Inflow Design Flood Control System Plan
Dolet Hills Ash Basins 1 and 2

CLECO Corporation

Dolet Hills Power Station
Project No. 90965

Revision 0
10/13/2016

Inflow Design Flood Control System Plan
Dolet Hills Ash Basins 1 and 2

prepared for

CLECO Corporation
Dolet Hills Power Station
DeSoto Parish, Louisiana

Project No. 90965

Revision 0
10/13/2016

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

INDEX AND CERTIFICATION

CLECO Corporation
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Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Louisiana, that the information in this document was assembled under my direct supervisory control. This report is not intended or represented to be suitable for reuse by the CLECO Corporation or others without specific verification or adaptation by the Engineer.

Randell L Sedlacek (signature)

Randell L Sedlacek, P.E.
Louisiana License #38408

Date: 10/13/16

STATE OF LOUISIANA
RANDELL L. SEDLACEK
License No. 38408
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

Randell L Sedlacek (signature)
10/13/16

This document has been digitally sealed and signed. October 13, 2016.

TABLE OF CONTENTS

Page No.

LIST OF TABLES

Page No.

LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
ac	acre
BMcD	Burns & McDonnell
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
cfs	cubic feet per second
CLECO	CLECO Corporation
CY	cubic yard
Dolet Hills	Dolet Hills Power Station
ELG	Effluent Limitations Guidelines
EPA	Environmental Protection Agency
ft	feet
GPM	Gallons per Minute
hr	hour
in	inch
LDOTD	Louisiana Department of Transportation and Development
LPDES	Louisiana Pollutant Discharge Elimination System
LSU	Louisiana State University
MGD	Million Gallons per Day
min	minute
NAD 27	North American Datum of 1927
NAD 83	North American Datum of 1983

Abbreviation	Term/Phrase/Name
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
NRCS	Natural Resources Conservation Service
PFDS	Precipitation Frequency Data Server
RCRA	Resource Conservations and Recovery Act
SCS	Soil Conservation Service
U.S.C	United States Code
USDA	US Department of Agriculture

1.0 INTRODUCTION

On April 17, 2015, the Environmental Protection Agency (EPA) issued the final version of the federal Coal Combustion Residual (CCR) Rule to regulate the disposal of CCR materials generated at coal-fired units. The rule will be administered as part of the Resource Conservation and Recovery Act [RCRA, 42 United States Code (U.S.C.) §6901 et seq.], using the Subtitle D approach.

The existing CCR impoundments at CLECO Corporation's (CLECO's) Dolet Hills Power Station (Dolet Hills) are subject to the CCR Rule and as such must meet the hydrologic and hydraulic capacity requirements outlined in 40 Code of Federal Regulations (CFR) §257.82. This report serves as the inflow design flood control system initial plan for Ash Basins 1 and 2 at Dolet Hills.

This inflow design flood control system plan is in addition to, not in place of, any other applicable site permits, environmental standards, or work safety practices.

2.0 PLAN OBJECTIVES

Per 40 CFR §257.82, the inflow design flood control system initial plan must contain documentation (including supporting engineering calculations) that the inflow design flood control system has been designed and constructed to:

- Adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood,
- Adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood, and
- Handle discharge from the CCR surface impoundment in accordance with the surface water requirements described in 40 CFR §257.3-3.

Per 40 CFR §257.82(c)(5), CLECO must obtain certification from a qualified professional engineer that the inflow design flood control system plan, and subsequent updates to the plan, meet the requirements of 40 CFR §257.82. This sealed document serves as that certification.

3.0 EXISTING CONDITIONS

Dolet Hills is located east of Mansfield in DeSoto Parish, Louisiana. Dolet Hills contains two CCR surface impoundments, Ash Basin 1 and Ash Basin 2, which overflow to the Secondary Pond. A site plan is included in Appendix A. The existing ponds were constructed by following the natural topography of the area and building a single shared berm to form a cross-valley configuration. Intermediate berms separate Ash Basin 1 from the Secondary Pond, and the Secondary Pond from Ash Basin 2.

Bottom ash and economizer ash are sluiced to either Ash Basin 1 or Ash Basin 2, both of which gravity drain decant water to the Secondary Pond via an overflow structure and/or an auxiliary spillway. The Secondary Pond contains a pump structure which allows sluice water to be pumped back to the plant for reuse. Sluice water can also be discharged through an outlet pipe to Mundy Bayou via LPDES Outfall 002. The outlet pipe has a 36-inch diameter riser (top of riser elevation is 238 feet) with trash rack. According to the design documents included in Appendix B, the original impoundment operational conditions are as follows:

Table 3-1: Pond Operational Design Characteristics

Pond Operations	Ash Basin 1	Secondary Pond	Ash Basin 2	Unit
Top of Dike	256	246 (min)	246	ft
100-yr Water Level	254	239	244	ft
Auxiliary Spillway Crest	253.5	238	243.5	ft
Maximum Operating Level	251	-	240.5	ft
Maximum Ash Level	248	-	237.5	ft
Ash Capacity	256	-	256	ac-ft
Operating Water Depth	3	-	3	ft
Normal Operating Water Level	-	226.5	-	ft
Low Water Level	-	209	-	ft
Bottom of Pond	-	206	-	ft
Total Capacity	-	117	-	ac-ft
Live Storage	-	54	-	ac-ft
Rainfall Runoff Surge Capacity	-	63	-	ac-ft

When one of the two impoundments is close to reaching capacity, it is put offline and dewatered via the adjustable weir overflow structure. CCR material is then removed from the offline impoundment and hauled to the on-site landfill.

4.0 DESIGN BASIS / FLOOD CONTROL SYSTEM

4.1 Hazard Potential Classification

Per 40 CFR §257.73, CLECO has determined Dolet Hills Ash Basins 1 and 2 to be a low hazard potential CCR surface impoundments.

4.2 Inflow Design Flood System Criteria

4.2.1 Capacity Criteria

The CCR Rule requires CCR surface impoundments to have adequate hydrologic and hydraulic capacity to manage flows for the inflow design flood. For this analysis, the criteria was interpreted as being the top of the surface impoundment dike should not be overtopped during the inflow design flood event.

4.2.2 Freeboard Criteria

The CCR documentation discusses that operating freeboard must be adequate to meet performance standards, but a specific freeboard is not defined.

4.2.3 Flood Routing Design Criteria

The inflow design flood for this analysis was a 100-year flood event per 40 CFR §257.82(a)(3)(iii).

4.3 Project Mapping

Project mapping for this analysis consisted of an inventory of stormwater assets that contribute to the surface impoundment. Two primary sources of information were utilized: construction record drawings and survey data.

4.3.1 Mapping Sources

Survey data utilized included LIDAR topography from the Louisiana State University (LSU) Atlas Lidar Downloader, which was posted in February of 2008 and retrieved in January of 2016. Because contours from the LSU Atlas Lidar reflect time-specific conditions where the pond is partially full of ash, pre-construction topographical information was used to approximate contours within the pond area in order to determine stage / storage information for each pond. Pre-construction topographical information was based on the USGS Bayou Pierre Lake Quadrangle Map (1980) retrieved from the USGS topoView website (see Appendix B).

Construction record drawings of the surface impoundment were also utilized in the analysis.

4.3.2 Vertical Datum

Elevations shown on the existing drawings in Appendix B are in the National Geodetic Vertical Datum of 1929 (NGVD 29). Mapping sources referenced were in the North American Vertical Datum of 1988 (NAVD 88) and have been converted to NGVD 29.

4.3.3 Horizontal Coordinate System

Data from the LSU Atlas Lidar which was utilized as the basis for mapping and modeling efforts is in the Louisiana State Plane North, North American Datum of 1983 (NAD 83) coordinate system. Existing drawings are based on the plant grid coordinate system with the origin at N 498,700 and E 1,668,230 Louisiana State North, North American Datum of 1927 (NAD 27).

5.0 HYDROLOGIC AND HYDRAULIC CAPACITY

HEC-HMS 4.0 was used to model reservoir characteristics under the design storm event. Inputs to the HEC-HMS model were assumed to be as follows.

5.1 Pond Inflows

5.1.1 Runoff

5.1.1.1 Recurrence Interval and Rainfall Duration

The inflow flood design event for this study, as dictated by the hazard potential classification, was a 100-year flood event. Because a storm duration is not specified under 40 CFR §257.82 or other pertinent inflow flood design sections within the CCR Rule, a 24-hour storm duration was utilized.

5.1.1.2 Rainfall Distribution and Depth

The Soil Conservation Service (SCS) Type III rainfall distribution was used for computations associated with this evaluation. Precipitation data was acquired from the NOAA Precipitation Frequency Data Server (PFDS). Precipitation depth for the inflow design flood event is 11.1 inches.

5.1.1.3 Subbasin Characteristics

Calculations were determined based on the watershed parameters shown in Table 5-1. Refer to Appendix C for more detailed calculations.

Table 5-1: Watershed Runoff Calculated Data for Dolet Hills Ash Basins 1 and 2

Component	Value		Unit
	Ash Basin 1	Ash Basin 2	
Watershed Area	122.0	118.8	ac
SCS Storm Depth: 100-yr, 24-hr	11.1	11.1	in
Weighted Curve Number	81	77	-
Initial Abstraction	0.469	0.597	in
Time of Concentration	51.01	50.48	min
Basin Lag Time	30.60	30.29	min

5.1.2 Process Flows

The ponds were modeled under a conservative condition whereby approximately half of the pond area is completely full of CCR material (no available runoff storage) and the remaining half is full of sluice water and/or CCR material up to the maximum operating level prior to the storm event.

When conducting the hydraulic analysis, it was assumed the ponds are maintained at the auxiliary spillway elevation for Ash Basins 1 and 2 and at the normal operating level for the Secondary Pond. All runoff into the ponds is considered additional flow above these levels.

All sluice water routed to Ash Basins 1 and 2 is supplied from the Secondary Pond. The maximum sluice flow is 3,500 GPM for approximately 12 hours per day; however, since there is no net increase in water level within the pond system and because of the conservative initial water levels included in this analysis, this flow was not modeled as part of this calculation.

5.2 Pond Outflows

Under the modeled conditions, Ash Basins 1 and 2 will overflow to the Secondary Pond via the auxiliary spillways; it was assumed that the adjustable weir overflow structures are plugged or inoperable over the duration of the storm event. The auxiliary spillways have 20-foot bottom widths with 10H:1V side slopes. Flow through each spillway is channelized to the Secondary Pond via trapezoidal channels with 20-foot bottom widths, approximately 6H:1V bottom slopes, and 3H:1V side slopes.

Overflow into the Secondary Pond was assumed to discharge to Mundy Bayou via the outlet pipe (Outfall 002). Stage discharge information was included for the outlet pipe in the Secondary Pond. Flow was modeled through the trash rack using Neenah Foundry's Weir & Orifice Calculator[1] with the trash rack modeled as a Neenah 4370-26: G grate. Stage discharge information is included in Table 5-2.

Table 5-2: Secondary Pond Stage-Discharge Data

EL	Head (ft)	Q (cfs)
238	0	0
239	1	13.5
240	2	19.1
241	3	23.4
242	4	27.0
243	5	30.1
244	6	33.0
245	7	35.7
246	8	38.1

[1] **Neenah Enterprises, Inc.** Resources. *Weir & Orifice Calculator*. [Online]. [Cited: April 21, 2016.] http://www.nfco.com/municipal/resources/weir-orifice-calculator.

6.0 RESULTS

Ponds were modeled for a 100-year, 24-hour storm event with initial elevations set at the maximum operating level or normal operating level, as applicable, and overflow into the Secondary Pond allowable via the auxiliary spillway at each pond. For the purpose of the model, the adjustable weir overflow structures between the Ash Basins and the Secondary Pond were assumed to be plugged or inoperable.

Under the modeled conditions, Ash Basins 1 and 2 were able to control runoff from the design storm event and convey it to the Secondary Pond without overtopping, and the Secondary Pond was able to accept runoff from the 100-year, 24-hour storm in addition to overflow from Ash Basins 1 and 2 without overtopping. The results of the modeled conditions are as follows:

Table 6-1: Modeled Pond Conditions – Ash Basin 1

Component	Property	Value	Unit
Subbasin Watershed	Peak Discharge	531.7	cfs
	Runoff Volume	8.7	in
Reservoir Ash Basin 1 - 50% full of ash	Initial EL	251.0	ft
	Peak Inflow	531.7	cfs
	Peak Discharge	99.0	cfs
	Peak Elevation	254.9	ft
	Peak Storage (above initial EL)	55.6	ac-ft

Table 6-2: Modeled Pond Conditions – Ash Basin 2

Component	Property	Value	Unit
Subbasin Watershed	Peak Discharge	494.7	cfs
	Runoff Volume	8.2	in
Reservoir Ash Basin 2 - 50% full of ash	Initial EL	240.5	ft
	Peak Inflow	494.7	cfs
	Peak Discharge	54.3	cfs
	Peak Elevation	244.4	ft
	Peak Storage (above initial EL)	56.6	ac-ft

See Appendix C for details of calculations.

It is recommended that the ponds are operated in a manner similar to the prescribed design conditions; however, as long as the ponds are maintained in a condition at or below the conservatively modeled scenario the ponds will manage flow into and out of the CCR unit during and following the peak discharge of the inflow design flood.

After a significant storm event, excess water from Ash Basins 1 and 2 can be drained to the Secondary Pond via the overflow structures. Excess water collected in the Secondary Pond can be pumped back to the plant using the existing pump structure or discharged via Outfall 002.

7.0 PERIODIC ASSESSMENT AND AMENDMENT

CLECO must place the initial plan in the CCR Operating Record by October 17, 2016. After the initial plan is published in the Operating Record, periodic inflow design flood control system plans will be required every five years. CLECO may publish revised plans at shorter intervals, noting, however, the deadline for publishing the next revision will be maintained as five years after publish of the previous revision. CLECO may amend the plan at any time, and is required to do so whenever there is a change in conditions which would affect the current plan. All amendments and revisions must be placed on the CCR public website. A record of revisions made to this document is included in Section 8.0.

8.0 RECORD OF REVISIONS AND UPDATES

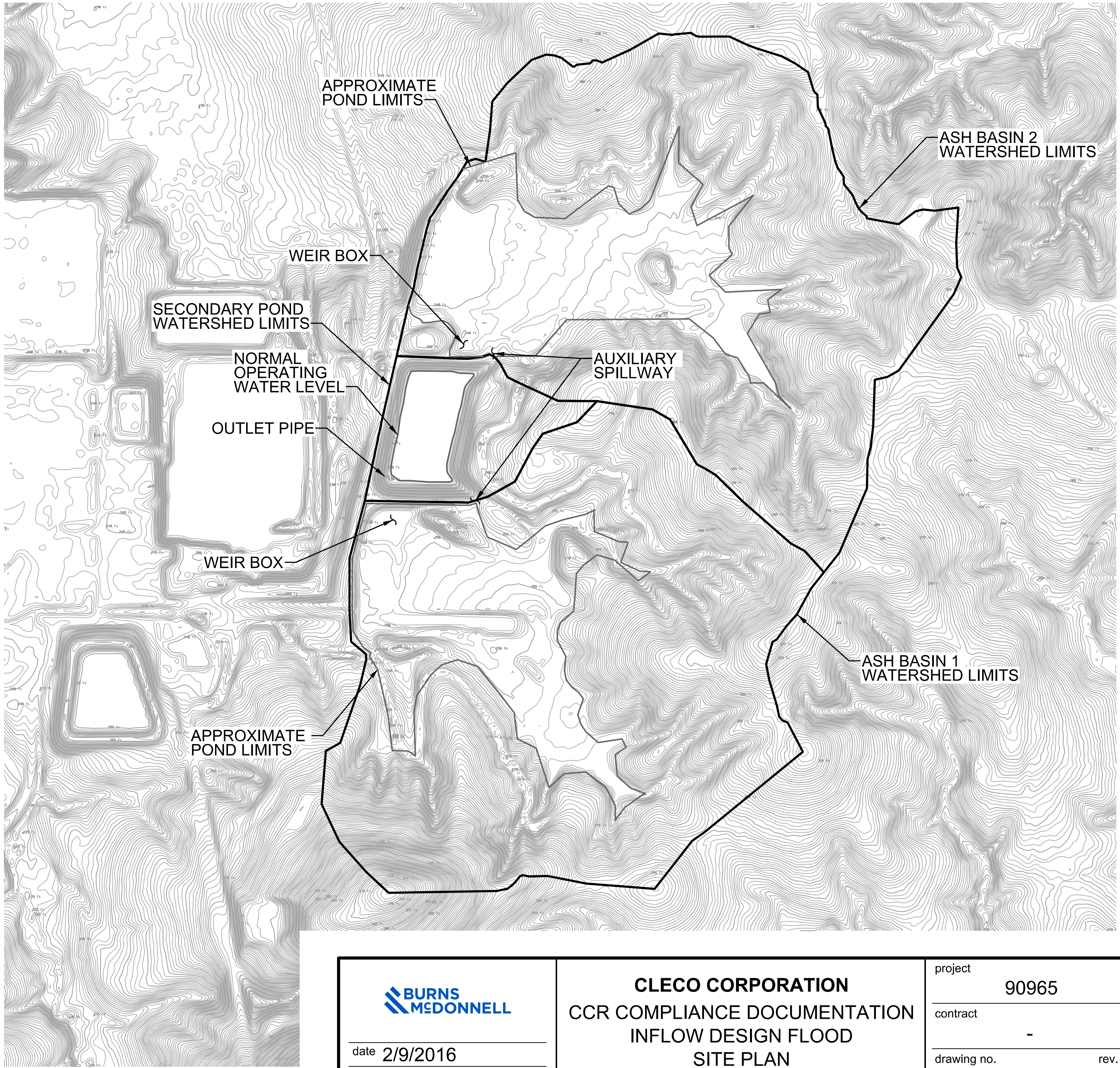
Revision Number	Date	Revisions Made	By Whom
0	10/13/2016	Initial Issue	Burns & McDonnell

APPENDIX A – SITE PLAN

NOTES:

1. EXISTING CONTOURS PER LOUISIANA STATE UNIVERSITY ATLAS LIDAR DOWNLOADER, RETRIEVED JANUARY 2016
2. ASH BASIN EXISTING OPERATING CHARACTERISTICS ARE AS FOLLOWS:

	WATERSHED AREA (AC)	MAX OPERATING LEVEL (FT)
ASH BASIN 1	122.6	251
SECONDARY POND	15.2	226.5
ASH BASIN 2	115.8	240.5



N

0 600' 1200'
SCALE IN FEET

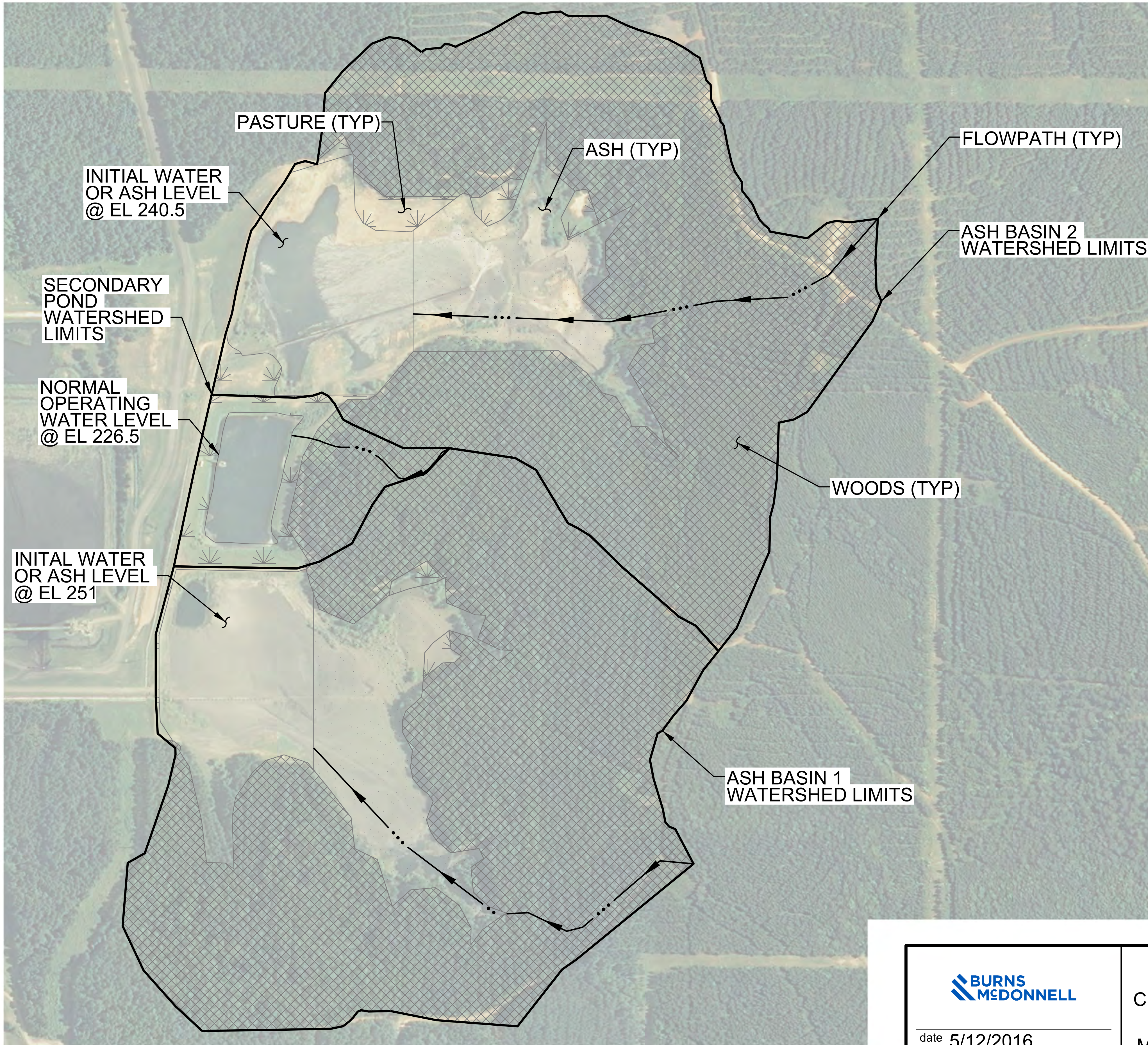
BURNS McDONNELL

date 2/9/2016
designed A. MYERS

CLECO CORPORATION
CCR COMPLIANCE DOCUMENTATION
INFLOW DESIGN FLOOD
SITE PLAN

project 90965
contract -
drawing no. **SK - CIVIL - 001** rev. **0**

10/11/2016 Z:\Clients\ENR\Cleco\90965_CCRDocuments\Design\Civil\Dwgs\Sketches\Inflow Flood\SK-DH-001.dgn

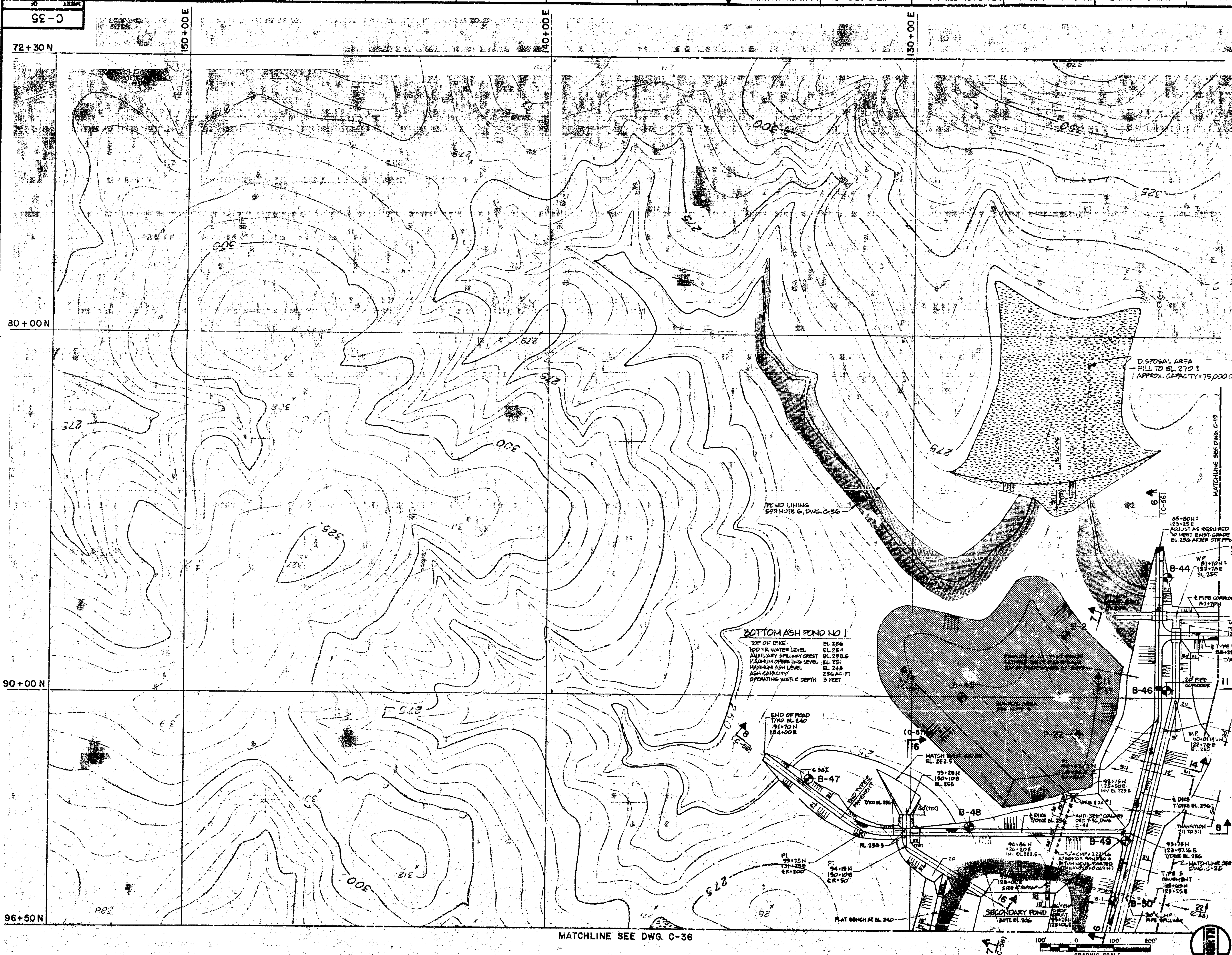


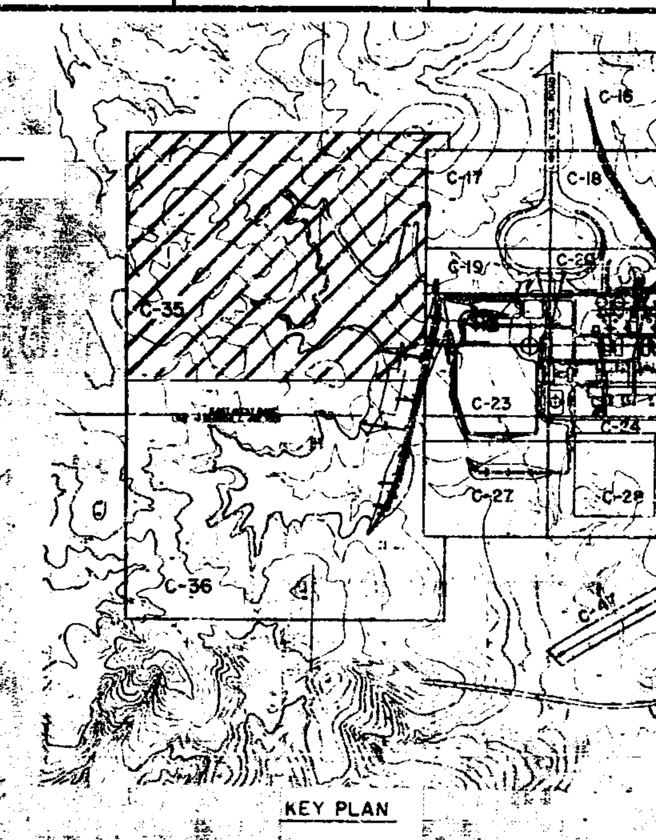
NOTES:

1. AS A CONSERVATIVE ESTIMATE, IT WAS ASSUMED APPROXIMATELY HALF THE ASH BASIN IS FILLED WITH ASH UP TO THE TOP OF THE DIKE AT THE TIME OF THE STORM EVENT. TIME OF CONCENTRATION WAS ESTIMATED BY ASSUMING A 1% SLOPE ACROSS THE FULL PORTION OF THE POND.

BURNS McDONNELL date 5/12/2016 designed A. MYERS	**CLECO CORPORATION** CCR COMPLIANCE DOCUMENTATION INFLOW DESIGN FLOOD MODELED CONDITIONS FOR START OF STORM EVENT	project 90965 contract - drawing no. **SK - CIVIL - 002** rev. **0**

APPENDIX B – EXISTING DRAWINGS





LEGEND

- BORROW AREAS
- TOPSOIL AND RED CLAY DISPOSAL AREAS
- AREAS THAT REQUIRE LINING

NOTES

1. TOPSOIL AND RED EXPANSIVE CLAY DISPOSAL AREAS:
   CLEAN TOPSOIL SHALL BE STOCKPILED IN THE DISPOSAL AREAS IN A MANNER WHICH WILL FACILITATE ITS REMOVAL AT A LATER DATE FOR USE IN COVERING AND SEEDING EMBANKMENT AND DIKE SLOPES FOR EROSION PROTECTION. AFTER COMPLETION OF THE EROSION PROTECTION WORK, GRADE EACH DISPOSAL AREA TO DRAIN, SPREAD 4" OF TOPSOIL OVER EXPOSED RED CLAY, AND SEED THE ENTIRE AREA.
2. FOR GENERAL NOTES SEE DRAWING C-10.
3. BORROW AREA:
   DRAWING C-14A PRESENTS AN ESTIMATE OF THE VOLUME OF CLAY BORROW REQUIRED. IT IS ESTIMATED THAT EXCAVATION TO EL. 208 IS REQUIRED TO OBTAIN THAT MATERIAL.

REFERENCE DRAWINGS

C-10	DRAWING INDEX, LEGEND & GENERAL NOTES
C-36	ASH POND GRADING PLAN - SHEET 2
C-56	ASH PONDS - SECTIONS & DETAILS - SHEET 1
C-57	ASH PONDS - SECTIONS & DETAILS - SHEET 2
C-1	BORING LOCATION PLAN
C-14A	MASS EARTHWORK PLAN - SPEC. H-5333.
C-43	DRAINAGE DETAILS
C-58	ASH PONDS - SECTIONS & DETAILS - SHEET 3

DRAWING RELEASE RECORD

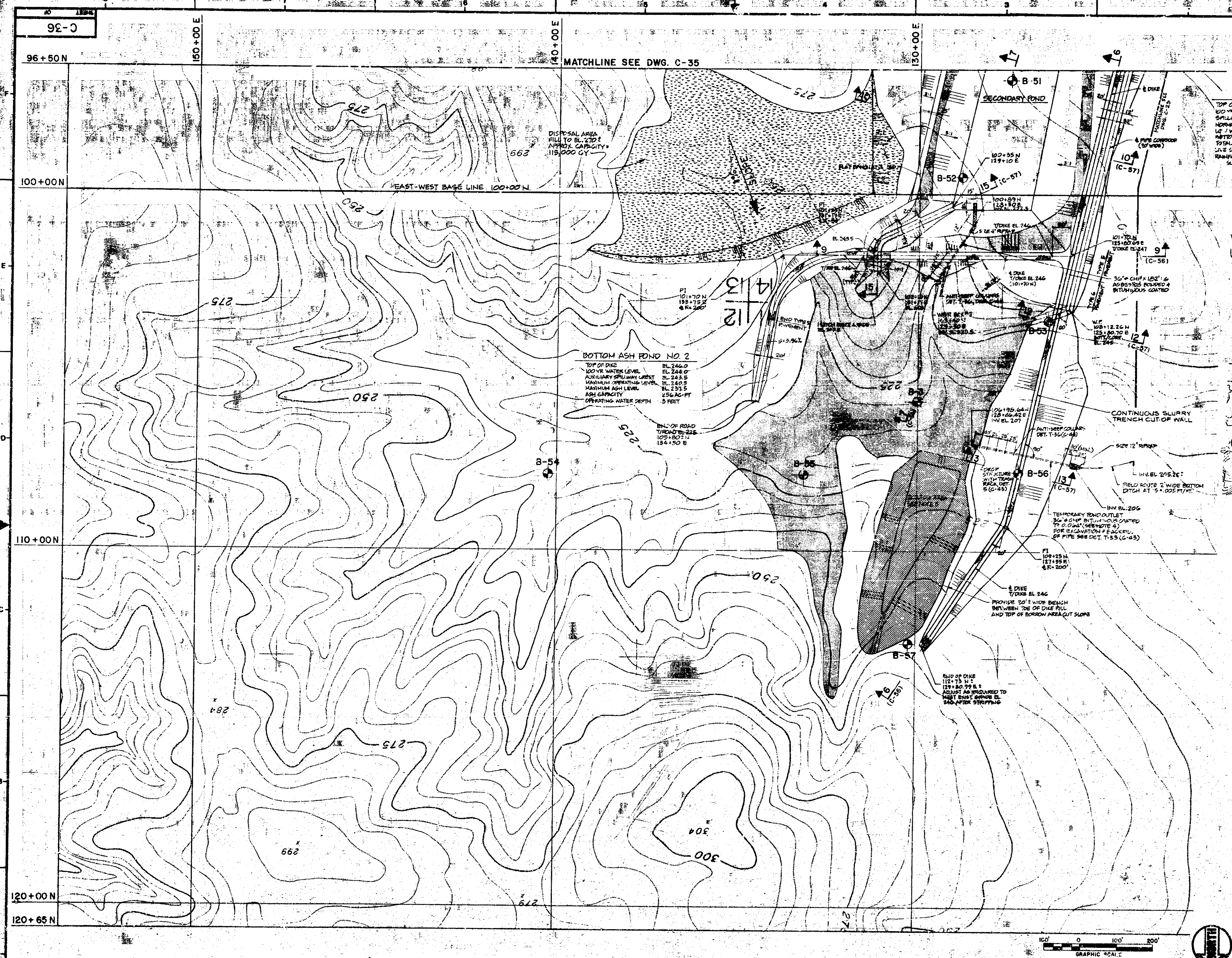
REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	11-1-81	[illegible]			FOR BID REFERENCE, SPEC. H-5370	✓

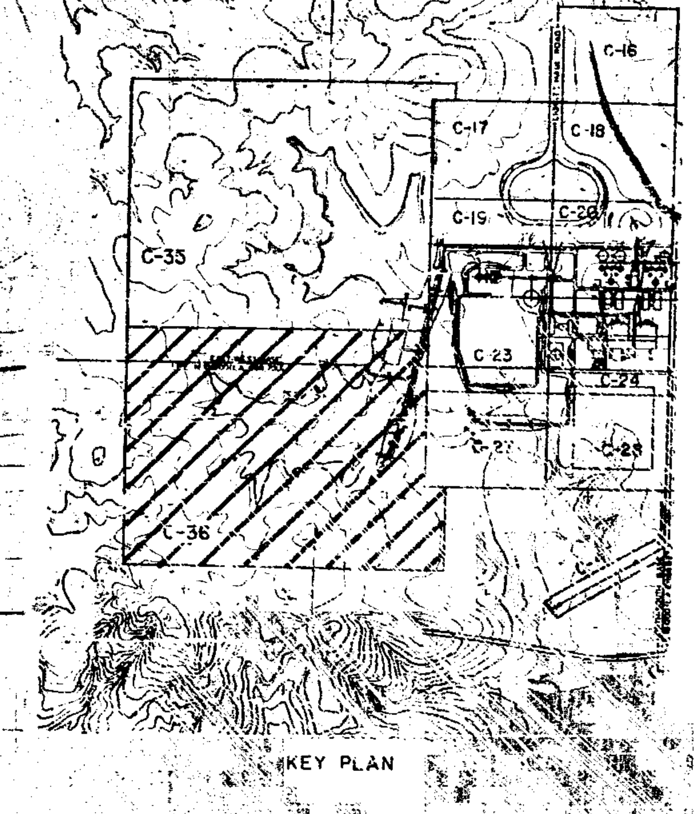
SCALE	1" = 100'-0"
PROJECT NUMBER	5803-03

ASH POND GRADING
PLAN - SHEET 1
DOLET HILLS POWER PLANT UNIT NO. 1
SOUTHWESTERN ELECT. POWER CO.
CENTRAL LOUISIANA ELECT. CO., INC.
NABORTON, LOUISIANA

SARGENT & LUNDY
ENGINEERS
CHICAGO

DRAWING NO. C-35 REV. A
SHEET OF





NOTES

1. FOR GENERAL NOTES SEE DRAWING C-10
2. FOR LEGEND SEE DRAWING C-35.
3. BORROW AREA - CUT TO DEPTH NECESSARY TO BORROW REQUIRED VOLUME OF CLAY FOR LINING FOR INTERIOR OF ASH POND NO. 2. IT IS ESTIMATED THAT EXCAVATION TO EL. 203 IS NECESSARY TO OBTAIN THAT MATERIAL. CONSULT PURCHASER IF EXCAVATION BELOW EL. 203 IS REQUIRED.
4. THE TEMPORARY POND OUTLET WILL BE USED TO DISCHARGE CLEAN STORM RUNOFF FROM ASH POND NO. 2 UNTIL THAT POND IS USED TO STORE ASH. JUST PRIOR TO PLACING THE POND INTO OPERATION. THE TEMPORARY OUTLET SHALL BE FILLED WITH LEAN GROUT.

REFERENCE DRAWINGS

C-10.	DRAWING INDEX, LEGEND & GENERAL NOTES
C-35	ASH POND GRADING PLAN - SHEET 1
C-56	ASH PONDS - SECTIONS & DETAILS SHEET 1
C-57	ASH PONDS - SECTIONS & DETAILS SHEET 2
C-1	BORING LOCATION PLAN
C-43	DRAINAGE DETAILS

DRAWING RELEASE RECORD

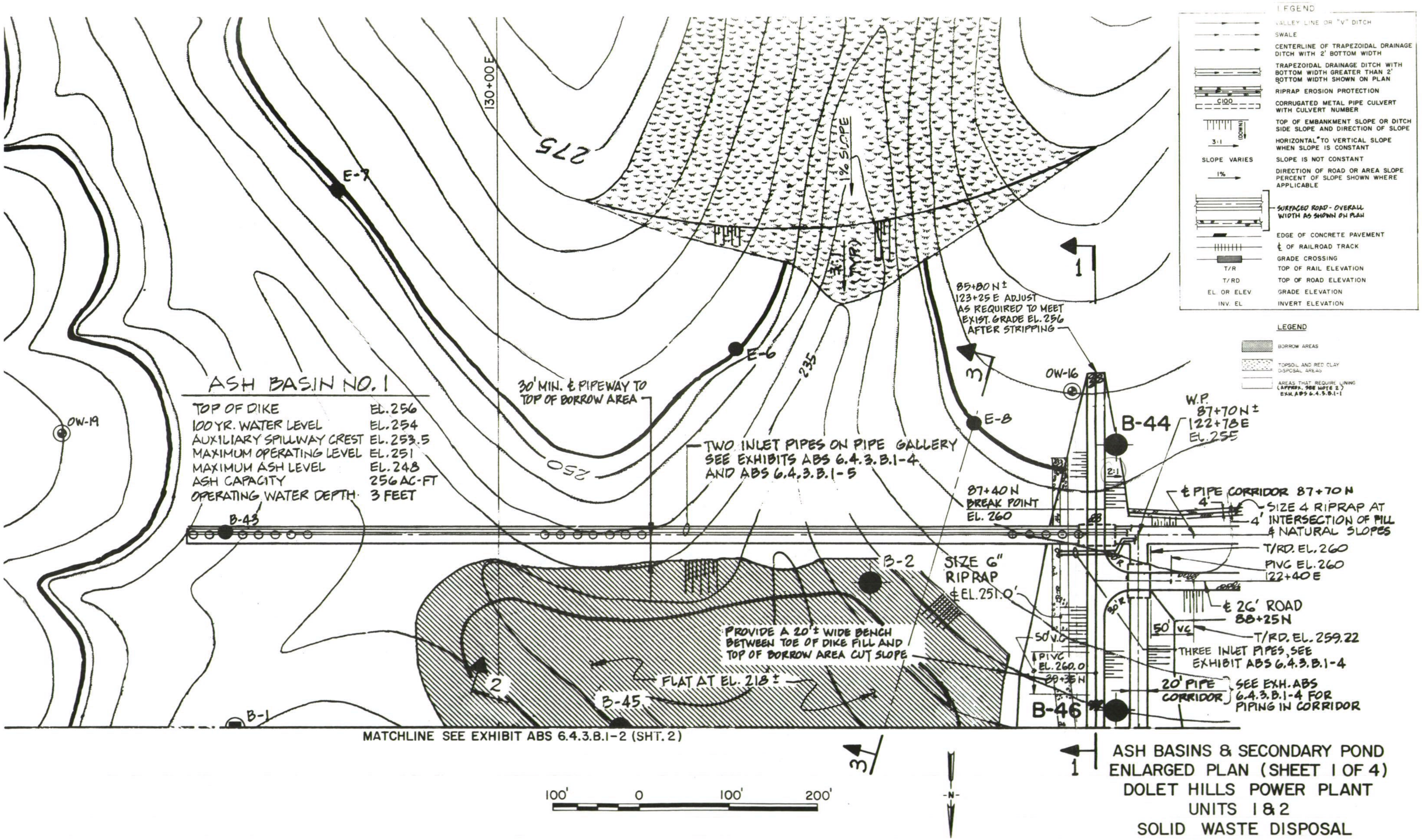
REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
A	11-1-81	[illegible]			FOR BID REFERENCE, SPEC. H-5370	X

SCALE 1" = 100'-0"
PROJECT NUMBER 5803-03

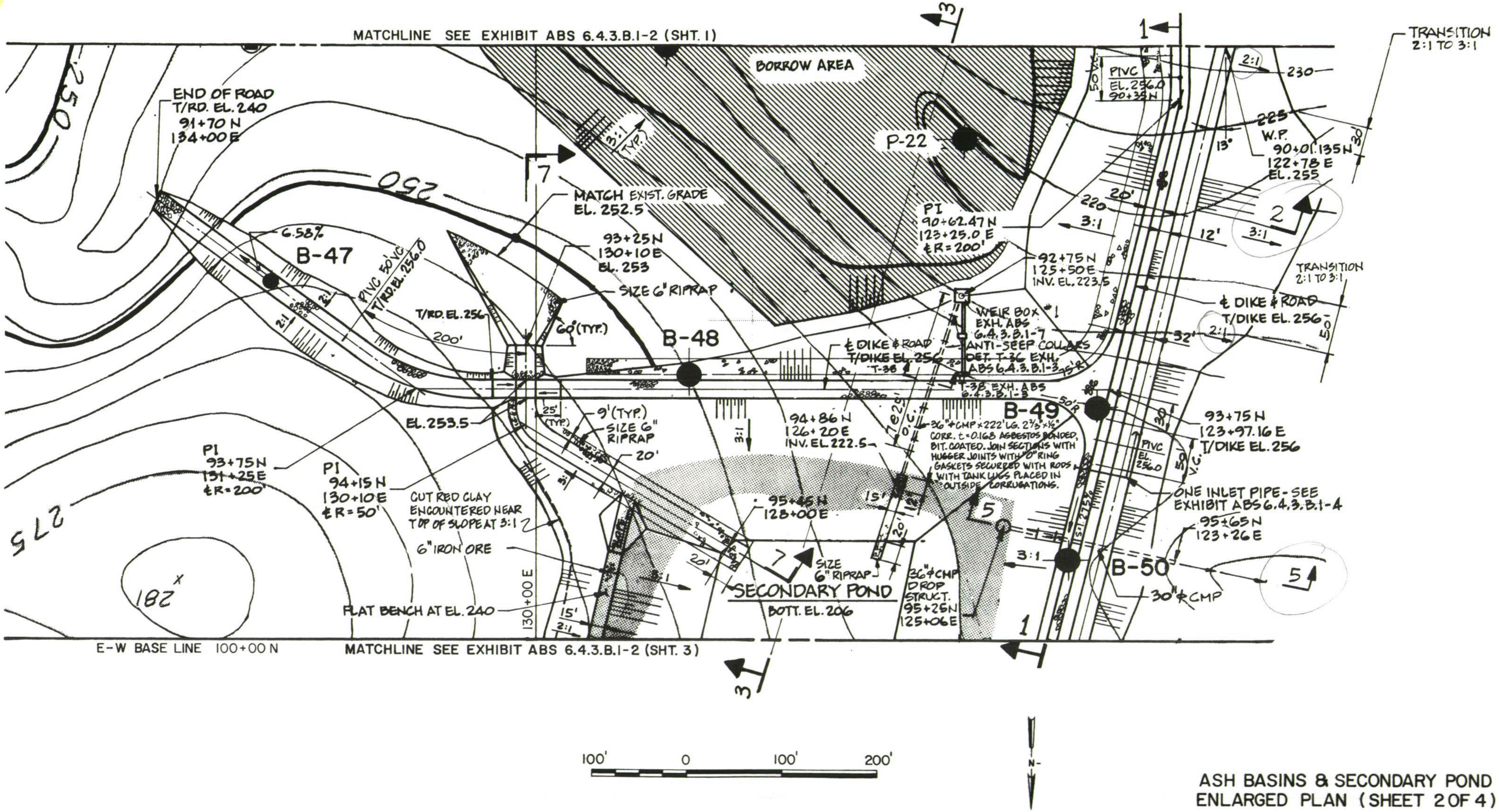
ASH POND GRADING
PLAN - SHEET 2
DOLET HILLS POWER PLANT UNIT NO. 1
SOUTHWESTERN ELECT. POWER CO.
CENTRAL LOUISIANA ELECT. CO., INC.
NABORTON, LOUISIANA

SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO. C-36 REV. A
SHEET OF

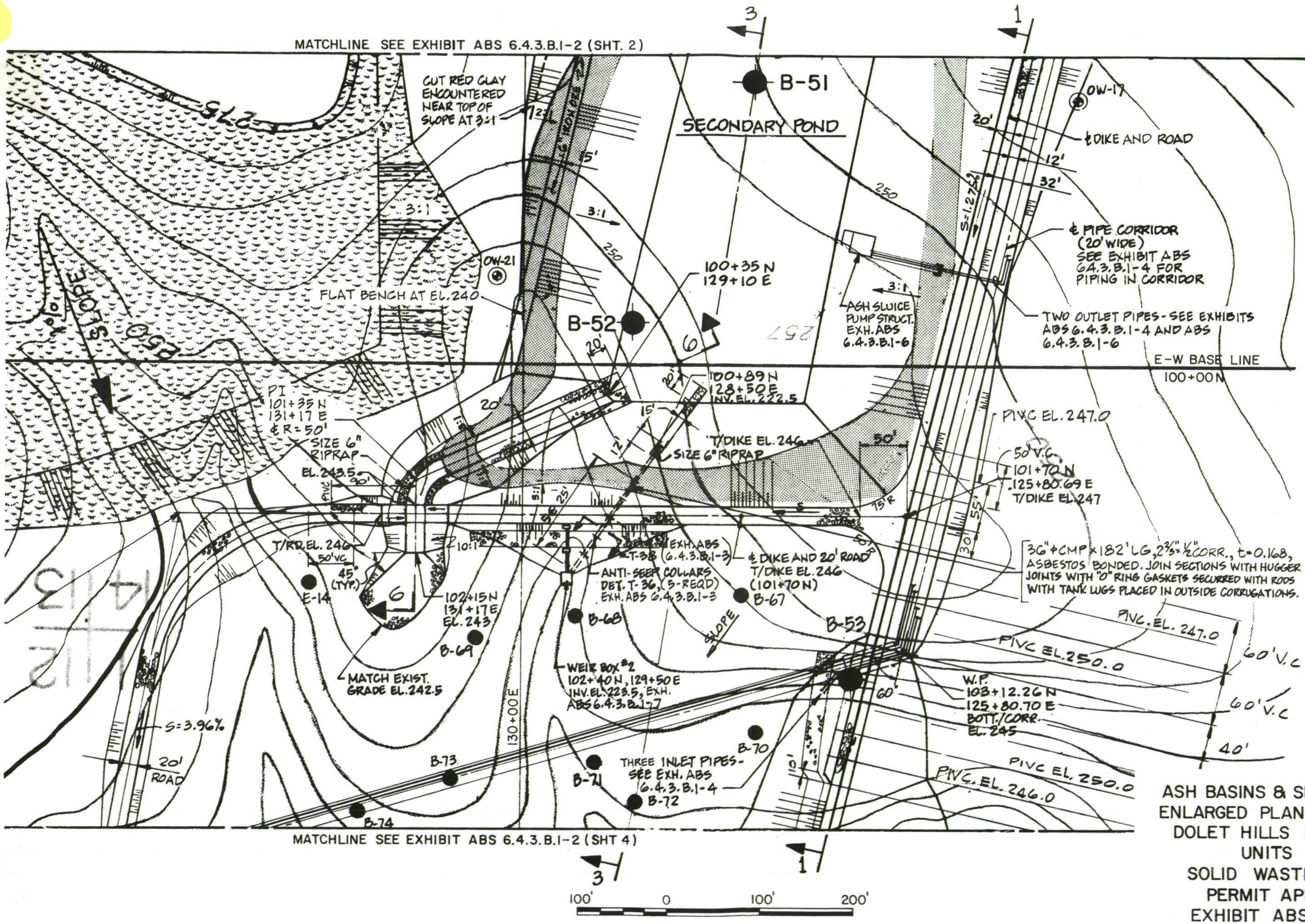


ASH BASINS & SECONDARY POND
ENLARGED PLAN (SHEET 1 OF 4)
DOLET HILLS POWER PLANT
UNITS 1 & 2
SOLID WASTE DISPOSAL
PERMIT APPLICATION
EXHIBIT ABS 6.4.3.B.1-2

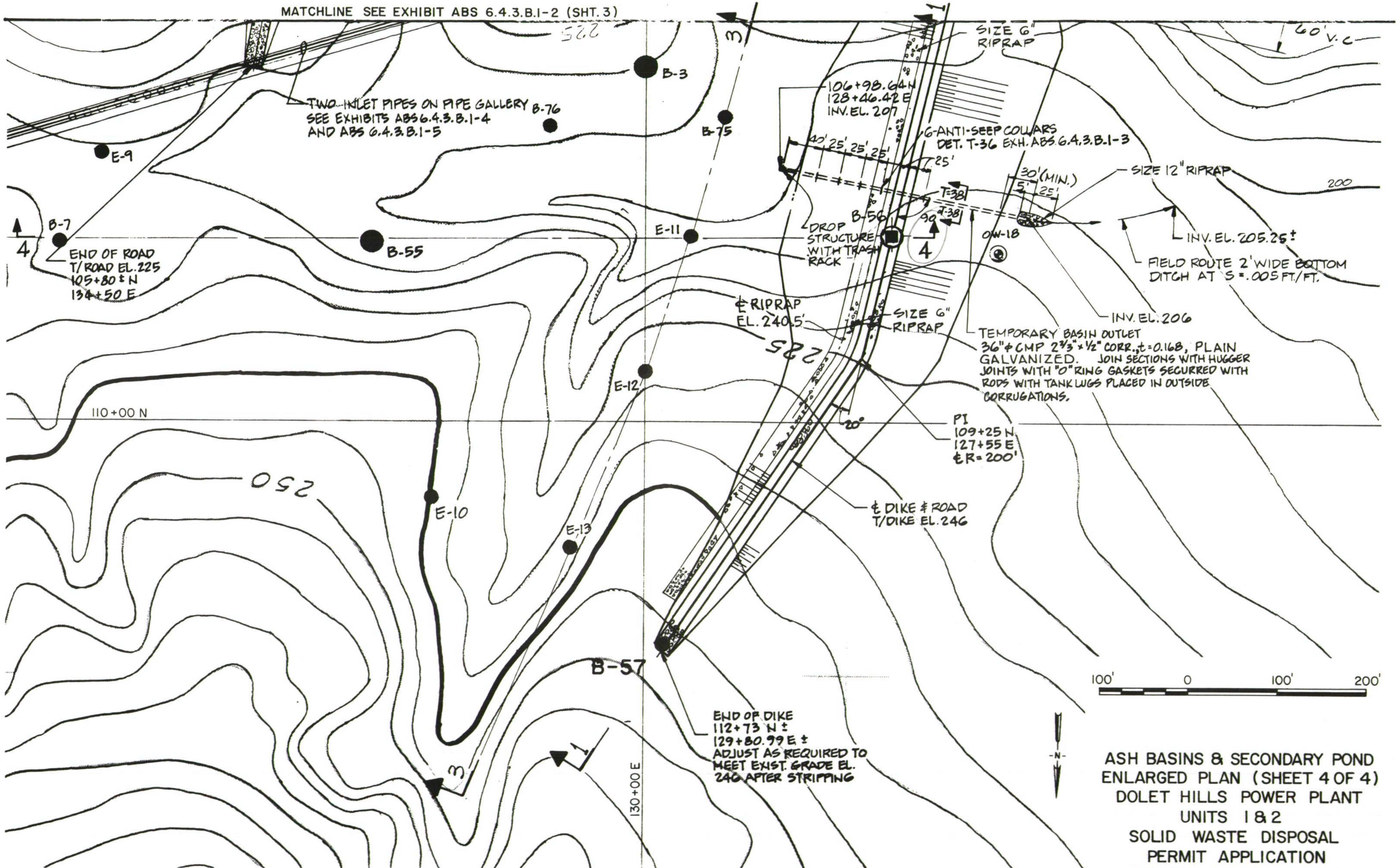


ASH BASINS & SECONDARY POND
ENLARGED PLAN (SHEET 2 OF 4)
DOLET HILLS POWER PLANT
UNITS 1 & 2
SOLID WASTE DISPOSAL
PERMIT APPLICATION
EXHIBIT ABS 6.4.3.B.1-2

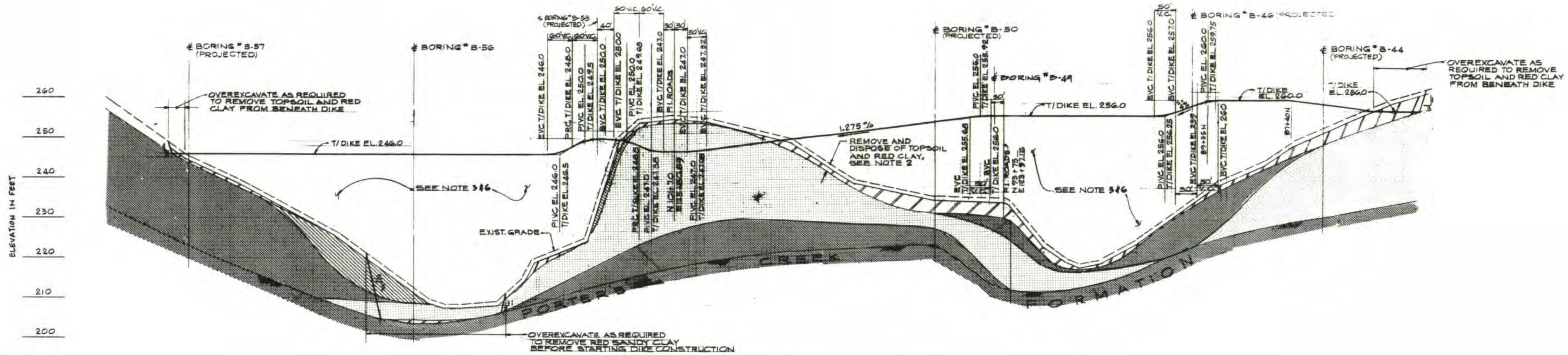
ABS-4



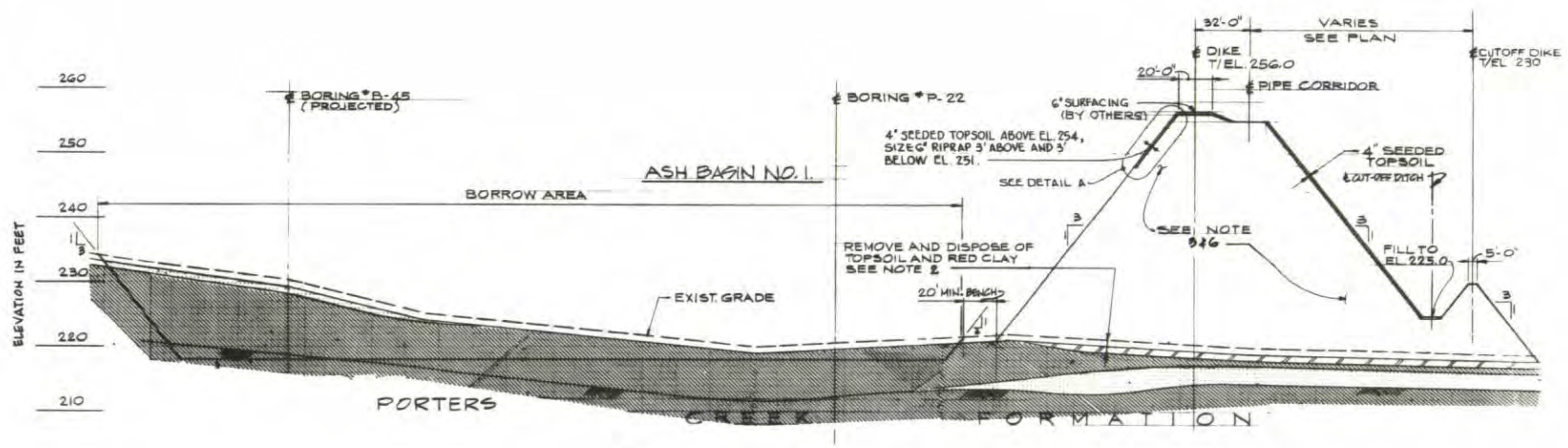
ASH BASINS & SECONDARY POND
ENLARGED PLAN (SHEET 3 OF 4)
DOLET HILLS POWER PLANT
UNITS 1 & 2
SOLID WASTE DISPOSAL
PERMIT APPLICATION
EXHIBIT ABS 6.4.3.B.1-2



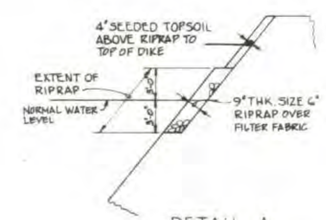
ASH BASINS & SECONDARY POND
ENLARGED PLAN (SHEET 4 OF 4)
DOLET HILLS POWER PLANT
UNITS 1 & 2
SOLID WASTE DISPOSAL
PERMIT APPLICATION
EXHIBIT ABS 6.4.3.B.1-2



SECTION 1



SECTION 2



DETAIL A
(TYPICAL FOR ASH PONDS NO. 1 & 2)

LEGEND

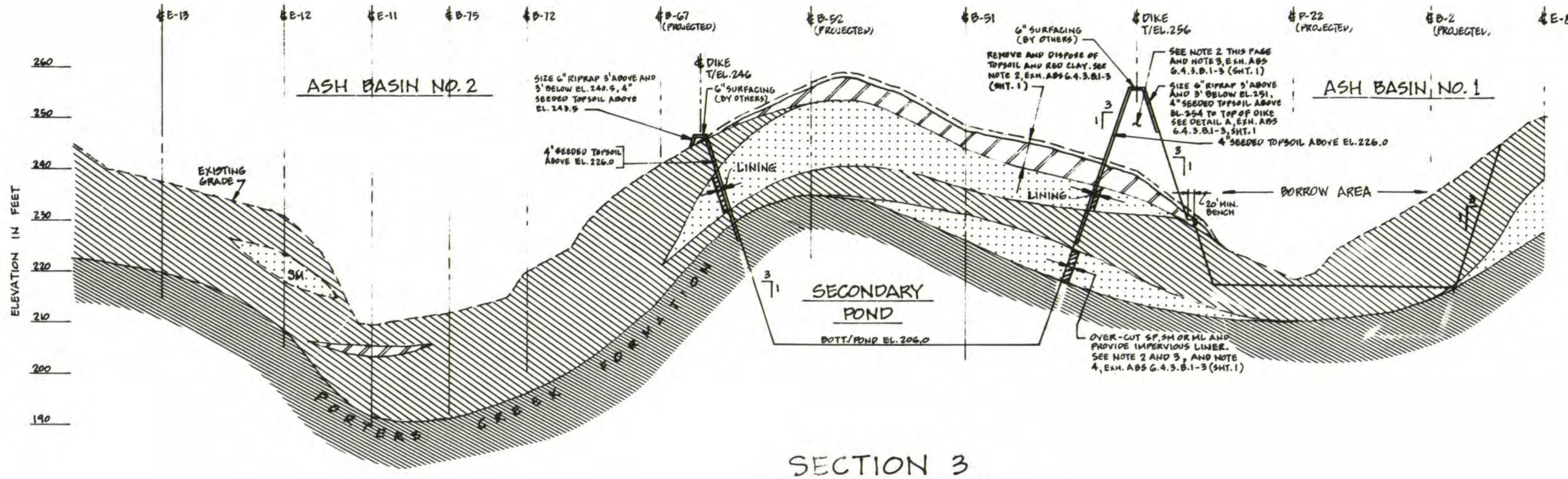
- CL OR CH - RED CLAY
- SP, SM OR ML - BROWN, SILTY FINE SAND TO SANDY SILT
- CL OR SC - GRAY, ORANGE SANDY SILTY CLAY
- CL - GRAY, HARD SILTY CLAY

NOTE:
SECTIONS OBTAINED FROM S&L DWGS. C-56 & C-57

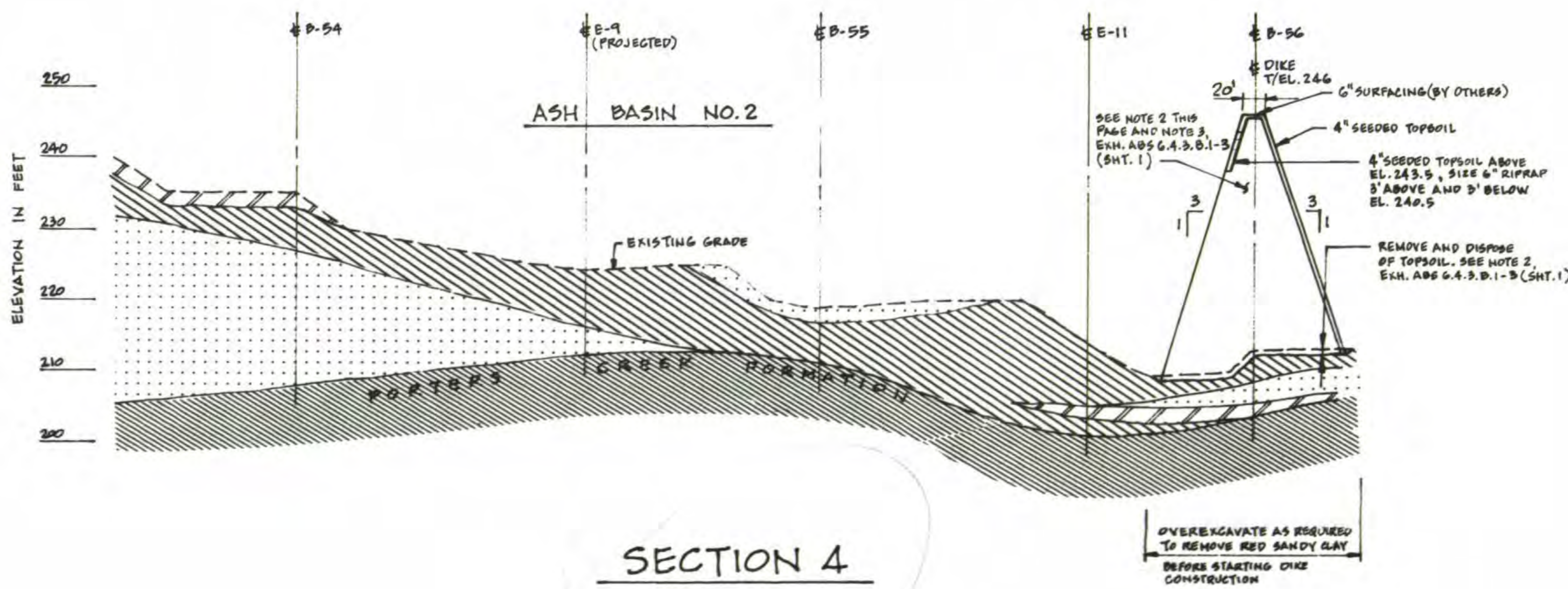
NOTES

1. SUBSURFACE CONDITIONS.
   THE SUBSURFACE CONDITIONS SHOWN IN SECTION 1 AND 2 ARE APPROXIMATE AND SHOULD BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
2. TOPSOIL AND RED CLAY SPOILS
   DISPOSAL AREAS FOR TOPSOIL AND RED CLAY SPOILS ARE SHOWN ON EXH. ABS 6.4.3.B.1-1
3. COHESIVE SOILS FOR DIKE CONSTRUCTION AND LININGS
   COHESIVE SOIL USED FOR DIKE CONSTRUCTION AND FOR IMPERVIOUS LININGS SHALL HAVE THE FOLLOWING PROPERTIES:
   - PERCENT PASSING NO 200 U.S. STANDARD SIEVE ----- 50% MINIMUM
   - LIQUID LIMIT ----- 30% MINIMUM
   - PLASTICITY INDEX ----- 15% MINIMUM
   - COEF OF PERMEABILITY --- 1×10^{-7} cm/sec max
4. IMPERVIOUS LINER - INSIDE SECONDARY POND A MINIMUM OF 3 FEET OF COHESIVE MATERIAL IS REQUIRED ON POND SLOPES AS AN IMPERVIOUS LINER TO CONTROL SEEPAGE FROM WITHIN THE SECONDARY POND. INSTALLATION OF THE LINER IS REQUIRED WHERE SP, SM OR ML IS EXPOSED. THE LINER MAYBE OMITTED WHERE THE INSITU SOIL IS SUITABLE AS A LINER. THIS WILL BE DETERMINED BY THE PURCHASER AND/OR THE CONSULTING ENGINEER. NO LINING SHALL BE OMITTED UNLESS APPROVED IN ADVANCE.
5. DELETED
6. FOR ADDITIONAL NOTES SEE EXH. ABS 6.4.3.B.1-3, SHEET 2

ASH BASINS & SECONDARY POND
SECTIONS AND DETAILS (SHEET 1 OF 3)
DOLET HILLS POWER PLANT
UNITS 1 & 2
SOLID WASTE DISPOSAL
PERMIT APPLICATION
EXHIBIT ABS 6.4.3.B.1-3



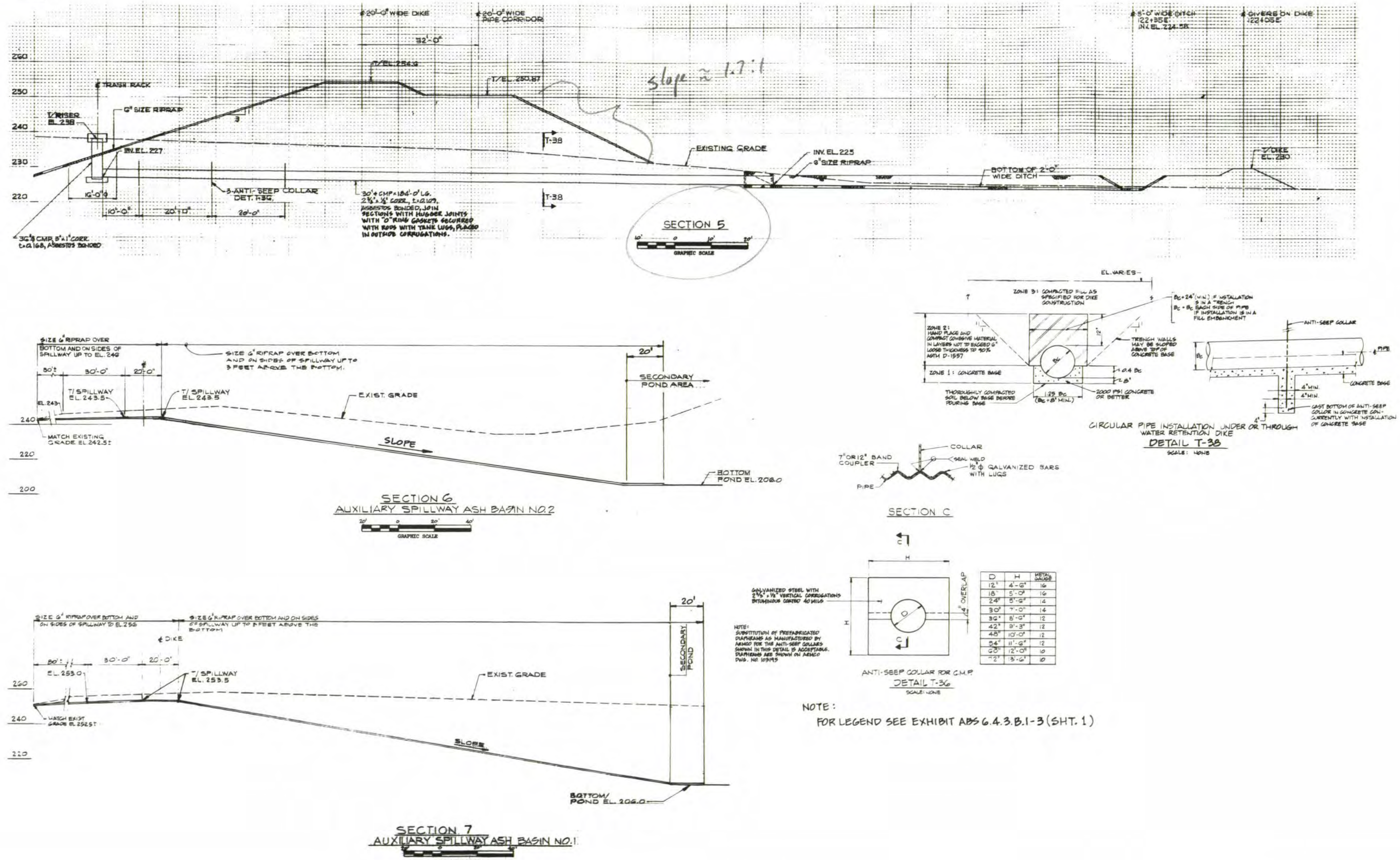
SECTION 3



SECTION 4

	NOTES
1.	FOR LEGEND SEE EXH. ABS 6.4.3.B.1-3 (SHT. 1).
2.	CLAY FOR DIKES AND LININGS (SEE NOTES 3, 4 ON EXH. ABS 6.4.3.B.1-3 (SHT. 1)) SHALL BE PLACED IN HORIZONTAL LAYERS NOT EXCEEDING 6" LOOSE DEPTH AND UNIFORMLY COMPACTED TO 90% OF MAXIMUM DRY DENSITY OBTAINED BY THE MODIFIED PROCTOR TEST (ASTM D-557). CLAY SHALL BE COMPACTED IN A KNEADING ACTION USING SHEEPS FOOT ROLLERS. COMPACTION EQUIPMENT SHALL BE APPROVED BY THE PURCHASER PRIOR TO USE
3.	CLAY FOR POND LINING SHALL BE PLACED ON SIDE SLOPES IN HORIZONTAL LAYERS IN A STAIR STEP PATTERN SUCH THAT EACH SUCCEEDING LAYER IS STEPPED BACK FROM THE PRECEEDING LAYER
4.	DELETED
5.	SUBSURFACE CONDITIONS SHOWN IN SECTIONS 3 AND 4 ARE APPROXIMATE AND SHOULD BE VERIFIED IN THE FIELD.

ASH BASINS & SECONDARY POND
SECTIONS AND DETAILS (SHEET 2 OF 3)
DOLET HILLS POWER PLANT
UNITS 1 & 2
SOLID WASTE DISPOSAL
PERMIT APPLICATION
EXHIBIT ABS 6.4.3.B.1-3



D	H	METAL GAUGE
12"	4'-6"	16
18"	5'-0"	16
24"	5'-6"	14
30"	7'-0"	14
36"	8'-0"	12
42"	9'-3"	12
48"	10'-0"	12
54"	11'-9"	12
60"	12'-0"	10
72"	13'-6"	10

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

ASH BASINS & SECONDARY POND
SECTIONS AND DETAILS (SHEET 3 OF 3)
DOLET HILLS POWER PLANT
UNITS 1 & 2
SOLID WASTE DISPOSAL
PERMIT APPLICATION
EXHIBIT ABS 6.4.3.B.1-3

SARGENT & LUNDY ENGINEERS CHICAGO

ABS-9

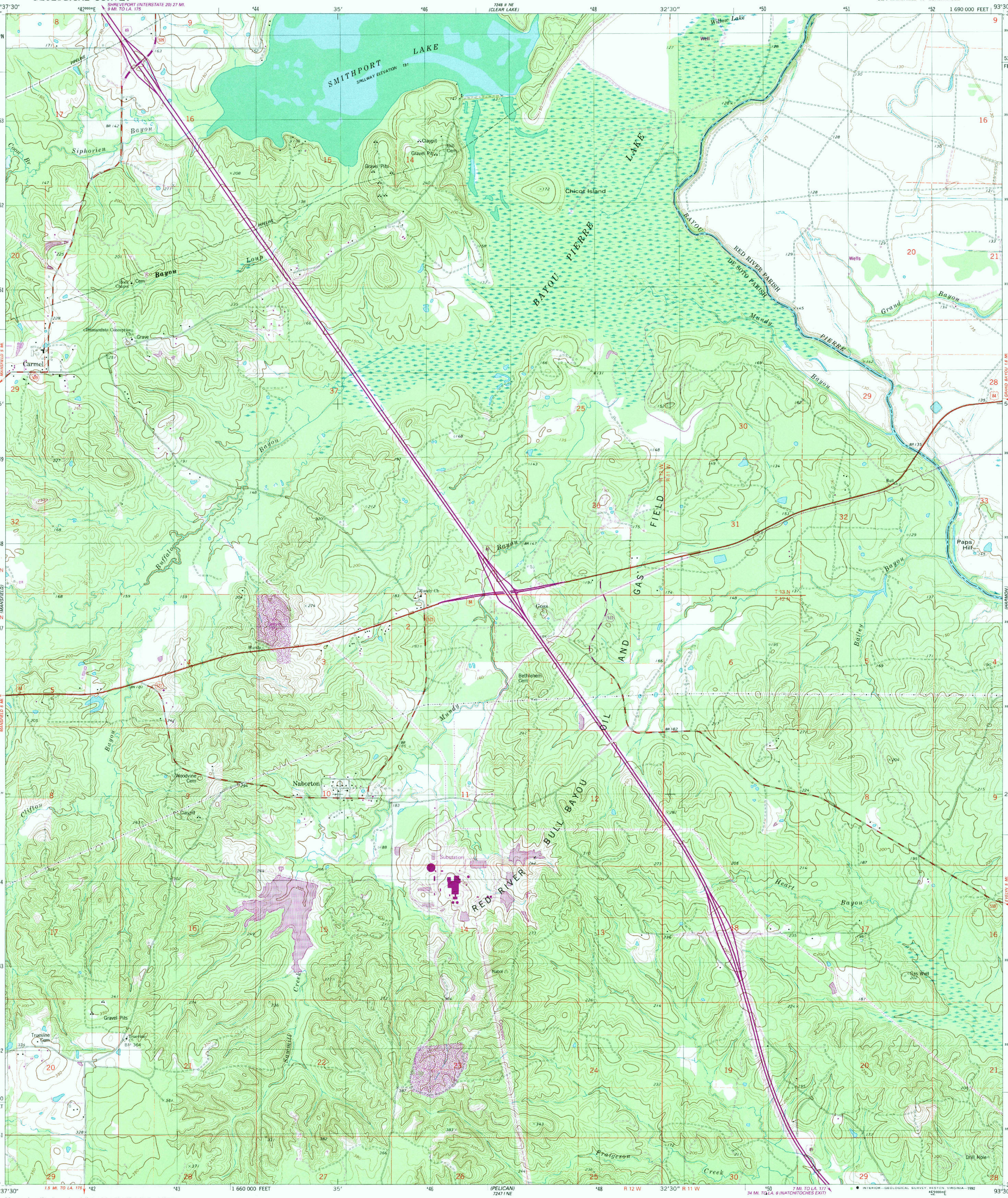
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

BAYOU PIERRE LAKE QUADRANGLE

LOUISIANA

7.5 MINUTE SERIES (TOPOGRAPHIC)

SE/4 MANSFIELD 15' QUADRANGLE



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1974. Field checked 1975. Map edited 1980

Projection and 10,000-foot grid ticks: Louisiana coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid, zone 15
1927 North American Datum
To place on the predicted North American Datum 1983 move the projection lines 14 meters south and 17 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1992 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Revisions shown in purple compiled in cooperation with State of Louisiana agencies from aerial photographs taken 1989 and other sources. Contours not revised. This information not field checked. Map edited 1992

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
AND LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT, BATON ROUGE, LOUISIANA 70804
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route

BAYOU PIERRE LAKE, LA.

SE/4 MANSFIELD 15' QUADRANGLE
32093-A5-TF-024

1980
REVISED 1992
DMA 7248 II SE–SERIES V885

APPENDIX C – ENGINEERING CALCULATIONS

WORKSHEET TITLE:	Inflow Design Flood - Dolet Hills	**CALCULATION NO.:**	90965 - C - 001
CREATED:	2/5/2016	**REVISION:**	0
PERFORMED BY:	A. MYERS	**REVIEWED BY:**	J. Eichenberger
OBJECTIVE:	Determine capacity of pond system to maintain a 100-year, 24-hour storm event		

REFERENCES:

1 Lindeburg, M. (2008). Civil engineering reference manual for the PE exam. 11th ed. Belmont, CA: Professional Publications, Inc.

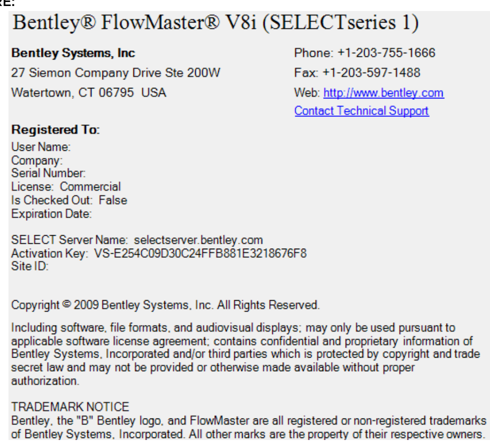
2 US Department of Agriculture. (no date). Custom soils resouces report for DeSoto Parish, LA. Retrieved from http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

3 National Oceanic and Atmospheric Administration. (2016). NOAA Atlas 14, Volume 9, Version 2. [Point precipitation frequency estimates for Mansfield, LA, Station Mansfield (16-5874), US]. Retrieved from http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=la

4 United States. Department of Agriculture. Natural Resources Conservation Service. National Engineering Handbook: Part 630 Hydrology, Chapter 15 Time of Concentration. N.p., n.d. Web. 9 Feb. 2016. Retrieved from http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=27002.wba

SOFTWARE:

1



Bentley® FlowMaster® V8i (SELECTseries 1)

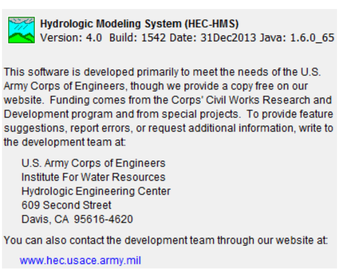
Bentley Systems, Inc
27 Siemon Company Drive Ste 200W
Watertown, CT 06795 USA

Phone: +1-203-755-1666
Fax: +1-203-597-1488
Web: http://www.bentley.com
Contact Technical Support

Registered To:
User Name:
Company:
Serial Number:
License: Commercial
Is Checked Out: False
Expiration Date:

SELECT Server Name: selectserver.bentley.com
Activation Key: VS-E254C09D30C24FFB881E3218676F8
Site ID:

2



Hydrologic Modeling System (HEC-HMS)
Version: 4.0 Build: 1542 Date: 31Dec2013 Java: 1.6.0_65

This software is developed primarily to meet the needs of the U.S. Army Corps of Engineers, though we provide a copy free on our website. Funding comes from the Corps' Civil Works Research and Development program and from special projects. To provide feature suggestions, report errors, or request additional information, write to the development team at:

U.S. Army Corps of Engineers
Institute For Water Resources
Hydrologic Engineering Center
609 Second Street
Davis, CA 95616-4620

You can also contact the development team through our website at:

www.hec.usace.army.mil

ASSUMPTIONS:

1 Design storm is 100 years (low hazard classification per 2016 hazard potential classification)

2 Max intensity duration is 5 minutes

3 Soils are generally sandy loam, Hydrologic Soil Group D for Ash Basin 1 and Hydrologic Soil Group C for Ash Basin 2 and Secondary Pond. Reference 2

4 Eastern portion of Ash Basins 1 & 2 is full of CCR at the time of the storm event (see SK-CIVIL-002 in Appendix A in Appendix A). Western portion is full of water and/or ash up to the max operating level.

5 CCR material in the eastern portion of Ash Basins will be modeled as Hydrologic Soil Group C

6 Weir box outfalls at Ash Basins 1 and 2 are plugged or inoperable over duration of storm event.

7 Discharge pump in Secondary Pond is inoperable over duration of storm event. Discharge is allowable via outlet pipe only.

EQUATIONS:

1	Rational Method		
		$Q = CIA_d$	Reference 1, p. 20-13, eq. 20.36
2	Sheet Flow Travel Time		
		$t_{sheet} = 0.007*(nL)^{0.8}/\sqrt{(P_2)}*S_{decimal}^{0.4}$	Reference 1, p. 20-3, eq. 20.6
3	Shallow Flow Travel Time		
		$t_{shallow} = L/v_{shallow}$	Reference 1, p. 20-3, section 5
4	Velocity of Shallow Flow		
		$v_{shallow} = 16.1345\sqrt{(S_{decimal})}$	Reference 1, p. 20-3, eq. 20.7, [unpaved]
5	Channel Flow Travel Time		
		$t_{channel} = L/v_{channel}$	Reference 1, p. 20-3, section 5
6	Time of Concentration		
		$t_c = t_{sheet} + t_{shallow} + t_{channel}$	Reference 1, p. 20-3, eq. 20.5
7	Lag Time		
		$t_{lag} = 0.6*t_c$	Reference 1, p.20-11, eq. 20.27
8	Soil Water Storage Capacity		
		$S = (1000/CN) - 10$	Reference 1, p. 20-19, eq. 20.43
9	Initial Abstraction		
		$I_a = 0.2*S$	Reference 1, p. 20-15, eq. 20.38

10 Weighted Curve Number

$CN_W = (CN_i*A_i)/A_T$

11 Weighted Rational Runoff Coefficient

$C_W = (C_i*A_i)/A_T$

VARIABLES:

1	Q	peak runoff rate, cfs
2	C	rational runoff coefficient, unitless
3	I	rainfall intensity, in/hr
4	A_d	total drainage area, ac or mi^2
5	t_{sheet}	sheet flow travel time, min
6	n	Manning's roughness coefficient, unitless
7	L	hydraulic length of the watershed, ft
8	P_2	2yr 24hr rainfall, in
9	$S_{decimal}$	slope, ft/ft
10	$t_{shallow}$	shallow concentrated flow travel time, min
11	$v_{shallow}$	shallow velocity, ft/s
12	$t_{channel}$	channel flow travel time, min
13	$v_{channel}$	channel velocity, ft/s
14	t_c	time of concentration, min
15	t_{lag}	lag time, hrs
16	S	soil water storage capacity, in
17	CN	curve number, unitless
18	I_a	initial abstraction, in
19	CN_W	weighted curve number, unitless
20	A_T	total area, ac
21	C_W	weighted rational runoff coefficient, unitless
22	CN_{WT}	total weighted curve number, unitless
23	C_{WT}	weighted rational runoff coefficient, unitless

CALCULATIONS:

1 Establish drainage area

	Ash Basin 1	Secondary	Ash Basin 2	
A_d (ac)	122.0	15.2	118.8	Measured in Microstation, see SK-CIVIL-001 in Appendix A. Area delineated using contours generated from the LSU Atlas
A_d (mi^2)	0.191	0.024	0.186	Conversion from ac to mi^2

2 Establish rainfall data

SCS Storm	Depth (in)	
100yr, 24hr	11.1	Reference 3

3 Establish CN, Percent Impervious Cover, and Initial Abstraction

	Ash Basin 1			Secondary			Ash Basin 2			
Land Description	CN_i*	A_i** (ac)	CN_W	CN_i*	A_i** (ac)	CN_W	CN_i*	A_i** (ac)	CN_W	
Open space, fair condition (pasture)	84	1.3	0.9	79	5.2	26	79	4.5	3.0	Equation 10
Open space, poor condition (ash)	86	15.6	11.0	86	0.0	0	86	16.2	11.8	Equation 10
Woods, good condition	77	89.1	56.2	70	5.7	25	70	82.2	48.5	Equation 10
Pond	100	15.9	13.1	100	4.9	31	100	15.8	13.3	Equation 10
A_T (ac)		122.0			15.8			118.8		Sum
CN_{WT}			81			82			77	Sum
S (in)			2.35			2.20			2.99	Equation 8
I_a (in)			0.469			0.439			0.597	Equation 9

*Reference 1, Table 20.4, p. 20-17 and Assumption 6

**Measured in Microstation, see SK-CIVIL-002 in Appendix A

4 Establish Time of Concentration and Basin Lag time for SCS Unit Hydrograph Transform

Subbasin	Ash Basin 1	Secondary	Ash Basin 2	
Design Storm	**100yr**	**100yr**	**100yr**	
Sheet Flow				
n	0.4	0.4	0.4	Reference 1, p. 20-3, Table 20.1 - woods
L* (ft)	300.00	300.00	300.00	Measured in Microstation, see SK-CIVIL-002 in Appendix A
P_2 (in)	4.39	4.39	4.39	Reference 3, 2yr 24hr rainfall
$S^*_{decimal}$ (ft/ft)	0.100	0.100	0.100	Measured in Microstation, see SK-CIVIL-002 in Appendix A
t_{sheet} (hrs)	0.39	0.39	0.39	Equation 2
t_{sheet} (min)	23.19	23.19	23.19	Conversion from hrs to min
Shallow Flow				
$S^*_{decimal}$ (ft/ft)	0.100	0.100	0.100	Measured in Microstation, see SK-CIVIL-002 in Appendix A
$v_{shallow}$ (ft/s)	1.60	1.60	1.60	Reference 4, Figure 15-4 - woods
L* (ft)	750.00	445.00	1100.00	Measured in Microstation, see SK-CIVIL-002 in Appendix A
$t_{shallow}$ (s)	468.75	278.13	687.50	Equation 3
$t_{shallow}$ (min)	7.81	4.64	11.46	Conversion from s to min
Shallow Flow				
$S^*_{decimal}$ (ft/ft)	0.010	0.333	0.010	Measured in Microstation, see SK-CIVIL-002 in Appendix A
$v_{shallow}$ (ft/s)	1.00	3.95	1.00	Reference 4, Figure 15-4 - nearly bare and untilled (overland)
L* (ft)	1200.00	100.00	950.00	Measured in Microstation, see SK-CIVIL-002 in Appendix A
t_{sheet} (hrs)	1200.00	25.32	950.00	Equation 3
t_{sheet} (min)	20.00	0.42	15.83	Conversion from s to min
Time of Concentration				
t_c (min)	51.01	28.25	50.48	Equation 6
Lag Time				
t_{lag} (min)	30.60	16.95	30.29	Equation 7

*Measured in Microstation, see SK-CIVIL-002 in Appendix A

5 Run HEC-HMS with input parameters: all discharge into ponds (rainfall) is additional flow above assumed initial elevation.
Elevation-area data for the pond is as noted below.

Ash Basin 1	
EL	area* (ac)
251	13.3
252	13.8
253	14.3
253.5	14.6
254	14.8
255	15.4
256	15.9

*Measured in Microstation

Ash Basin 2	
EL	area* (ac)
240.5	13.5
241	13.7
242	14.1
243	14.6
243.5	14.8
244	15.0
245	15.5
246	15.9

*Measured in Microstation

Secondary Pond	
EL	area* (ac)
226.5	4.4
227	4.5
228	4.6
229	4.8
230	5.0
231	5.2
232	5.4
233	5.6
234	5.8
235	6.0
236	6.2
237	6.4
238	6.6
239	6.8
240	6.9
241	7.1
242	7.3
243	7.5
244	7.7
245	7.9
246	8.1

*Measured in Microstation

RESULTS:

Component	Subbasin		Reservoir					
Property	Peak Discharge (cfs)	Runoff Volume (in)	Initial EL	Peak Inflow (cfs)	Peak Discharge (cfs)	Peak Elevation (ft)	Peak Storage*** (ac-ft)	Time to Drain (hrs)
Ash Basin 1	531.7	8.71	251	531.7	99.0	254.9	55.6	80*
Ash Basin 2	494.7	8.18	240.5	494.7	54.3	244.4	56.6	104**
Secondary Pond	87.6	8.84	226.5	155.9	23.0	240.9	82.6	80*

*Drain to top of spillway EL without adjusting overflow weirs.
**Drain to top elevation of vertical riser without any supplemental pumping.
***Peak Storage reflects storage above the initial EL.

CONCLUSION:

Under the modeled conditions (conservative scenario), the Ash Basins and Secondary Pond can accept inflows from the design flood event without overtopping.

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