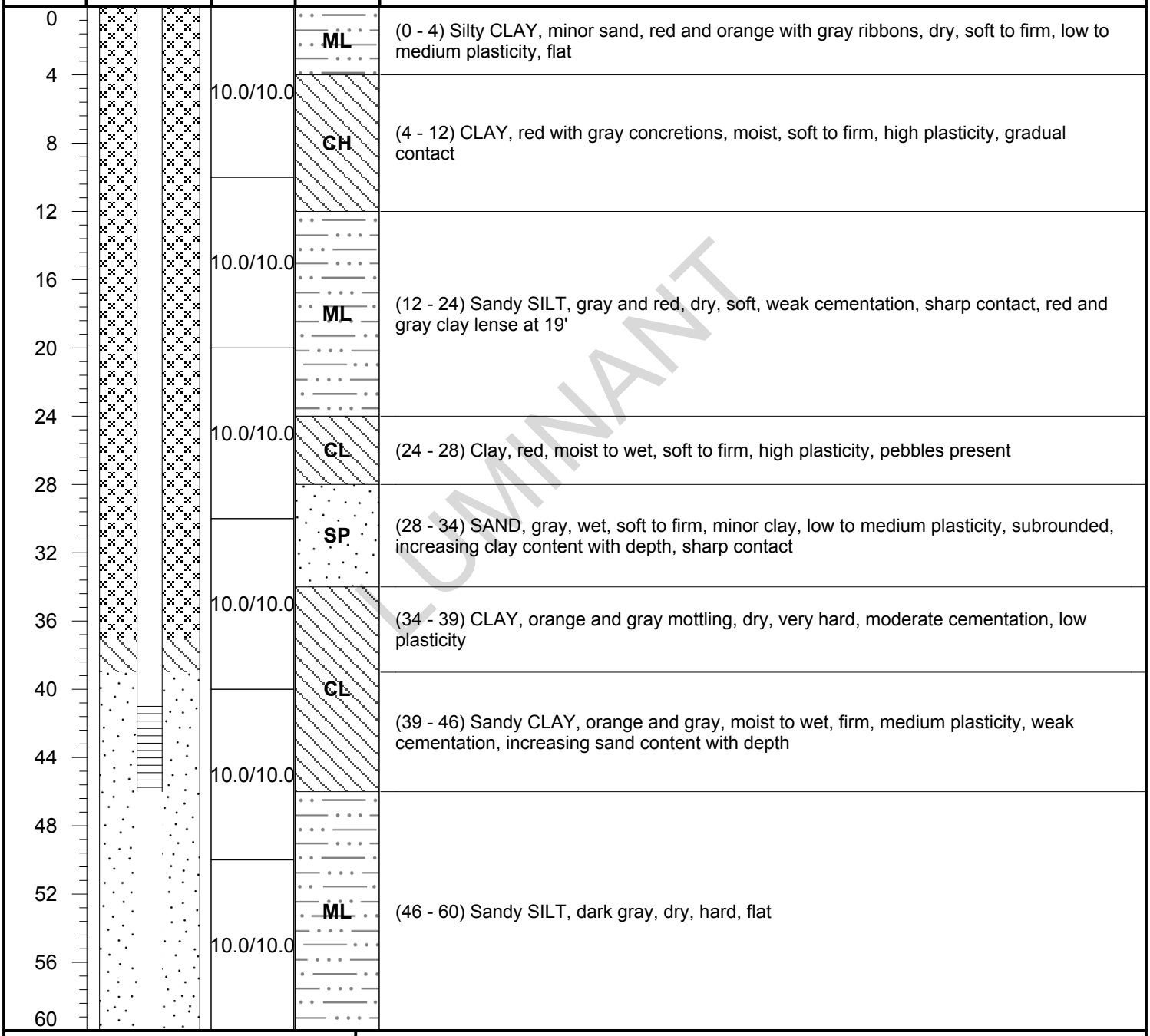
Luminant

Log of Boring: H-33

Martin Lake Steam Electric Station
Tatum, TX

PBW Project No. 5164B

Completion Date:	9/14/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.5
Driller:	Timmy Beach	Total Depth (ft):	60
Driller's License:	5814M	TOC Elevation (ft. AMSL):	
Logged By:	Ryan Francis	Northing:	
Sampling Method:	4"x10' Core barrel	Easting:	



Lithologic Description
(0 - 4) Silty CLAY, minor sand, red and orange with gray ribbons, dry, soft to firm, low to medium plasticity, flat
(4 - 12) CLAY, red with gray concretions, moist, soft to firm, high plasticity, gradual contact
(12 - 24) Sandy SILT, gray and red, dry, soft, weak cementation, sharp contact, red and gray clay lense at 19'
(24 - 28) Clay, red, moist to wet, soft to firm, high plasticity, pebbles present
(28 - 34) SAND, gray, wet, soft to firm, minor clay, low to medium plasticity, subrounded, increasing clay content with depth, sharp contact
(34 - 39) CLAY, orange and gray mottling, dry, very hard, moderate cementation, low plasticity
(39 - 46) Sandy CLAY, orange and gray, moist to wet, firm, medium plasticity, weak cementation, increasing sand content with depth
(46 - 60) Sandy SILT, dark gray, dry, hard, flat

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Well Materials
(0-41) Casing, 2" Sch 40 FJT PVC
(41-46) Screen, 2" Sch 40 FJT PVC, 0.010" slot

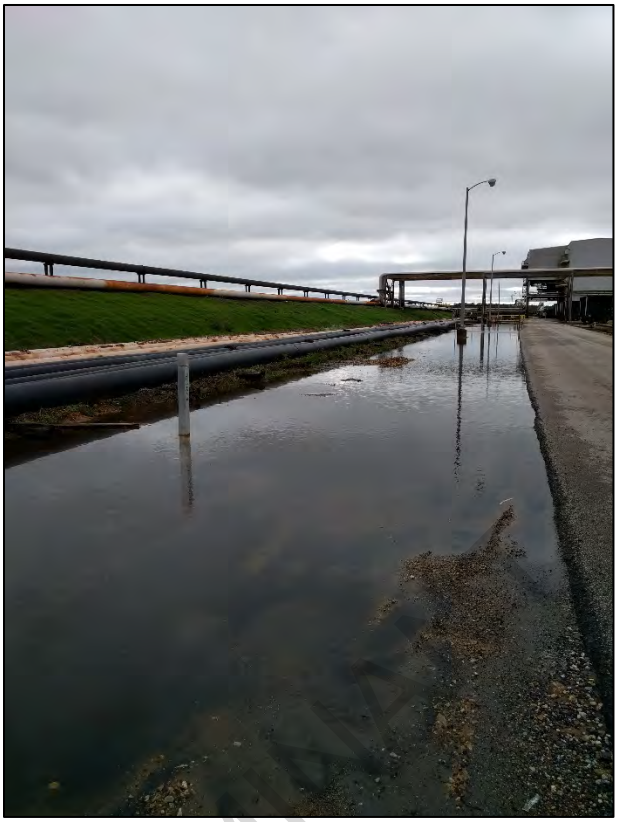
Annular Materials
(0'-37') Grout
(37'-39') Bentonite pellets
(39'-46') 20/40 sand

Appendix B

Photographs of CCR Groundwater Monitoring Wells

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Martin Lake Steam Electric Station

ASH POND AREA



Photograph 1: H26

Photograph 2: H27

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Martin Lake Steam Electric Station

Photograph 3: H28

Photograph 4: H29

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Martin Lake Steam Electric Station

Photograph 6: H31

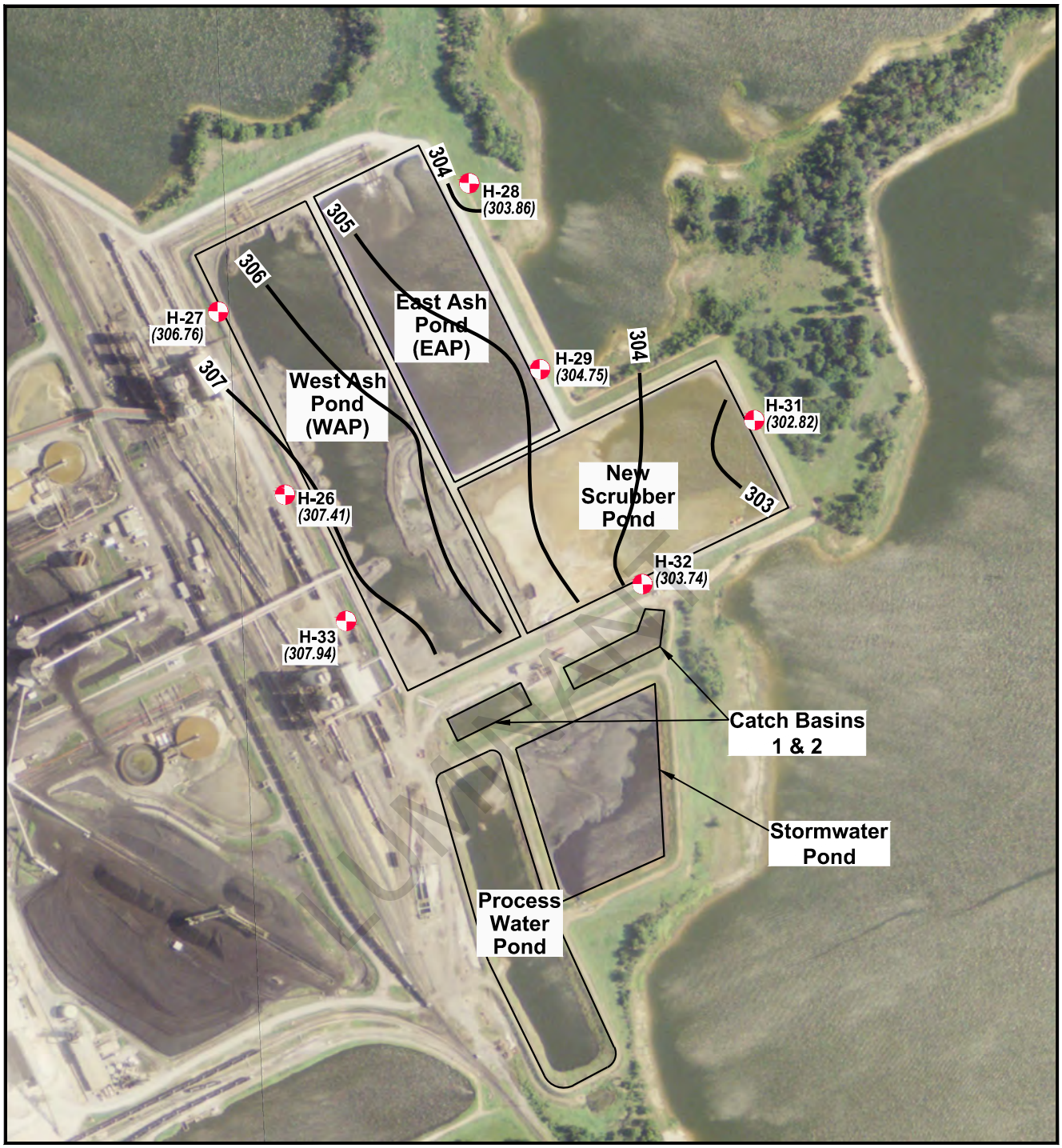
Photograph 7: H32

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Martin Lake Steam Electric Station

Photograph 8: H33

Appendix C

Groundwater Potentiometric Surface Maps



EXPLANATION

- CCR Monitoring Well Location
- (308.70) Groundwater Potentiometric Surface (ft. MSL)
- 308 Groundwater Potentiometric Surface Contour (C.I. = 1 ft.)

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

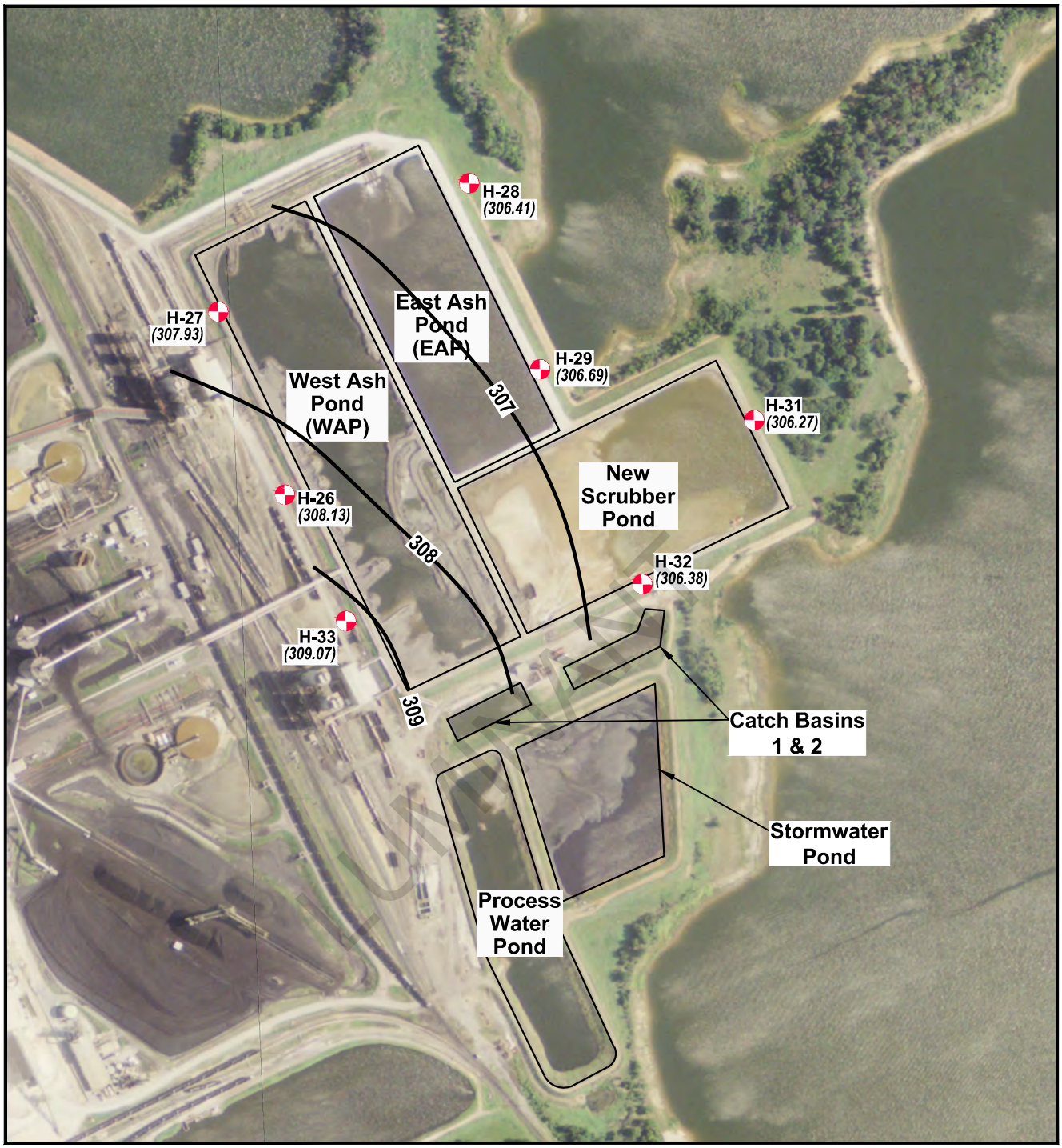
MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 1

ASH POND AREA - GROUNDWATER ZONE B POTENTIOMETRIC SURFACE MAP - OCTOBER 21-22, 2015

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well Location
- (308.70) Groundwater Potentiometric Surface (ft. MSL)
- 308 Groundwater Potentiometric Surface Contour (C.I. = 1 ft.)

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

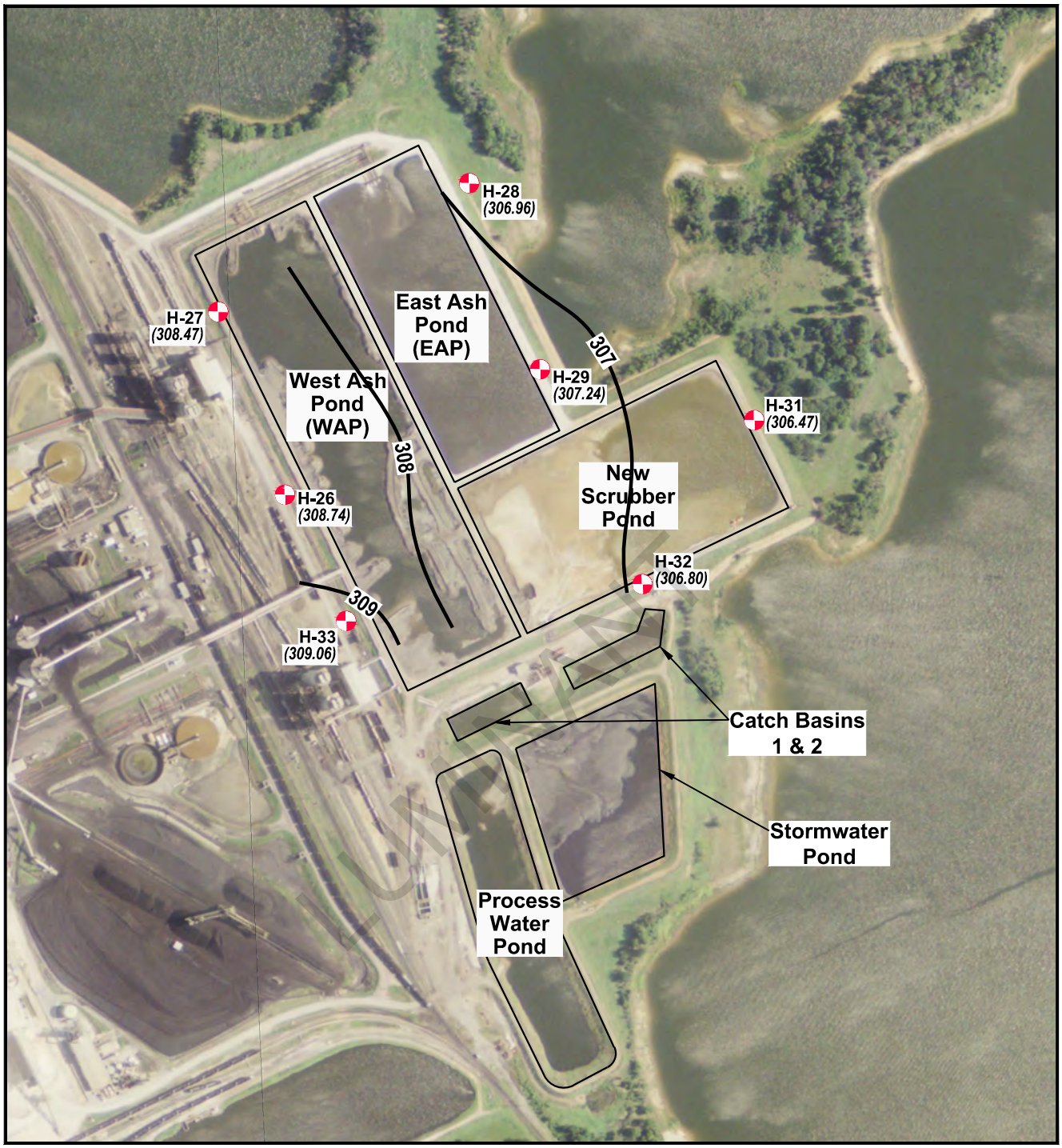
MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 2

ASH POND AREA - GROUNDWATER ZONE B POTENTIOMETRIC SURFACE MAP - DECEMBER 14, 2015

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well Location
- (308.70) Groundwater Potentiometric Surface (ft. MSL)
- 308 Groundwater Potentiometric Surface Contour (C.I. = 1 ft.)

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

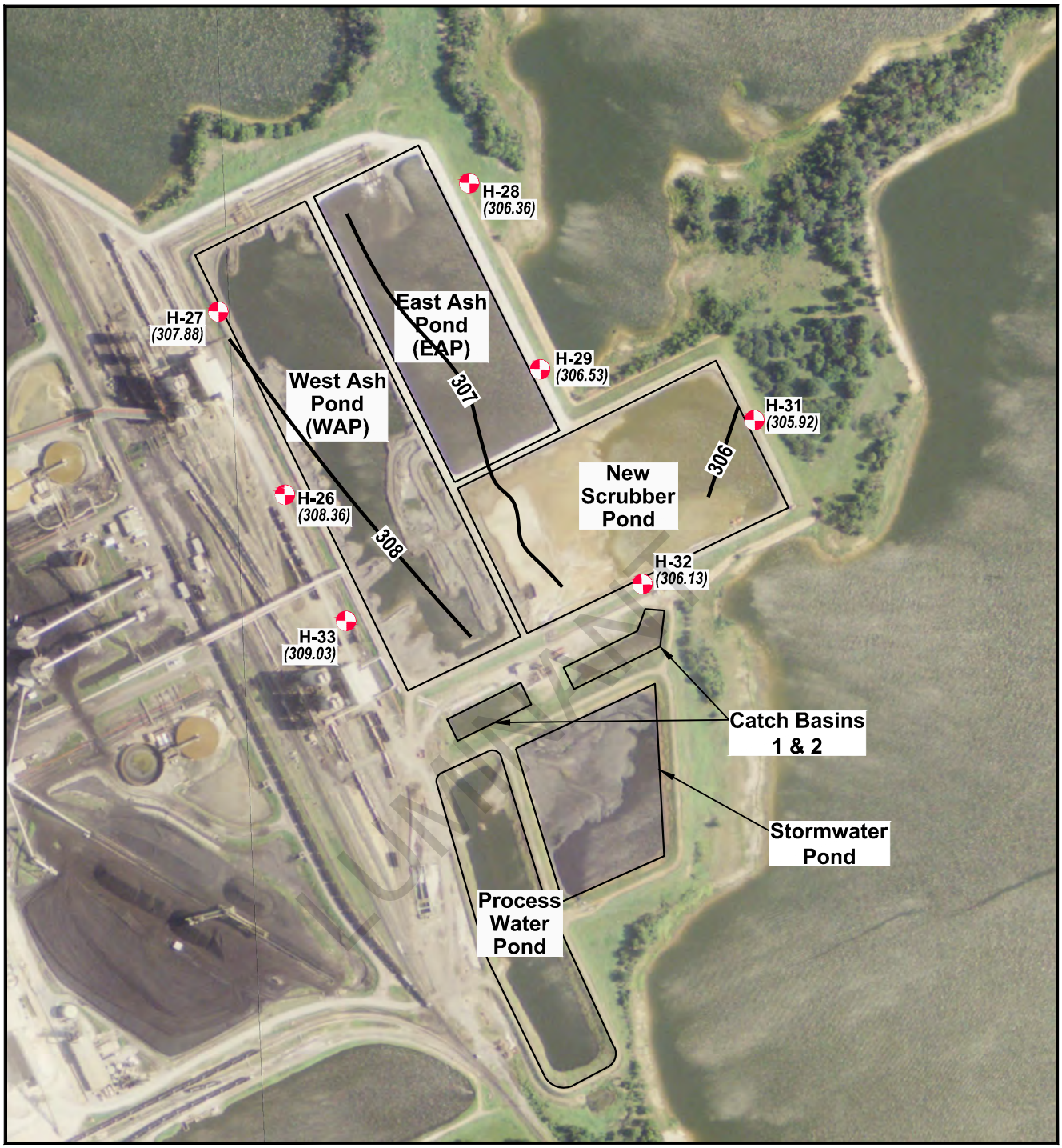
MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 3

ASH POND AREA - GROUNDWATER ZONE B POTENTIOMETRIC SURFACE MAP - FEBRUARY 25, 2016

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well Location
- (308.70) Groundwater Potentiometric Surface (ft. MSL)
- 308 Groundwater Potentiometric Surface Contour (C.I. = 1 ft.)

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

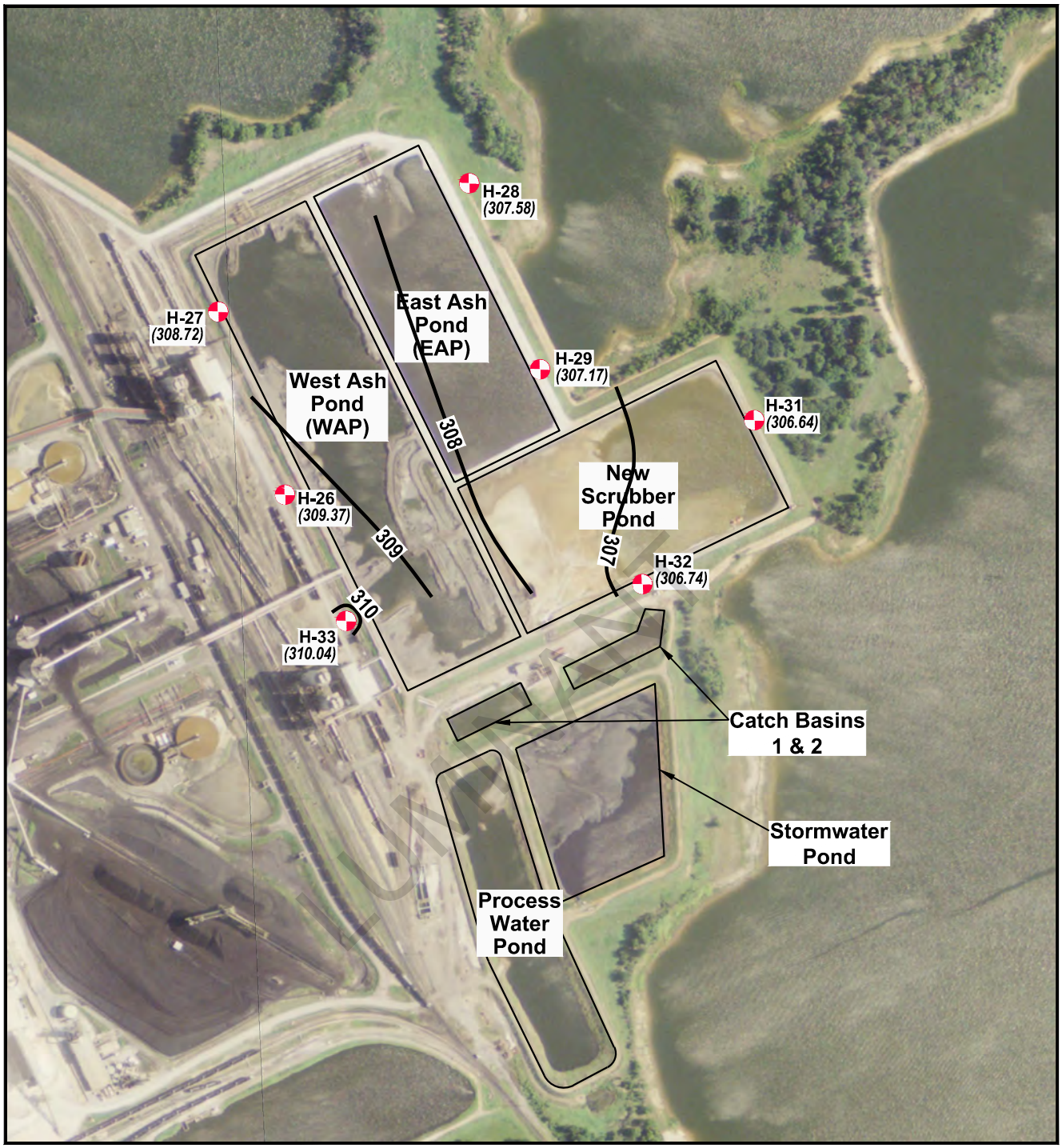
MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 4

ASH POND AREA - GROUNDWATER ZONE B POTENTIOMETRIC SURFACE MAP - APRIL 5, 2016

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well Location
- (308.70) Groundwater Potentiometric Surface (ft. MSL)
- —308— Groundwater Potentiometric Surface Contour (C.I. = 1 ft.)

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

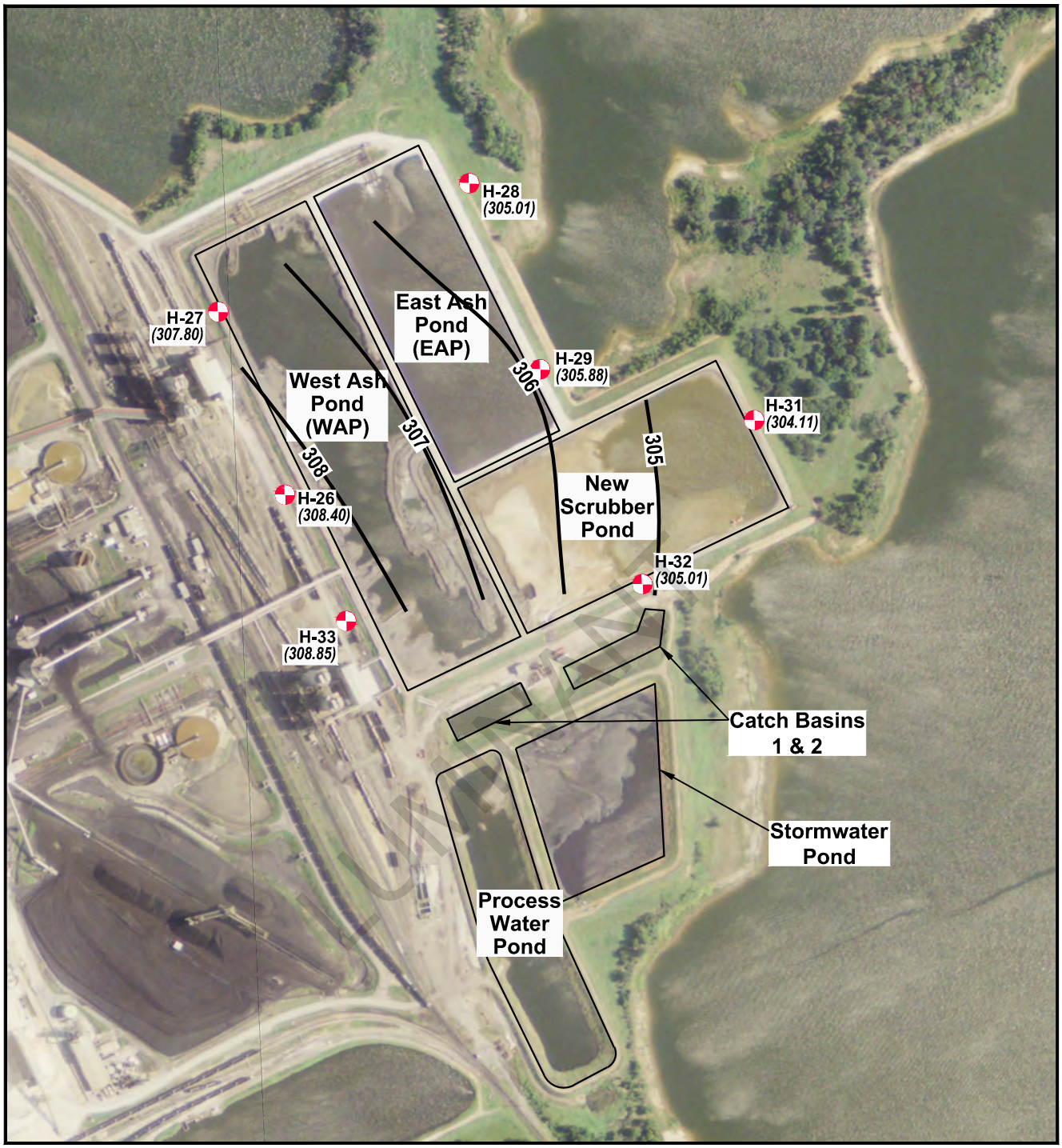
MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 5

ASH POND AREA - GROUNDWATER ZONE B POTENTIOMETRIC SURFACE MAP - JUNE 6, 2016

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well Location
- (308.70) Groundwater Potentiometric Surface (ft. MSL)
- 308 Groundwater Potentiometric Surface Contour (C.I. = 1 ft.)

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 6

ASH POND AREA - GROUNDWATER ZONE B POTENTIOMETRIC SURFACE MAP - AUGUST 9, 2016

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

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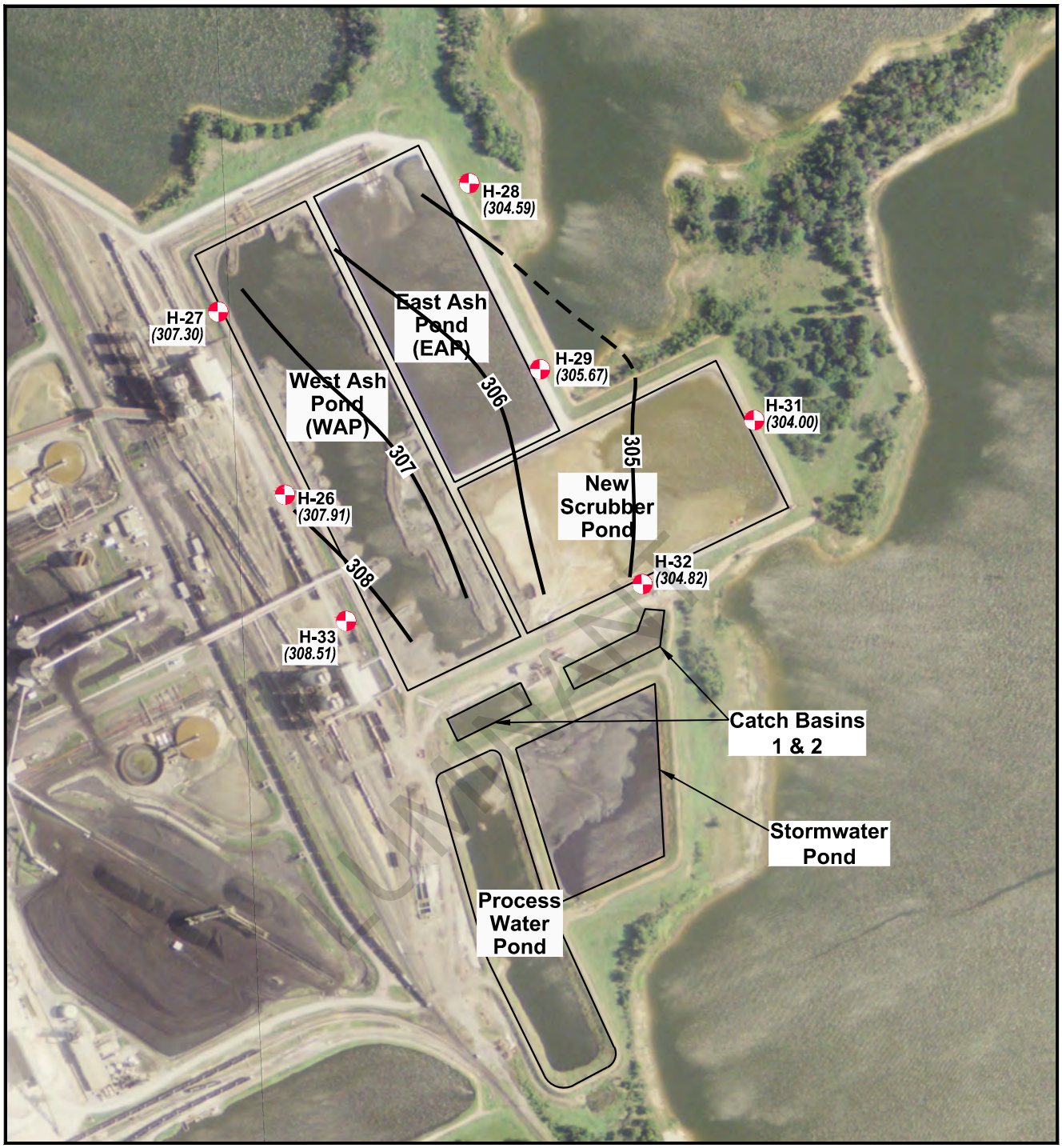


EXPLANATION

- CCR Monitoring Well Location
- (308.70) Groundwater Potentiometric Surface (ft. MSL)
- 308 Groundwater Potentiometric Surface Contour (C.I. = 1 ft.)

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

MARTIN LAKE STEAM ELECTRIC STATION

TATUM, TEXAS

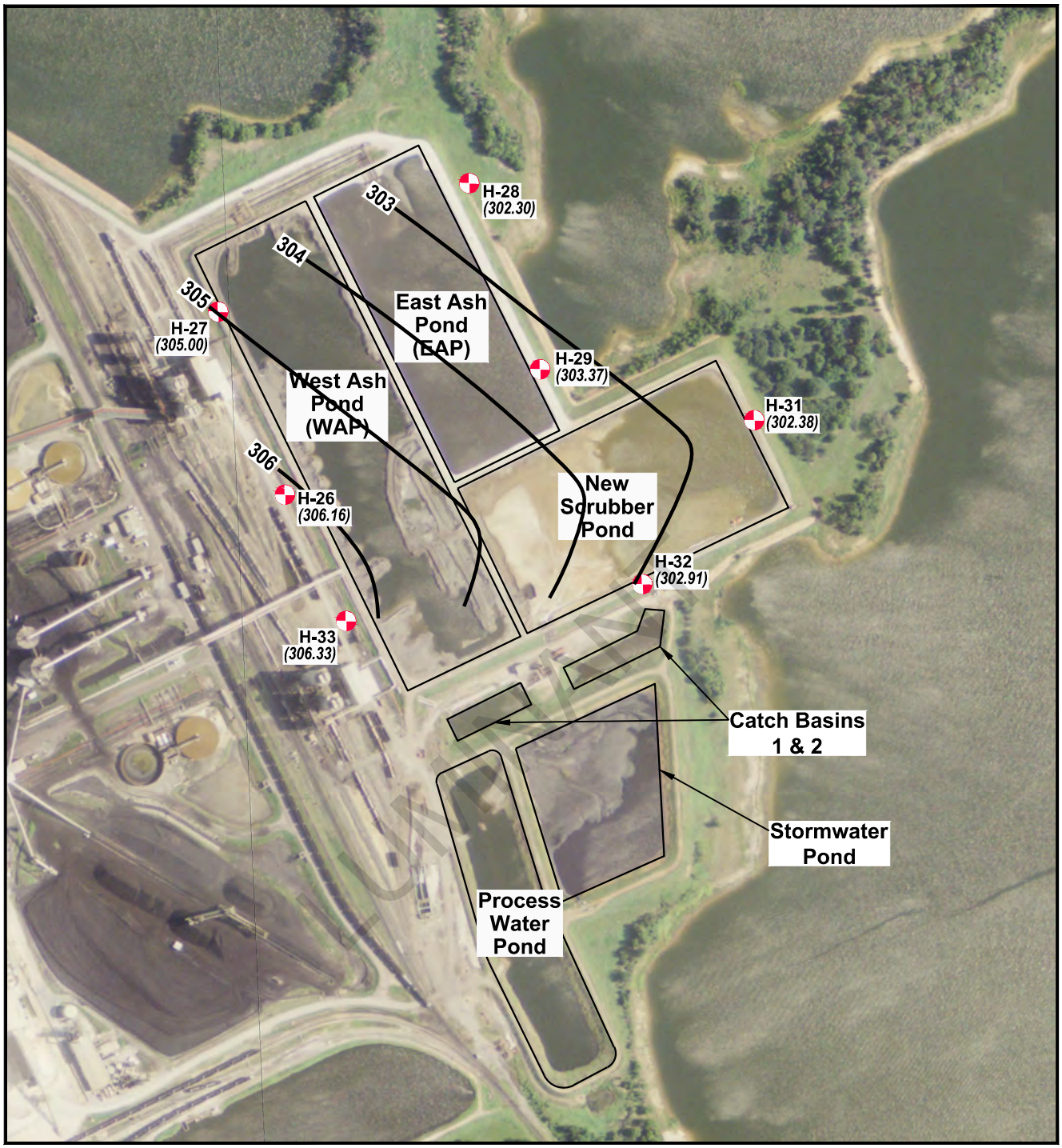
Figure 7

ASH POND AREA - GROUNDWATER ZONE B POTENTIOMETRIC SURFACE MAP - OCTOBER 17, 2016

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well Location
- (308.70) Groundwater Potentiometric Surface (ft. MSL)
- 308 Groundwater Potentiometric Surface Contour (C.I. = 1 ft.)

N

Scale in Feet

0 250 500

SOURCE: Imagery from www.tnris.gov, Rusk County, aerial photographs, 2012.

MARTIN LAKE STEAM ELECTRIC STATION
TATUM, TEXAS

Figure 8

ASH POND AREA - GROUNDWATER ZONE B POTENTIOMETRIC SURFACE MAP - DECEMBER 11, 2016

PROJECT: 5164B	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS