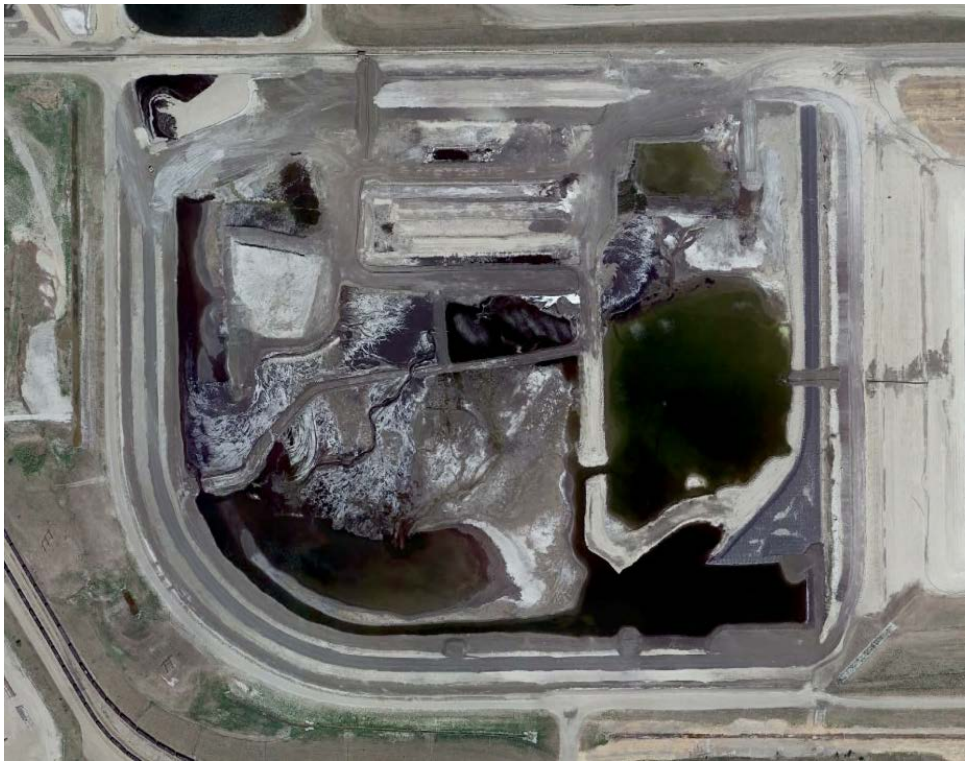
ANNUAL REPORT

ANNUAL INSPECTION REPORT

GREAT RIVER ENERGY – COAL CREEK STATION

Upstream Raise 91



Submitted to: Great River Energy
Coal Creek Station
2875 Third Street SW
Underwood, North Dakota 58576

Submitted by: Golder Associates Inc.
44 Union Blvd.
Suite 300
Lakewood, Colorado 80228

January 2018 **1772255**

Golder Associates

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1.0 INTRODUCTION

As part of 40 CFR Part 257 of the Subtitle D solid waste provisions under the Resource Conservation and Recovery Act (RCRA), utilities are required to complete annual inspections for surface impoundments and landfills containing Coal Combustion Residuals (CCR). This report has been prepared by Golder Associates Inc. (Golder) for Great River Energy (GRE) to satisfy the annual inspection requirements for CCR surface impoundments under 40 CFR Part 257.83.

Coal Creek Station (CCS) is located in McLean County, approximately 10 miles northwest of Washburn, North Dakota. There are four facilities located at CCS that fall under the CCR rule requirements (Figure 1):

- Drains Pond System CCR Surface Impoundment (Drains Pond System)
- Upstream Raise 91 CCR Surface Impoundment (Upstream Raise 91)
- Upstream Raise 92 CCR Surface Impoundment (Upstream Raise 92)
- Southeast Section 16 CCR Landfill (Southeast 16)

Upstream Raise 91 and Upstream Raise 92 both operate as impoundments and will be closed with CCR in-place. The Drains Pond System is currently being used to dewater bottom ash and as a process water impoundment to return conveyance water back to the plant. The Southeast 16 landfill operates as a landfill and is used as a storage/disposal facility for CCRs that do not contain free liquid. This report presents a review of available facility information and findings of the inspection of Upstream Raise 91 at CCS performed September 21, 2017.

2.0 REVIEW OF EXISTING INFORMATION

2.1 Geological Conditions

Upstream Raise 91 is generally constructed over a glacial till layer consisting of sandy and silty-clay soils. Glacial till varies in thickness from 20 feet to several hundred feet in the area of Coal Creek Station. Silty-sand and sand lenses are present throughout the glacial till formation, which is underlain by poorly consolidated siltstone/sandstone bedrock (Barr Engineering 1982; Cooperative Power and United Power Association 1989).

2.2 Site History and Liner Systems

Upstream Raise 91 (Figure 2) is located in Sections 16 and 17, Township 145N, Range 82W and covers approximately 70 acres. The facility is used as a combined dewatering and storage facility for CCRs including fly ash, bottom ash, economizer ash, and flue gas desulfurization (FGD) material. Bottom ash and fly ash are hauled to the facility. During 2017, economizer ash and associated conveyance water entered Upstream Raise 91 through the 12-inch ash lines. Process water enters Upstream Raise 91 through the drain pipes from Upstream Raise 92. FGD material and hydraulic conveyance water enter Upstream Raise 91 through a high-density polyethylene (HDPE) pipe from the plant to the northeast corner of the facility. The pipe runs above ground from the northeast corner of the facility to the final discharge location. The on- grade HDPE pipe is periodically moved to different areas of Upstream Raise 91 to achieve an even distribution of FGD material in the facility. A small amount of water may also enter through culverts draining stormwater from the ash pipeline corridor into Upstream Raise 91. Upstream Raise 91 is approximately 300 feet south of Lower Samuelson Slough and 100 feet north of rail lines. The Drains Pond System is adjacent to the northwest side of Upstream Raise 91 and Upstream Raise 92 is adjacent to the east side of Upstream Raise 91. A drainage ditch also exists along the south and west sides of Upstream Raise 91.

Upstream Raise 91 was originally part of the South Ash Pond. The South Ash Pond was constructed with a clay core dike and soil liner. A new clay liner was installed over the South Ash Pond in 1982 and the facility remained in operation until 1987 when ash was excavated from the South Ash Pond and transported to the Section 5 dry CCR landfill. The South Ash Pond was then divided into Ash Pond 91 (Upstream Raise 91) and Ash Pond 92 (west half of Upstream Raise 92). Ash Pond 91 (Upstream Raise 91) was deepened and a new composite liner consisting of a 2-foot thick clay and a 40- mil HDPE liner was completed in 1992. The liner is overlain with 1 foot of sand, 1 foot of gravel, and a drainage system.

An additional 7 acres of composite liner was installed in the southeast corner of Upstream Raise 91 and in the area between Upstream Raise 91 and the Upstream Raise 92 in 2016. The liner completes a continuous composite-lined area between Upstream Raise 91 and Upstream Raise 92. The composite liner system installed in 2016 consists of (from bottom to top): Geosynthetic Clay Liner (GCL) and 60-mil HDPE liner.

Selected construction drawings from the 1992 work and 2016 work as well as the current permit drawings are included in Appendix A.

2.3 Site Geometry

The design crest of the original soil berms surrounding Upstream Raise 91 are at a constant elevation of approximately 1922 feet above mean sea level (amsl). This berm surrounding the facility on the north, west, and south sides has a gravel surfaced roadway supporting both light passenger vehicles and heavy construction equipment, such as Caterpillar 777 haul trucks. Based on existing topography, original berm downstream slopes generally have 3:1 slopes to the surrounding grades and perimeter drainage ditches with elevations of 1897 feet amsl on the north side of Upstream Raise 91 and 1898 feet amsl on the south and west sides of Upstream Raise 91. Original soil perimeter berm downstream slopes have grass vegetation. Berm upstream slopes of the original soil perimeter berms have an approximate 3:1 slopes to the base of the facility between elevations 1900 feet amsl and 1914 feet amsl. The top of the HDPE liner is anchored at elevation 1920 feet amsl.

The entire facility is designed with 5:1 final CCR slopes from the perimeter berms to elevation 1974 feet amsl, 15% final CCR grades between elevations 1974 feet amsl and 2004 feet amsl, and a 5% crown to achieve a final CCR elevation of approximately 2018 feet amsl.

2.4 Changes in Geometry

No significant changes to geometry were noted other than the continued placement of CCRs to the design grades. Between January and December of 2017, the bottom ash/fly ash has increased in elevation from approximately 1920 feet amsl to 1929 feet amsl.

2.5 Storage Capacity and Volumes

Based on a comparison between the approximate grades as of the fall of 2017 and the final permitted grades of Upstream Raise 91, the facility has a remaining CCR capacity of approximately 6,840,000 cubic yards (CY). The approximate total CCR capacity of Upstream Raise 91 is approximately 8,340,000 CY. Therefore, the amount of CCR contained in the facility at the time of the inspection is estimated to be approximately 1,500,000 CY.

2.6 Impounded Water

The water level in Upstream Raise 91 has historically been managed between elevation 1916 feet amsl and 1918 feet amsl (4 to 6 feet freeboard to the top of the original soil perimeter berms). The water level in Upstream Raise 91 was being actively managed an elevation of approximately 1917 feet amsl at the time of the inspection. Based on an estimated amount of CCRs contained within the facility footprint and a water elevation of 1917 feet amsl, the volume of impounded water at the time of the inspection was approximately 50 acre-feet or 16,500,000 gallons. The maximum depth of water in Upstream Raise 91 was approximated to be 10 feet based on as-built surveys, CCR deposition, and the operating level during the evaluation.

During operation as an upstream raise facility (to accommodate closure with CCRs in place), the depth of impounded water in Upstream Raise 91 will vary with time as more CCRs are deposited and as operational variables change (such as drainage pipe elevations).

2.7 Permits

Upstream Raise 91 is currently permitted with the North Dakota Department of Health (NDDH) under Permit Number 0033. Previous permit modification documents describe additional historical information about the design of the facility (CPA 1997, CPA and UPA 1989, GRE 2003, GRE 2012, GRE 2015).

2.8 Summary of 2017 Weekly Inspections

Routine weekly inspections of Upstream Raise 91 were performed by GRE as a part of the final CCR Rule. Based on a review of the available inspection forms, the following items were noted:

- Generally good site maintenance.
- No signs of significant seepage, settlement, or cracking of the berm downstream slopes.
- No signs of animal burrows were noted on berm downstream slopes.
- Fugitive dust was actively controlled using a water truck (as required).

2.9 Summary of Previous Inspections

The most recent annual professional engineer inspection of Upstream Raise 91 was performed by Golder in the fall of 2016 (Golder 2017) and a summary of the observations of that inspection are as follows:

- Generally good vegetation and site maintenance.
- No signs of significant seepage, settlement, or cracking of the berm downstream slopes.
- Several small animal burrows, but none that were anticipated to cause areas of structural weakness.
- Erosion rills on the west and south berm downstream slopes.
- Sparse vegetation on portions of the west and south berm downstream slopes.
- Culverts around the south and west sides of Upstream Raise 91 were partially obstructed by vegetation and debris at both the inlets and outlets.

A previous “Coal Ash Impoundment Site Assessment Report” performed by Kleinfelder in 2011 (Kleinfelder 2012) under contract with the United States Environmental Protection Agency (USEPA) assigned the facility a “Low” hazard rating and had similar observations with respect to facility stability.

3.0 2017 ANNUAL INSPECTION

On September 21, 2017, Craig Schuettpelz of Golder performed an inspection of Upstream Raise 91 per USEPA Regulation 40 CFR Part 257.83(b) requirements. The inspection consisted of visual observations while walking around the facility traversing up and down the perimeter berm and CCR placement areas. An annual inspection checklist used during the inspection is presented in Appendix B. Photographs were taken and are presented in Appendix C. The following presents a summary of the observations made during the 2017 annual inspection.

3.1 Hydraulic Structures

Inflow structures to Upstream Raise 91 consist of drainage pipes from the Upstream Raise 92 facility, culverts from the ash pipeline ditch, and the ash lines conveying rejects and economizer ash. Some of these pipes are buried or below the water level and could not be observed. The pipes observed appeared to be in good condition with no noticeable settlement, cracking, significant corrosion, or significant erosion. The inspection noted minor erosion of the fly ash at the culvert inlet from the ash pipeline ditch into the northwest corner of Upstream Raise 91; however, the erosion has not exposed geomembrane liner. The inflow structures were in good condition.

Additional pipelines and contact water control features (contact water perimeter channels and culverts) inside Upstream Raise 91 convey water to downstream facilities. These include a series of gravity drainage pipes, seepage pipes, and perimeter channels and culverts that transfer CCR conveyance water from the facility to the adjacent Drains Pond System. The gravity drains were constructed at the design elevation, but were not yet operational at the time of inspection and the seepage piping was below the elevation of the water and could not be observed. The culverts connecting the contact water perimeter channels were in good condition at the time of the inspection.

The outflow structures from Upstream Raise 91 consist of cross-over pipes directing water to the east cell of the Drains Pond System. The cross-over pipes were below the water level and could not be observed.

3.2 Perimeter Berm

3.2.1 Berm Upstream Slope

The berm upstream slopes are mostly covered by CCR deposition and/or final cover. A small amount of berm upstream slopes was visible along the north, west and south sides of the facility. The observed slopes appeared to match the design slopes of 3:1 and are being protected from erosion with a cemented fly ash layer. The berm upstream slopes appeared to be competent with no signs of significant distress.

3.2.2 Berm Crest

The berm crest along the north, west, and south sides of Upstream Raise 91 is surfaced with gravel and used for both light vehicle and heavy construction equipment traffic. The berm crest on the east side of

Upstream Raise 91 was lined in September 2016 to connect the liner system of Upstream Raise 91 with the liner system of Upstream Raise 92. The exposed liner on the east berm crest appears to be in good condition with minor wrinkles noted of the geomembrane portion of the liner system. The berm crest roads on the west and south sides experience little heavy traffic and are mostly exposed to light vehicle traffic (cars, pickups, etc.). The berm crest road on the north side experiences frequent heavy traffic from large haul trucks. The road on the berm crest of Upstream Raise 91 appears to be in good condition, with no noticeable cracking or settlement, and appears to be well maintained. When wet, the road surface can become rutted and slippery. Ruts that develop on the road surface should be repaired as soon as possible to maintain access.

3.2.3 Berm Downstream Slope

The berm downstream slopes range from 0 to 20 feet in height. The grades of the west and south slopes were modified in 2015 and 2016, and the area was hydro-seeded to promote growth of grass vegetation. At the time of inspection (approximately one year after hydro-seeding), sparse vegetation existed on the bottom two-thirds on the west berm downstream slope and moderate vegetation existed on the bottom one-third of the south berm downstream slope. In 2017, erosion rills were repaired and covered with erosion control blankets and the area was reseeded; however, vegetation has yet to establish itself on these slopes and they will continue to be monitored. The north berm downstream slope is heavily vegetated with native grasses. Occasional small animal burrows up to approximately two inches in diameter were observed on the north, west, and south berm downstream slopes. Golder did not observe indications of seepage, sloughing, cracking, significant erosion, excessive settlement, or vegetation that seemed to be thriving abnormally. Ground conditions were firm, with the exception of small areas of animal burrowing along the north berm downstream slopes. The berm downstream slope appeared to be in good condition.

3.3 Toe

The environment at the toe of slope varies substantially surrounding Upstream Raise 91. Upstream Raise 92 is directly east of Upstream Raise 91 and there is no downstream slope or toe. North of the facility, the toe of the slope is covered with tall grass with no noticeable wet areas. A site surface water drainage ditch exists along the west and south side toes directing flow counterclockwise to the south side of Upstream Raise 91, then eastward away from the site. At the time of inspection, this surface water ditch contained approximately one foot of water. Culverts connecting different areas of this drainage ditch were clear of obstructions at both inlets and outlets. Recent erosion repairs were observed and appeared to be in good condition.

3.4 CCR Placement

CCR placement above the perimeter berm began recently in Upstream Raise 91. At the time of the inspection, CCR downstream slopes were approximately 9 feet tall (up to elevation 1929 feet amsl). With a wide CCR crest constructed of fly ash, bottom ash, and mixed competent CCR materials. Golder did not observe indications of seepage, sloughing, cracking, significant erosion, or excessive settlement in the CCR placement.

3.5 Instrumentation

Upstream Raise 91 did not have instrumentation at the time of inspection.

3.6 Signs of Structural Weakness or Other Observations that Could Affect Stability

No signs of structural weakness or other observations that could affect the stability of Upstream Raise 91 were observed during the site inspection in September 2017.

4.0 SUMMARY AND CONCLUSIONS

An annual inspection was performed for Upstream Raise 91 at Coal Creek Station on September 21, 2017. The inspection met the requirements for CCR surface impoundments under 40 CFR Part 257.83. Golder observed fair vegetation and good site maintenance and did not identify significant deficiencies such as seepage, excessive erosion or settlement, or cracking during visual observations of Upstream Raise 91. Overall, the facility appeared to be in good condition at the time of the visual evaluation.

In addition to annual inspections by the Professional Engineer, trained and qualified site personnel will perform the required weekly facility inspections to look for signs of potential structural weaknesses.

Minor maintenance items that may need to be continually addressed include repairing large animal burrows as they appear, monitoring erosion and vegetative success of the re-configured surface water channel along the west and south toe of the facility, clean-out of collected material in the contact water perimeter channels and maintaining gravity and culvert piping, repairing and re-seeding eroded areas on or adjacent to berm downstream slopes, and removal of any woody vegetation growing on the berm downstream slopes. In addition, the inflow and outflow piping should be monitored regularly and cleared of debris as required to ensure proper conveyance of water to and from the facility.

GOLDER ASSOCIATES INC.

Craig Schuettpelz, P.E.
Senior Project Engineer

Todd Stong, P.E.
Associate/Senior Consultant

5.0 REFERENCES

Barr Engineering. 1982. Coal Creek Station Hydrogeologic Study, June 3, 1982.

Cooperative Power Association. CPA, 1997. Application to Renew Permit SU-033 and Combine with Permit SU-118. Eden Prairie, Minnesota, July 30, 1997.

Cooperative Power and United Power Association. CPA and UPA, 1989. *Application to Renew Permit to Operate a Special Use Disposal Site, Coal Creek Station, Permit Number SU-033*. Prepared for the North Dakota State Department of Health and Consolidated Laboratories.

Golder Associates Inc. Golder 2017. Annual Inspection Report – Great River Energy – Coal Creek Station – Ash Pond 91. January 2017.

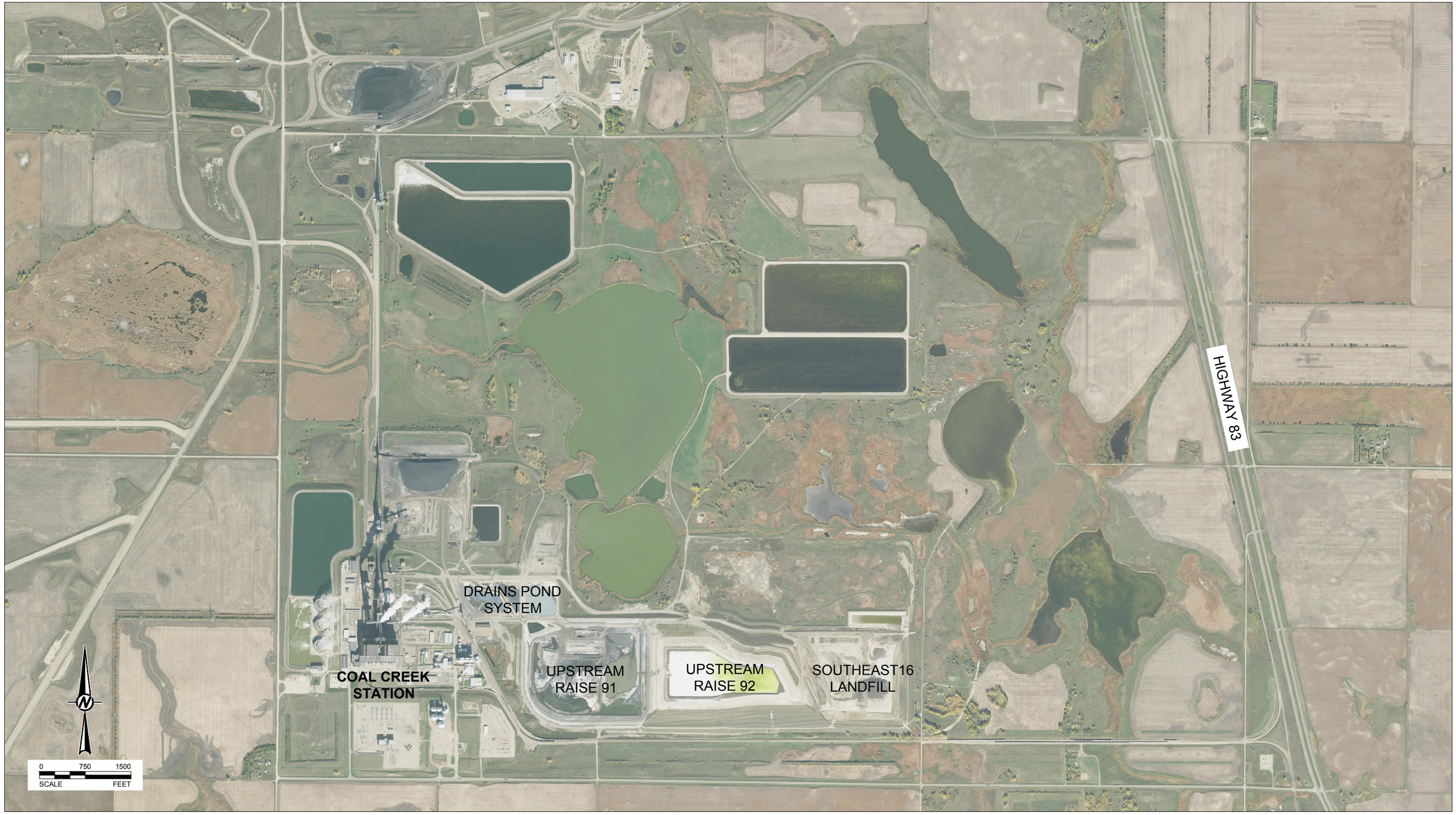
Great River Energy – Coal Creek Station. GRE 2003. Permit Modification Document, Permit No. SP-033. Original Permit Modification submitted September 30, 2003. Revised Permit Modification submitted to NDDH on July 8, 2004.

Great River Energy – Coal Creek Station. GRE 2012. Permit Modification Document, Permit No. SP-033. Original Permit Modification dated December 12, 2012.

Great River Energy – Coal Creek Station. GRE 2015. Permit Modification Document, Permit No. SP-033. Original Permit Modification dated February, 2015.

Kleinfelder. Kleinfelder 2012. Coal Ash Impoundment Site Assessment Final Report, dated October 31, 2012.

FIGURES



REFERENCES

1. AERIAL IMAGE FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM, PUBLISHED 2017.

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-12-12
DESIGNED	RFS
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

PROJECT
2017 ANNUAL INSPECTION REPORT

TITLE
COAL CREEK STATION SITE OVERVIEW

PROJECT NO.	REV.	FIGURE
1772255	A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in
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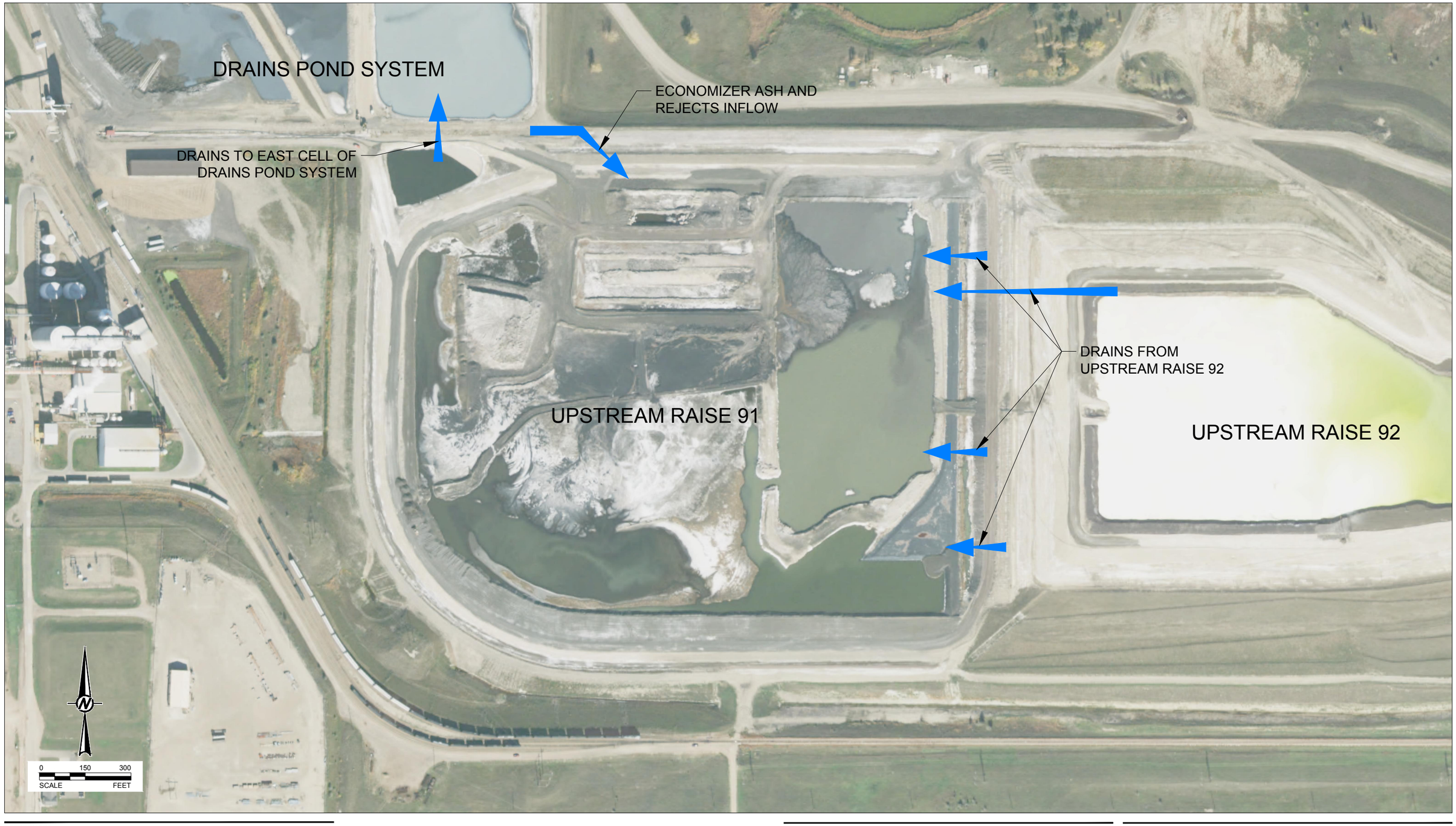

REFERENCES

1. AERIAL IMAGE FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM, PUBLISHED IN 2017.

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-12-12
DESIGNED	RFS
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

PROJECT
2017 ANNUAL INSPECTION REPORT

TITLE
UPSTREAM RAISE 91 CCR SURFACE IMPOUNDMENT SITE OVERVIEW

PROJECT NO.	REV.	FIGURE
1772255	A	2

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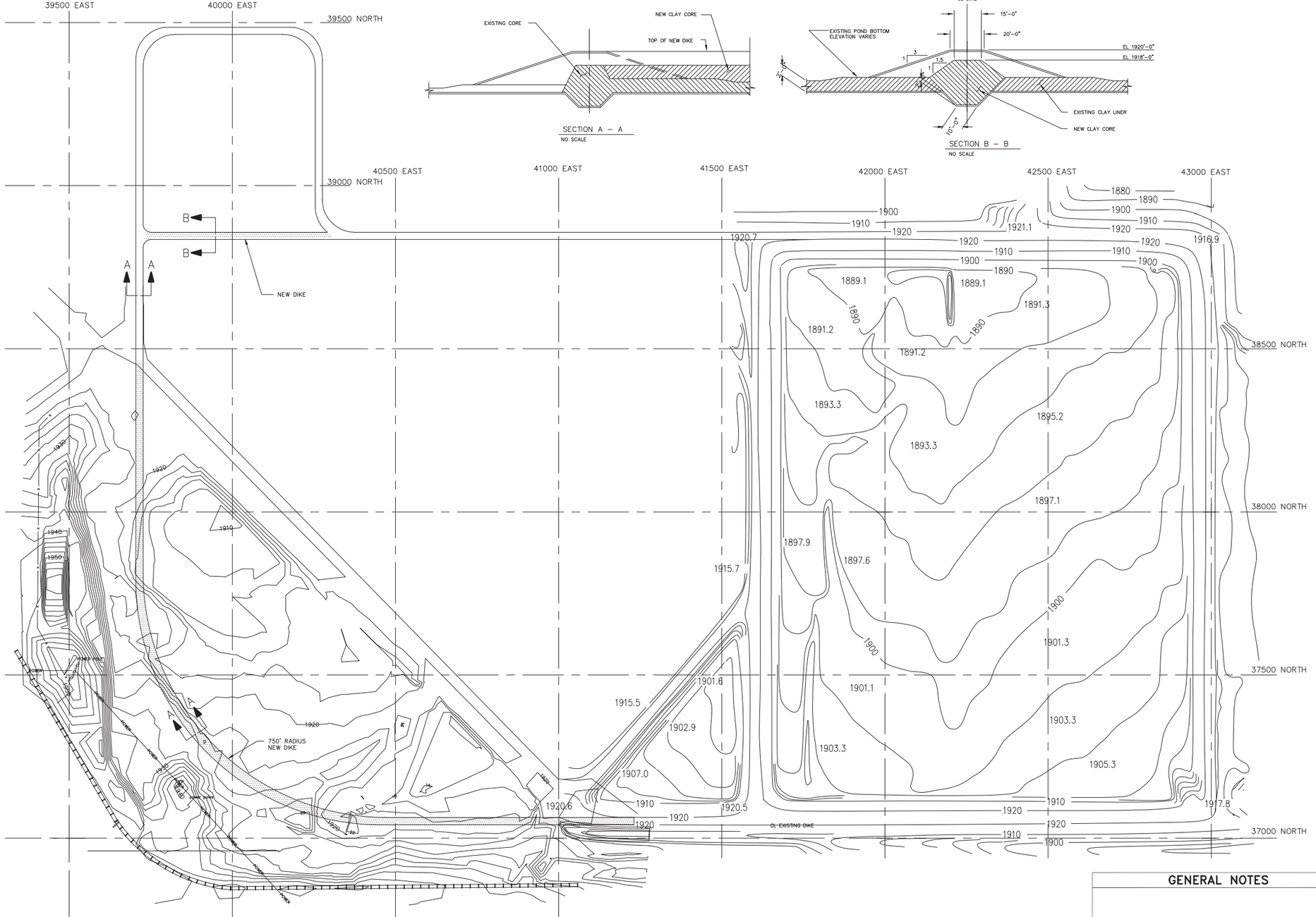
APPENDIX A

SELECTED CONSTRUCTION DRAWINGS AND PERMIT DRAWINGS

SECTION A – A
NO SCALE

SECTION B – B
NO SCALE



GENERAL NOTES

DRAWING NO.	REVISION	REFERENCE DRAWINGS

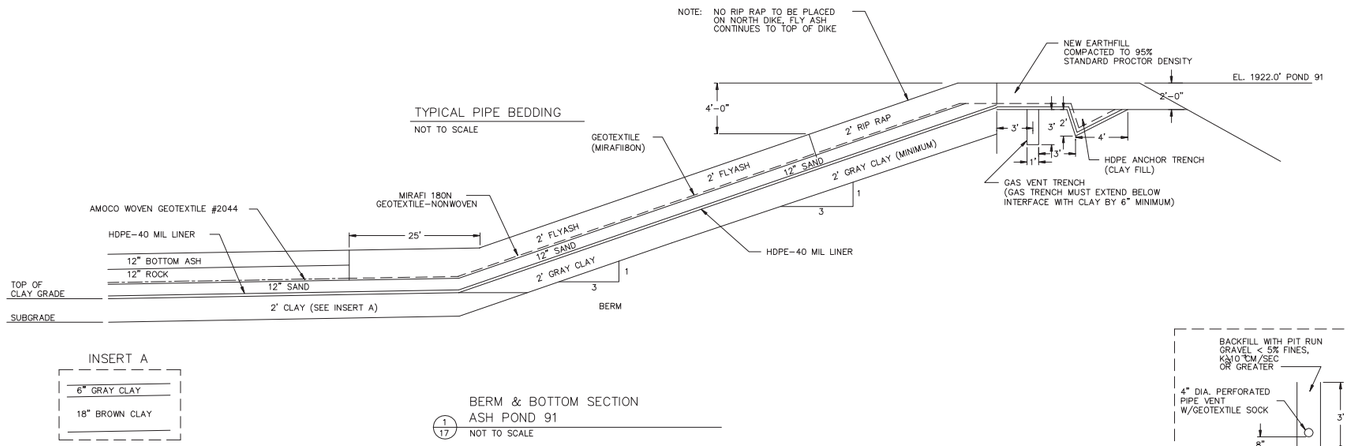
DWN. JJ CHK.
DATE 01/07/91
W/O 91G105

SOUTH ASH POND–
SECTIONS AND ELEVS
1991 ASH DISPOSAL

DRAWING NO.
91G105–26

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK.	APP
02/27/91	ISSUED FOR CONSTRUCTION	1	RR	AS	
01/18/91	ISSUED FOR BID	0	JJ	AS	

COOPERATIVE Association POWER



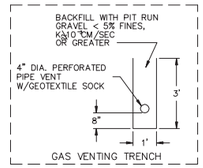
TYPICAL PIPE BEDDING
NOT TO SCALE

INSERT A

6" GRAY CLAY

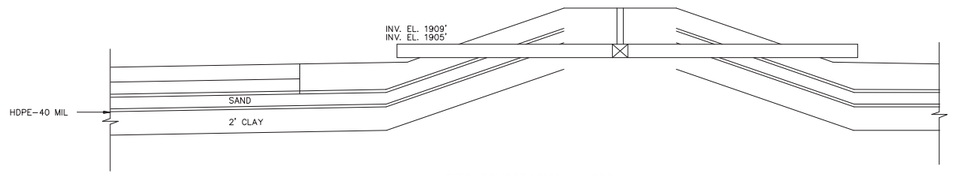
18" BROWN CLAY

BERM & BOTTOM SECTION
ASH POND 91
(1/17) NOT TO SCALE



GAS VENTING TRENCH

NOTE:
1. PROVIDE PERFORATED PIPE VENTS (PVC-SHED40), EACH APPROX. 120' LONG AND 4" DIA. IN THE GAS VENTING TRENCHES. THE EXACT LENGTHES TO BE DETERMINED BY SITE REPRESENTATIVE.
2. THE EXPOSED ENDS OF 4" DIA. GAS VENTING PIPE SHALL BE PROTECTED WITH BOTH A 1/2" STAINLESS STEEL SCREEN AND REGULAR SCREENING MATERIALS.



PIPE PENETRATION - BERM
ASH POND 91 AND DRAIN POND 91
(2/17) NOT TO SCALE

VALVE LIST

ITEM NO.	SYSTEM TAG	DESCRIPTION	B & V FILE NO.	SIZE IN.	PRESS TEMP	PRESS CLASS	TYPE	BODY MAT	END PREP	MFGR NO.	SHOP NO.	REMARKS
	WC08-VL9168	ASH POND 91-PLANT DRAIN POND		18	100	150	GA	CI				UNDERGROUND VALVE WITH VALVE BOX
	WC08-VL9169	PLANT DRAIN POND DISCHARGE		18	100	150	GA	CI				UNDERGROUND VALVE WITH VALVE BOX

GENERAL NOTES

DRAWING NO. | REVISION | REFERENCE DRAWINGS

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK.	APP
03-18-92	ISSUED FOR CONSTRUCTION	1	BK	AS	AS
01/09/92	ISSUED FOR BID	0	BK	AS	AS

DWN. BAK | CHK.
DATE 12/26/91
W/O 92G213

TYPICAL SECTIONS AND DETAILS

1992 ASH DISPOSAL

DRAWING NO. 92G213-17

COOPERATIVE Association POWER

ASH POND 91 FINAL CONTOURS

PLANT DRAIN POND

POND 92

ELECTRIC MANHOLE-45
N 38954.63
E 40259.63
ELEV. 1920.39

ELECTRIC MANHOLE-46
N 38843.63
E 40681.63
ELEV. 1920.49

ELECTRIC MANHOLE-47
N 38844.62
E 41166.63
ELEV. 1920.48

4" VENT PIPE
N 38839.66
E 41400.78

CONTROL POINT
AP91-3 REBAR & CAP
N 38832.49
E 41569.72
ELEV. 1921.38

ELECTRIC MANHOLE-48
N 38798.00
E 41593.00
ELEV. 1922.34

ELECTRIC MANHOLE-49
N 38243.00
E 41593.00
ELEV. 1922.54

ELECTRIC MANHOLE-50
N 37808.00
E 41591.00
ELEV. 1922.49

GATE VALVE
N 38846.8
E 40099.8

18" PIPE
N 38772.31
E 40098.77
ELEV. 1910.15

N 38723.82
E 39693.05

N 38682.31
E 39692.89

4" VENT PIPE
N 38702.95
E 39660.72

N 38813.25
E 41381.06

TOP OF DIKE ELEV. 1922.0

ELECTRIC LINE

30" R.C.P.
N 37499.79
E 41293.83
ELEV. 1907.34

CONTROL POINT
AP91-2 REBAR & CAP
N 37510.08
E 41486.19
ELEV. 1918.71

RIPRAP ROCK

N 37449.76
E 39782.19

N 37415.38
E 39802.41

4" VENT PIPE
N 37409.86
E 39754.54

CONTROL POINT
AP91-1 REBAR & CAP
N 37166.52
E 39839.74
ELEV. 1941.89

CONTROL POINT
SH87-5 REBAR & CAP
N 37047.16
E 41076.12
ELEV. 1920.06

N 37083.67
E 40890.58

N 37032.95
E 40850.84

4" VENT PIPE
N 37032.95
E 40855.76

AUTOCAD DWG: V:\PEC\SITE\P91SH9.DWG

N 38500
N 38000
N 37500
N 37000

E 39200
E 39500
E 40000
E 40500
E 41000
E 41500

N

100 0 100 200
scale feet

Revision No.	Date	By	Description

COOPERATIVE POWER ASSOCIATION
UNDERWOOD, NORTH DAKOTA

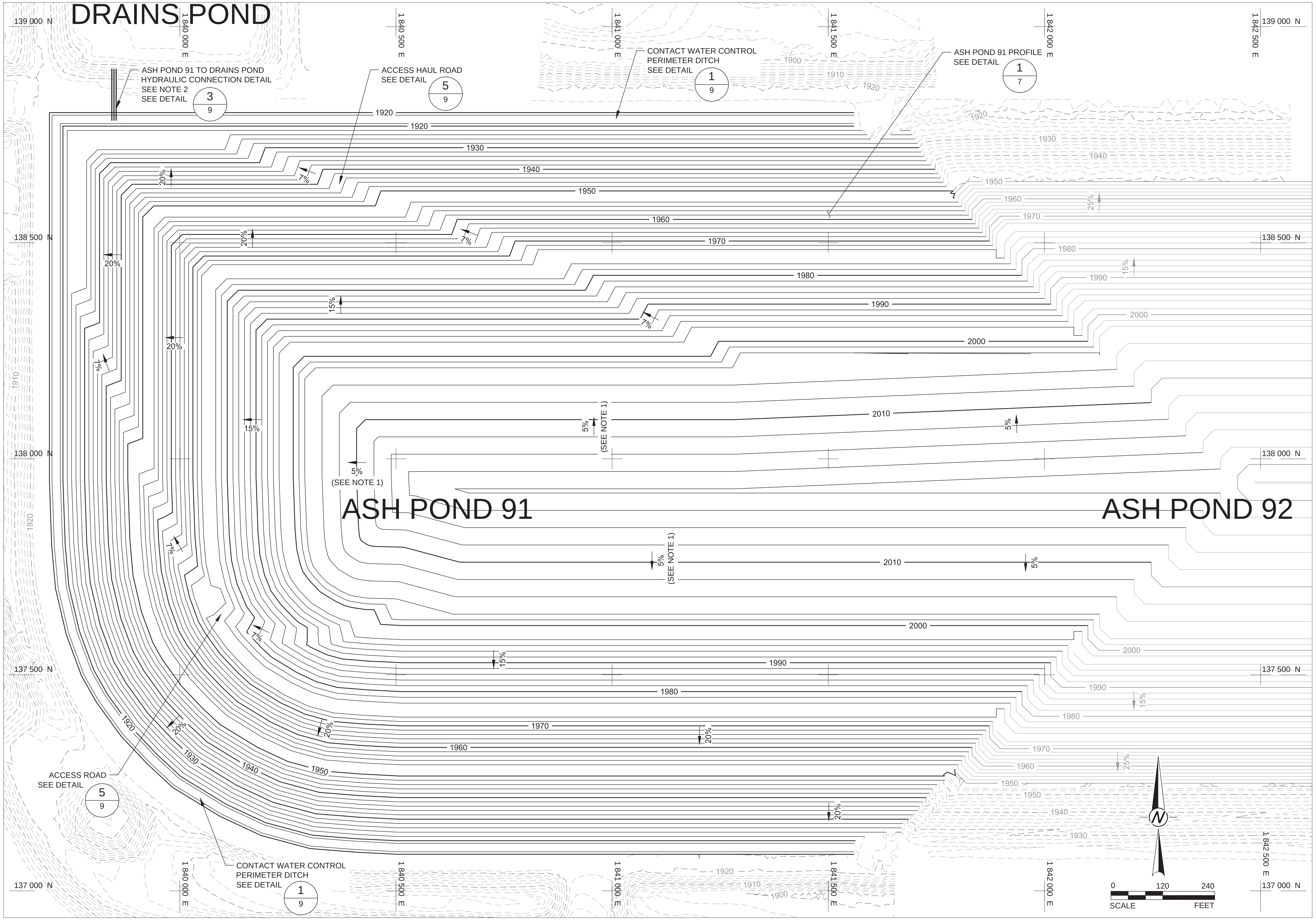
ASH POND 91 FINAL CONTOURS

Drawn By D.B.J. Project No. B92-17-02

Checked By L.H.K. Date 1/25/94

interstate engineering, inc.
Engineering - Surveying - Planning

9
SHEET NO.



LEGEND

1910 / 1900	EXISTING GROUND TOPOGRAPHY (SEE REFERENCE 2)
1960 / 1970	DESIGN TOP OF CCP GRADES (ASH POND 92 AND SW SECTION 16 UPSTREAM RAISE)
1960 / 1970	PROPOSED TOP OF CCP GRADES (ASH POND 91 UPSTREAM RAISE)
	CROSS-OVER PIPING

NOTES

1. CROWN OF CCP GRADES ARE SHOWN AT FIVE PERCENT, BUT MAY BE CONSTRUCTED BETWEEN THREE PERCENT AND FIVE PERCENT.
2. CONTACT WATER IS COLLECTED IN THE PERIMETER DITCH AROUND ASH POND 91. WATER IS DIRECTED THROUGH CROSS-OVER PIPES TO THE DRAINS POND OR DOWNWARD INTO THE UPSTREAM RAISE.

REFERENCES

1. SITE LOCATION: SECTIONS 16 AND 17, T145N, R82W, MCLEAN COUNTY, NORTH DAKOTA.
2. EXISTING GROUND TOPOGRAPHY WAS PROVIDED BY GREAT RIVER ENERGY. THE SURVEYS WERE PERFORMED BETWEEN 1996 AND 2011 EXCEPT DRAINS POND AS-BUILT TOP OF LINER SYSTEM GRADES, WHICH WERE SURVEYED BY INTERSTATE ENGINEERING, INC. AND ARE REFERENCED FROM A SURVEY DRAWING PROVIDED BY GREAT RIVER ENERGY, DATED JANUARY 10, 1994.
3. COORDINATES ARE BASED ON THE PLANT GRID SYSTEM.
4. THE CONTOUR INTERVAL IS TWO FEET.
5. ALL PROPERTY SHOWN ON THIS MAP IS OWNED BY GREAT RIVER ENERGY.

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
B	2015-02-11	ISSUED FOR PERMIT MODIFICATION	CCS	CCS	TJS	RRJ
A	2014-11-10	ISSUED FOR CLIENT REVIEW	CCS	CCS	TJS	RRJ

SEAL

REGISTERED PROFESSIONAL ENGINEER TODD J. STONG PE-6144 NORTH DAKOTA DATE 2/11/2015

CLIENT

GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

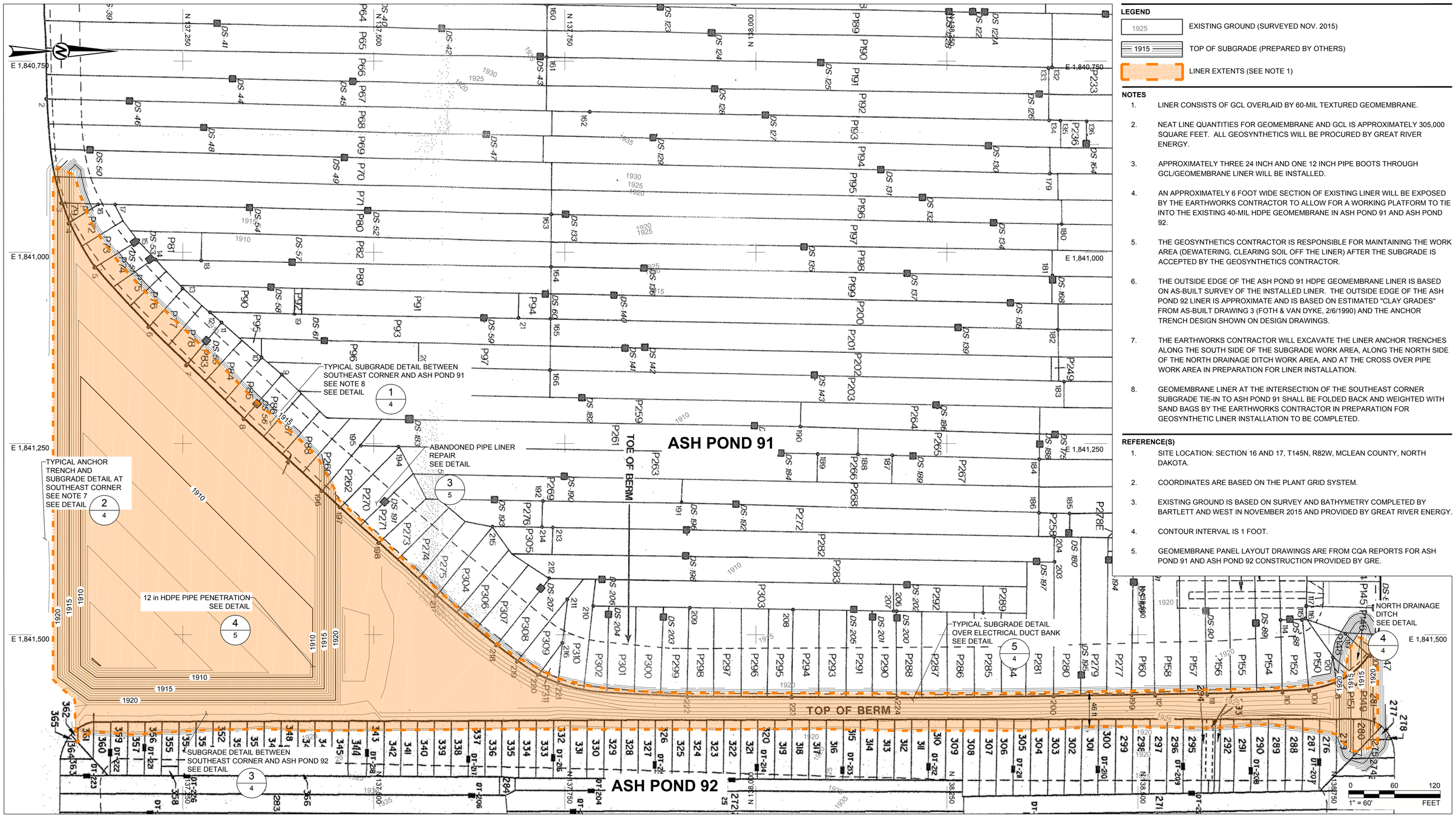
CONSULTANT

GOLDER ASSOCIATES INC.
44 UNION BLVD. SUITE 300
LAKEWOOD, COLORADO
USA
(303) 980-0540
www.golder.com

PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
PROPOSED FINAL CCP GRADES

PROJECT No. 1400644 | Rev. B | 4 of 10 | SHEET 4



LEGEND

- 1925 — EXISTING GROUND (SURVEYED NOV. 2015)
- 1915 — TOP OF SUBGRADE (PREPARED BY OTHERS)
- LINER EXTENTS (SEE NOTE 1)

NOTES

1. LINER CONSISTS OF GCL OVERLAID BY 60-MIL TEXTURED GEOMEMBRANE.
2. NEAT LINE QUANTITIES FOR GEOMEMBRANE AND GCL IS APPROXIMATELY 305,000 SQUARE FEET. ALL GEOSYNTHETICS WILL BE PROCURED BY GREAT RIVER ENERGY.
3. APPROXIMATELY THREE 24 INCH AND ONE 12 INCH PIPE BOOTS THROUGH GCL/GEOMEMBRANE LINER WILL BE INSTALLED.
4. AN APPROXIMATELY 6 FOOT WIDE SECTION OF EXISTING LINER WILL BE EXPOSED BY THE EARTHWORKS CONTRACTOR TO ALLOW FOR A WORKING PLATFORM TO TIE INTO THE EXISTING 40-MIL HDPE GEOMEMBRANE IN ASH POND 91 AND ASH POND 92.
5. THE GEOSYNTHETICS CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE WORK AREA (DEWATERING, CLEARING SOIL OFF THE LINER) AFTER THE SUBGRADE IS ACCEPTED BY THE GEOSYNTHETICS CONTRACTOR.
6. THE OUTSIDE EDGE OF THE ASH POND 91 HDPE GEOMEMBRANE LINER IS BASED ON AS-BUILT SURVEY OF THE INSTALLED LINER. THE OUTSIDE EDGE OF THE ASH POND 92 LINER IS APPROXIMATE AND IS BASED ON ESTIMATED "CLAY GRADES" FROM AS-BUILT DRAWING 3 (FOTH & VAN DYKE, 2/6/1990) AND THE ANCHOR TRENCH DESIGN SHOWN ON DESIGN DRAWINGS.
7. THE EARTHWORKS CONTRACTOR WILL EXCAVATE THE LINER ANCHOR TRENCHES ALONG THE SOUTH SIDE OF THE SUBGRADE WORK AREA, ALONG THE NORTH SIDE OF THE NORTH DRAINAGE DITCH WORK AREA, AND AT THE CROSS OVER PIPE WORK AREA IN PREPARATION FOR LINER INSTALLATION.
8. GEOMEMBRANE LINER AT THE INTERSECTION OF THE SOUTHEAST CORNER SUBGRADE TIE-IN TO ASH POND 91 SHALL BE FOLDED BACK AND WEIGHTED WITH SAND BAGS BY THE EARTHWORKS CONTRACTOR IN PREPARATION FOR GEOSYNTHETIC LINER INSTALLATION TO BE COMPLETED.

REFERENCE(S)

1. SITE LOCATION: SECTION 16 AND 17, T145N, R82W, MCLEAN COUNTY, NORTH DAKOTA.
2. COORDINATES ARE BASED ON THE PLANT GRID SYSTEM.
3. EXISTING GROUND IS BASED ON SURVEY AND BATHYMETRY COMPLETED BY BARTLETT AND WEST IN NOVEMBER 2015 AND PROVIDED BY GREAT RIVER ENERGY.
4. CONTOUR INTERVAL IS 1 FOOT.
5. GEOMEMBRANE PANEL LAYOUT DRAWINGS ARE FROM CQA REPORTS FOR ASH POND 91 AND ASH POND 92 CONSTRUCTION PROVIDED BY GRE.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-08-25	ISSUED FOR CONSTRUCTION	RFS	RFS	CCS	TJS
B	2016-08-01	ISSUED FOR CONTRACTOR INFORMATION	RFS	RFS	CCS	TJS
A	2016-06-28	ISSUED FOR BID	RFS	RFS	CCS	TJS

SEAL

REGISTERED PROFESSIONAL ENGINEER — TODD J. STONG — PE-6144 — DATE 8/25/16 — NORTH DAKOTA

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT

GOLDER ASSOCIATES, INC.
44 UNION BLVD, SUITE 300
LAKEWOOD, COLORADO
USA
[+1] (303) 980-0540
www.golder.com

PROJECT
ASH POND 91 UPSTREAM RAISE CONSTRUCTION
GEOSYNTHETICS INSTALLATION

TITLE
GEOSYNTHETICS INSTALLATION PLAN VIEW

PROJECT NO.	REV.	3 of 5	DRAWING
1658202	0		3

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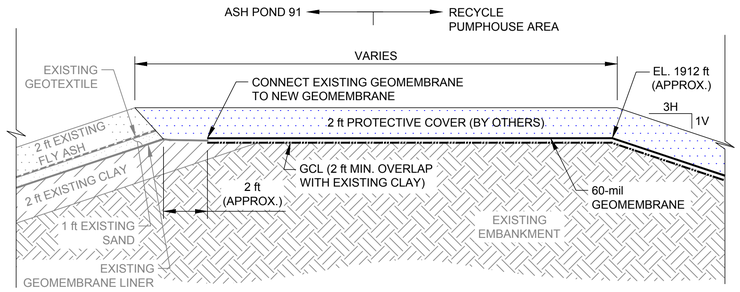
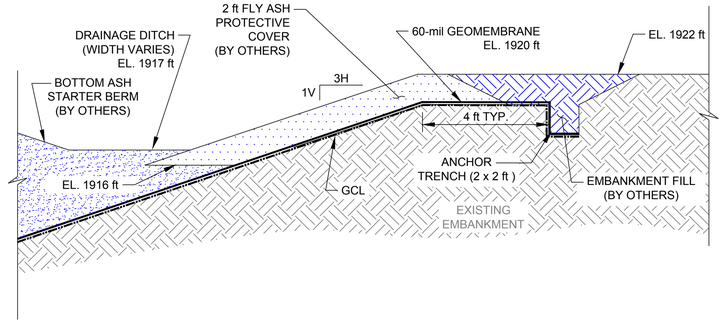
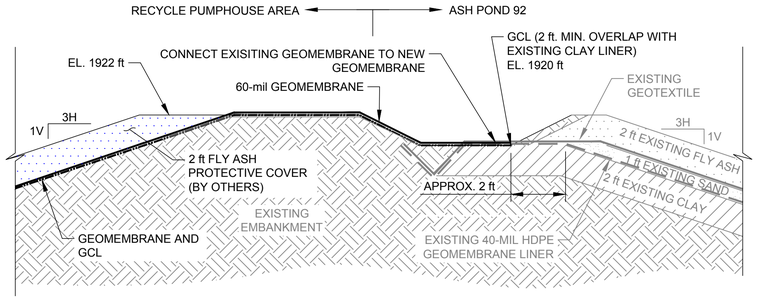


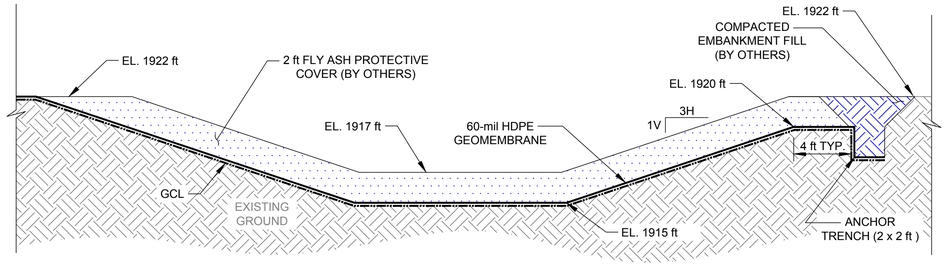
N.T.S. 1/4 1 ASH POND 91 TO SOUTHEAST CORNER SUBGRADE DETAIL



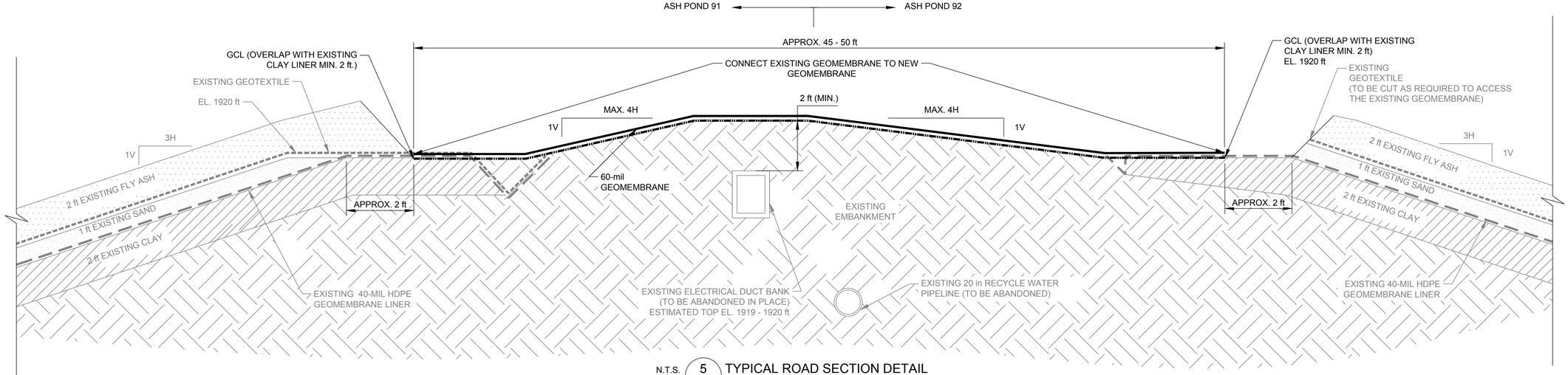
N.T.S. 2/4 2 SOUTHEAST CORNER ANCHOR TRENCH DETAIL



N.T.S. 3/4 3 SOUTHEAST CORNER TO ASH POND 92 LINER DETAIL



N.T.S. 4/4 4 NORTH DRAINAGE DITCH DETAIL



N.T.S. 5/4 TYPICAL ROAD SECTION DETAIL

NOTES

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Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
0	2016-08-25	ISSUED FOR CONSTRUCTION	RFS	RFS	CCS	TJS
A	2016-06-28	ISSUED FOR BID	RFS	RFS	CCS	TJS

SEAL

REGISTERED PROFESSIONAL ENGINEER
TODD J. STONG
PE-6144
DATE 8/25/16
NORTH DAKOTA

CLIENT
GREAT RIVER ENERGY
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PROJECT
ASH POND 91 UPSTREAM RAISE CONSTRUCTION
GEOSYNTHETICS INSTALLATION

TITLE
GEOSYNTHETICS DETAILS 1 OF 2

PROJECT No. 1658202 | Rev. 0 | 4 of 5 | DRAWING 4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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APPENDIX B
VISUAL OBSERVATIONS CHECKLIST

IMPOUNDMENT INSPECTION CHECKLIST

Facility Name: ***Upstream Raise 91***

Owner and Address: **Great River Energy – Coal Creek Station**

Purpose of Facility: **CCR Dewatering and Containment**

Legal: **Section 16 and 17** ***Township:*** **145N** ***Range:*** 82W

County: **McLean**

Inspected By: **Craig Schuettpelz** ***Inspection Date:*** 09/21/2017

Weather: **Mostly sunny, 60-70° F Wind:6 mph E**

ITEM	Y	N	N/A	REMARKS
1. General Conditions				
a. Alterations	X			
b. Development of downstream plain		X		
c. Grass cover	X			Some areas require re-seeding
d. Settlement/misalignment/cracks		X		
e. High water mark			X	Elevation:
f. Current water level	X			Elevation: 1917 ft
g. Sudden drops in water level?		X		
2. Inflow Structure				Include Reject pipes and Upstream Raise 92 drainage and culvert piping
a. Settlement			X	
b. Cracking			X	
c. Corrosion		X		
d. Obstacles in inlet		X		
e. Riprap/erosion control			X	Fly ash protective cover at culvert piping
3. Outflow Structure				Cross-over pipes to Drains Pond System were submerged
a. Settlement		X		
b. Cracking		X		
c. Corrosion		X		
d. Obstacles in outlet		X		
e. Riprap/erosion control	X			Fly ash protective cover
4. Upstream slope				
a. Erosion – liner exposed?		X		
b. Rodent burrows		X		
c. Vegetation		X		
d. Cracks/settlement		X		
e. Riprap/other erosion protection	X			Fly ash protective cover
5. Crest				
a. Soil condition	X			
b. Comparable to design width	X			
c. Vegetation		X		
d. Rodent burrows		X		
e. Exposed to heavy traffic	X			CAT 777 haul trucks on north side
f. Damage from vehicles/machinery		X		Rutting and slippery when wet
6. Downstream slope				
a. Erosion		X		Erosion controls recently installed
b. Vegetation	X	X		North side has healthy vegetation, limited vegetation of areas seeded 2015 (south, west)
c. Rodent burrows	X			
d. Cracks/settlement/scarps		X		
e. Drain conditions			X	
f. Seepage		X		
7. Toe				
a. Vegetation	X			
b. Rodent burrows		X		
c. Settlement		X		
d. Drainage conditions	X			Standing water on south, west sides (Culvert piping cleaned out to promote flow through surface water ditches)
e. Seepage		X		

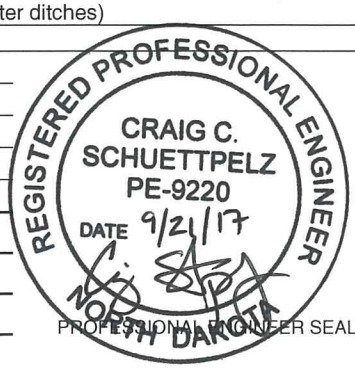
General Remarks: The impoundment is in good condition (no significant. stability concerns). Downstream slopes were repaired and reseeded, and erosion controls were installed. Areas on the south downstream slope may need to be reseeded again to limit future erosion.

Name of Engineer: Craig Schuettpelz

Date: 9/21/17

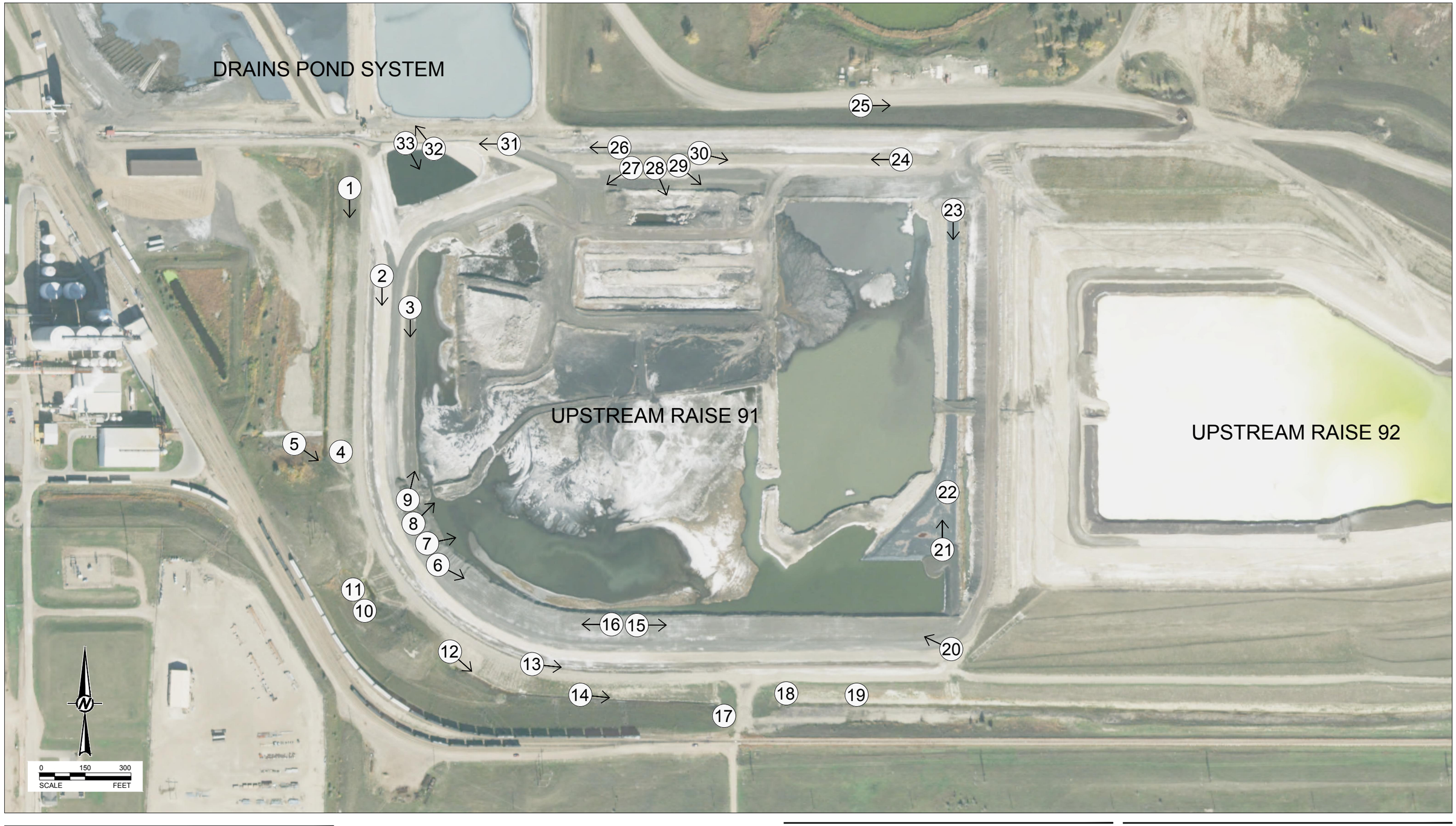
Engineering Firm: Golder Associates Inc.

Signature:



PROFESSIONAL ENGINEER SEAL

APPENDIX C
PHOTOGRAPHS



LEGEND

1 PHOTOGRAPH LOCATION

REFERENCES

1. AERIAL IMAGE FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM, PUBLISHED IN 2017.

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-12-18
DESIGNED	RFS
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

PROJECT
2017 ANNUAL INSPECTION REPORT

TITLE
UPSTREAM RAISE 91 CCR SURFACE IMPOUNDMENT PHOTOGRAPH LOCATIONS

PROJECT NO.	REV.	FIGURE
1772255	A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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Upstream Raise 91

Photograph 1 (West berm downstream slope)
Recently vegetated west berm downstream slope of Upstream Raise 91 and toe, 1-2 feet of water in the ditch (DSCN1697.JPG)

Photograph 2 (West berm upstream slope)
Berm upstream slope of Upstream Raise 91 and contact water control channel (DSCN1698.JPG)

Upstream Raise 91

Photograph 3 (West CCR crest)
CCR material placement (DSCN1699.JPG)

Photograph 4 (West toe)
Inlet of north surface water culvert (DSCN1704.JPG)

Upstream Raise 91

Photograph 5 (West berm downstream slope)
Erosion control blanket on west berm downstream slope of Upstream Raise 91 (DSCN1705.JPG)

Photograph 6 (Southwest CCR upstream slope)
Panoramic of Upstream Raise 91 interior (1 of 4) (DSCN1709.JPG)

Upstream Raise 91

Photograph 7 (Southwest CCR upstream slope)
Panoramic of Upstream Raise 91 interior (2 of 4) (DSCN1710.JPG)

Photograph 8 (Southwest CCR upstream slope)
Panoramic of Upstream Raise 91 interior (3 of 4) (DSCN1711.JPG)

Upstream Raise 91

Photograph 9 (Southwest CCR upstream slope)
Panoramic of Upstream Raise 91 interior (4 of 4) (DSCN1712.JPG)

Photograph 10 (Southwest berm downstream slope)
Southwest surface water ditch and southwest culvert inlets, 1 foot of water in ditch (DSCN1715.JPG)

Upstream Raise 91

Photograph 11 (Southwest berm downstream slope)
Southwest surface water ditch and berm downstream slope of Upstream Raise 91 (DSCN1717.JPG)

Photograph 12 (South berm downstream slope)
Outlet of southwest culverts and erosion control blankets installed on south berm downstream slope (DSCN1719.JPG)

Upstream Raise 91

Photograph 13 (South berm upstream slope)
Berm upstream slope of Upstream Raise 91 and contact water control channel (DSCN1723.JPG)

Photograph 14 (South toe)
Approximately 1 foot of water in concrete surface water channel (DSCN1726.JPG)

Upstream Raise 91

Photograph 15 (South CCR upstream slope)
CCR placement in Upstream Raise 91 (DSCN1727.JPG)

Photograph 16 (South CCR upstream slope)
CCR placement in Upstream Raise 91 (DSCN1728.JPG)

Upstream Raise 91

Photograph 17 (South berm downstream slope)
South berm downstream slope and concrete surface water channel (DSCN1731.JPG)

Photograph 18 (South berm downstream slope)
Scarce vegetation on south berm downstream slope (recently repaired) (DSCN1734.JPG)

Upstream Raise 91

Photograph 19 (South berm downstream slope)
Animal burrow (DSCN1738.JPG)

Photograph 20 (South CCR upstream slope)
Interior of Upstream Raise 91 (DSCN1740.JPG)

Upstream Raise 91

Photograph 21 (East berm crest)
Upstream Raise 91/Upstream Raise 92 liner connection (DSCN1741.JPG)

Photograph 22 (East berm crest)
Geomembrane wrinkles in Upstream Raise 91/Upstream Raise 92 liner connection (DSCN1742.JPG)

Upstream Raise 91

Photograph 23 (East berm crest)
Upstream Raise 91/Upstream Raise 92 liner connection (DSCN1747.JPG)

Photograph 24 (Northeast berm crest)
Culvert outlet from Upstream Raise 92 and contact water control channel (DSCN1748.JPG)

Upstream Raise 91

Photograph 25 (North toe)
North toe in good condition (DSCN1752.JPG)

Photograph 26 (North CCR upstream slope)
Interior panoramic of Upstream Raise 91 (1 of 5) (DSCN1754.JPG)

Upstream Raise 91

Photograph 27 (North CCR upstream slope)
Interior panoramic of Upstream Raise 91 (2 of 5) (DSCN1755.JPG)

Photograph 28 (North CCR upstream slope)
Interior panoramic of Upstream Raise 91 (3 of 5) (DSCN1756.JPG)

Upstream Raise 91

Photograph 29 (North CCR upstream slope)
Interior panoramic of Upstream Raise 91 (4 of 5) (DSCN1757.JPG)

Photograph 30 (North CCR upstream slope)
Interior panoramic of Upstream Raise 91 (5 of 5) (DSCN1758.JPG)

Upstream Raise 91

Photograph 31 (North Berm crest)
Ash pipeline ditch (DSCN1763.JPG)

Photograph 32 (North berm upstream slope)
Ash pipelines ditch culvert to Upstream Raise 91 (DSCN1770.JPG)

Upstream Raise 91

Photograph 33 (North berm upstream slope)
Gravity drainage pipelines (left side of photograph) and contact water management culverts (right side of photograph) (DSCN1769.JPG)