ANNUAL REPORT

ANNUAL INSPECTION REPORT

GREAT RIVER ENERGY – COAL CREEK STATION

Upstream Raise 92 CCR Surface Impoundment

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 the Upstream Raise 92 facility at CCS performed September 20, 2017.

2.0 REVIEW OF EXISTING INFORMATION

2.1 Geological Conditions

Upstream Raise 92 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 92 (Figure 2) is located in Section 16, Township 145N, Range 82W and covers approximately 110 acres. The facility is used as a combined dewatering and storage facility for CCRs including fly ash, bottom ash, and flue gas desulfurization (FGD) material. FGD material and hydraulic conveyance water enter Upstream Raise 92 through a high-density polyethylene (HDPE) pipe from the plant to the northwest corner of the facility. The pipe runs above ground from the northwest corner of the facility to the final discharge location. The on-grade HDPE pipe is periodically moved to different areas of Upstream Raise 92 to achieve an even distribution of FGD material in the facility. Bottom ash and fly ash are hauled to the facility using heavy construction equipment, such as Caterpillar 777 haul trucks. The facility is dewatered using gravity-driven drainage pipes that extend from the west side of Upstream Raise 92 to the east side of Upstream Raise 91. Upstream Raise 92 is approximately 300 feet south of Lower Samuelson Slough and 100 feet north of rail lines. Upstream Raise 91 is adjacent to the west end of the facility and the plant dry CCR landfill (Southeast 16) is adjacent to the east side of the facility. Upstream Raise 92 was constructed within the boundaries of the historic Ash Pond 92 (west side of Upstream Raise 92) and the Southwest Section 16 Landfill (east side of Upstream Raise 92).

Ash Pond 92 was originally part of the South Ash Pond. The South Ash Pond was constructed with a clay core dike around the perimeter and a soil liner. A new clay liner was installed over the South Ash Pond in 1982 and the facility remained in operation until 1987 when in-place CCRs were excavated from the South Ash Pond and transported to the Section 5 dry CCR landfill (Eugene A. Hickok & Associates 1986; Foth & Van Dyke 1988). The South Ash Pond was then divided into Ash Pond 91 and Ash Pond 92. Ash Pond 92 was deepened and a new composite liner consisting of a 2-foot thick clay and 40-mil HDPE liner was completed in 1989. The liner is overlain with 1 foot of sand, 1 foot of Pit Run gravel, and a drainage system with collection pipes that slope to the north side of the facility. Ash Pond 92 was modified in 2002 to allow for “vertical” placement of CCRs. Since September of 2002, the facility has been constructed with an interior area of FGD material, a drainage layer of bottom ash, and an outer shell of fly ash (Figure 3).

The Southwest Section 16 Landfill was originally part of the East Ash Pond and was constructed with a natural clay liner. In 1989, the facility was reclassified as a solid waste disposal area and CCRs from the other parts of the East Ash Pond were excavated and placed in the Southwest Section 16 Landfill. The

Southwest Section 16 Landfill was re-graded and a new composite liner consisting of a 1-foot thick clay and 60-mil LLDPE liner was installed over the previously placed CCR in three phases between 2005 and 2008. The liner is overlain with a “liner head reduction system” consisting of 18 inches of granular material and drainage pipes overlain by a 1-foot clay liner. The Southwest Section 16 Landfill was re-graded and relined to allow for “vertical” placement of CCRs and has been connected with the “vertical” placement of CCRs occurring in Ash Pond 92. Appendix A contains additional information regarding the design of Upstream Raise 92.

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 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.

2.3 Site Geometry

The design crest of the original soil perimeter berms surrounding Upstream Raise 92 are at approximate elevations between 1900 feet above mean sea level (amsl) and 1920 feet amsl. This berm surrounding the facility 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 or 2.5:1 slopes down to perimeter drainage ditches with elevations between approximately 1880 feet amsl and 1900 feet amsl. Original soil perimeter berm upstream slopes have an approximate 3:1 slope from this original soil perimeter berm to the base of the facility between 1892 feet amsl and 1910 feet amsl.

An expansion berm on the east half of the facility built with soil and CCRs extends from the original soil perimeter berms to an elevation of 1950 feet amsl at 3.5:1 to 4:1 slopes. The entire facility is designed with 4:1 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 2022 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 1986 feet amsl to 1992 feet amsl and the FGD material has increased in elevation from approximately 1974 feet amsl to 1980 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 the Upstream Raise 92, the facility has a remaining CCR capacity of approximately 1,200,000 cubic yards (CY). The approximate total CCR capacity of Upstream Raise 92 is 12,920,000 CY.

Therefore, the amount of CCR contained in the facility at the time of the inspection is estimated to be approximately 11,720,000 CY.

2.6 Impounded Water

The depth of impounded water in Upstream Raise 92 varies with time as more CCRs are deposited and as operational variables change (such as gravity drainage pipe elevations). The water elevation at the time of the inspection was approximately 1980 feet amsl. Although not directly measured because of access safety constraints, the average elevation of FGD material in the facility was approximately 1978 feet amsl based on visual observations. An average of approximately 2 feet of water was impounded in Upstream Raise 92 at the time of inspection. Based on an area of impounded water of 21.5 acres, the volume of impounded water at the time of the inspection was approximately 43 acre-feet or 14,000,000 gallons.

2.7 Permits

Upstream Raise 92 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).

2.8 Summary of 2017 Weekly Inspections

Routine weekly inspections of Upstream Raise 92 facility were performed throughout 2017 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.
- Cracks in bottom ash and fly ash crests and side slopes were noted and onsite staff discussed the cracks with the design engineers. These cracks were attributed to consolidation of interior FGD materials and are expected to continue during placement of CCRs.
- Fugitive dust actively controlled using a water truck (as required).

2.9 Summary of Previous Inspections

The most recent annual professional engineer inspection of Upstream Raise 92 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 or unexpected seepage, settlement, or cracking of the berm downstream slopes.
- Cracks in bottom ash and fly ash crests were noted and were attributed to consolidation of interior FGD materials. These cracks were expected to continue during placement of CCRs.
- Minor erosion of the fly ash “shell” (within the lined footprint of the facility).
- Several small animal burrows, but none that were anticipated to cause areas of structural weakness.

- Portions of the final cover seeded in the past two years have fair native grass vegetative growth.

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 20, 2017, Craig Schuettpelz and Ryan Shedivy of Golder performed a visual inspection of Upstream Raise 92 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

Upstream Raise 92 has an inflow pipe for depositing FGD material. The on-grade HDPE pipe is 8 inches in diameter and is periodically moved to different areas of Upstream Raise 92 to achieve an even distribution of FGD material in the facility.

The outflows from Upstream Raise 92 consist of a series of gravity drainage pipes and culverts that transfer CCR conveyance water from the facility to the adjacent Upstream Raise 91. Over time, the gravity drainage pipes can become clogged with material and new pipes are installed to convey water between the facilities. At the time of the inspection, gravity drainage pipes were in good condition. Similarly, the culverts connecting the drainage ditch on the west side of Upstream Raise 92 to Upstream Raise 91 were in good condition.

The inflow and outflow systems appear to be in good condition with no sign of settlement, cracking, or corrosion.

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 from elevation 1917 to 1920 was visible on the north and west 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 crest of the original perimeter soil berm surrounding the facility (elevation 1900 feet amsl to 1920 feet amsl) is a gravel surfaced road that appeared to be in good condition. The road was well-compacted and experiences frequent heavy traffic. The visual inspections did not reveal signs of cracking, erosion, or settlement.

3.2.3 Berm Downstream Slope

The berm downstream slopes of Upstream Raise 92 below the original and expansion berms are covered with tall grass. There is no noticeable significant erosion, cracks, or scarps on these grassy slopes and they appear to be in good condition.

3.3 Toe

The toe of the slopes on the north and south sides of Upstream Raise 92 are mostly covered with tall grass. A few small animal burrows were noticed during the inspection, but there were no noticeable signs of seepage, cracks, or settlement.

The surface water drainage at the toe of the slope on the south side of Upstream Raise 92 had some marshy vegetation and standing water. The surface water drainage ditch in this area was recently modified to promote flow toward site surface water drainages and therefore portions of this ditch were not yet well-vegetated. The presence of some standing water in this surface water drainage ditch was still noted due to the low average slope of this ditch and the fact that it is near groundwater levels. Side slopes of this drainage ditch are also relatively steep near the toe, but did not show signs of movement. The toe may need to be regraded and reseeded in the future to limit erosion. In addition, the downchute channels should be extended and hydraulic jump basins constructed on the south side of the facility to limit erosion when final cover is constructed over the entirety of Upstream Raise 92.

3.4 CCR Placement

3.4.1 CCR Upstream Slope

The CCR upstream slope is defined as the slope that toes out into the raise pool. The CCR upstream slope of Upstream Raise 92 is constantly changing as bottom ash and FGD material are deposited. Therefore, the CCR upstream slopes are temporary and dependent on the angle of repose of the bottom ash material. The vertical distance from the top of the bottom ash CCR upstream slope to the water/FGD material mixture is approximately 9 to 12 feet in most locations. The CCR upstream slopes appear to be in good condition with no signs of structural weakness.

3.4.2 CCR Crest

The CCR crest along the top of the facility is constructed mainly of bottom ash. The CCR crest is bordered on the outsides of the facility by a fly ash “shell” primarily for erosion protection and as a trafficking surface. Bottom ash on the CCR crest of the facility is in good condition and is continually worked and compacted with heavy equipment. During the inspection, cracks were noted on the surface of the CCR downstream slopes and the CCR crest (between elevations 1974 feet amsl and 1992 feet amsl) within the lined footprint of the facility. In each case, the cracks were between approximately 1 and 18 inches wide, up to several feet deep, and up to several hundred feet long. The cracks are expected and can be attributed to consolidation of FGD material on the interior of the facility and the relatively rigid bottom ash and fly ash exterior of the facility. These cracks are continually observed and evaluated by onsite operations personnel for changes to the shape, offset, or length of the features, and the installed instrumentation (inclinometers and piezometers) provides additional information regarding the performance of the facility with respect to the design.

3.4.3 CCR Downstream Slope (no Cover)

The area above the original and expansion berm downstream slopes surrounding the west and east sides, and a portion of the north and south sides of Upstream Raise 92 had an exposed fly ash “shell” at the time of the inspections (CCR downstream slope). The fly ash CCR downstream slope is in good condition and there was no noticeable seepage, sloughing, cracking, or abnormally thriving vegetation, or settlement during the inspections; however, there was some minor erosion of the fly ash shell. The eroded fly ash is collected within the lined footprint in a perimeter ditch and must be periodically cleaned out as required.

3.4.4 CCR Downstream Slope (with Cover)

Portions of CCR downstream slopes on the north side of Upstream Raise 92 have temporary cover installed as of late 2016. These areas had some vegetation beginning to grow in 2017 (a combination of grassy vegetation and weeds) and minor erosion on the soil surface below. However, these CCR downstream slopes with temporary cover appeared to be in generally good condition to aid in controlling erosion of the outer fly ash “shell” and limit wind-blown fugitive dust.

The south CCR downstream slope of Upstream Raise 92 has final cover on the side slopes to an elevation of 1974 feet amsl with terraces approximately every 20 vertical feet and downchute drainage channels along the side slopes. Portions of the CCR downstream slope with final cover seeded in the past two years have fair native grass vegetative growth. These areas should continue to be monitored and should be re-seeded to promote growth of native grass species, as required. Other areas of the CCR downstream slope with final cover covered more than two years ago show good native grass vegetative growth.

3.5 Instrumentation

Water levels in Upstream Raise 92 are monitored monthly using 15 piezometers located within the placed CCR slopes of the facility. In addition, two inclinometers were installed in the CCR slopes of the facility to monitor slope movements associated with ongoing consolidation of FGD material in the facility. The plan view location of each piezometer and inclinometer is shown in Figure 4.

Piezometer measurements for the past year are included in Appendix D-1. Piezometers PZ-1 through PZ-12 were constructed near the perimeter bottom ash seepage piping and have historically fluctuated by less than approximately 3 feet as the facility height has increased. Piezometers PZ-13 (D and S) and PZ-14 (D and S) were constructed along the side slopes of the facility and show greater variability since installation as they are nearer to the FGD material pool in the center of the facility.

Between July 2016 and November 2016, the drain lines connecting Upstream Raise 91 and Upstream Raise 92 were closed to complete construction associated with the composite liner connection between the facilities. During this time period, the water levels in the piezometers were monitored weekly and were observed to rise as water was backed up in the bottom ash drainage layer in Upstream Raise 92. Once the piping connecting the bottom ash drainage layer within Upstream Raise 92 was re-connected to Upstream

Raise 91 in November 2016, the piezometer levels returned to their expected pre-Upstream Raise 91 construction levels. Going forward, the piezometers will continue to be monitored on a monthly basis unless conditions warrant additional information.

In 2016, piezometer PZ-13D rose approximately 15 feet, and has equilibrated at this new higher level. Preliminary evaluation of Piezometer PZ-13D suggests that the casing may be damaged and connecting the water within the piezometer to a different zone than the screened portion of the piezometer. This piezometer will continue to be monitored, but may be removed from future monitoring if deemed to be damaged.

Inclinometer measurements taken since 2014 are shown in Appendix D-2. Inclinometer measurements show a general trend that supports the consolidation of the FGD material in the middle of the facility. Consolidation of thicker zones of FGD material in the middle of the facility is greater than consolidation of FGD material zones near the perimeter. Therefore, the inclinometers show a trend of the rigid fly ash and bottom ash material settling toward the center of the facility.

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 92 were observed during the site inspection in September 2017.

4.0 CONCLUSIONS AND RECOMMENDATIONS

An annual visual inspection was performed for Upstream Raise 92 at Coal Creek Station on September 20, 2017. The inspection met the requirements for CCR surface impoundments under 40 CFR Part 257.83. Golder observed good vegetation and site maintenance and did not identify significant structural deficiencies such as significant seepage, settlement, or unexpected cracking during visual observations of Upstream Raise 92. Overall, the facility appeared to be in good condition at the time of the visual evaluation.

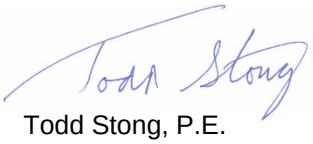
In addition to annual inspections by the Professional Engineer, trained and qualified site personnel will continue to perform the required weekly facility inspections to look for signs of potential structural weaknesses. Instrumentation (inclinometers and piezometers) will be monitored regularly to ensure proper operation of the equipment and to evaluate the overall structural stability of the facility.

Minor maintenance items that may need to be continually addressed include monitoring the size and shape of cracks in CCR downstream slope and CCR crest of the facility, repairing large animal burrows as they appear, monitoring erosion and vegetative success of the re-configured surface water channel along the south toe of the facility (including construction to complete downchute channels and hydraulic jump basins prior to final cover of the entirety of Upstream Raise 92), clean-out of collected material in the perimeter channels and maintaining gravity and culvert piping between Upstream Raise 91 and Upstream Raise 92, re-seeding of CCR downstream slopes with final cover, and removal of any woody vegetation growing on the berm downstream slopes. In addition, the inflow and outflow piping should be monitored regularly to ensure proper conveyance of water to and from the facility.

GOLDER ASSOCIATES INC.

Craig Schuettpelz, P.E.
Senior Project Engineer

Ryan Shedivy, P.E.
Project Engineer



Todd Stong, P.E.
Associate/Senior Consultant

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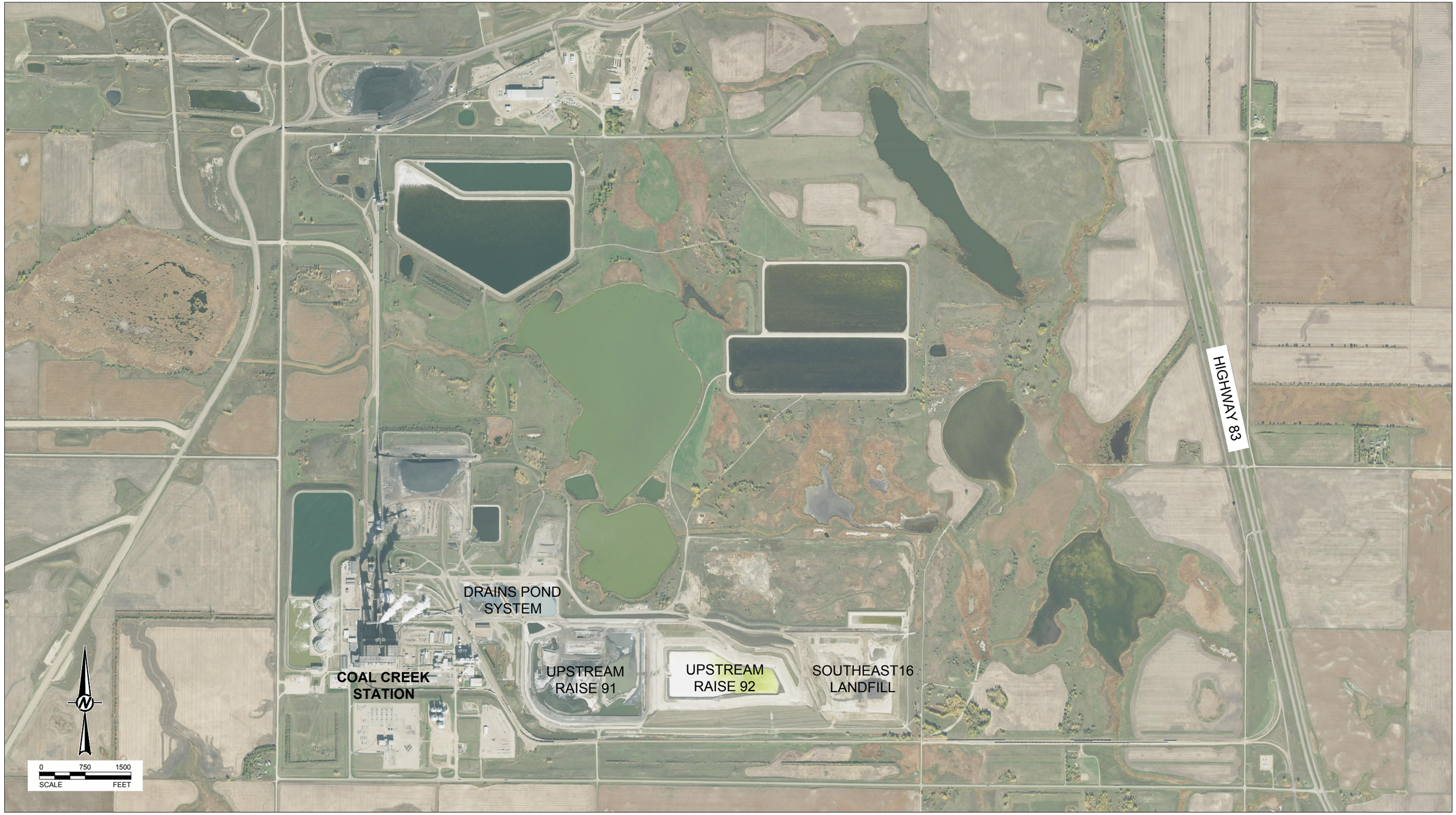
FIGURES



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

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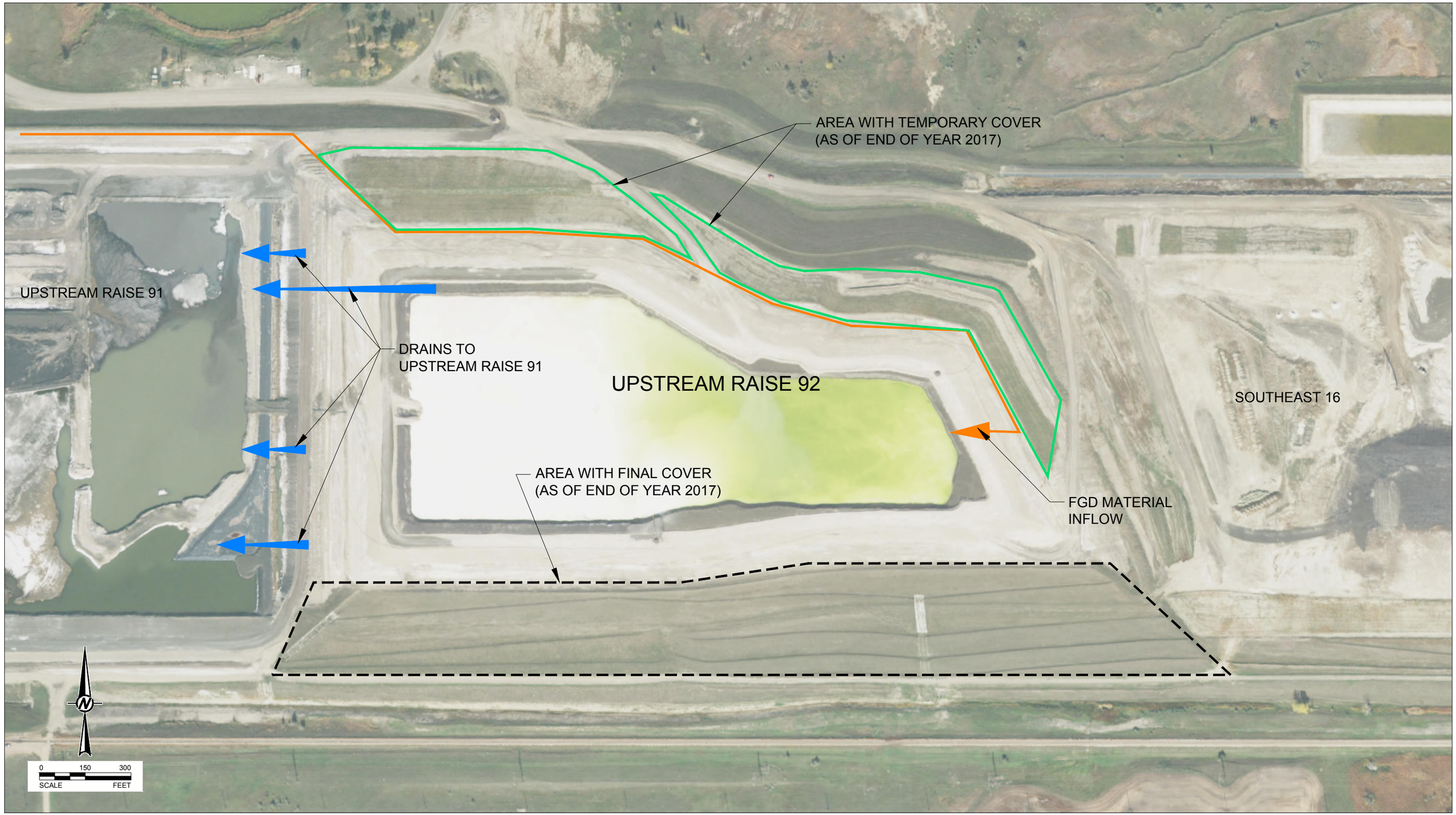

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UNDERWOOD, NORTH DAKOTA

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Golder Associates

YYYY-MM-DD	2017-12-13
DESIGNED	RFS
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

PROJECT
2017 ANNUAL INSPECTION REPORT

TITLE
UPSTREAM RAISE 92 CCR SURFACE IMPOUNDMENT SITE OVERVIEW

PROJECT NO.	REV.	FIGURE
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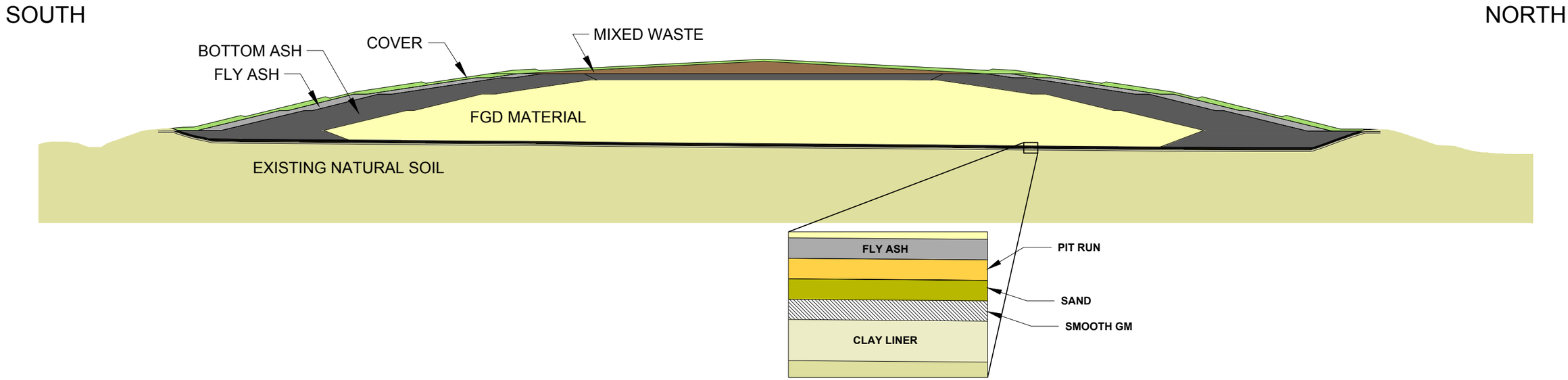

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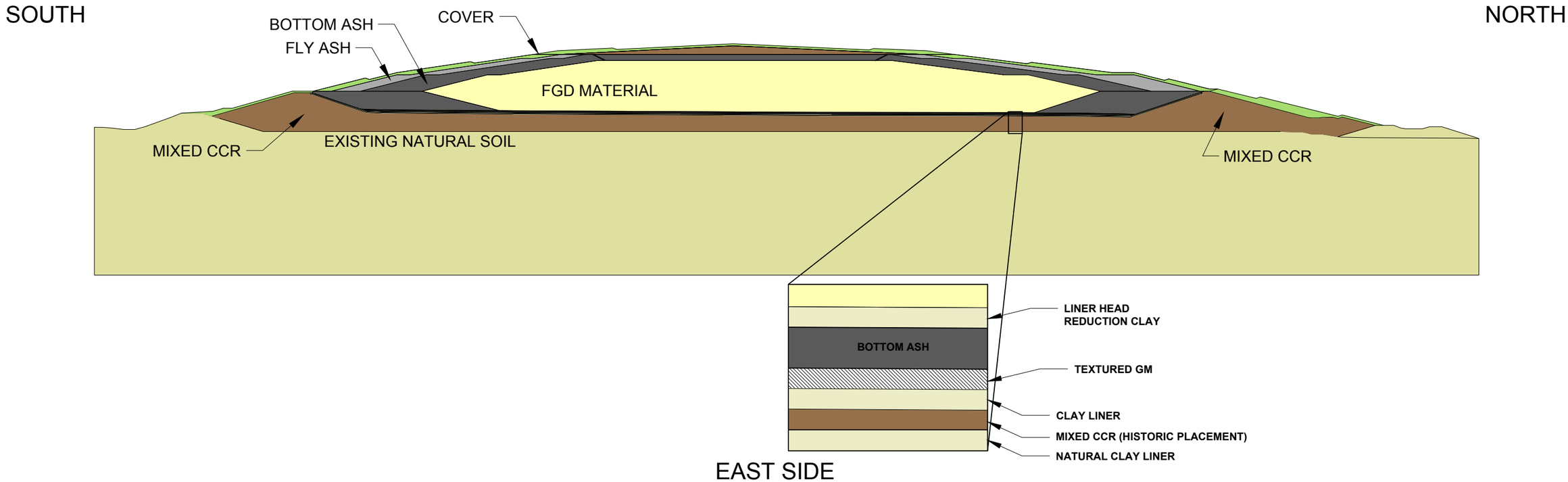

EAST SIDE

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT

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DESIGNED	RFS
PREPARED	RFS
REVIEWED	CCS
APPROVED	TJS

PROJECT
2017 ANNUAL INSPECTION REPORT

TITLE
UPSTREAM RAISE 92 CCR SURFACE IMPOUNDMENT CROSS SECTIONS

PROJECT NO. 1772255 | REV. A | FIGURE 3

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LEGEND

- PZ-2 — PIEZOMETER
- PZ-14 — SET OF TWO NESTED PIEZOMETERS
- IN-2 — INCLINOMETER

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

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DESIGNED	RFS
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

PROJECT
2017 ANNUAL INSPECTION REPORT

TITLE
UPSTREAM RAISE 92 CCR SURFACE IMPOUNDMENT INSTRUMENTATION OVERVIEW

PROJECT NO.	REV.	FIGURE
1772255	A	4

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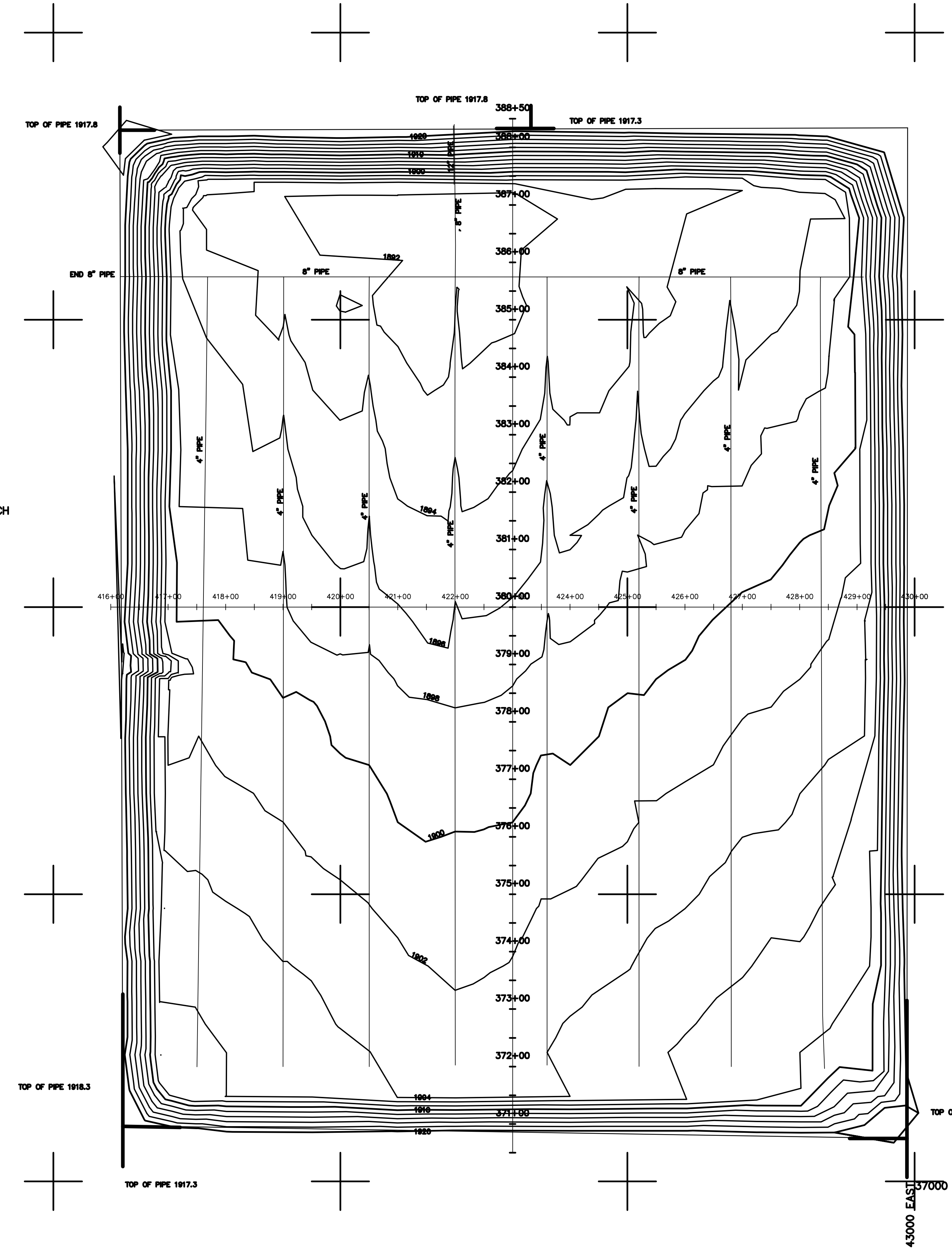
APPENDIX A
SELECTED CONSTRUCTION AND PERMIT DRAWINGS

COAL CREEK STATION

EAST HALF SOUTH ASH POND

FINISHED GRADES
AND PIPING

UNDERWOOD, NORTH DAKOTA



VENT PIPE
PIPING
GAS TRENCH

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.

THIS DRAWING PREPARED JANUARY 26, 1990
FROM INFORMATION COMPLETED ON DECEMBER 20, 1989

NOTES
1. SITE LOCATION SW 1/4 SECTION 16
   T. 145 N., R. 82 W., McLEAN COUNTY, NORTH DAKOTA.
2. TOPOGRAPHY IS BASED ON AN ACTUAL SURVEY OF THE GROUNDS.
3. ELEVATIONS ARE BASED ON SEA LEVEL DATUM.
4. HORIZONTAL DATUM IS BASED ON NORTH DAKOTA STATE PLANE COORDINATES SYSTEM AS FOLLOWS:
   SITE GRID NORTH = NORTH STATE PLANE COORDINATES MINUS 1000,000.
   SITE GRID EAST = EAST STATE PLANE COORDINATES MINUS 1,800,000.

SURVEYOR'S CERTIFICATE

I, LARRY J. SMITH, A REGISTERED LAND SURVEYOR IN THE STATE OF NORTH DAKOTA, HEREBY CERTIFY THAT THE ANNEXED PLAT IS A TRUE COPY OF THE NOTES OF SURVEY COMPLETED ON DECEMBER 20, 1989 AND IS A TRUE REPRESENTATION OF THE AS-BUILT CONDITION.

LARRY J. SMITH
NORTH DAKOTA REGISTRATION
NO. 2363

CIVIL ENGINEERING LAND PLANNING LAND SURVEYING
SWENSON, HAGEN & CO. P.C.
CONSULTING ENGINEERS
P.O. BOX 1135, 909 BASIN AVENUE
BISMARCK, NORTH DAKOTA

Foth & Van Dyke

PRF NAME:
DATE:
DATE:
CADD PROJ CODE:
DRAWN BY:
SURVEYED BY:
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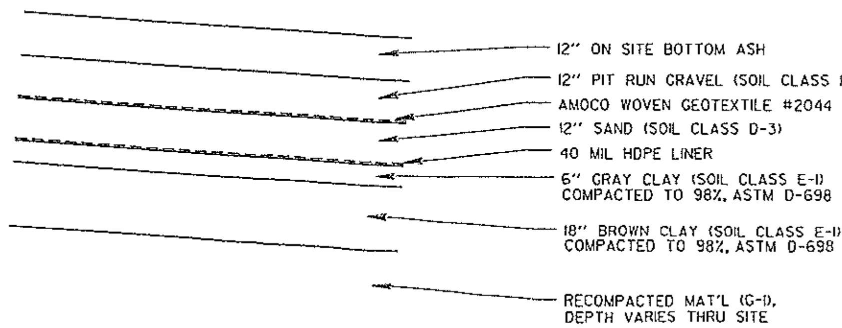
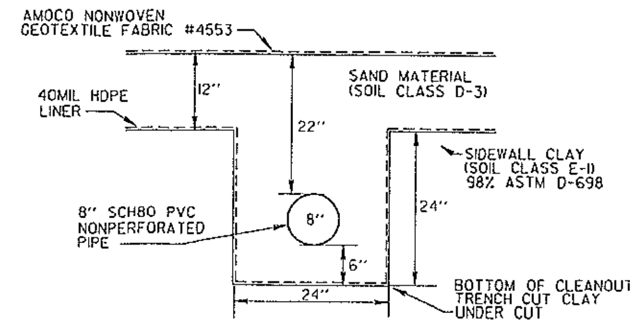
SCALE
SCOPE ID.
DRAWING NO.

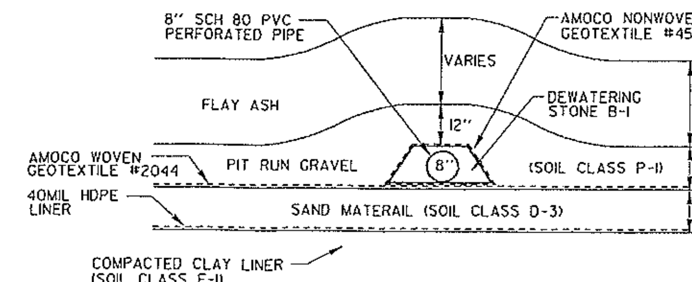


1/11 TYPICAL FLEXIBLE MEMBRANE LINER (FML) DETAIL

NOT TO SCALE



SECTION A - A'



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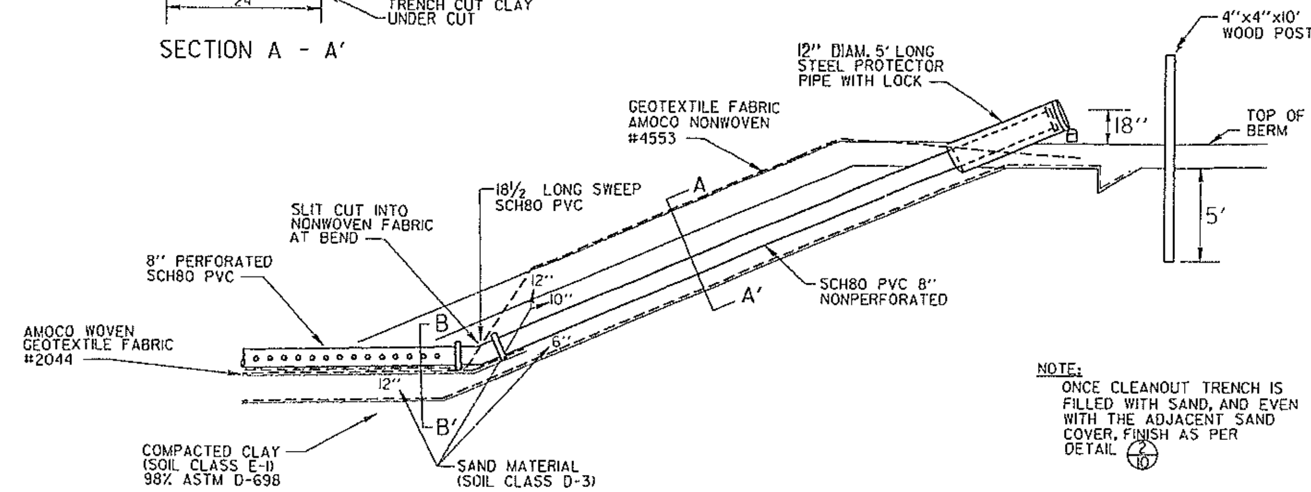
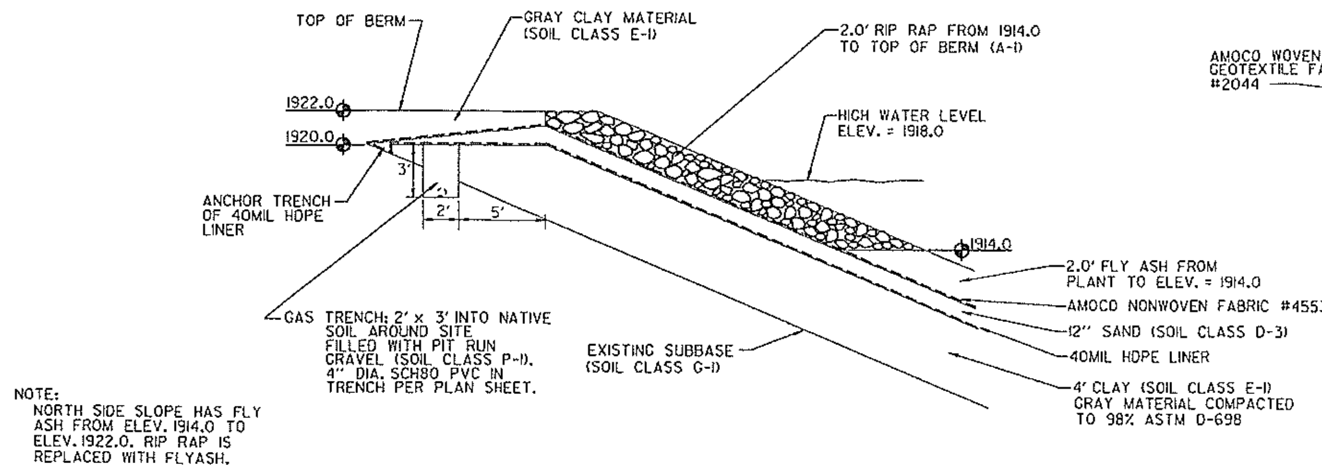


NOTE:
ONCE CLEANOUT TRENCH IS FILLED WITH SAND, AND EVEN WITH THE ADJACENT SAND COVER, FINISH AS PER DETAIL 2/10

4/11 TYPICAL CLEAN-OUT RISERS EAST AND WEST SLOPES

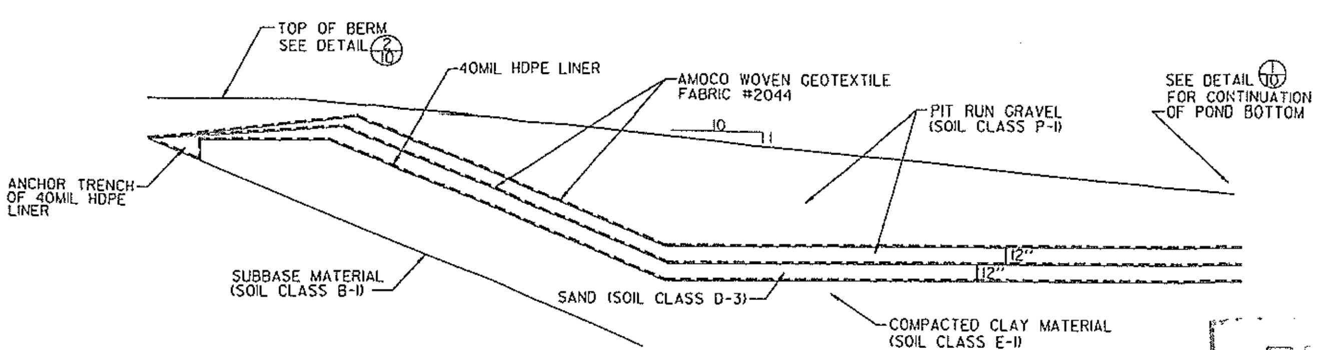
NOT TO SCALE



NOTE:
NORTH SIDE SLOPE HAS FLY ASH FROM ELEV. 1914.0 TO ELEV. 1922.0. RIP RAP IS REPLACED WITH FLYASH.

2/11 TYPICAL SIDE WALL DETAIL OF SOUTH, EAST AND WEST SLOPES

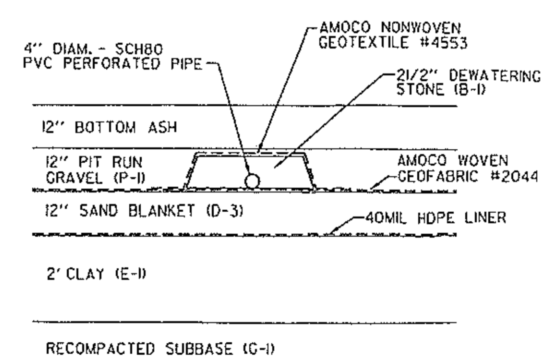
NOT TO SCALE

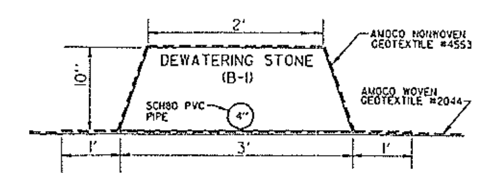


3/11 PERMANENT HEAVY EQUIPMENT ENTRANCE RAMP DETAIL (SOUTHEAST CORNER OF POND)

NOT TO SCALE

REDUCED DRAWING DO NOT SCALE





TYPICAL DEWATERING STONE DETAIL

5/11 TYPICAL DEWATERING AND HEADER TRENCH DETAIL WITH DETAIL OF THE BEDDING AROUND THE PERFORATED PIPE

NOT TO SCALE

REUSE OF DOCUMENTS

THIS DOCUMENT HAS BEEN DEVELOPED FOR A SPECIFIC APPLICATION AND NOT FOR GENERAL USE. THEREFORE, IT MAY NOT BE USED WITHOUT THE WRITTEN APPROVAL OF FOTH & VAN DYKE AND ASSOCIATES. UNAPPROVED USE IS THE SOLE RESPONSIBILITY OF THE UNAUTHORIZED USER.

CADD PROJ CODE: 9C00	PRF NAME: 9C00DET
DRAWN BY: DP	DATE: 1/25/90
SURVEYED BY: LS	DATE: 9/8/89
SURVEY DATA:	

RECORD DRAWINGS OF COMPLETED CONSTRUCTION CONFORMING TO CONTRACTORS AND/OR OWNERS RECORDS DURING CONSTRUCTION. BY TDM DATE 2-6-90

REVISIONS / REMARKS — NO. / BY / DATE

APPROVED BY: [signature] DATE: 2-6-90
REVIEWED BY: GJV DATE: 2-6-90
PREPARED BY: TDM DATE: 2-6-90

Foth & Van Dyke

COOPERATIVE POWER EDEN PRAIRIE, MINN.
AND
UNITED POWER ELK RIVER, MINN.

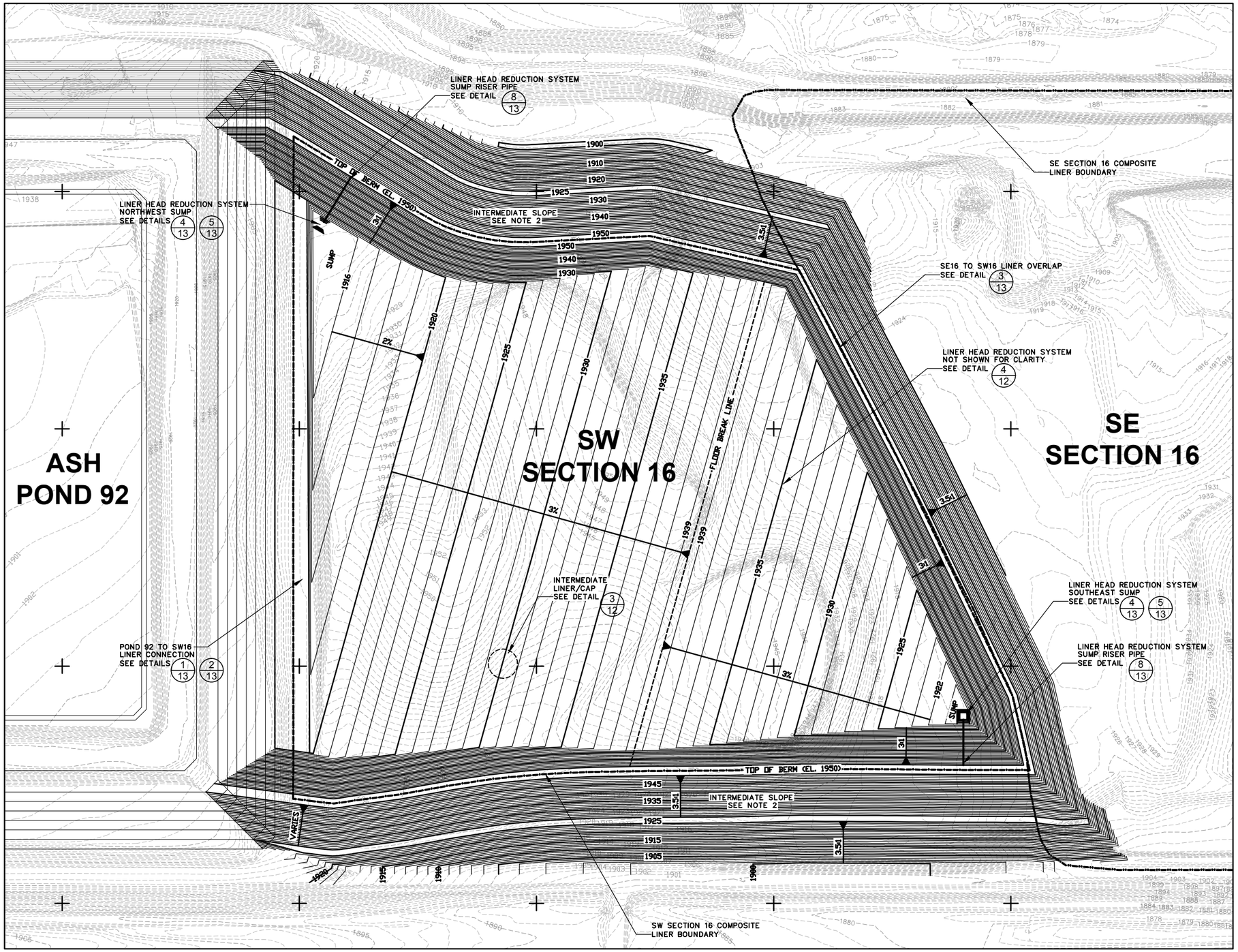
DOCUMENTATION DRAWINGS COAL CREEK STATION EAST HALF OF SOUTH ASH POND

DETAILS

SCALE NOT TO SCALE

SCOPE ID 89016

DRAWING NO. 11



LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)
- PREVIOUS PHASE PROPOSED TOPOGRAPHY
- PROPOSED CONSTRUCTION TOPOGRAPHY
- SW SECTION 16 COMPOSITE LINER BOUNDARY
- SE SECTION 16 COMPOSITE LINER BOUNDARY

NOTES

1. SW SECTION 16 GRADES REPRESENT TOP OF CLAY LINER/SOIL DIKE.
2. SW SECTION 16 CONTAINMENT DIKE SLOPES ARE INTERMEDIATE SLOPES AT 3.5H:1V. FINAL CLOSURE SLOPES WILL BE GRADED TO 4H:1V.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS FROM A TWENTY-FIVE-YEAR, TWENTY-FOUR-HOUR STORM EVENT (3.75"), PER SUBDIVISION A OF SUBSECTION 3 OF NDAC SECTION 33-20-04.1-09.
2. OPERATE THE UPSTREAM RAISE (SURFACE IMPOUNDMENT) TO HAVE A FREEBOARD OF AT LEAST TWO FEET, PER SUBDIVISION D OF SUBSECTION 2 OF NDAC SECTION 33-20-08.1-01.
3. MINIMIZE EROSION OF FINAL COVER, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.
4. MAXIMUM FINAL SLOPES NOT LESS THAN THREE PERCENT, NOR MORE THAN TWENTY-FIVE PERCENT, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.
5. EVALUATE SLOPES STEEPER THAN FIFTEEN PERCENT TO ENSURE STABILITY, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.
6. CONTROL OF SURFACE WATER DRAINAGE FROM FINAL SLOPES, PER SUBDIVISIONS B2-B4 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.
7. COMPOSITE LINER, PER SUBDIVISION B OF SUBSECTION 2 OF NDAC SECTION 33-20-08.1-01.
8. APPROPRIATE ENGINEERED FINAL COVER DESIGN, PER NDAC SECTION 33-20-07.1-02.
9. ALL OTHER APPLICABLE RULES FROM NDCC CHAPTER 23-29 AND NDAC ARTICLE 33-20.

REFERENCES

1. SITE LOCATION: SECTION 16, T145N, R82W, MCLEAN COUNTY, NORTH DAKOTA.
2. EXISTING GROUND TOPOGRAPHY PROVIDED BY GREAT RIVER ENERGY. PERFORMED BY INTERSTATE ENGINEERING AND KADRMAS, LEE & JACKSON BETWEEN 1996 AND 2003.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM, CONTOUR INTERVAL IS ONE FOOT.
4. HORIZONTAL DATUM BASED ON NORTH DAKOTA STATE PLANE COORDINATE SYSTEM AS FOLLOWS:
   SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
   SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000
5. ALL PROPERTY SHOWN ON THIS MAP IS OPERATED BY GREAT RIVER ENERGY.

DRAFT

100 0 100
1" = 100 FEET

ENGINEER'S STAMP	REFERENCE DRAWINGS

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	08/04/03	TJS	–	RRJ

PRINT ISSUE RECORD	
DATE	
FOR	
REVISED	
CLIENT	
FIELD	

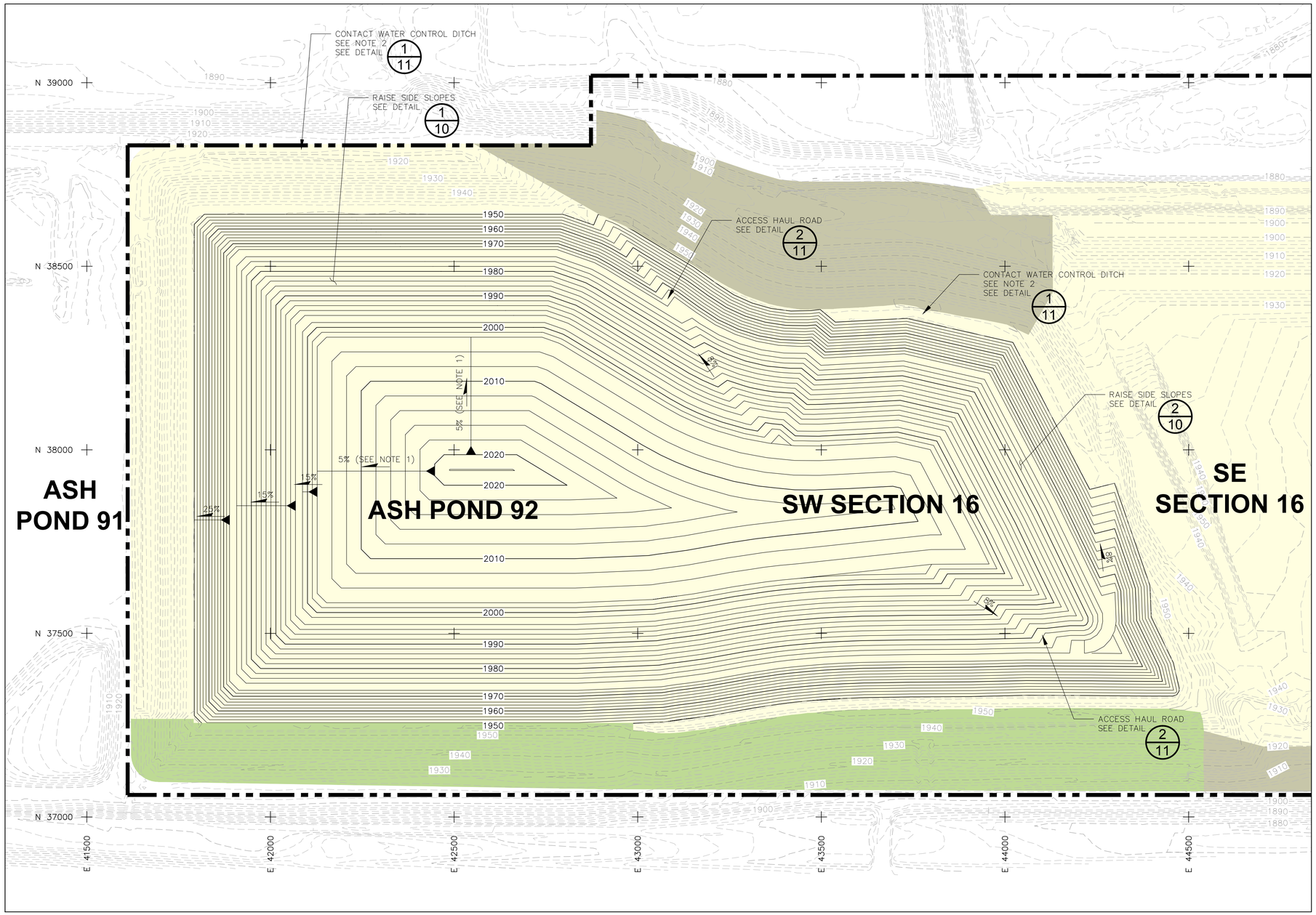
PROJECT
GREAT RIVER ENERGY
COAL CREEK STATION
PERMIT NO. SP-033 PERMIT MODIFICATION

TITLE
PHASE 2: SW SECTION 16 INTERMEDIATE LINER/CAP

Golder Associates
Denver, Colorado

PROJECT No.	023-2411		FILE No.	0232411A020	
DESIGN	TJS	05/01/03	SCALE	AS SHOWN	REV. C
CADD	TJS	05/01/03			
CHECK	RRJ	06/02/03	5		
REVIEW	RRJ	06/02/03			

Dwg Name: A:\1\0232411A020.dwg
Layout: Layout1
Last Plot: Sep 27, 2010 15:28
Machine: NOT SET
Reference(s):
By: RCarpenter
By: CSchuettpelz



LEGEND

- EXISTING GROUND TOPOGRAPHY (1880)
- PROPOSED TOP OF CCP TOPOGRAPHY (1980)
- AREA OF ACTIVE CCP PLACEMENT
- TEMPORARY COVER PLACED
- FINAL COVER PLACED
- PERMITTED LIMIT OF CCP PLACEMENT

NOTES

1. CCP GRADES OF THE CROWN OF THE FACILITY ARE SHOWN AT 5%, BUT MAY BE CONSTRUCTED BETWEEN 3% AND 5%.
2. CONTACT WATER IS COLLECTED IN THE DITCH AROUND ASH POND 92 AND SW SECTION 16. WATER IS DIRECTED THROUGH CULVERTS TO ASH POND 91 OR DOWNWARD INTO THE UPSTREAM RAISE.

REFERENCES

1. SITE LOCATION: SECTION 16, T145N, R82W, MCLEAN COUNTY, NORTH DAKOTA.
2. EXISTING GROUND TOPOGRAPHY PROVIDED BY GREAT RIVER ENERGY. PERFORMED BETWEEN 1996 AND 2011.
3. COORDINATES BASED ON PLANT GRID SYSTEM.
4. CONTOUR INTERVAL IS TWO FEET.
5. ALL PROPERTY SHOWN ON THIS MAP IS OWNED BY GREAT RIVER ENERGY.

150 0 150
SCALE FEET

DRAFT

ENGINEER'S STAMP

ORIGINAL DRAWING STAMPED BY TODD STONG, REGISTERED PROFESSIONAL ENGINEER IN THE STATE OF NORTH DAKOTA (PE #6144), IS ON FILE AT GOLDER ASSOCIATES' LAKEWOOD, COLORADO, OFFICE.

NO.	REVISION DESCRIPTION	DATE	DESIGN	CADD	CHECK	REVIEW
6						
5						
4						
3						
2						
1						
B	ISSUED FOR PERMIT MODIFICATION	11/30/12	CCS	CCS	TJS	RRJ
A	ISSUED FOR CLIENT REVIEW	10/24/12	CCS	CCS	TJS	RRJ

PROJECT
GREAT RIVER ENERGY
COAL CREEK STATION
PERMIT NO. SP-033 PERMIT MODIFICATION

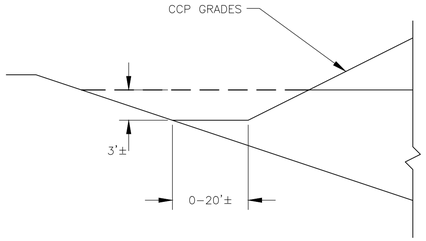
TITLE
PHASES 3 AND 4: ASH POND 92 & SW SECTION 16 RAISE VERTICAL EXPANSION

Golder Associates

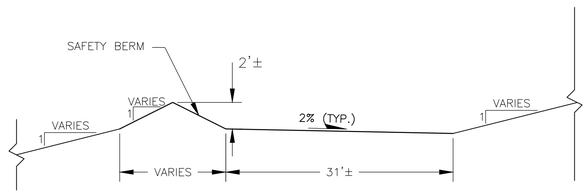
GREAT RIVER ENERGY

FILE No. 11381519A006
PROJECT No. 113-81519

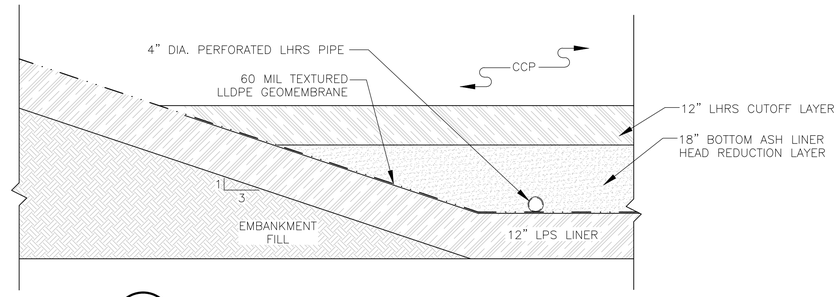
5



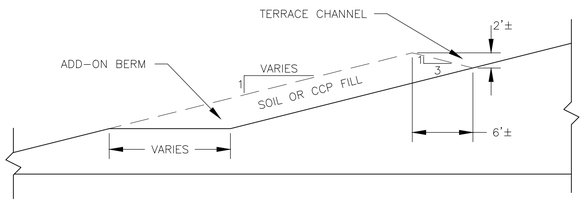
1/11 CONTACT WATER CONTROL DITCH
NOT TO SCALE



2/11 ACCESS HAUL ROAD
NOT TO SCALE



3/11 SW 16 INTERMEDIATE LINER/CAP AND LHRS DETAIL
NOT TO SCALE



4/11 TERRACE CHANNEL DETAIL
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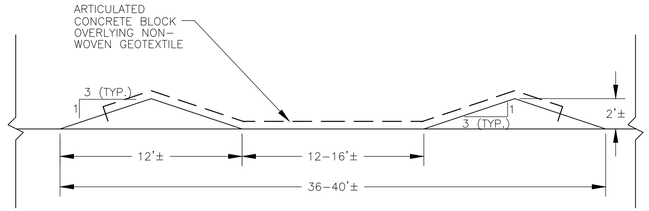

5/11 TYPICAL DOWN-CHUTE CHANNEL
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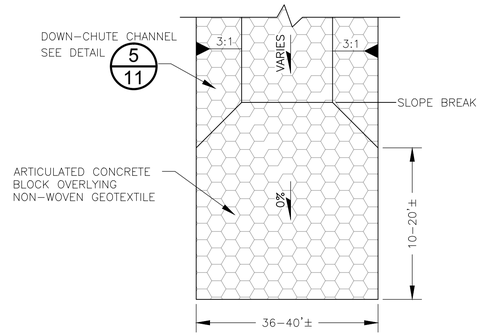
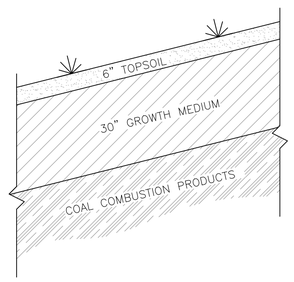
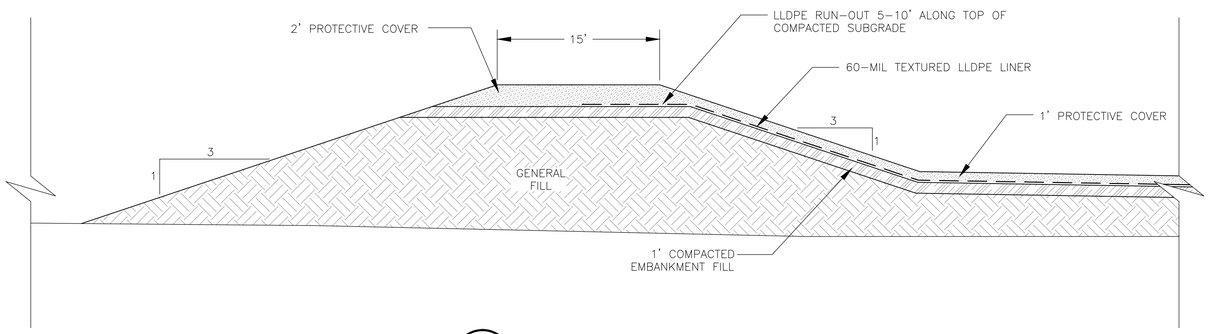


6/11 HYDRAULIC JUMP BASIN
NOT TO SCALE



7/11 FINAL COVER DETAIL
NOT TO SCALE



8/11 SUMP EXTENSION DETAIL
NOT TO SCALE

DRAFT

PROJECT
GREAT RIVER ENERGY
COAL CREEK STATION
PERMIT NO. SP-033 PERMIT MODIFICATION

TITLE
DETAIL SHEET 2

ENGINEER'S STAMP

ORIGINAL DRAWING STAMPED BY TODD STONG, REGISTERED PROFESSIONAL ENGINEER IN THE STATE OF NORTH DAKOTA (PE #6144), IS ON FILE AT GOLDER ASSOCIATES' LAKEWOOD, COLORADO, OFFICE.

NO.	REVISION DESCRIPTION	DATE	DESIGN	CADD	CHECK	REVIEW
△						
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△						
B	ISSUED FOR PERMIT MODIFICATION	11/30/12	CCS	CCS	TJS	RRJ
A	ISSUED FOR CLIENT REVIEW	10/24/12	CCS	CCS	TJS	RRJ

Golder Associates

GREAT RIVER ENERGY

FILE No. 11381519A012
PROJECT No. 113–81519

11

APPENDIX B
VISUAL OBSERVATION CHECKLIST

IMPOUNDMENT INSPECTION CHECKLIST

Facility Name: ***Upstream Raise 92 CCR Surface Impoundment***

Owner and Address: **Great River Energy**

Purpose of Facility: **CCR Containment**

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

County: **McLean**

Inspected By: **Craig Schuettpelz, Ryan Shedivy** ***Inspection Date:*** 09/20/2017

Weather: **Sunny, 60°F**

ITEM	Y	N	N/A	REMARKS
1. General Conditions				
a. Alterations	X			Vertical placement of CCR
b. Development of downstream plain		X		
c. Grass cover	X			Original soil berms, partial final cover, and temporary cover
d. Settlement/misalignment/cracks	X			Cracks, see report text
e. High water mark			X	Elevation:
f. Current water level	X			Elevation: FGD pool = 1980 ft
g. Sudden drops in water level?		X		
2. Inflow Structure				FGD material inlet pipe
a. Settlement		X		
b. Cracking		X		
c. Corrosion		X		
d. Obstacles in inlet		X		
e. Riprap/erosion control		X		
3. Outflow Structure				
a. Settlement		X		
b. Cracking		X		
c. Corrosion		X		
d. Obstacles in outlet		X		
e. Riprap/erosion control	X			Fly ash protective cover in perimeter ditches
4. Upstream slope				
a. Erosion – liner exposed?		X		
b. Rodent burrows		X		
c. Vegetation		X		
d. Cracks/settlement	X			Settlement of fly ash over FGD material
e. Riprap/other erosion protection		X		
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
f. Damage from vehicles/machinery		X		
6. Downstream slope				
a. Erosion	X			Minor fly ash and temporary cover erosion
b. Vegetation	X			Less vegetation above 1950ft and on temporary cover, healthy vegetation below 1950ft
c. Rodent burrows	X			South and north downstream berms
d. Cracks/settlement/scarps	X			Cracks, see report text
e. Drain conditions	X			Channels/downchutes in good condition
f. Seepage		X		
7. Toe				
a. Vegetation	X			Healthy grass and reeds, some sparse vegetation along south toe
b. Rodent burrows	X			Mostly on south side
c. Settlement		X		
d. Drainage conditions	X			Some standing water
e. Seepage		X		

General Remarks:

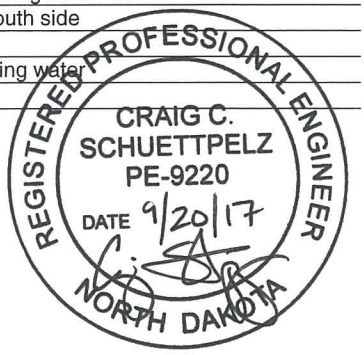
No significant issues. Cracking of fly ash within the facility is to be expected and should be monitored.

Name of Engineer: Craig Schuettpelz

Date: 9/20/17

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 2016.

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-12-11
DESIGNED	RFS
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

PROJECT
2017 ANNUAL INSPECTION REPORT

TITLE
UPSTREAM RAISE 92 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

1 in

0

Path: \\Denver.golder.gds\projects\17JOBS\1772255 GRE CCS\CCR Rules\Annual Inspections\UR92\ | File Name: UR92_AnnualInspections_2017.dwg

Upstream Raise 92

Photograph 1 (North CCR downstream slope)
Minor (<6 inches) crack approximately 50 feet long (P1040090.JPG)

Photograph 2 (North CCR crest)
Fly ash/bottom ash CCR crest (P1040093.JPG)

Upstream Raise 92

Photograph 3 (North CCR upstream slope)
CCR upstream slope bottom ash (P1040095.JPG)

Photograph 4 (North CCR upstream slope)
CCR upstream slope bottom ash (P1040098.JPG)

Upstream Raise 92

Photograph 5 (North CCR downstream slope)
Minor crack in fly ash (<4 inches) (P1040099.JPG)

Photograph 6 (West CCR crest)
Fly ash/bottom ash CCR crest (P1040101.JPG)

Upstream Raise 92

Photograph 7 (West CCR downstream slope)
Crack in fly ash CCR downstream slope (approximately 8 inches wide) (P1040103.JPG)

Photograph 8 (West CCR downstream slope)
Crack on fly ash CCR downstream slope (approximately 18 inches) (P1040105.JPG)

Upstream Raise 92

Photograph 9 (South CCR crest)
Fly ash/bottom ash CCR crest (P1040109.JPG)

Photograph 10 (South CCR downstream slope with final cover)
Final cover on CCR downstream slope (P1040112.JPG)

Upstream Raise 92

Photograph 11 (South CCR downstream slope with final cover)
Crack on final cover slope near 1974 ft. bench (P1040117.JPG)

Photograph 12 (South CCR crest)
Fly ash CCR crest (P1040120.JPG)

Upstream Raise 92

Photograph 13 (South CCR upstream slope)
Bottom ash CCR upstream slope (P1040123.JPG)

Photograph 14 (South CCR downstream slope with final cover)
Articulated Concrete Block (ACB) downchute channel (P1040124.JPG)

Upstream Raise 92

Photograph 15 (East CCR downstream slope)
Fly ash haul road on east side (P1040129.JPG)

Photograph 16 (East CCR downstream slope)
Crack in fly ash (approximately 6 inches wide) (P1040131.JPG)

Upstream Raise 92

Photograph 17 (East CCR downstream slope with temporary cover)
CCR downstream slope temporary cover and 1950 ft. bench (P1040136.JPG)

Photograph 18 (North CCR downstream slope with temporary cover)
Well vegetated slope below 1950 ft. elevation (DSCN1600.JPG)

Upstream Raise 92

Photograph 19 (North berm crest)
North haul road (DSCN1602.JPG)

Photograph 20 (North berm downstream slope)
Berm downstream slope below 1920 ft. road (DSCN1605.JPG)

Upstream Raise 92

Photograph 21 (North CCR downstream slope with temporary cover)
North haul road ramp and CCR downstream slope temporary cover (DSCN1607.JPG)

Photograph 22 (Northwest berm upstream slope)
Contact water culvert to Upstream Raise 91 (DSCN1616.JPG)

Upstream Raise 92

Photograph 23 (West CCR downstream slope)
Minor erosion rills in fly ash at 1950 ft. bench (DSCN1619.JPG)

Photograph 24 (West CCR downstream slope)
West CCR downstream slope and 1950 ft. bench (DSCN1622.JPG)

Upstream Raise 92

Photograph 25 (Southwest CCR downstream slope with final cover)
Southwest downchute channel (DSCN1623.JPG)

Photograph 26 (South berm downstream slope and toe)
South surface water drainage ditch (DSCN1625.JPG)

Upstream Raise 92

Photograph 27 (South CCR downstream slope with final cover)
Terrace channel rutting (approximately 12 inches deep) (DSCN1635.JPG)

Photograph 28 (South berm downstream slope and toe)
Standing water in south surface water drainage ditch and toe of downchute channel (DSCN1638.JPG)

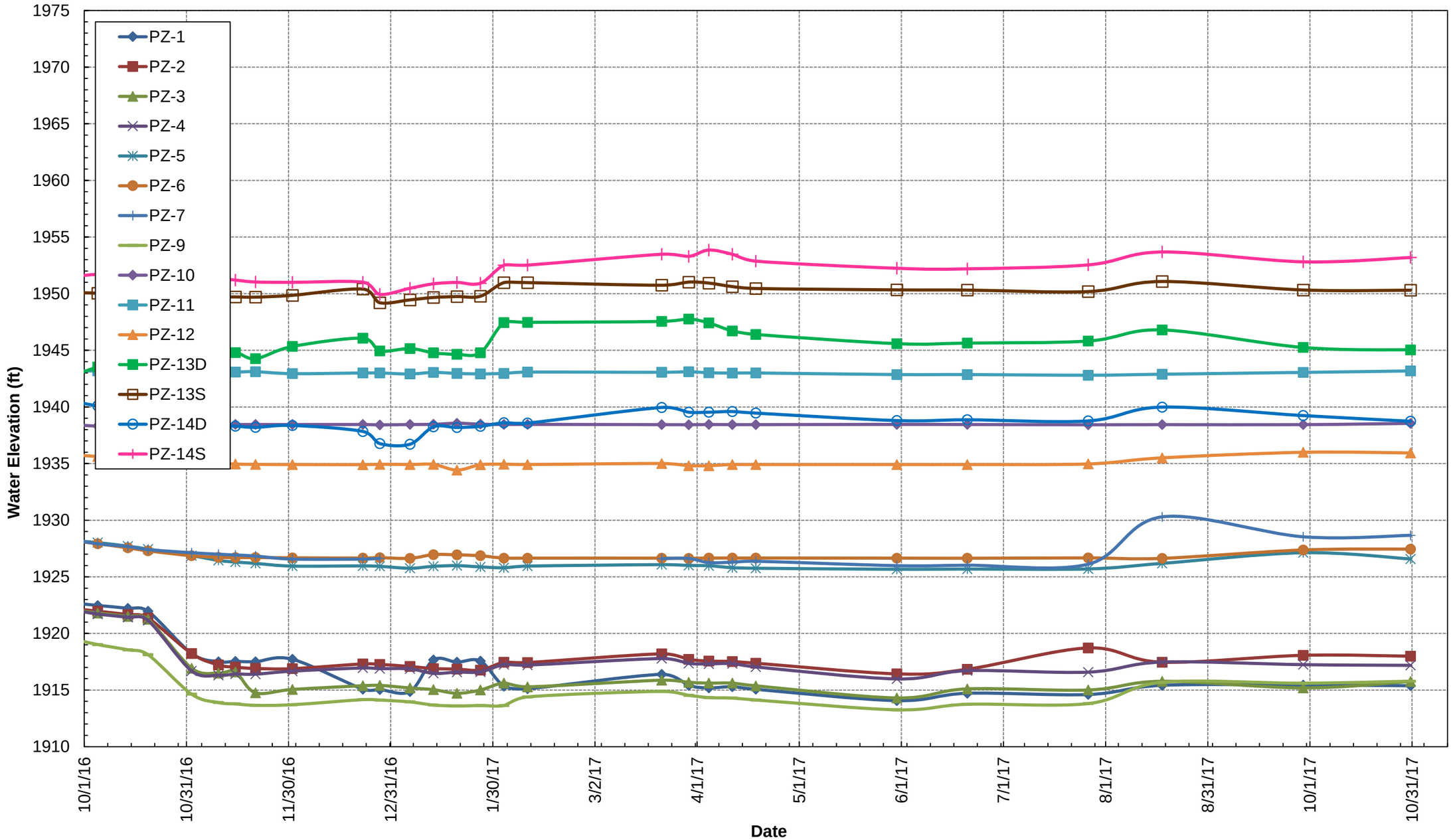
Upstream Raise 92

Photograph 29 (East CCR downstream slope)
East CCR downstream slope and connection with Southeast 16 (DSCN1644.JPG)

APPENDIX D
INSTRUMENTATION RESULTS

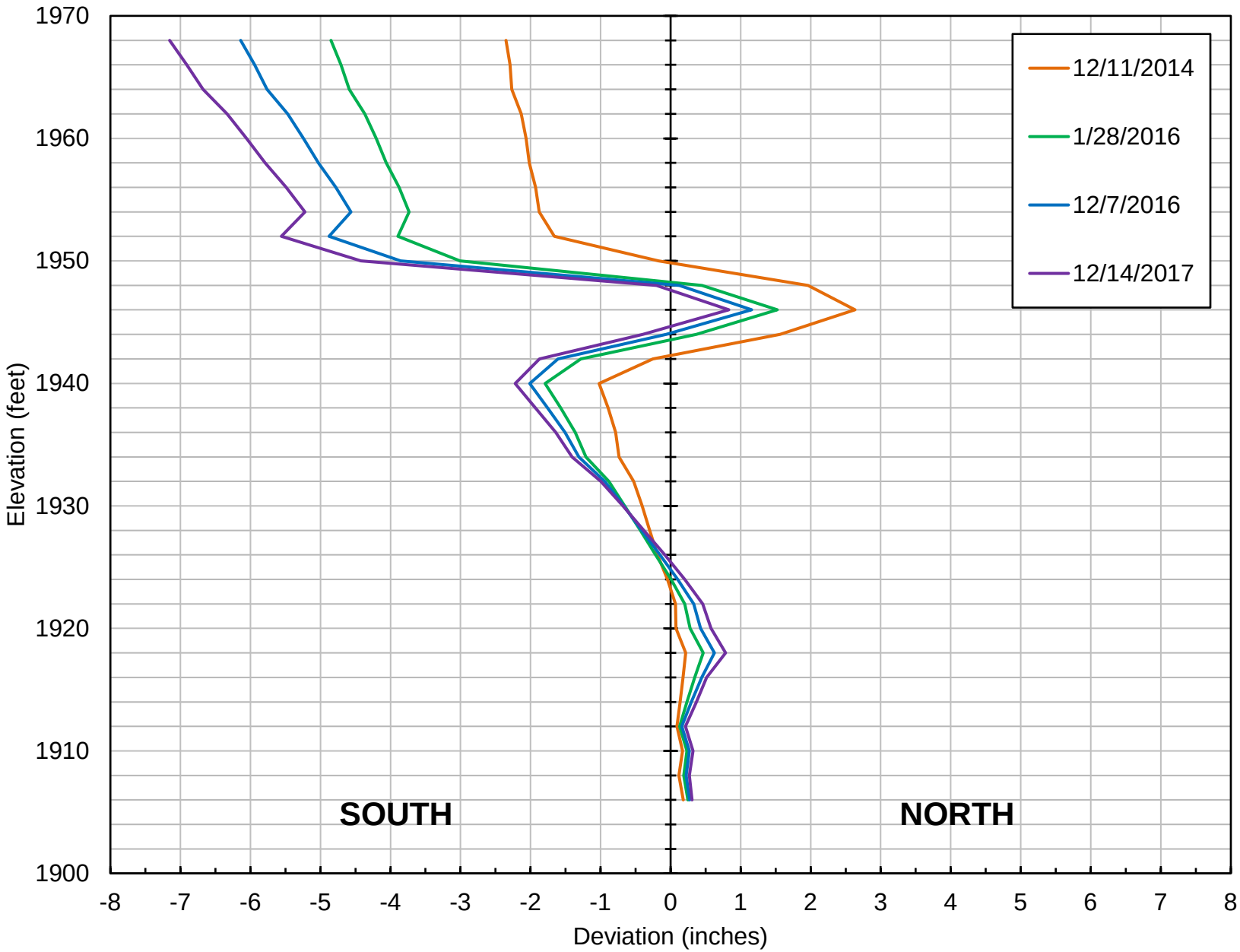
APPENDIX D-1
PIEZOMETER INFORMATION

Upstream Raise 92 Piezometer Elevations

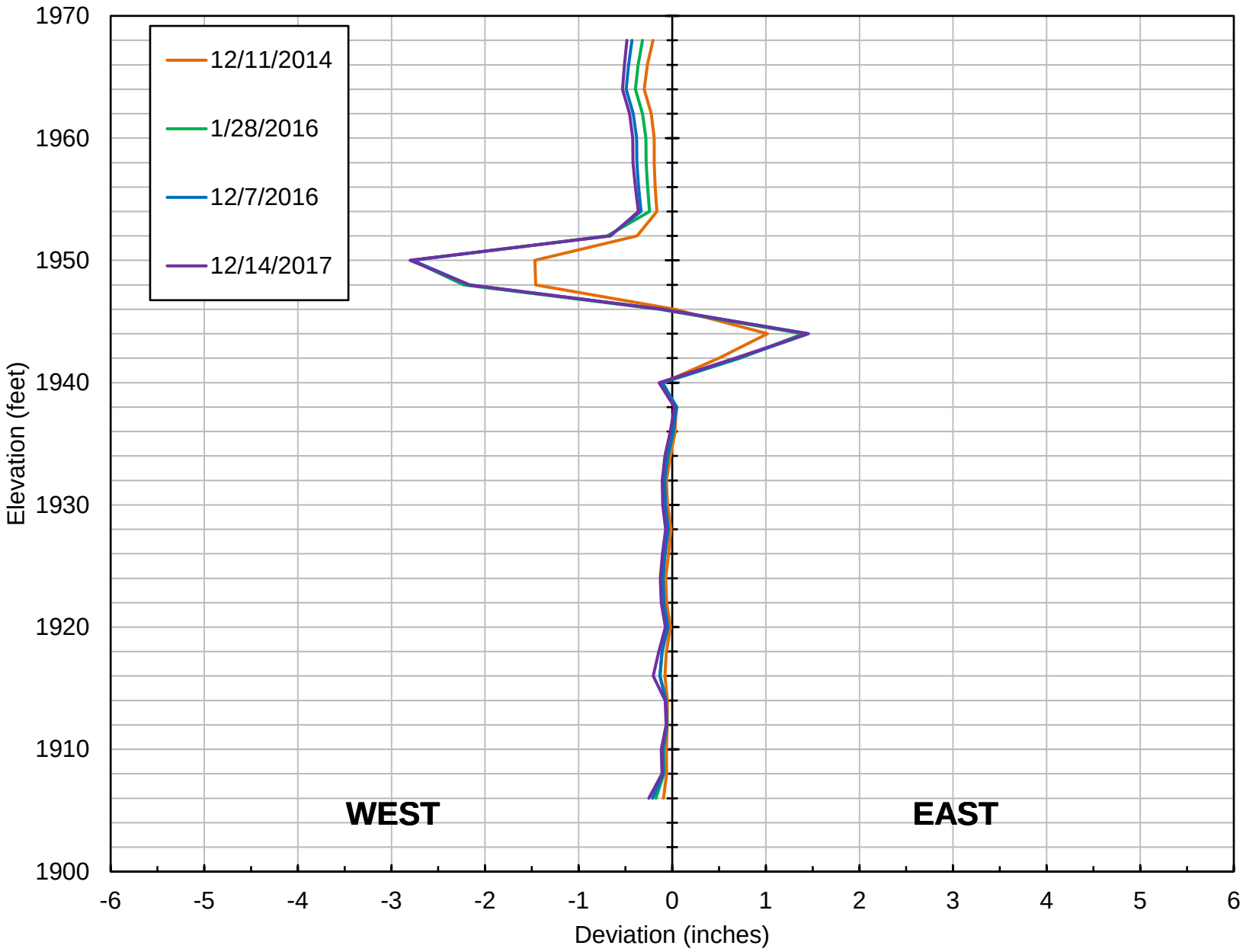


APPENDIX D-2
INCLINOMETER INFORMATION

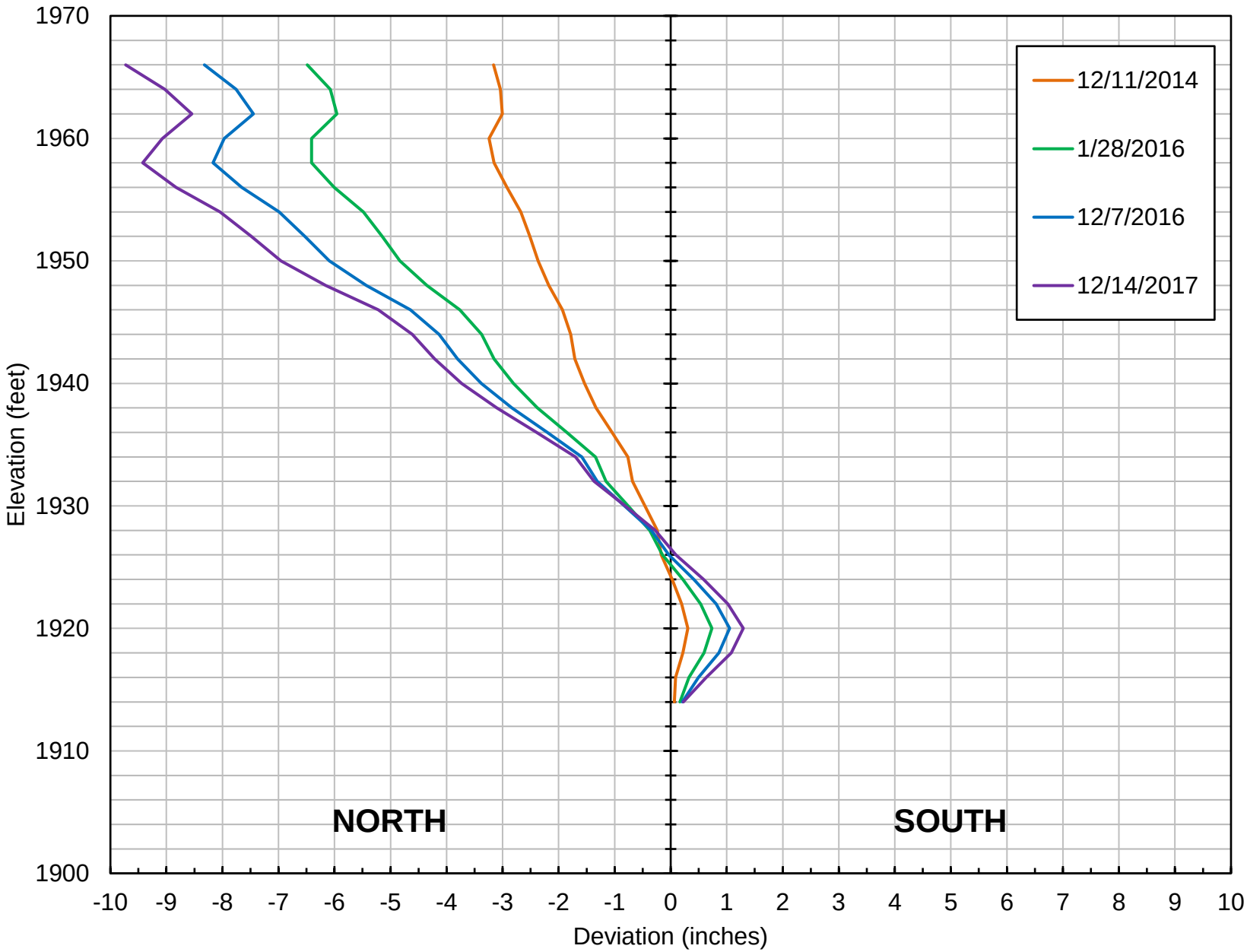
Upstream Raise 92
Inclinometer IN-3 Summary



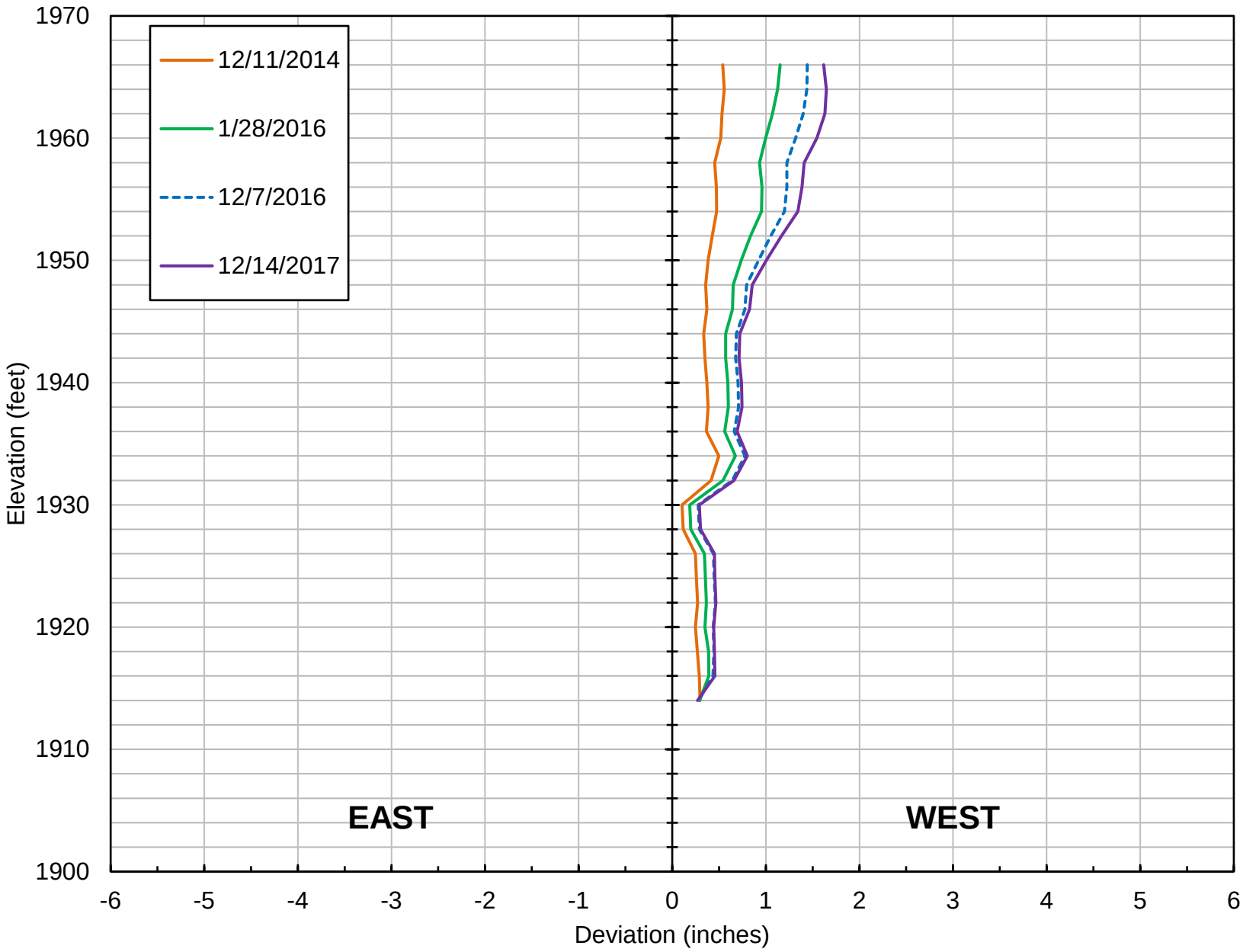
Upstream Raise 92
Inclinometer IN-3 Summary



Upstream Raise 92
Inclinometer IN-4 Summary



Upstream Raise 92
Inclinometer IN-4 Summary



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