

A 3D perspective rendering of a dam and reservoir. The dam is a grey, multi-bay structure spanning a valley. The reservoir is a large body of teal water behind the dam. The surrounding terrain is green and hilly, with blue lines indicating water flow paths. The sky is white.

Nevada Irrigation District Centennial Reservoir Project Draft Conceptual Engineering Report

July 12, 2017

Agenda

Ø Alternative Selection

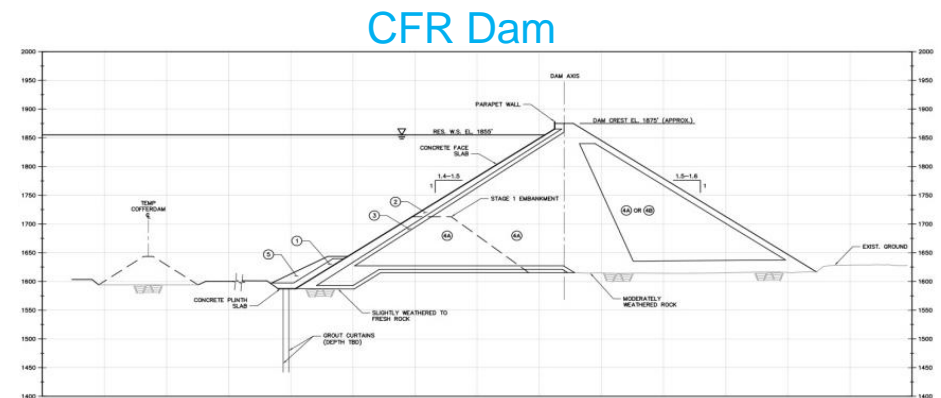
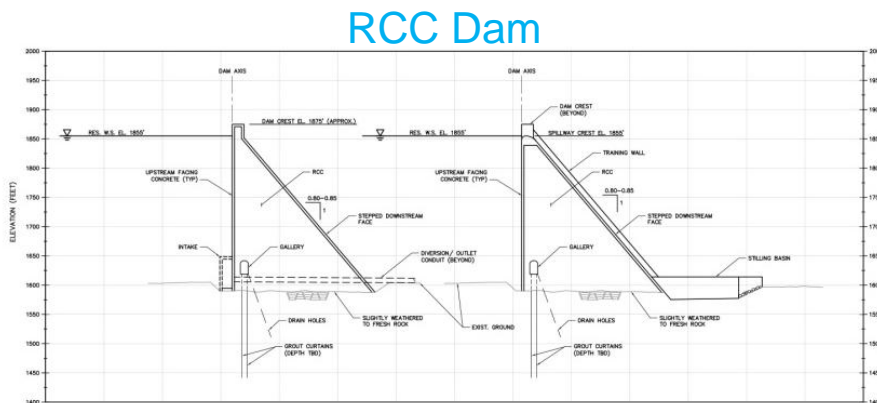
Ø Dam Foundation and Rock Borrow Area Characterization

Ø Dam and Appurtenant Works

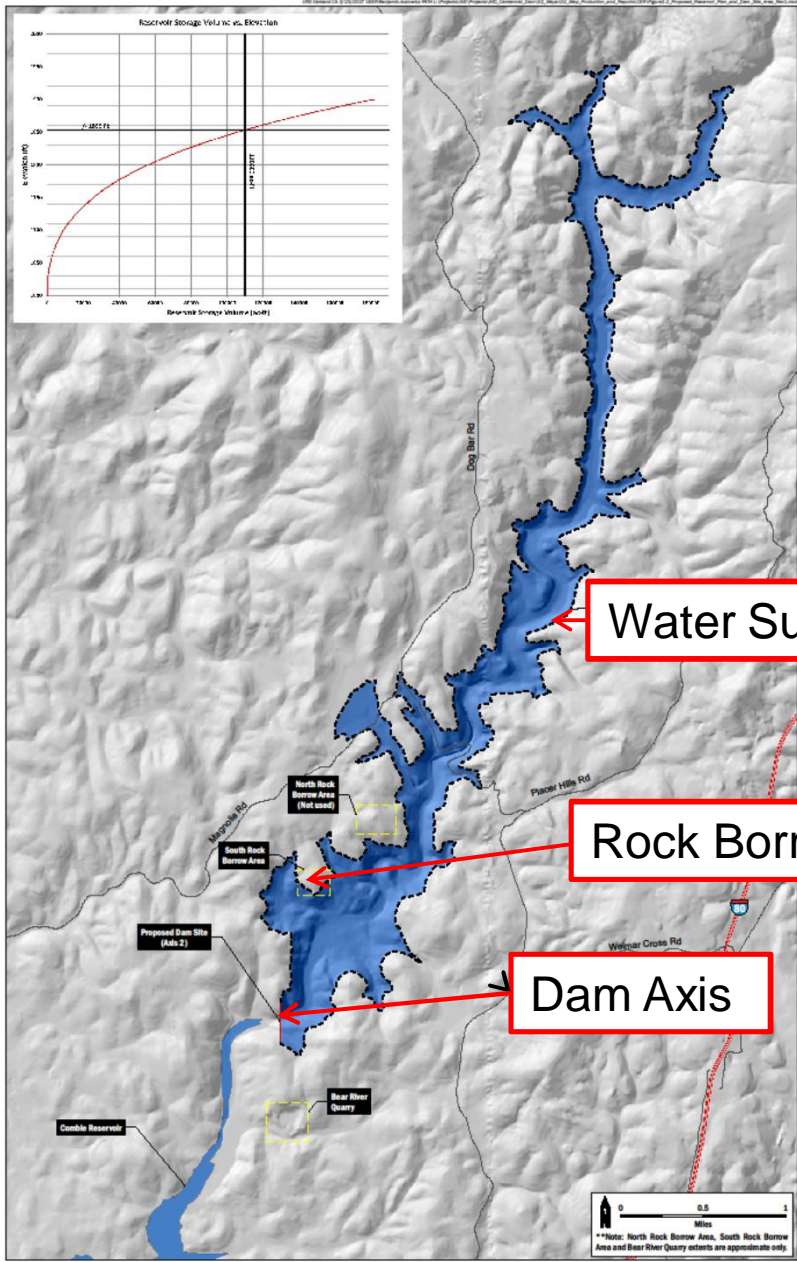
Ø Construction Schedule and Cost Estimate

Selection of RCC Dam at Axis 2

- Considered roller compacted concrete (RCC) dam and concrete face rockfill (CFR) dam at Axes 2 & 6
 - RCC dam alternative at Axis 2 has lowest expected construction cost of alternatives.
 - RCC dam could be constructed in less time than a CFR dam.
 - RCC dam more capable of withstanding flood overtopping during construction than CFR dam.
 - Axis 2 would have a 3-ft lower reservoir elevation than for Axis 6 to store 110,000 AF.
 - Lower reservoir elevation would reduce level of inundation around reservoir
- RCC dam at Axis 2 carried forward to design.



Proposed Reservoir and Dam Axis Location



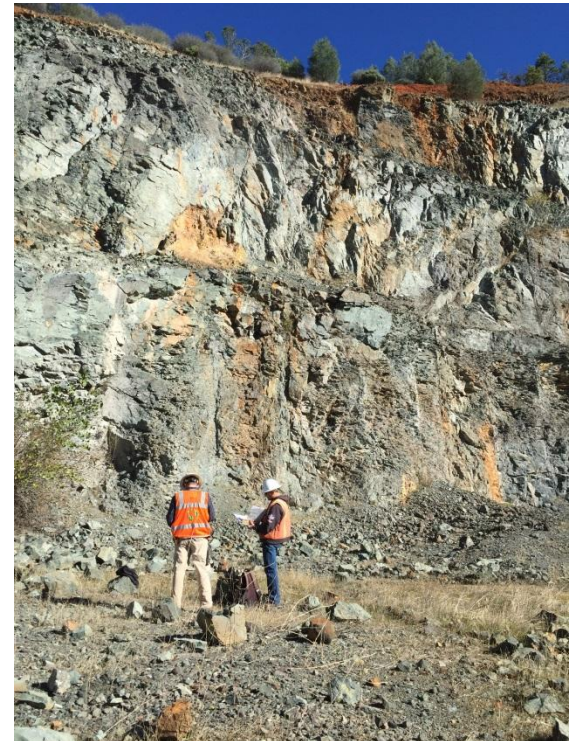
Water Surface El. 1885

Rock Borrow Area

Dam Axis

Dam Foundation and Rock Borrow Area

- Summary of site investigation activities
- Geotechnical conditions at Dam Site
- Geotechnical conditions at South Rock Borrow Area

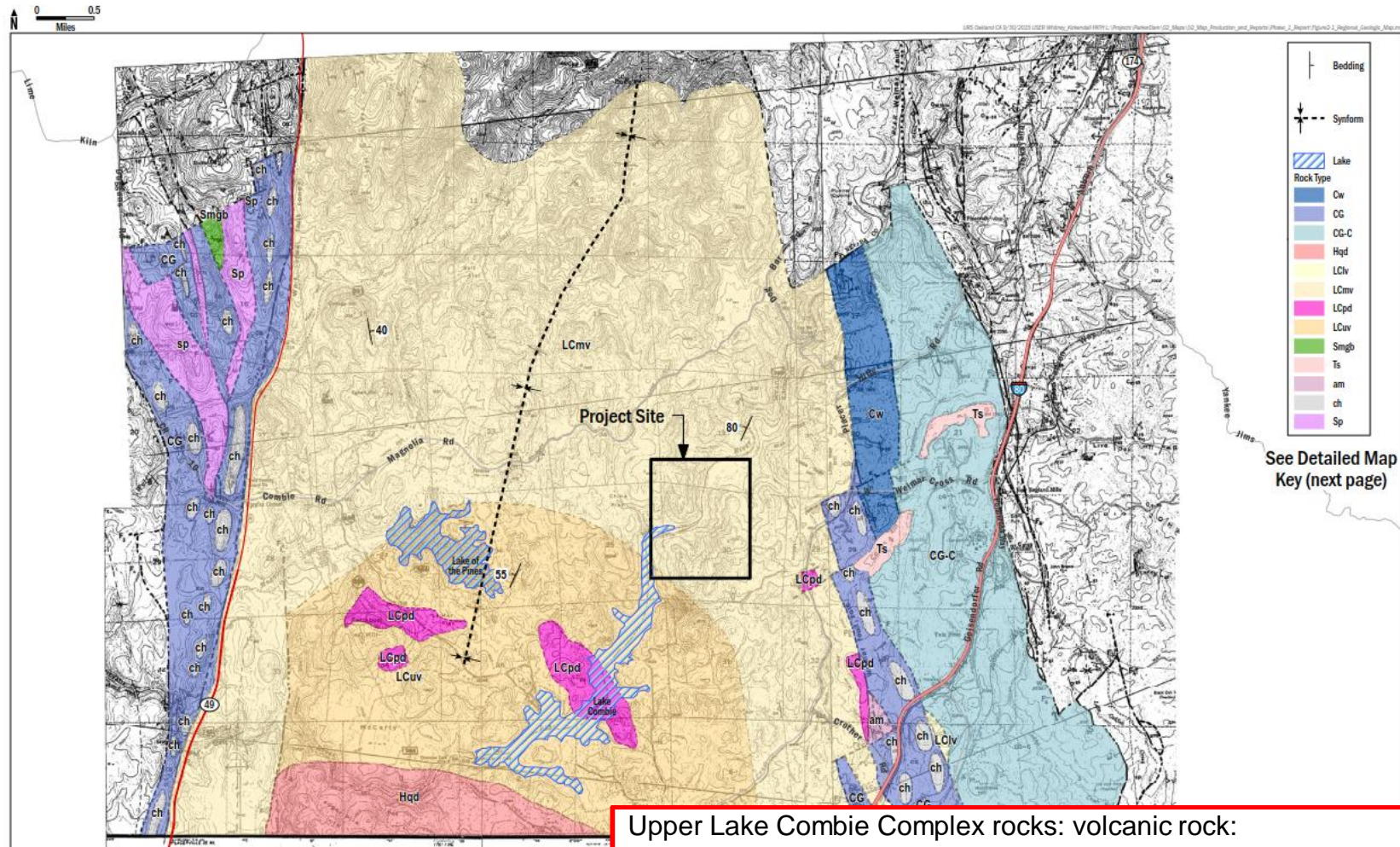


Summary of Field Investigations

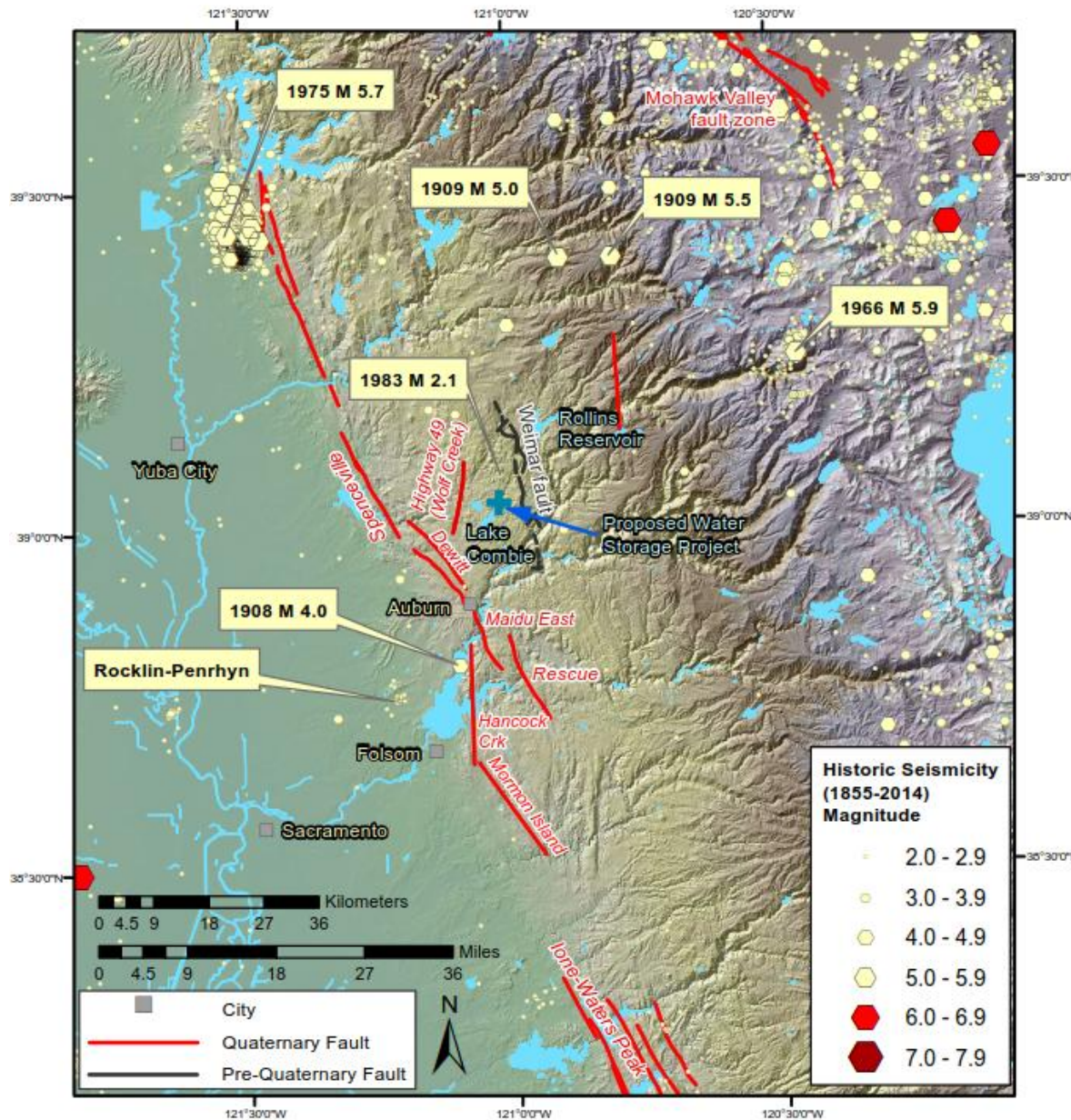
- Three phases of investigations:
 - Phase I: 2015
 - Phase II: 2015
 - Phase III: 2016
- Geologic mapping
- Seismic refraction surveys
- Core borings
- Hydraulic conductivity testing
- Bore hole geophysical surveys
- Rock strength testing



Regional Geologic Map



Historical Seismicity and Regional Fault Map



Geologic Mapping

- Mapping of rock outcrops, alluvium and landslides
- Evaluation of photo lineaments
- Developed plans for seismic line and boring locations
- Confirmed regional geologic mapping



Strike (Degrees Az.)	Dip (Degrees)	Discontinuity Type	No. of Data points
120-130	12 SW	Bedding	25
8-20	80 E	Joint Set 1	37
277-292	85 N	Joint Set 2	29

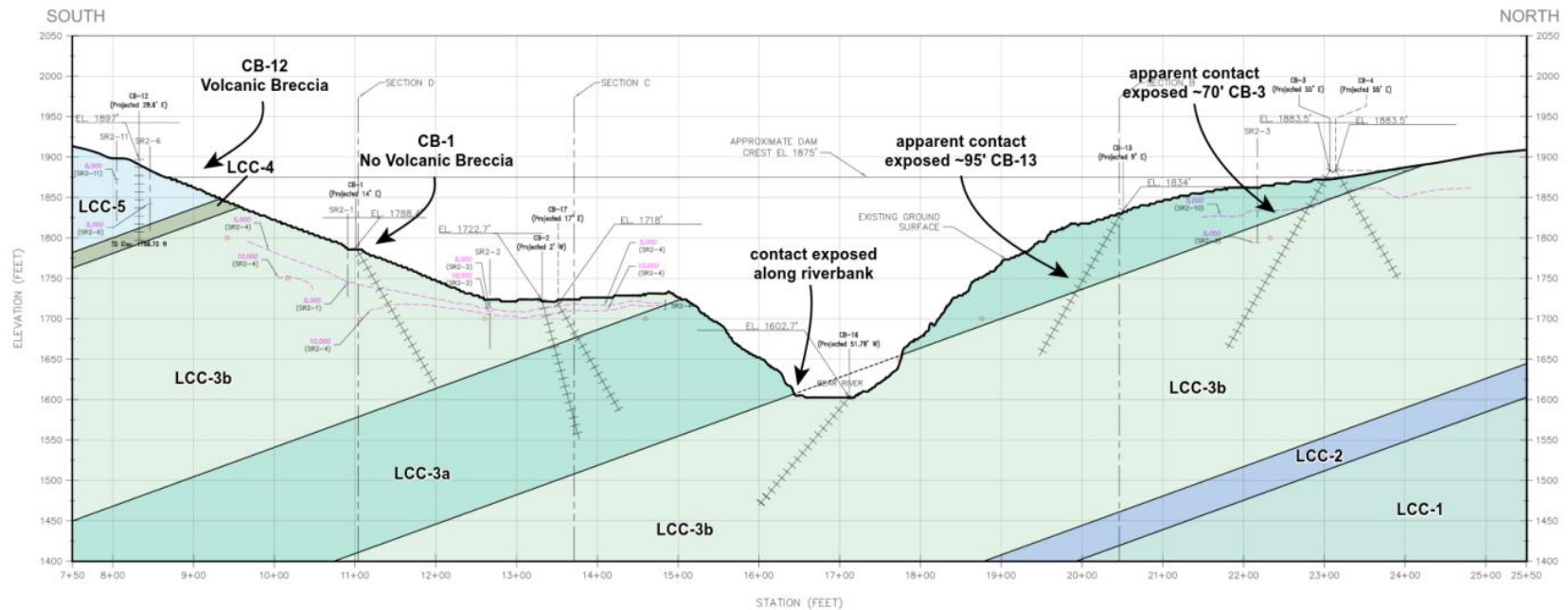


Independent Evaluation of Potential for Active Faulting

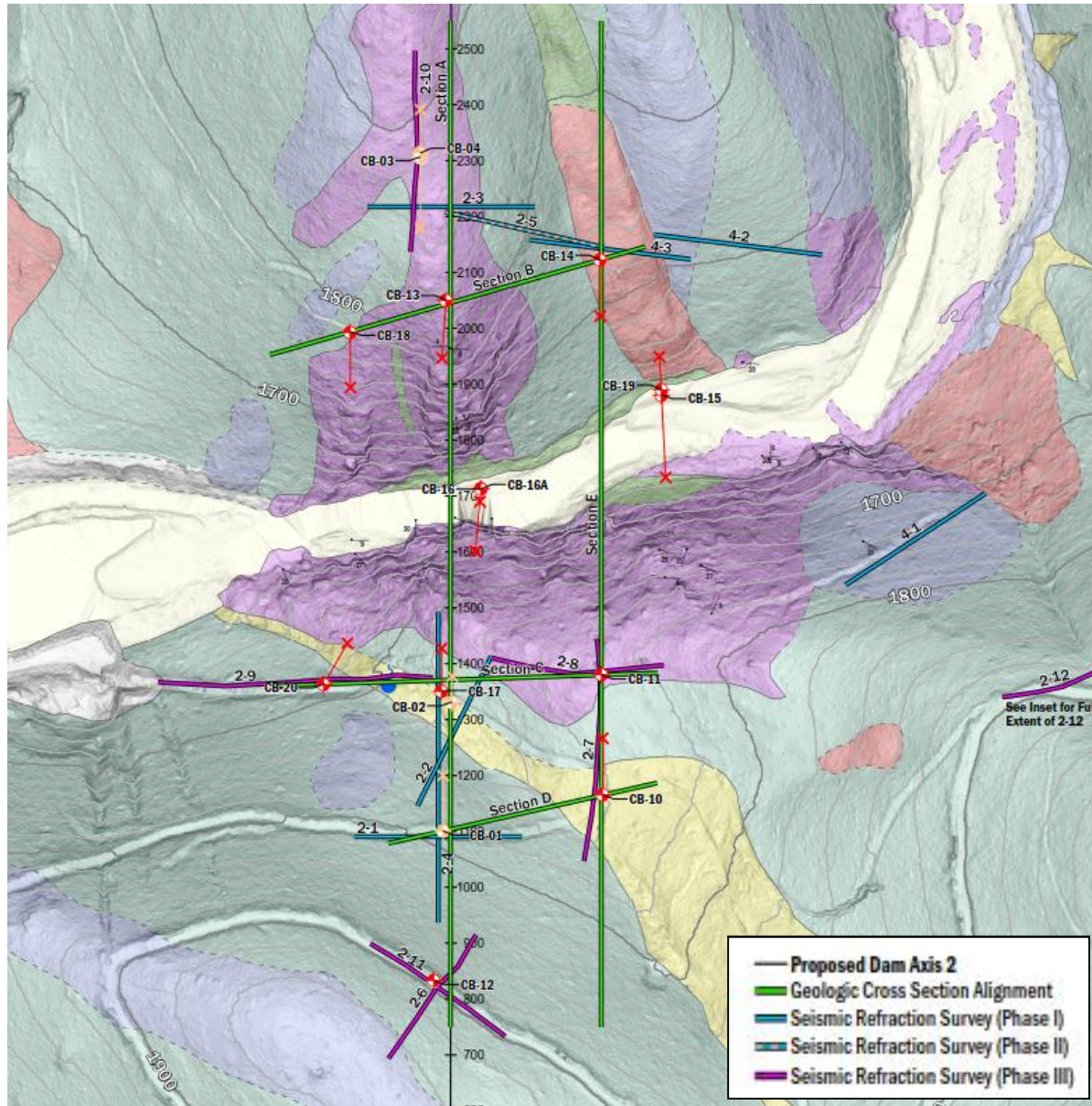
Conclusions



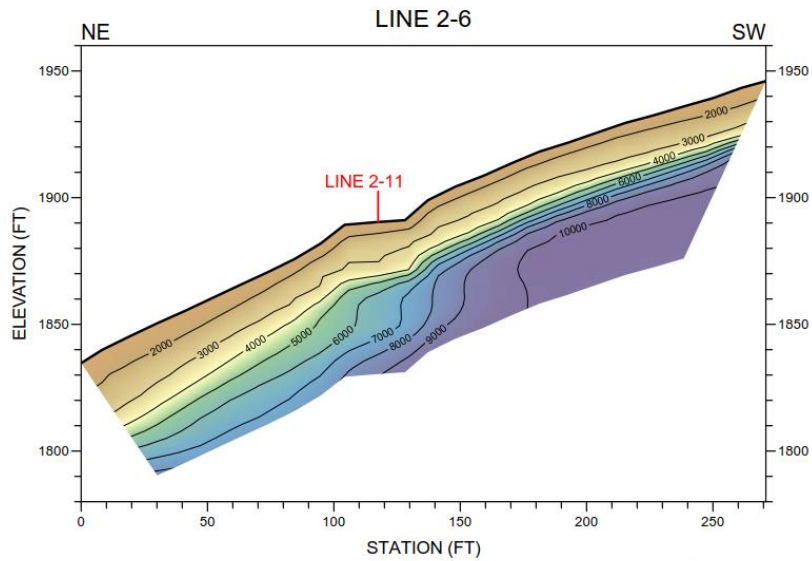
- Lack of positive evidence of active faulting at Axis 2 site.
- Stratigraphy near Axis 2 site appears to be consistent across the river.
 - Absence of vertical separation of contacts supports conclusion that faulting is not present.



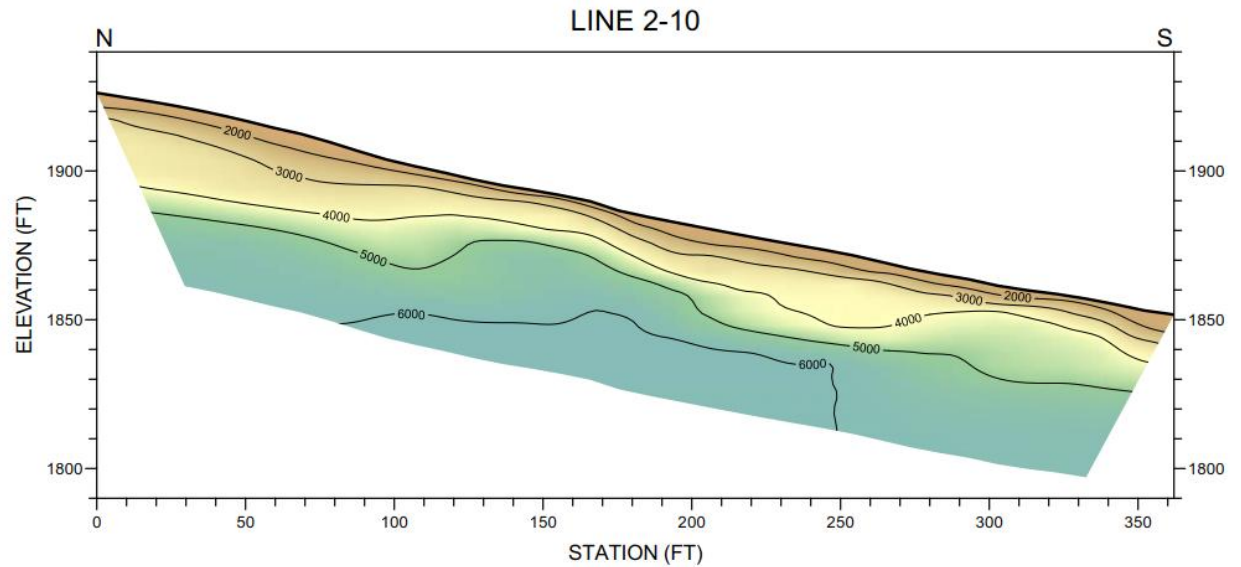
Site Exploration Map – Seismic Refraction Surveys



Surface Geophysical Surveys



- 15 seismic refraction survey lines at Axis 2 site
- Close confirmation with bore hole data



Geotechnical Drilling Investigation – Axis 2

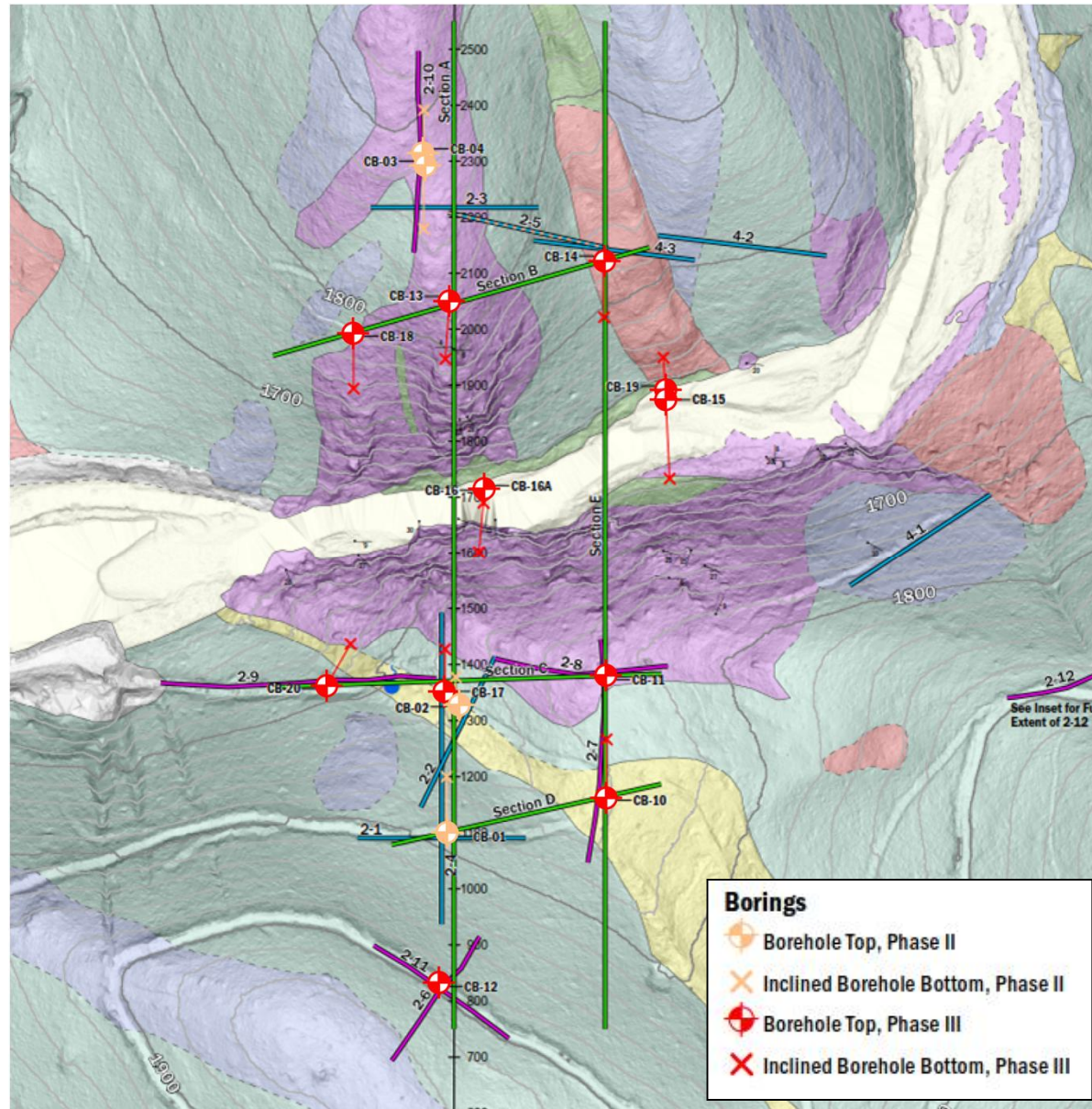
- 16 core borings
 - 2 vertical
 - 14 inclined
 - Up to 254 feet deep
 - Total drilling 2715 ft
- Water pressure (packer) testing
- Televiwer and caliper logging
- Downhole seismic velocities
- Rock strength testing



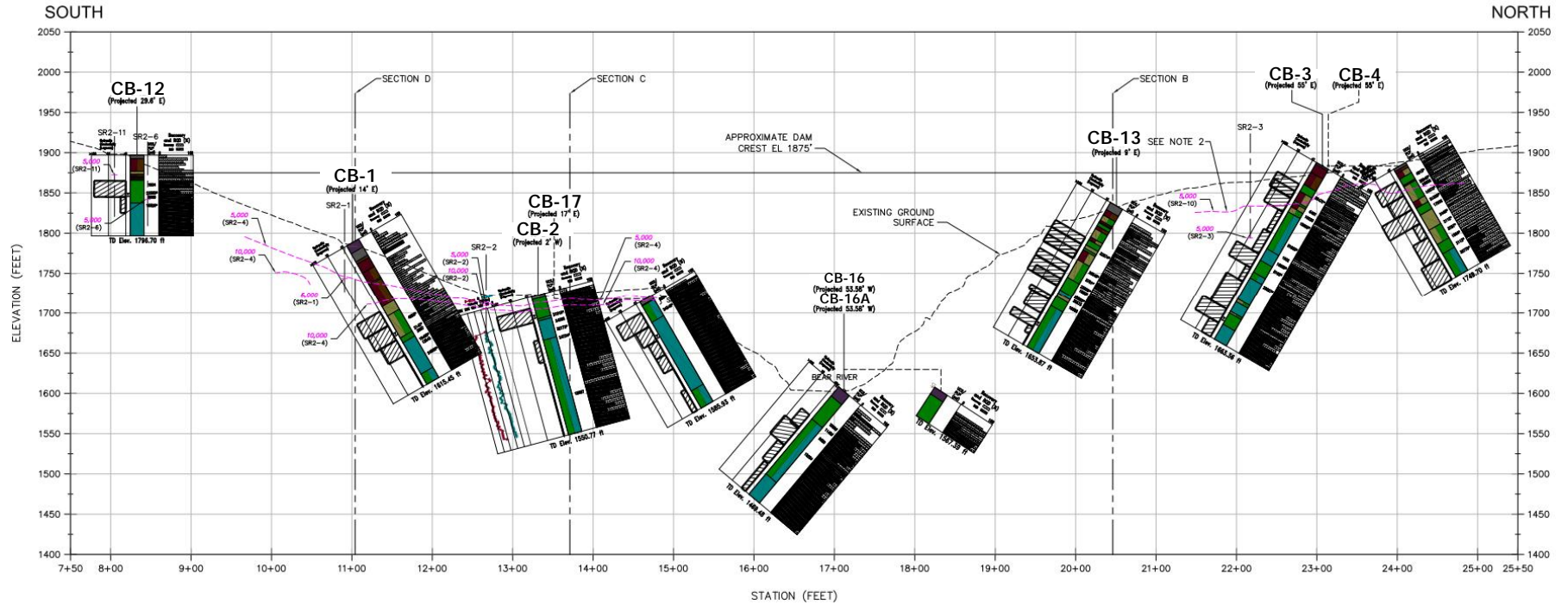
Boring CB-15 on Bear River



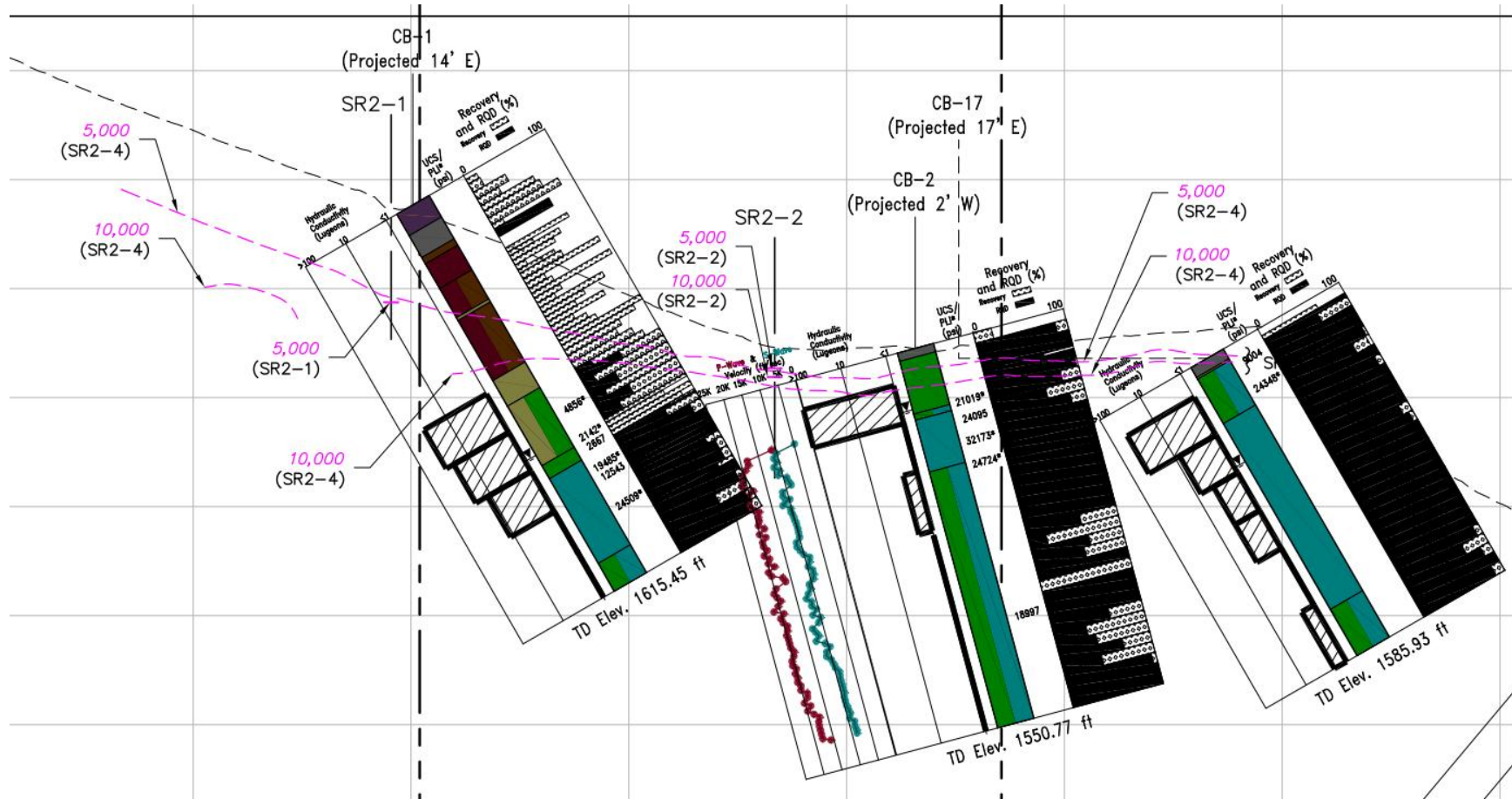
Site Exploration Map - Borings



Geotechnical Profile - Axis 2

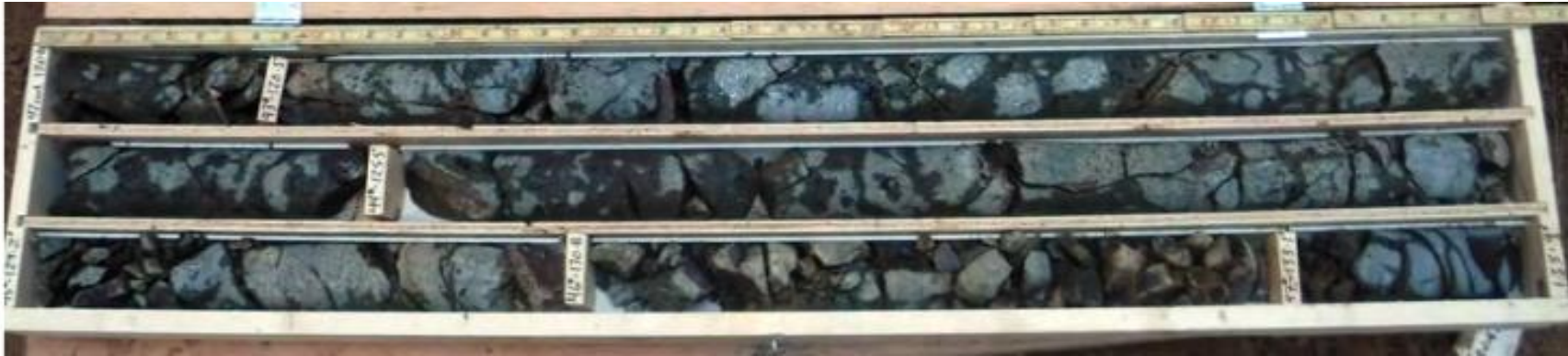


Detail of Exploratory Boring “Stick Logs”



Core Boring Sample: south (left) abutment

CB-1, 120.0 – 133.9 ft.



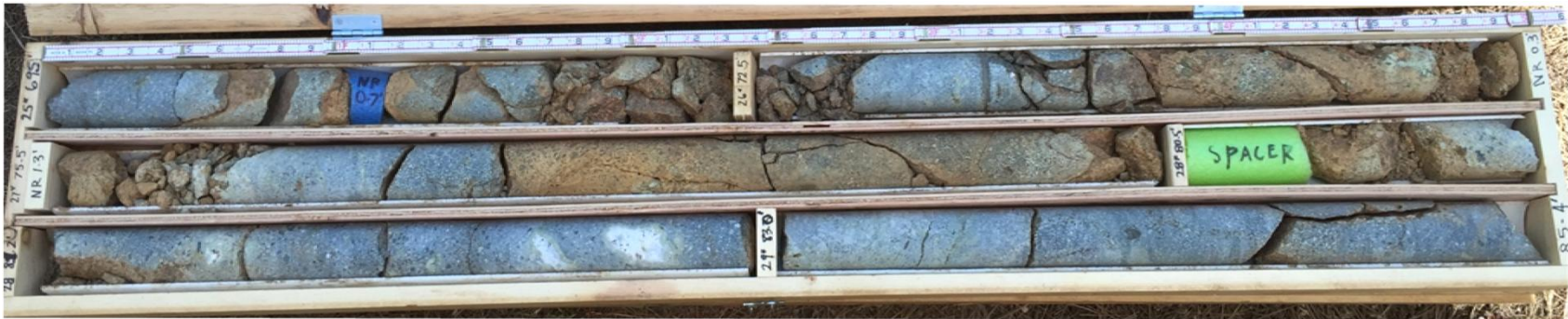
CB-1, 133.9 – 147.5 ft.



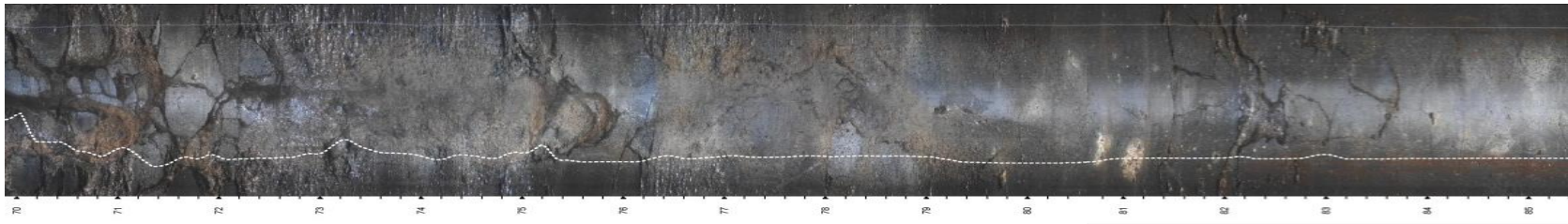
∅ Weathering and fracturing decrease with depth

Rock Core and Televiwer Log: north (right) abutment

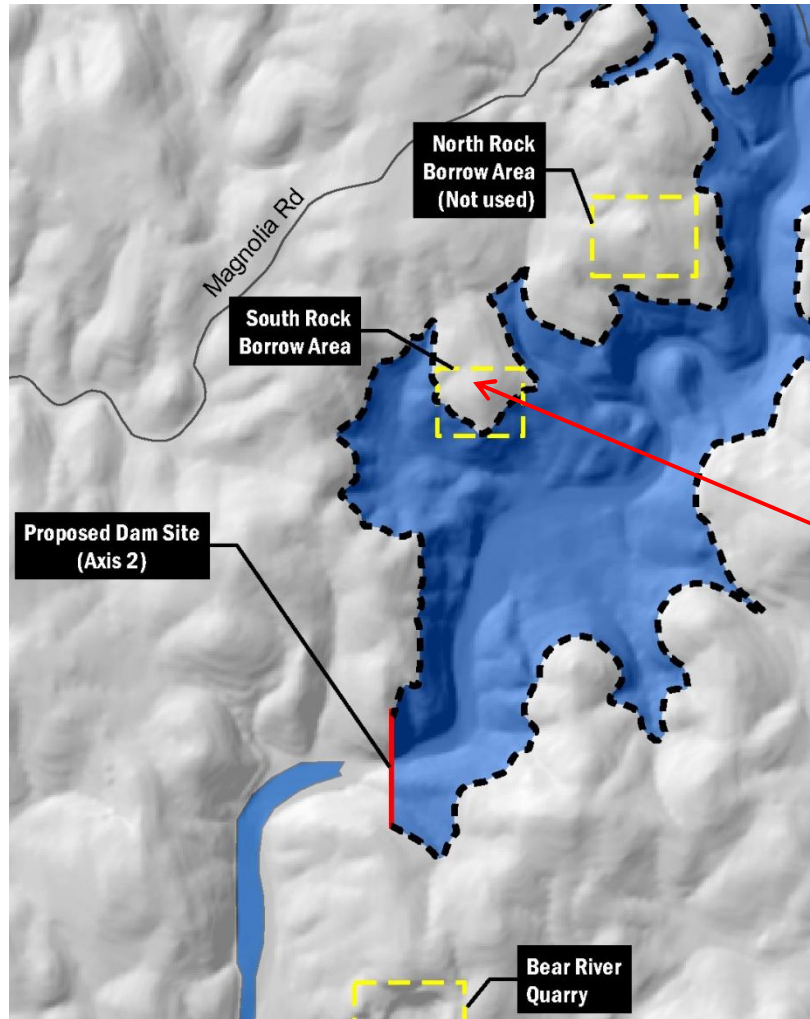
Rock Core: CB-13, 69.5 – 85.4 ft.



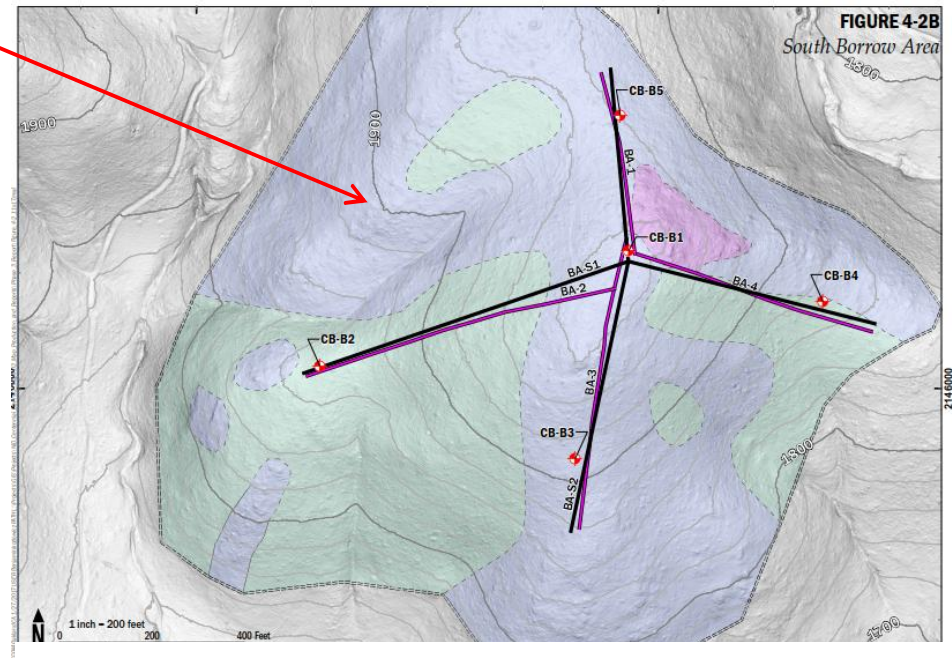
Optical Televiwer Log: CB-13, 69.5 – 85.4 ft.



Potential Rock Borrow Area Investigation



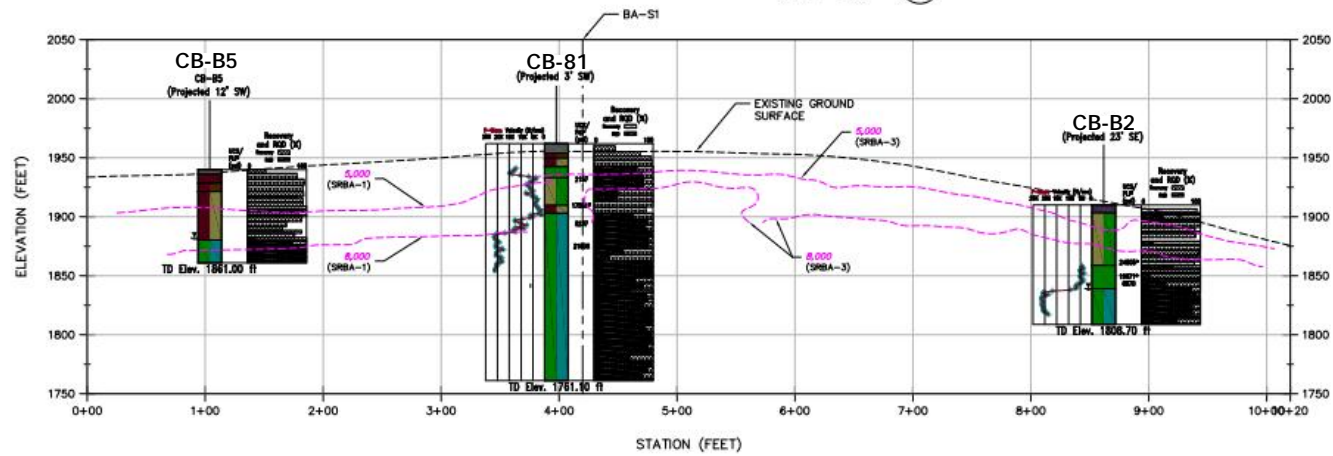
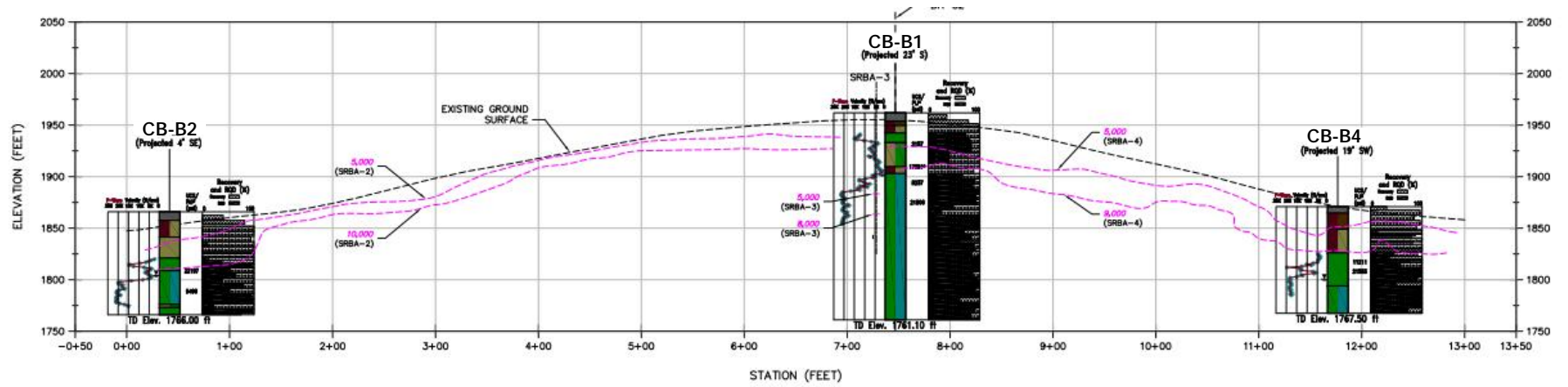
- Geologic mapping
- Seismic refraction surveys
- 5 core borings totaling 585 ft
- Downhole seismic velocities
- 2 piezometers
- Rock strength testing
- Durability testing



Findings

- Hard basaltic rock
- Favorable topographic conditions
- Close to the dam site area

Geotechnical Sections South Borrow Area



Geotechnical Investigation Findings – Foundation Conditions

- Depth to weathered rock generally less than 20 ft.
- Weathered rock found to depths of 100 – 130 ft. at some locations
- All borings encountered less fractured rock with depth
- Evaluation of significant joint sets and shears indicates a lack of persistence between adjacent bore holes
- Hydraulic conductivities mostly decrease with depth and with decreasing fracture intensity

Geotechnical Investigation - Conclusions

- Confirmed no fatal flaws at Dam Axis 2 site
- Hard volcanic and metavolcanic rock is suitable dam foundation
- Evidence for lack of active faulting along mapped lineaments at site
- Potential rock borrow area present on north side of reservoir, upstream of dam
- Further investigations needed to develop final design

CENTENNIAL RESERVOIR PROJECT

Nevada Irrigation District

1036 W. Main Street
Grass Valley, CA 95945

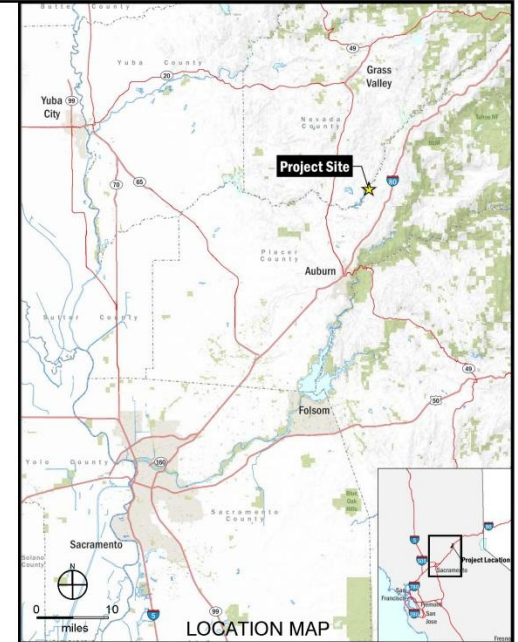
MAY 2017

EXHIBITS

DRAFT
NOT FOR CONSTRUCTION

AECOM

300 Lakeside Dr., Suite 400
Oakland, CA 94612



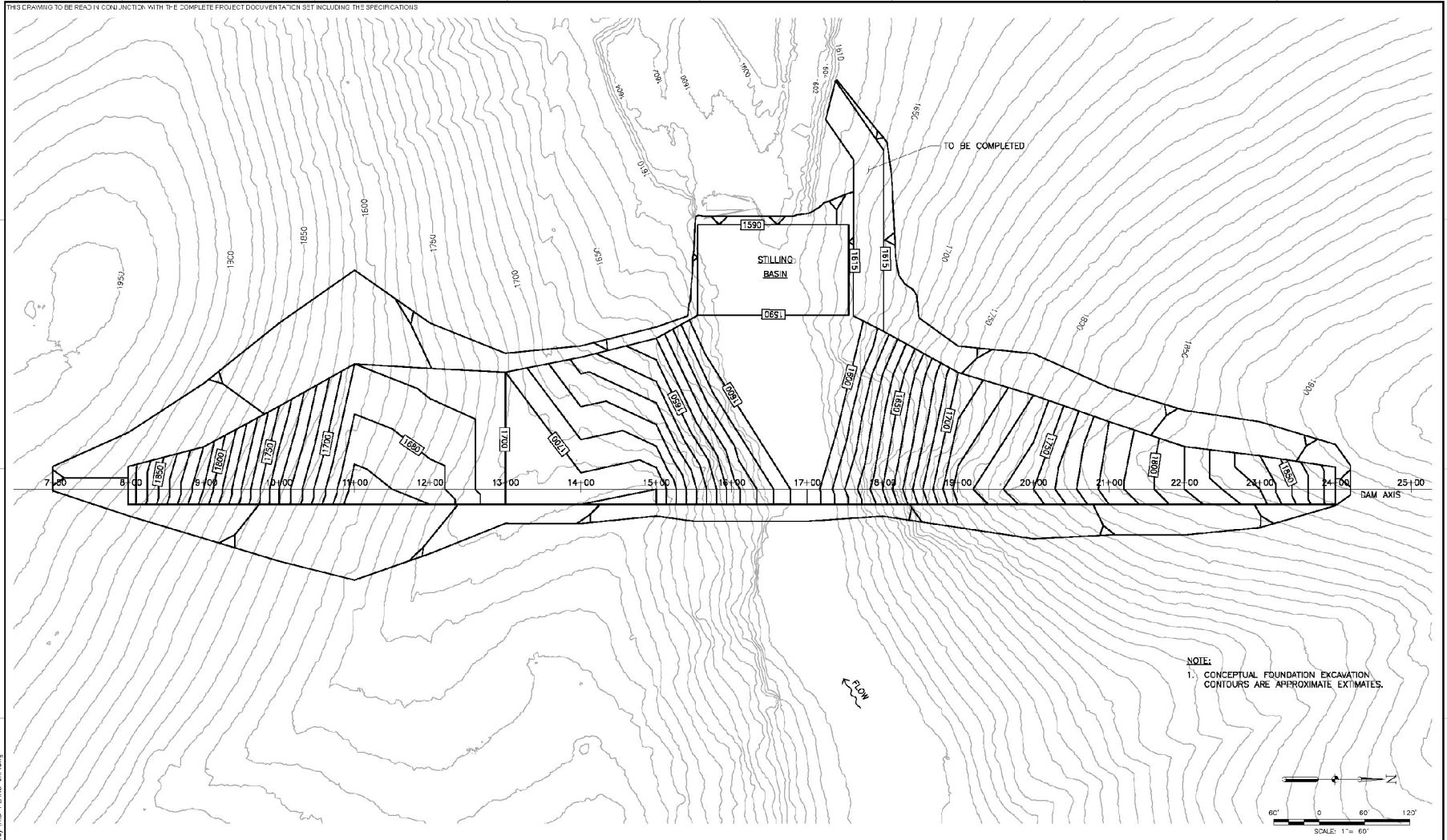
List of Exhibits

Exhibit No.	Title
1	COVER SHEET
2	EXCAVATION PLAN
3	PLAN OF DAM
4A	FOUNDATION PROFILE
4B	DAM PROFILE
5	MAXIMUM SPILLWAY SECTION AND CREST DETAIL
6	NON-OVERFLOW SECTIONS
7	DAM SECTIONS - 1
8	DAM SECTIONS - 2
9	OUTLET WORKS PLAN AND PROFILE
10	MAIN DETAILS
11	SPILLWAY BRIDGE PLAN AND ELEVATION
12	SPILLWAY BRIDGE SECTIONS
13	INSTRUMENTATION PLAN AND TYPICAL SECTION
14	DIVERSION CONCEPT
15	CONSTRUCTION SITE LAYOUT - CONCEPT PLAN 1
16	CONSTRUCTION SITE LAYOUT - CONCEPT PLAN 2

DRAWING NO.	REV
	1
SHEET NO.	
EXHIBIT 1	
PAGE NO.	OF

AECOM

Excavation Plan

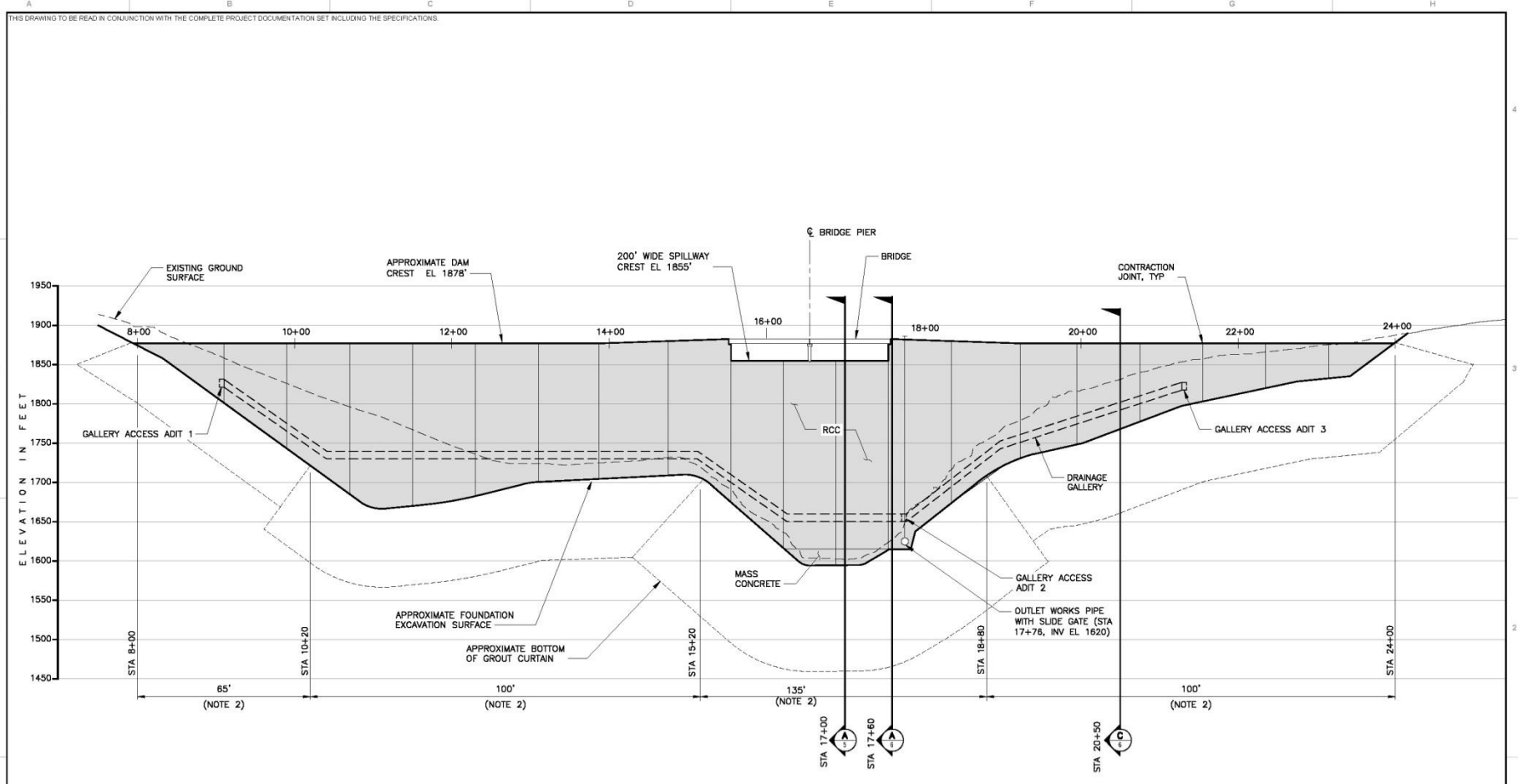


Apr 13, 2017 - 3:53pm
 C:\COC\1010\1010.dwg - Stillbary.MXD PLANS EXH.DWG

REV	DESCRIPTION	APP'D	DATE	VERIFY SCALES	DESIGN	APPROVED	PROJECT INFO		REV
	PRELIMINARY DRAFT NOT FOR CONSTRUCTION			0 1" <small> DRUGS OR DIMENSIONS ORIGINAL DRAWINGS IF NOT DIMENSION ON THE SHEET ADJUST SCALES ACCORDINGLY </small>	 <small> 300 Lakeside Drive, Suite 400, Oakland, CA 94612 Tel: (510) 865-3000 Fax: (510) 876-2008 </small>	SCALE AS NOTED CAD FILE 1010 PLANS EXH.DWG	Nevada Irrigation District Grass Valley, California	Centennial Reservoir Project EXCAVATION PLAN	PROJECT NO 60319496 SHEET EXHIBIT 2 OF



Dam Profile



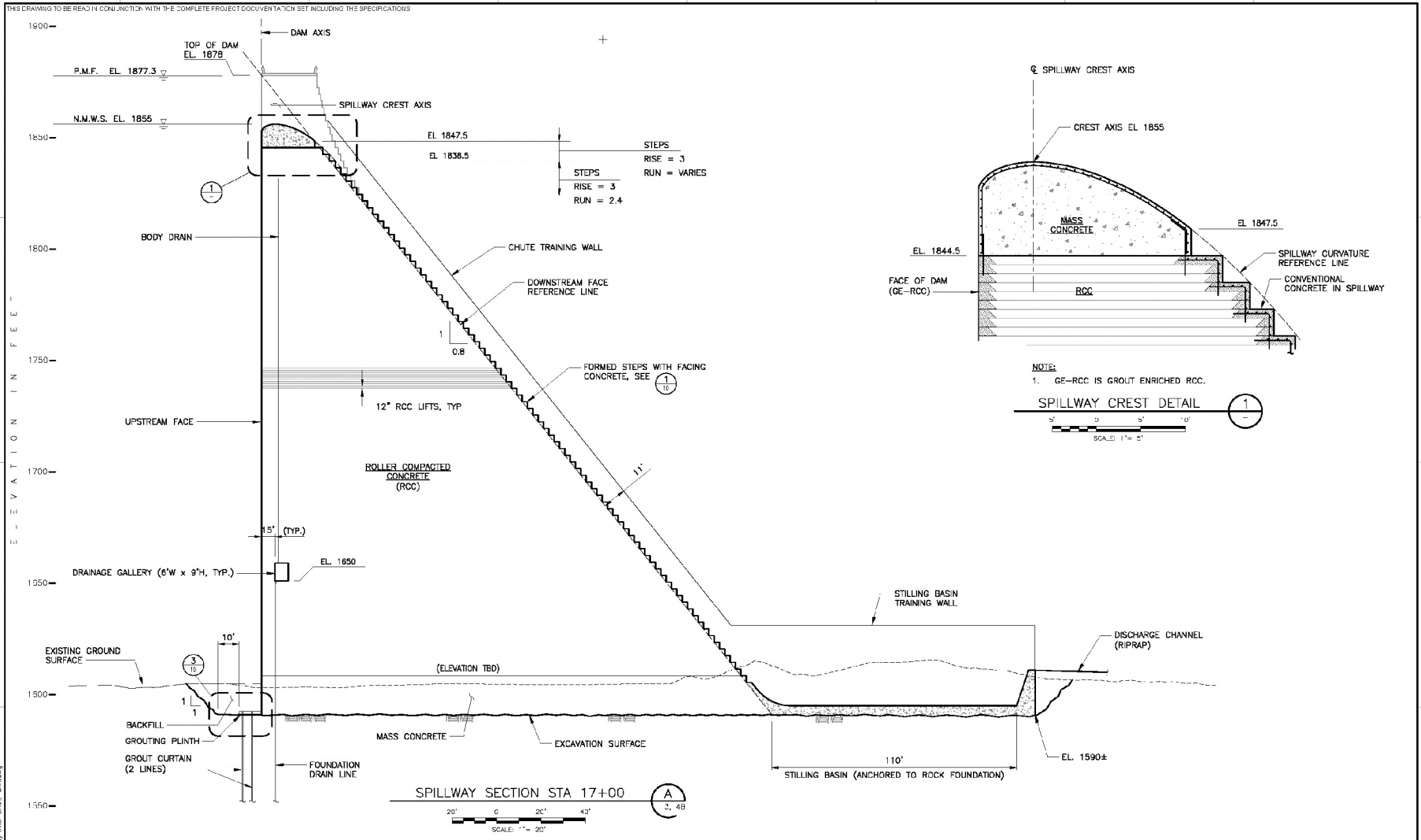
SECTION ALONG DAM AXIS
 60' 0 90' 120'
 SCALE: 1" = 60'

- NOTES:
1. PARAPET WALL AND RAILINGS NOT SHOWN, SEE EXHIBIT 10.
 2. MIN. LENGTHS OF PRIMARY & SECONDARY CURTAIN HOLES SHALL BE SUCH THAT THE DEPTH OF GROUT CURTAIN IS AS SHOWN IN PROFILE, MEASURED NORMAL TO FOUNDATION SURFACE.

May 15, 2017 - 12:22pm
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REV	DESCRIPTION	APPR	DATE	VERIFY SCALES 0 1" BARS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY	 300 Lakeside Drive, Suite 400, Concord, CA 94612 Tel: (916) 466-3600 Fax: (916) 474-3308	DESIGN	APPROVED	Nevada Irrigation District Grass Valley, California	Centennial Reservoir Project DAM PROFILE	PROJECT NO	REV
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				CHECKED		AS NOTED					REV

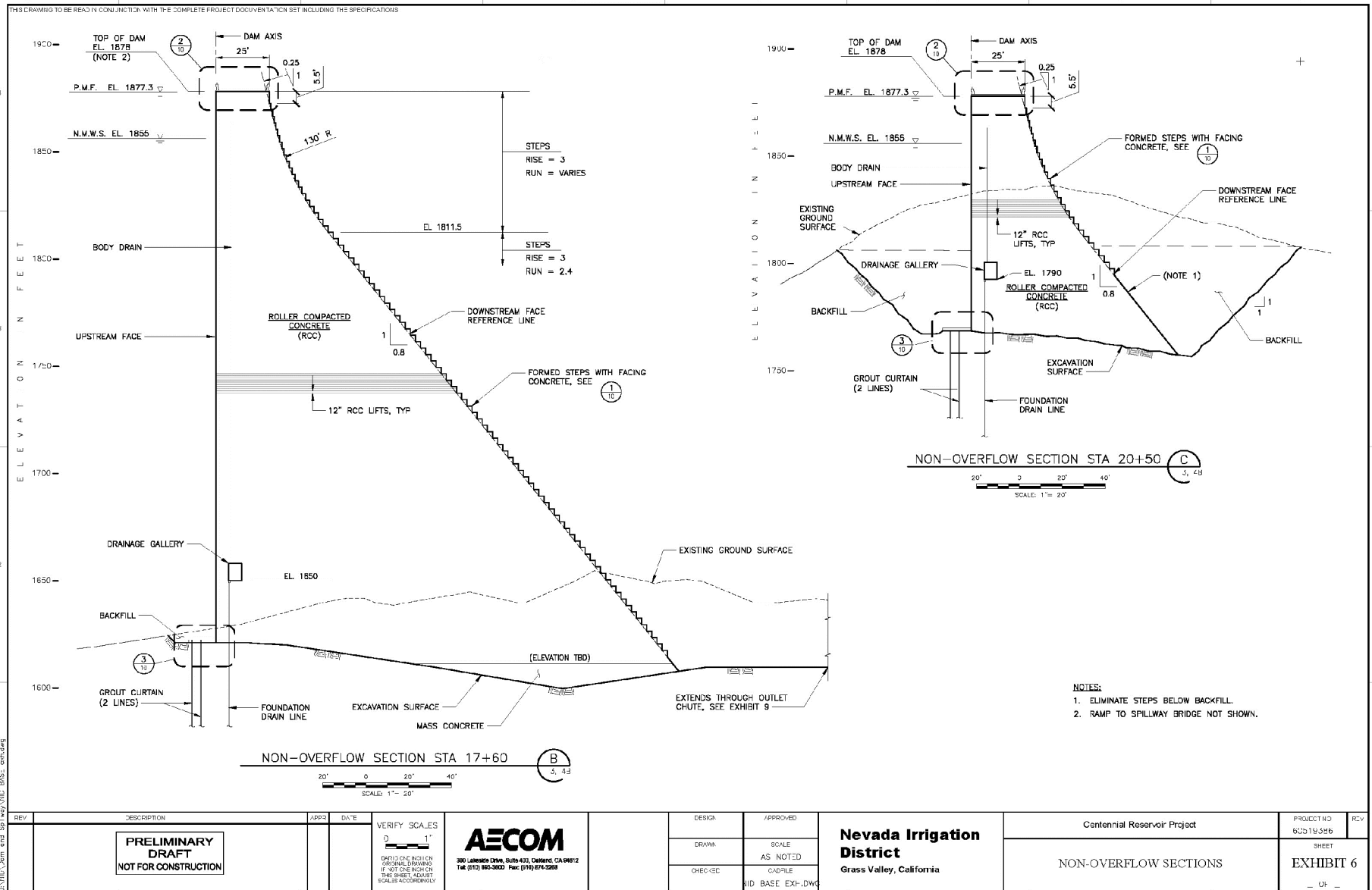
Maximum Spillway Section



MAY 15, 2017 11:27am
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							MAXIMUM SPILLWAY SECTION AND CREST DETAIL			

Non-Overflow Sections

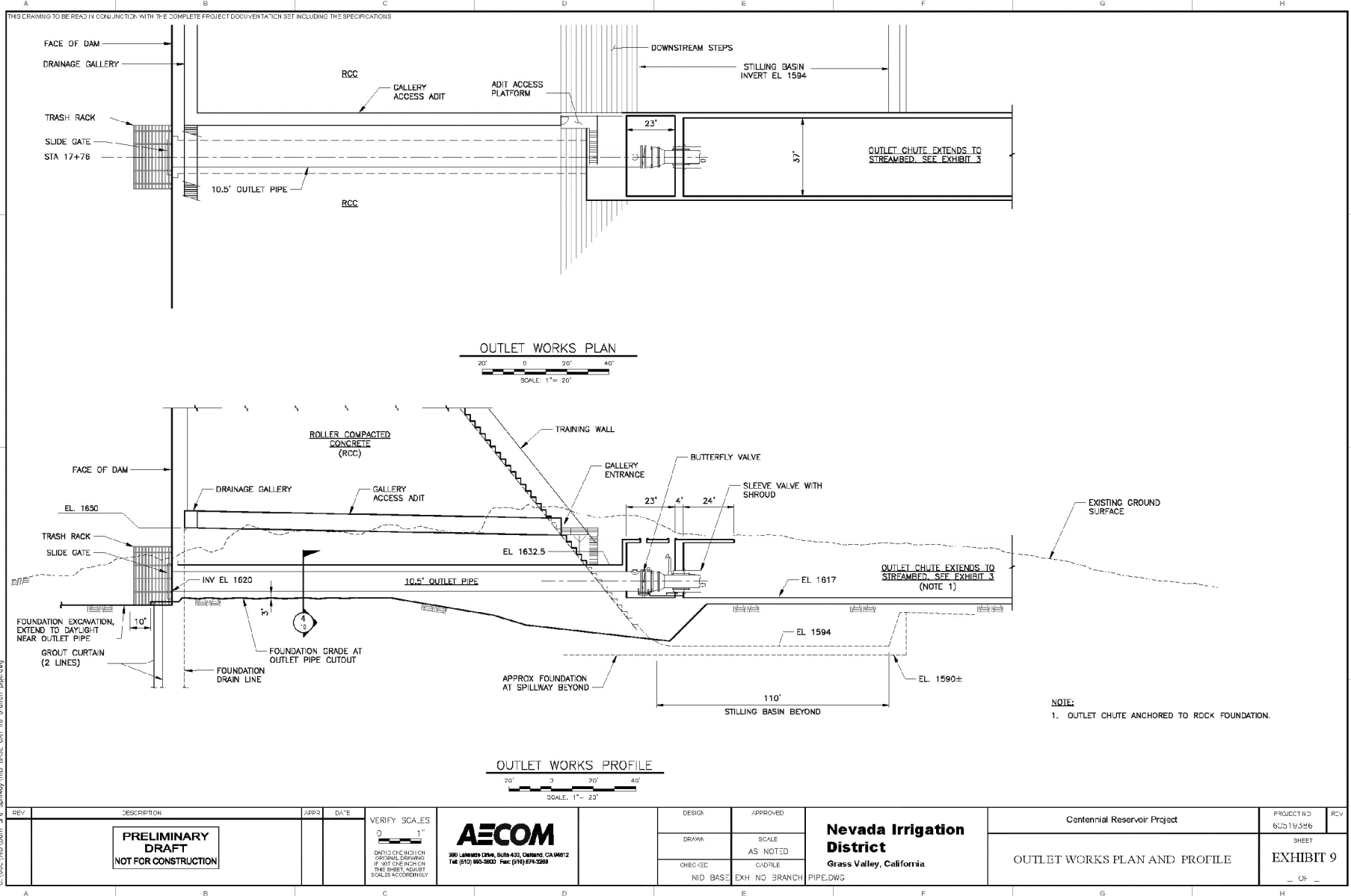


MAY 15, 2017 11:20am
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Outlet Works

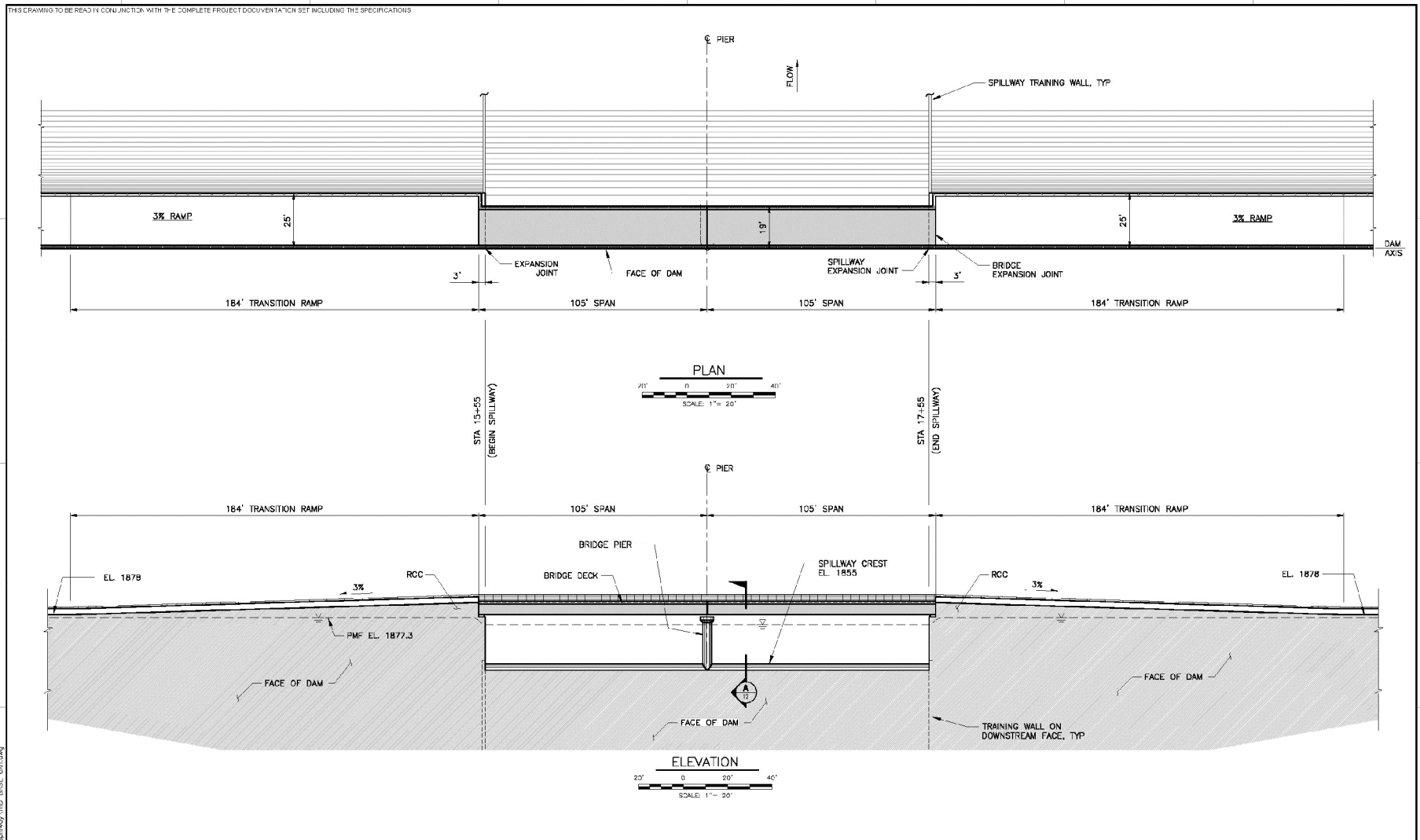


Jul 05, 2017 9:31 am
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				AECOM <small> 300 Lakeside Drive, Suite 400, Oakland, CA 94612 Tel: (916) 865-3600 Fax: (916) 876-2588 </small>			Grass Valley, California			
							OUTLET WORKS PLAN AND PROFILE			EXHIBIT 9
										1 OF 1



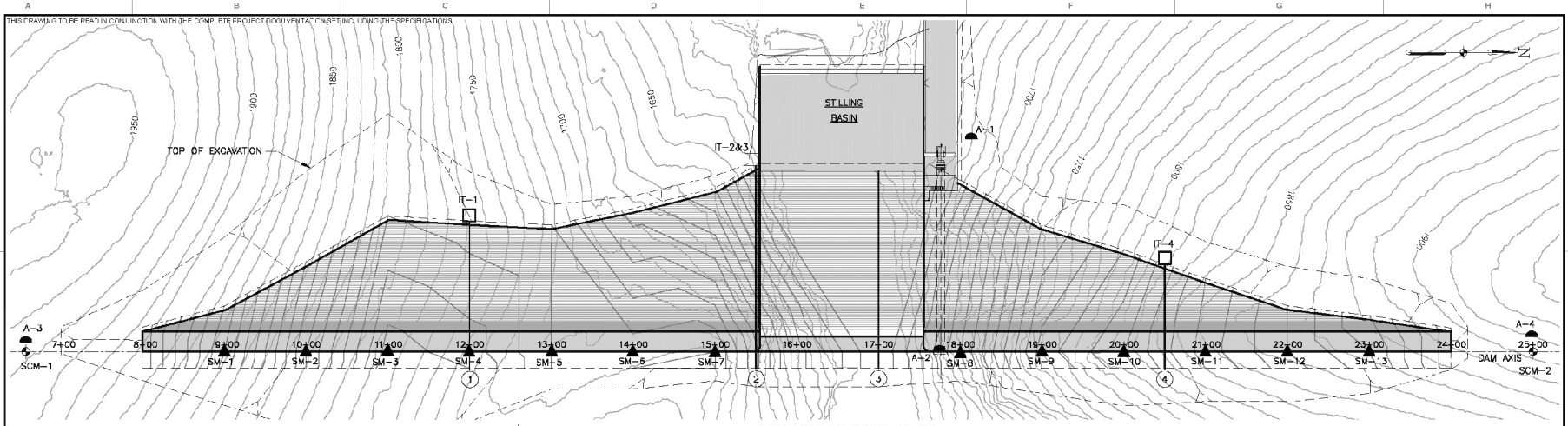
Spillway Bridge



Apr 11, 2017 - 11:35am
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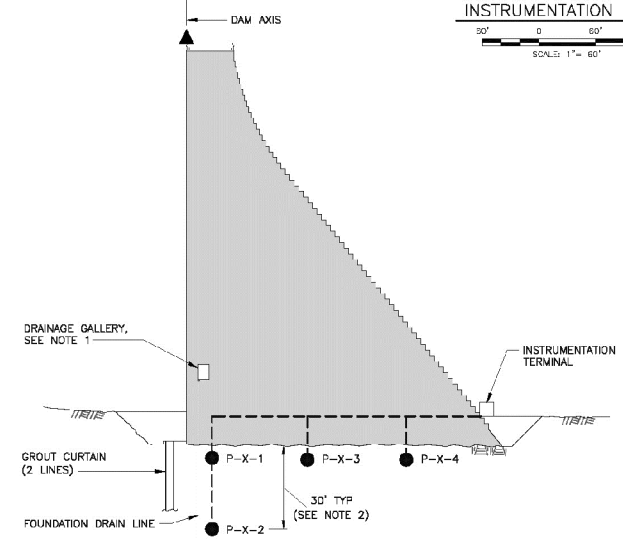
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									SHEET	
									EXHIBIT 11	

Instrumentation Plan



- NOTES:**
1. SEEPAGE V-NOTCH WEIRS TO BE LOCATED IN GALLERY GUTTERS.
 2. PIEZOMETERS INSTALLED IN DRILLED HOLES.

- LEGEND**
- ① INSTRUMENTATION SECTION No.
 - SCM-1 SURVEY CONTROL MONUMENT (4 TOTAL, 2 SHOWN)
 - SW-1 SURVEY MONUMENT
 - P-X-1 VIBRATING WIRE PIEZOMETER (2 AT EACH LOCATION)
 - PIEZOMETER CABLE
 - A-1 ACCELEROGRAPH
 - IT-1 INSTRUMENTATION TERMINAL



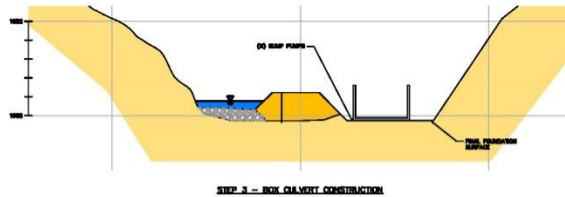
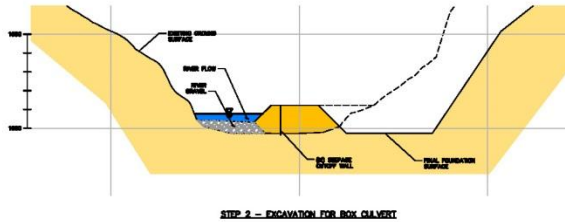
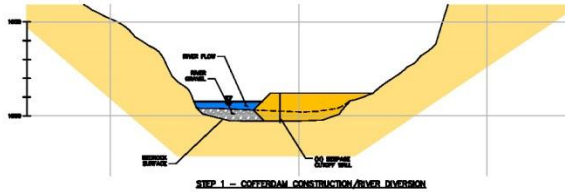
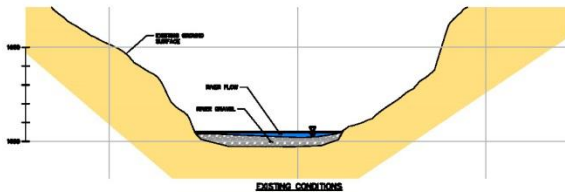
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	PRELIMINARY DRAFT NOT FOR CONSTRUCTION			0 1"			INSTRUMENTATION PLAN AND TYPICAL SECTION		SHEET	
				AECOM 300 Lakeside Drive, Suite 400, Oakland, CA 94612 Tel: (916) 885-3820 Fax: (916) 874-2268			Nevada Irrigation District Grass Valley, California		EXHIBIT 13	
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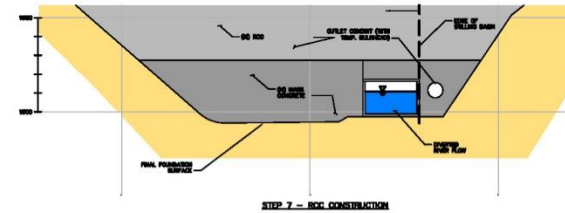
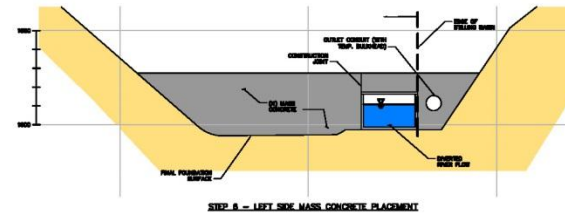
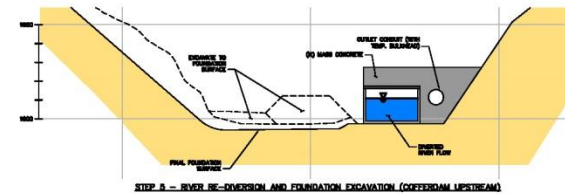
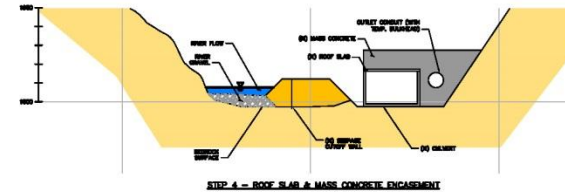


River Diversion Concept

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE COMPLETE PROJECT DOCUMENTATION SET INCLUDING THE SPECIFICATIONS.



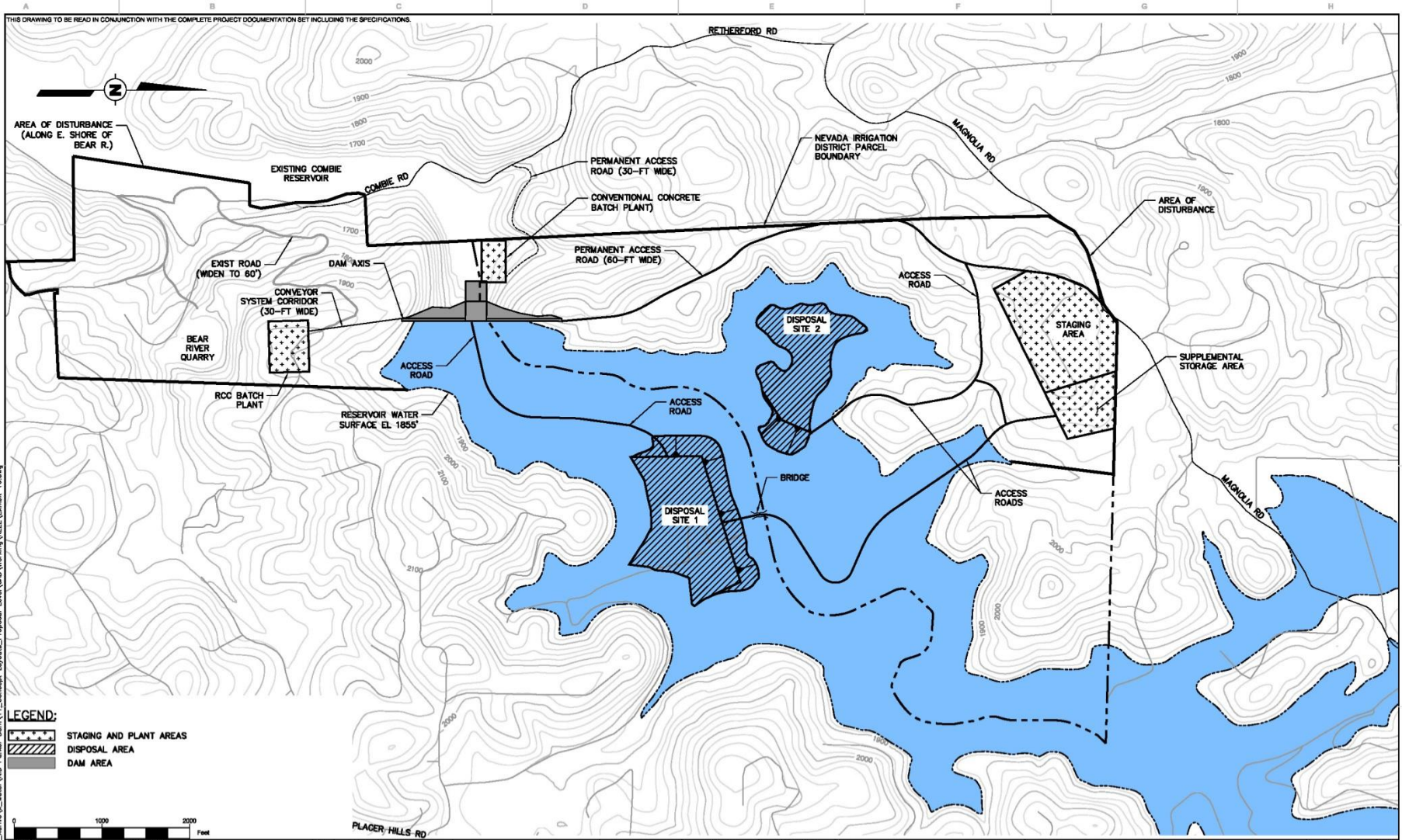
- NOTES**
1. NOT TO SCALE.
 2. EXCAVATE AND BRACE LOCATIONS DOWNSTREAM.
 3. FOUNDATION BRACING NOT SHOWN.



Mar 27, 2017 - 10:11am
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									DIVERSION CONCEPT		EXHIBIT 14
											... OF ...

Construction Site Layout – 2 (Bear River Quarry Borrow)



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						CHECKED	CADFILE EXHIBIT 16.DWG				OF	

Basis of Construction Schedule

- Work performed up to 6 days per week, 2 shifts per day
- No overly restrictive constraints on trucking materials to the site
- Dam foundation excavation: 15,000 cy per week
- Foundation grouting (drilling and grouting): 600 lf per week for each drill rig and grout plant.
- RCC construction: 16,000 cy per week

Opinion of Probable Construction Cost (2017 dollars)

WBS Category	Description	Category Total	Category % of Total
A	Mobilization and Demobilization	\$18,737,000	7.3%
B	Site Development	\$21,497,000	8.4%
C	River Diversion	\$2,600,000	1.0%
D	Dam Foundation	\$41,862,000	16.3%
E	RCC, Facing Concrete and Gallery	\$136,325,000	53.3%
F	Spillway and Dam Crest	\$12,766,000	5.0%
G	Spillway Bridge	\$2,340,000	0.9%
H	Outlet and Intake Structures and Pipe	\$14,759,000	5.8%
I	Miscellaneous Civil	\$3,224,000	1.3%
J	Instrumentation and SCADA	\$1,950,000	0.8%
	Total OPCC	\$256,059,000	100.0%
	Estimated Range - Low (-15%)	\$217,685,000	
	Estimated Range - High (+20%)	\$307,320,000	

Thank You

AECOM