Utah Division of Water Resources

Volume II of III
Bear River Development Report Figures

Consultant Job No. 233-18-01

October 2019

Prepared by: BOWEN COLLINS & ASSOCIATES

In Association with: HDR

BEAR RIVER DEVELOPMENT REPORT

VOLUME II OF III - FIGURES

October 2019

Prepared for:

UTAH DNR WATER RESOURCES

Prepared by:

BOWEN COLLINS & ASSOCIATES

In association with:

HDR

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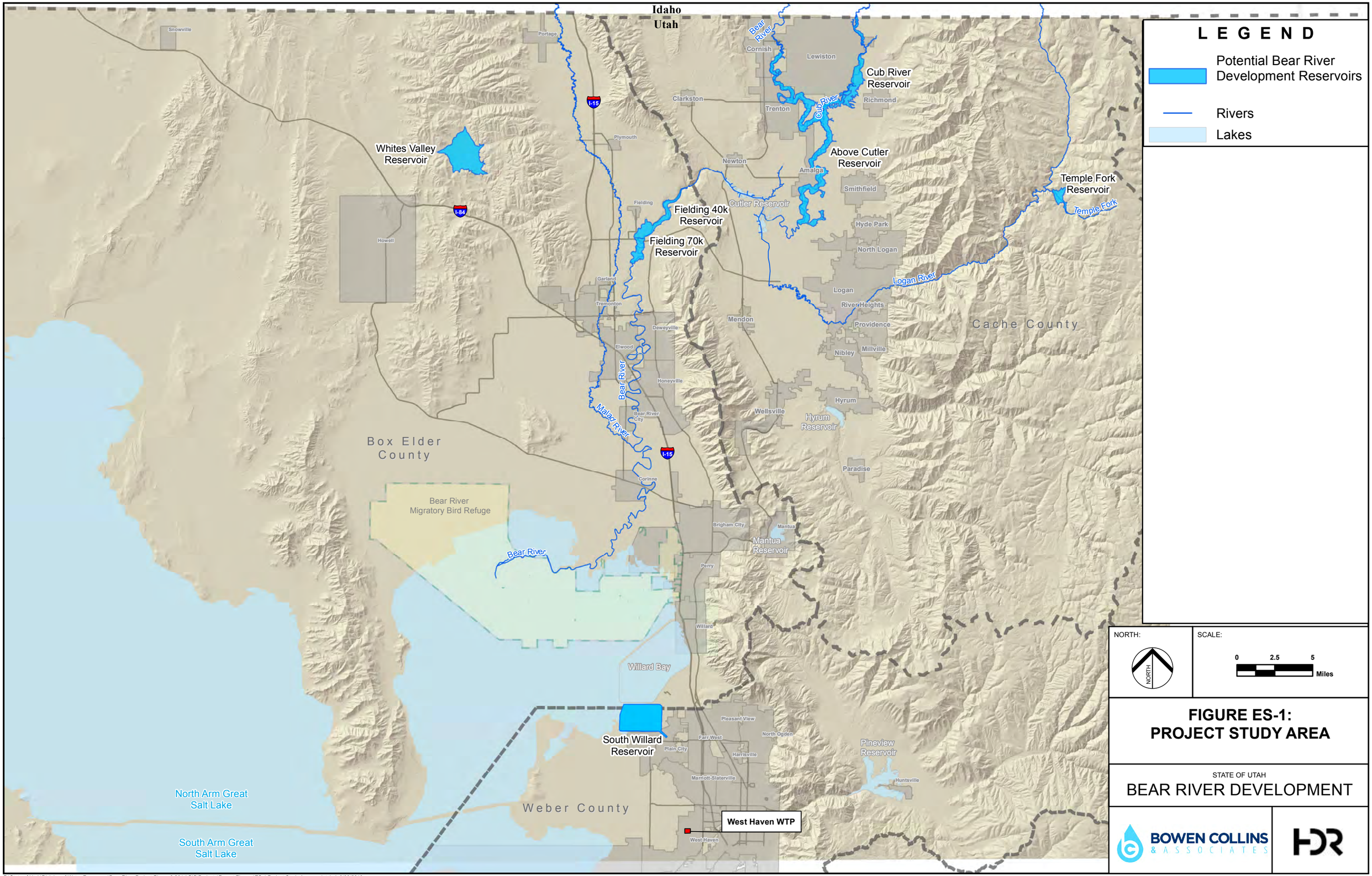
EXECUTIVE SUMMARY FIGURES



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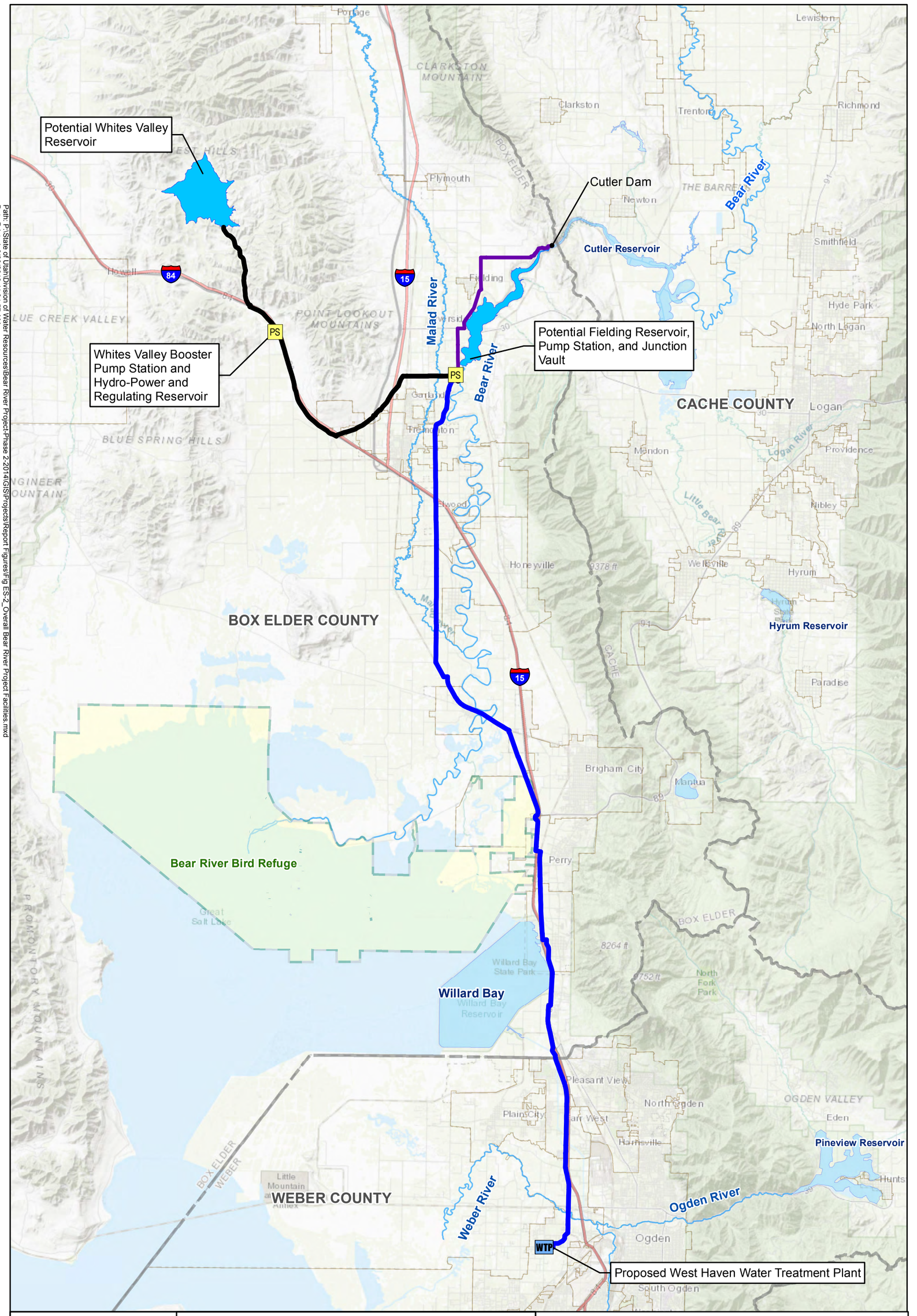

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L E G E N D

- PS Pump Station
- WTP Water Treatment Plant
- Potential Reservoirs

NORTH

0 2 4 8 Miles

Recommended Raw Water Pipeline Alignments:

- Fielding to Cutler
- Fielding to Whites
- Fielding to Willard

FIGURE ES-2: OVERALL BEAR RIVER DEVELOPMENT SYSTEM, SCENARIO J

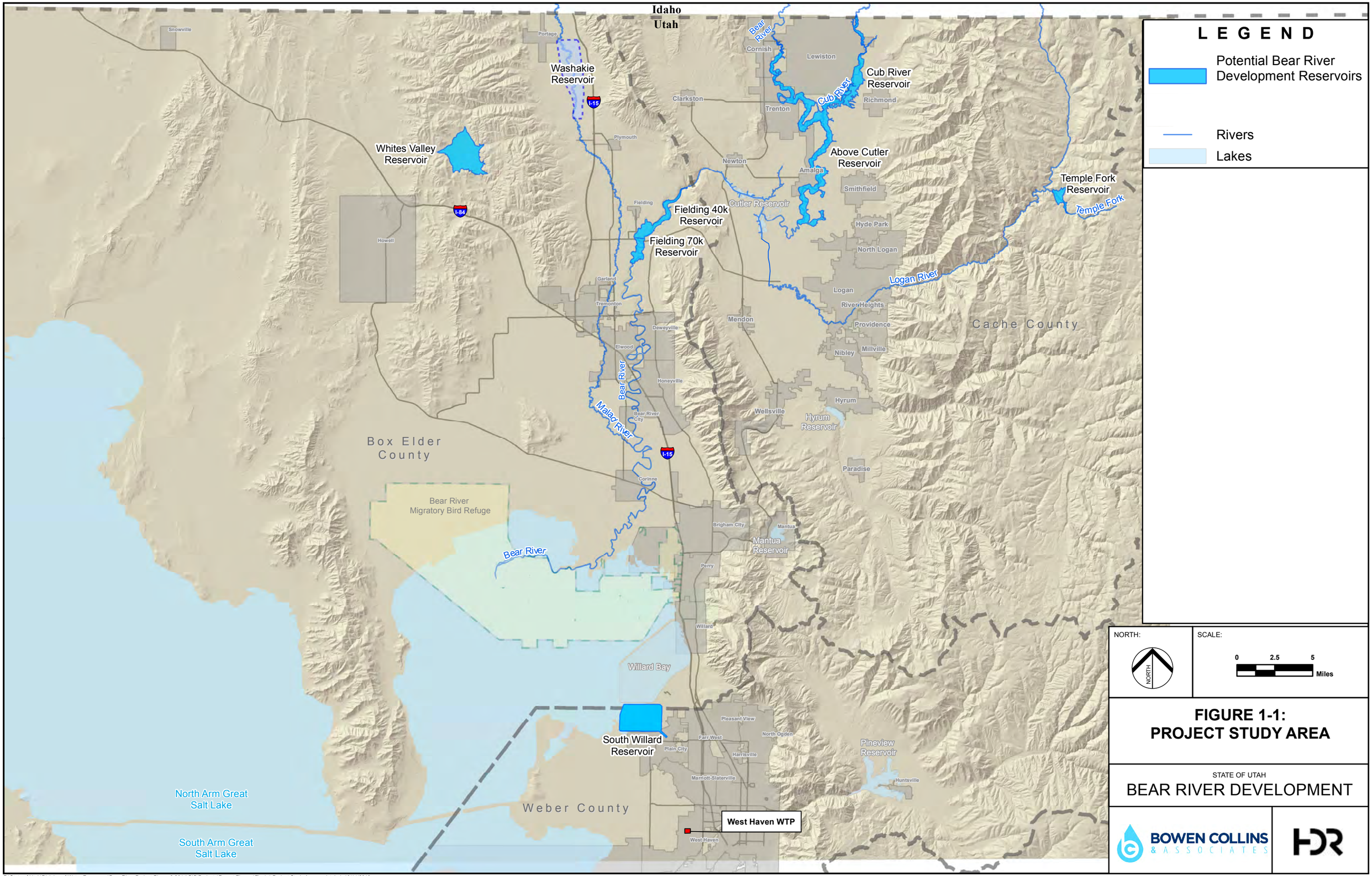
BEAR RIVER DEVELOPMENT

State of Utah
Division of Water Resources

BOWEN COLLINS & ASSOCIATES

HDR

CHAPTER 1 FIGURES



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CHAPTER 6 FIGURES

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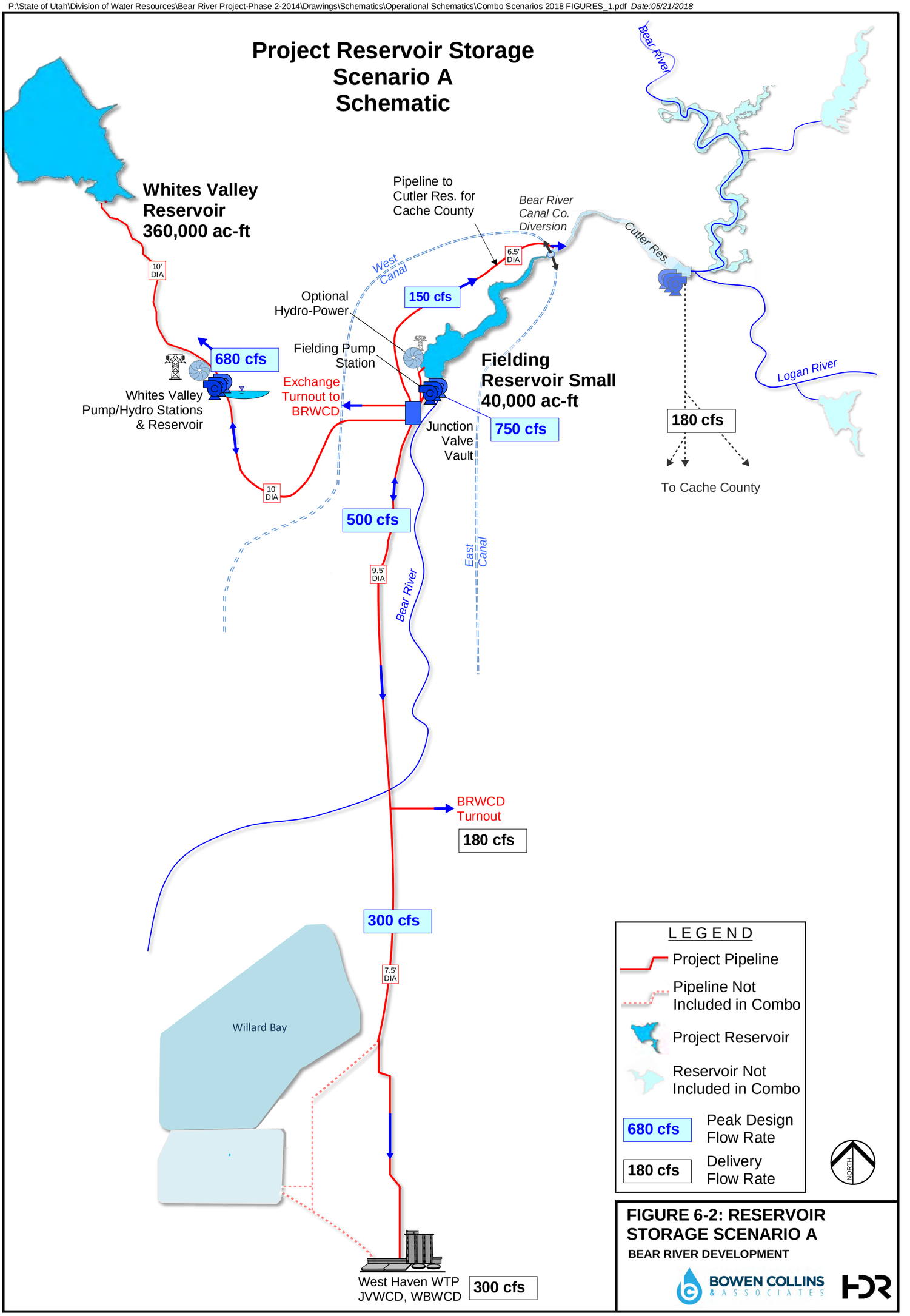

FIGURE 6-2: RESERVOIR STORAGE SCENARIO A

BEAR RIVER DEVELOPMENT

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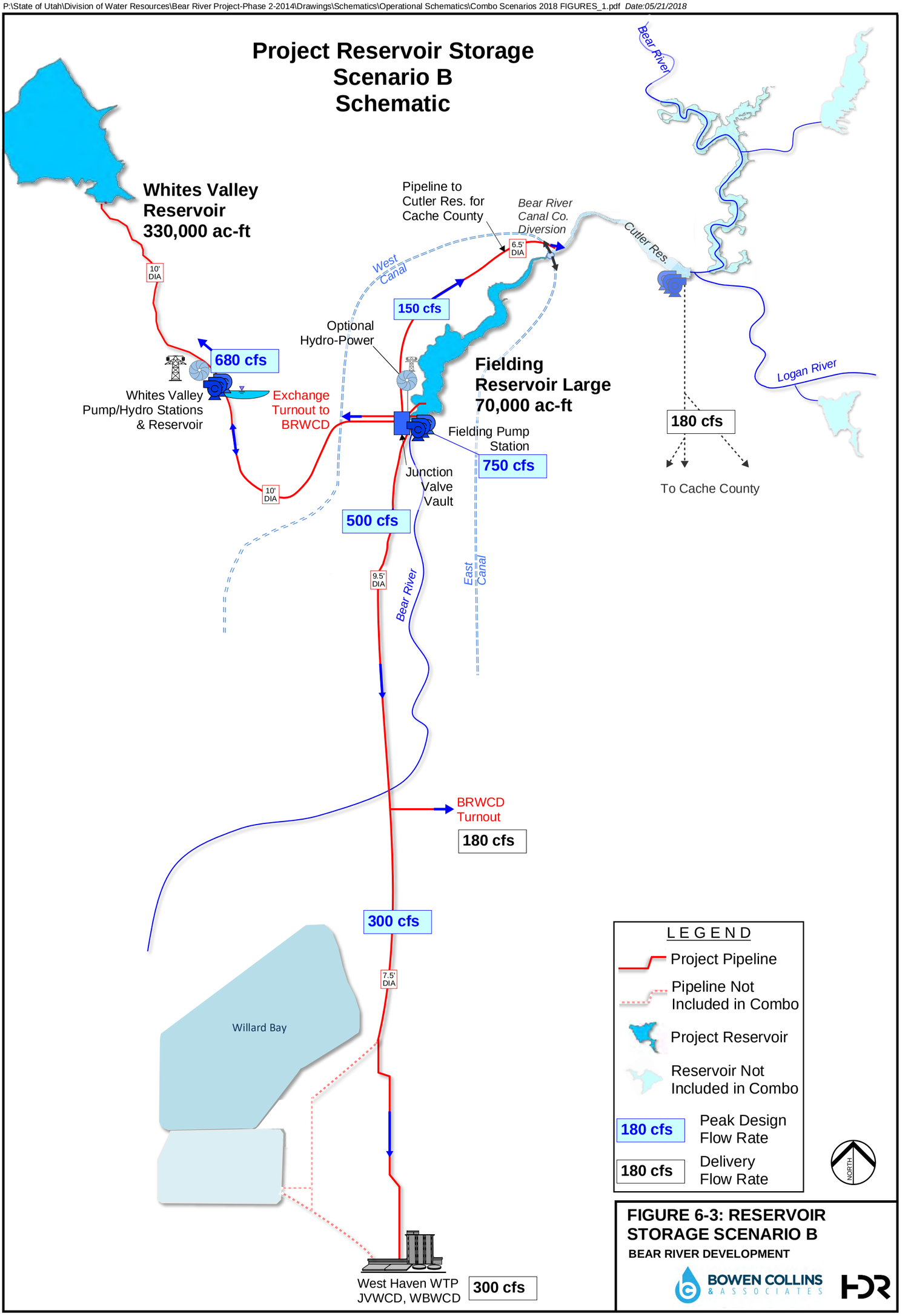

FIGURE 6-3: RESERVOIR STORAGE SCENARIO B

BEAR RIVER DEVELOPMENT

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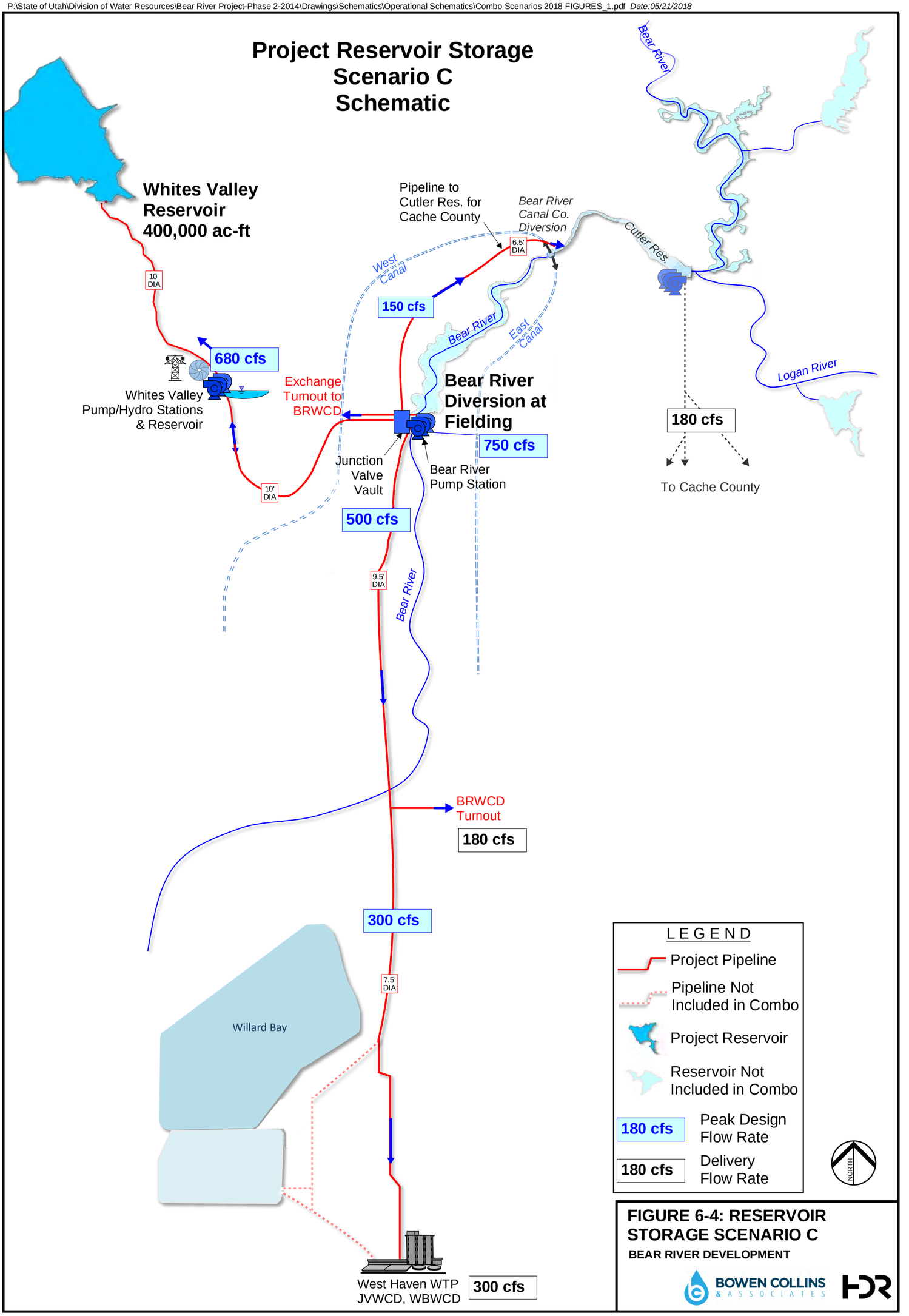

FIGURE 6-4: RESERVOIR STORAGE SCENARIO C

BEAR RIVER DEVELOPMENT

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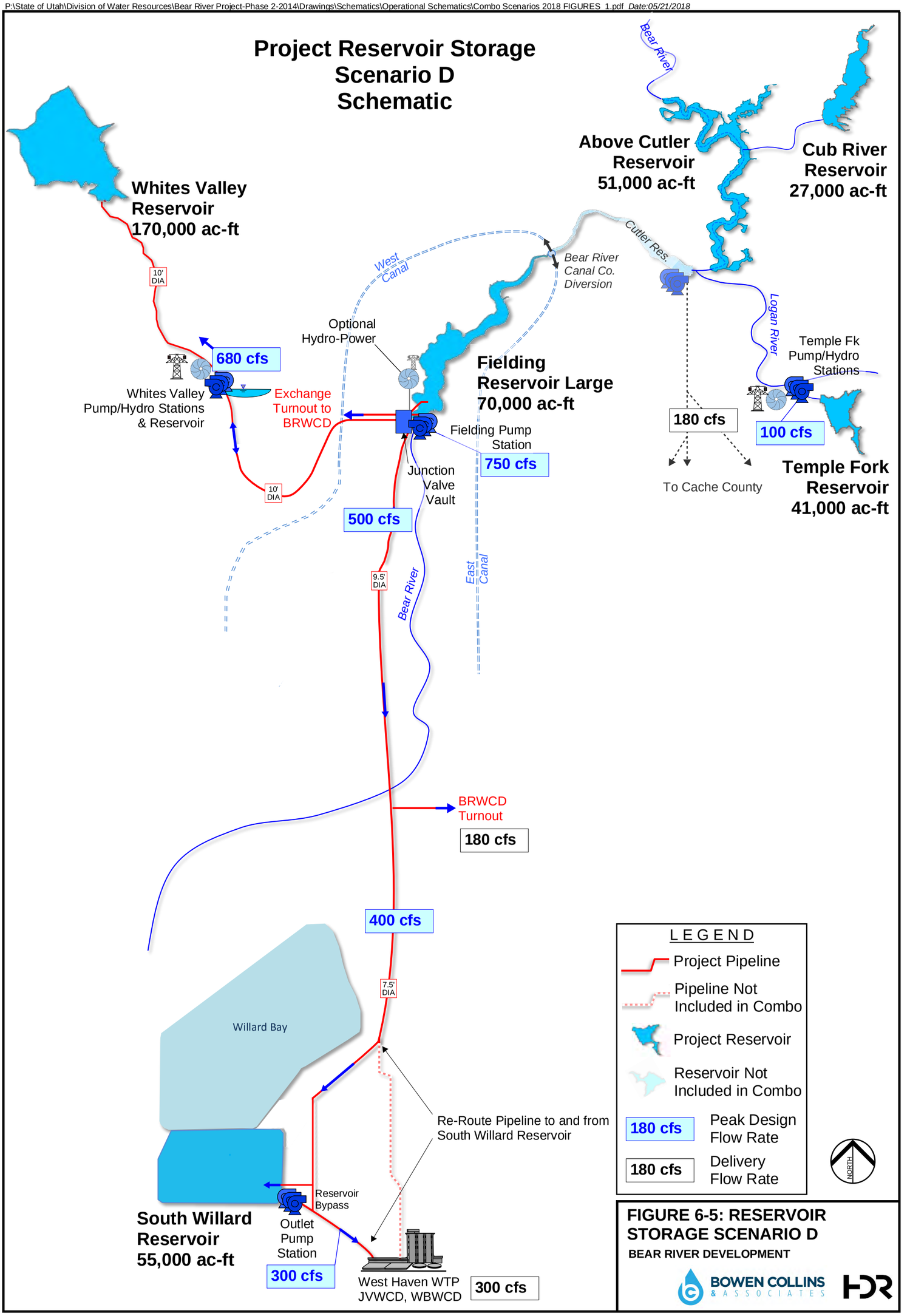

FIGURE 6-5: RESERVOIR STORAGE SCENARIO D

BEAR RIVER DEVELOPMENT

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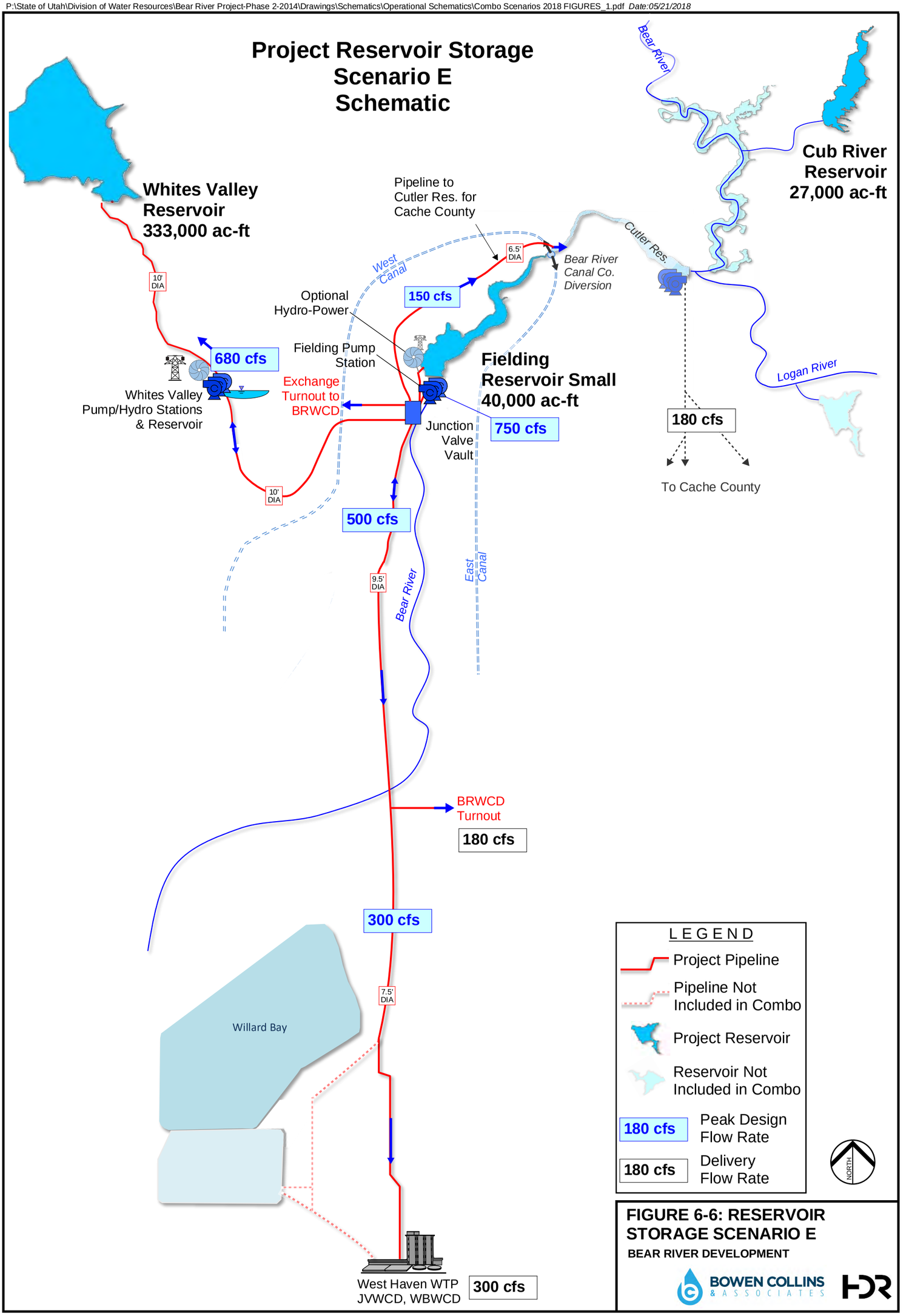

FIGURE 6-6: RESERVOIR STORAGE SCENARIO E

BEAR RIVER DEVELOPMENT

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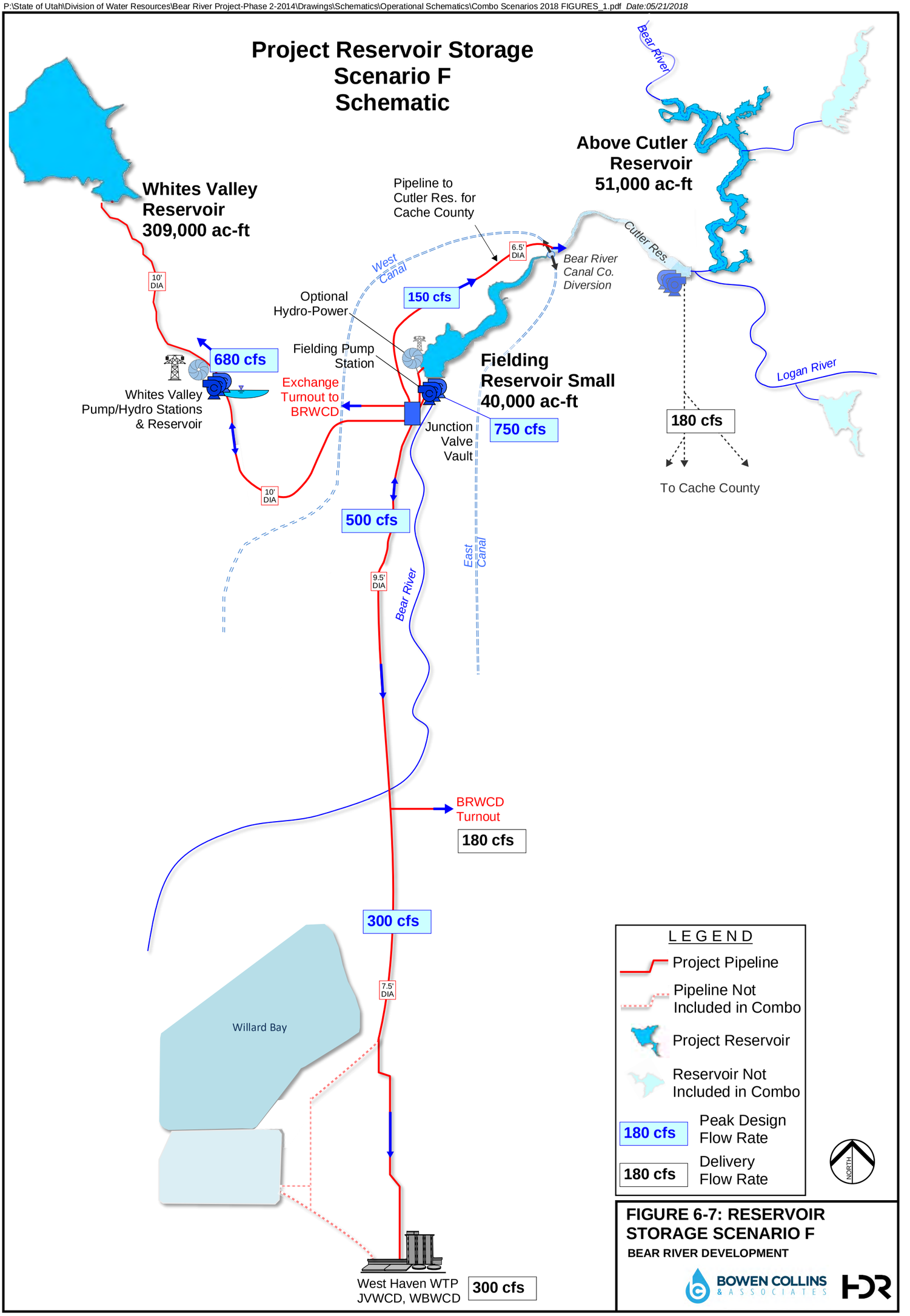

FIGURE 6-7: RESERVOIR STORAGE SCENARIO F

BEAR RIVER DEVELOPMENT

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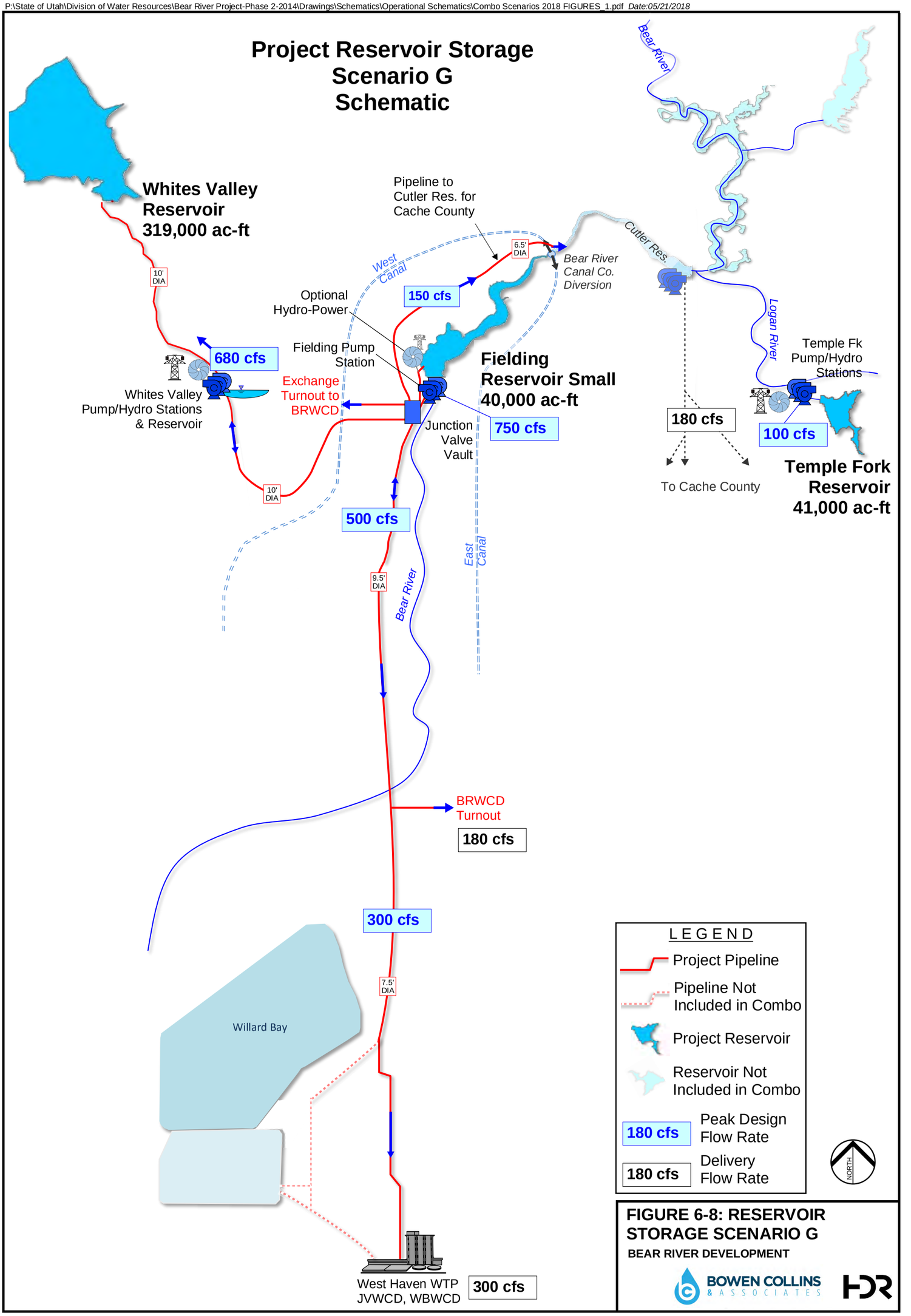

FIGURE 6-8: RESERVOIR STORAGE SCENARIO G

BEAR RIVER DEVELOPMENT

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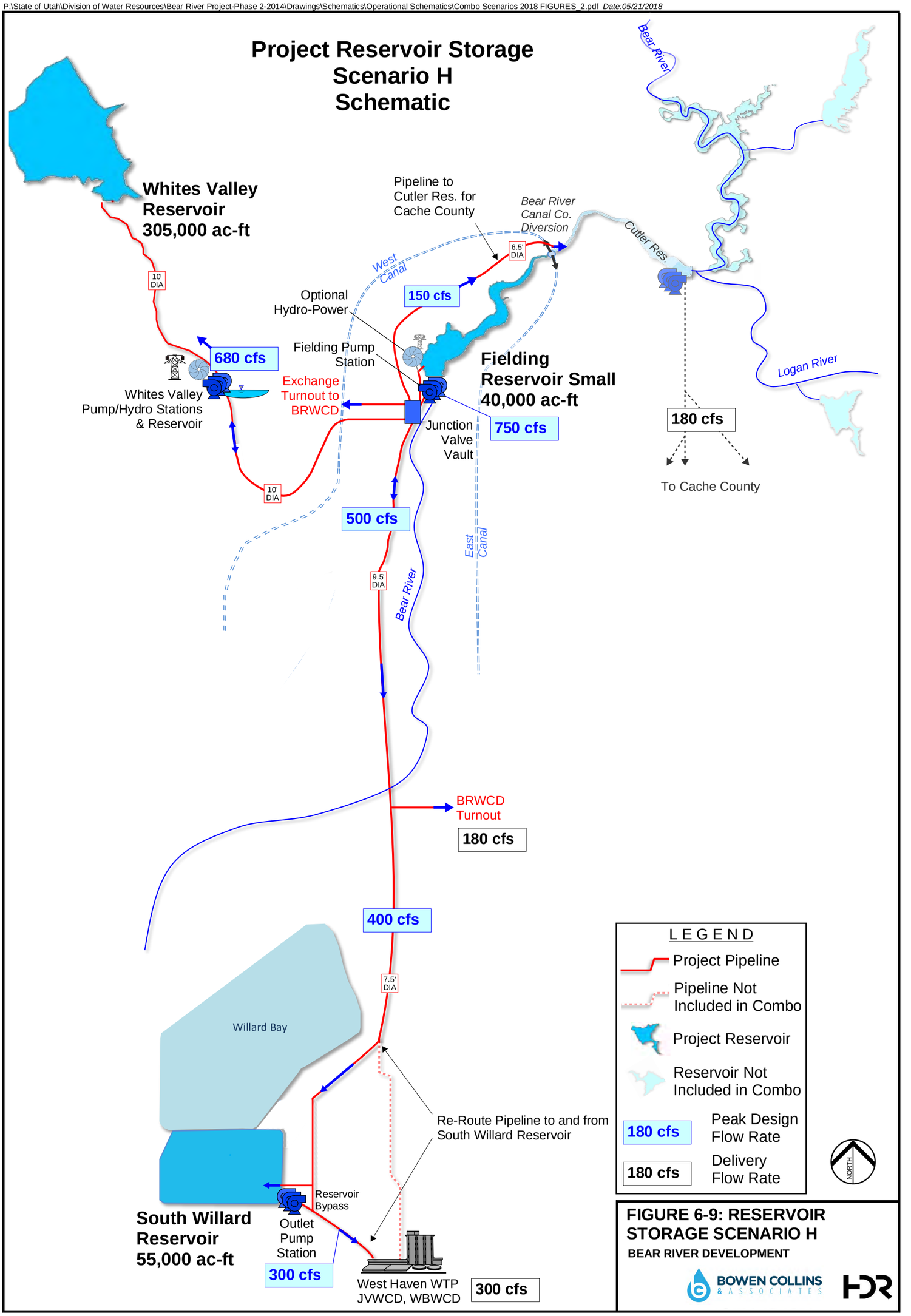

FIGURE 6-9: RESERVOIR STORAGE SCENARIO H

BEAR RIVER DEVELOPMENT

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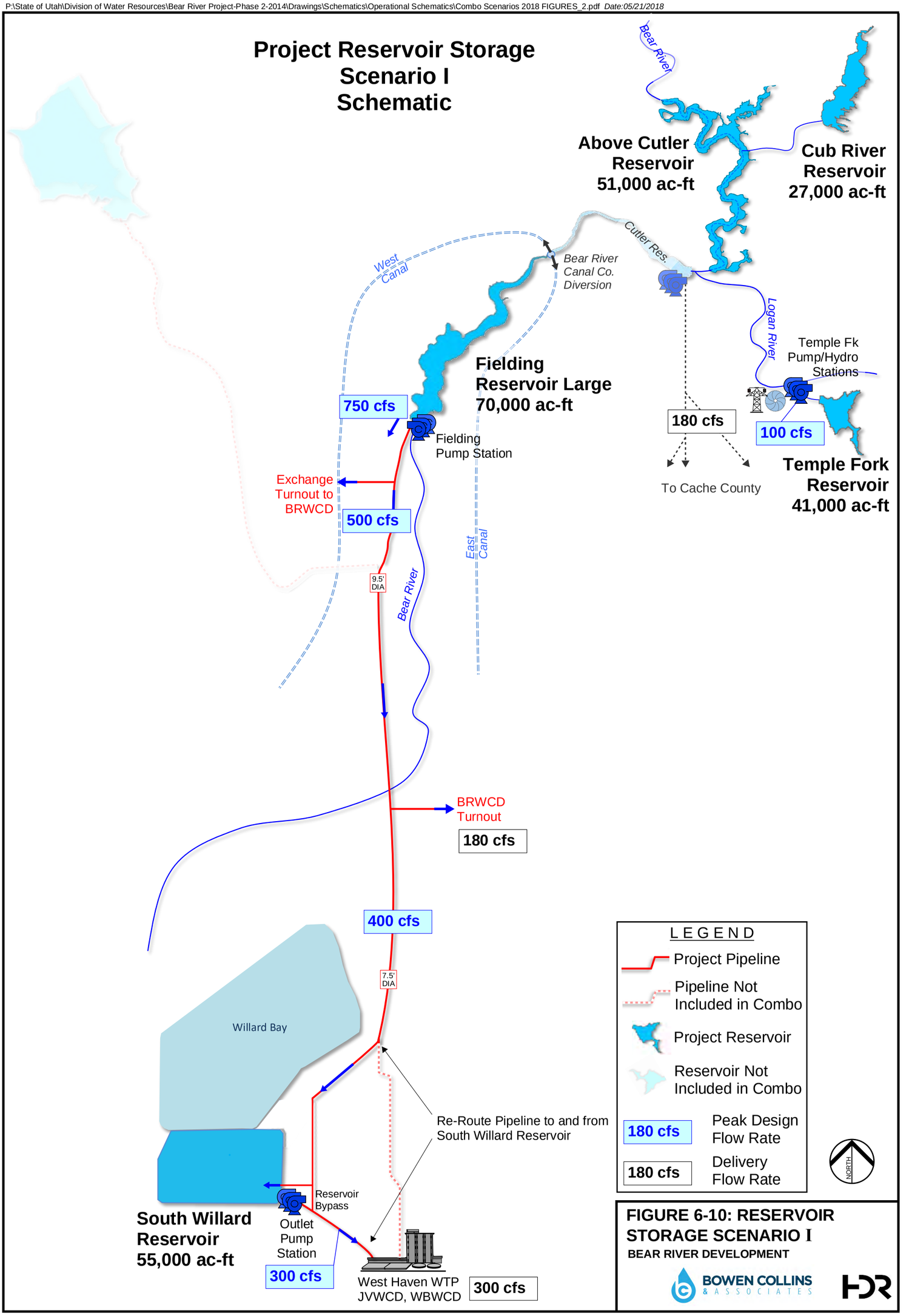

FIGURE 6-10: RESERVOIR STORAGE SCENARIO I

BEAR RIVER DEVELOPMENT

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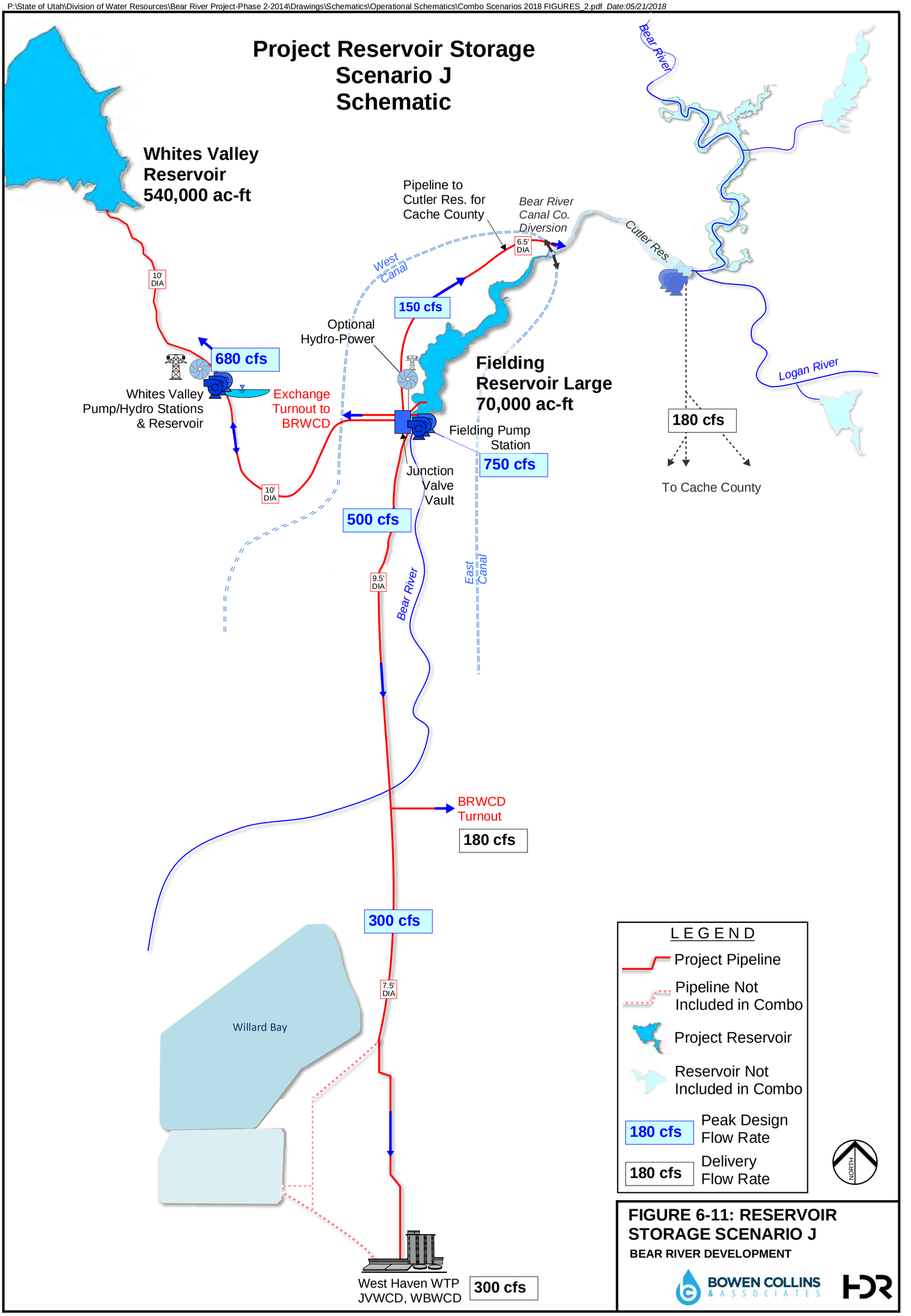

FIGURE 6-11: RESERVOIR STORAGE SCENARIO J

BEAR RIVER DEVELOPMENT

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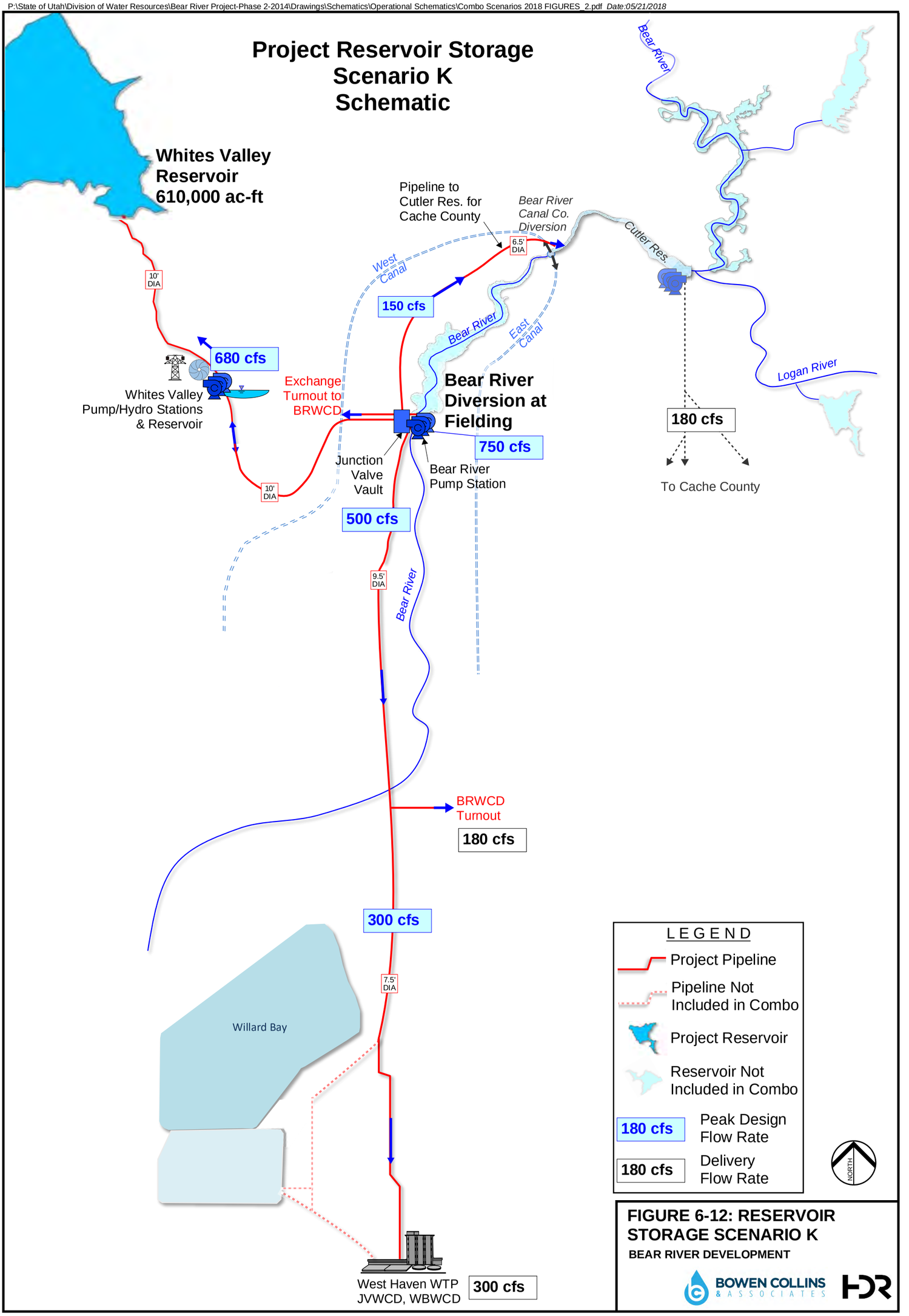

FIGURE 6-12: RESERVOIR STORAGE SCENARIO K

BEAR RIVER DEVELOPMENT

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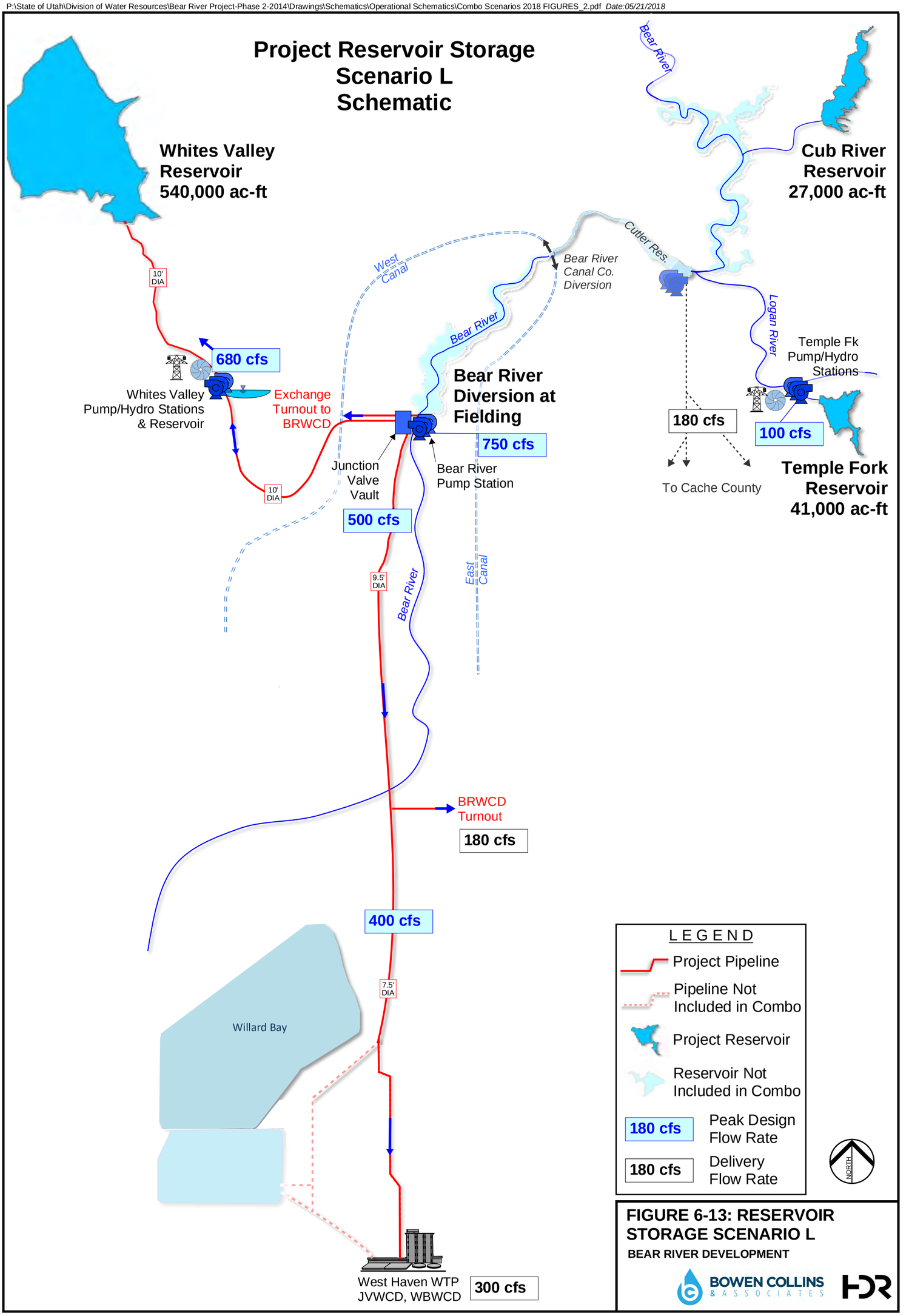

FIGURE 6-13: RESERVOIR STORAGE SCENARIO L

BEAR RIVER DEVELOPMENT

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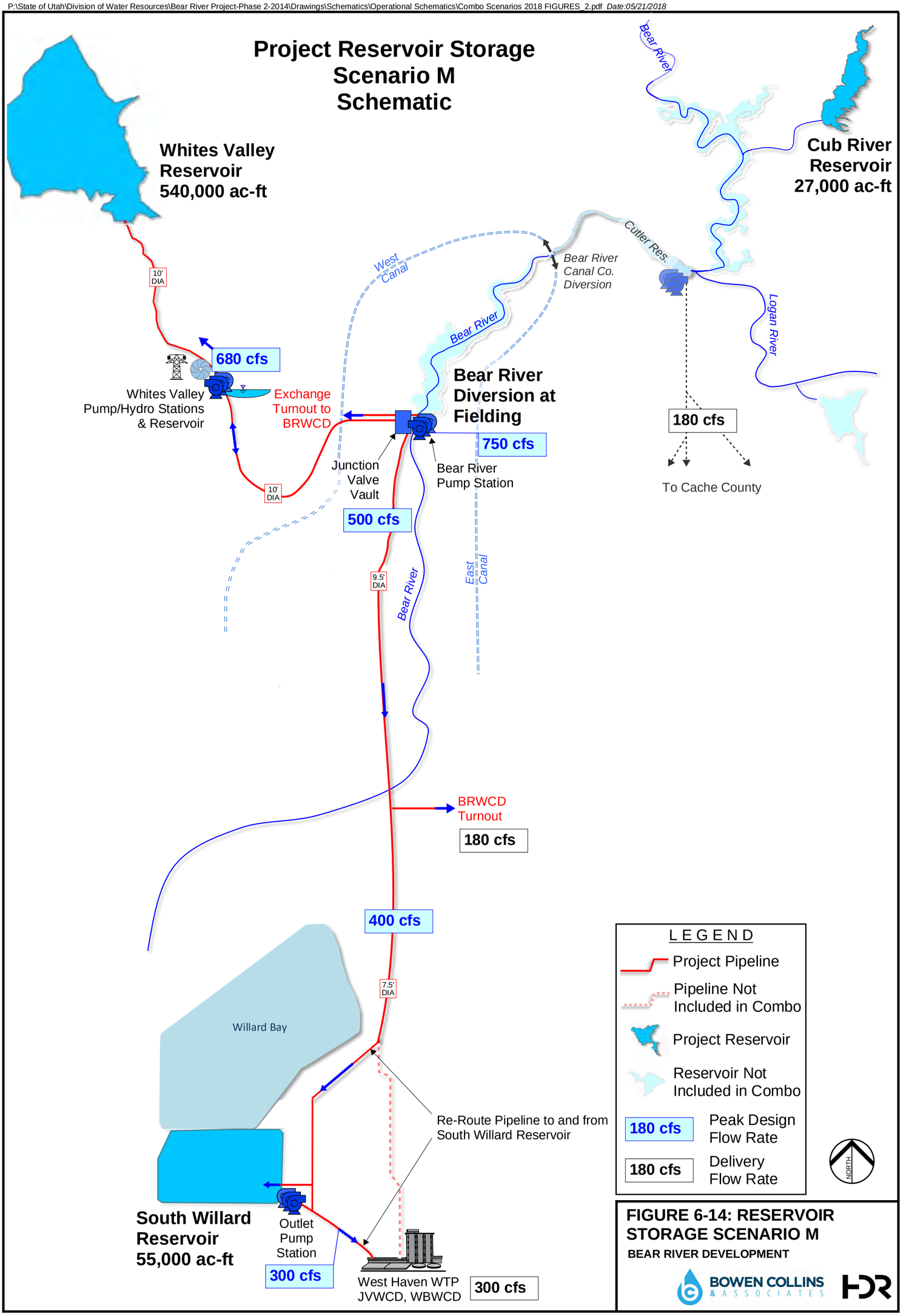

FIGURE 6-14: RESERVOIR STORAGE SCENARIO M

BEAR RIVER DEVELOPMENT

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CHAPTER 7 FIGURES

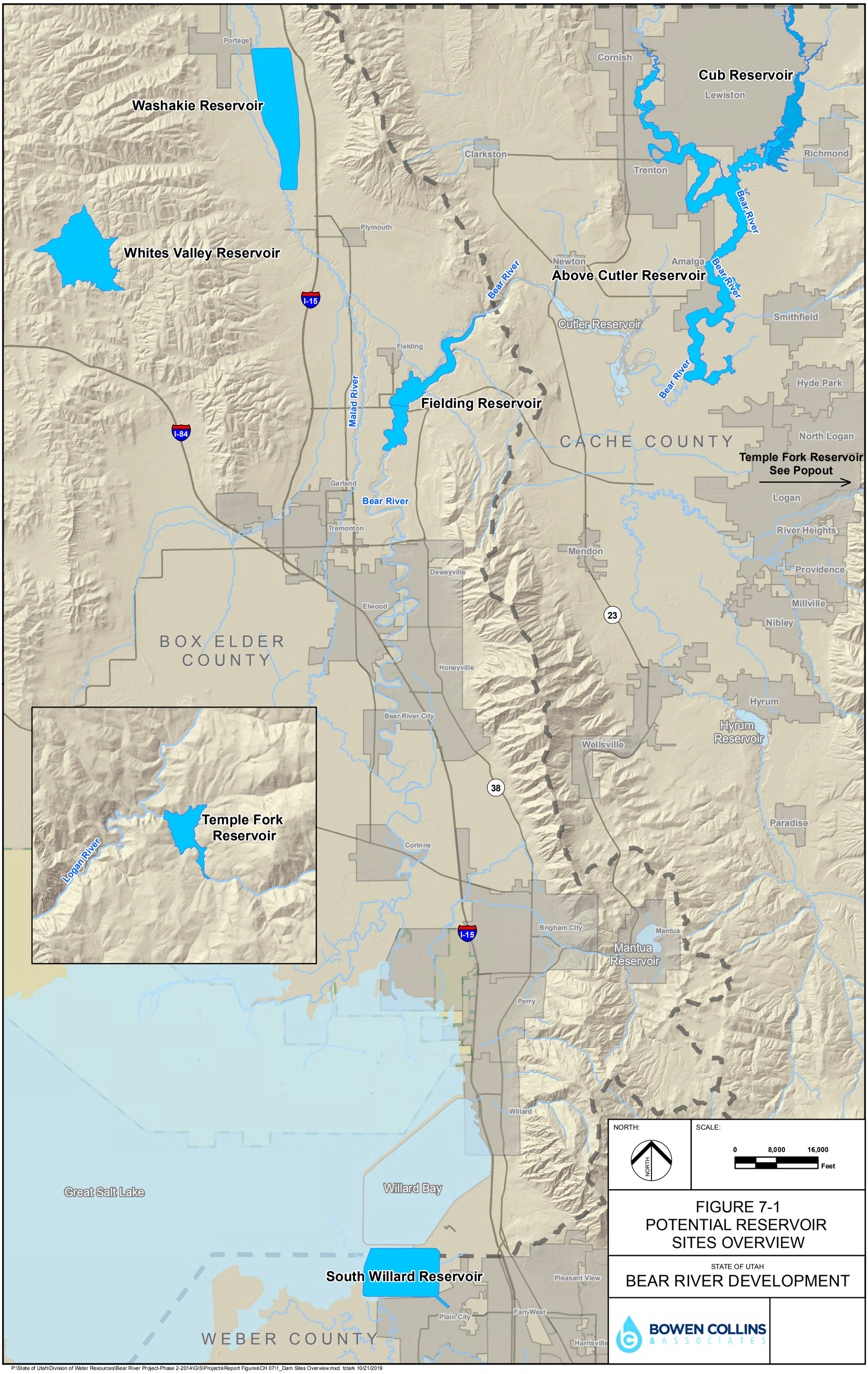

FIGURE 7-1
POTENTIAL RESERVOIR SITES OVERVIEW

STATE OF UTAH
BEAR RIVER DEVELOPMENT

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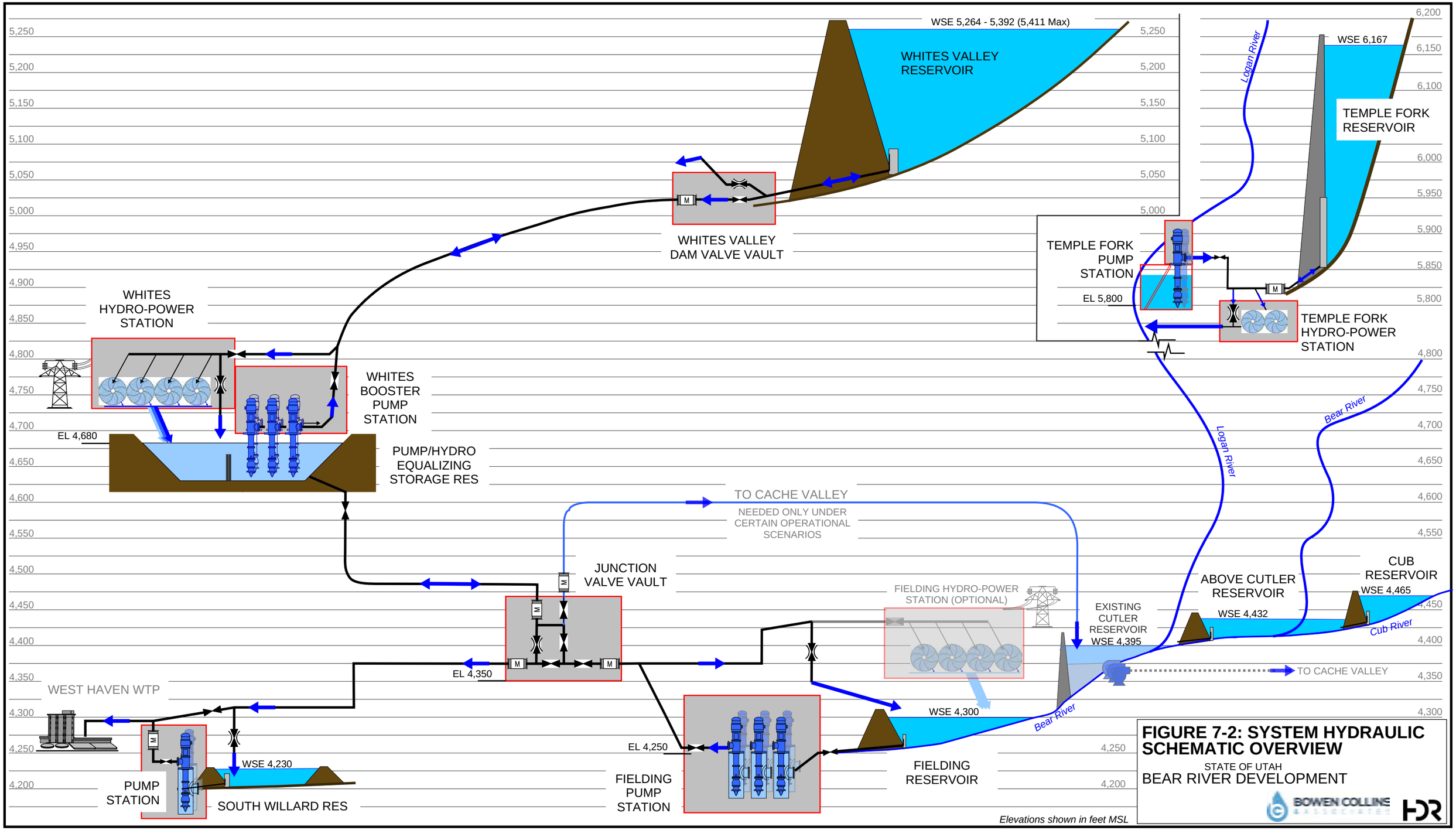

FIGURE 7-2: SYSTEM HYDRAULIC SCHEMATIC OVERVIEW

STATE OF UTAH

BEAR RIVER DEVELOPMENT

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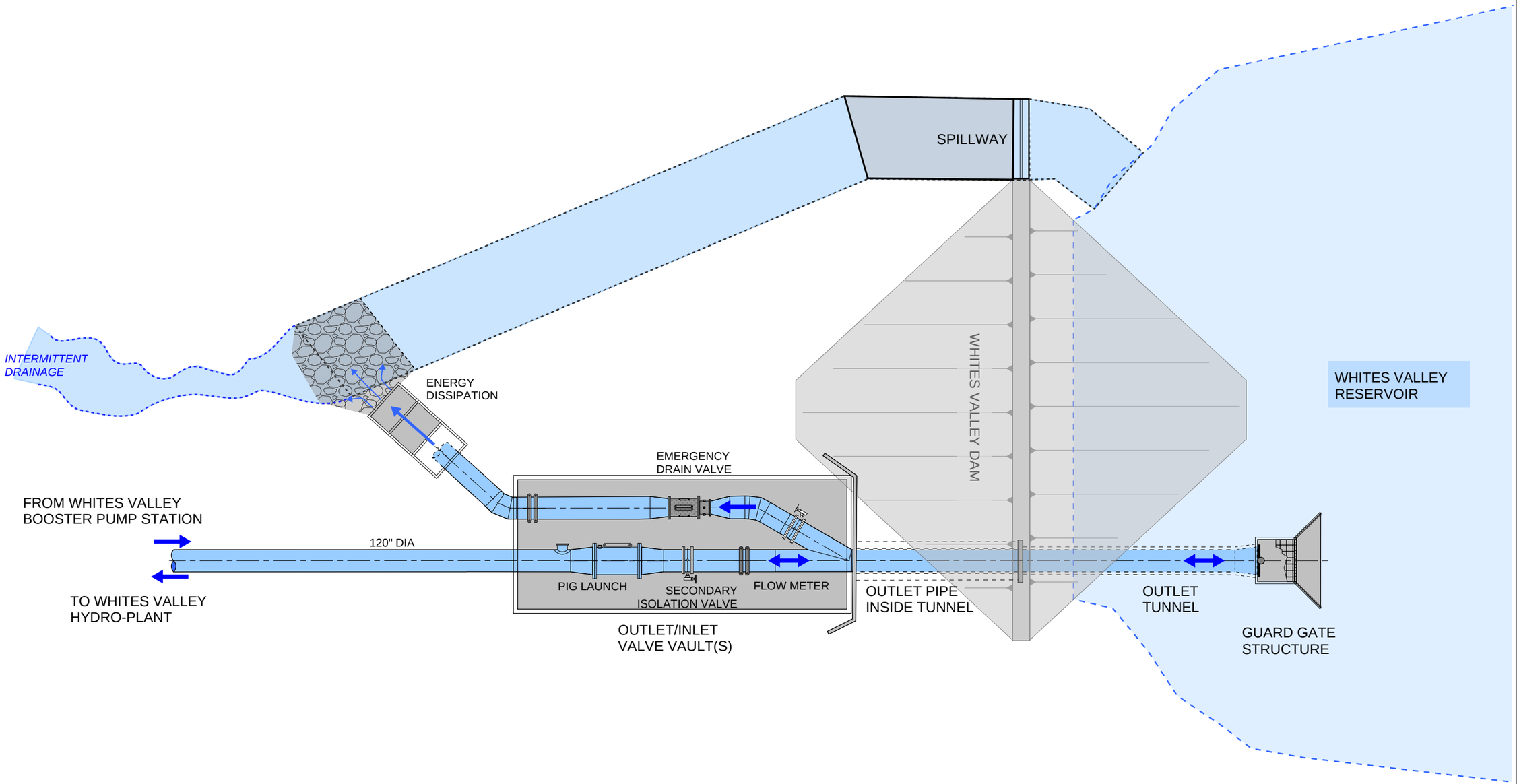
P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Schematics\Fig 7.2 - Hydraulic Schematic.pdf *Date:12/08/2017*



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STATE OF UTAH DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

WHITES VALLEY DAM
OUTLET WORKS SCHEMATIC

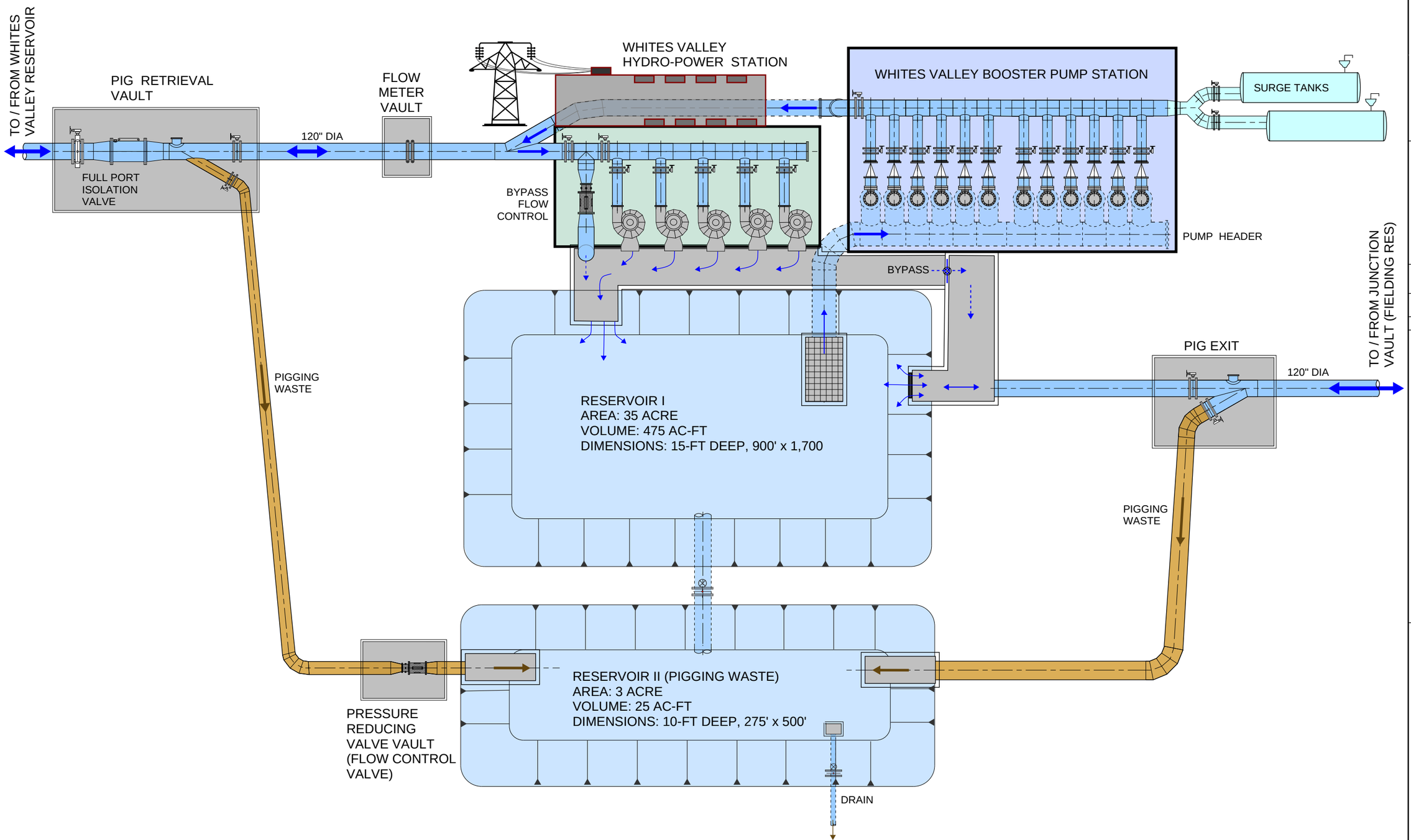
DATE: DECEMBER 2017

PROJECT NUMBER: 2331401

FIGURE

7-4

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Schematics\Fig 7.4 - Schematic Whites_Dam_Outlet.pdf *Date:12/08/2017*



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STATE OF UTAH DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE

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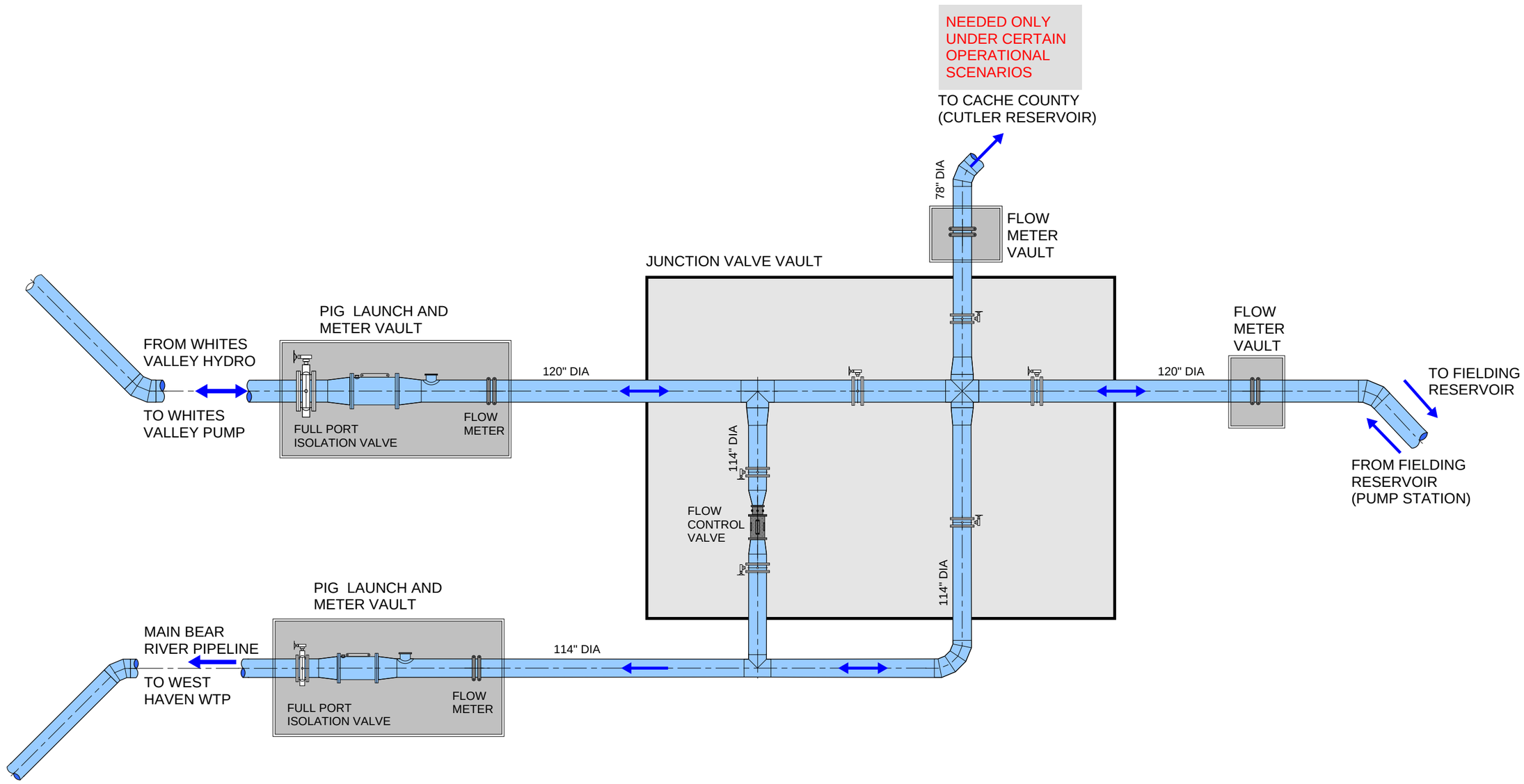
WHITES VALLEY PUMP/HYDROPOWER STATION SCHEMATIC

DATE: DECEMBER 2017

PROJECT NUMBER: 2331401

FIGURE

7-5



STATE OF UTAH DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE

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JUNCTION VALVE VAULT SCHEMATIC

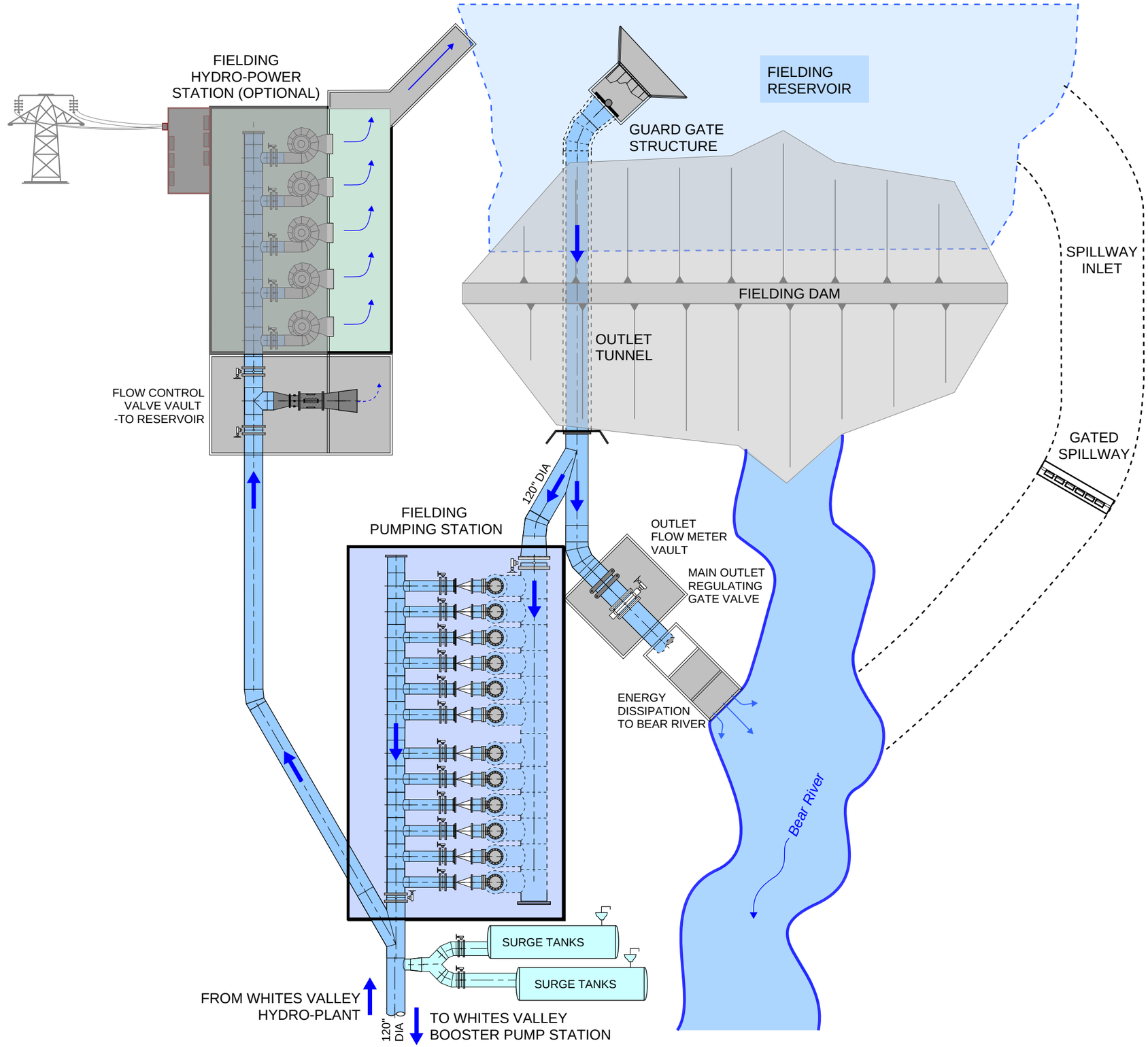
DATE: DECEMBER 2017

PROJECT NUMBER: 2331401

FIGURE

7-6

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Schematics\Fig 7.6 - Schematic Junction Vault.pdf *Date:12/08/2017*



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BEAR RIVER DEVELOPMENT

VERIFY SCALE

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FIELDING DAM PUMP STATION SCHEMATIC

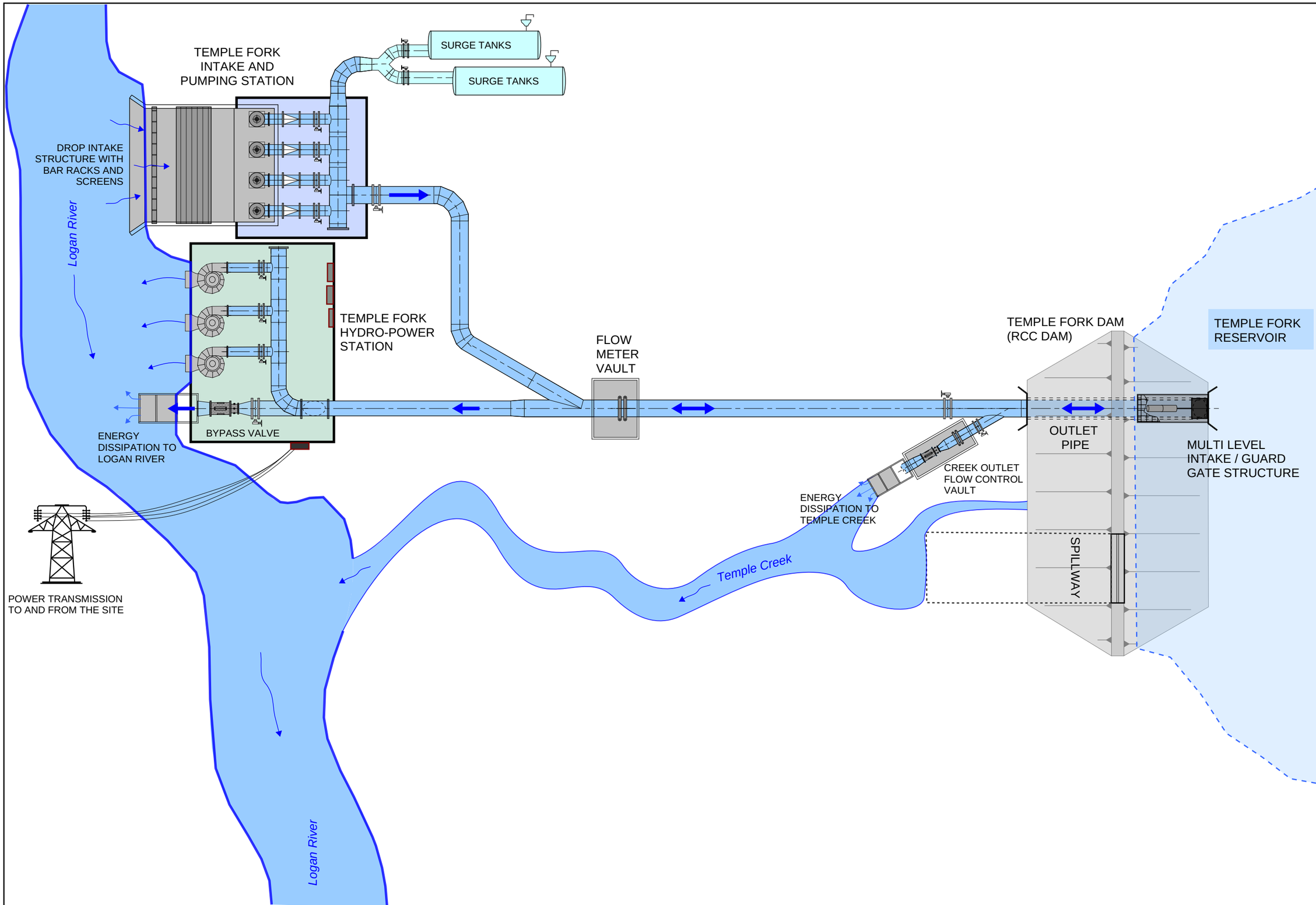
DATE: DECEMBER 2017

PROJECT NUMBER: 2331401

FIGURE

7-9

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Schematics\Fig 7.9 - Schematic Fielding_Dam_Outlet.pdf *Date:12/08/2017*



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STATE OF UTAH DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE

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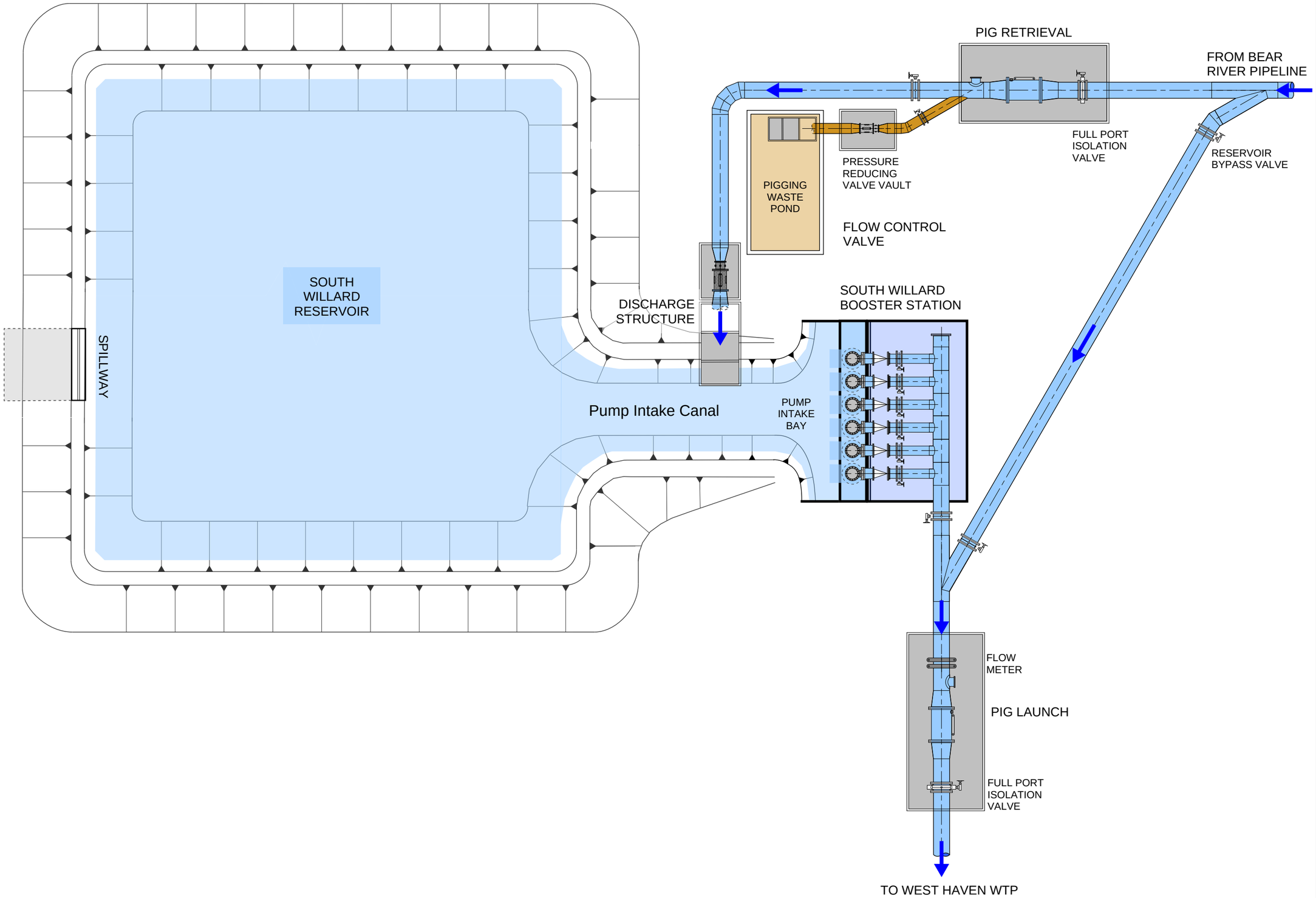
TEMPLE FORK DAM OUTLET WORKS SCHEMATIC

DATE: DECEMBER 2017

PROJECT NUMBER: 2331401

FIGURE

7-12



STATE OF UTAH DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

SOUTH WILLARD DAM
INLET/OUTLET SCHEMATIC

DATE: DECEMBER 2017

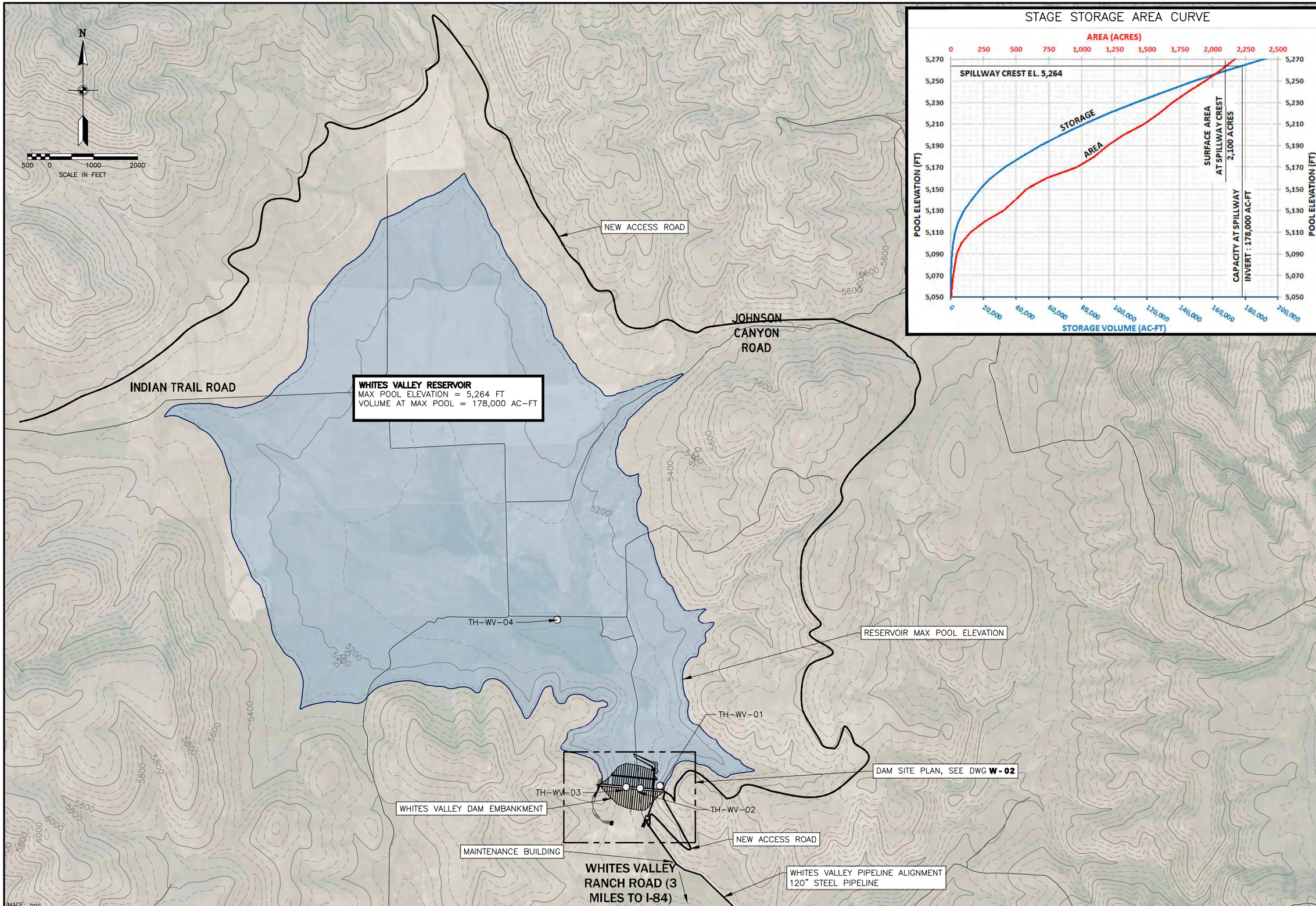
PROJECT NUMBER: 233-14-01

FIGURE
7-14

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Schematics\Fig 7.14 - Schematic S_Willard_Res_.pdf *Date:12/08/2017*

WHITES VALLEY 170 K

WHITES VALLEY 400 K



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CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
WHITES VALLEY DAM AND RESERVOIR SITE PLAN OVERVIEW

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
W-01

SHEET 1 OF 12

IMAGE: png

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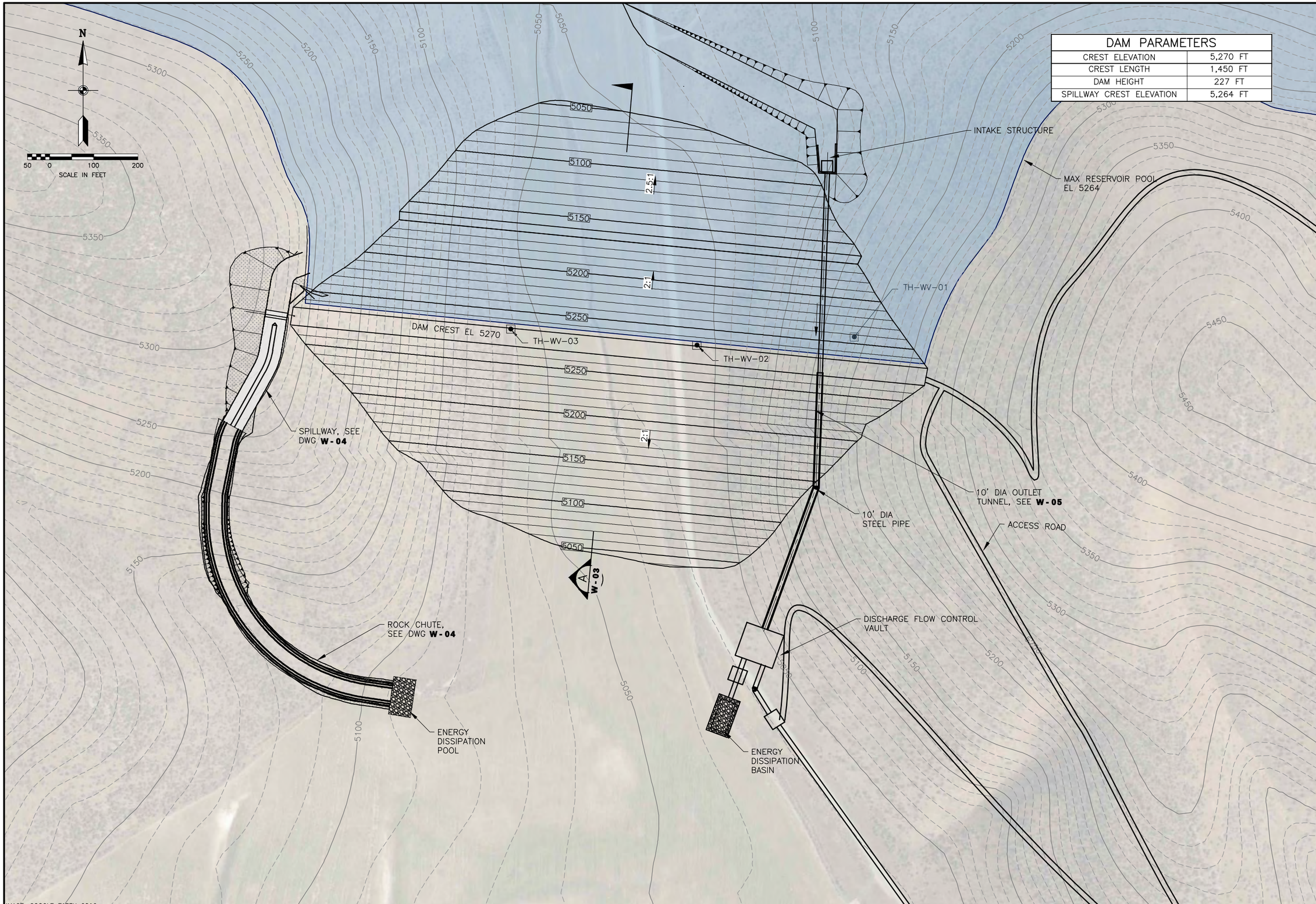

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BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

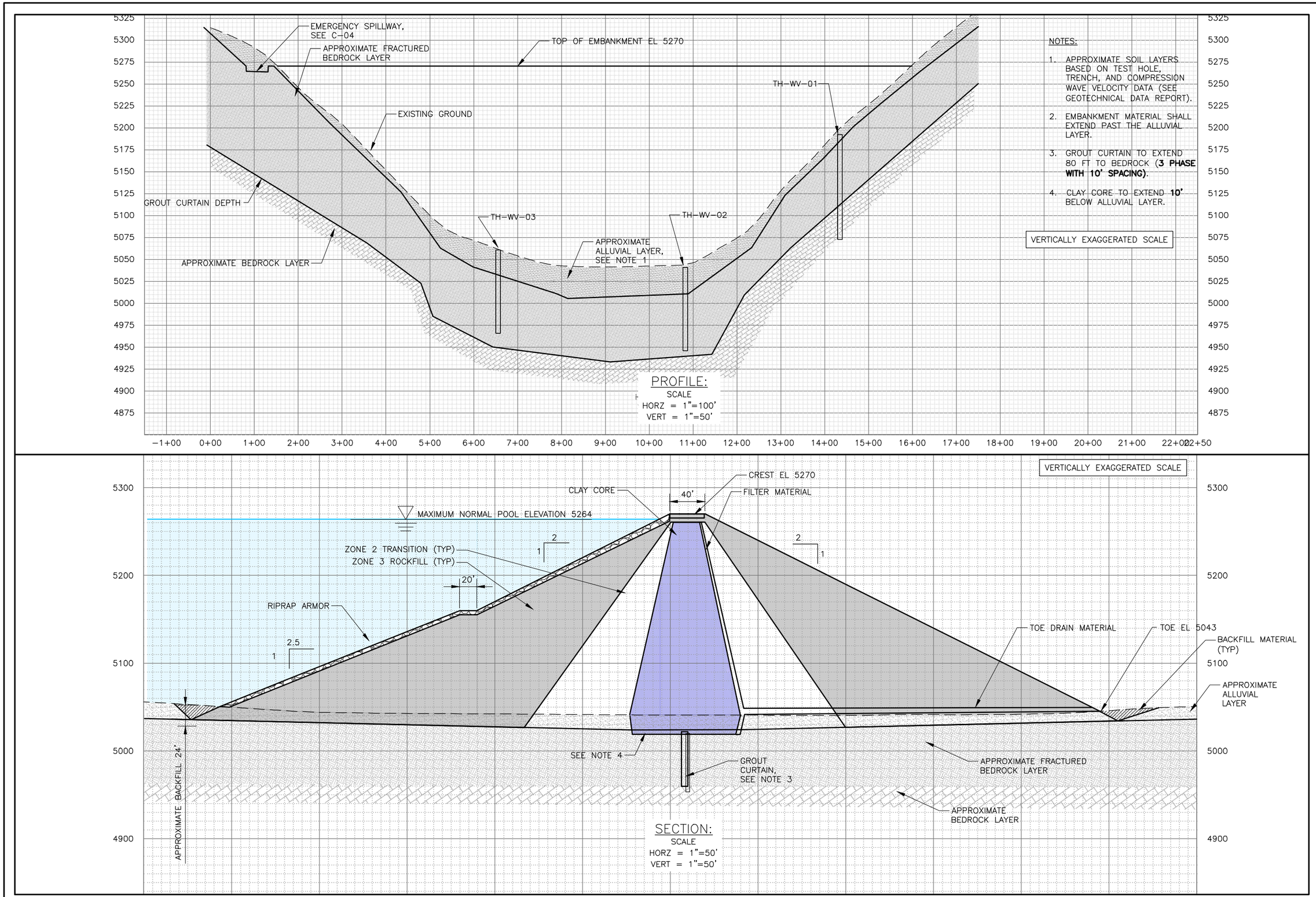
DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
WHITES VALLEY DAM
SITE PLAN

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
W-02

SHEET 2 OF 12



NOTES:

1. APPROXIMATE SOIL LAYERS BASED ON TEST HOLE, TRENCH, AND COMPRESSION WAVE VELOCITY DATA (SEE GEOTECHNICAL DATA REPORT).
2. EMBANKMENT MATERIAL SHALL EXTEND PAST THE ALLUVIAL LAYER.
3. GROUT CURTAIN TO EXTEND 80 FT TO BEDROCK (**3 PHASE WITH 10' SPACING**).
4. CLAY CORE TO EXTEND **10'** BELOW ALLUVIAL LAYER.

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL

WHITES VALLEY DAM
PROFILE AND SECTION

PROJECT NUMBER 233-14-01

DATE: MARCH 2017

DRAWING NO.
W-03

SHEET 3 OF 12

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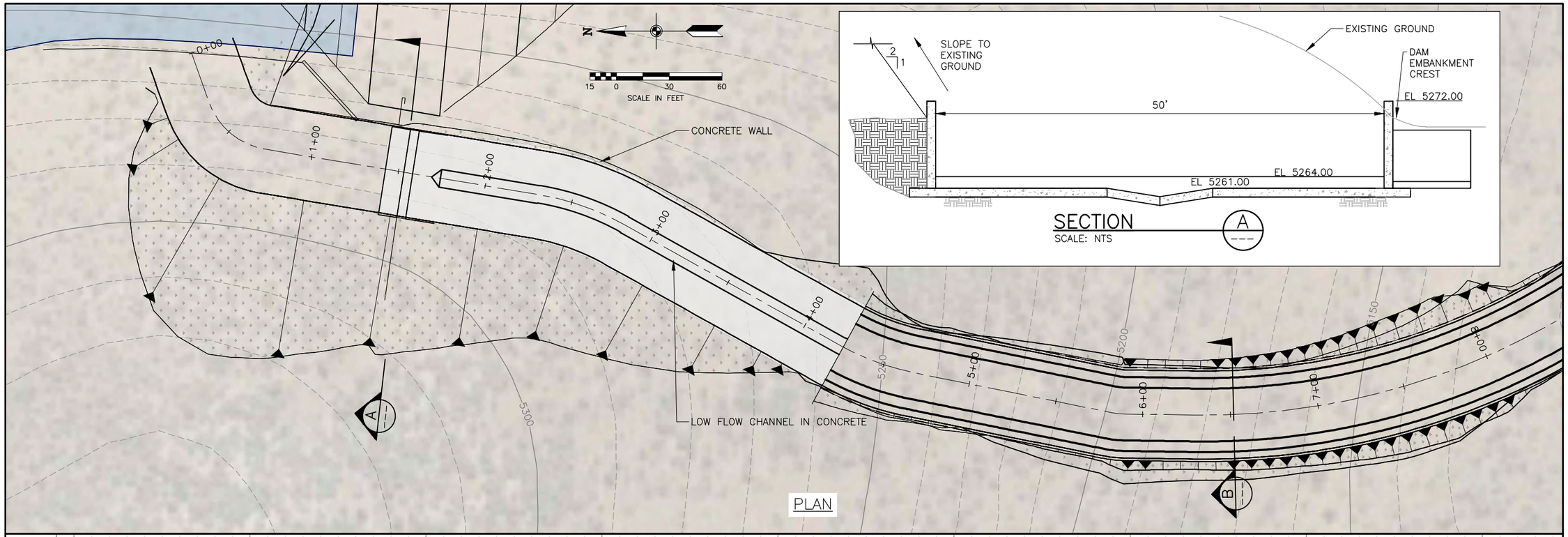

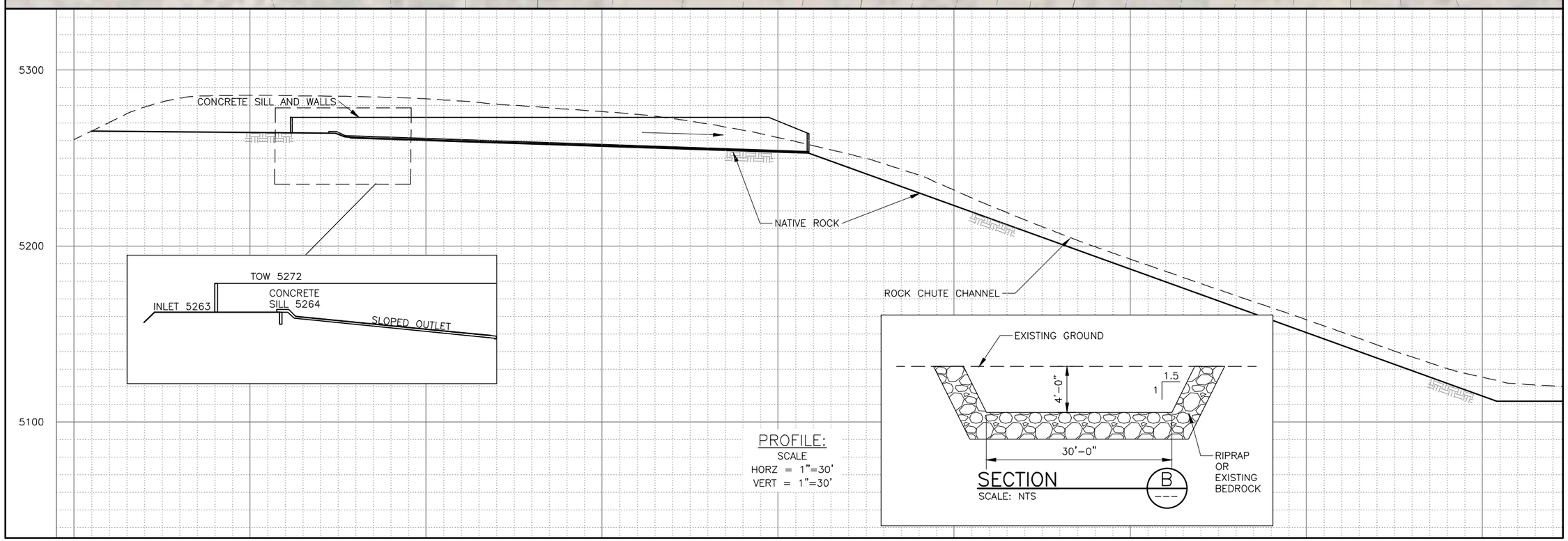

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

CIVIL

WHITES VALLEY DAM SPILLWAY PROFILE AND SECTION

DATE: MARCH 2017

PROJECT NUMBER 233-14-01

DRAWING NO.
W-04

SHEET 4 OF 12

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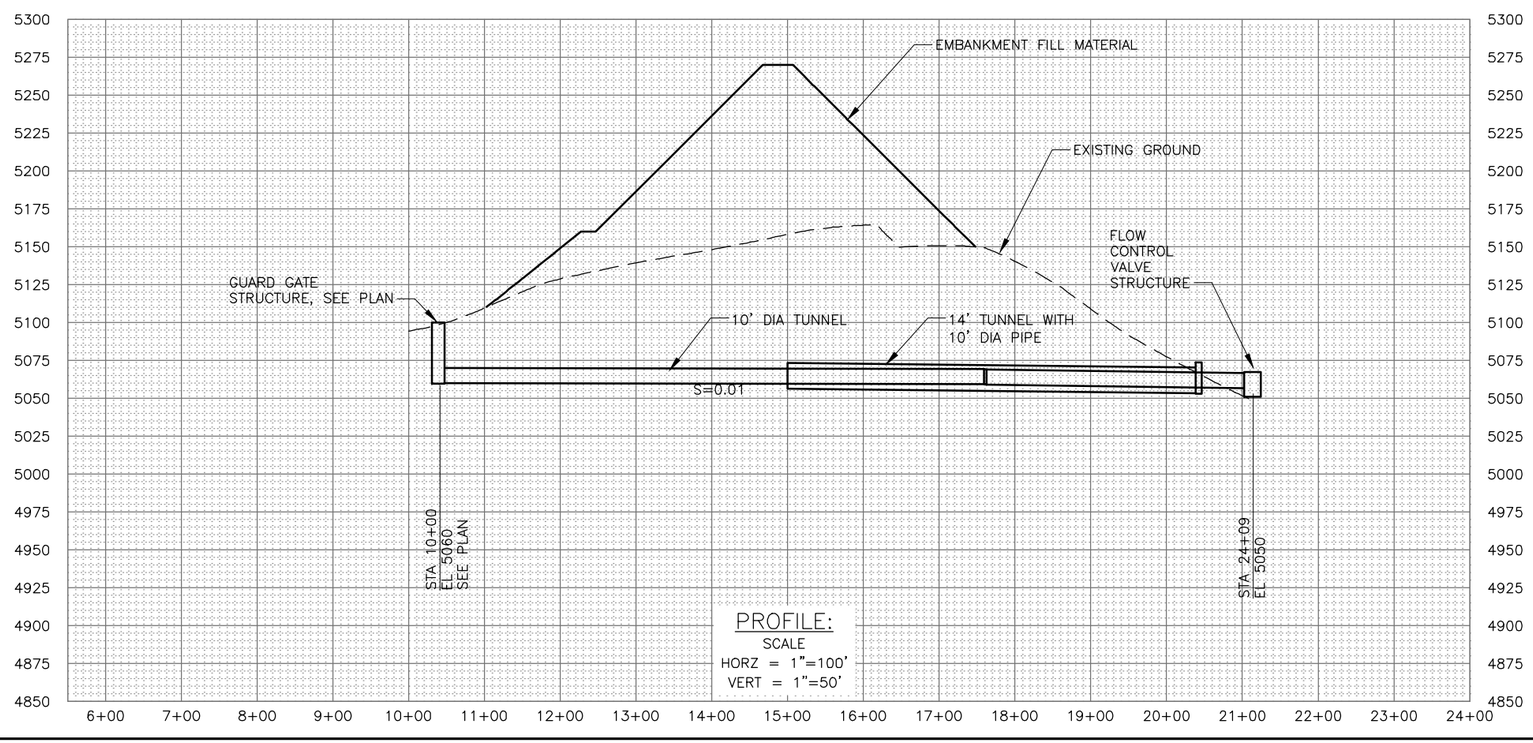
PLAN



PROFILE:
SCALE
HORZ = 1"=100'
VERT = 1"=50'

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

CIVIL

WHITES VALLEY DAM
INLET/OUTLET
PLAN AND PROFILE

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
W-05

SHEET 5 OF 12

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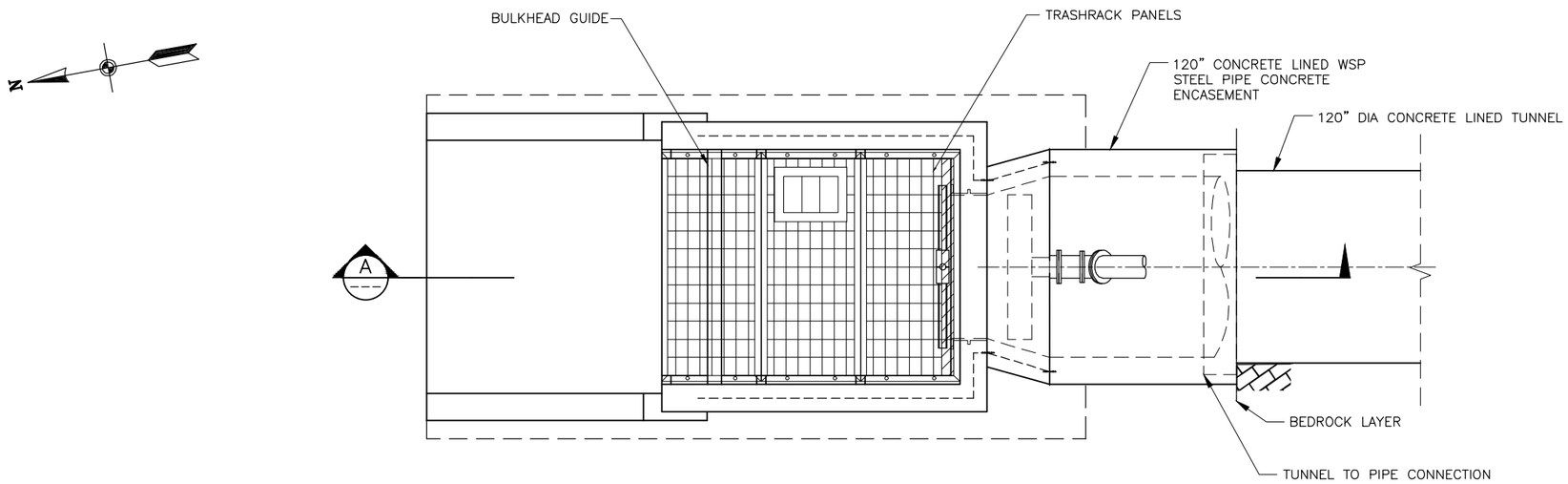
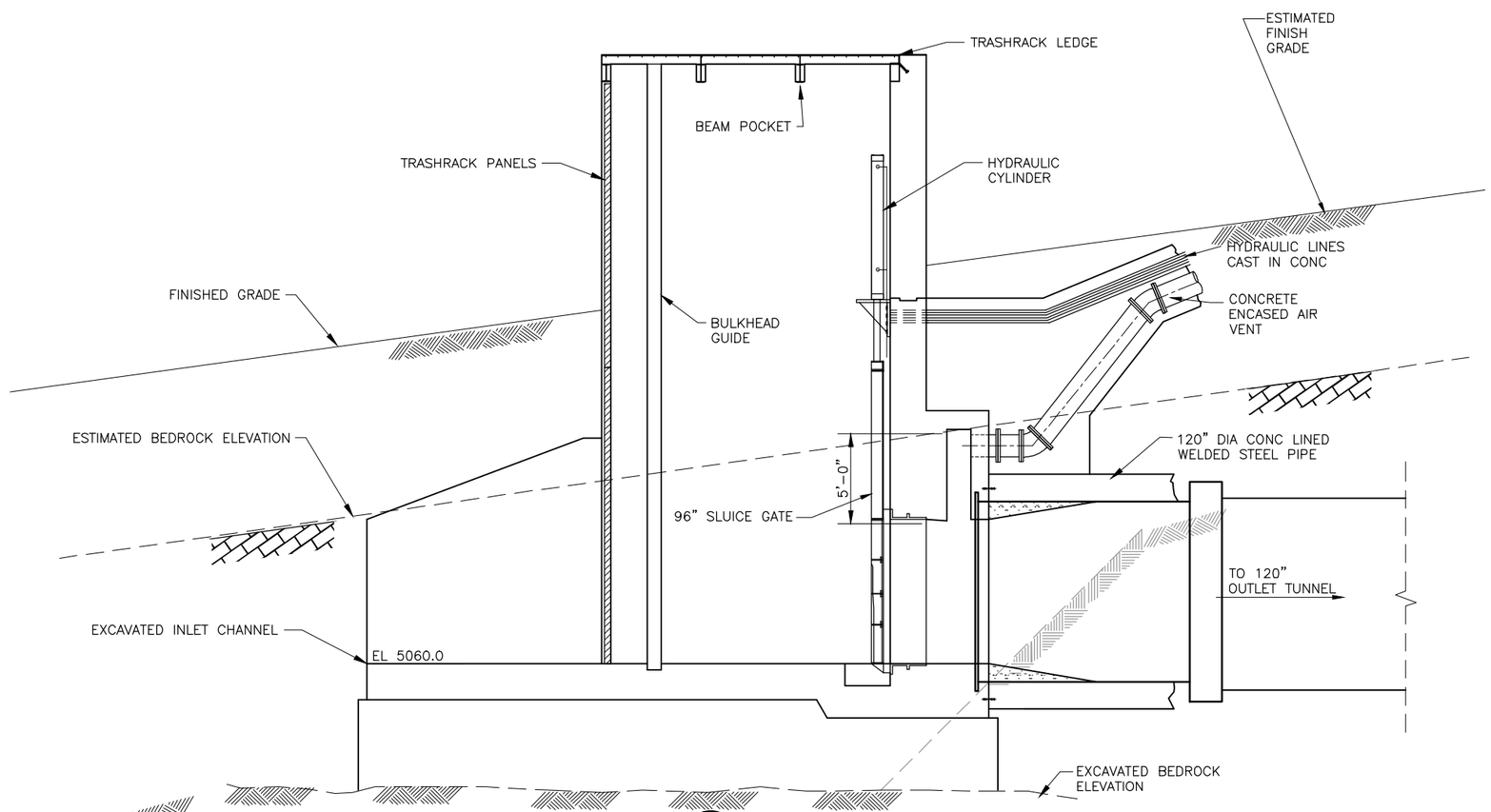


PLAN
SCALE: 1/4" = 1'-0"



SECTION A
SCALE: 1/4" = 1'-0"

BOWEN COLLINS & ASSOCIATES

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

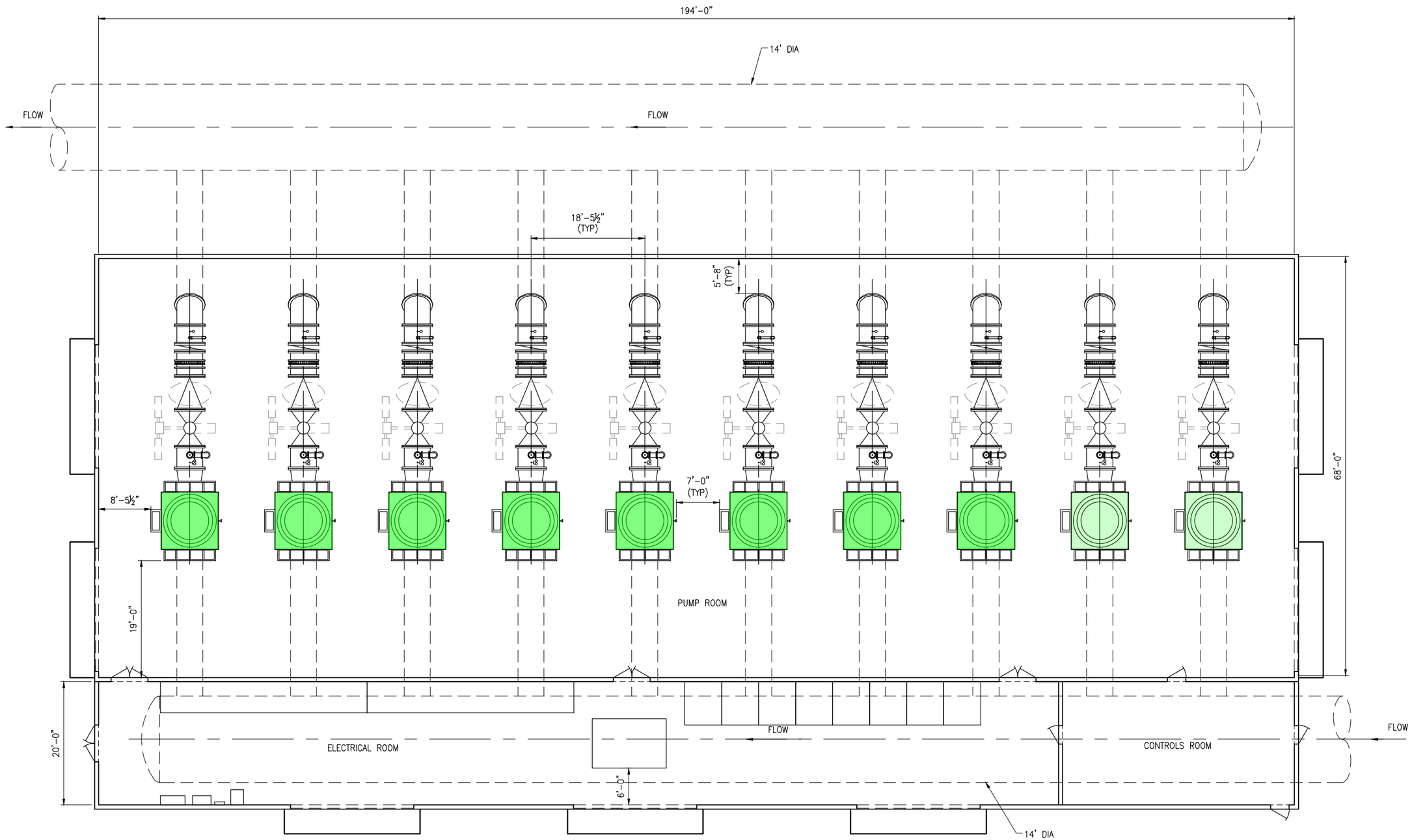
REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

MECHANICAL
WHITES VALLEY DAM
GUARD GATE
STRUCTURE

PROJECT NUMBER 233-14-01
DATE: MAY 2018

DRAWING NO.
W-06
SHEET 6 OF 12



MAIN HIGH HEAD PUMPS:
(8) 8,000 HP @ 87.5 CFS EA
(2) VFDS
(6) SOFT STARTS

REDUNDANT HIGH HEAD PUMPS:
(2) 8,000 HP @ 87.5 CFS EA
(2) SOFT STARTS

PLAN

SCALE: 1/8" = 1'-0"

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN
DESIGN B. ASHCROFT
DRAWN T. ANDERSON

REVIEW
CHECKED J. OYLER
APPROVED T. CLARK

MECHANICAL
WHITES VALLEY
BOOSETER PUMP STATION
MECHANICAL PLAN

PROJECT NUMBER 233-14-01

DATE: OCTOBER 2017

DRAWING NO.
W-07

SHEET 7 OF 12

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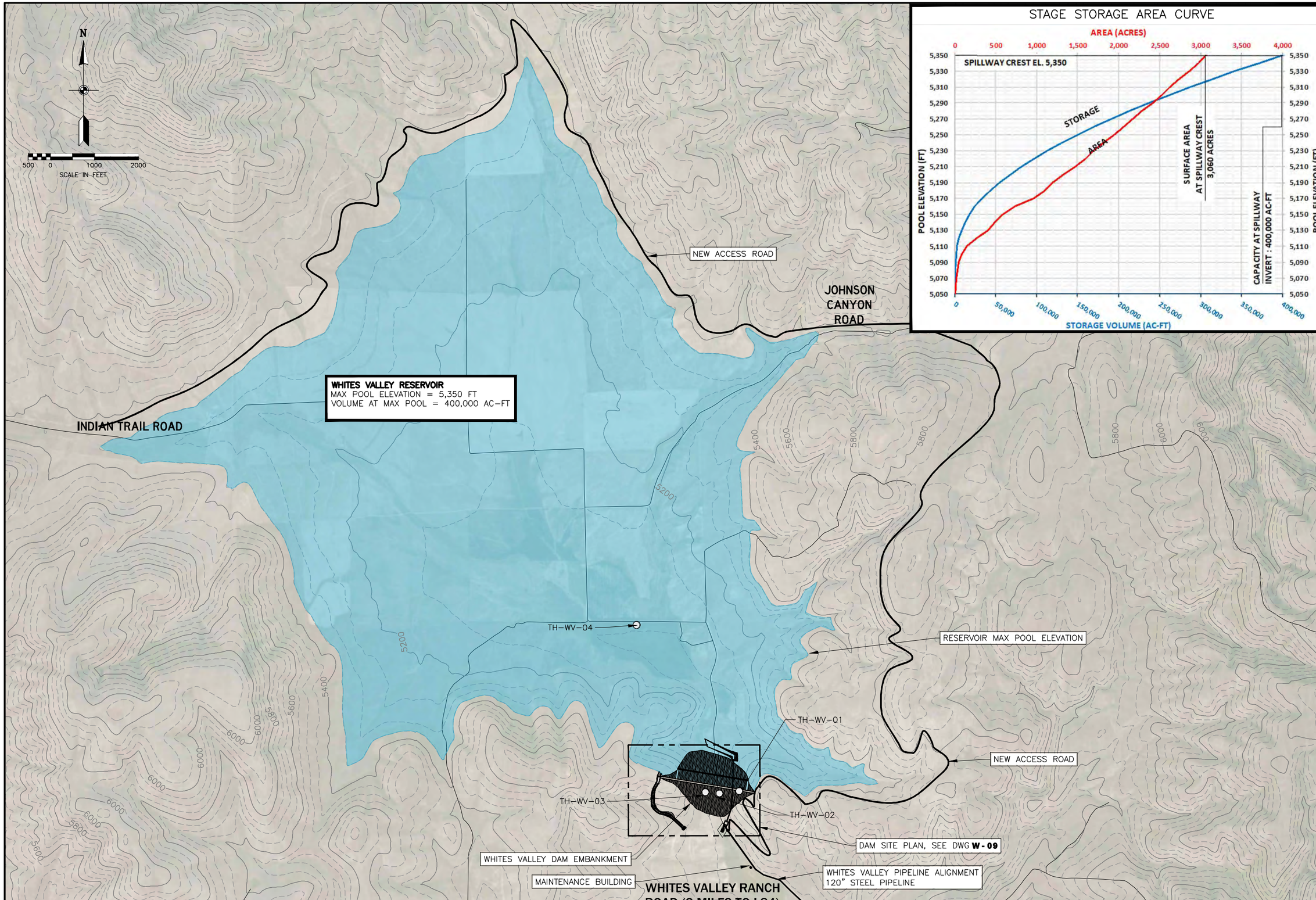

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
WHITES VALLEY DAM 400K AND RESERVOIR SITE PLAN OVERVIEW

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
W-08

SHEET 8 OF 12

IMAGE: png

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DAM PARAMETERS	
CREST ELEVATION	5,360 FT
CREST LENGTH	2,150 FT
DAM HEIGHT	320 FT
SPILLWAY CREST ELEVATION	5,350 FT

IMAGE: GOOGLE EARTH 2016

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
WHITES VALLEY DAM 400K
SITE PLAN

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
W-09

SHEET 9 OF 12

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Sht\Whites 400k\2331401_W-09.dwg Plotted: 11/7/2017 1:21 PM By: Seth Riggs

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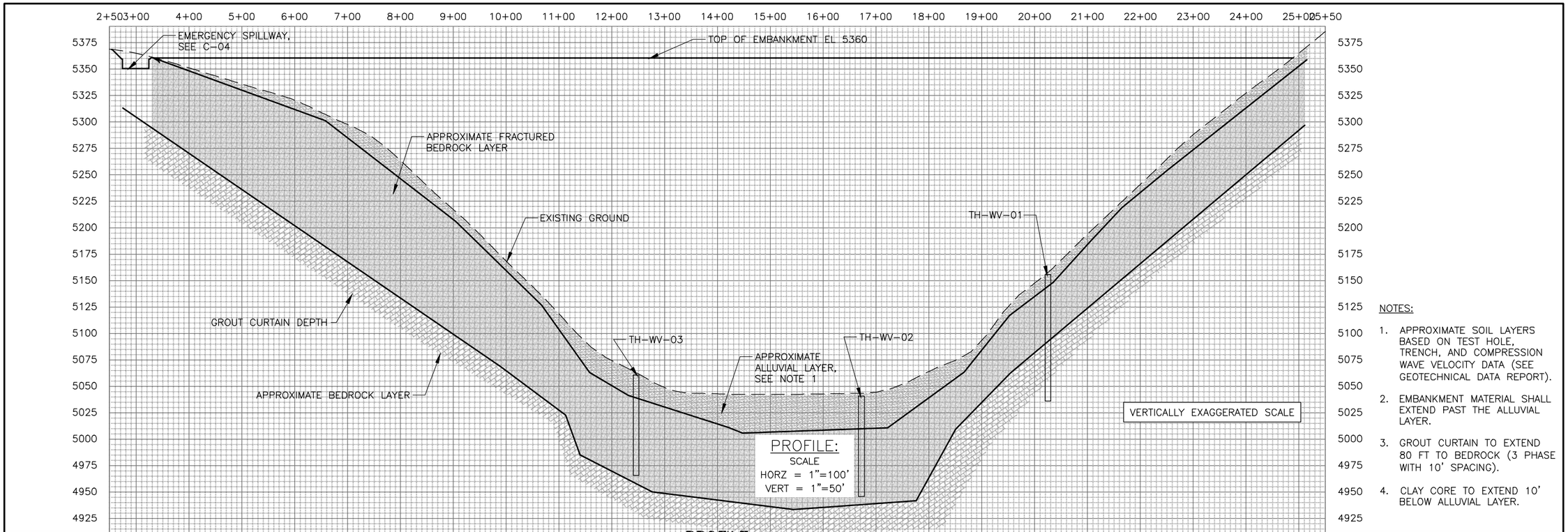
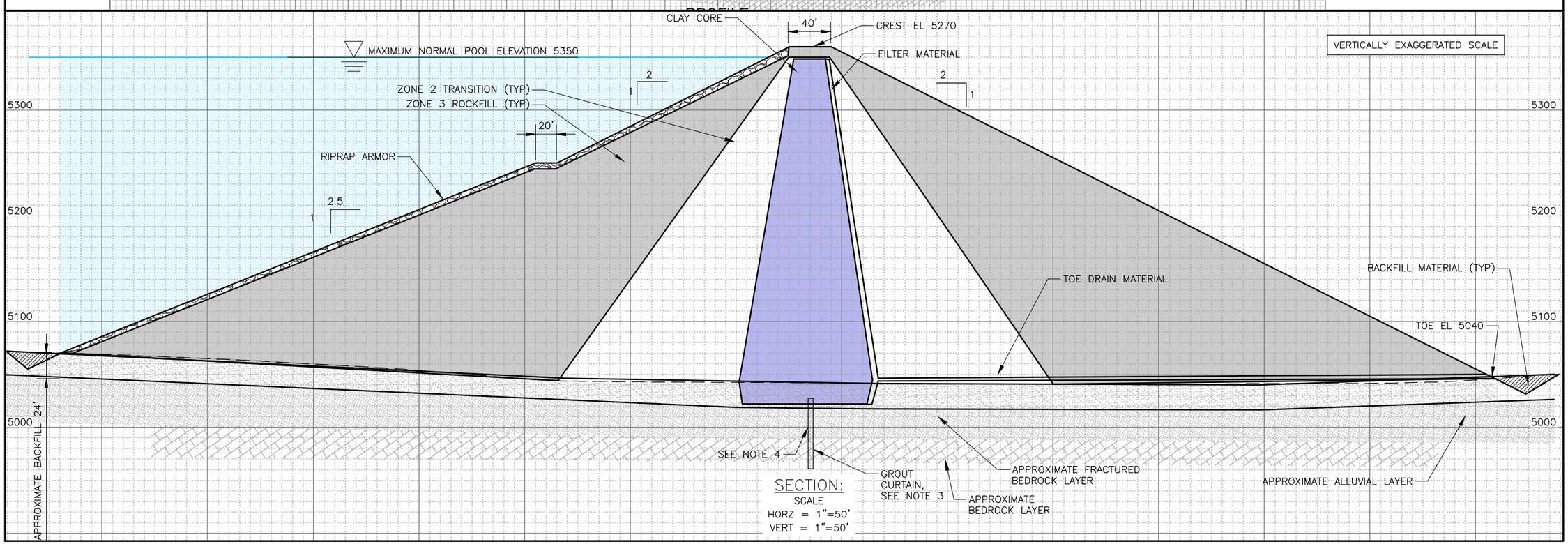


NOTES:

1. APPROXIMATE SOIL LAYERS BASED ON TEST HOLE, TRENCH, AND COMPRESSION WAVE VELOCITY DATA (SEE GEOTECHNICAL DATA REPORT).
2. EMBANKMENT MATERIAL SHALL EXTEND PAST THE ALLUVIAL LAYER.
3. GROUT CURTAIN TO EXTEND 80 FT TO BEDROCK (3 PHASE WITH 10' SPACING).
4. CLAY CORE TO EXTEND 10' BELOW ALLUVIAL LAYER.



BOWEN COLLINS & ASSOCIATES

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CONCEPTUAL

REVISIONS

NO.	DATE	REV. BY	DESCRIPTION

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
WHITES VALLEY DAM 400K
PROFILE AND SECTION

PROJECT NUMBER 233-14-01
DATE: MARCH 2017

DRAWING NO.
W-10
SHEET 10 OF 12

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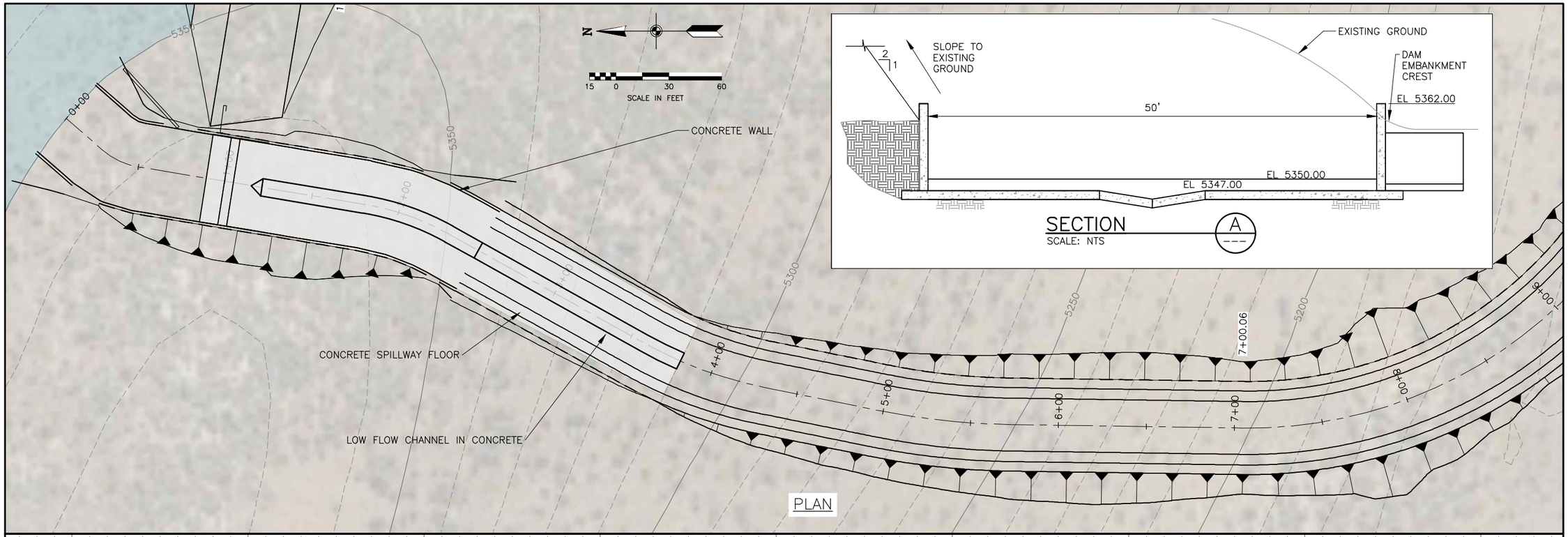
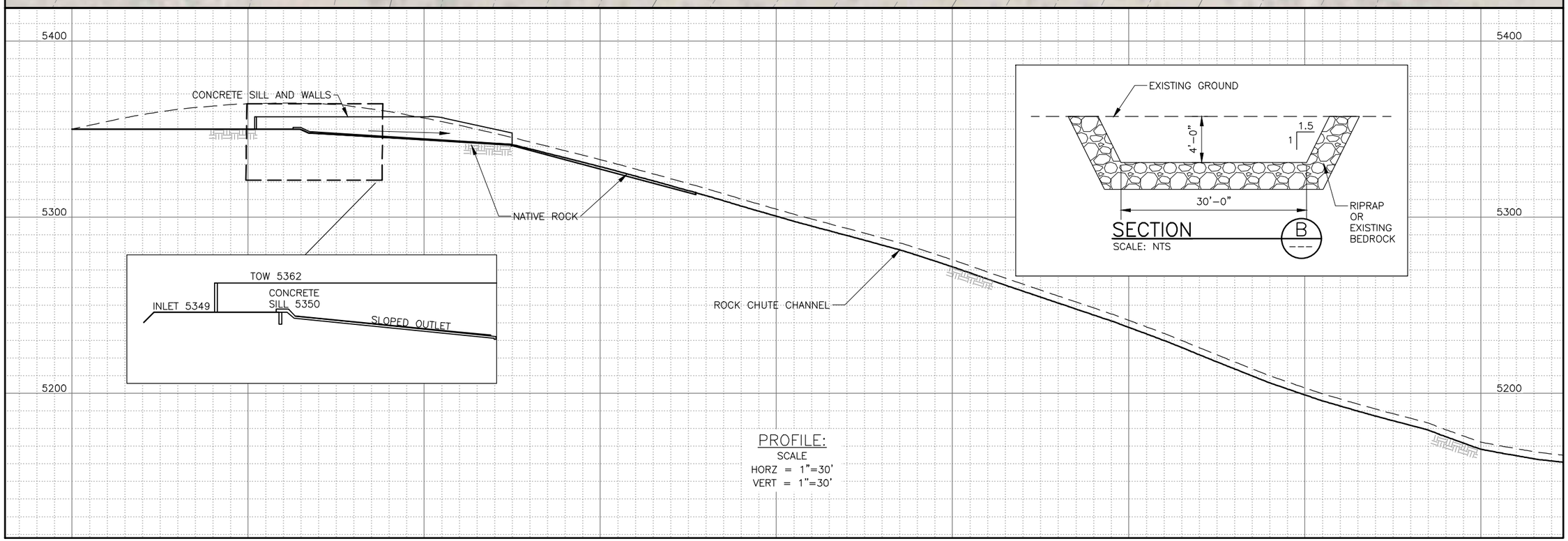


PLAN



PROFILE:
SCALE
HORZ = 1"=30'
VERT = 1"=30'

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
WHITES VALLEY DAM 400K
SPILLWAY PROFILE AND SECTION

DATE: MARCH 2017
PROJECT NUMBER 233-14-01

DRAWING NO.
W-11

SHEET 11 OF 12

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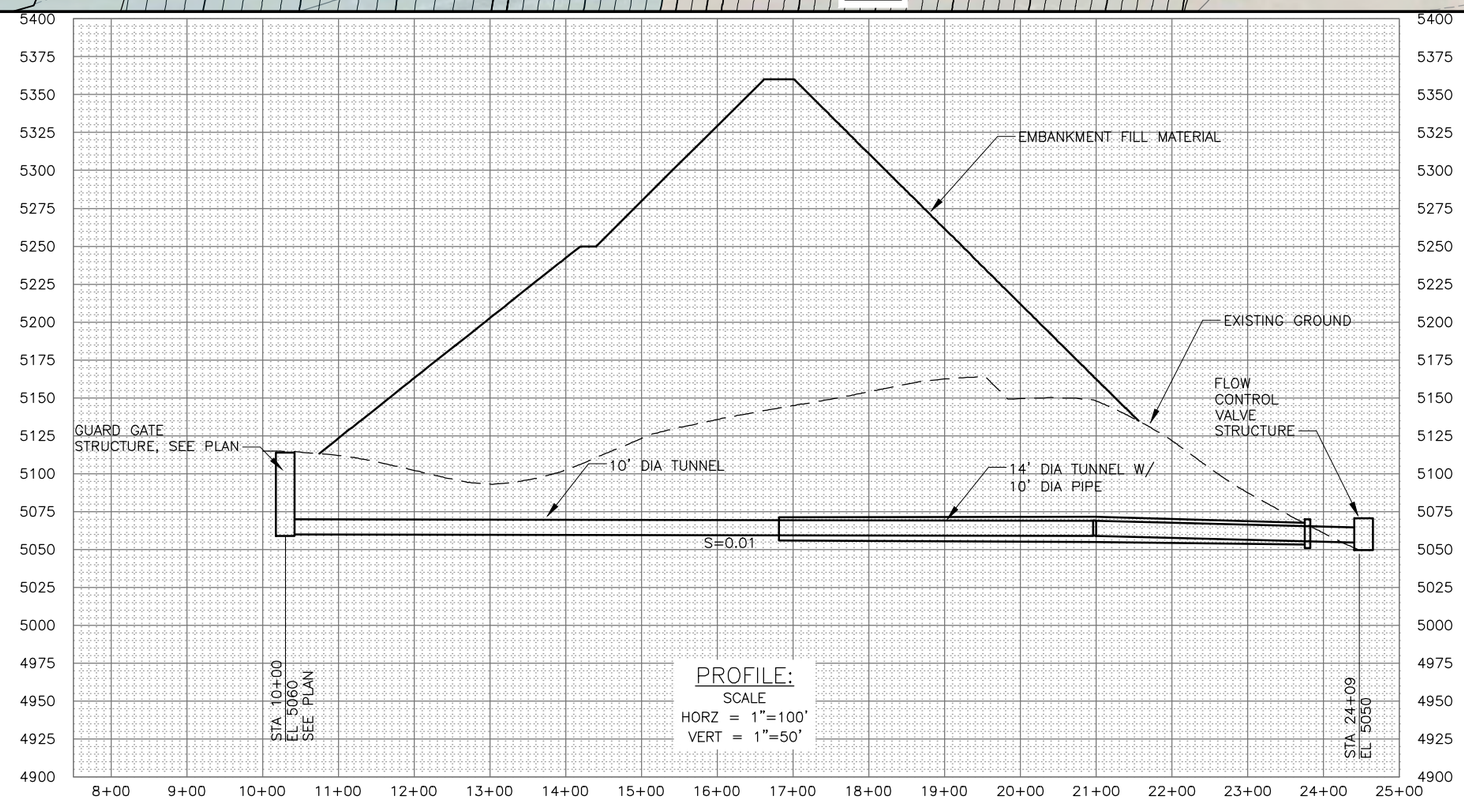
PLAN



PROFILE:
SCALE
HORZ = 1"=100'
VERT = 1"=50'

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
WHITES VALLEY DAM 400K
INLET/OUTLET
PLAN AND PROFILE

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
W-12
SHEET 12 OF 12

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BEAR RIVER DIVERSION STRUCTURE

(AT FIELDING SITE)

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN B. ASHCROFT

REVIEW CHECKED T. CLARK APPROVED T. CLARK

DRAWN B. ASHCROFT

CIVIL

BEAR RIVER DIVERSION SITE PLAN (AT FIELDING)

DATE: OCTOBER 2017

PROJECT NUMBER: 233-14-01

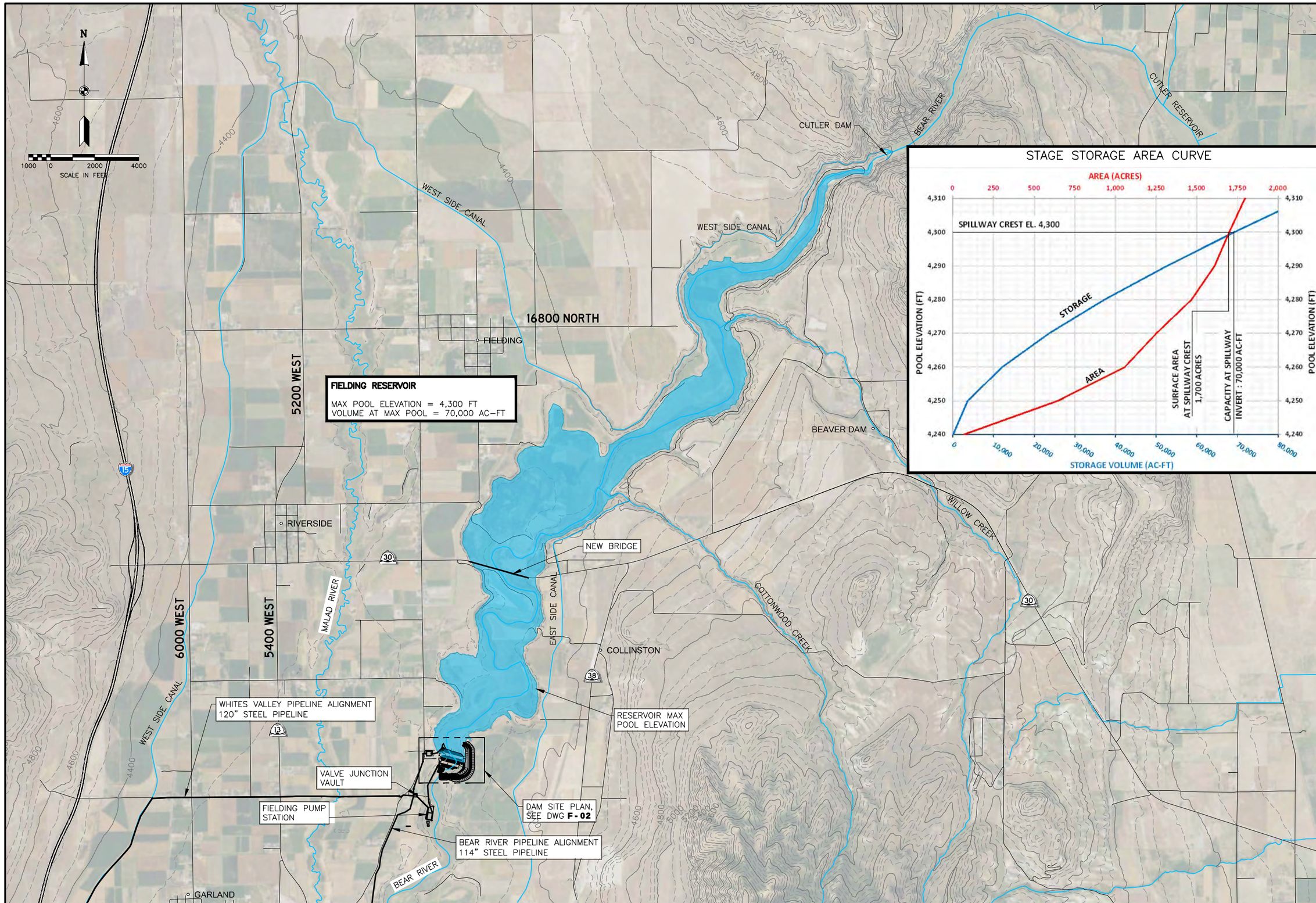
DRAWING NO. BR-01

SHEET 1 OF 1

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\pdf\Diversion Fielding\Fielding Diversion sketch.pdf Date:10/13/2017

FIELDING 70 K

FIELDING 40 K



BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

CIVIL

70K FIELDING DAM AND RESERVOIR SITE PLAN OVERVIEW

DATE: MAY 2018

PROJECT NUMBER 233-14-01

DRAWING NO.
F-01

SHEET 1 OF 11

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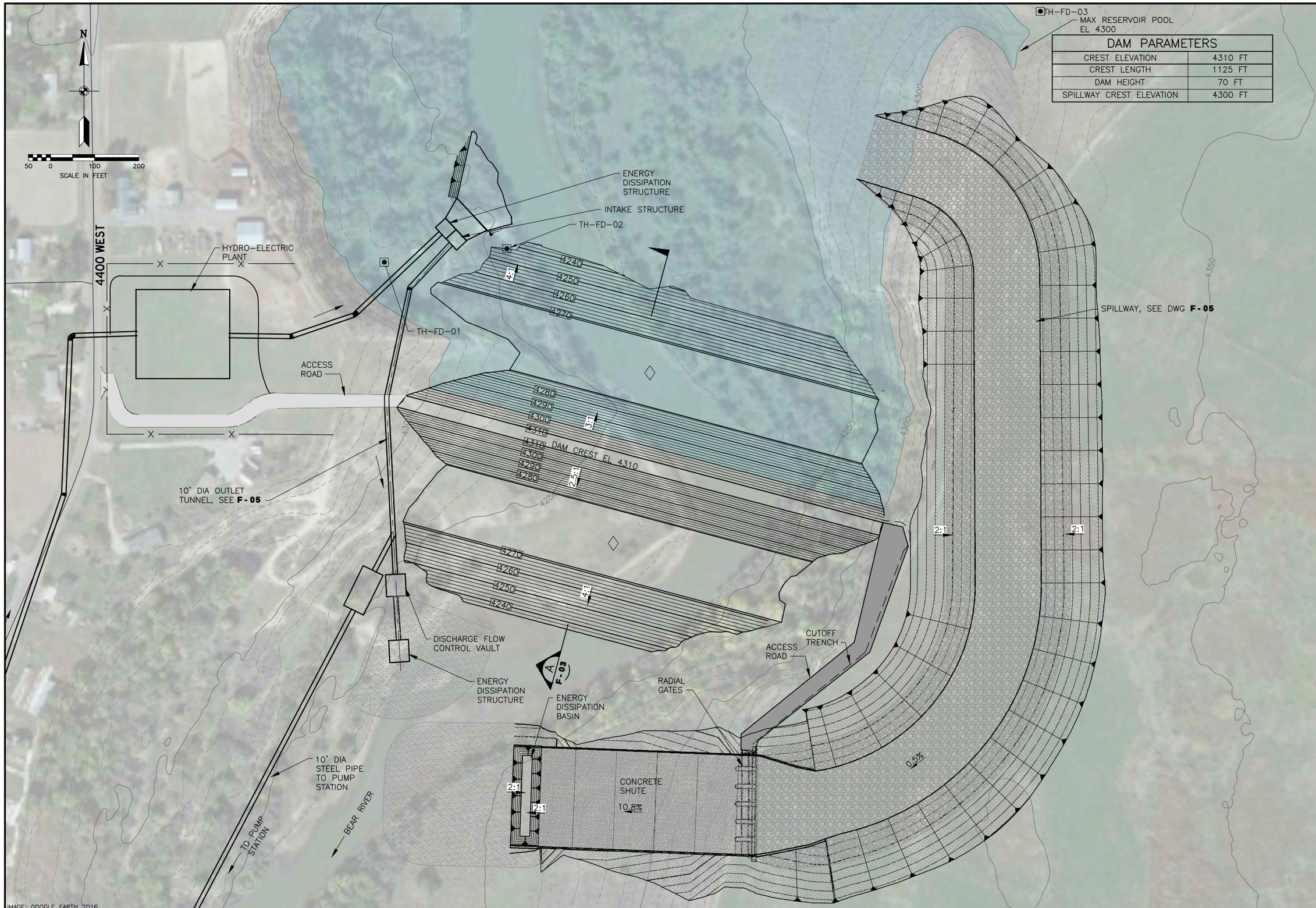

DAM PARAMETERS	
CREST ELEVATION	4310 FT
CREST LENGTH	1125 FT
DAM HEIGHT	70 FT
SPILLWAY CREST ELEVATION	4300 FT

IMAGE: GOOGLE EARTH 2016

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
FIELDING DAM 70K SITE PLAN

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
F-02

SHEET 2 OF 11

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Sht\Fielding 70k\2331401_F-02.dwg Plotted: 11/7/2017 1:59 PM By: Seth Riggs

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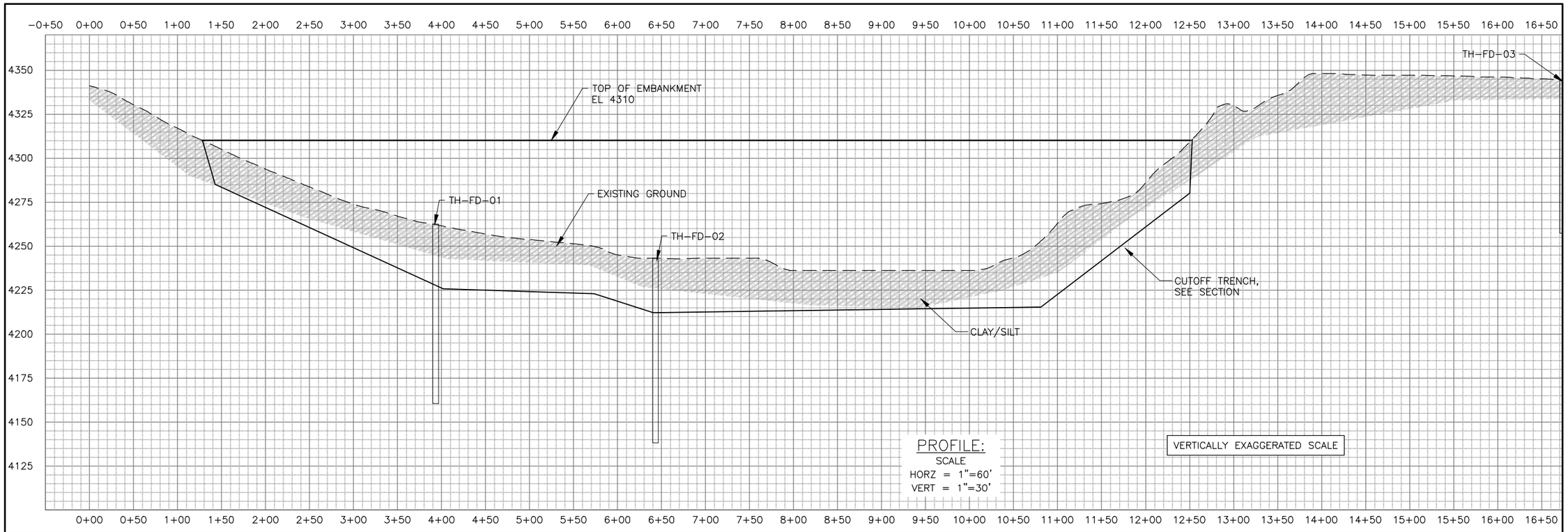

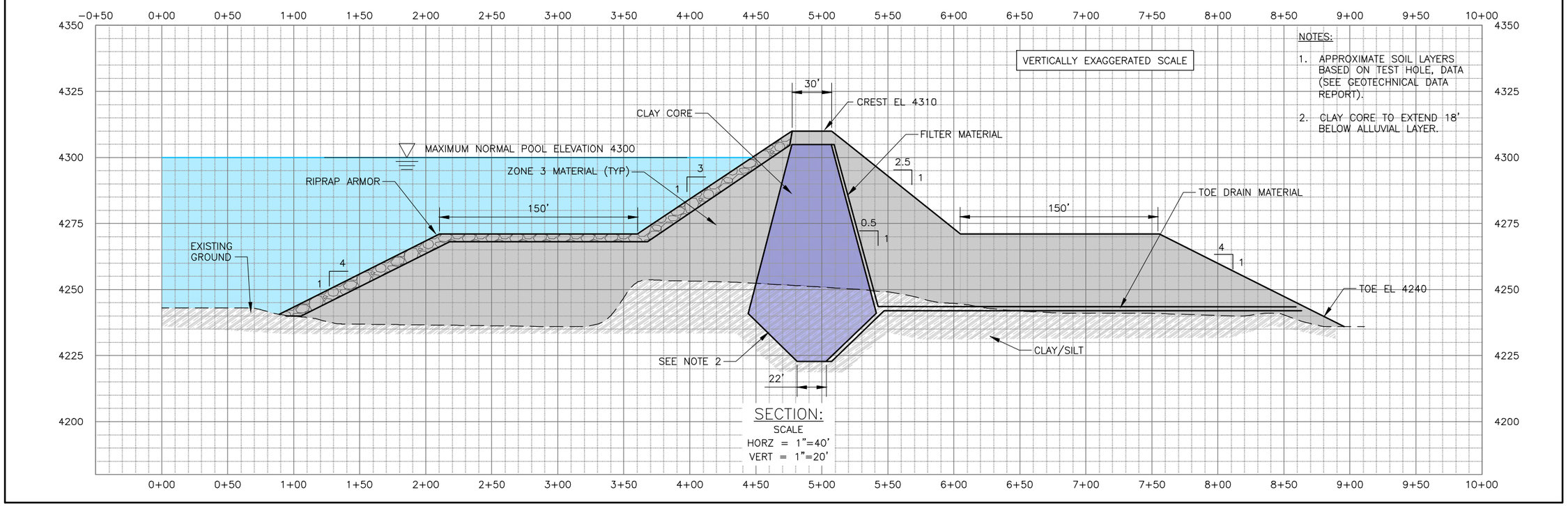

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
FIELDING DAM 70K
PROFILE AND SECTION

PROJECT NUMBER 233-14-01
DATE: MARCH 2017

DRAWING NO.
F-03

SHEET 3 OF 11

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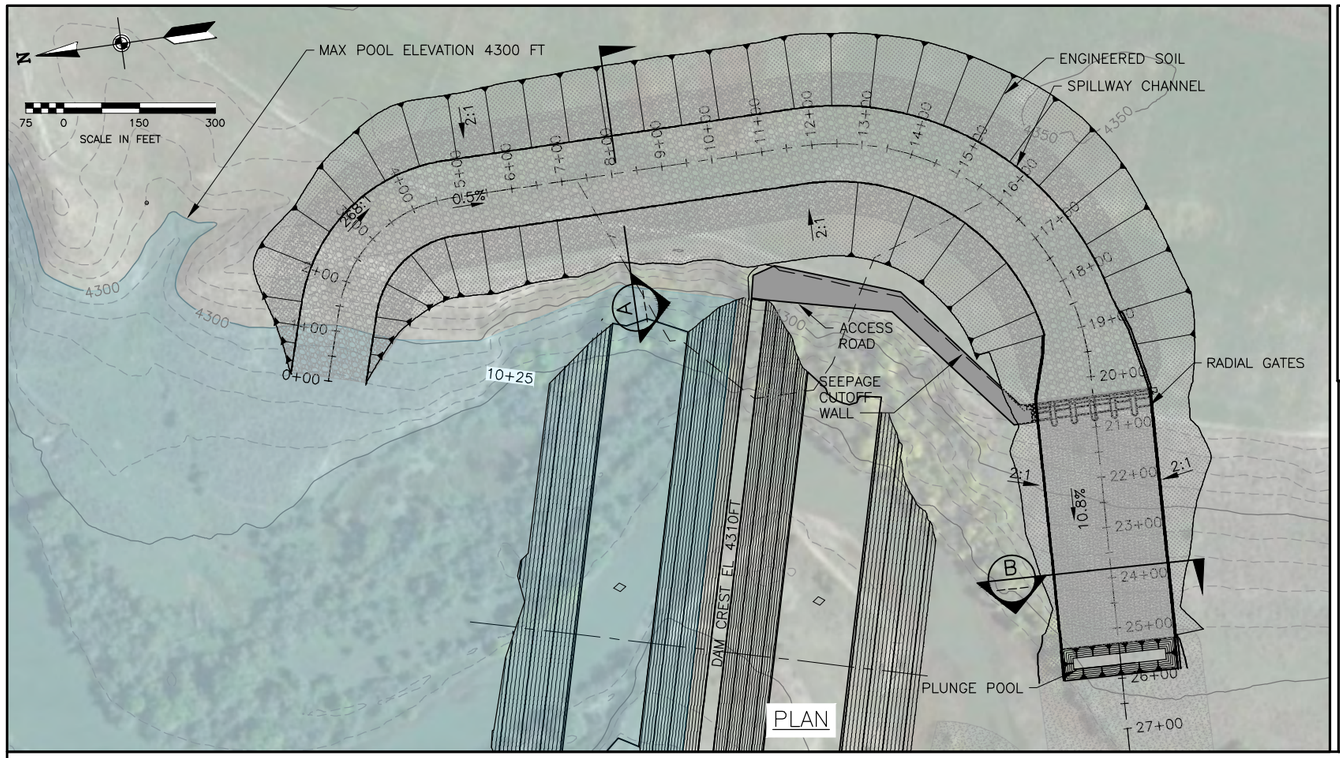
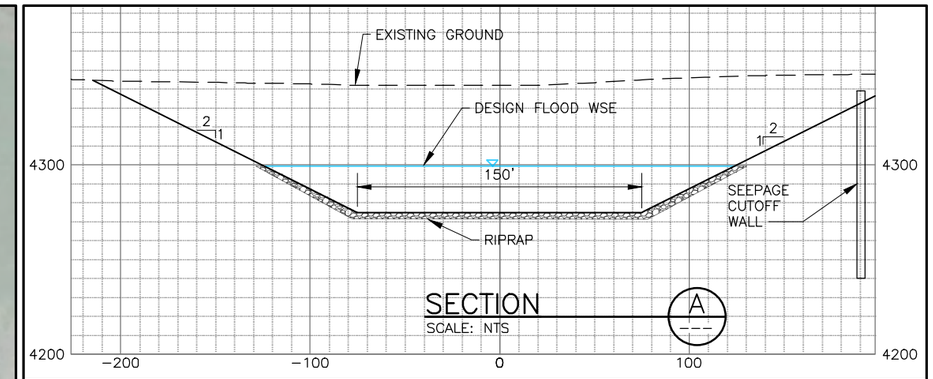
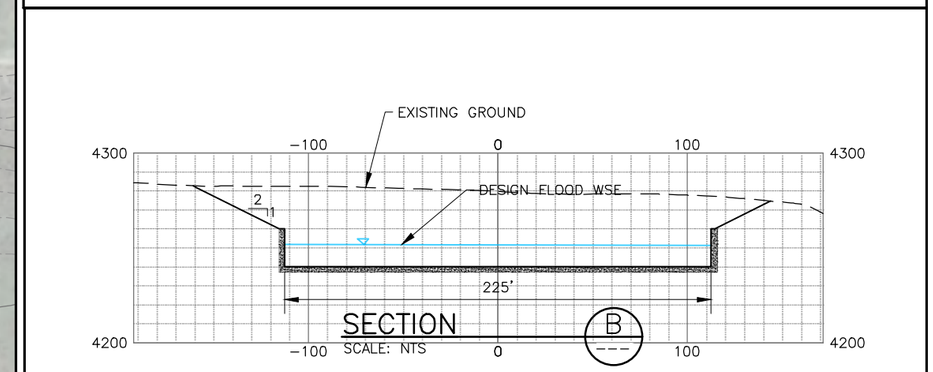
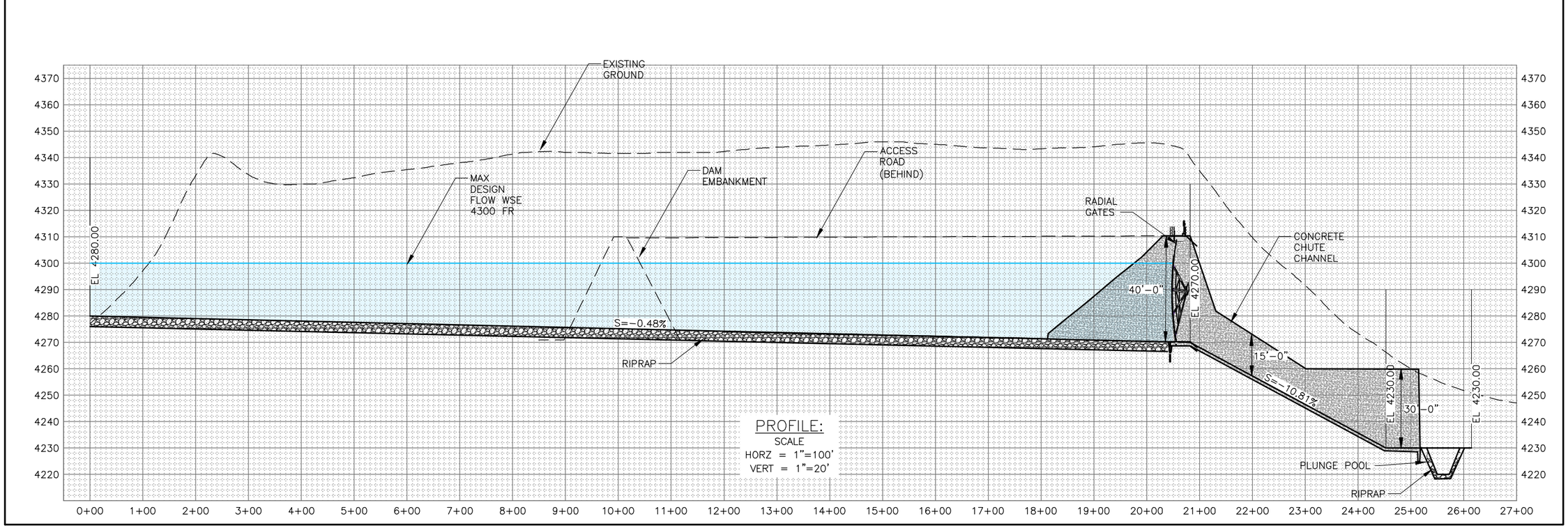








BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

CIVIL
FIELDING DAM 70K
SPILLWAY PLAN AND PROFILE

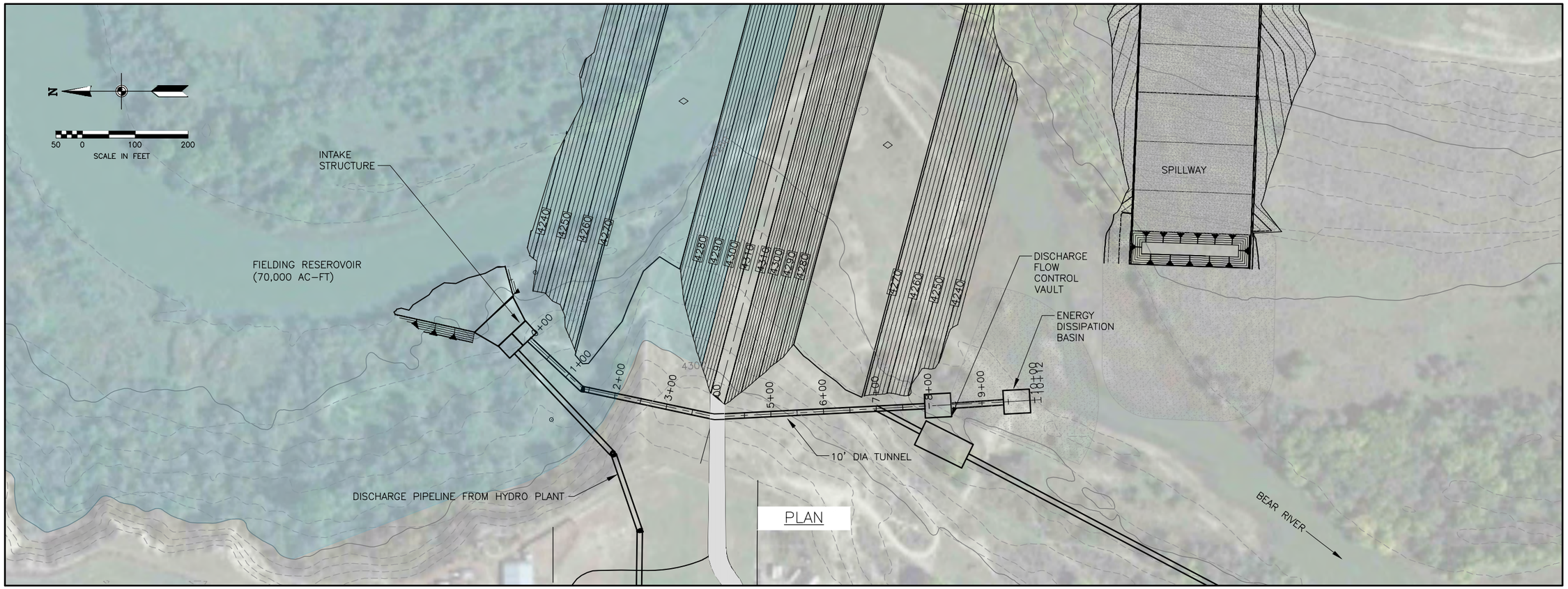
PROJECT NUMBER 233-14-01

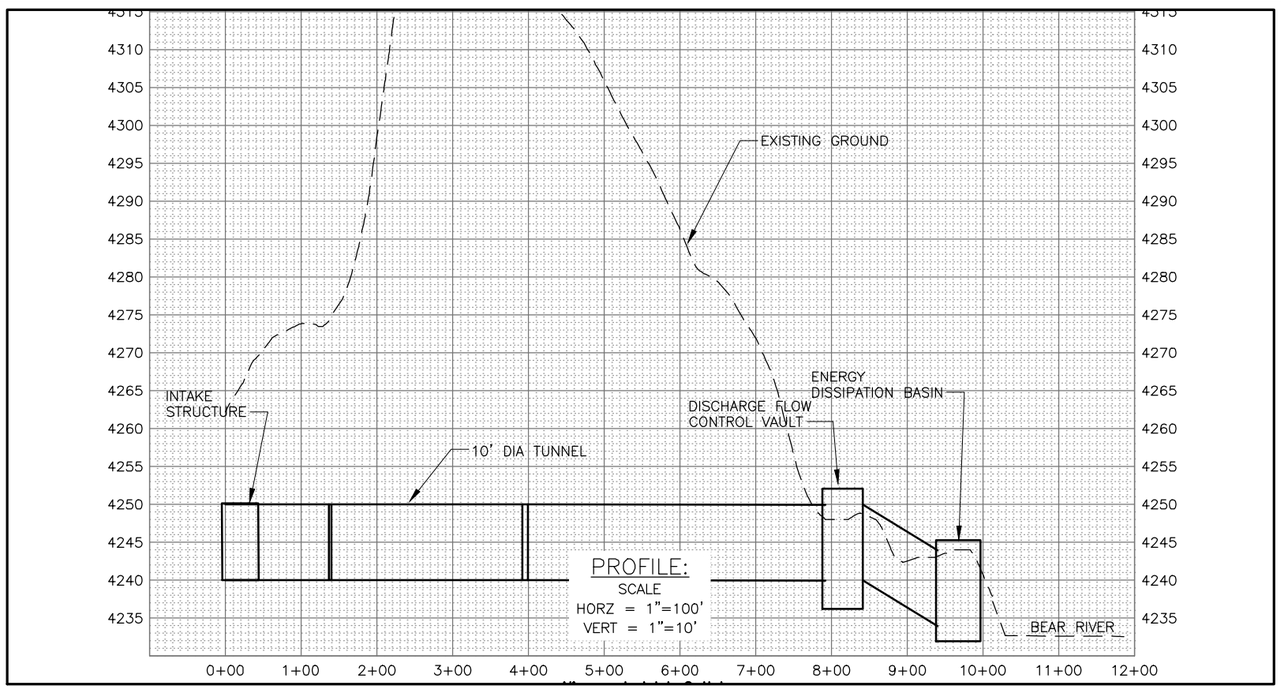
DATE: MARCH 2017

DRAWING NO.
F-04

SHEET 4 OF 11

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Sht\Fielding 70k\2331401_F-04.dwg Plotted: 11/7/2017 2:06 PM By: Seth Riggs





BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
FIELDING DAM 70K
INLET/OUTLET
PLAN AND PROFILE

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
F-05

SHEET 5 OF 11

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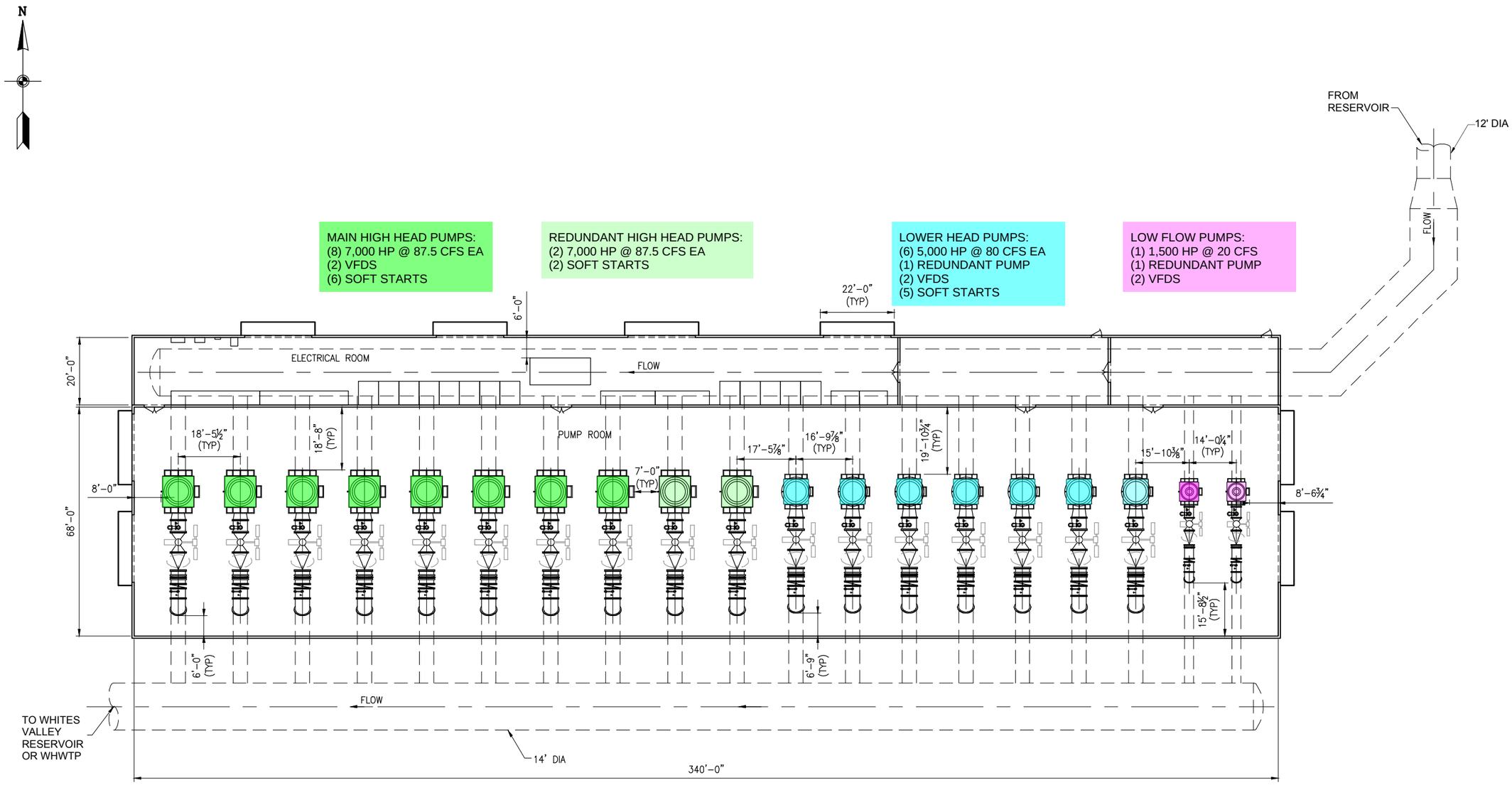


PLAN

SCALE: 1/16" = 1'-0"

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

REVISIONS

NO.	DATE	REV. BY	DESCRIPTION

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

STATE OF UTAH

BEAR RIVER DEVELOPMENT

DIVISION OF WATER RESOURCES

REVIEW

CHECKED J. OYLER

APPROVED T. CLARK

DESIGN

DESIGN B. ASHCROFT

DRAWN T. ANDERSON

MECHANICAL

FIELDING PUMP STATION MECHANICAL PLAN

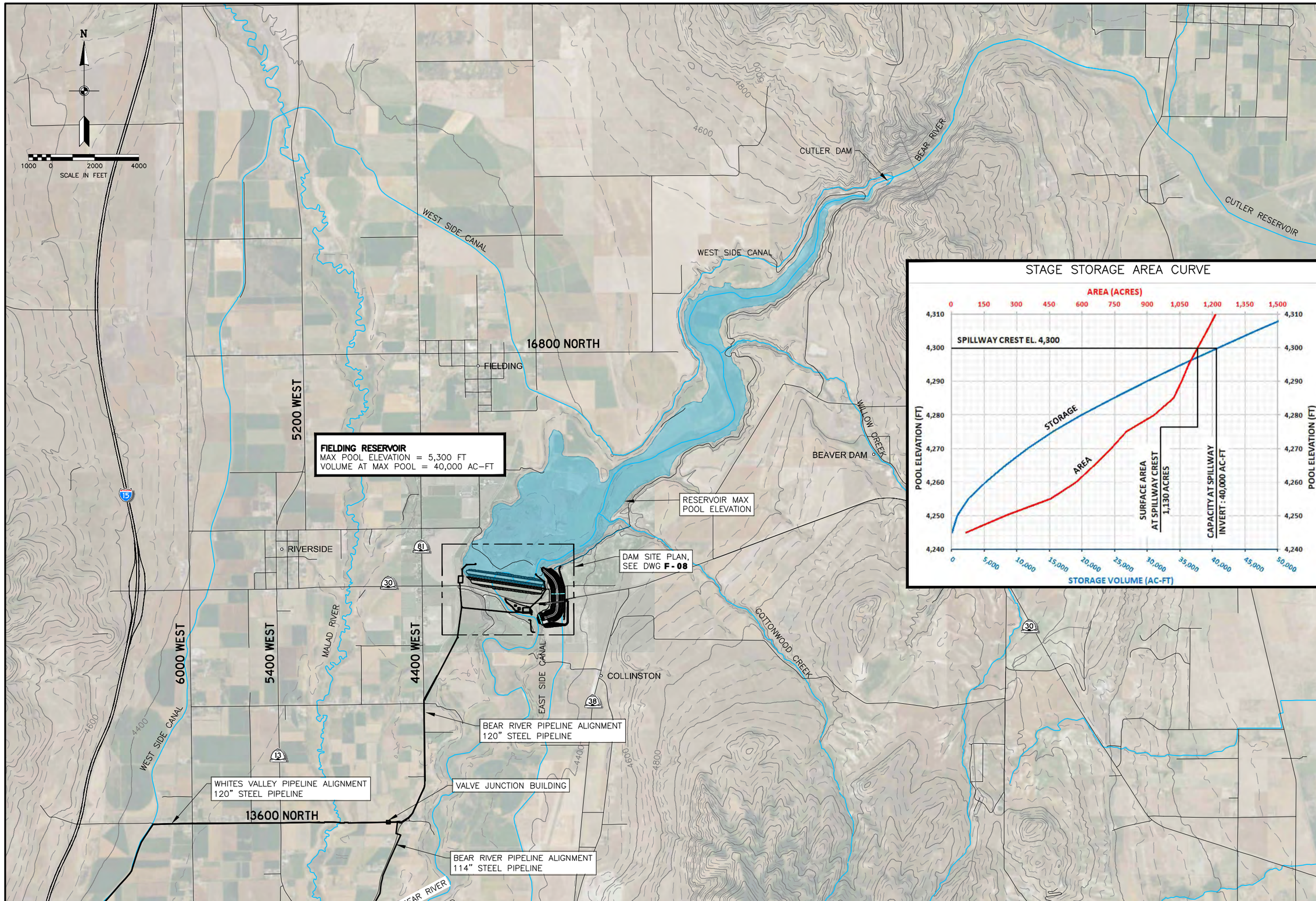
PROJECT NUMBER 233-14-01

DATE: OCTOBER 2017

DRAWING NO.

F-06

SHEET 6 OF 11



BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

REVISIONS

NO.	DATE	REV. BY	DESCRIPTION

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

REVIEW CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN DESIGN T. SEAMONS
DRAWN S. RIGGS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

CIVIL

FIELDING DAM AND 40K RESERVOIR SITE PLAN OVERVIEW

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO. F-07
SHEET 7 OF 11

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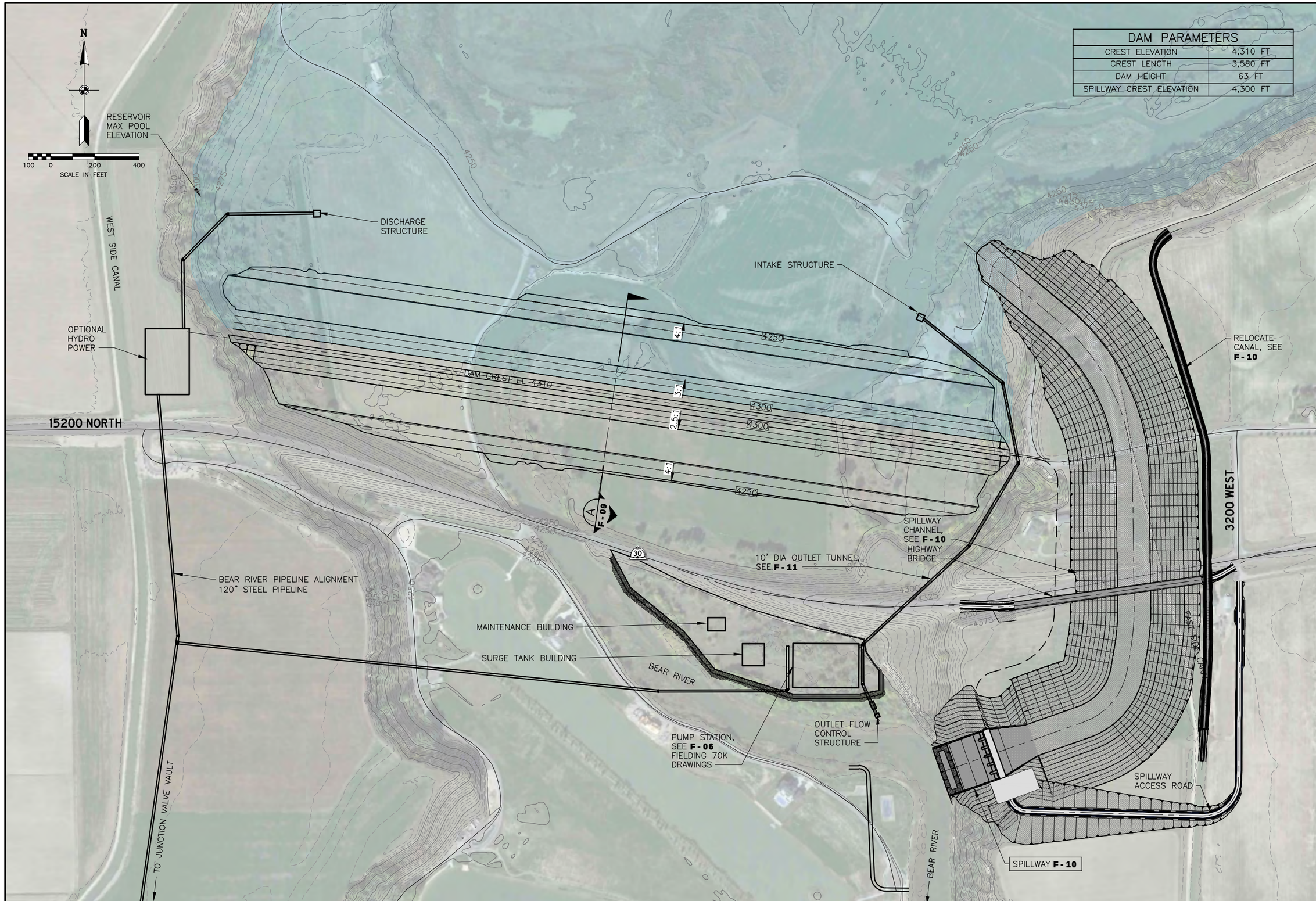

DAM PARAMETERS	
CREST ELEVATION	4,310 FT
CREST LENGTH	3,580 FT
DAM HEIGHT	63 FT
SPILLWAY CREST ELEVATION	4,300 FT

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

REVISIONS

NO.	DATE	REV. BY	DESCRIPTION

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
FIELDING DAM 40K
SITE PLAN

PROJECT NUMBER 233-14-01

DATE: MAY 2018

DRAWING NO.
F-08

SHEET 8 OF 11

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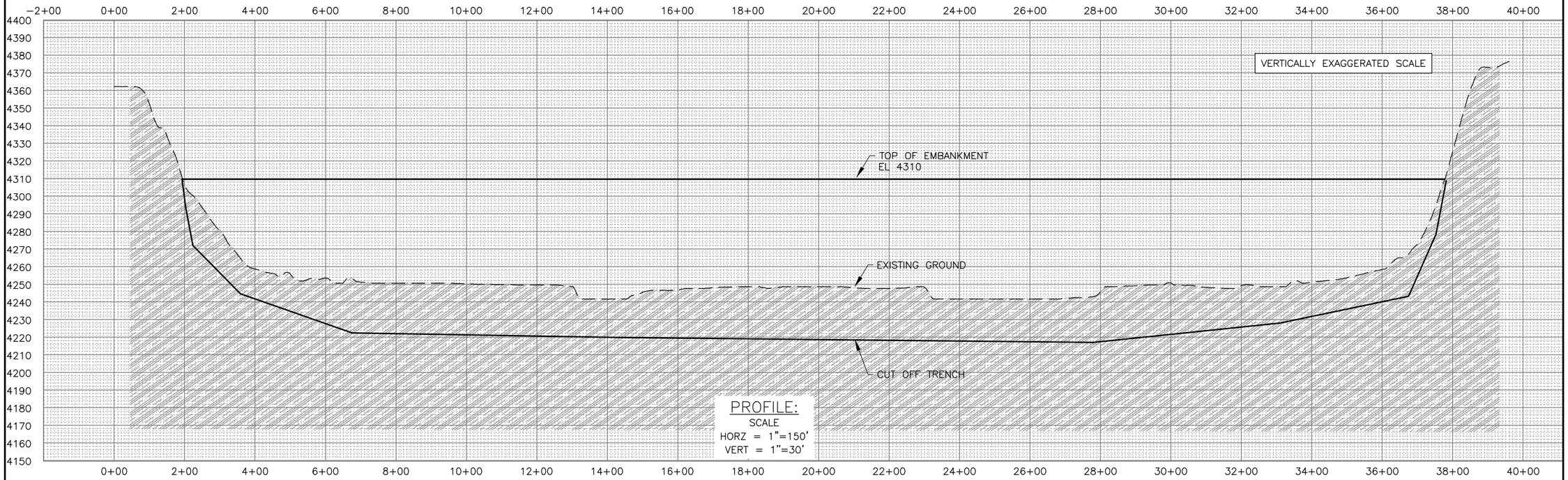
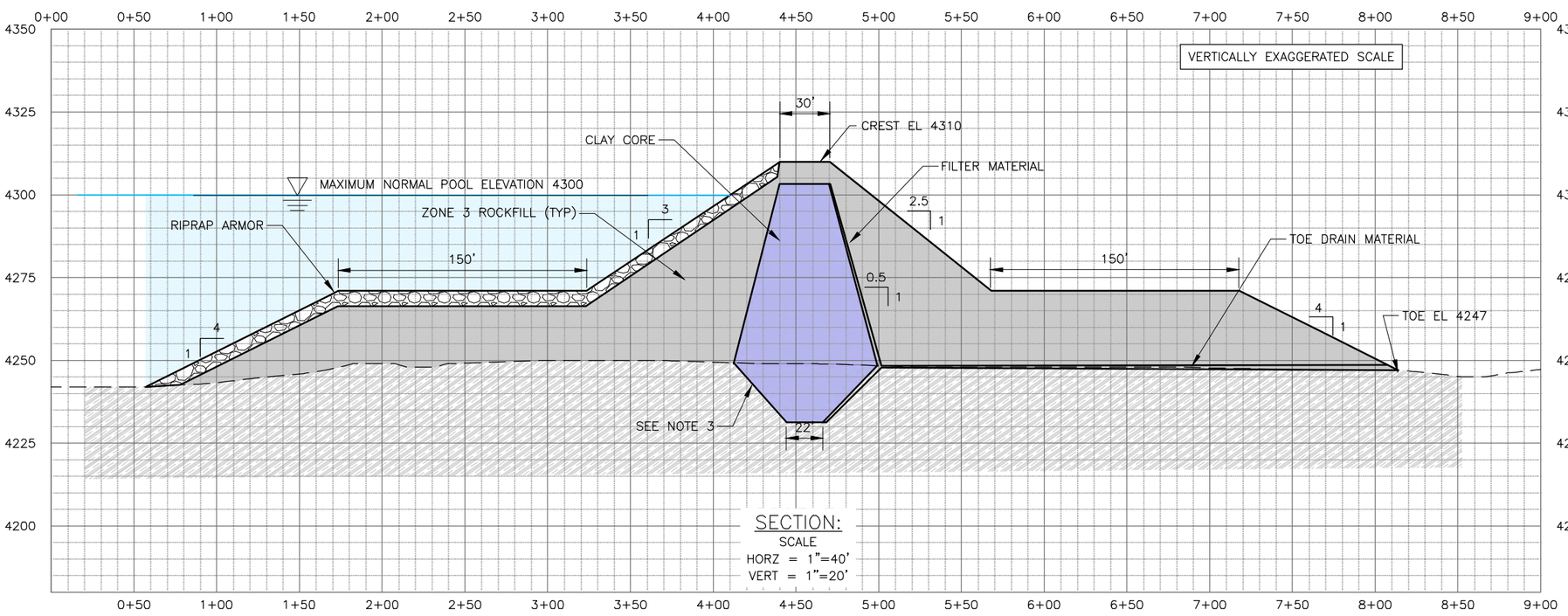




NOTES:

1. APPROXIMATE SOIL LAYERS BASED ON TEST HOLE, TRENCH, AND COMPRESSION WAVE VELOCITY DATA (SEE GEOTECHNICAL DATA REPORT).
2. EMBANKMENT MATERIAL SHALL EXTEND PAST THE ALLUVIAL LAYER.
3. CLAY CORE TO EXTEND 18' BELOW ALLUVIAL LAYER.

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

REVISIONS

NO.	DATE	REV. BY	DESCRIPTION

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
FIELDING DAM 40K
PROFILE AND SECTION

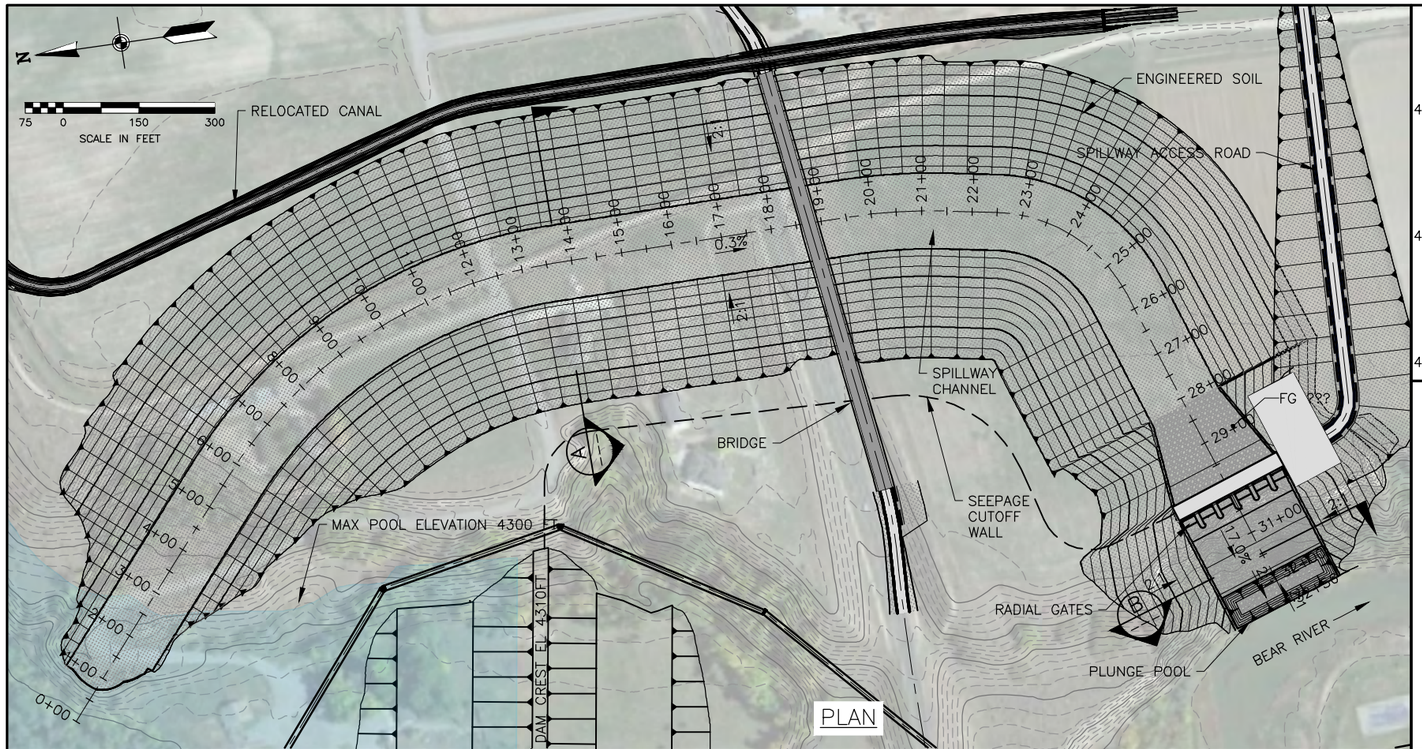
PROJECT NUMBER 233-14-01

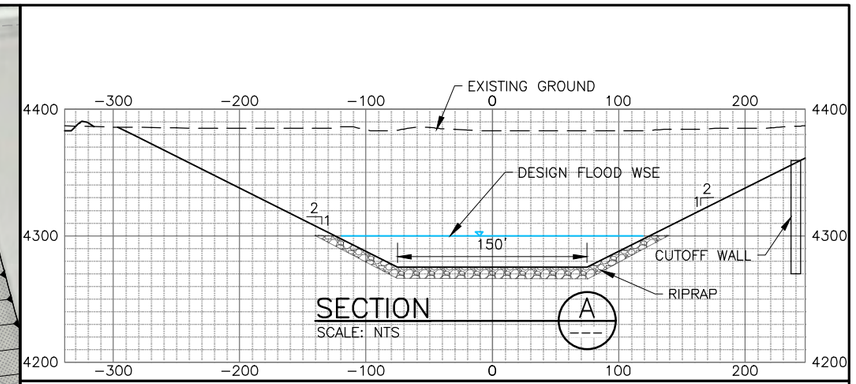
DATE: MARCH 2017

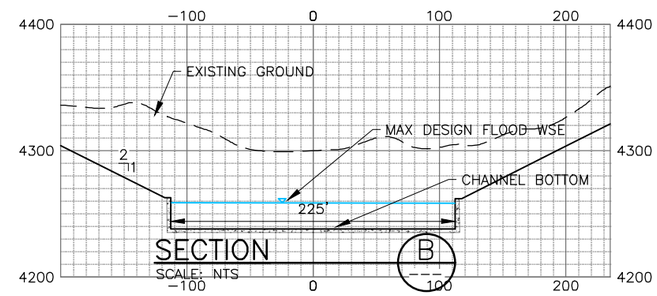
DRAWING NO.
F-09

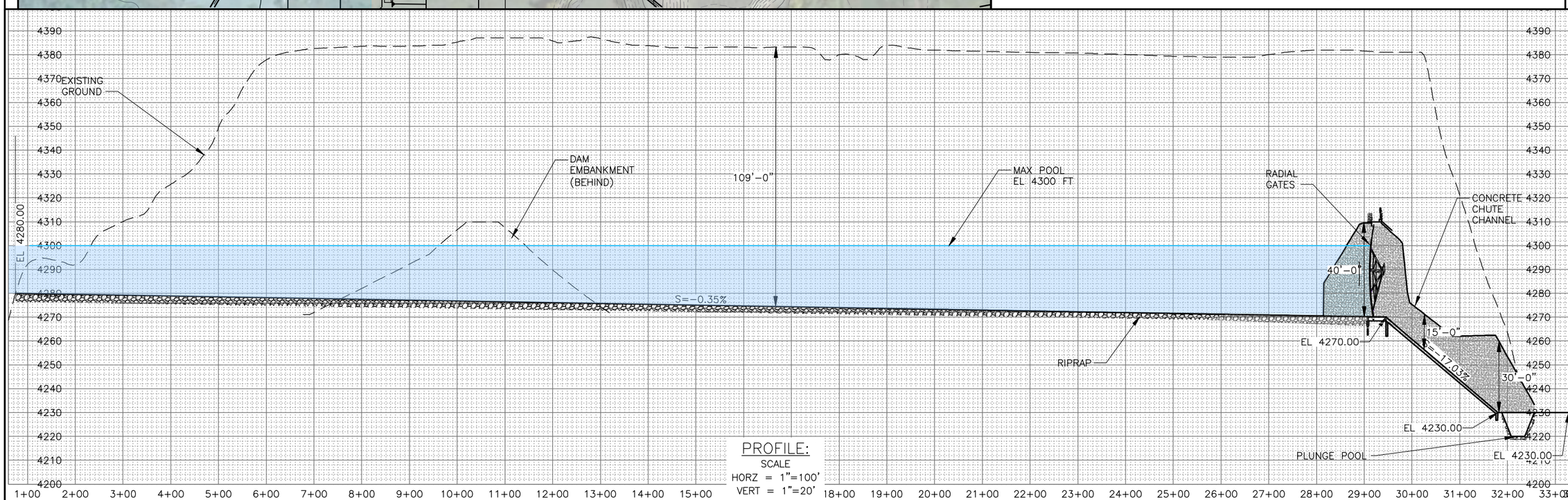
SHEET 9 OF 11

P:\State of Utah\Division of Water Resources\Bear River Project-Phase 2-2014\Drawings\Sht\Fielding 40k\2331401_F-09.dwg Plotted: 11/7/2017 2:53 PM By: Seth Riggs









BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

REVISIONS

NO.	DATE	REV. BY	DESCRIPTION

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL

FIELDING DAM 40K SPILLWAY PLAN AND PROFILE

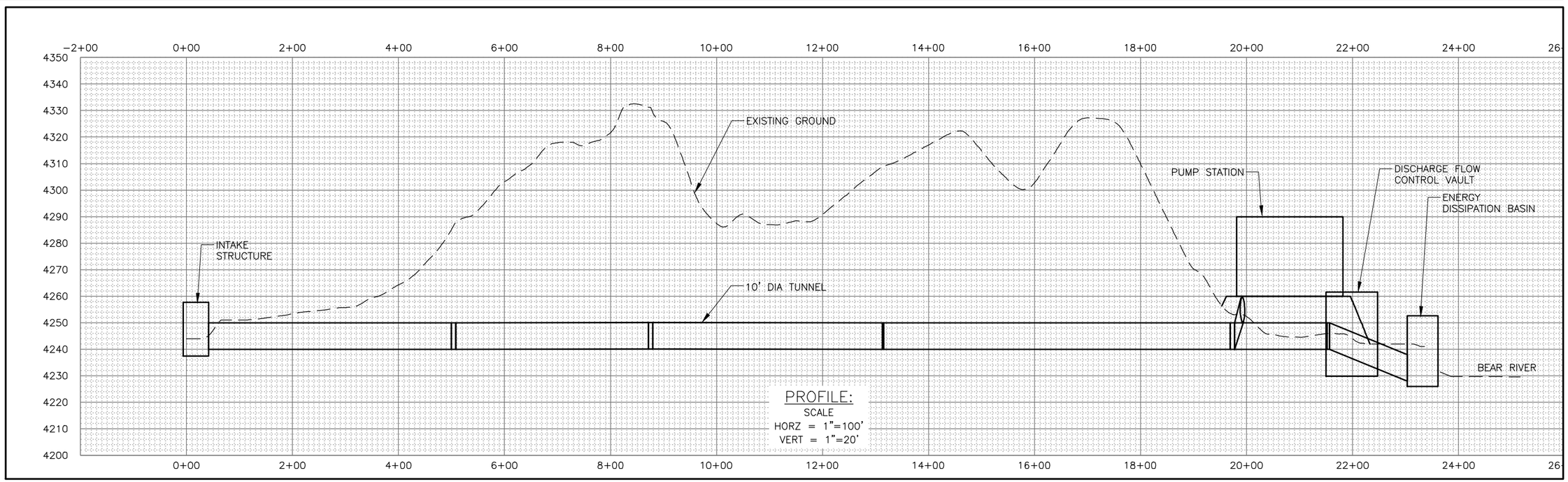
PROJECT NUMBER 233-14-01

DATE: MAY 2018

DRAWING NO.
F-10

SHEET 10 OF 11

PLAN



PROFILE:
SCALE
HORZ = 1"=100'
VERT = 1"=20'

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

CIVIL

FIELDING DAM 40K
INLET/OUTLET
PLAN AND PROFILE

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
F-11

SHEET 11 OF 11

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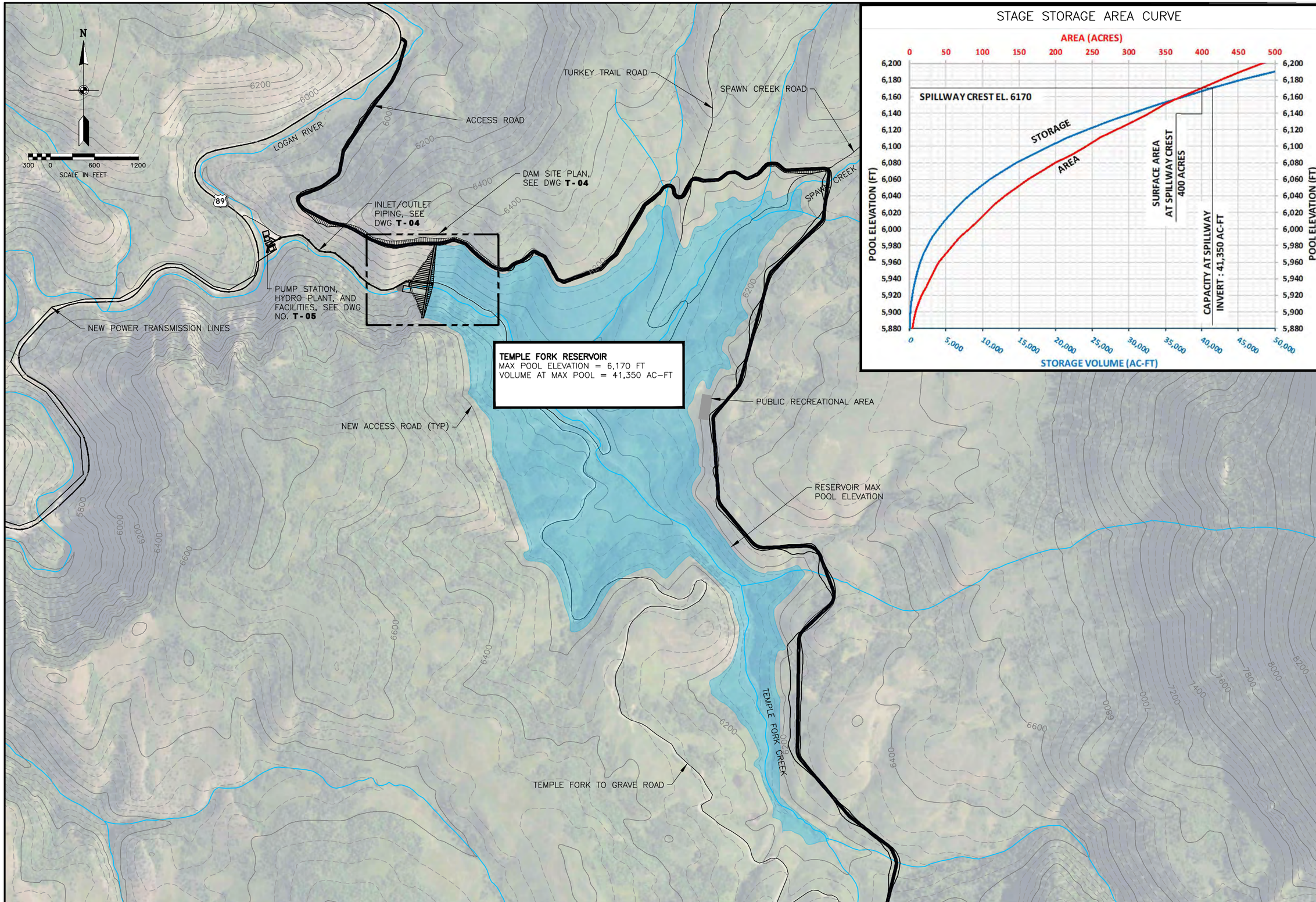
TEMPLE FORK



BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

CIVIL

TEMPLE FORK DAM AND RESERVOIR SITE PLAN OVERVIEW

DATE: MAY 2018

PROJECT NUMBER 233-14-01

DRAWING NO.
T-01

SHEET 1 OF 6

IMAGE: png

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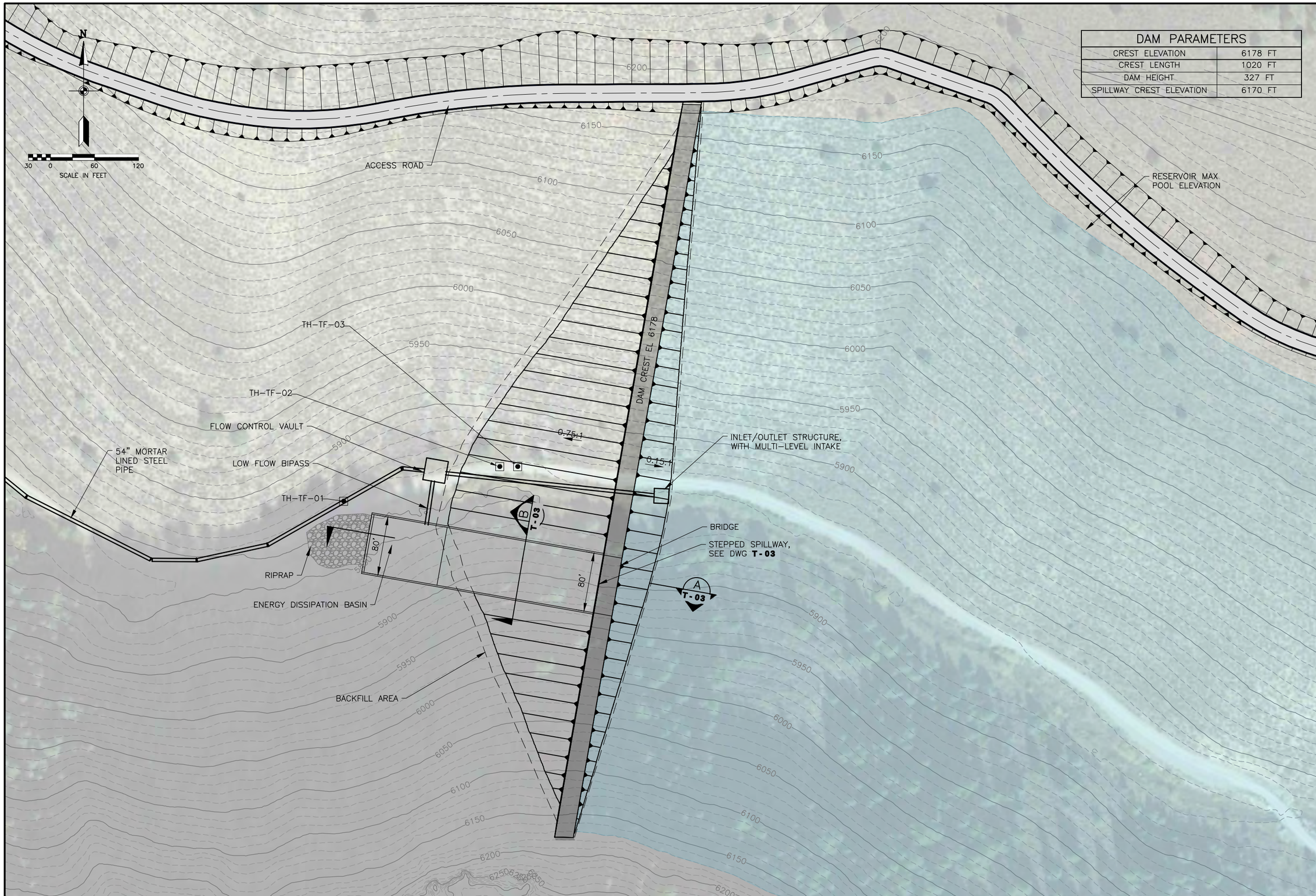


DAM PARAMETERS	
CREST ELEVATION	6178 FT
CREST LENGTH	1020 FT
DAM HEIGHT	327 FT
SPILLWAY CREST ELEVATION	6170 FT

IMAGE: GOOGLE EARTH 2016

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

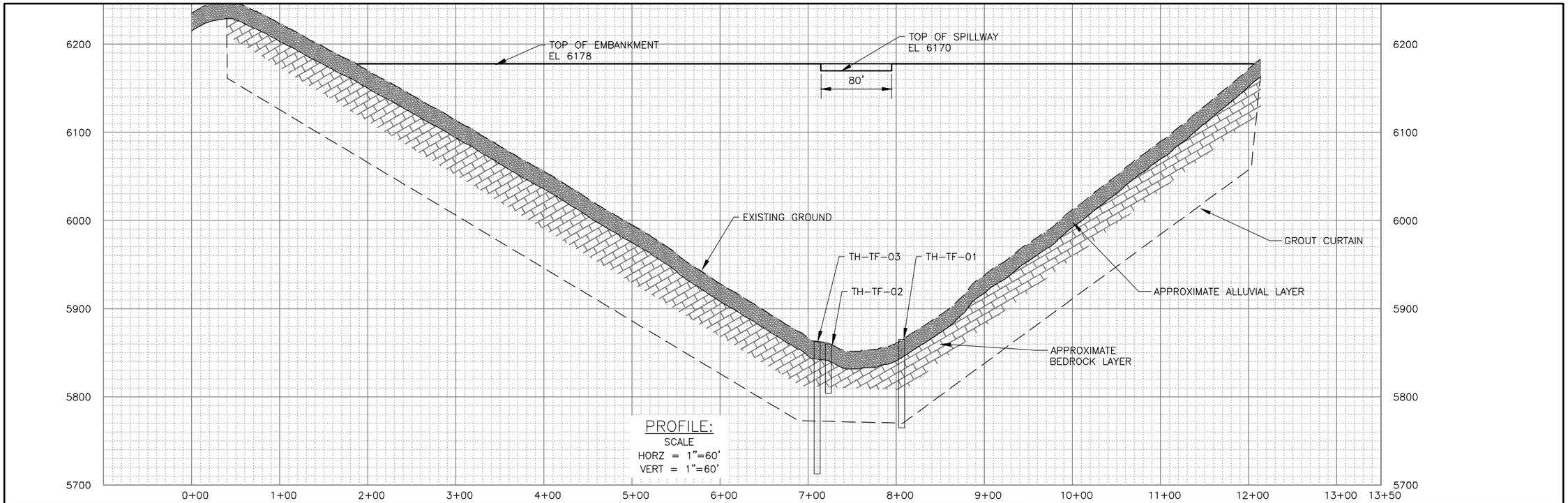
DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
TEMPLE FORK DAM SITE PLAN

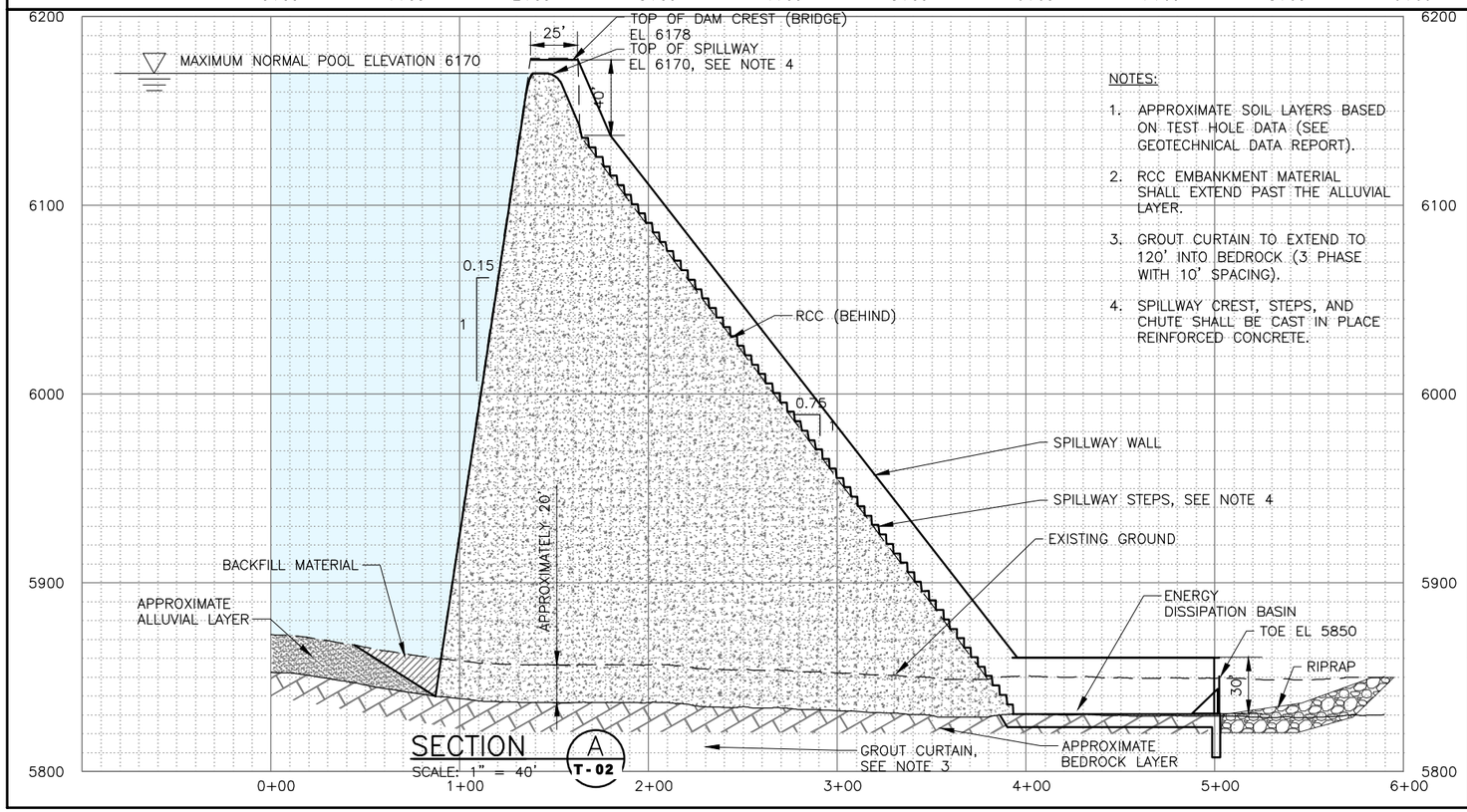
DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
T-02

SHEET 2 OF 6



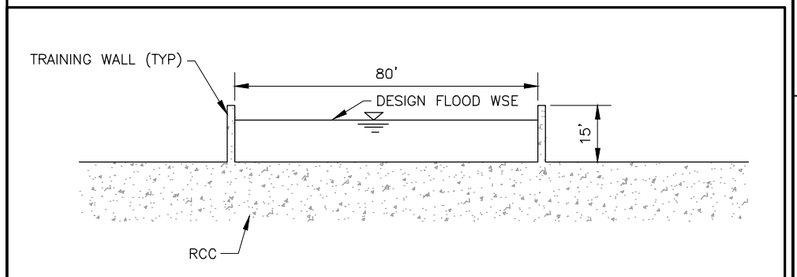
PROFILE:
SCALE
HORZ = 1"=60'
VERT = 1"=60'



NOTES:

1. APPROXIMATE SOIL LAYERS BASED ON TEST HOLE DATA (SEE GEOTECHNICAL DATA REPORT).
2. RCC EMBANKMENT MATERIAL SHALL EXTEND PAST THE ALLUVIAL LAYER.
3. GROUT CURTAIN TO EXTEND TO 120' INTO BEDROCK (3 PHASE WITH 10' SPACING).
4. SPILLWAY CREST, STEPS, AND CHUTE SHALL BE CAST IN PLACE REINFORCED CONCRETE.

SECTION A T-02
SCALE: 1" = 40'



SECTION B T-02
SCALE: NTS

BOWEN COLLINS & ASSOCIATES
HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

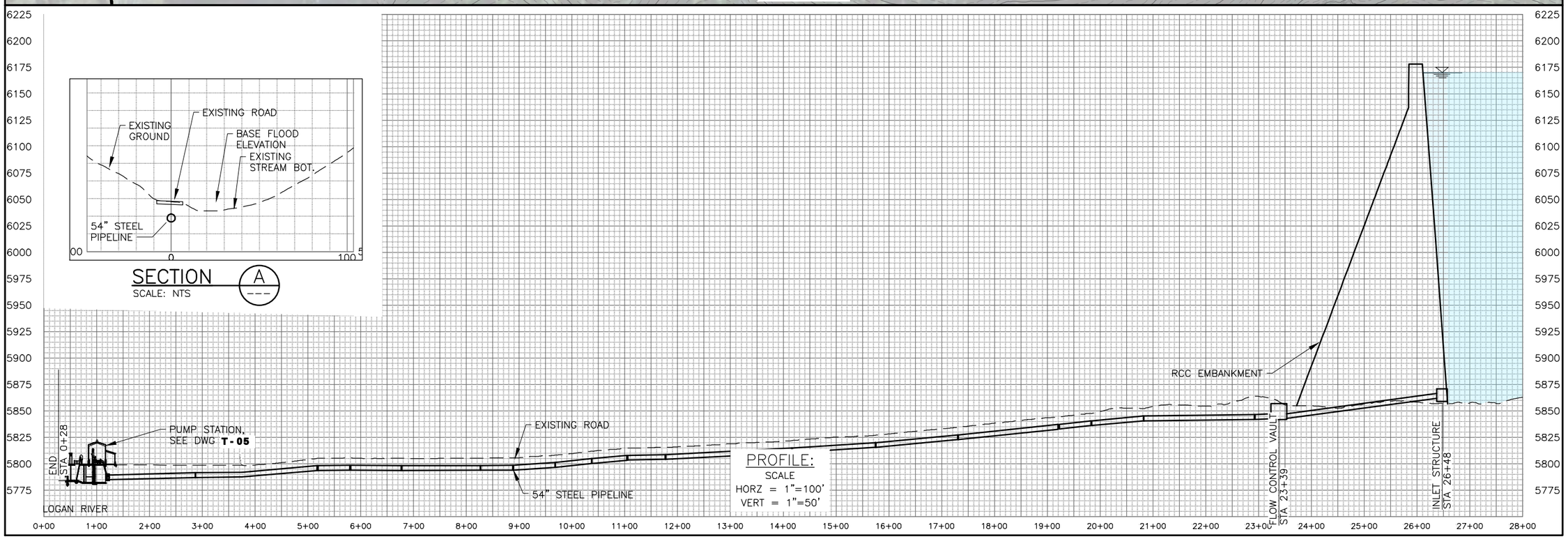
DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
TEMPLE FORK DAM
PROFILE AND SECTION

PROJECT NUMBER 233-14-01
DATE: MAY 2018

DRAWING NO.
T-03
SHEET 3 OF 6

PLAN



BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
TEMPLE FORK DAM
INLET/OUTLET
PLAN AND PROFILE

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
T-04

SHEET 4 OF 6

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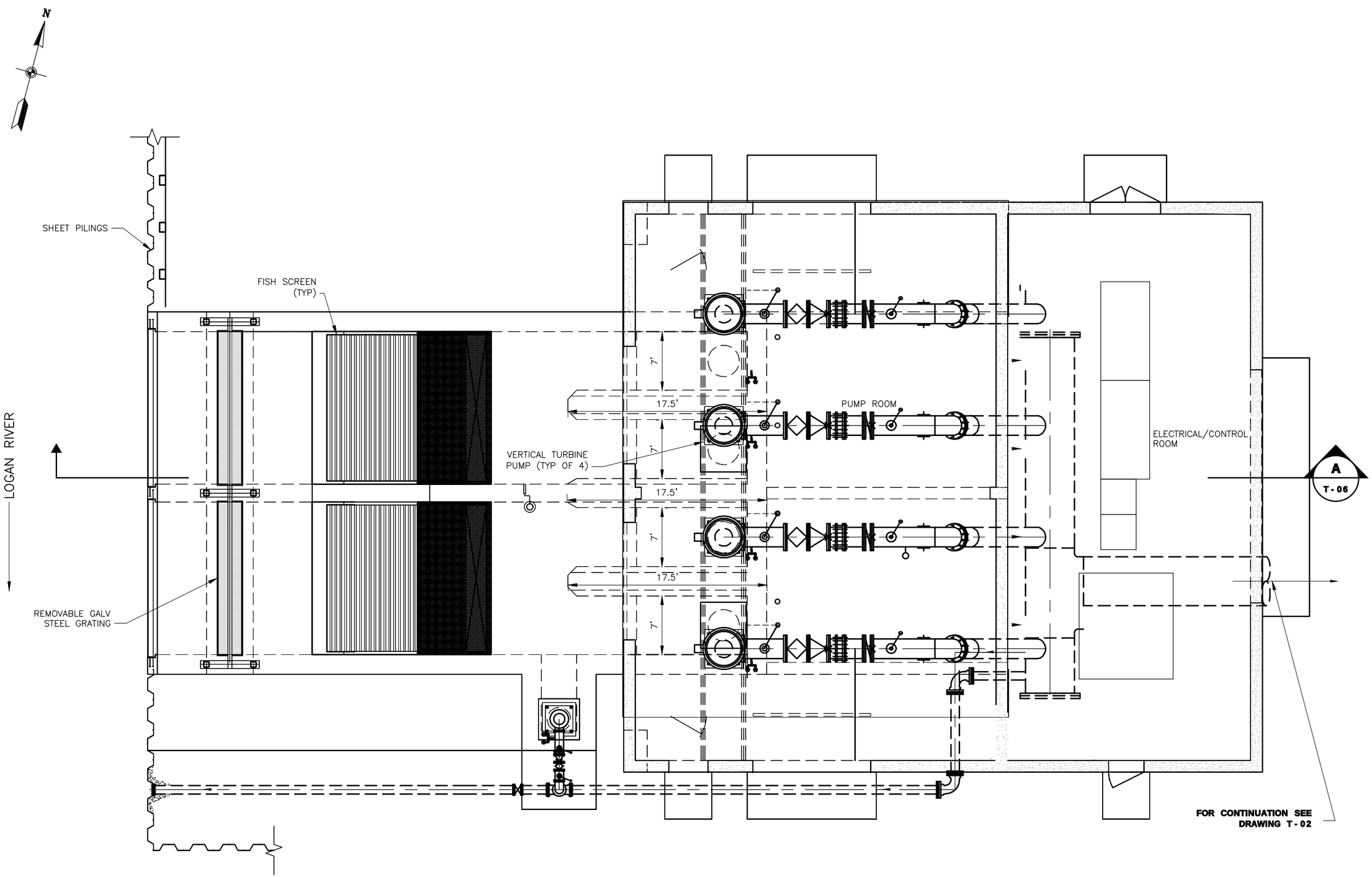


TEMPLE FORK PUMP STATION PLAN

SCALE: 1/4" = 1'-0"

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

STATE OF UTAH

BEAR RIVER DEVELOPMENT

DIVISION OF WATER RESOURCES

REVIEW

CHECKED J. OYLER

APPROVED T. CLARK

DESIGN

DESIGN J. OYLER

DRAWN S. RIGGS

MECHANICAL

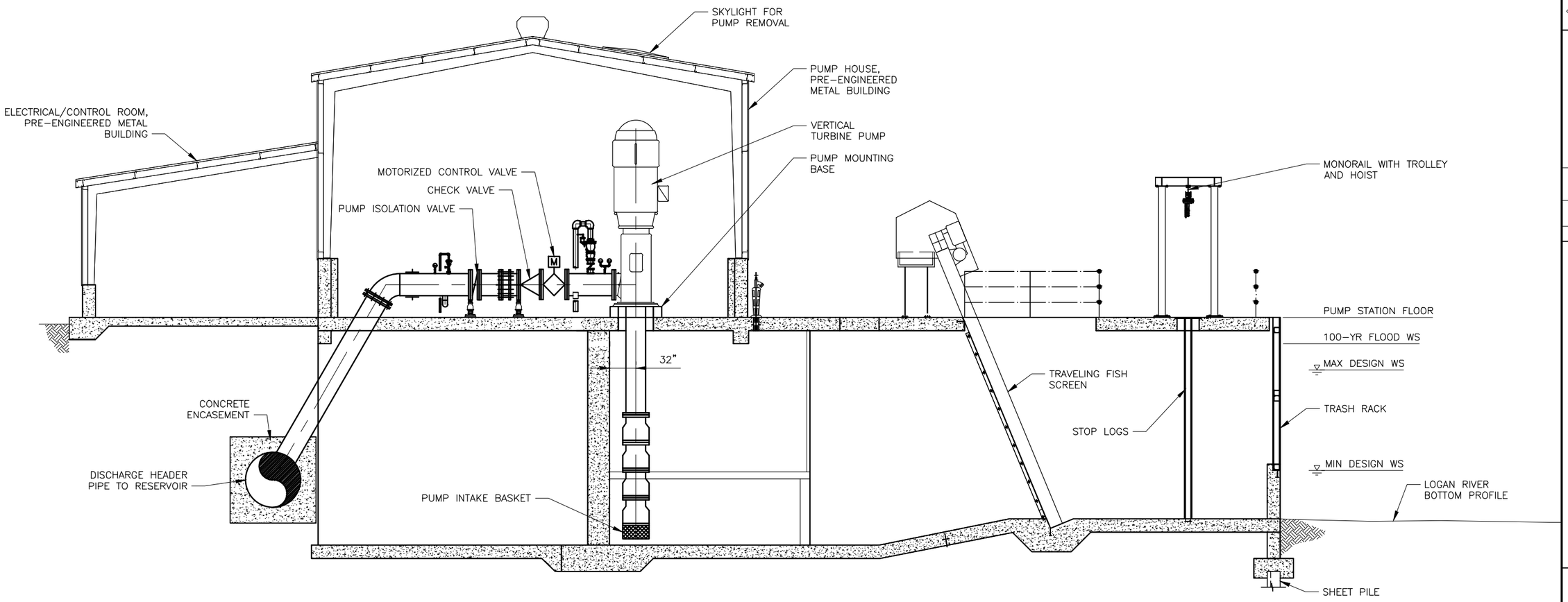
TEMPLE FORK RESERVOIR INTAKE AND PUMP STATION PLAN

PROJECT NUMBER 233-14-01

DATE: MAY 2018

DRAWING NO. T-05

SHEET 5 OF 6



TEMPLE FORK PUMP STATION SECTION (A / T-05)

SCALE: 1/4" = 1'-0"

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED J. OYLER
APPROVED T. CLARK

DESIGN
DESIGN J. OYLER
DRAWN S. RIGGS

MECHANICAL
TEMPLE FORK RESERVOIR INTAKE AND PUMP STRUCTURE SECTION

PROJECT NUMBER 233-14-01

DATE: MAY 2018

DRAWING NO. T-06

SHEET 6 OF 6

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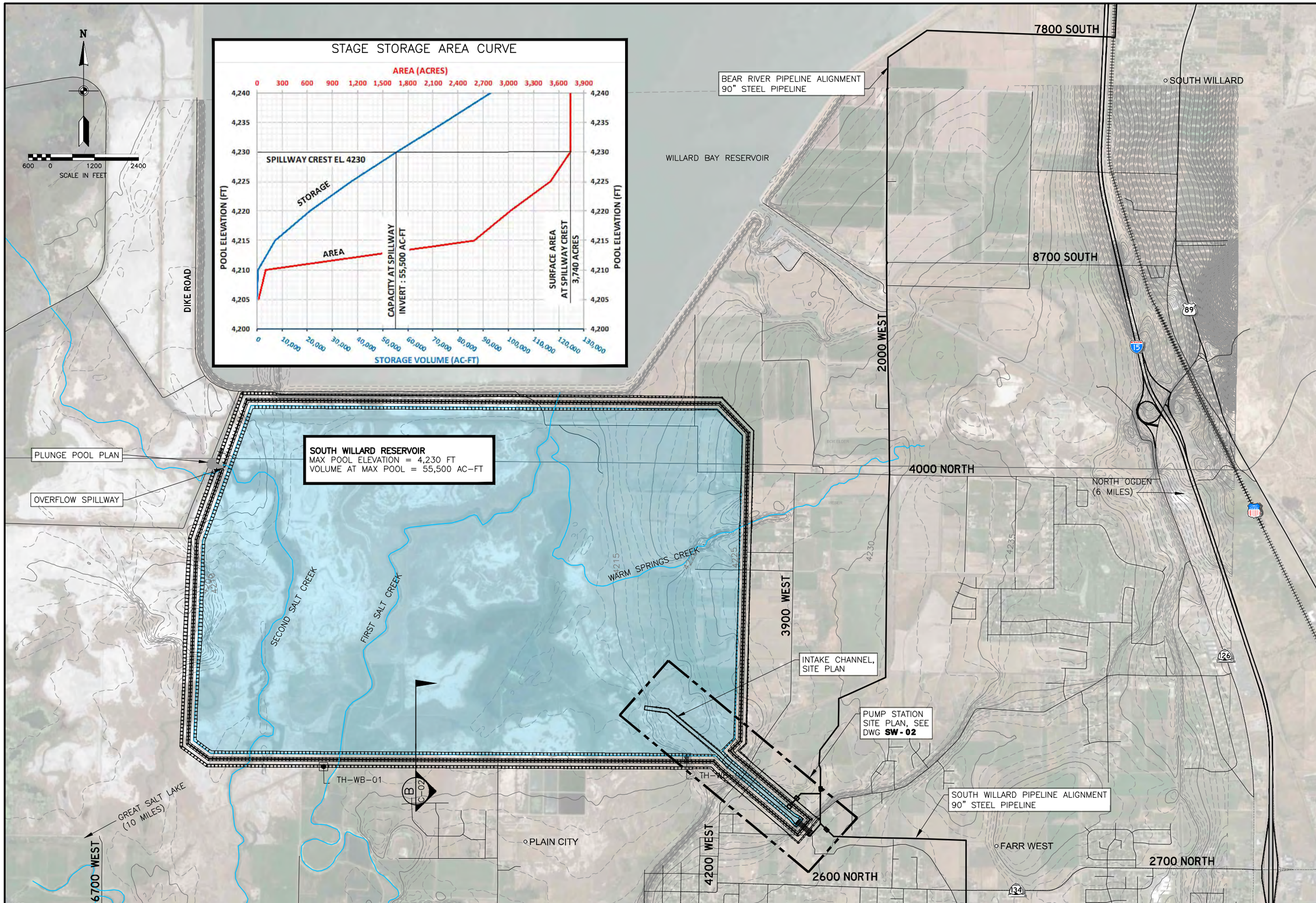
SOUTH WILLARD



BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
SOUTH WILLARD DAM AND RESERVOIR SITE PLAN OVERVIEW

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
SW-01

SHEET 1 OF 3

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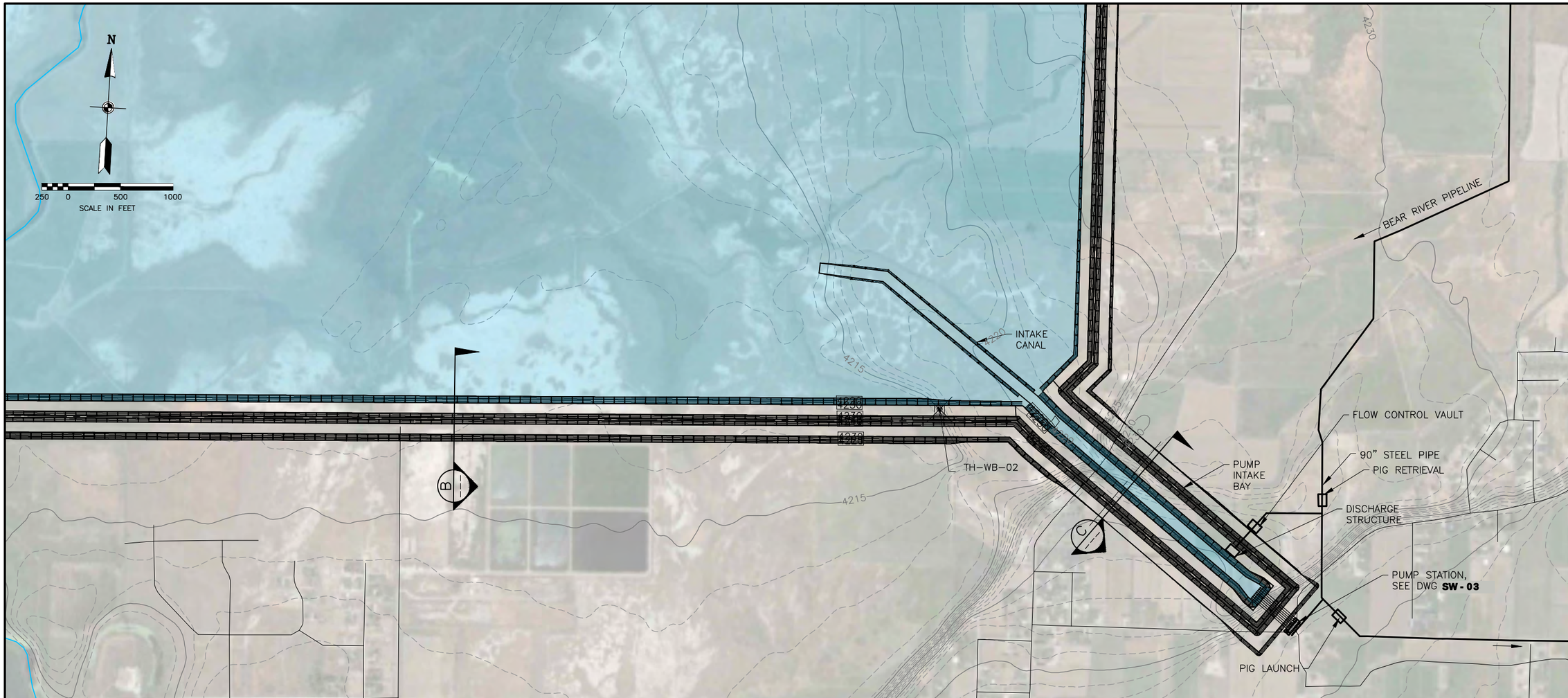
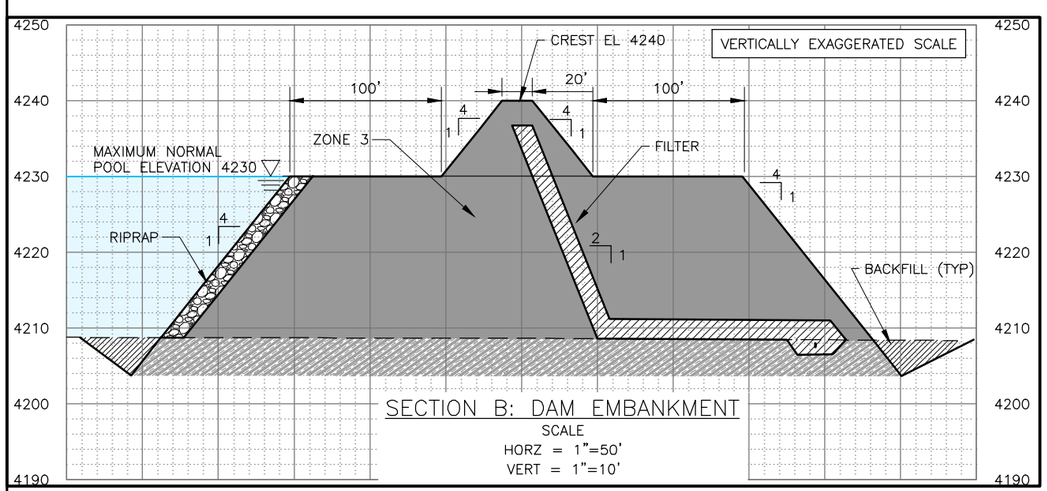
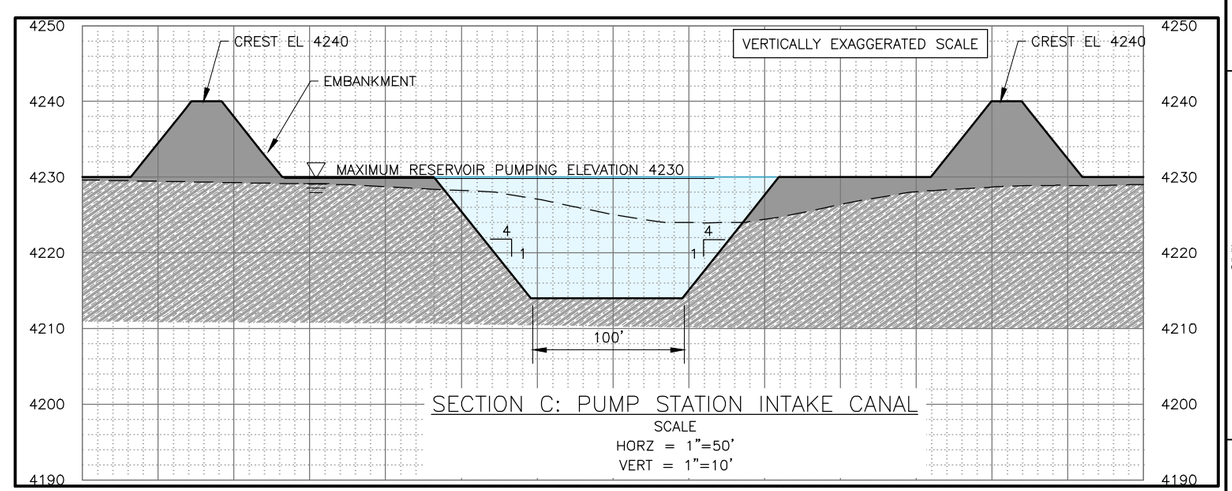




SECTION B: DAM EMBANKMENT

SCALE
HORZ = 1"=50'
VERT = 1"=10'



SECTION C: PUMP STATION INTAKE CANAL

SCALE
HORZ = 1"=50'
VERT = 1"=10'

IMAGE: GOOGLE EARTH 2016

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BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

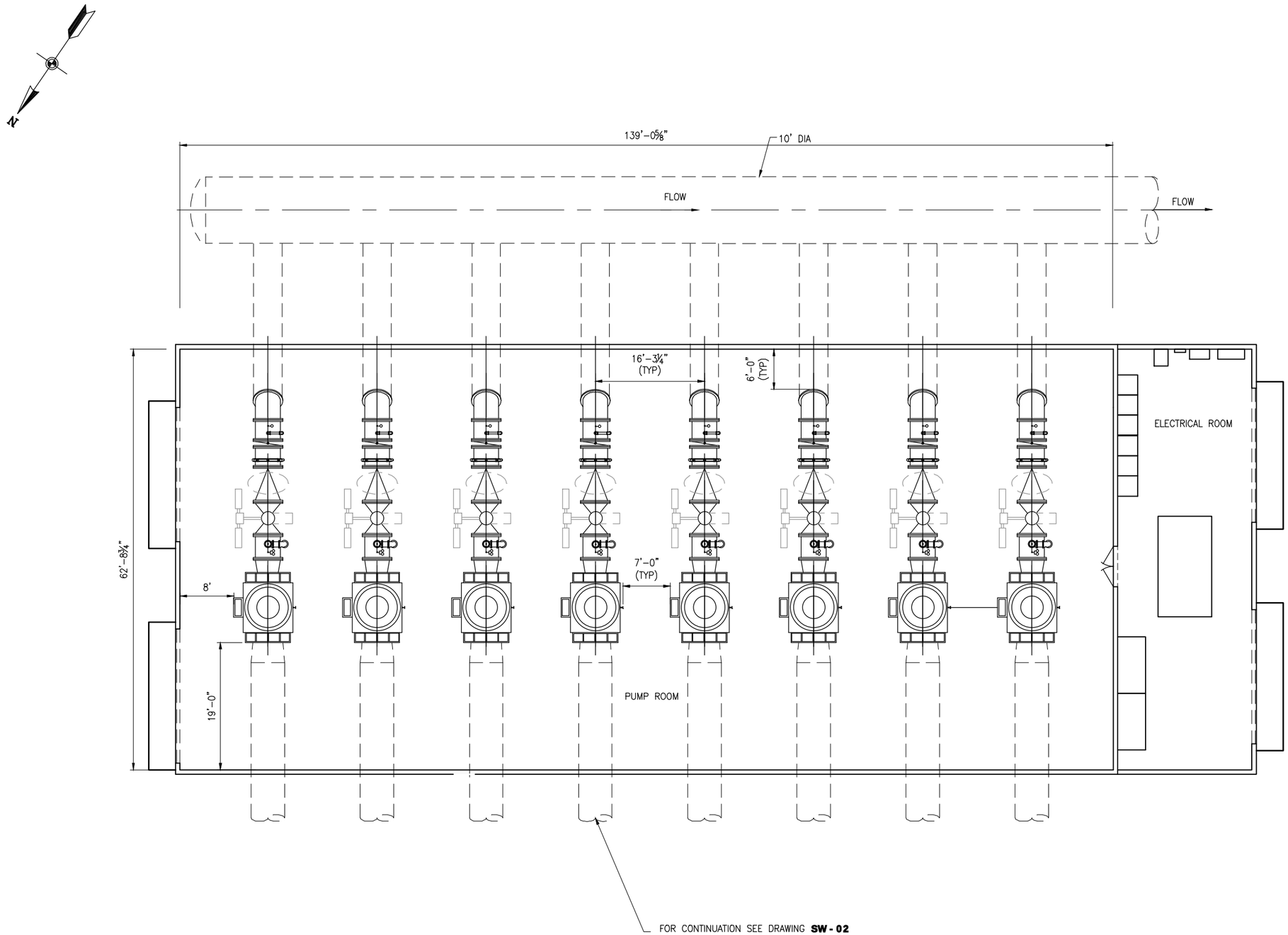
DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
SOUTH WILLARD DAM
SITE PLAN
AND SECTIONS

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
SW-02

SHEET 2 OF 3



PLAN

SCALE: 1/8" = 1'-0"

BOWEN COLLINS & ASSOCIATES

HDR

CONCEPTUAL

REVISIONS

NO.	DATE	REV. BY	DESCRIPTION

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

REVIEW
CHECKED J. OYLER
APPROVED T. CLARK

DESIGN
DESIGN B. ASHCROFT
DRAWN T. ANDERSON

MECHANICAL
SOUTH WILLARD PUMP STATION MECHANICAL PLAN

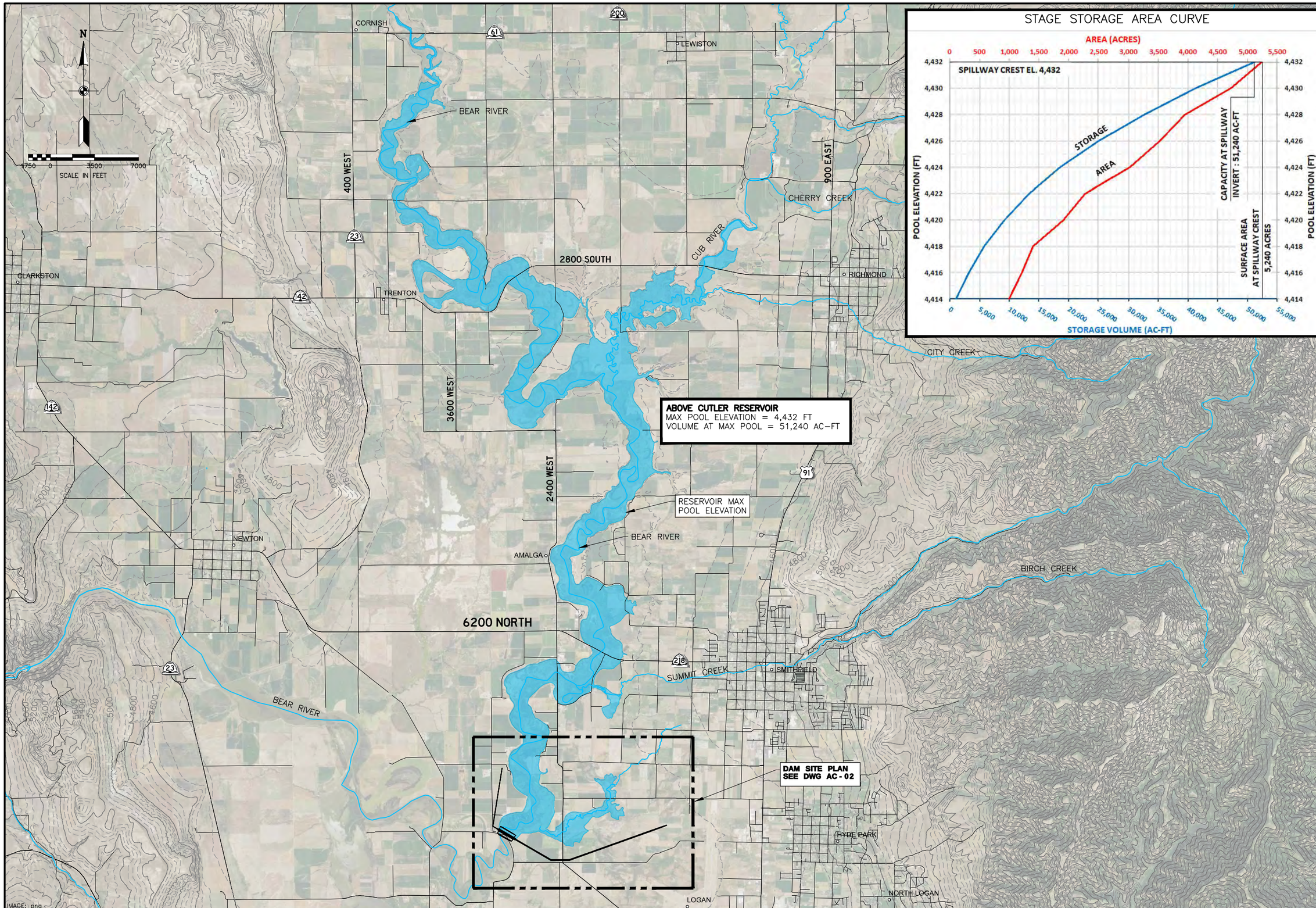
PROJECT NUMBER 233-14-01

DATE: MAY 2018

DRAWING NO.
SW-03

SHEET 3 OF 3

ABOVE CUTLER



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CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL

ABOVE CUTLER DAM AND RESERVOIR SITE PLAN OVERVIEW

DATE: MAY 2018
PROJECT NUMBER 233-14-01

DRAWING NO.
AC-01

SHEET 1 OF 3

IMAGE: png

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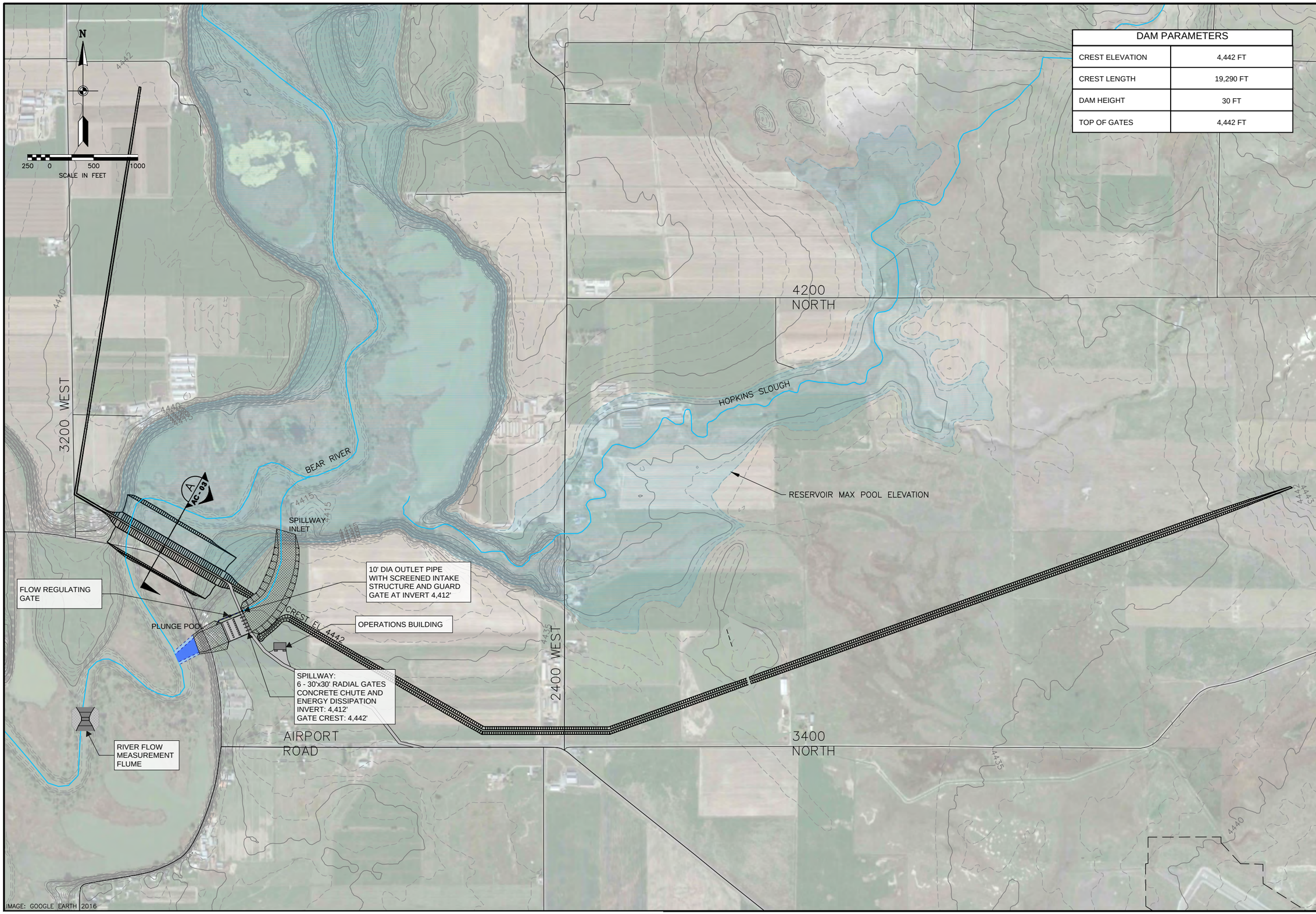

DAM PARAMETERS	
CREST ELEVATION	4,442 FT
CREST LENGTH	19,290 FT
DAM HEIGHT	30 FT
TOP OF GATES	4,442 FT

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CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

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BEAR RIVER DEVELOPMENT

VERIFY SCALE
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DESIGN T. SEAMONS
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ABOVE CUTLER DAM SITE PLAN

PROJECT NUMBER 233-14-01

DATE: MAY 2018

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AC-02

SHEET 2 OF 3

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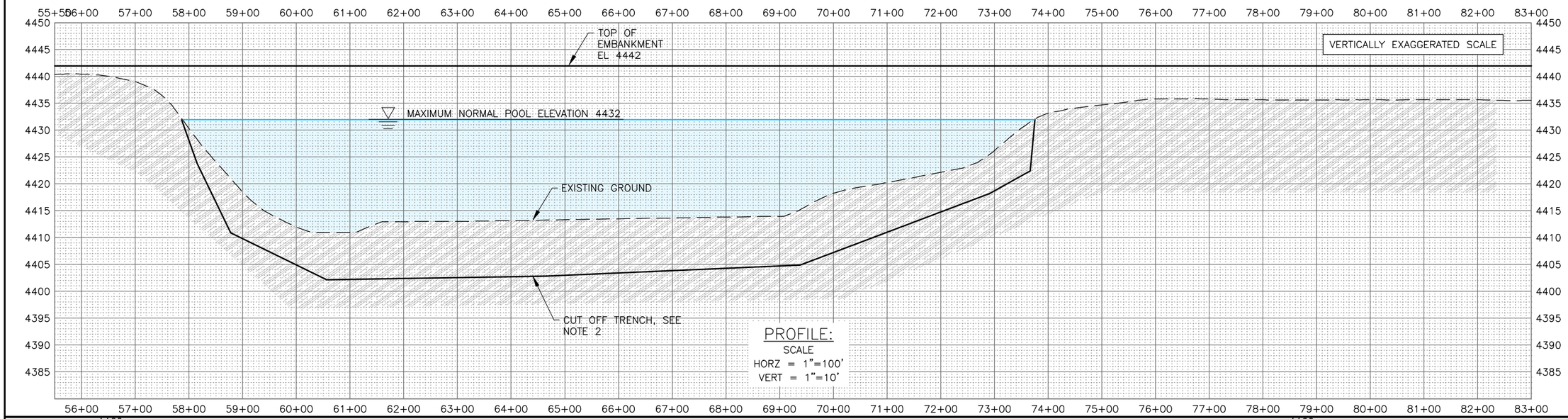

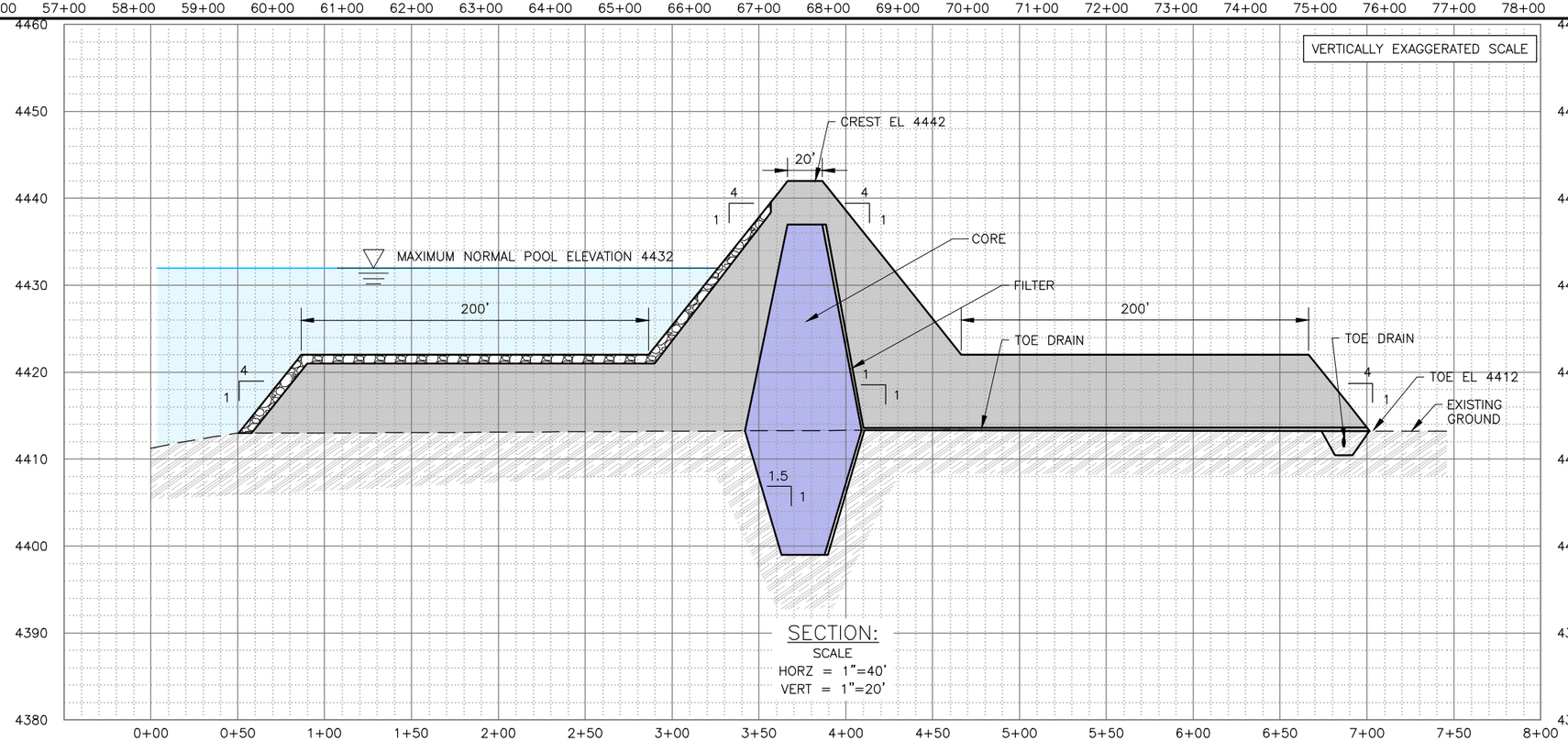

NOTES:

1. APPROXIMATE SOIL LAYERS BASED ON TEST HOLE, TRENCH, AND COMPRESSION WAVE VELOCITY DATA (SEE GEOTECHNICAL DATA REPORT).
2. CLAY CORE SHALL EXTEND XX' BELOW ALLUVIAL LAYER.

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CONCEPTUAL

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BEAR RIVER DEVELOPMENT

VERIFY SCALE
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ABOVE CUTLER DAM
PROFILE AND SECTION

PROJECT NUMBER 233-14-01

DATE: MARCH 2017

DRAWING NO.
AC-03

SHEET 3 OF 3

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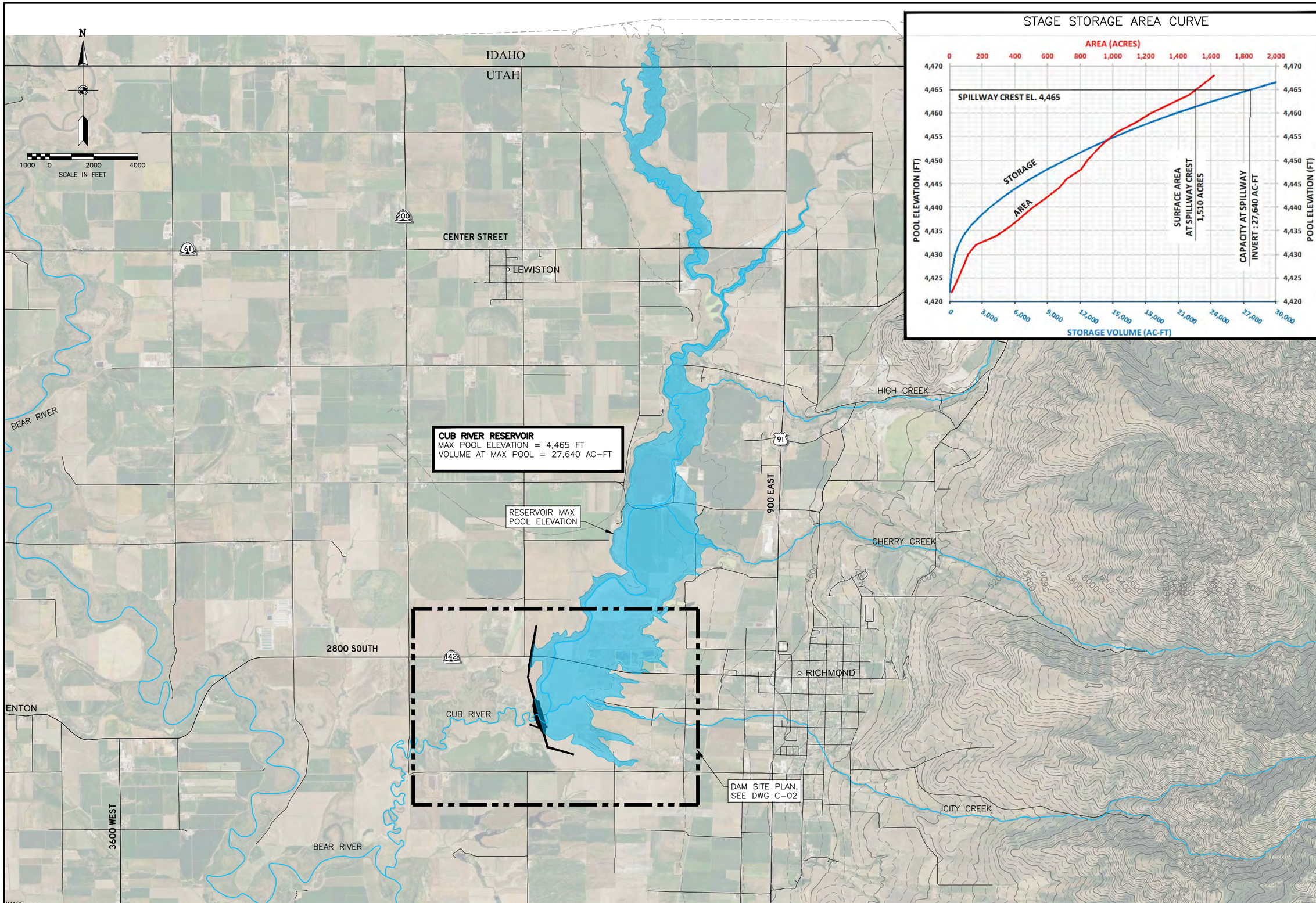
CUB RIVER



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REVISIONS

VERIFY SCALE

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DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

REVIEW
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APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL

CUB RIVER DAM AND RESERVOIR SITE PLAN OVERVIEW

DATE: MARCH 2017

PROJECT NUMBER 233-14-01

DRAWING NO.
C-01

SHEET 1 OF 3

DAM PARAMETERS	
CREST ELEVATION	4,475 FT
CREST LENGTH	6,880 FT
DAM HEIGHT	53 FT
SPILLWAY CREST ELEVATION	4,465 FT

N

150 0 300 600
SCALE IN FEET

2800 SOUTH

142

MAIN STREET

CUB RIVER

CITY CREEK

RESERVOIR MAX POOL ELEVATION

OPERATIONS BUILDING

DAM CREST EL 4475

SPILLWAY AND OUTLET STRUCTURE - SEE DETAILED AREA

TH-CUB-01

TH-CUB-02

TH-CUB-03

RIVER FLOW MEASUREMENT FLUME

A
C-03

4450 4425 4475

SPILLWAY:
2 - 30'x35' RADIAL GATES
CONCRETE CHUTE AND
ENERGY DISSIPATION
INVERT: 4,440'
GATE CREST: 4,465'

2 - 6 FT DIA OUTLET PIPES
WITH SCREENED INTAKE
STRUCTURE AND GUARD
GATES AT INVERT 4,425'

EL 4475

SPILLWAY INLET

PLUNGE POOL

TH-CUB-01

FLOW REGULATING
GATES (2)

CHANNEL TO RIVER

SPILLWAY AND OUTLET STRUCTURE DETAIL

IMAGE: PNG

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CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

DESIGN
DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
CUB RIVER DAM
SITE PLAN

DATE: OCTOBER 2017

PROJECT NUMBER 233-14-01

DRAWING NO.
C-02

SHEET 2 OF 3

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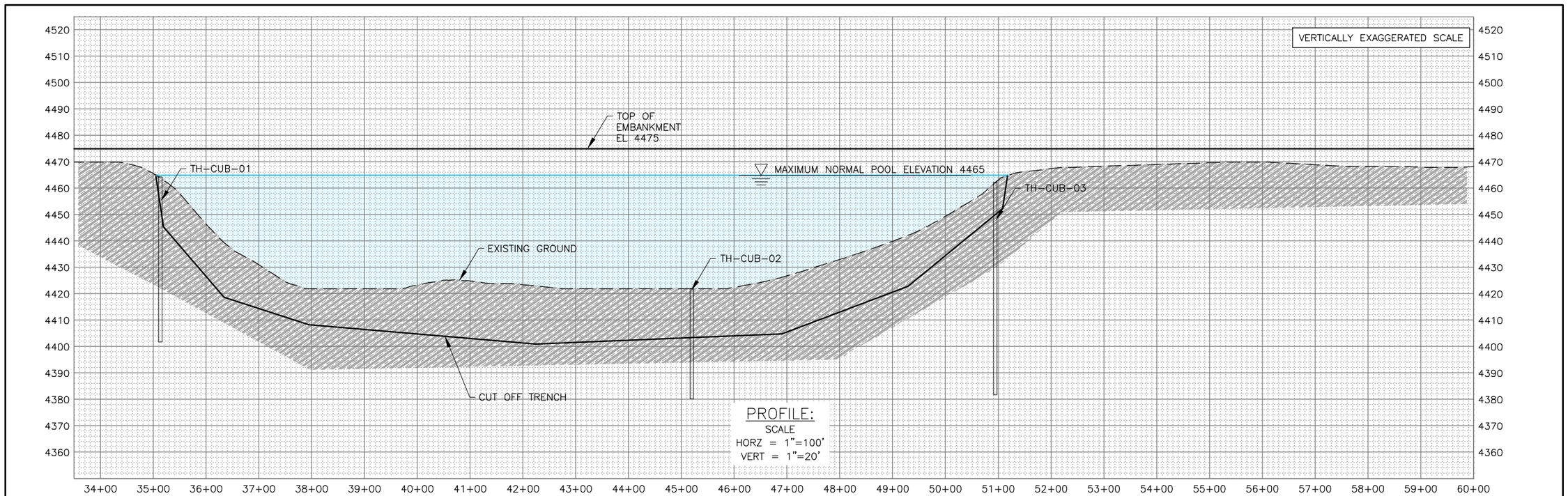
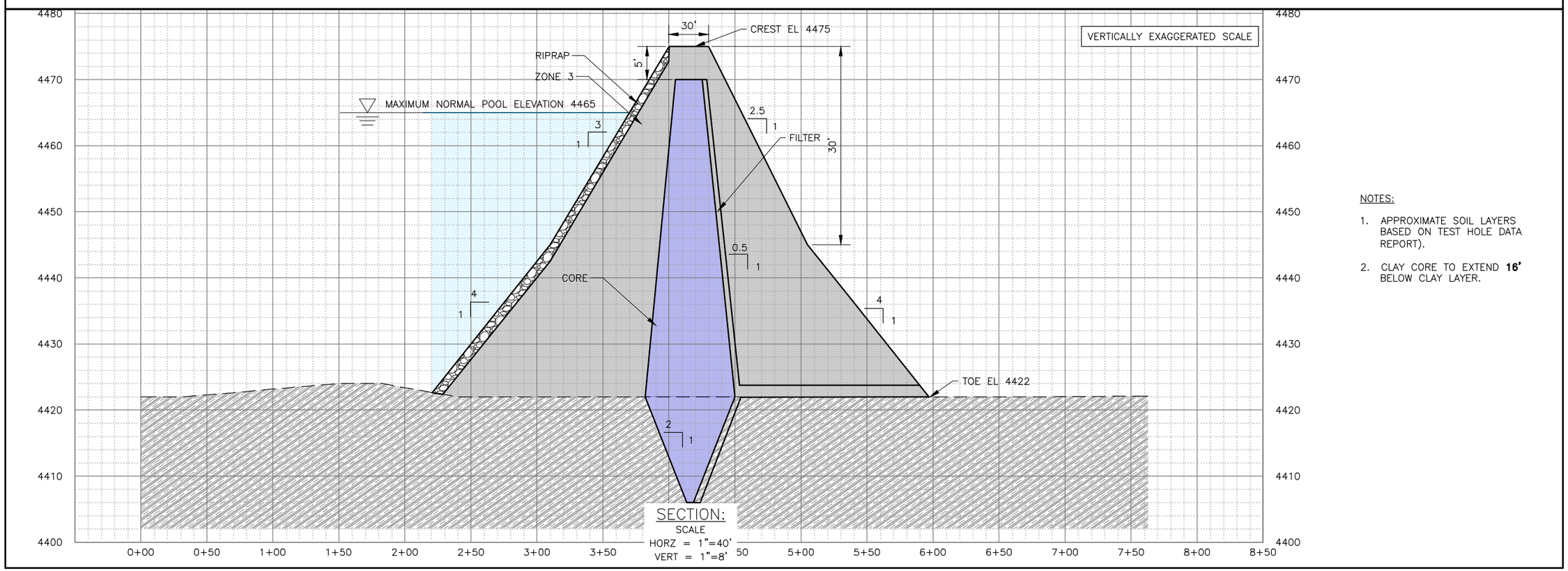


PROFILE:
SCALE
HORZ = 1"=100'
VERT = 1"=20'



SECTION:
SCALE
HORZ = 1"=40'
VERT = 1"=8'

NOTES:

1. APPROXIMATE SOIL LAYERS BASED ON TEST HOLE DATA REPORT).
2. CLAY CORE TO EXTEND **16'** BELOW CLAY LAYER.

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CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
DIVISION OF WATER RESOURCES

BEAR RIVER DEVELOPMENT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

REVIEW
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DESIGN T. SEAMONS
DRAWN S. RIGGS

CIVIL
CUB RIVER DAM
PROFILE AND SECTION

DATE: MARCH 2017
PROJECT NUMBER 233-14-01

DRAWING NO.
C-03
SHEET 3 OF 3

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CHAPTER 9 FIGURES

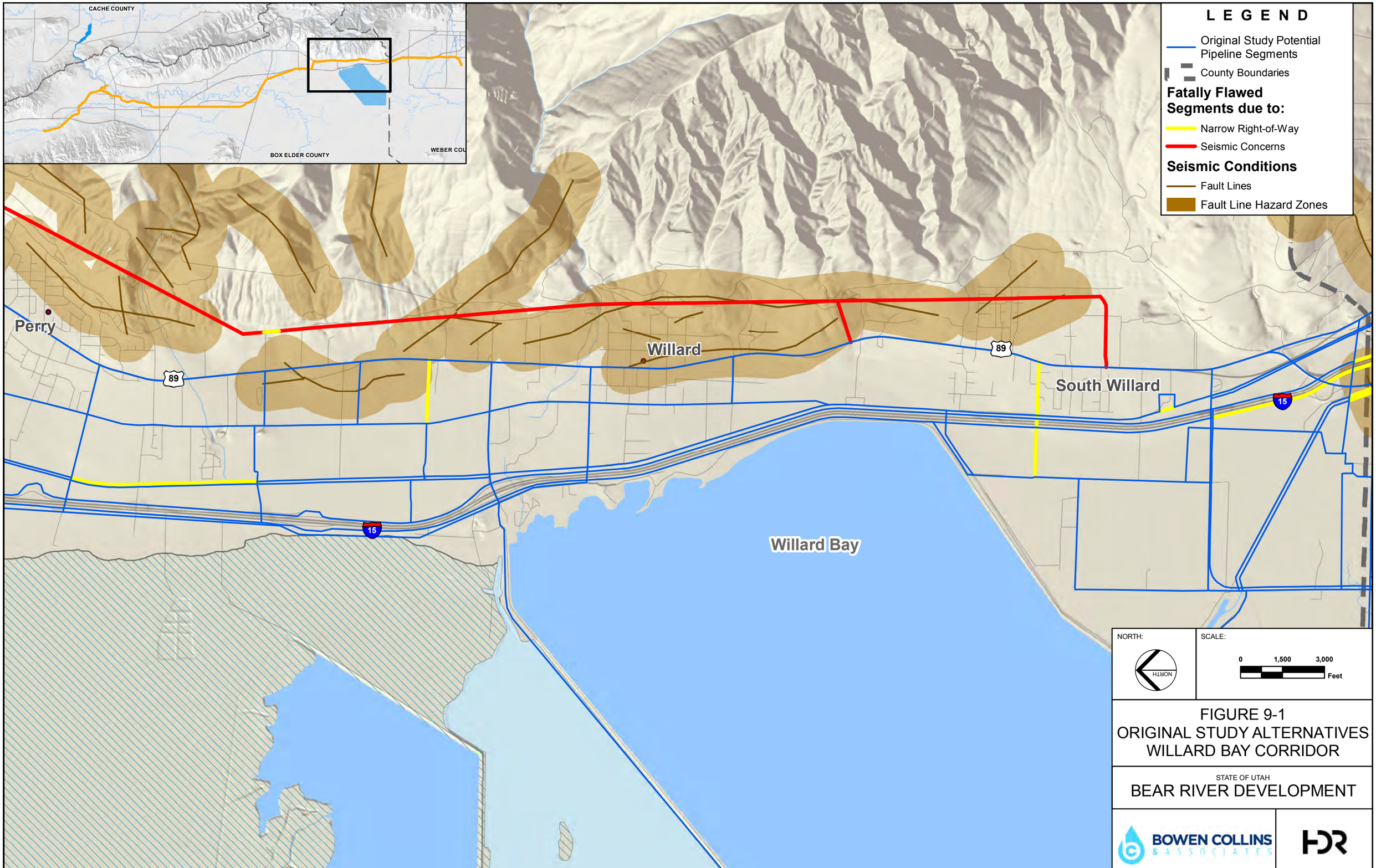

FIGURE 9-1
ORIGINAL STUDY ALTERNATIVES
WILLARD BAY CORRIDOR

STATE OF UTAH
BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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FIGURE 9-2 - ORIGINAL RECOMMENDED ALIGNMENT WILLARD BAY CORRIDOR

STATE OF UTAH

BEAR RIVER DEVELOPMENT

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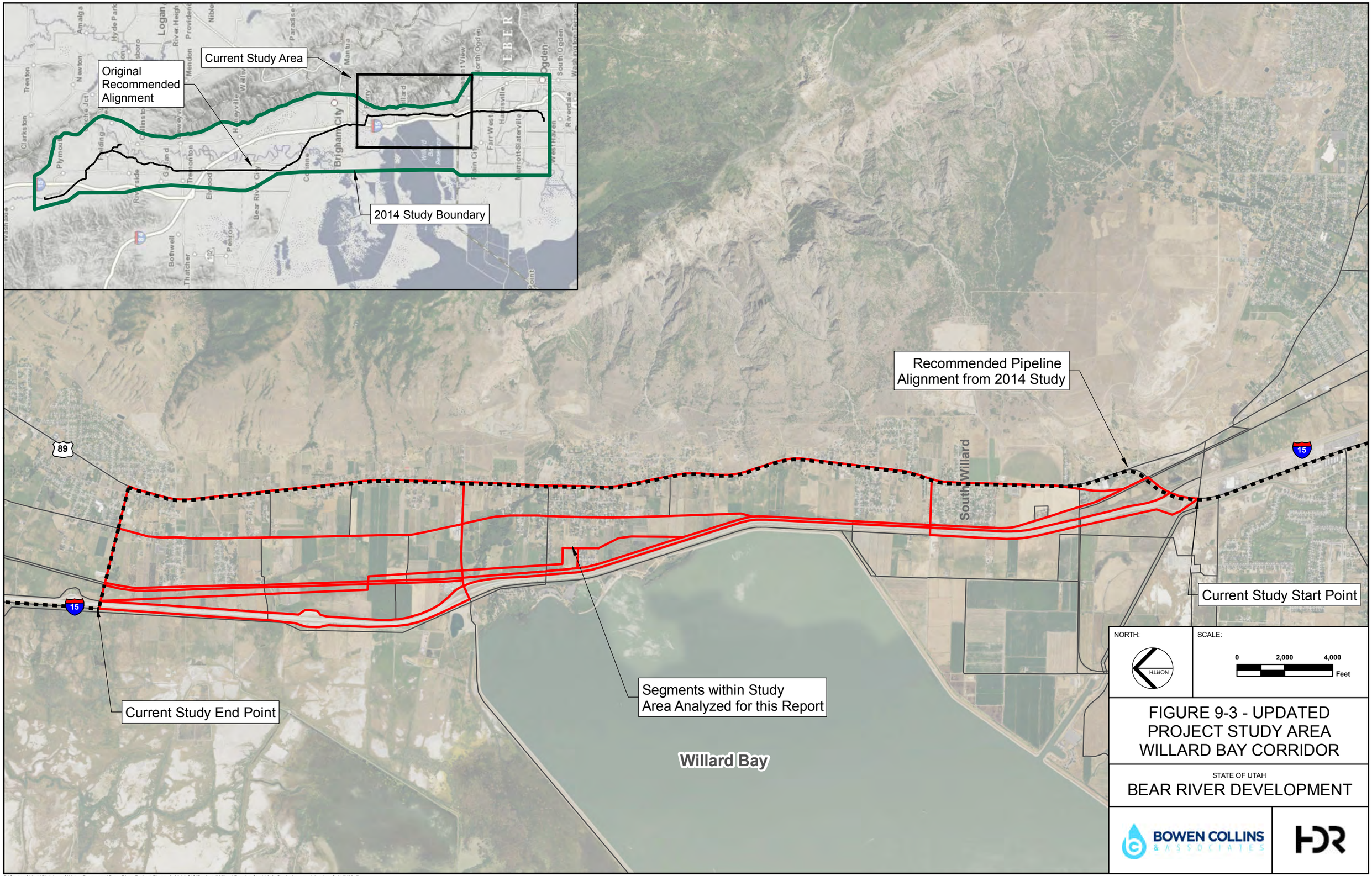

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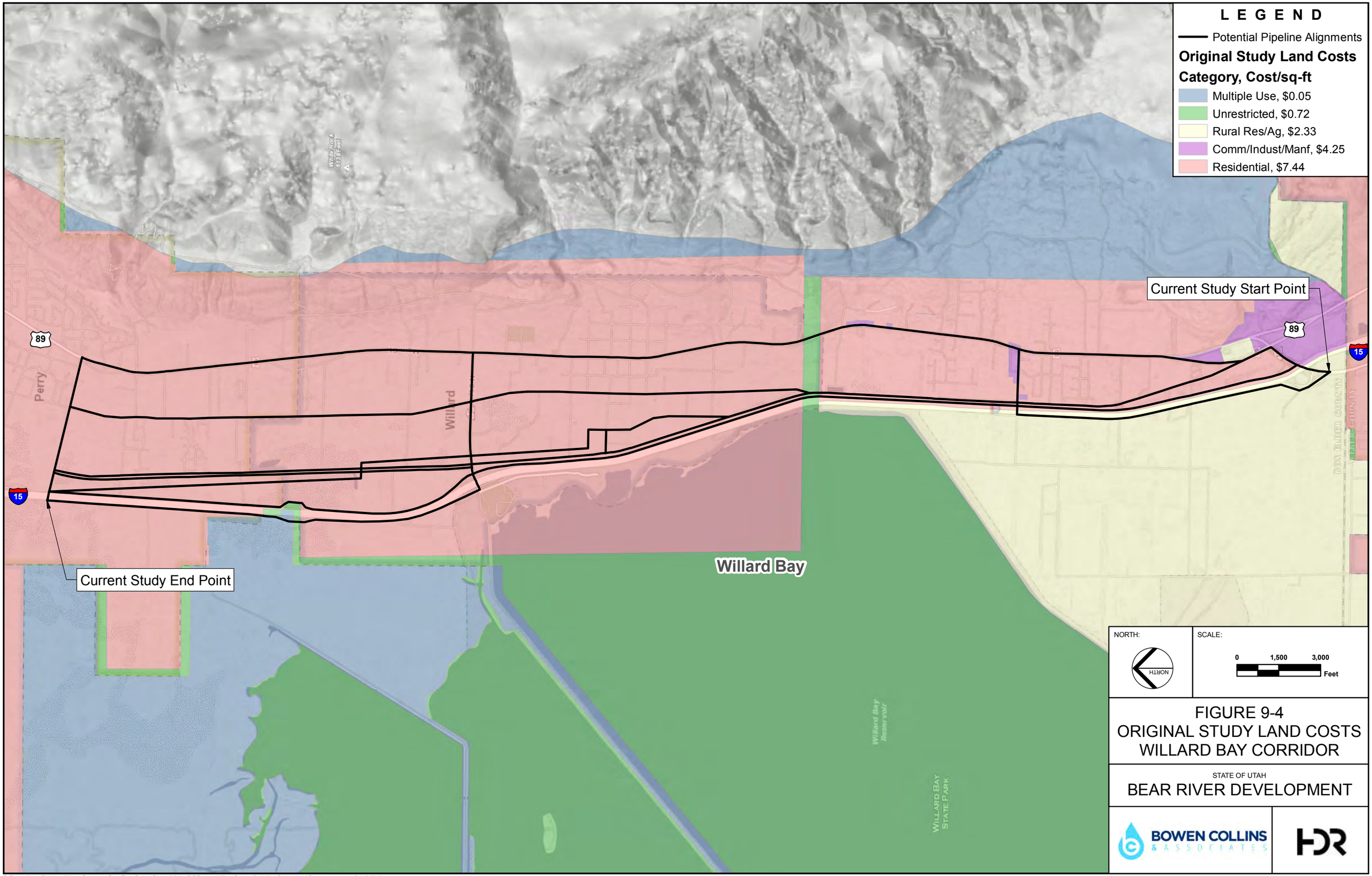

FIGURE 9-4
ORIGINAL STUDY LAND COSTS
WILLARD BAY CORRIDOR

STATE OF UTAH
BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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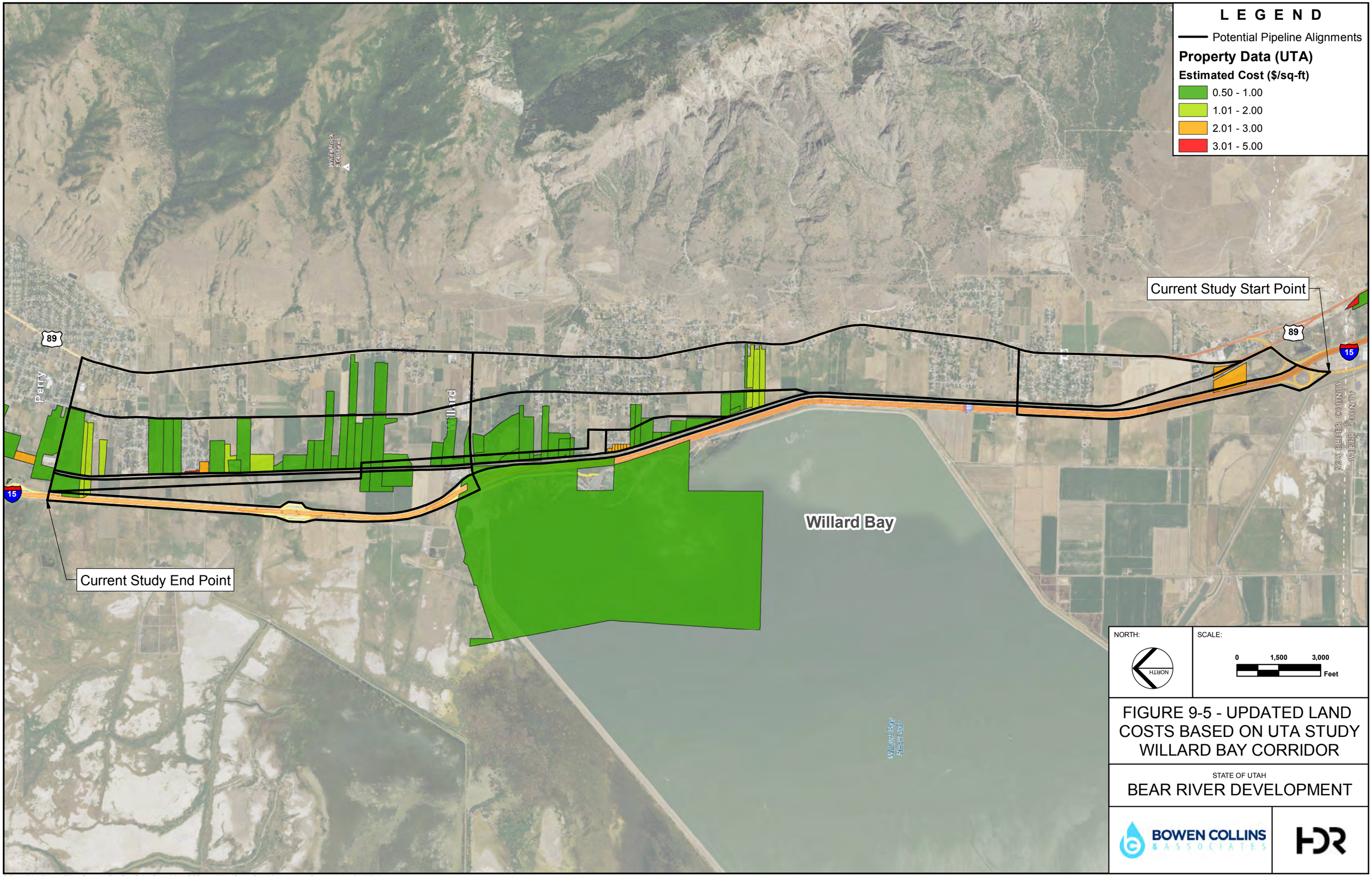

FIGURE 9-5 - UPDATED LAND COSTS BASED ON UTA STUDY WILLARD BAY CORRIDOR

STATE OF UTAH

BEAR RIVER DEVELOPMENT

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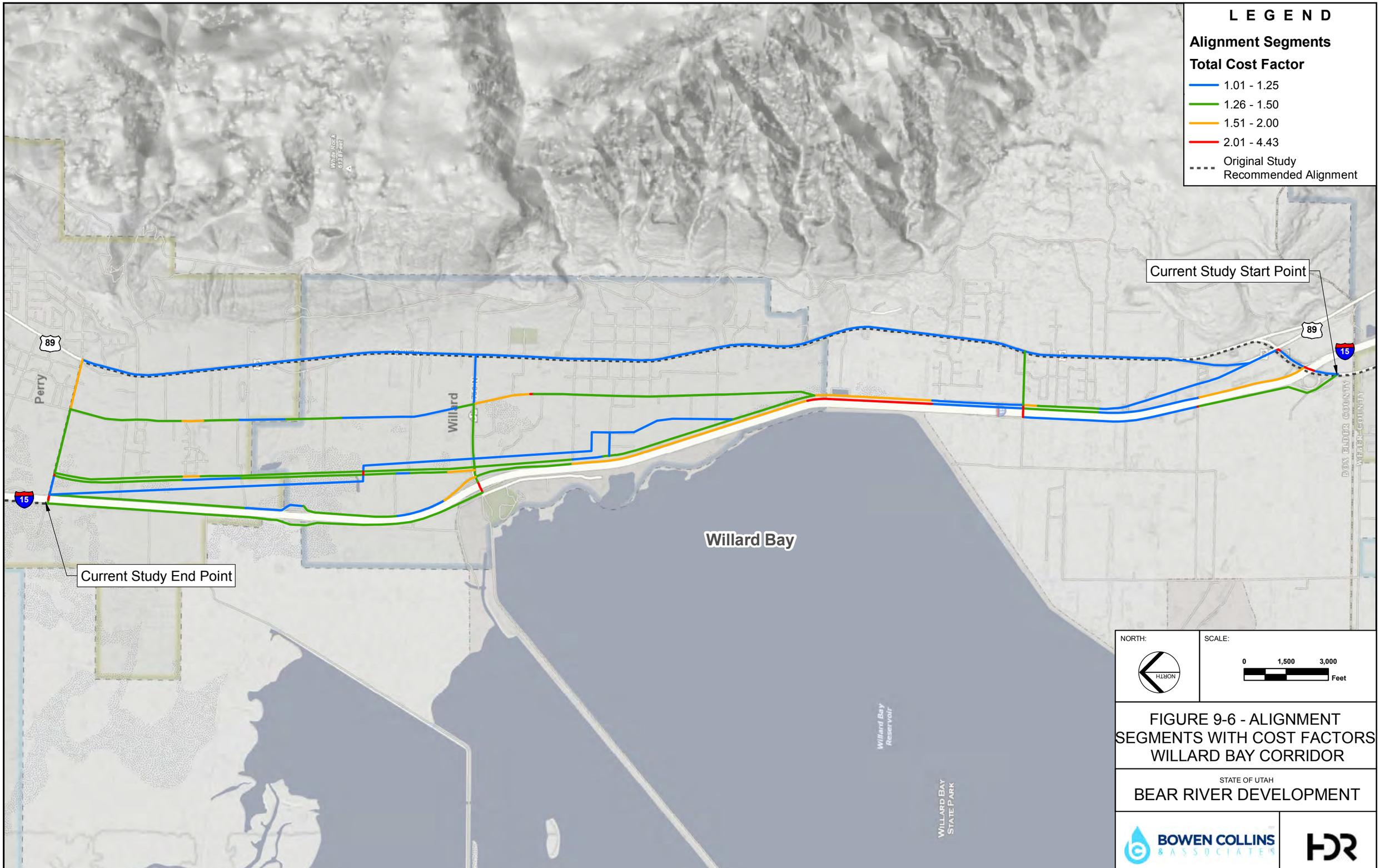

FIGURE 9-6 - ALIGNMENT SEGMENTS WITH COST FACTORS WILLARD BAY CORRIDOR

STATE OF UTAH

BEAR RIVER DEVELOPMENT

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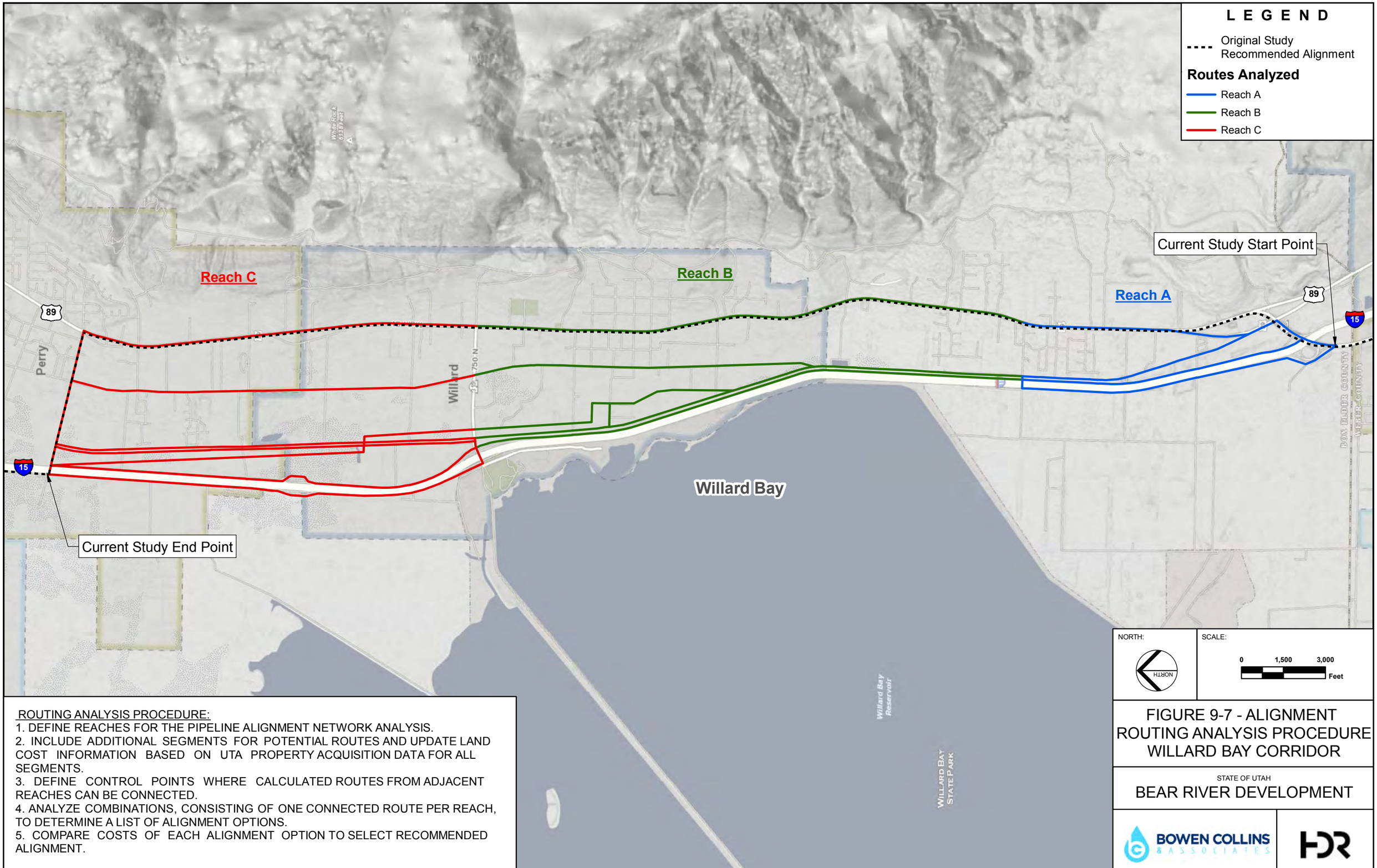

ROUTING ANALYSIS PROCEDURE:

1. DEFINE REACHES FOR THE PIPELINE ALIGNMENT NETWORK ANALYSIS.
2. INCLUDE ADDITIONAL SEGMENTS FOR POTENTIAL ROUTES AND UPDATE LAND COST INFORMATION BASED ON UTA PROPERTY ACQUISITION DATA FOR ALL SEGMENTS.
3. DEFINE CONTROL POINTS WHERE CALCULATED ROUTES FROM ADJACENT REACHES CAN BE CONNECTED.
4. ANALYZE COMBINATIONS, CONSISTING OF ONE CONNECTED ROUTE PER REACH, TO DETERMINE A LIST OF ALIGNMENT OPTIONS.
5. COMPARE COSTS OF EACH ALIGNMENT OPTION TO SELECT RECOMMENDED ALIGNMENT.

FIGURE 9-7 - ALIGNMENT ROUTING ANALYSIS PROCEDURE WILLARD BAY CORRIDOR

STATE OF UTAH

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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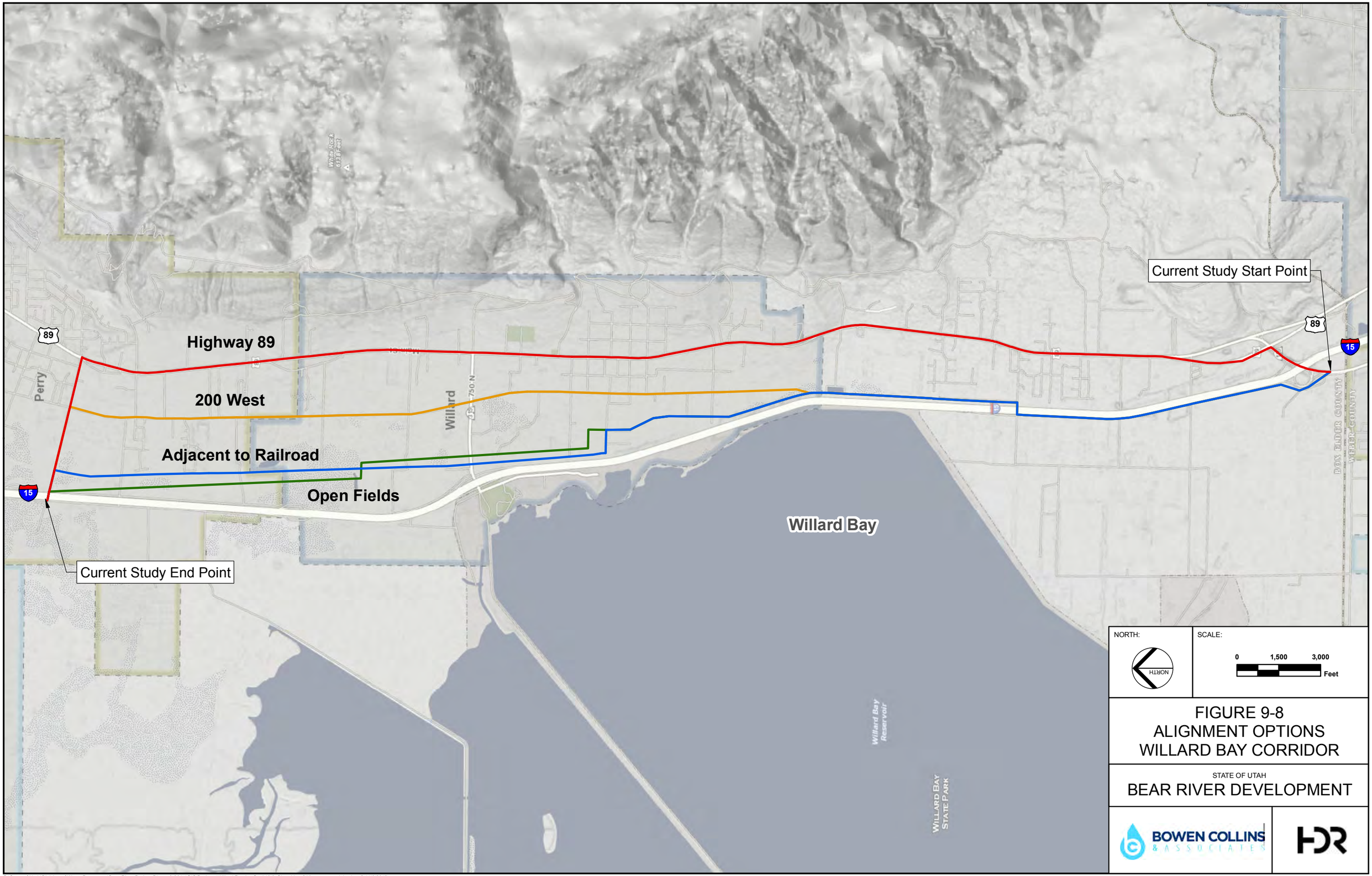

FIGURE 9-8
ALIGNMENT OPTIONS
WILLARD BAY CORRIDOR

STATE OF UTAH
BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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FIGURE 9-10 - RECOMMENDED ALIGNMENT CORRIDOR WILLARD BAY CORRIDOR

STATE OF UTAH

BEAR RIVER DEVELOPMENT

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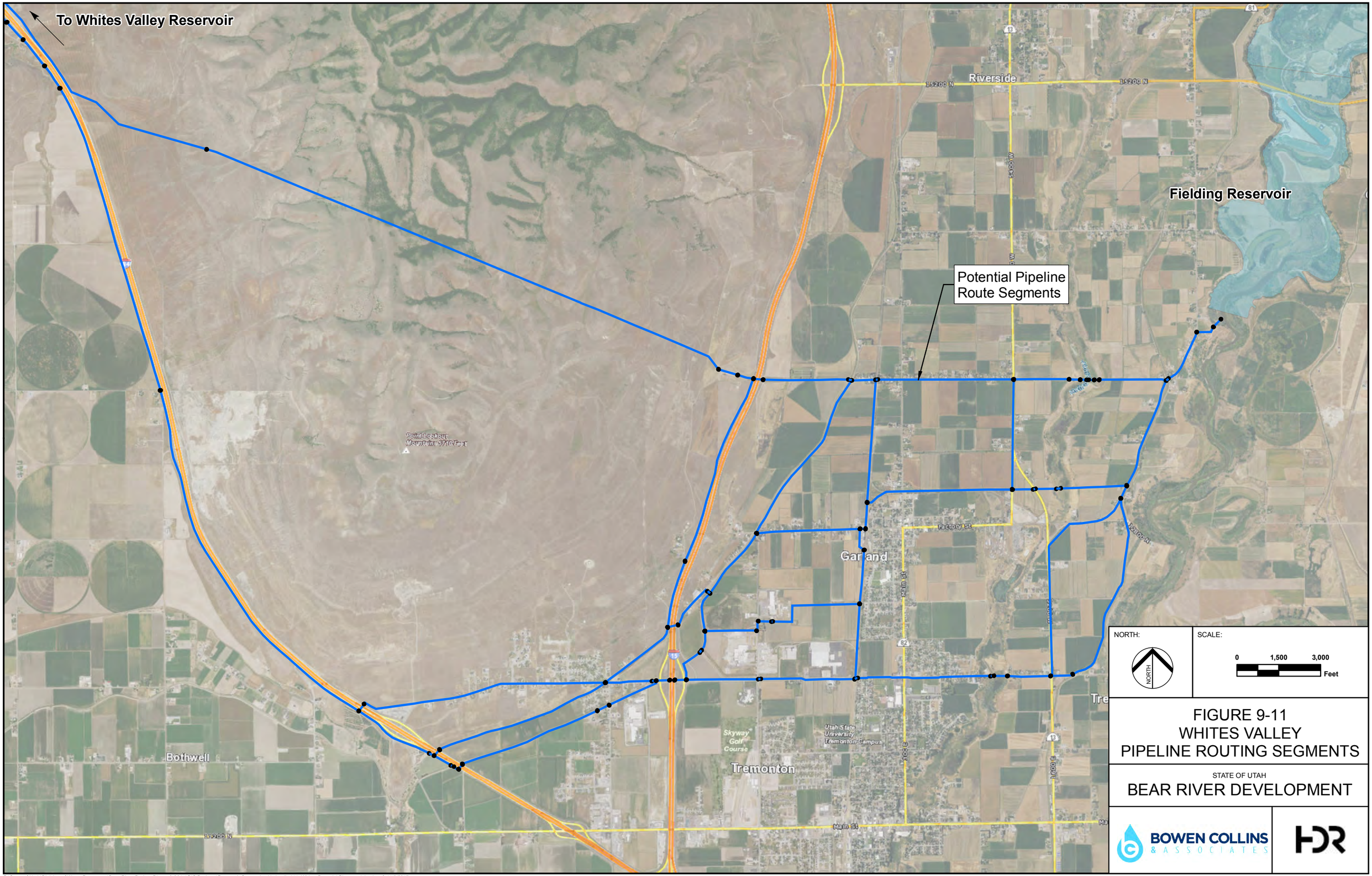

FIGURE 9-11
WHITES VALLEY
PIPELINE ROUTING SEGMENTS

STATE OF UTAH
BEAR RIVER DEVELOPMENT

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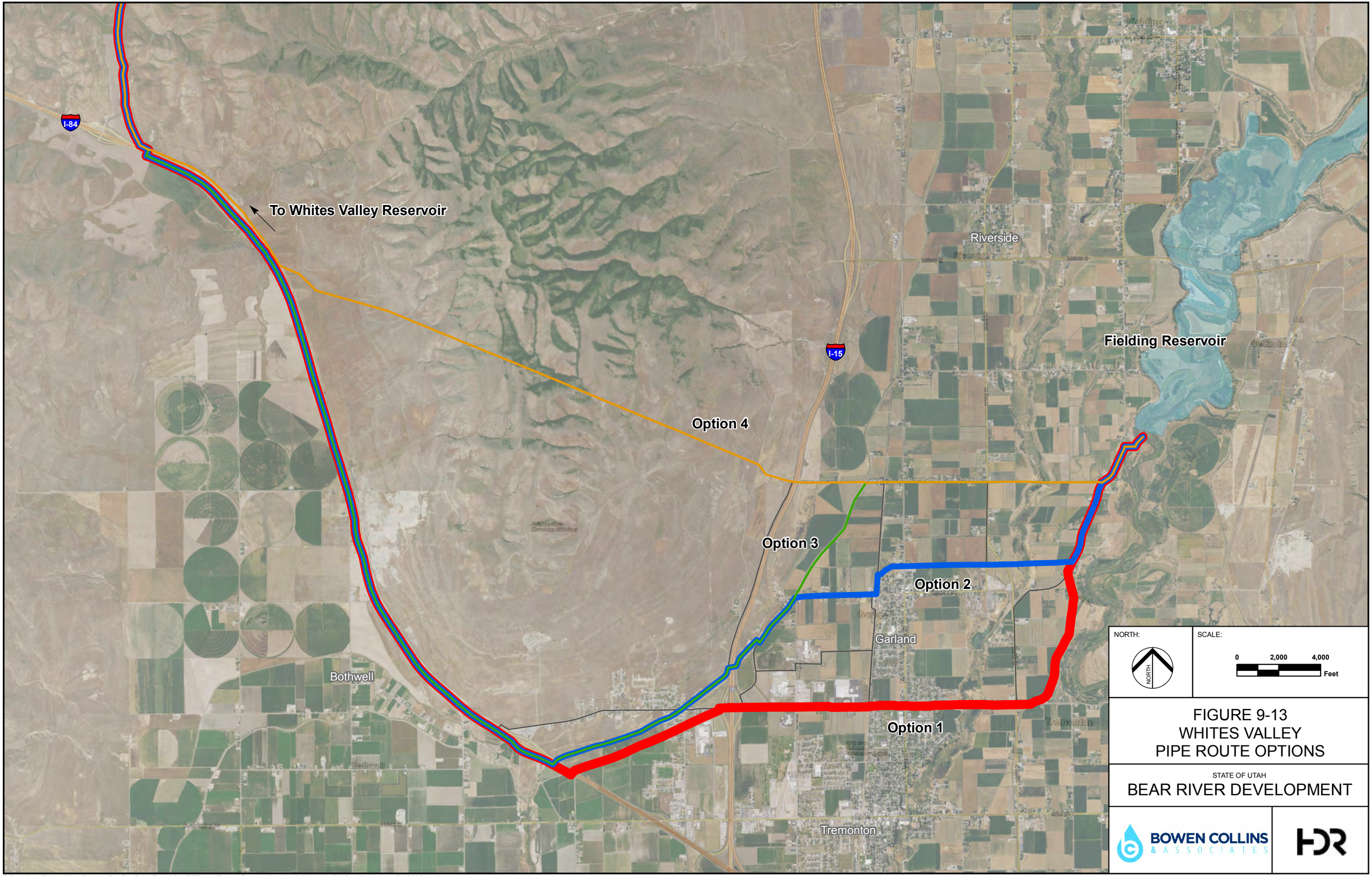

FIGURE 9-13
WHITES VALLEY
PIPE ROUTE OPTIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT

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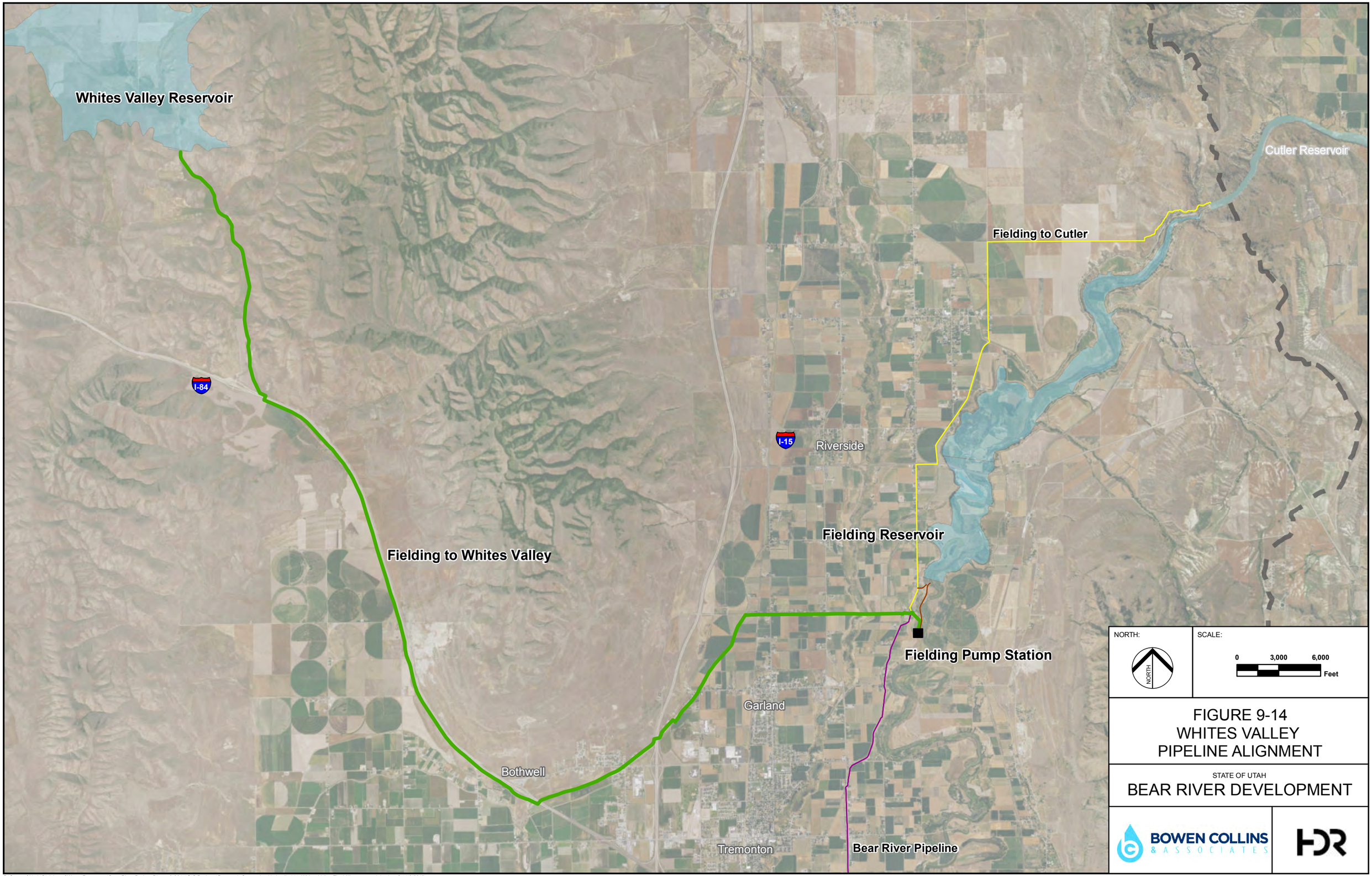

FIGURE 9-14
WHITES VALLEY
PIPELINE ALIGNMENT

STATE OF UTAH
BEAR RIVER DEVELOPMENT

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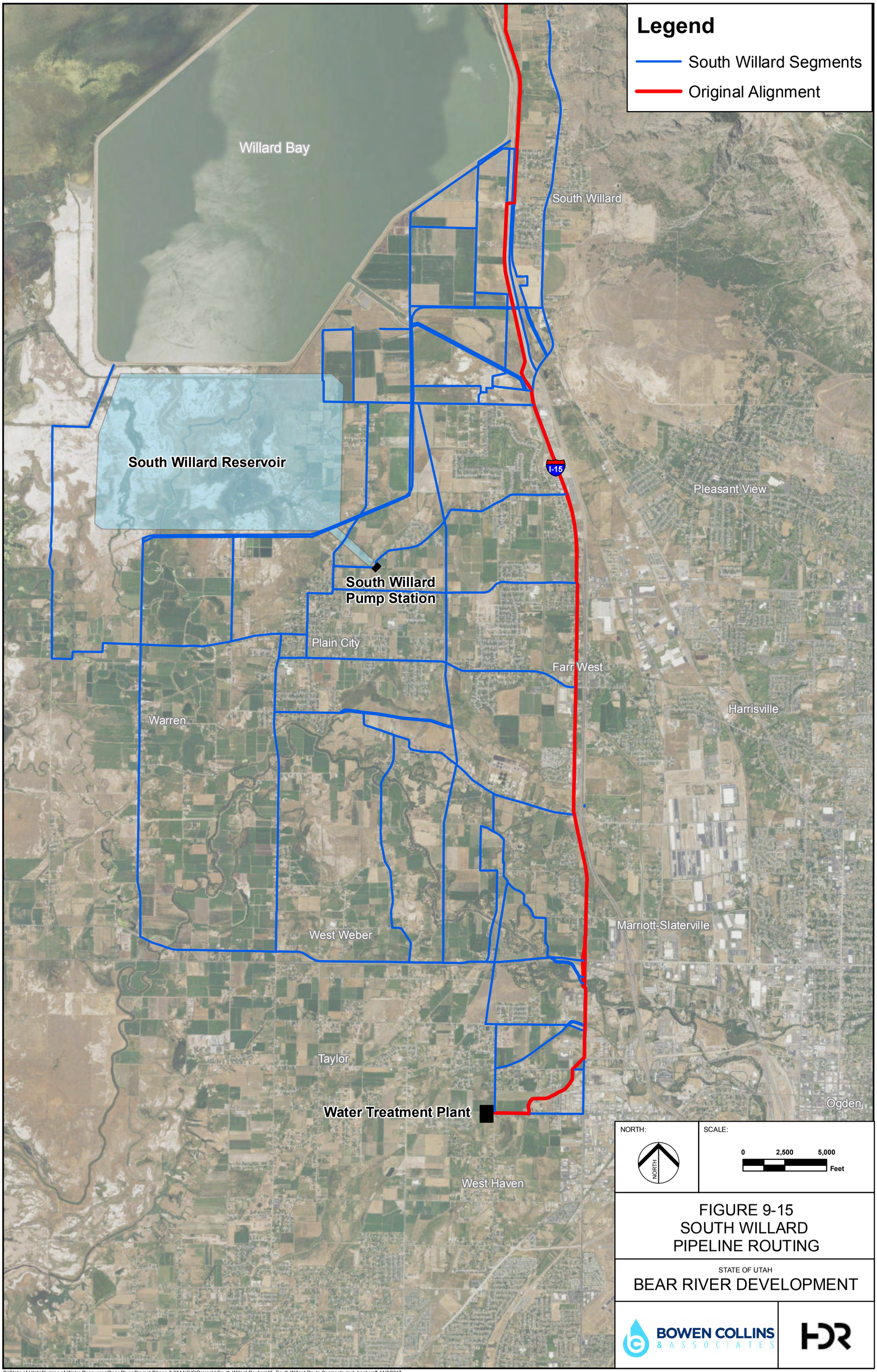

FIGURE 9-15
SOUTH WILLARD
PIPELINE ROUTING

STATE OF UTAH
BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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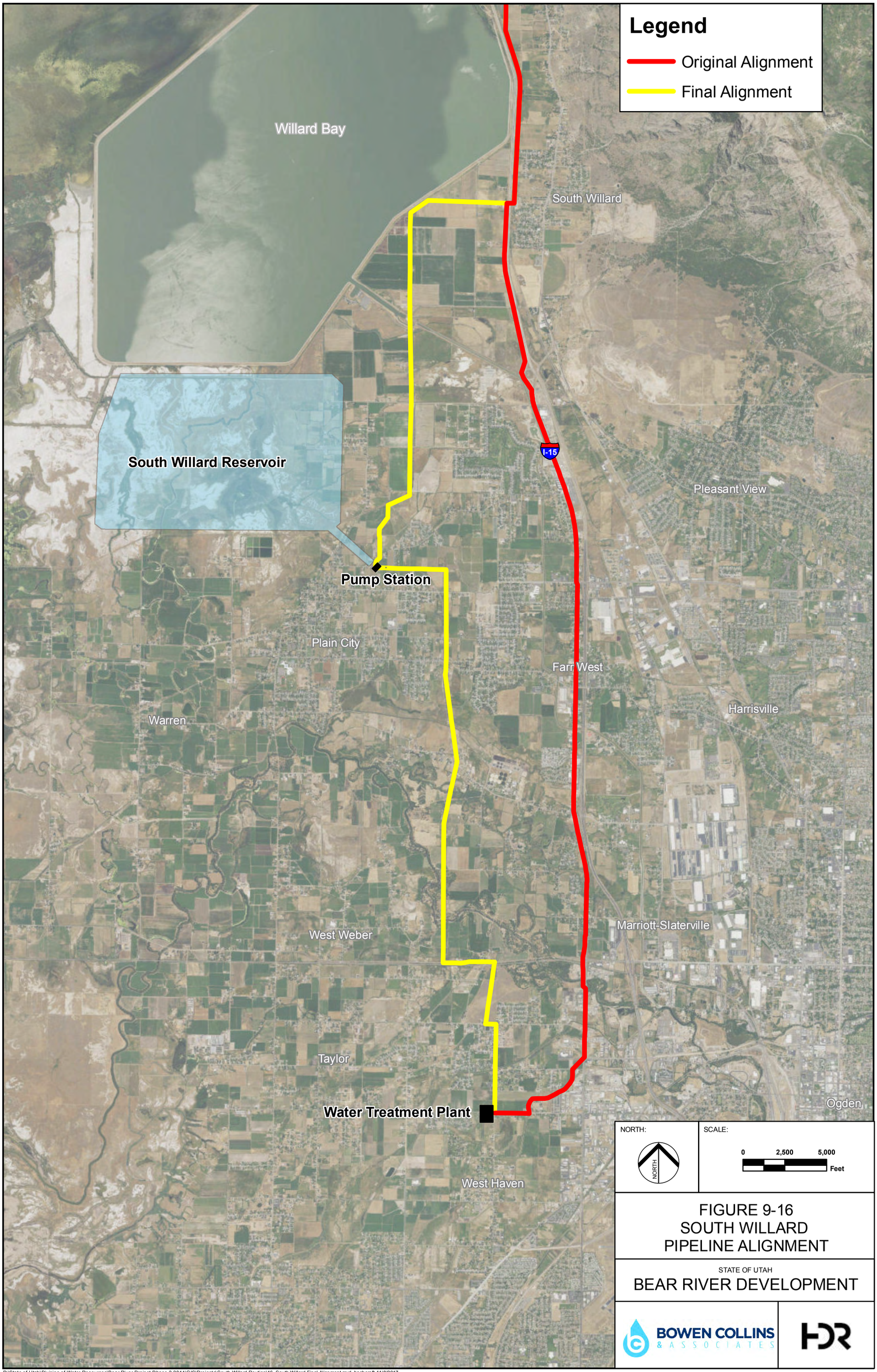

FIGURE 9-16
SOUTH WILLARD
PIPELINE ALIGNMENT

STATE OF UTAH
BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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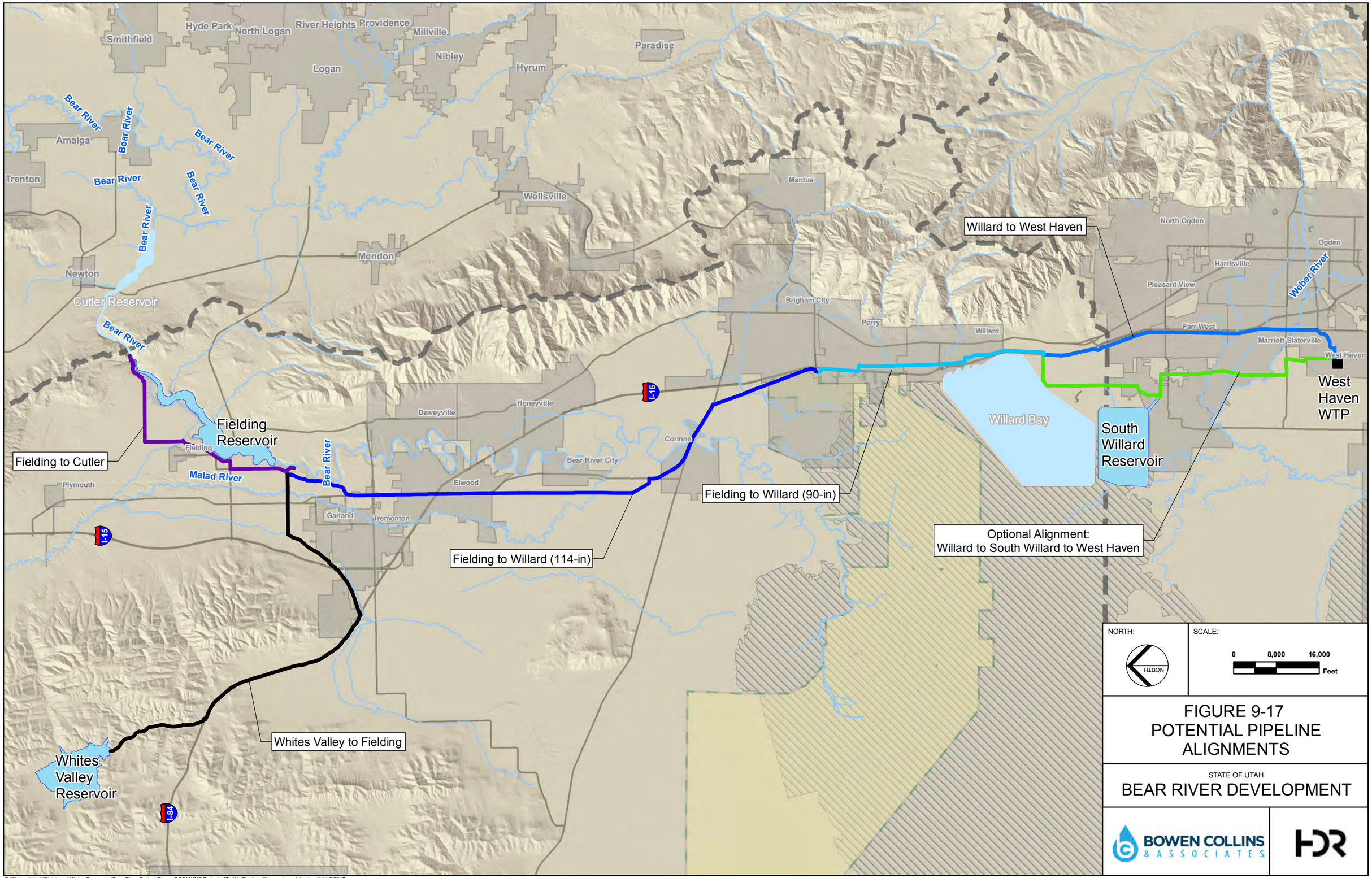

FIGURE 9-17
POTENTIAL PIPELINE ALIGNMENTS

STATE OF UTAH
BEAR RIVER DEVELOPMENT

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CHAPTER 10 FIGURES

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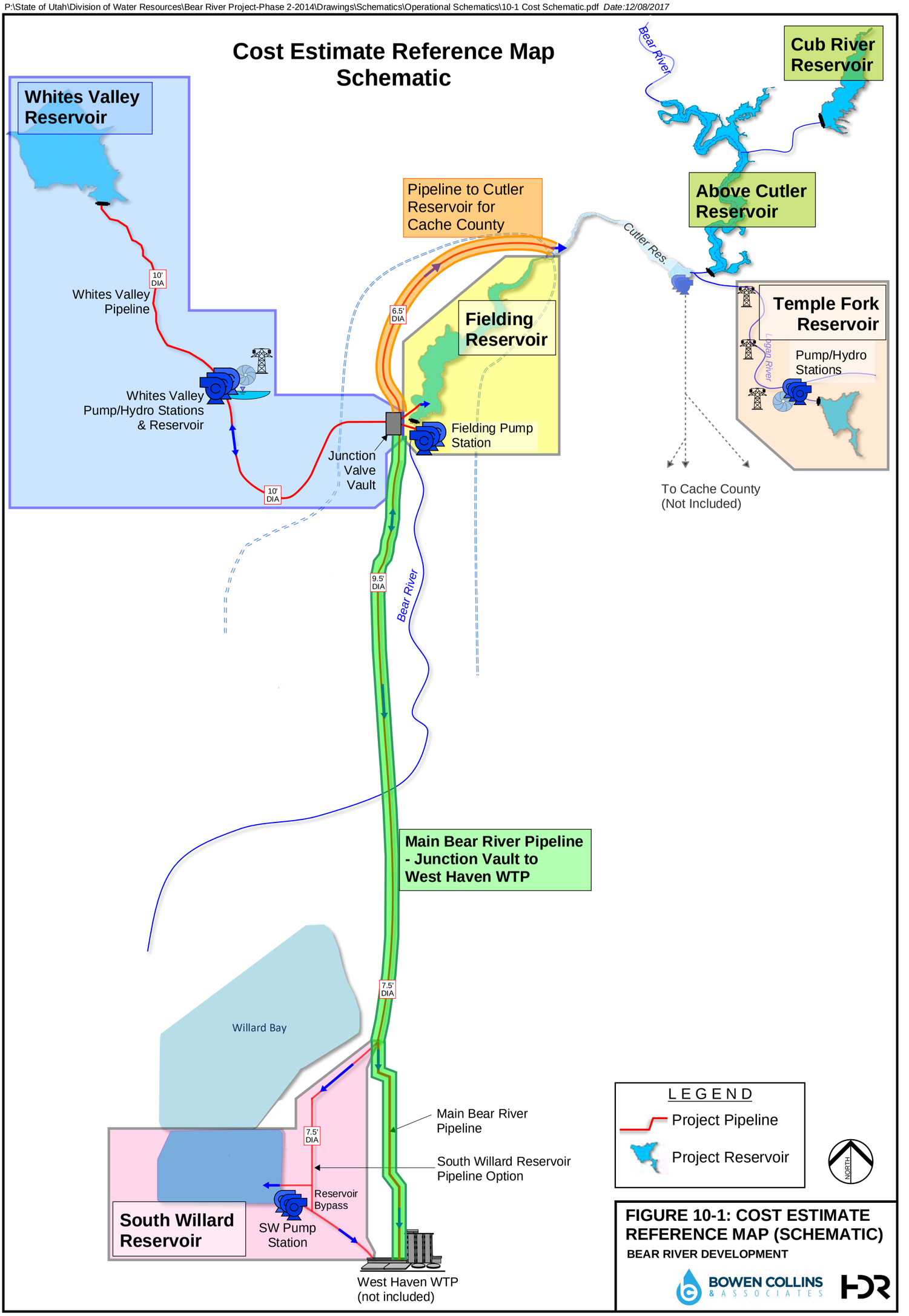

FIGURE 10-1: COST ESTIMATE REFERENCE MAP (SCHEMATIC)

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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Bear River Development Cost Comparison

Reservoir Combination Scenario A Cost

Small Fieldling, Large Whites Valley

	Storage Summary	
Fielding Reservoir	40,000	(smaller)
Whites Valley Reservoir	360,000	
TOTAL	**400,000**	

Last Update: 12/8/2017 Aug 2017 ENR 10,842

Scenario A

Cost Item	TOTAL	Comments
Fielding Reservoir (40k AF)	**Subtotal**	**$169,527,000**
Dam and Reservoir	$151,447,000	
Land Acquisition & Wetland Mitigation	$18,080,000	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (360k AF)	**Subtotal**	**$397,645,000**
Dam and Reservoir	$103,370,000	Escalation factor applied to dam facilities
Booster Pump Station & Reservoir	$77,717,000	includes site work & regulating reservoir
Power Cost	$47,184,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$8,080,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$462,945,000**
BRP Fielding to West Haven WTP	$399,420,000	
Fielding 40k AF Option Added BRP Pipe	$26,350,000	
Fielding to Cutler (shorter)	$37,175,000	For Cache County
	TOTAL	**$1,217,671,000**

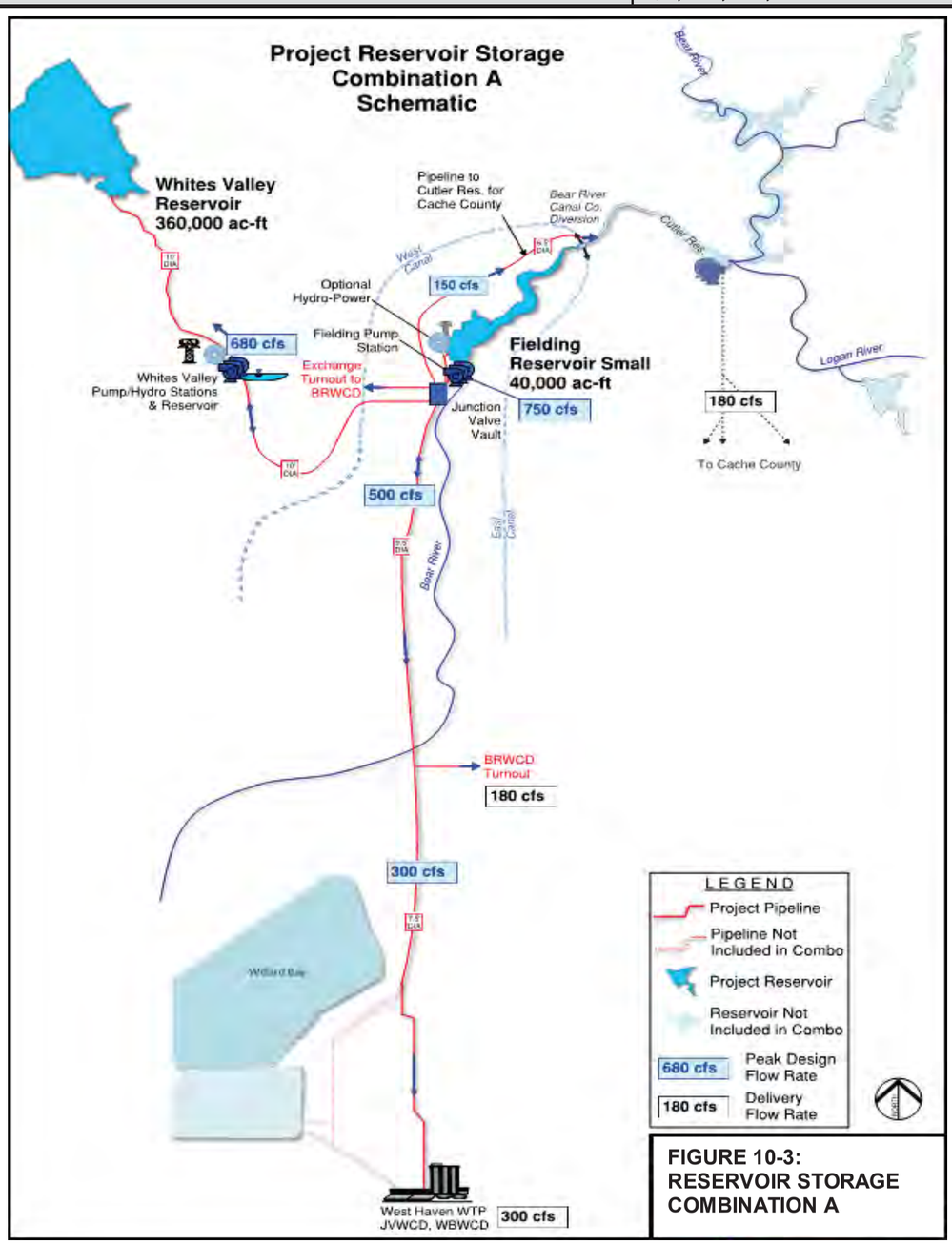

**FIGURE 10-3:
RESERVOIR STORAGE
COMBINATION A**

Bear River Development Cost Comparison

Reservoir Combination Scenario B Cost

Large Fielding, Whites Valley

	Storage Summary	
Fielding Reservoir	70,000	(larger)
Whites Valley Reservoir	330,000	
TOTAL	**400,000**	

Last Update: 12/8/2017 Aug 2017 ENR 10,842

Scenario B

Cost Item	TOTAL	Comments
Fielding Reservoir (70k AF)	**Subtotal**	**$111,355,000**
Dam and Reservoir	$76,728,000	
Land Acquisition & Wetland Mitigation	$34,627,000	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (330k AF)	**Subtotal**	**$389,651,000**
Dam and Reservoir	$97,480,000	Escalation factor applied to dam facilities
Booster Pump Station & Reservoir	$76,827,000	includes site work & regulating reservoir
Power Cost	$46,180,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$7,870,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$449,615,000**
BRP Fielding to West Haven WTP	$399,420,000	
Fielding to Cutler (longer)	$50,195,000	For Cache County
	TOTAL	**$1,138,175,000**

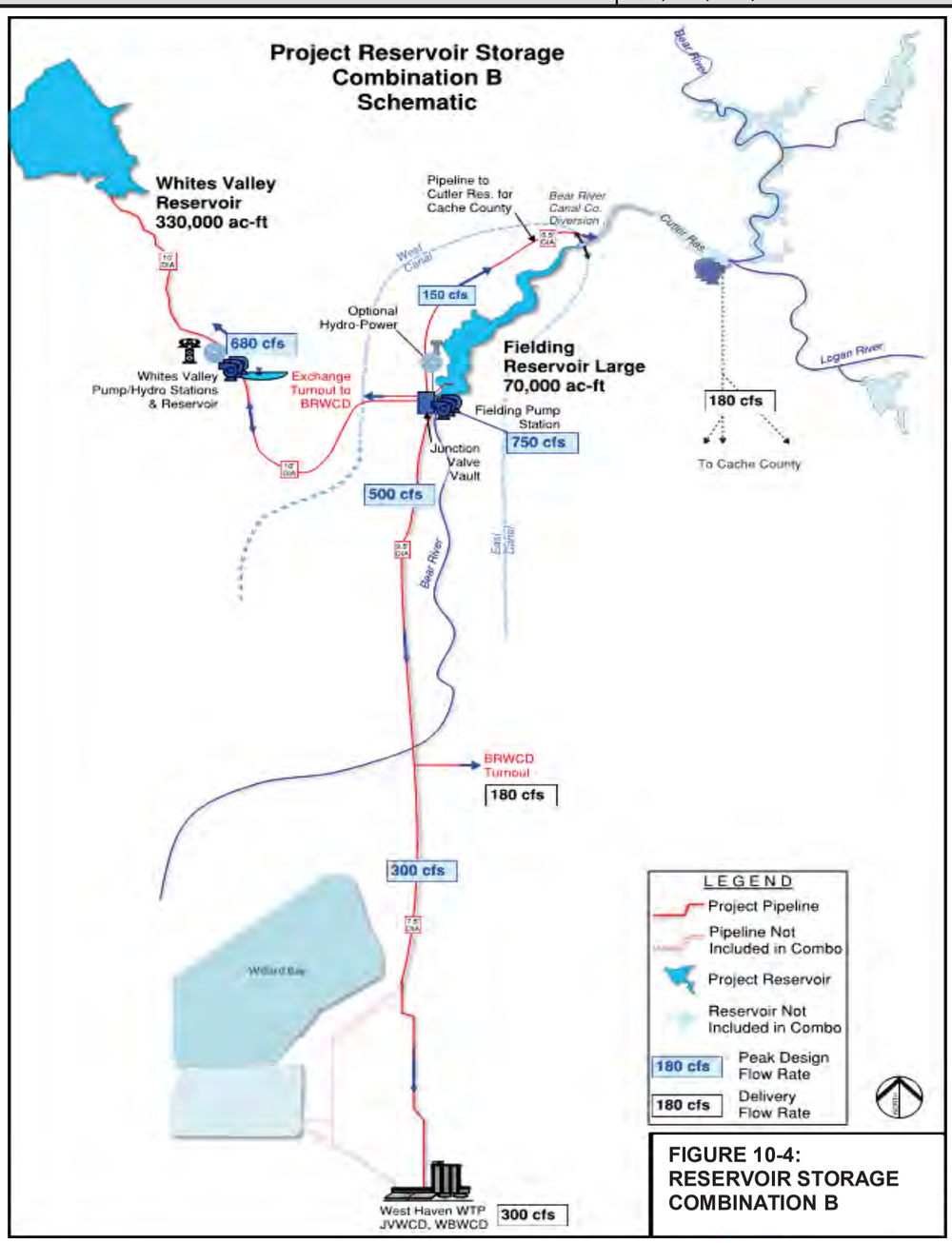

**FIGURE 10-4:
RESERVOIR STORAGE
COMBINATION B**

Bear River Development Cost Comparison

Reservoir Combination Scenario C Cost

Whites Valley Only

	Storage Summary
Fielding Reservoir	0
Whites Valley Reservoir	400,000
TOTAL	**400,000**

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Scenario C

Cost Item	TOTAL	Comments
Diversion on Bear River	**Subtotal**	**$11,686,600**
Diversion on Bear River	$7,950,000	at Fielding location
Land Acquisition & Wetland Mitigation	$3,736,600	
Pump Station at Diversion	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	Same as Fielding PS
HydroPower	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (400k AF)	**Subtotal**	**$414,726,000**
Dam and Reservoir	$117,418,000	
Booster Pump Station & Reservoir	$78,957,000	includes site work & regulating reservoir
Power Cost	$48,255,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$8,802,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$449,615,000**
BRP Fielding Diversion to West Haven WTP	$399,420,000	
Fielding to Cutler (longer)	$50,195,000	For Cache County
	TOTAL	**$1,063,581,600**

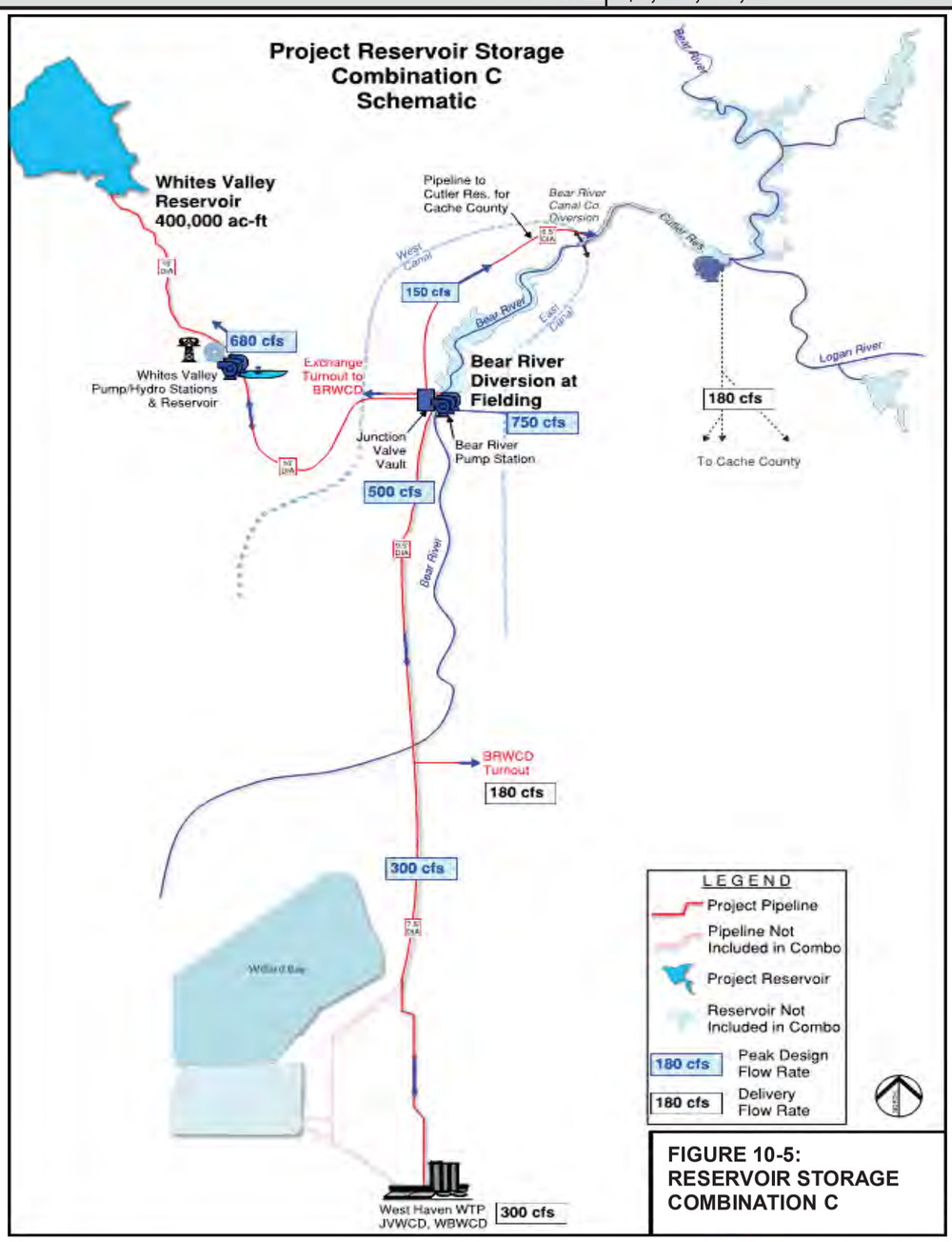

FIGURE 10-5:
RESERVOIR STORAGE
COMBINATION C

Bear River Development Cost Comparison

Reservoir Combination Scenario D Cost

All Reservoirs

	Storage Summary	
Fielding Reservoir	70,000	(larger)
Whites Valley Reservoir	170,000	
Cub River	27,000	
Above Cutler	51,000	
Temple Fork	41,000	
South Willard	55,000	
TOTAL	**414,000**	

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Scenario D

Cost Item	TOTAL	Comments
Fielding Reservoir (70k AF)	**Subtotal**	**$111,355,000**
Dam and Reservoir	$76,728,000	
Land Acquisition & Wetland Mitigation	$34,627,000	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (170k AF)	**Subtotal**	**$360,672,000**
Dam and Reservoir	$84,016,000	
Booster Pump Station & Reservoir	$72,355,000	includes site work & regulating reservoir
Power Cost	$36,197,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$6,810,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$430,780,000**
BRP Fielding to So.Willard to West Haven WTP	$430,780,000	
Cub River Reservoir	**Subtotal**	**$113,461,000**
Dam and Reservoir Facilities	$54,448,000	
Land Acquisition & Wetland Mitigation	$59,013,000	
Above Cutler Reservoir	**Subtotal**	**$285,506,000**
Dam and Reservoir Facilities	$79,586,000	
Land Acquisition & Wetland Mitigation	$205,920,000	
Temple Fork Reservoir	**Subtotal**	**$100,009,000**
Dam and Reservoir	$73,532,000	
Pump Station	$21,300,000	
Supply/Discharge Pipeline & Facilities	$2,169,000	
Power Cost	$2,008,000	includes Hydro Power recovery
Land Acquisition & Wetland Mitigation	$1,000,000	
South Willard Reservoir	**Subtotal**	**$396,433,000**
Dam Embankment and Reservoir	$151,102,500	
Outlet Pump Station	$23,717,000	
Pump Power Cost	$12,117,500	
Land Acquisition & Wetland Mitigation	$209,496,000	
	TOTAL	**$1,985,770,000**

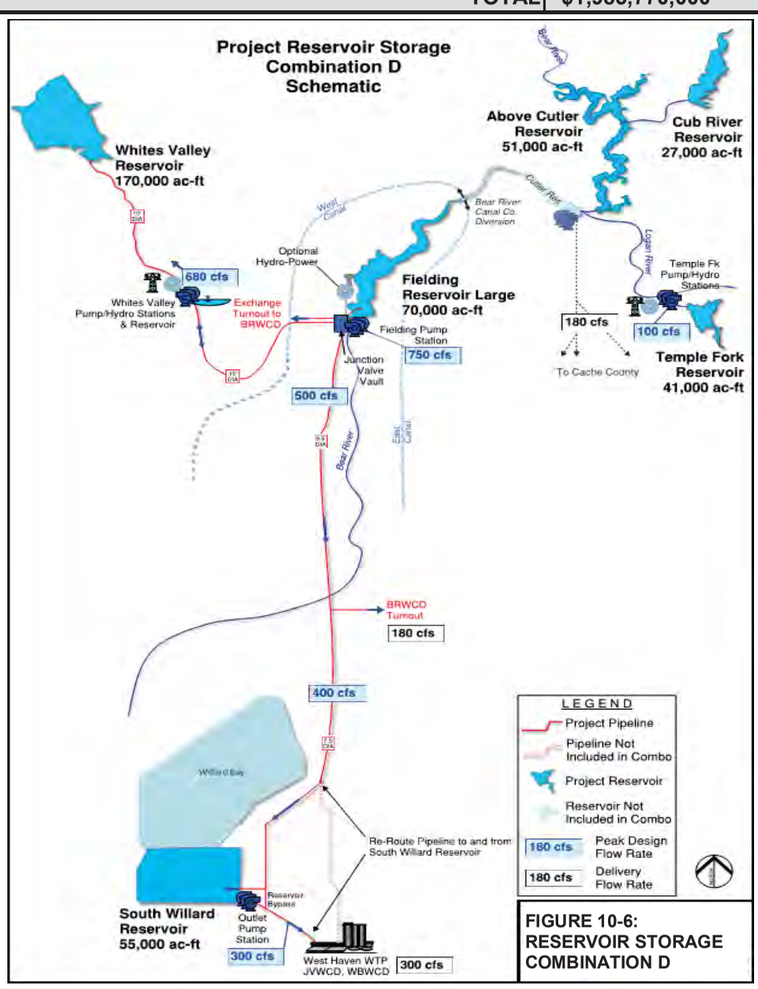

FIGURE 10-6: RESERVOIR STORAGE COMBINATION D

Bear River Development Cost Comparison

Reservoir Combination Scenario E Cost

Cub, Fielding, Whites Valley

	Storage Summary	
Fielding Reservoir	40,000	(smaller)
Whites Valley Reservoir	333,000	
Cub River	27,000	
Above Cutler	0	
Temple Fork	0	
South Willard	0	
TOTAL	**400,000**	

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Scenario E

Cost Item	TOTAL	Comments
Fielding Reservoir (40k AF)	**Subtotal**	**$169,527,000**
Dam and Reservoir	$151,447,000	
Land Acquisition & Wetland Mitigation	$18,080,000	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (333k AF)	**Subtotal**	**$388,140,000**
Dam and Reservoir	$98,010,000	Escalation factor applied to dam facilities
Booster Pump Station & Reservoir	$77,047,000	includes site work & regulating reservoir
Power Cost	$43,889,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$7,900,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$462,945,000**
BRP Fielding to West Haven WTP	$399,420,000	
Fielding 40k AF Option Added BRP Pipe	$26,350,000	
Fielding to Cutler (shorter)	$37,175,000	For Cache County
Cub River Reservoir	**Subtotal**	**$113,461,000**
Dam and Reservoir Facilities	$54,448,000	
Land Acquisition & Wetland Mitigation	$59,013,000	
	TOTAL	**$1,321,627,000**

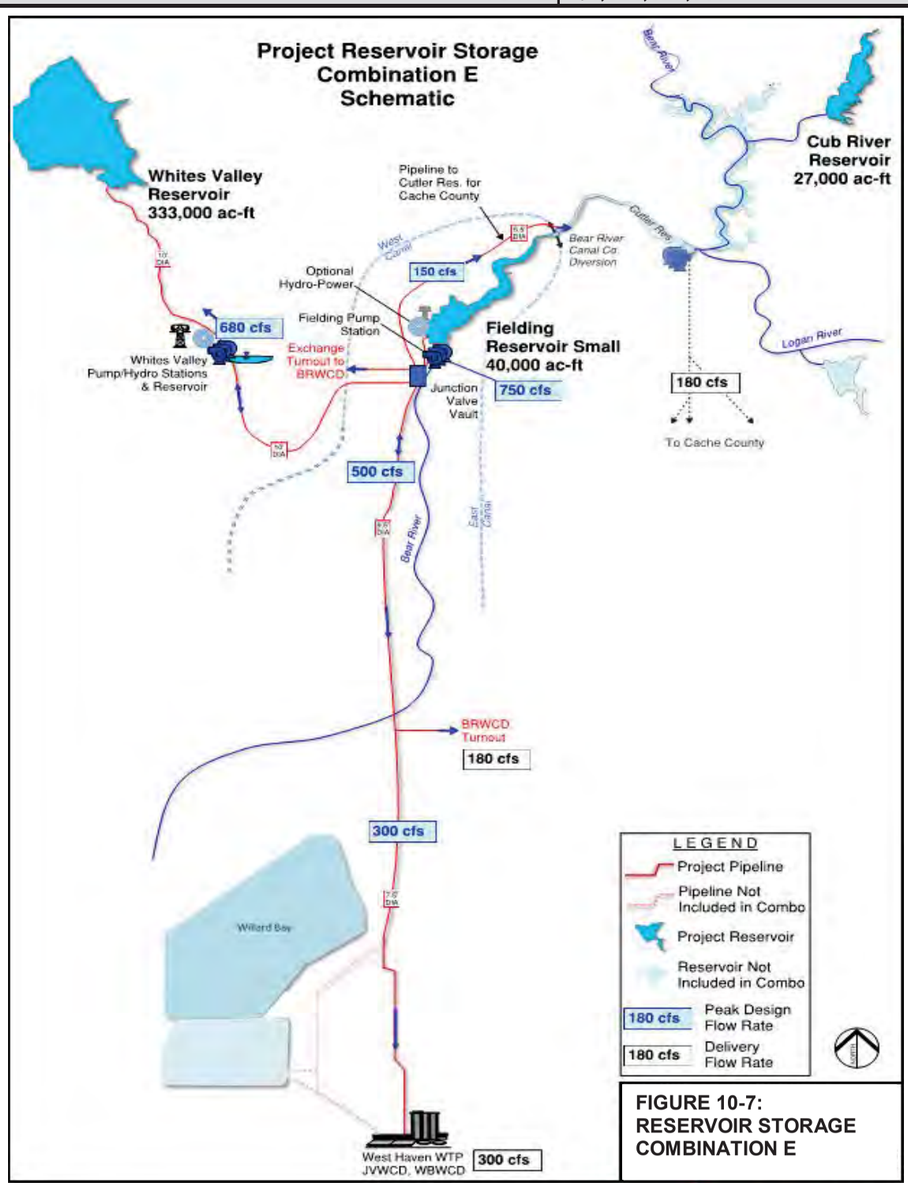

FIGURE 10-7:
RESERVOIR STORAGE
COMBINATION E

Bear River Development Cost Comparison

Reservoir Combination Scenario F Cost

Above Cutler, Fielding, Whites Valley

	Storage Summary	
Fielding Reservoir	40,000	(smaller)
Whites Valley Reservoir	309,000	
Cub River	0	
Above Cutler	51,000	
Temple Fork	0	
South Willard	0	
TOTAL	**400,000**	

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Scenario F

Cost Item	TOTAL	Comments
Fielding Reservoir (40k AF)	**Subtotal**	**$169,527,000**
Dam and Reservoir	$151,447,000	
Land Acquisition & Wetland Mitigation	$18,080,000	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (309k AF)	**Subtotal**	**$384,842,000**
Dam and Reservoir	$94,030,000	Escalation factor applied to dam facilities
Booster Pump Station & Reservoir	$76,097,000	includes site work & regulating reservoir
Power Cost	$45,711,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$7,710,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$462,945,000**
BRP Fielding to West Haven WTP	$399,420,000	
Fielding 40k AF Option Added BRP Pipe	$26,350,000	
Fielding to Cutler (shorter)	$37,175,000	For Cache County
Above Cutler Reservoir	**Subtotal**	**$285,506,000**
Dam and Reservoir Facilities	$79,586,000	
Land Acquisition & Wetland Mitigation	$205,920,000	
	TOTAL	**$1,490,374,000**

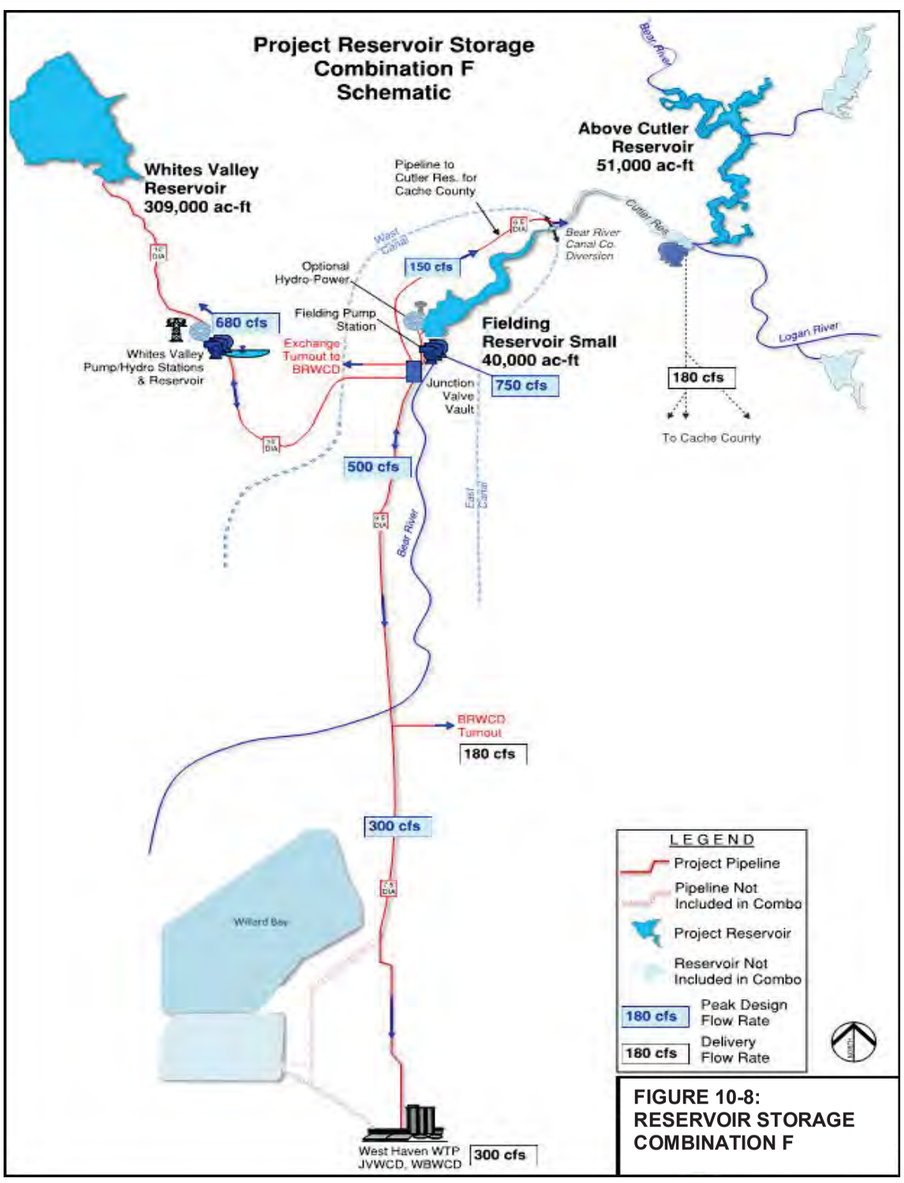

FIGURE 10-8:
RESERVOIR STORAGE
COMBINATION F

Bear River Development Cost Comparison

Reservoir Combination Scenario G Cost

Temple Fork, Fielding, Whites Valley

	Storage Summary	
Fielding Reservoir	40,000	(smaller)
Whites Valley Reservoir	319,000	
Cub River	0	
Above Cutler	0	
Temple Fork	41,000	
South Willard	0	
TOTAL	**400,000**	

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Scenario G

Cost Item	TOTAL	Comments
Fielding Reservoir (40k AF)	**Subtotal**	**$169,527,000**
Dam and Reservoir	$151,447,000	
Land Acquisition & Wetland Mitigation	$18,080,000	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (319k AF)	**Subtotal**	**$385,763,000**
Dam and Reservoir	$95,600,000	Escalation factor applied to dam facilities
Booster Pump Station & Reservoir	$76,387,000	includes site work & regulating reservoir
Power Cost	$44,722,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$7,760,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$462,945,000**
BRP Fielding to West Haven WTP	$399,420,000	
Fielding 40k AF Option Added BRP Pipe	$26,350,000	
Fielding to Cutler (shorter)	$37,175,000	For Cache County
Temple Fork Reservoir	**Subtotal**	**$100,009,000**
Dam and Reservoir	$73,532,000	
Pump Station	$21,300,000	
Supply/Discharge Pipeline & Facilities	$2,169,000	
Land Acquisition & Wetland Mitigation	$1,000,000	
Power Cost	$2,008,000	includes Hydro Power recovery
	TOTAL	**$1,305,798,000**

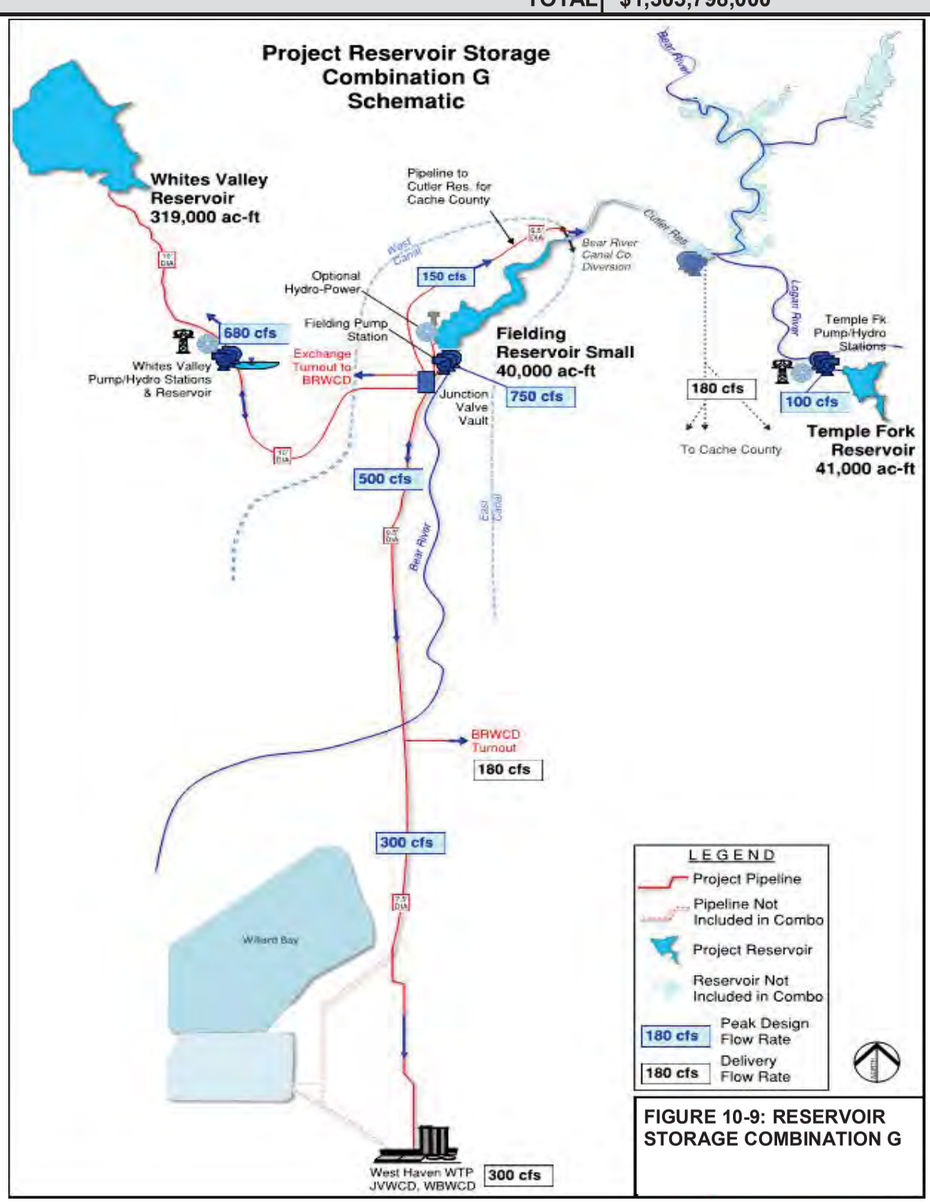

FIGURE 10-9: RESERVOIR STORAGE COMBINATION G

Bear River Development Cost Comparison

Reservoir Combination Scenario H Cost

South Willard, Fielding, Whites Valley

	Storage Summary	
Fielding Reservoir	40,000	(smaller)
Whites Valley Reservoir	305,000	
Cub River	0	
Above Cutler	0	
Temple Fork	0	
South Willard	55,000	
TOTAL	**400,000**	

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Scenario H

Cost Item	TOTAL	Comments
Fielding Reservoir (40k AF)	**Subtotal**	**$169,527,000**
Dam and Reservoir	$151,447,000	
Land Acquisition & Wetland Mitigation	$18,080,000	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (305k AF)	**Subtotal**	**$381,913,000**
Dam and Reservoir	$93,430,000	Escalation factor applied to dam facilities
Booster Pump Station & Reservoir	$76,027,000	includes site work & regulating reservoir
Power Cost	$43,502,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$7,660,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$494,305,000**
BRP Fielding to So.Willard to West Haven WTP	$430,780,000	
Fielding to Cutler (shorter)	$37,175,000	For Cache County
Fielding 40k AF Option Added BRP Pipe	$26,350,000	
South Willard Reservoir	**Subtotal**	**$396,433,000**
Dam Embankment and Reservoir	$151,102,500	
Outlet Pump Station	$23,717,000	
Pump Power Cost	$12,117,500	
Land Acquisition & Wetland Mitigation	$209,496,000	
	TOTAL	**$1,629,732,000**

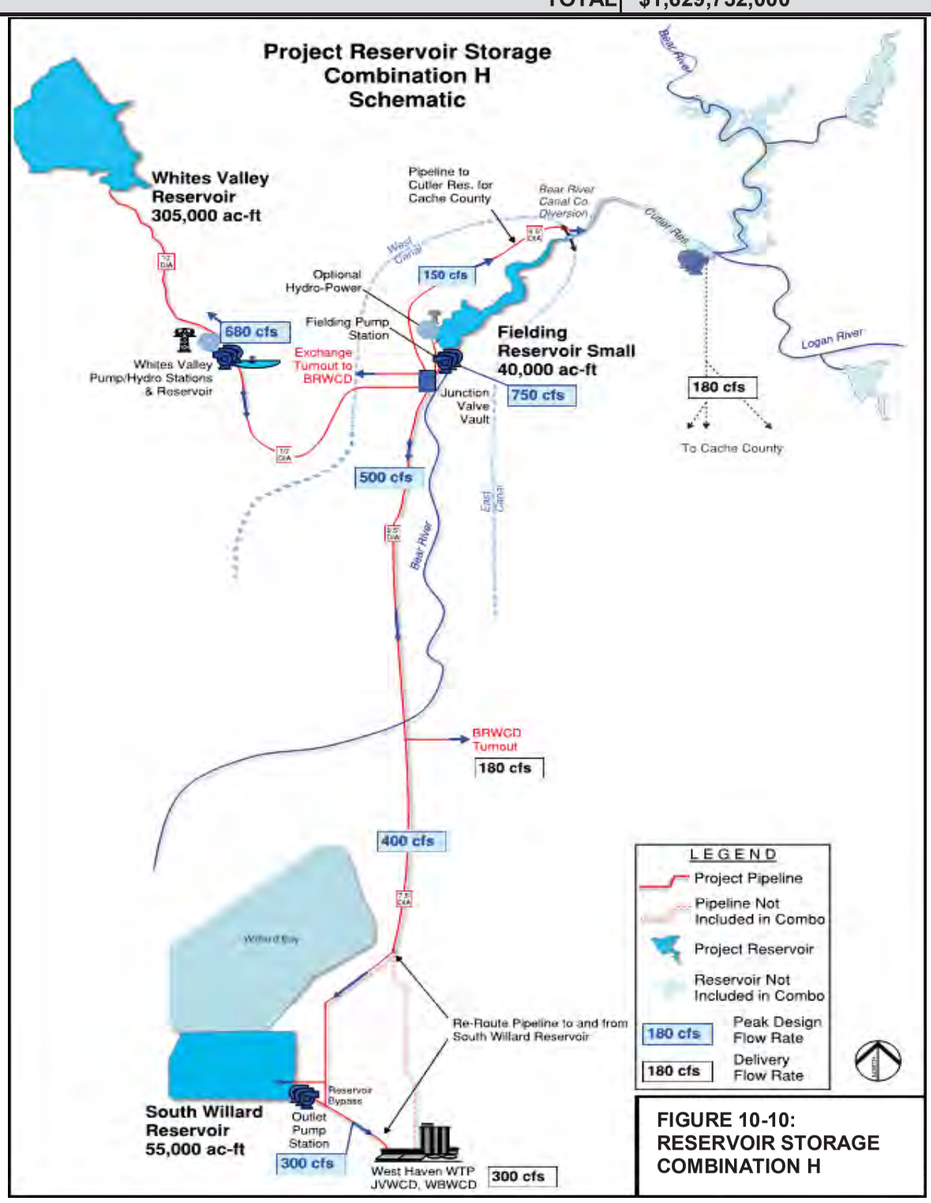

FIGURE 10-10:
RESERVOIR STORAGE
COMBINATION H

Bear River Development Cost Comparison

Reservoir Combination Scenario I Cost

No Whites Valley

	Storage Summary	
Fielding Reservoir	70,000	(larger)
Whites Valley Reservoir	0	
Cub River	27,000	
Above Cutler	51,000	
Temple Fork	41,000	
South Willard	55,000	
TOTAL	**244,000**	

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Scenario I

Cost Item	TOTAL	Comments
Fielding Reservoir (70k AF)	**Subtotal**	**$111,355,000**
Dam and Reservoir	$76,728,000	
Land Acquisition & Wetland Mitigation	$34,627,000	
Pump Station at Fielding	**Subtotal**	**$73,358,000**
Pump Station	$37,348,000	smaller pump station
Power Cost	$34,010,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Cub River Reservoir	**Subtotal**	**$113,461,000**
Dam and Reservoir Facilities	$54,448,000	
Land Acquisition & Wetland Mitigation	$59,013,000	
Pipeline Facilities	**Subtotal**	**$430,780,000**
BRP Fielding to So.Willard to West Haven WTP	$430,780,000	
Temple Fork Reservoir	**Subtotal**	**$100,009,000**
Dam and Reservoir	$73,532,000	
Pump Station	$21,300,000	
Supply/Discharge Pipeline & Facilities	$2,169,000	
Land Acquisition & Wetland Mitigation	$1,000,000	
Power Cost	$2,008,000	includes Hydro Power recovery
Above Cutler Reservoir	**Subtotal**	**$285,506,000**
Dam and Reservoir Facilities	$79,586,000	
Land Acquisition & Wetland Mitigation	$205,920,000	
South Willard Reservoir	**Subtotal**	**$396,433,000**
Dam Embankment and Reservoir	$151,102,500	
Outlet Pump Station	$23,717,000	
Pump Power Cost	$12,117,500	
Land Acquisition & Wetland Mitigation	$209,496,000	
	TOTAL	**$1,510,902,000**

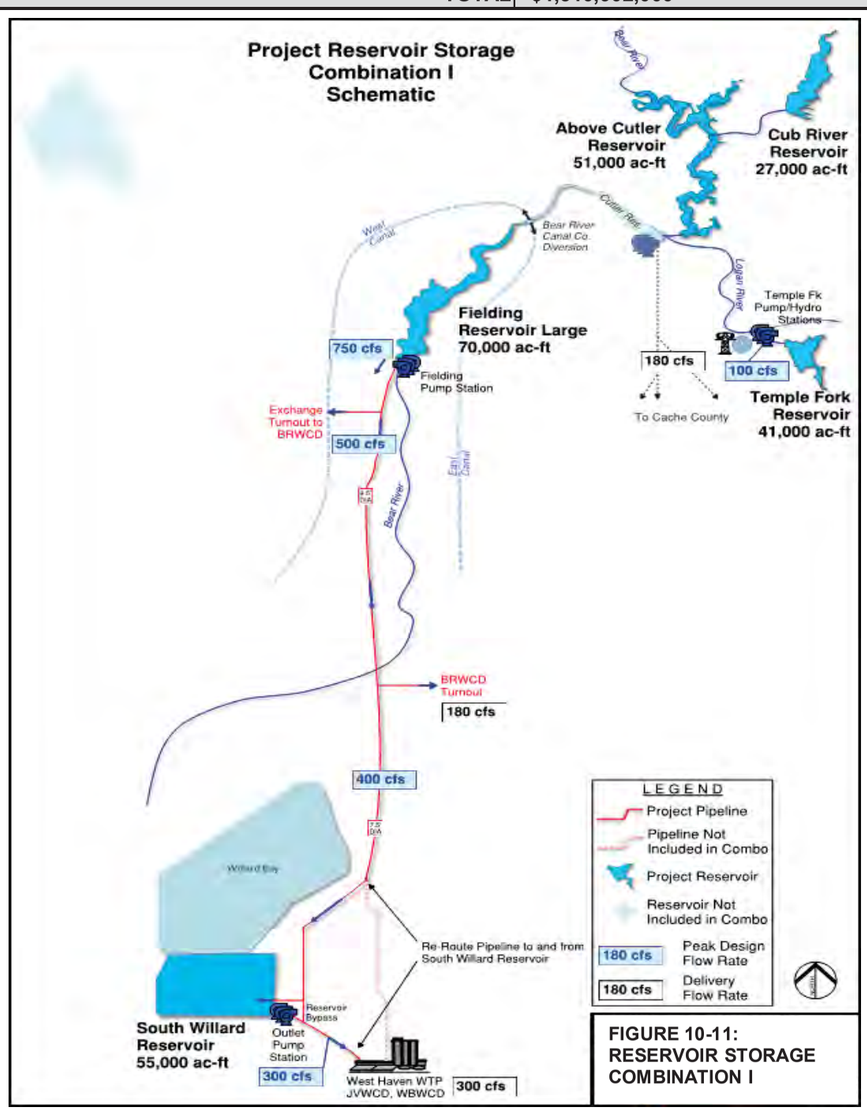

FIGURE 10-11: RESERVOIR STORAGE COMBINATION I

Bear River Development Cost Comparison

Reservoir Combination Scenario J Cost

Whites Valley Large, Cub, South Willard

	Storage Summary	
Whites Valley Reservoir	540,000	
Fielding Reservoir	0	(larger)
TOTAL	**540,000**	

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Scenario J

Cost Item	TOTAL	Comments
Fielding Reservoir (70k AF)	**Subtotal**	**$111,355,000**
Dam and Reservoir	$76,728,000	
Land Acquisition & Wetland Mitigation	$34,627,000	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (540k AF)	**Subtotal**	**$483,385,000**
Dam and Reservoir	$178,600,000	
Booster Pump Station & Reservoir	$82,627,000	includes site work & regulating reservoir
Power Cost	$51,454,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$9,410,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$449,615,000**
BRP Fielding Diversion to West Haven WTP	$399,420,000	
Fielding to Cutler (longer)	$50,195,000	For Cache County
	TOTAL	**$1,231,909,000**

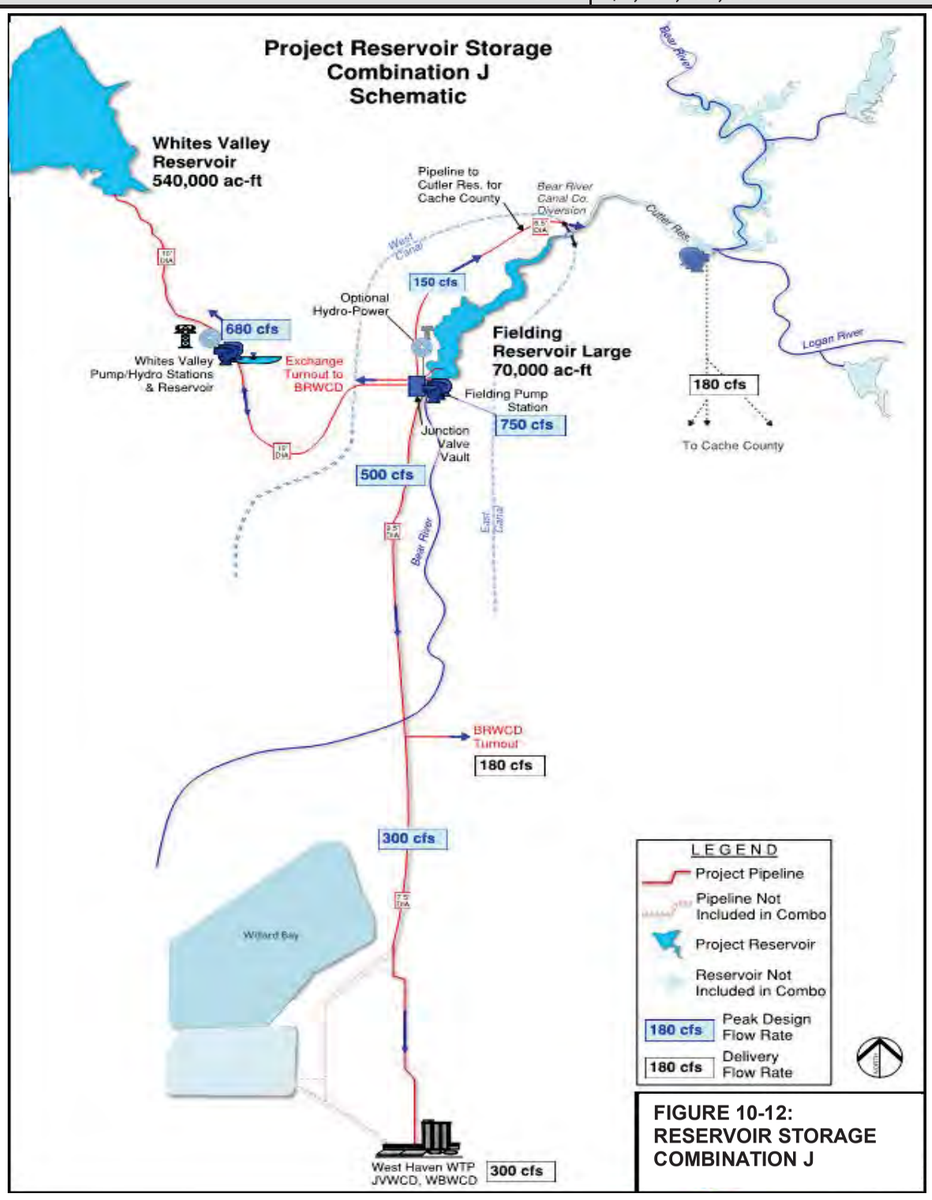

FIGURE 10-12:
RESERVOIR STORAGE
COMBINATION J

Bear River Development Cost Comparison

Reservoir Combination Scenario K Cost

Whites Valley Large ONLY

	Storage Summary
Fielding Reservoir	0
Whites Valley Reservoir	610,000
TOTAL	**610,000**

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Scenario K

Cost Item	TOTAL	Comments
Diversion on Bear River	**Subtotal**	**$11,686,600**
Diversion on Bear River	$7,950,000	at Fielding location
Land Acquisition & Wetland Mitigation	$3,736,600	
Pump Station at Diversion	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	Same as Fielding PS
HydroPower	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (610k AF)	**Subtotal**	**$533,953,000**
Dam and Reservoir	$226,240,000	
Booster Pump Station & Reservoir	$84,167,000	includes site work & regulating reservoir
Power Cost	$52,622,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$9,630,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$449,615,000**
BRP Fielding Diversion to West Haven WTP	$399,420,000	
Fielding to Cutler (longer)	$50,195,000	For Cache County
	TOTAL	**$1,182,808,600**

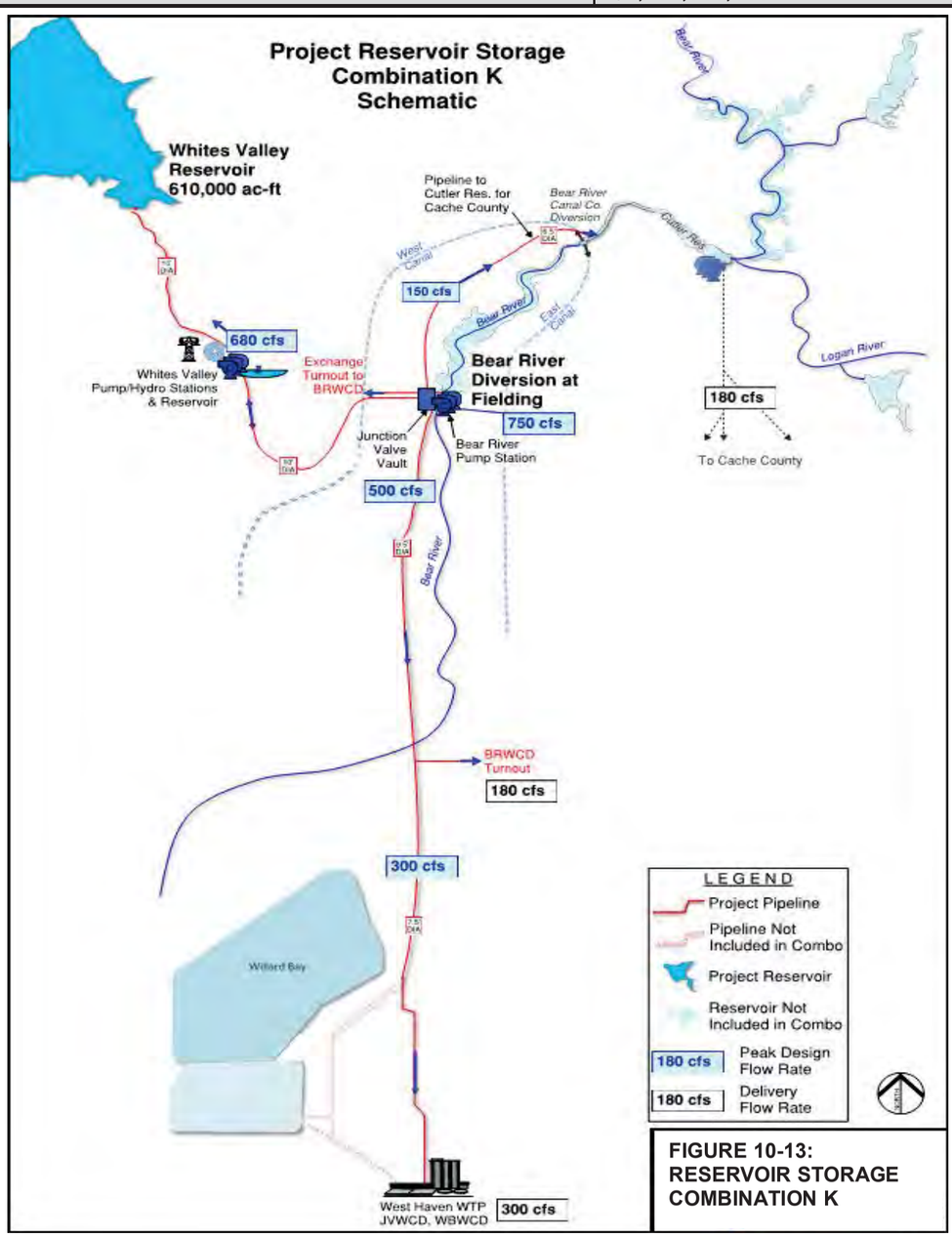

FIGURE 10-13:
RESERVOIR STORAGE
COMBINATION K

Bear River Development Cost Comparison

Reservoir Combination Scenario L Cost

Whites Valley Large, Cub, Temple

	Storage Summary
Whites Valley Reservoir	540,000
Cub River	27,000
Temple Fork	41,000
TOTAL	**608,000**

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Scenario L

Cost Item	TOTAL	Comments
Diversion on Bear River	**Subtotal**	**$11,686,600**
Diversion on Bear River	$7,950,000	at Fielding location
Land Acquisition & Wetland Mitigation	$3,736,600	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (540k AF)	**Subtotal**	**$483,385,000**
Dam and Reservoir	$178,600,000	
Booster Pump Station & Reservoir	$82,627,000	includes site work & regulating reservoir
Power Cost	$51,454,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$9,410,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$449,615,000**
BRP Fielding Diversion to West Haven WTP	$399,420,000	
Fielding to Cutler (longer)	$50,195,000	For Cache County
Cub River Reservoir	**Subtotal**	**$113,461,000**
Dam and Reservoir Facilities	$54,448,000	
Land Acquisition & Wetland Mitigation	$59,013,000	
Temple Fork Reservoir	**Subtotal**	**$100,009,000**
Dam and Reservoir	$73,532,000	
Pump Station	$21,300,000	
Supply/Discharge Pipeline & Facilities	$2,169,000	
Power Cost	$2,008,000	includes Hydro Power recovery
Land Acquisition & Wetland Mitigation	$1,000,000	
	TOTAL	**$1,345,710,600**

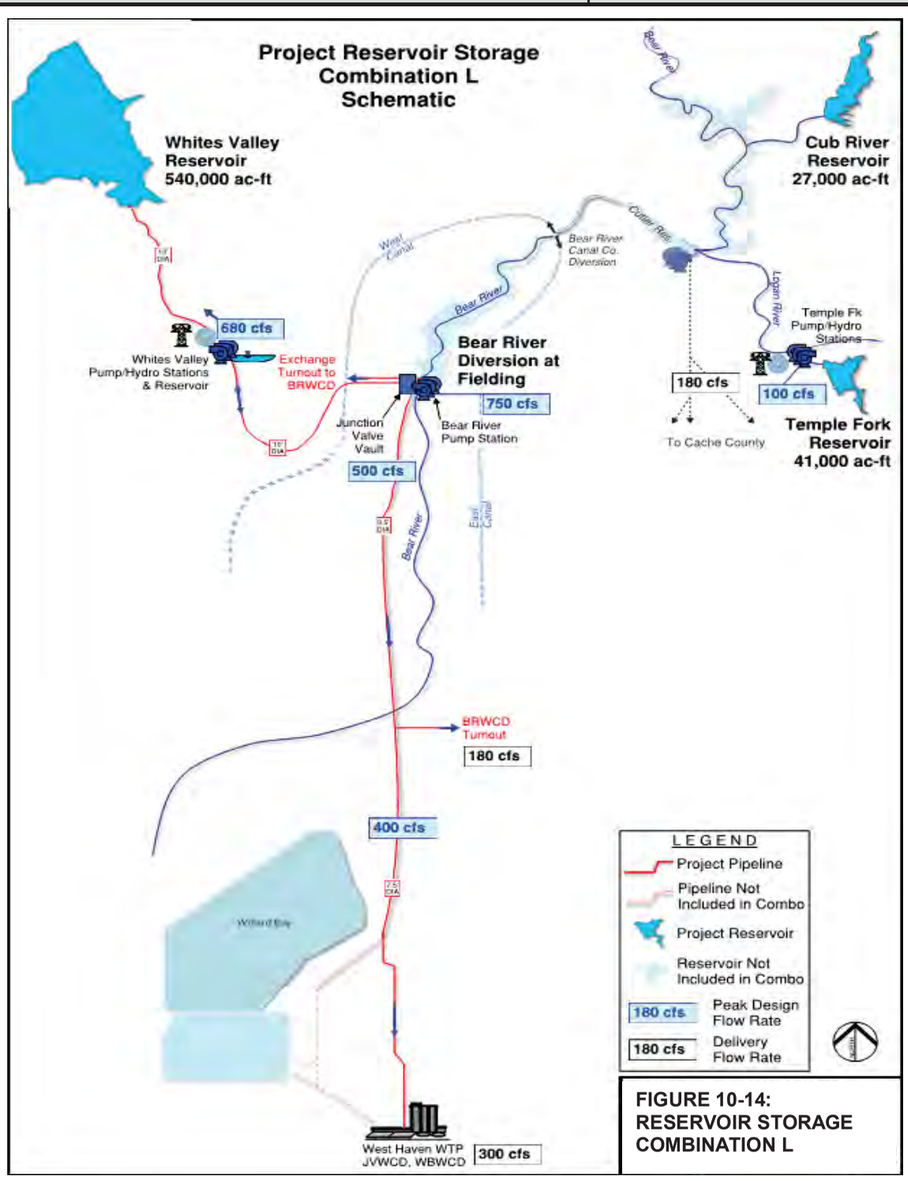

FIGURE 10-14:
RESERVOIR STORAGE
COMBINATION L

Bear River Development Cost Comparison

Reservoir Combination Scenario M Cost

0	Storage Summary
Whites Valley Reservoir	540,000
Cub River	27,000
South Willard	55,000
TOTAL	**622,000**

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Scenario M

Cost Item	TOTAL	Comments
Diversion on Bear River	**Subtotal**	**$11,686,600**
Diversion on Bear River	$7,950,000	at Fielding location
Land Acquisition & Wetland Mitigation	$3,736,600	
Pump Station at Fielding	**Subtotal**	**$187,554,000**
Pump Station	$78,719,000	
Power Cost	$106,835,000	
Land Acquisition & Wetland Mitigation	$2,000,000	
Whites Valley Reservoir (540k AF)	**Subtotal**	**$483,385,000**
Dam and Reservoir	$178,600,000	
Booster Pump Station & Reservoir	$82,627,000	includes site work & regulating reservoir
Power Cost	$51,454,000	includes Hydro Power recovery
Junction Vault	$3,594,000	
Land Acquisition & Wetland Mitigation	$9,410,000	
Whites Valley Pipeline	$157,700,000	Junction Vault to Whites Valley Dam
Pipeline Facilities	**Subtotal**	**$480,975,000**
BRP Fielding to So.Willard to West Haven WTP	$430,780,000	
Fielding to Cutler (longer)	$50,195,000	For Cache County
Cub River Reservoir	**Subtotal**	**$113,461,000**
Dam and Reservoir Facilities	$54,448,000	
Land Acquisition & Wetland Mitigation	$59,013,000	
South Willard Reservoir	**Subtotal**	**$396,433,000**
Dam Embankment and Reservoir	$151,102,500	
Outlet Pump Station	$23,717,000	
Pump Power Cost	$12,117,500	
Land Acquisition & Wetland Mitigation	$209,496,000	
	TOTAL	**$1,673,494,600**

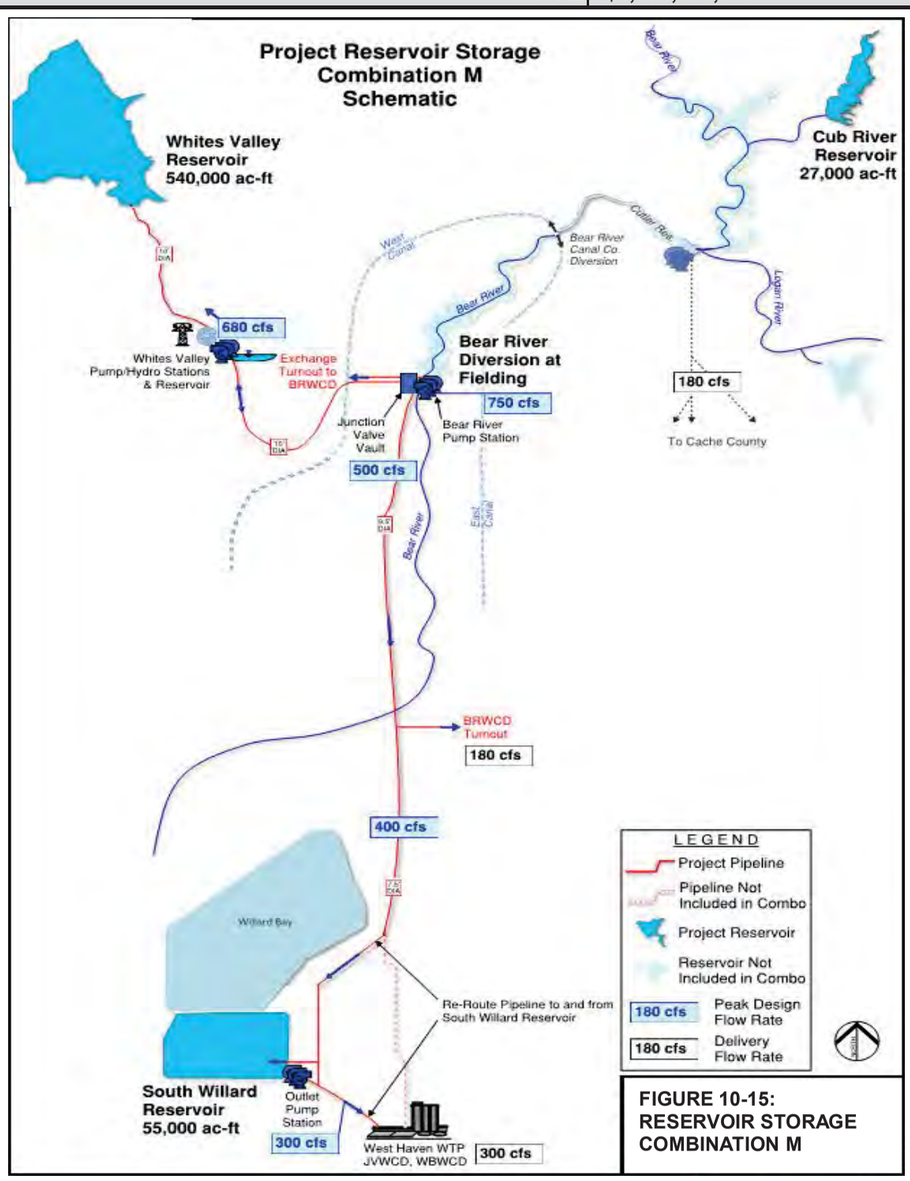

FIGURE 10-15: RESERVOIR STORAGE COMBINATION M

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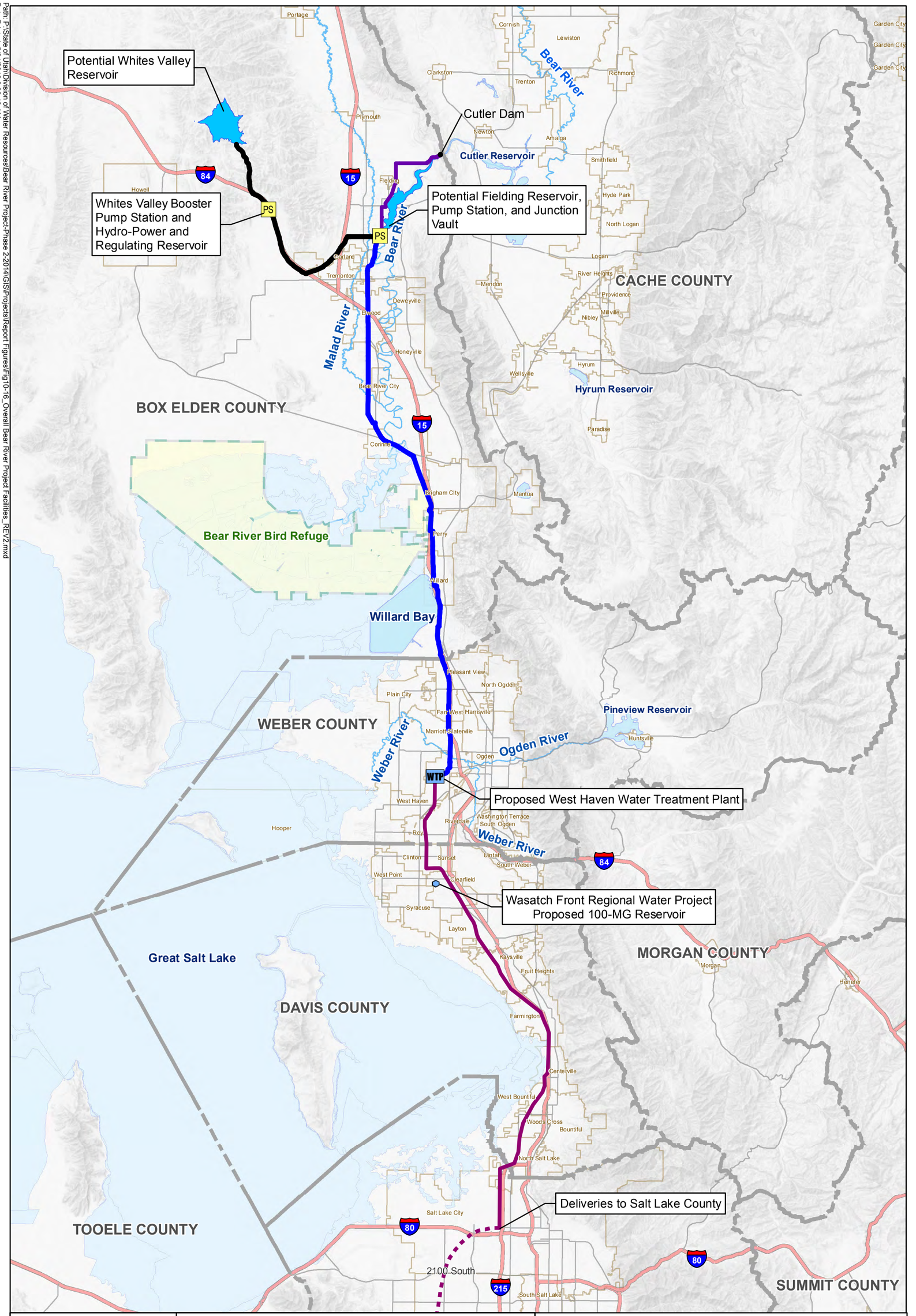

NORTH

0 3 6 12 Miles

L E G E N D

- PS Pump Station
- WTP Water Treatment Plant
- Potential Reservoirs
- Proposed Finished Water Transmission Pipeline

Recommended Raw Water Pipeline Alignments:

- Fielding to Cutler
- Fielding to Whites
- Fielding to Willard

FIGURE 10-16
OVERALL BEAR RIVER DEVELOPMENT SYSTEM

BEAR RIVER DEVELOPMENT

State of Utah
Division of Water Resources

BOWEN COLLINS & ASSOCIATES
HDR

CHAPTER 11 FIGURES

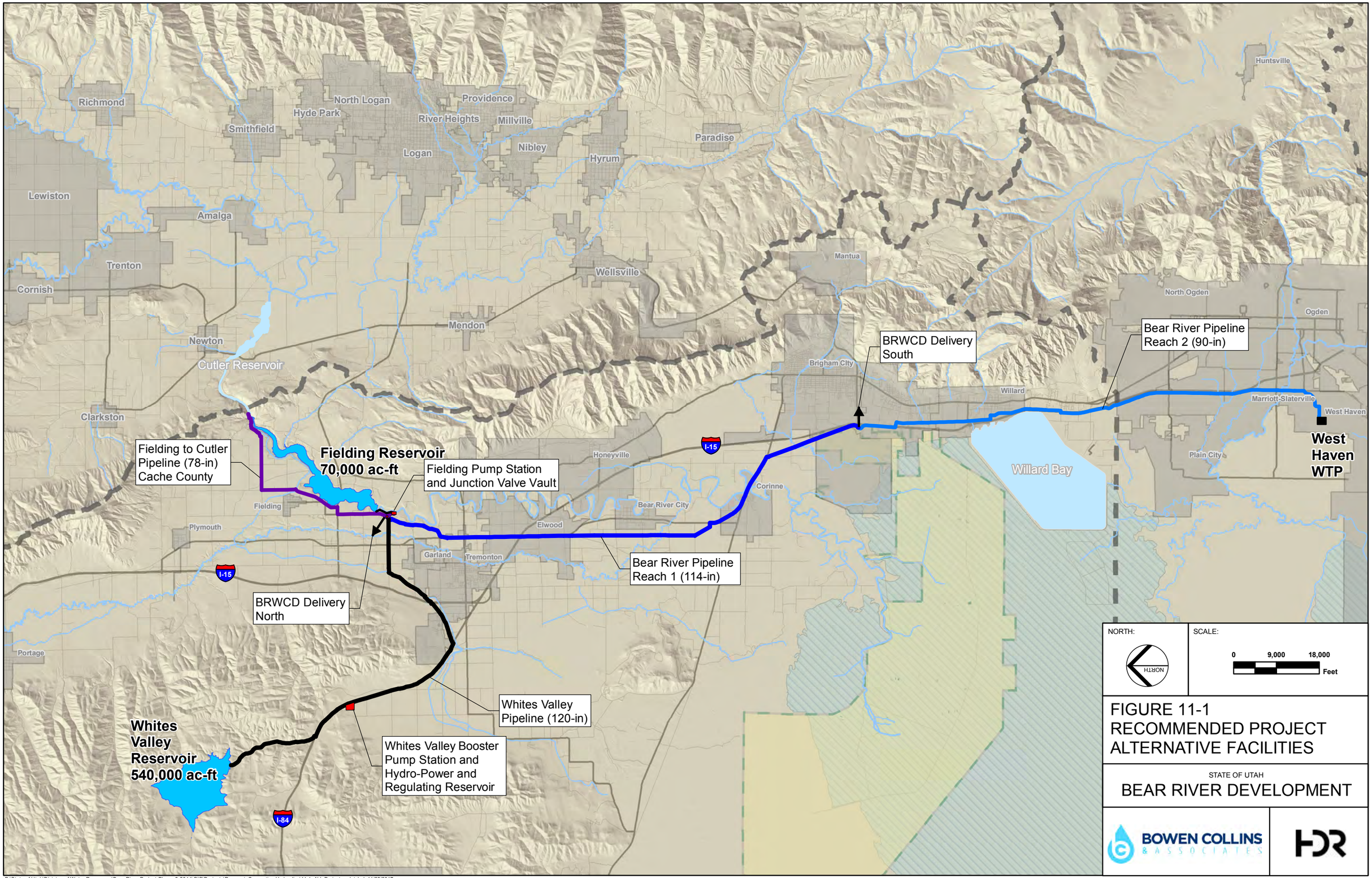

FIGURE 11-1
RECOMMENDED PROJECT ALTERNATIVE FACILITIES

STATE OF UTAH
BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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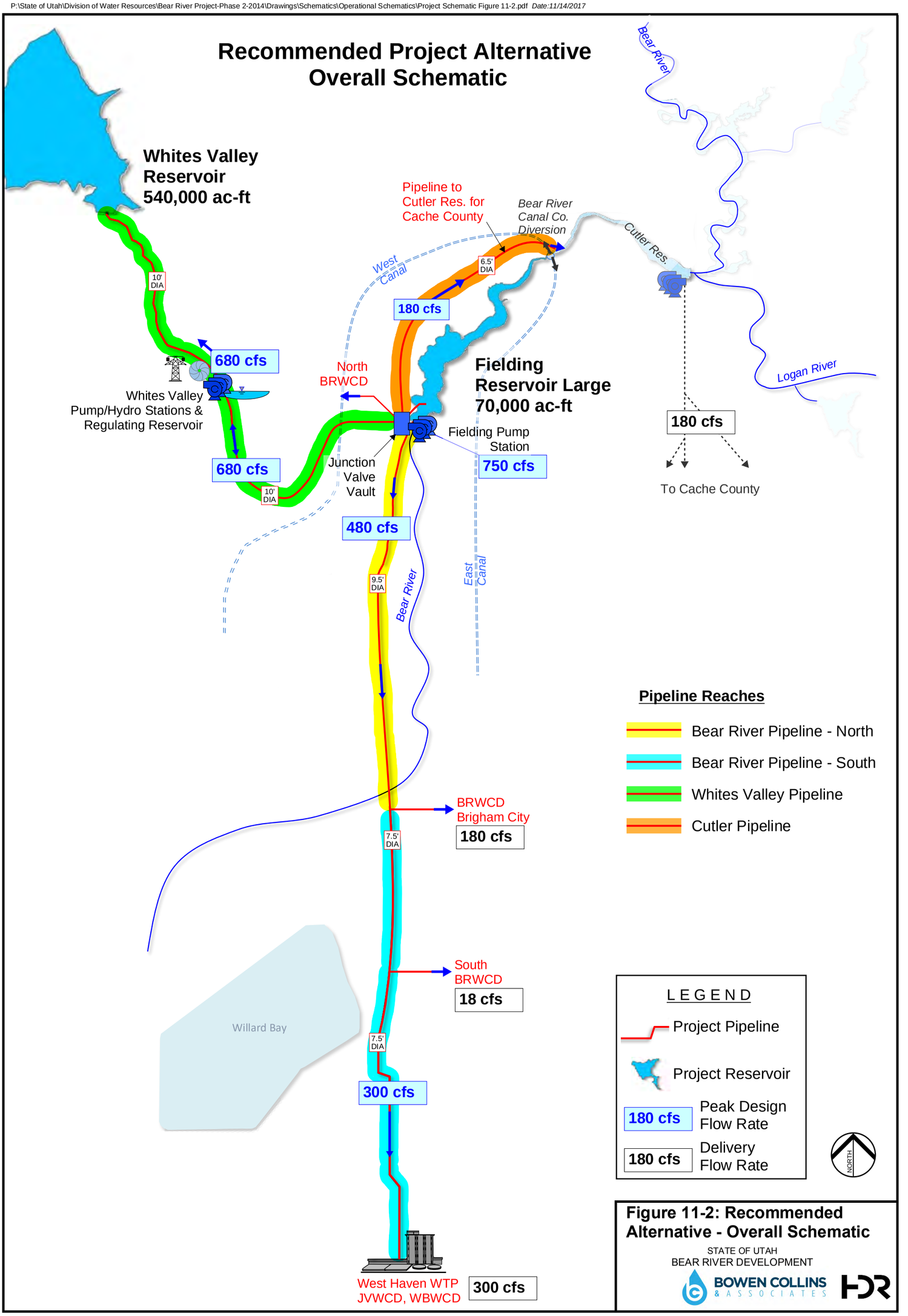
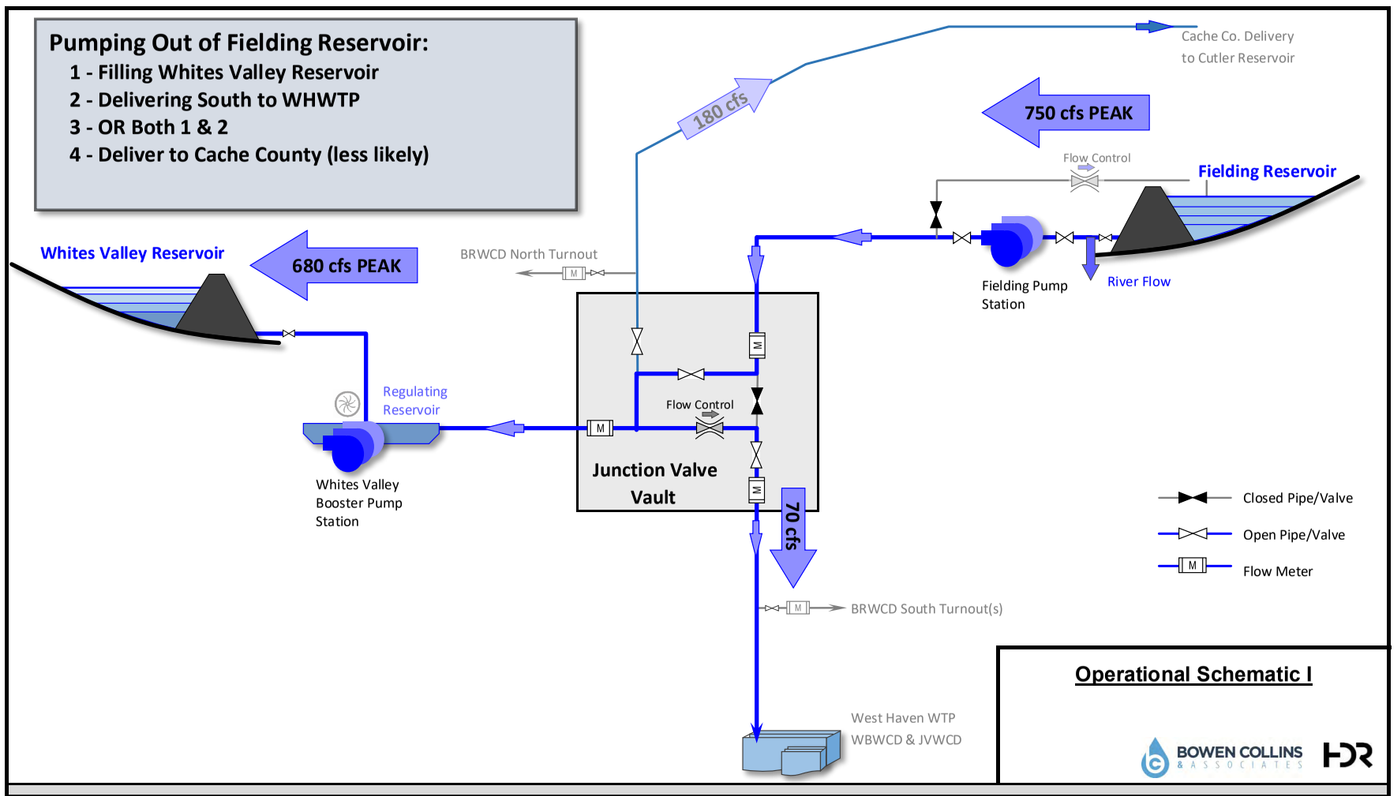
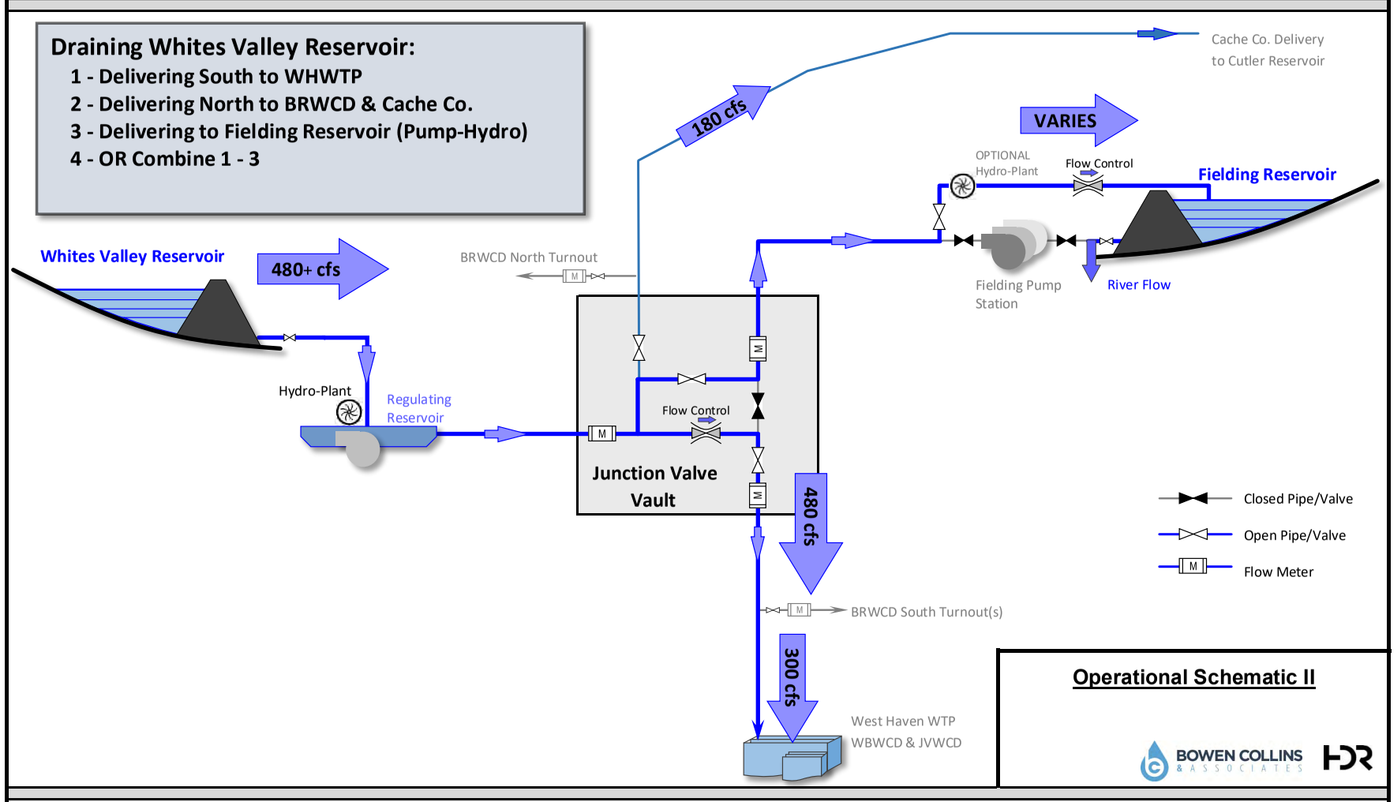


Figure 11-2: Recommended Alternative - Overall Schematic

STATE OF UTAH
BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES HDR





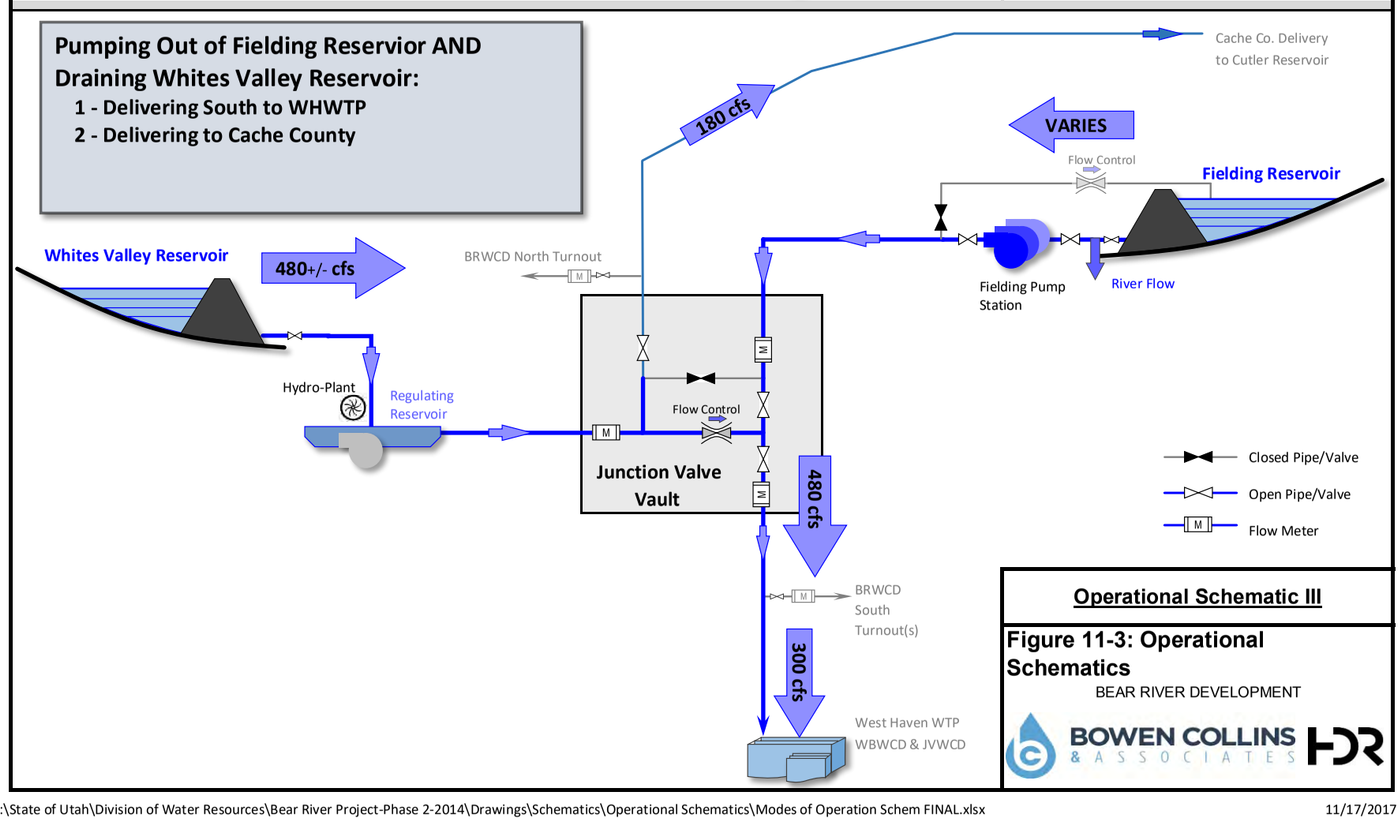
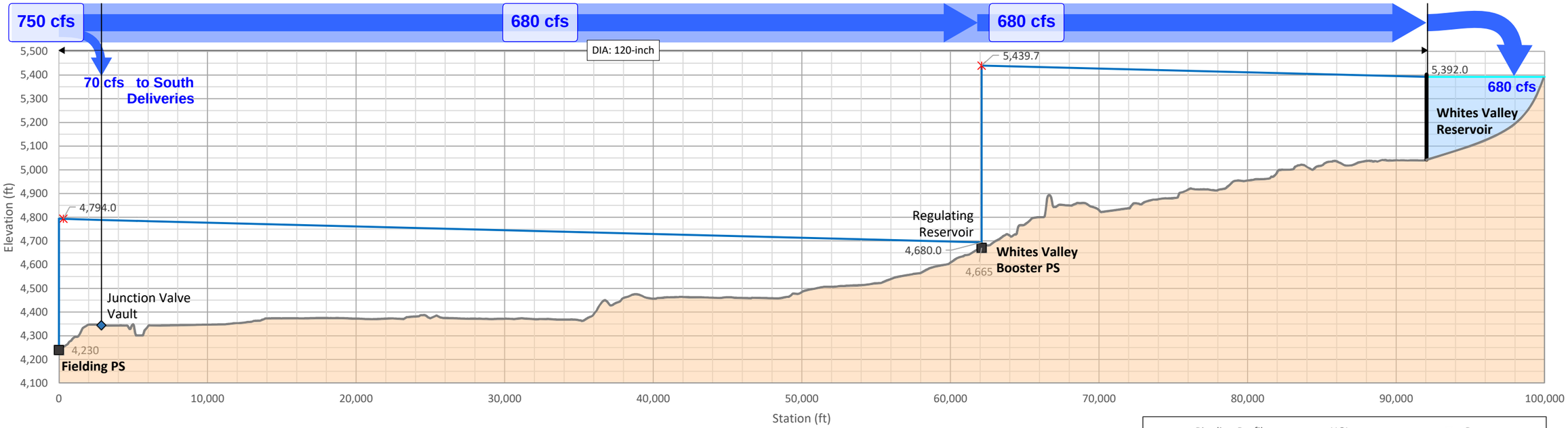
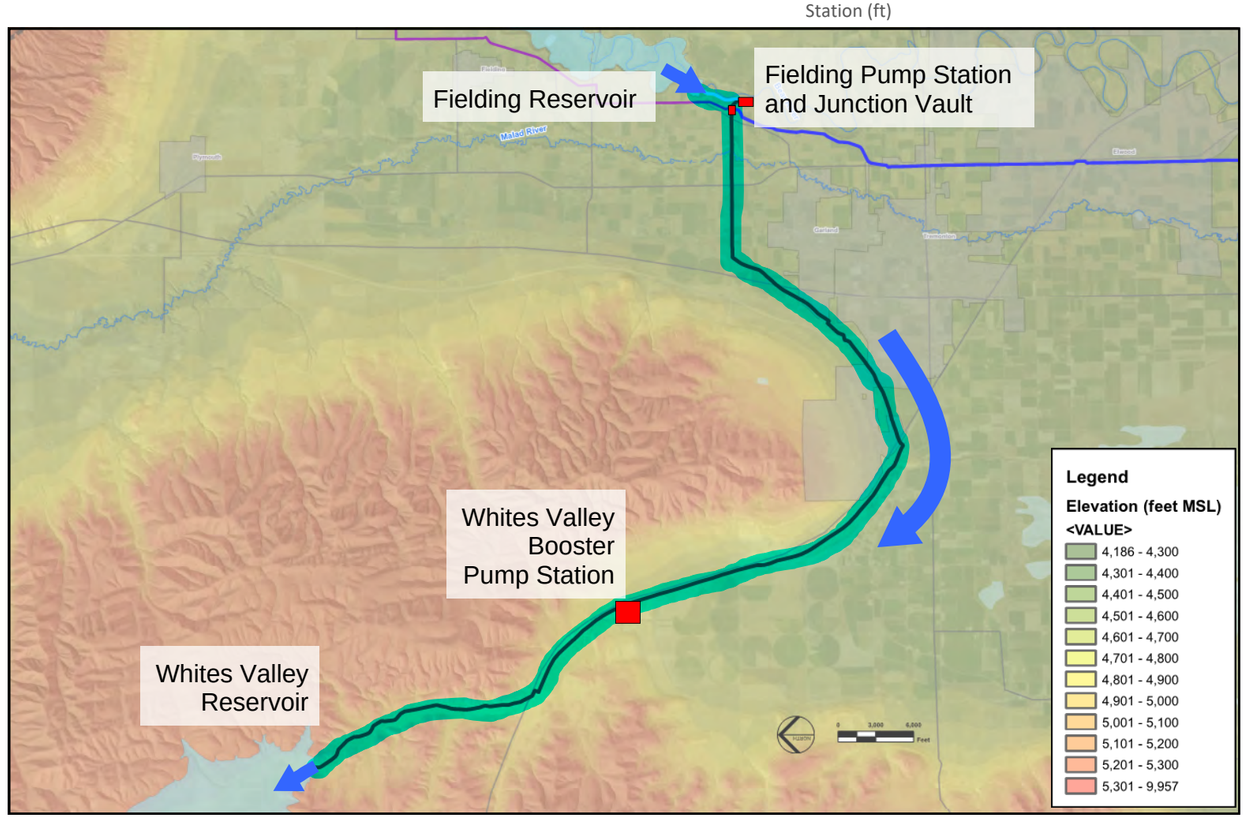


Figure 11-3: Operational Schematics

BEAR RIVER DEVELOPMENT





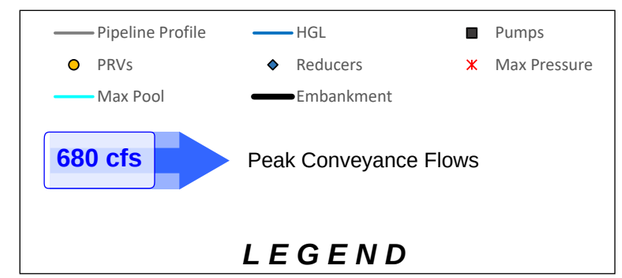


Figure 11-4: Hydraulic Profile I Fielding PS to Whites Valley Reservoir

STATE OF UTAH
BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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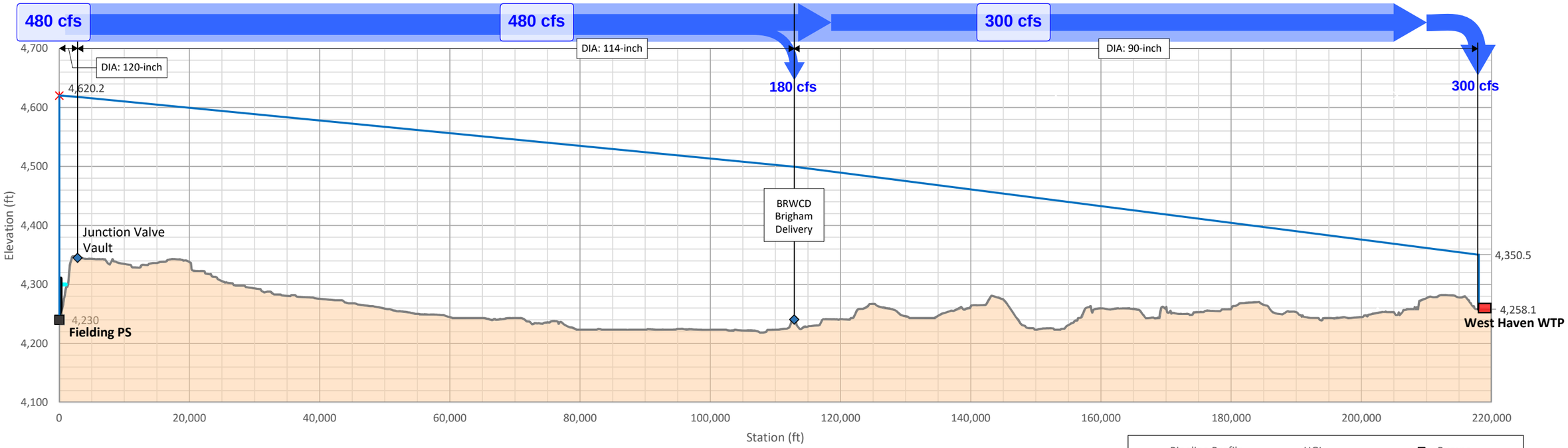

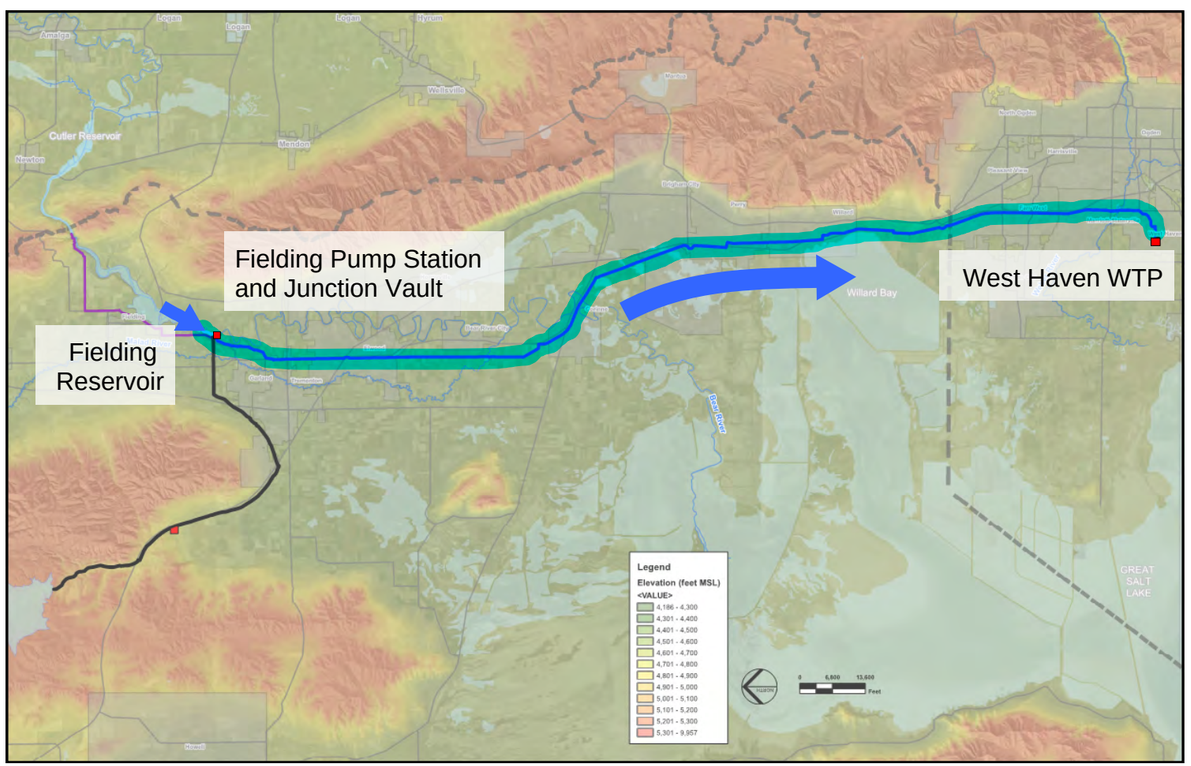

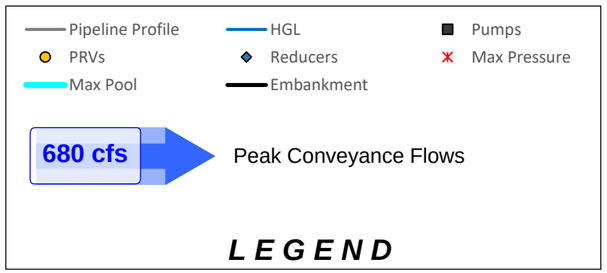

Figure 11-5: Hydraulic Profile II
Fielding PS to West Haven WTP

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BEAR RIVER DEVELOPMENT

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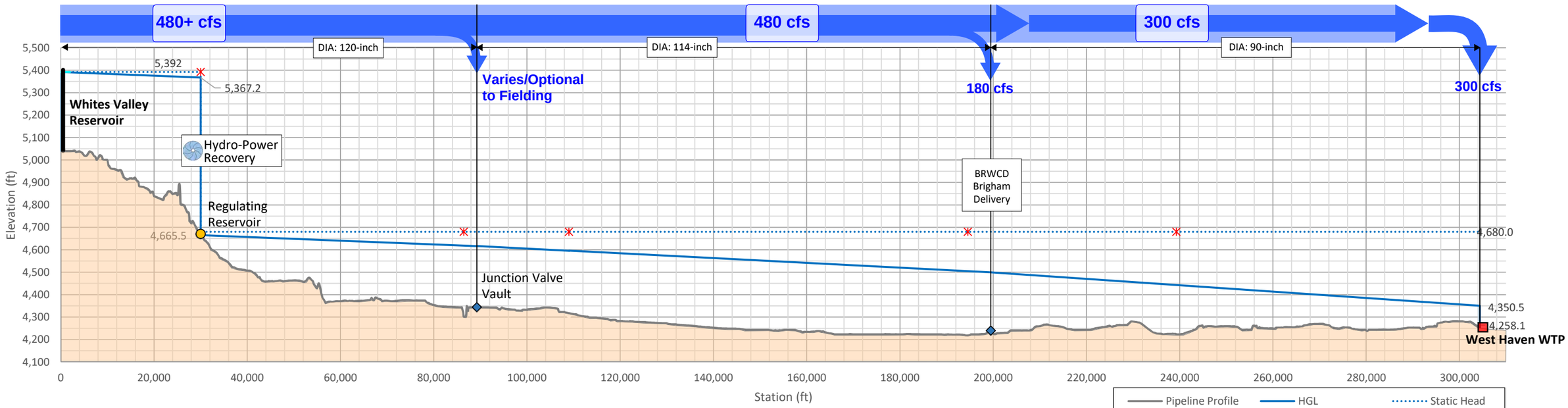

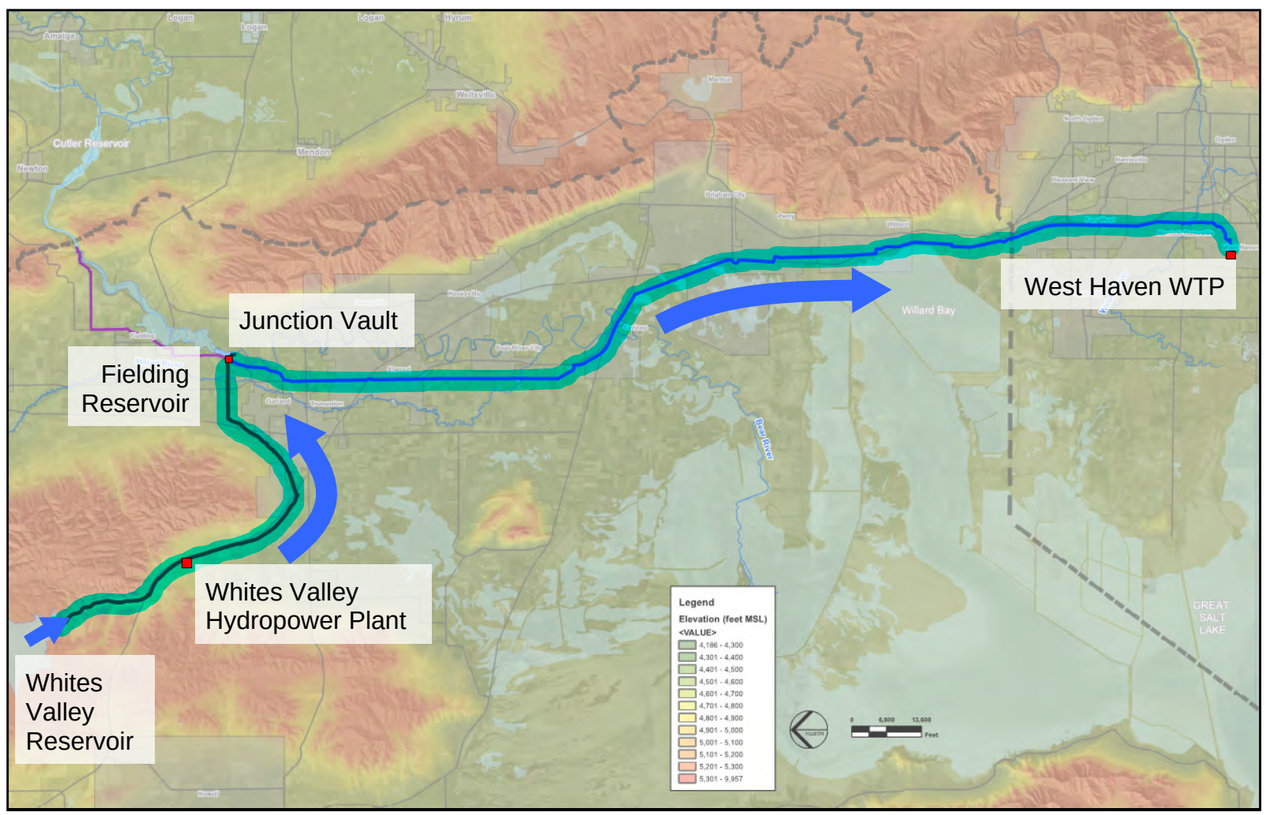

Figure 11-6: Hydraulic Profile III Whites Valley Reservoir to West Haven WTP

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BEAR RIVER DEVELOPMENT

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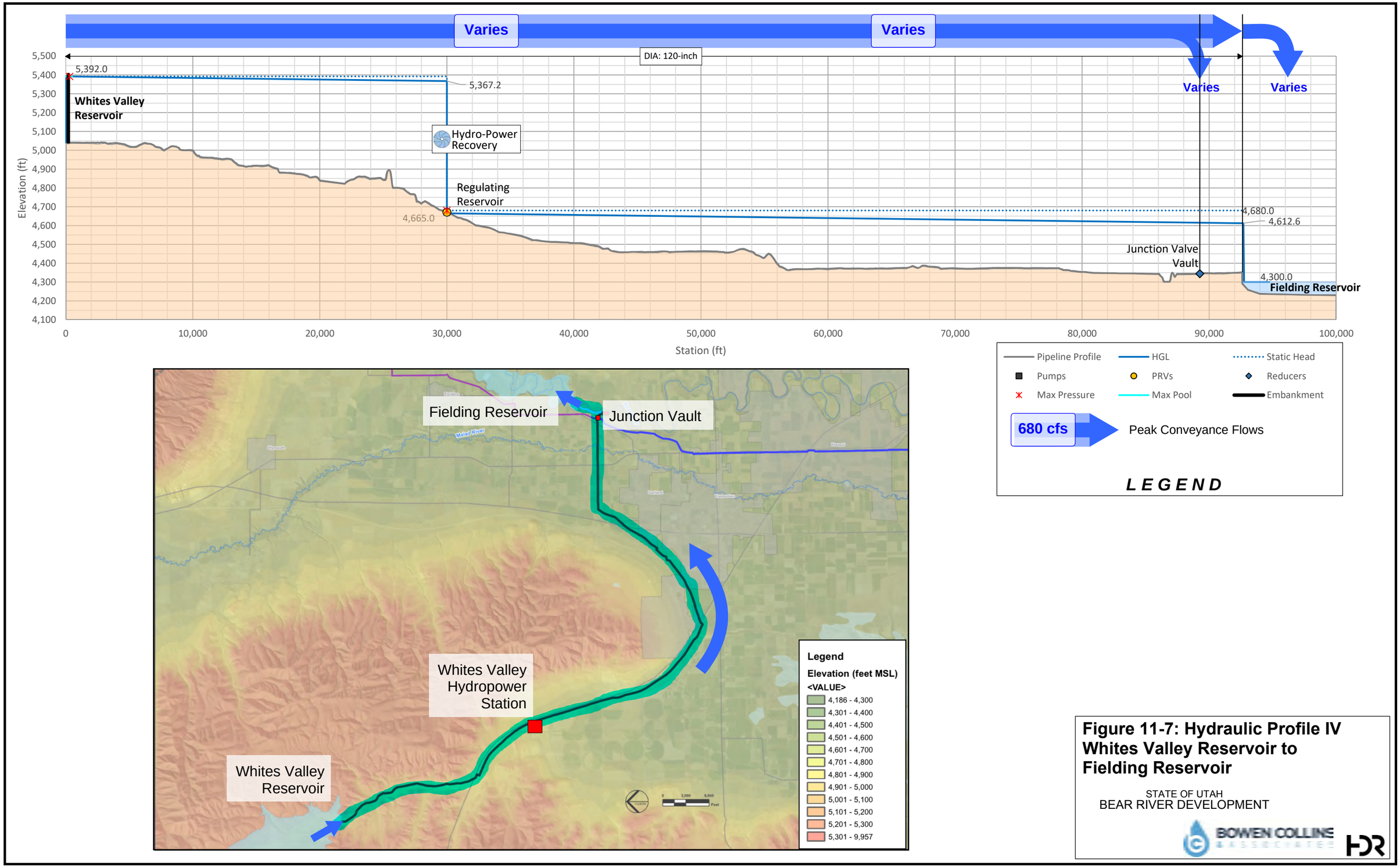

Figure 11-7: Hydraulic Profile IV Whites Valley Reservoir to Fielding Reservoir

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BEAR RIVER DEVELOPMENT

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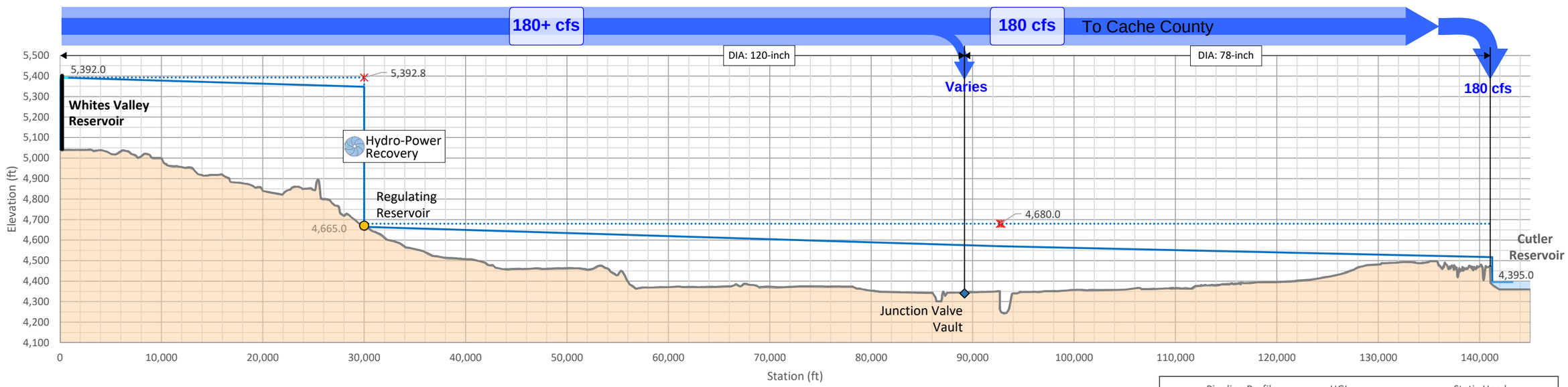

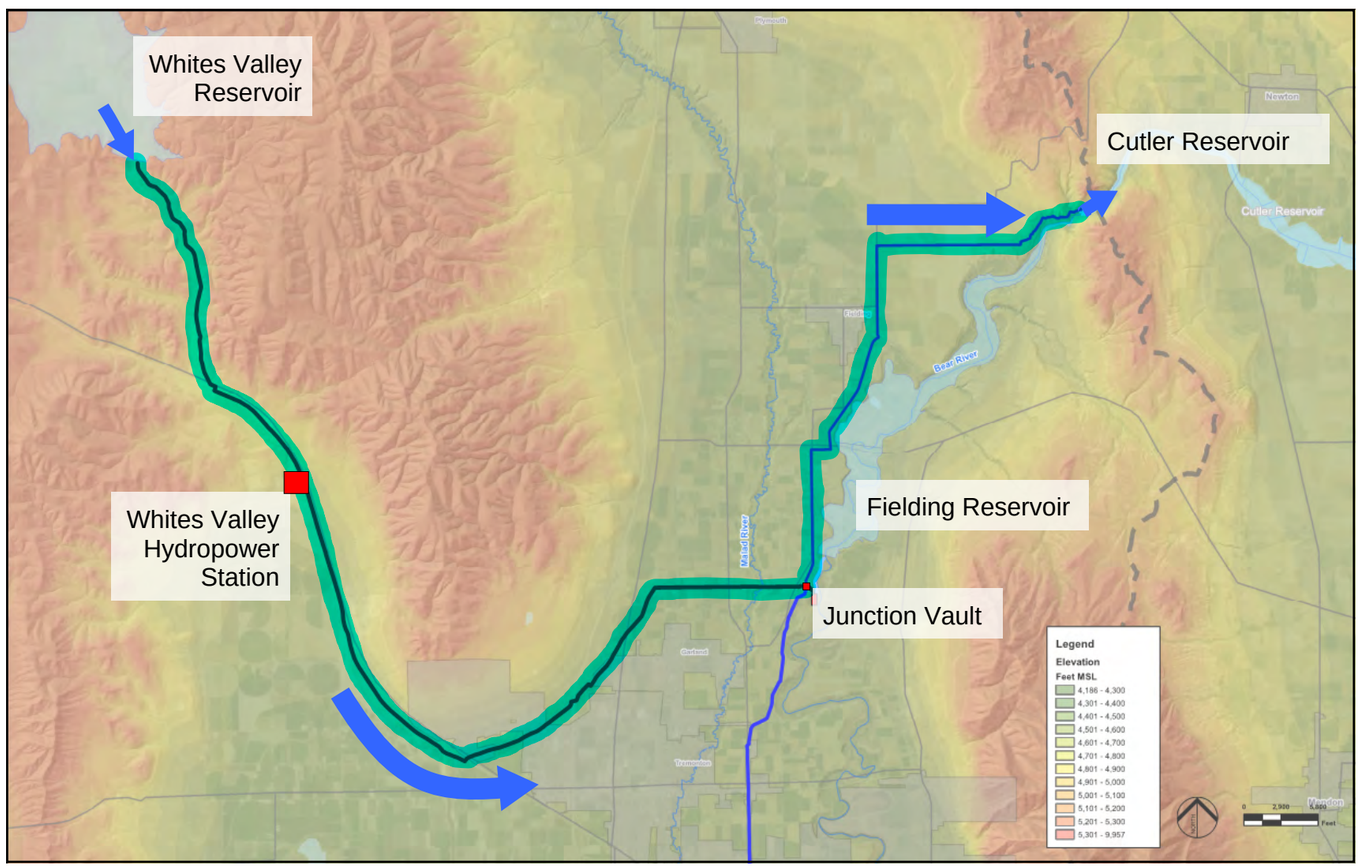

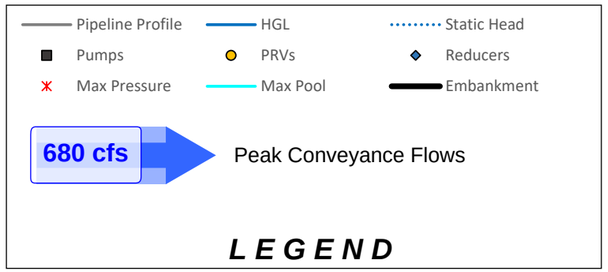

Figure 11-8: Hydraulic Profile V Whites Valley Reservoir to Cutler Reservoir (Cache Co.)

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BEAR RIVER DEVELOPMENT

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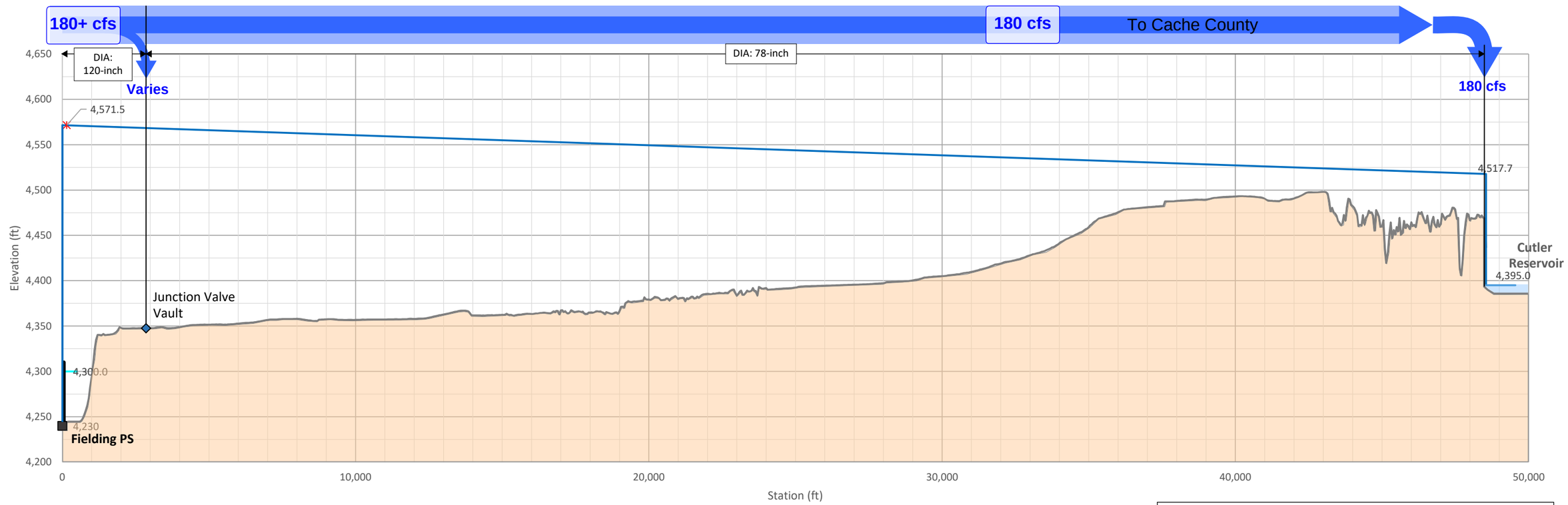

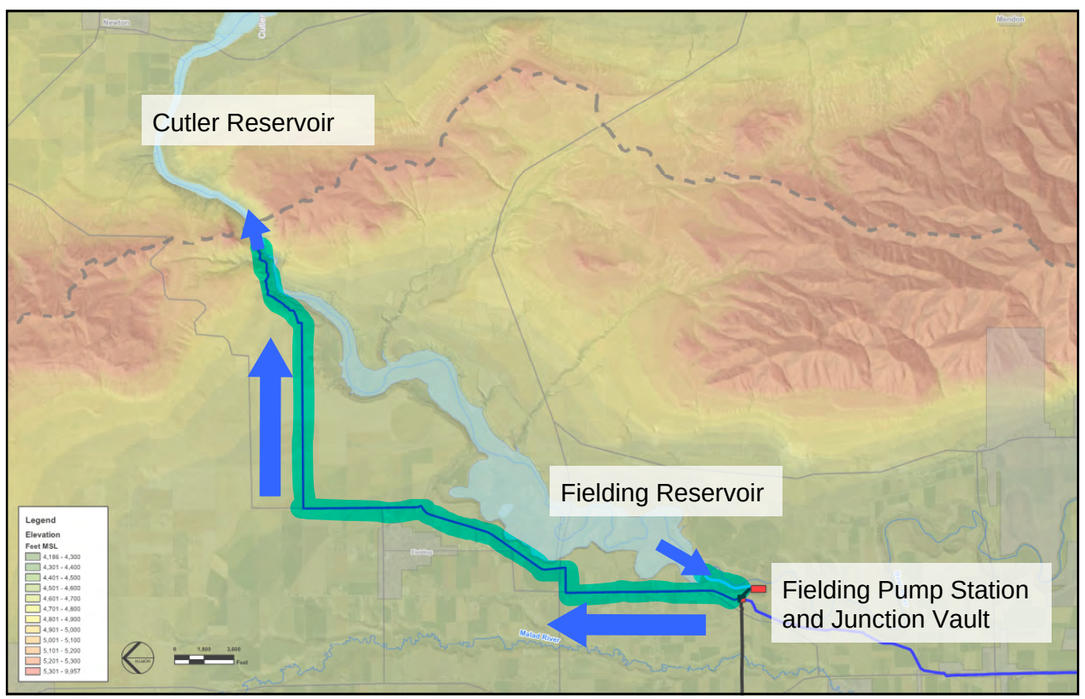

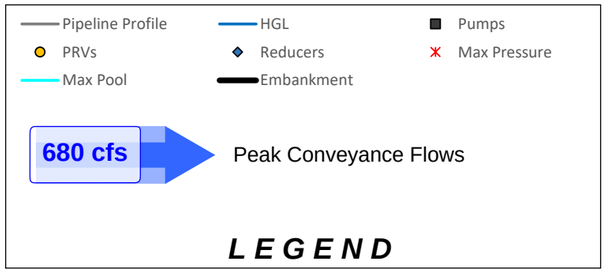

Figure 11-9: Hydraulic Profile VI Fielding PS to Cutler Reservoir (Cache Co.)

STATE OF UTAH
BEAR RIVER DEVELOPMENT

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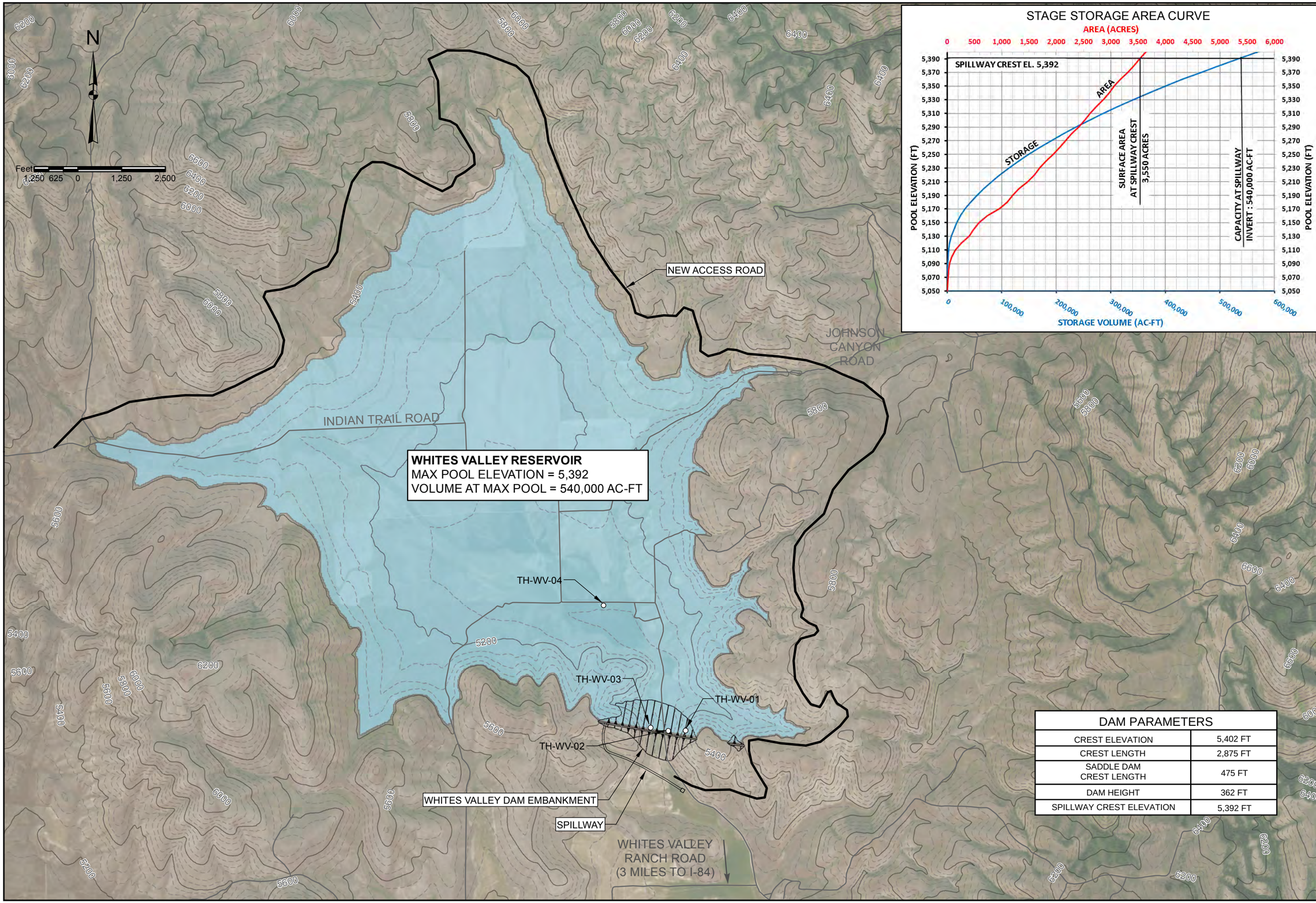

DAM PARAMETERS	
CREST ELEVATION	5,402 FT
CREST LENGTH	2,875 FT
SADDLE DAM CREST LENGTH	475 FT
DAM HEIGHT	362 FT
SPILLWAY CREST ELEVATION	5,392 FT

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CONCEPTUAL

NO.	DATE	REV. BY	DESCRIPTION

REVISIONS

STATE OF UTAH
BEAR RIVER DEVELOPMENT
DIVISION OF WATER RESOURCES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DESIGN
DESIGN T. SEAMONS
DRAWN B. ASHCROFT

REVIEW
CHECKED C. MOULTRIE
APPROVED T. CLARK

CIVIL
540 K WHITES VALLEY DAM AND RESERVOIR SITE PLAN OVERIVEW

DATE: NOV 2017
PROJECT NUMBER: 233-14-01

FIGURE 11-10

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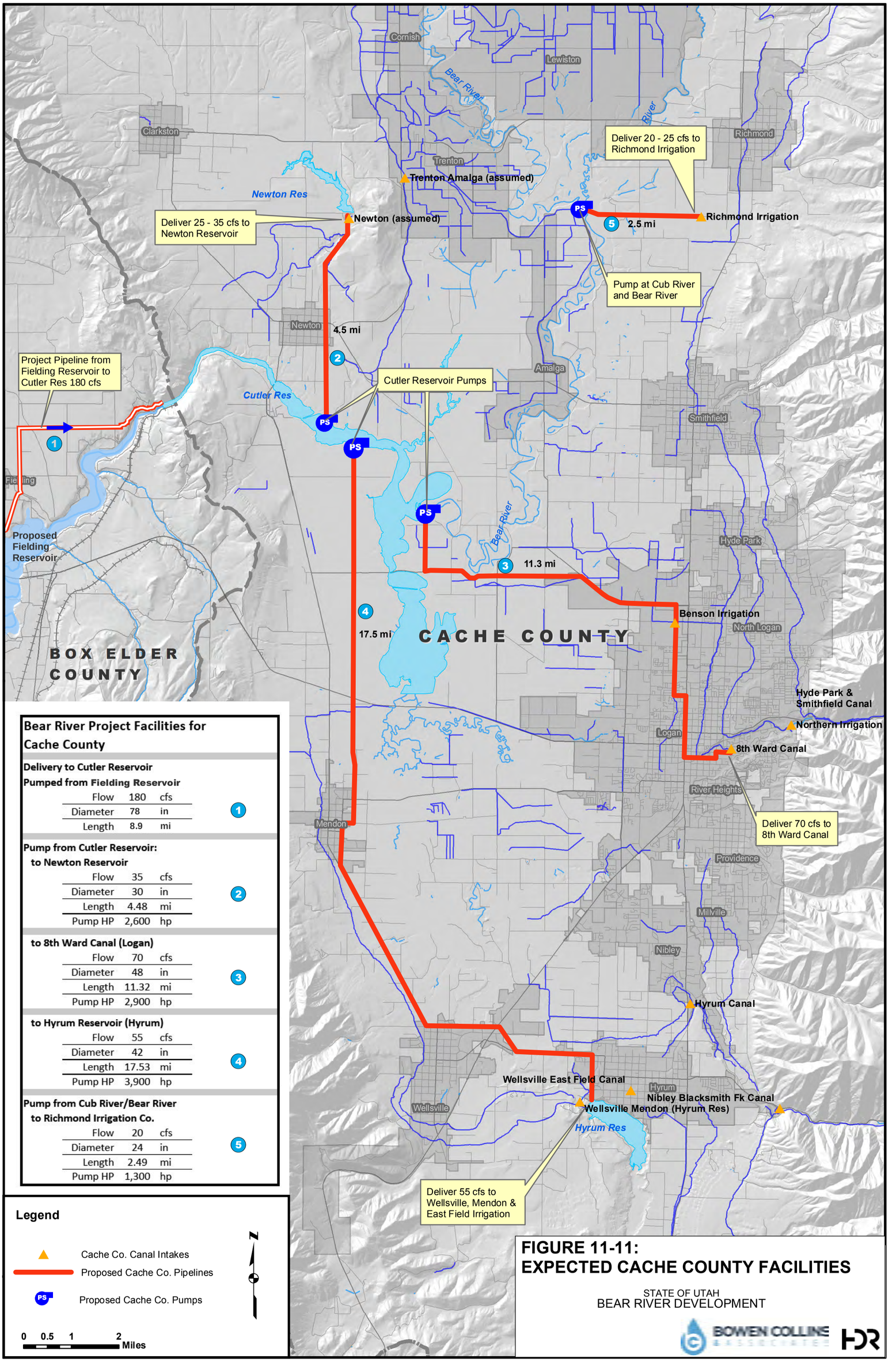

Bear River Project Facilities for Cache County

Delivery to Cutler Reservoir			
Pumped from Fielding Reservoir			
Flow	180	cfs	1
Diameter	78	in	
Length	8.9	mi	
Pump from Cutler Reservoir:			
to Newton Reservoir			
Flow	35	cfs	2
Diameter	30	in	
Length	4.48	mi	
Pump HP	2,600	hp	
to 8th Ward Canal (Logan)			
Flow	70	cfs	3
Diameter	48	in	
Length	11.32	mi	
Pump HP	2,900	hp	
to Hyrum Reservoir (Hyrum)			
Flow	55	cfs	4
Diameter	42	in	
Length	17.53	mi	
Pump HP	3,900	hp	
Pump from Cub River/Bear River to Richmond Irrigation Co.			
Flow	20	cfs	5
Diameter	24	in	
Length	2.49	mi	
Pump HP	1,300	hp	

FIGURE 11-11:
EXPECTED CACHE COUNTY FACILITIES

STATE OF UTAH
BEAR RIVER DEVELOPMENT

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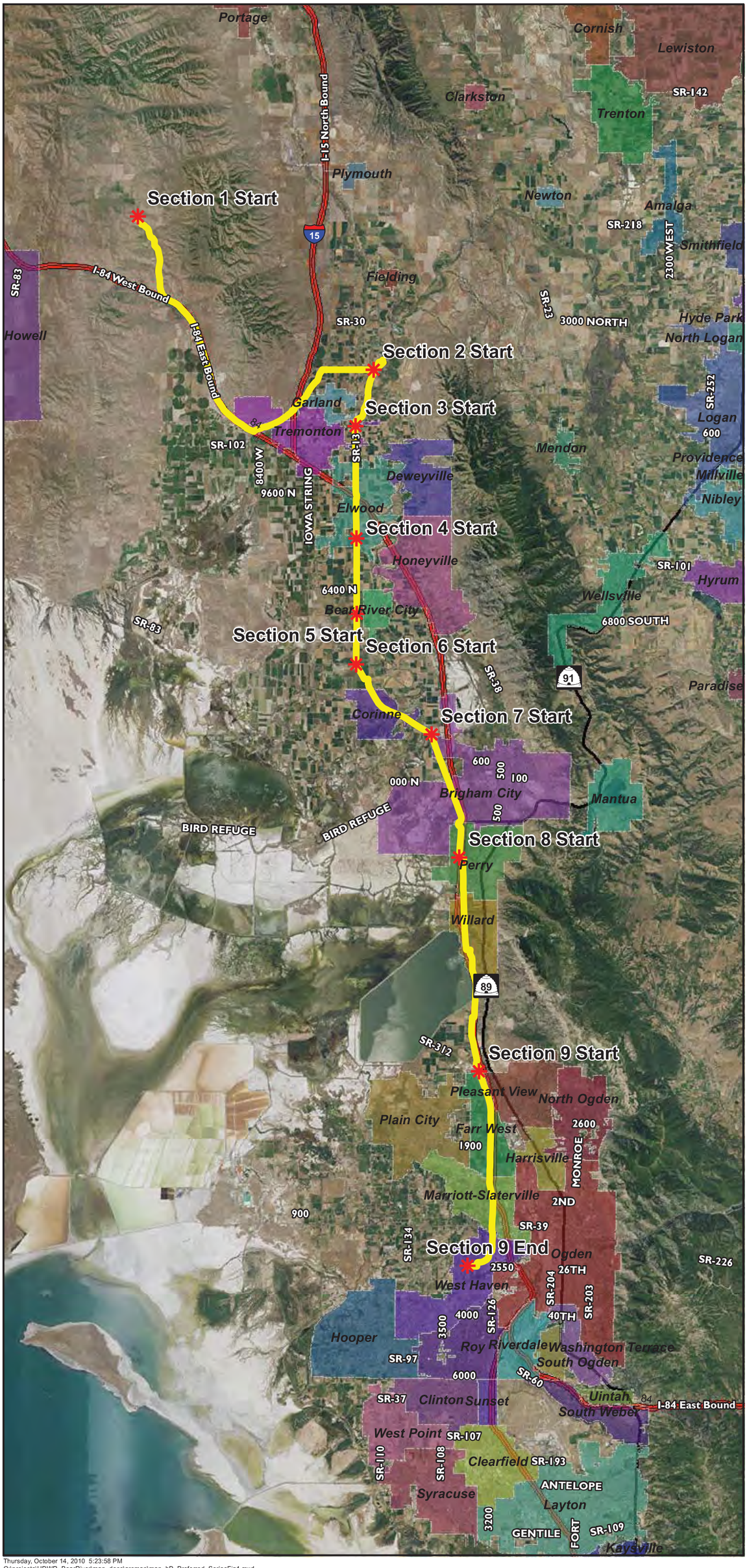
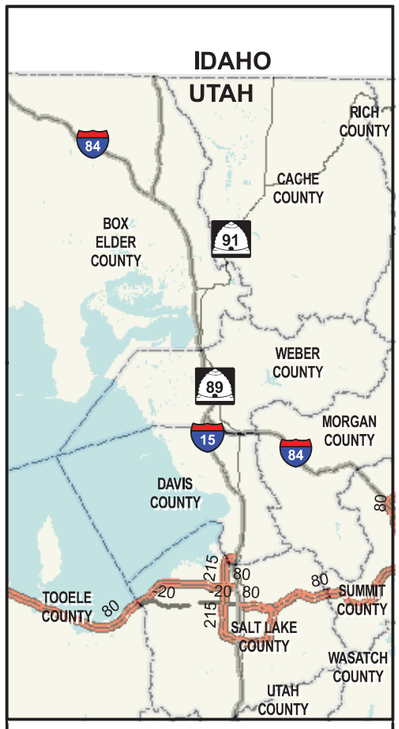
CHAPTER 12 FIGURES





LEGEND

- Section Junction
- Recommended Alignment

0 3.5 7
Miles

Recommended Alignment
Environmental Considerations
Project Area Overview

Figure 12- 0

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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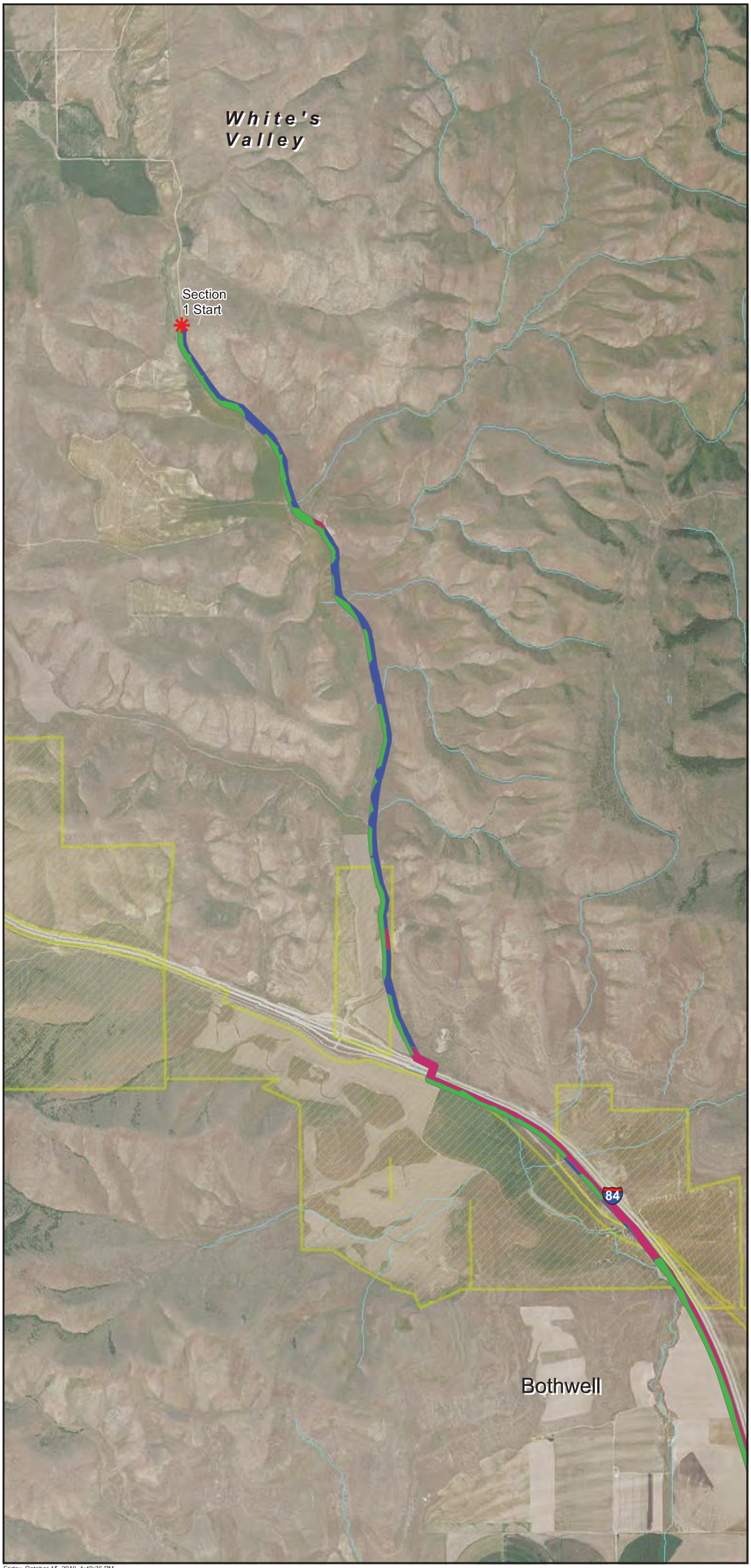

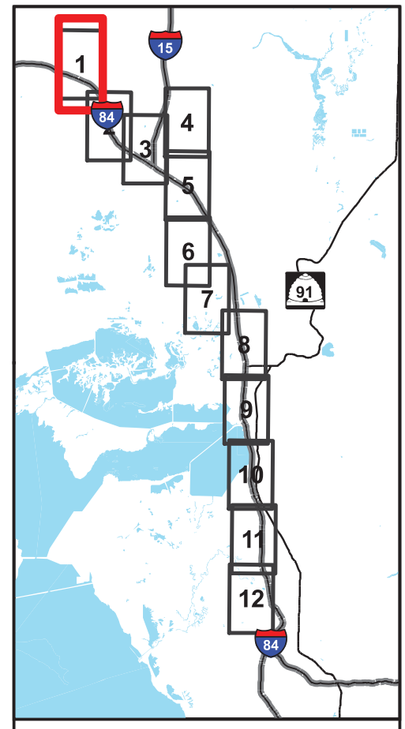

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 1

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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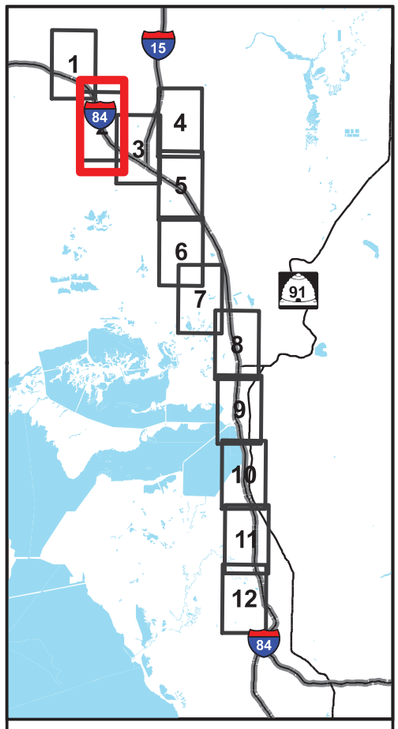

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 2

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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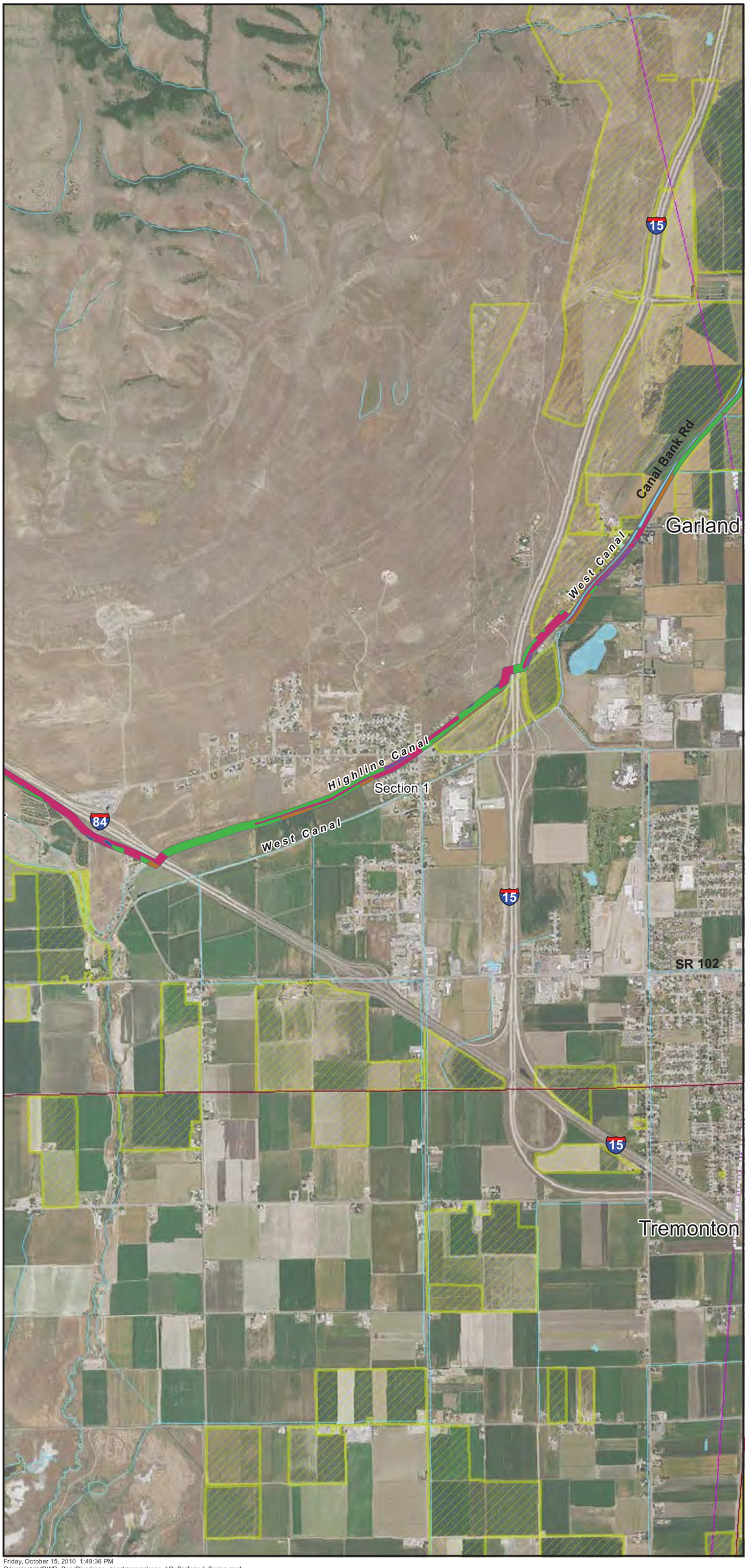

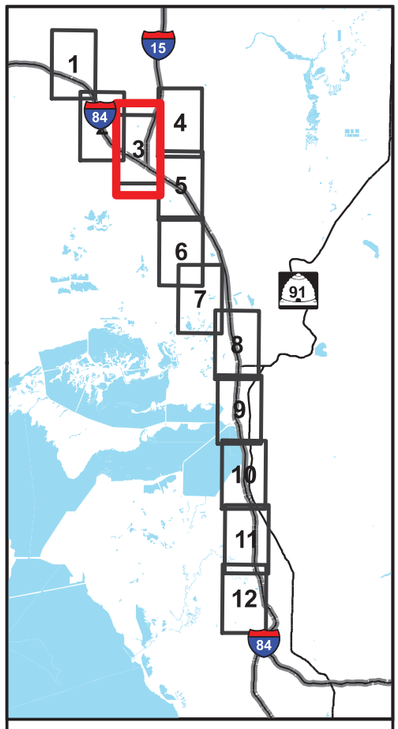

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 3

BEAR RIVER DEVELOPMENT

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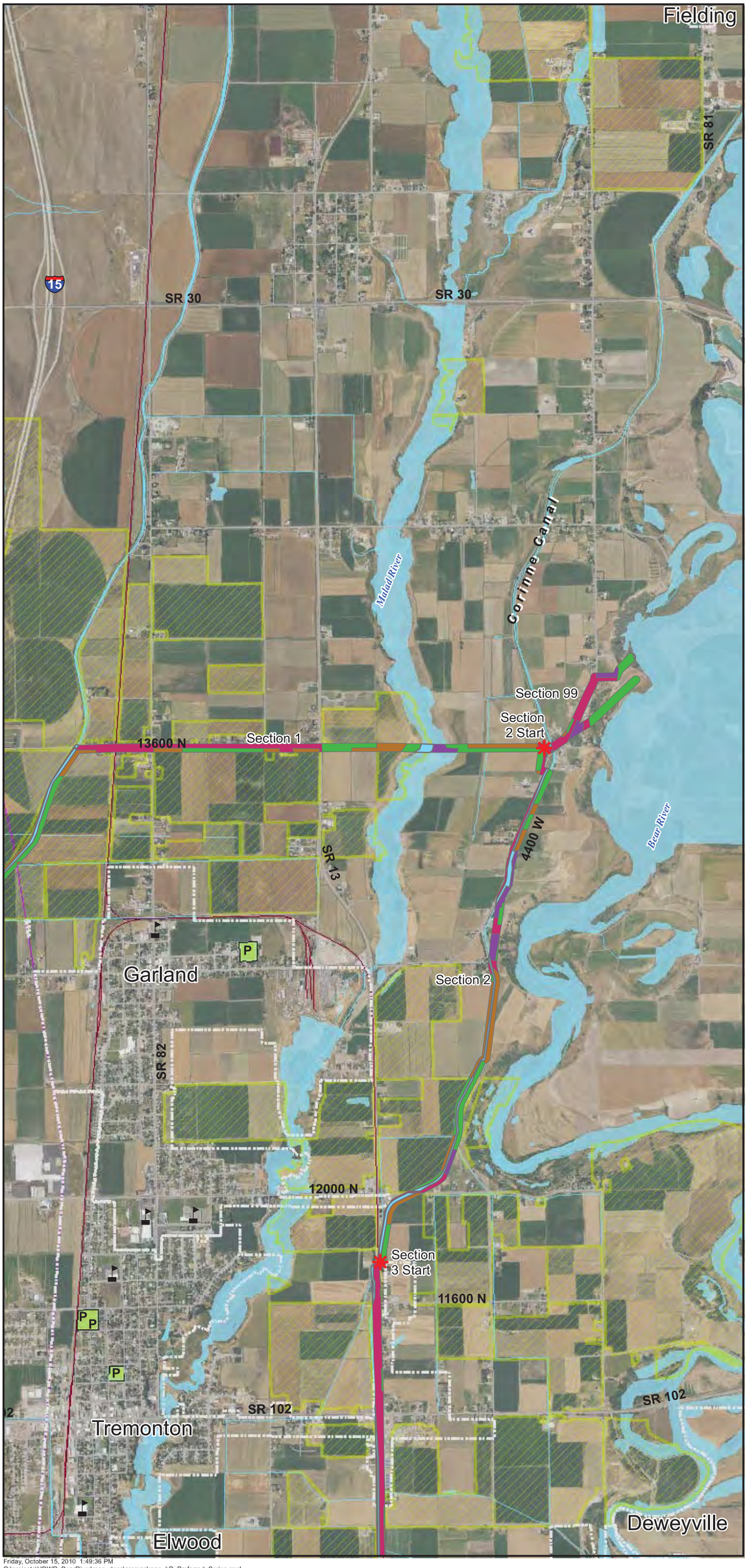

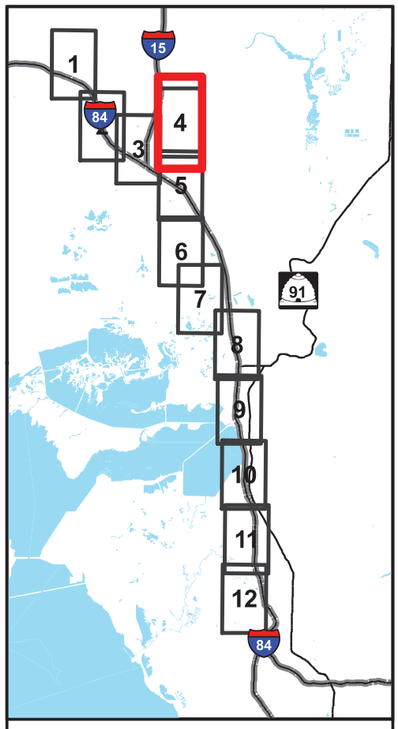

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 4

BEAR RIVER DEVELOPMENT

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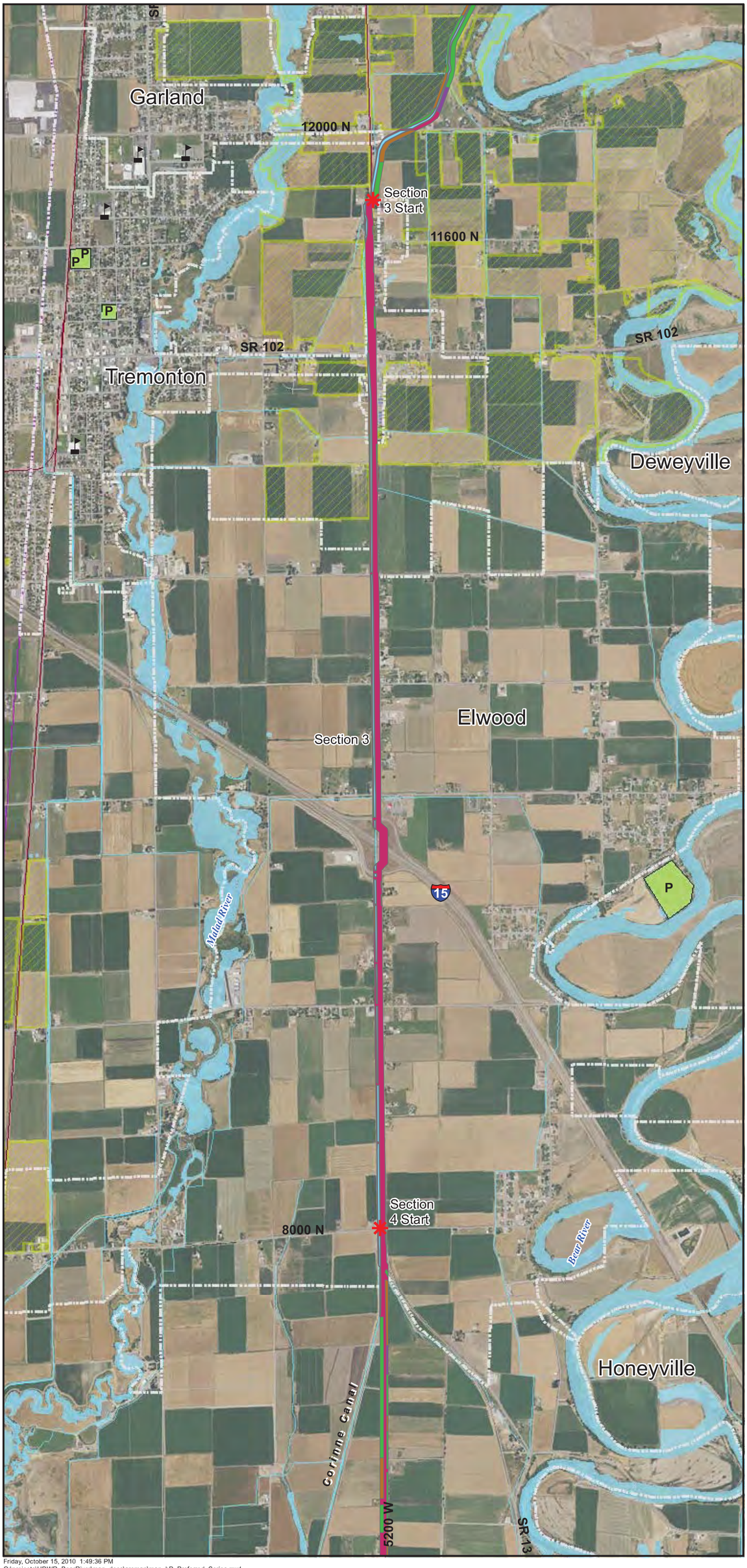

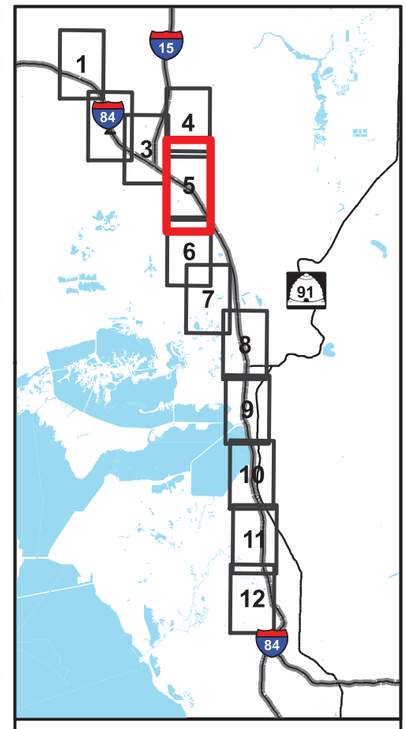

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 5

BEAR RIVER DEVELOPMENT

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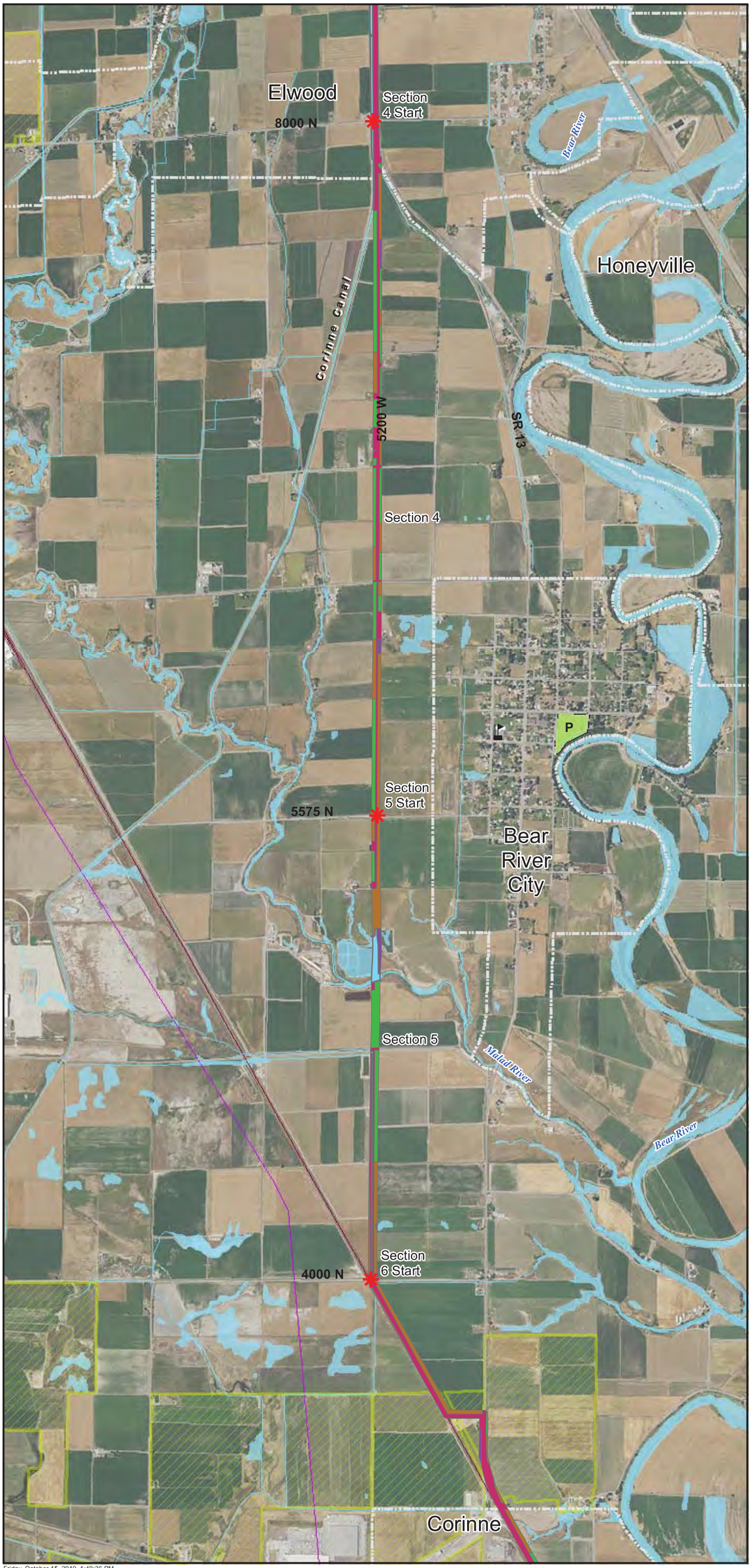

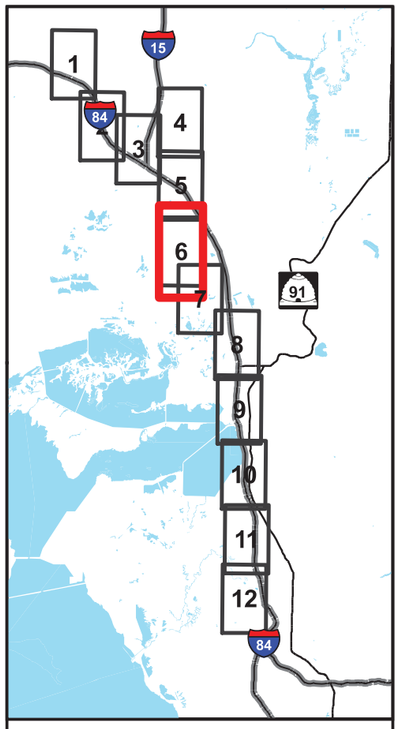

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 6

BEAR RIVER DEVELOPMENT

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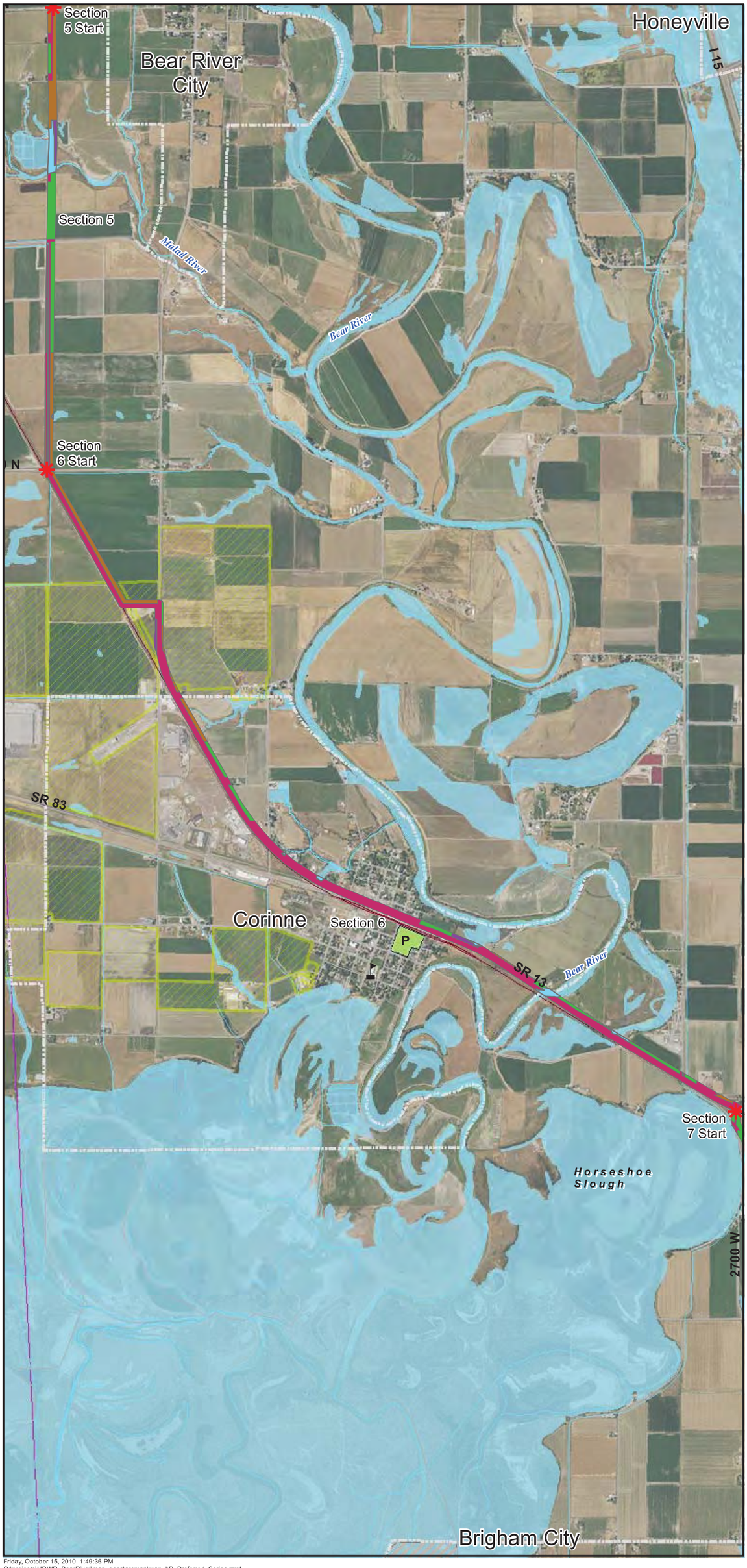

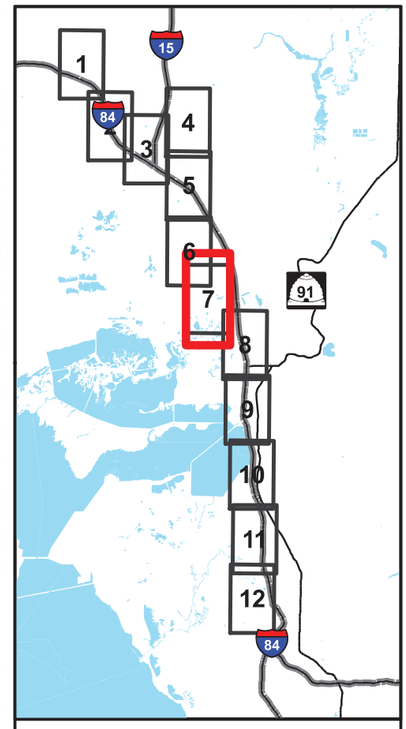

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 7

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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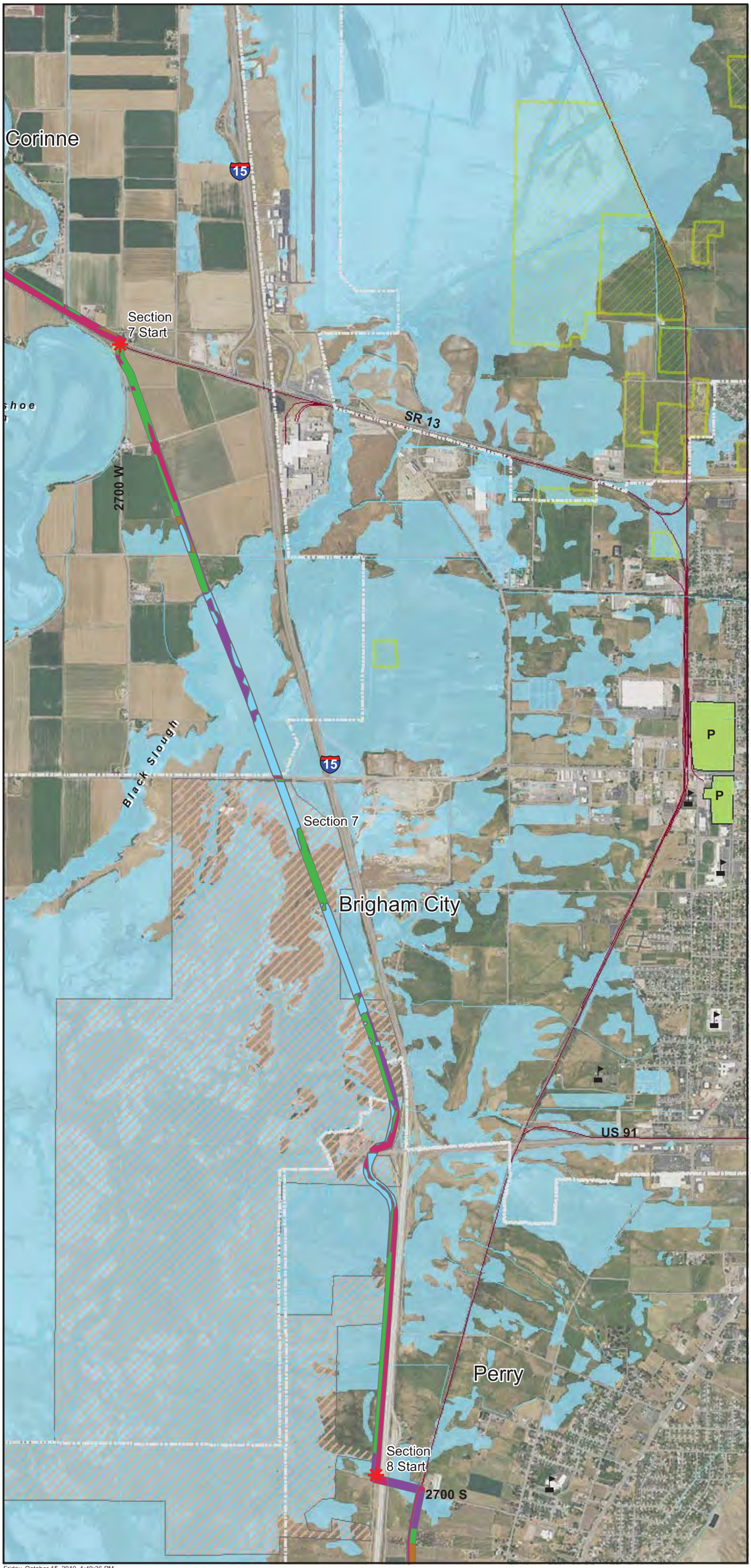

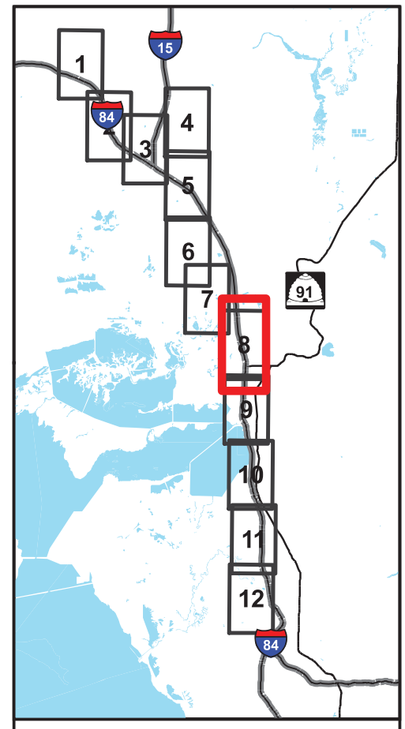

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 8

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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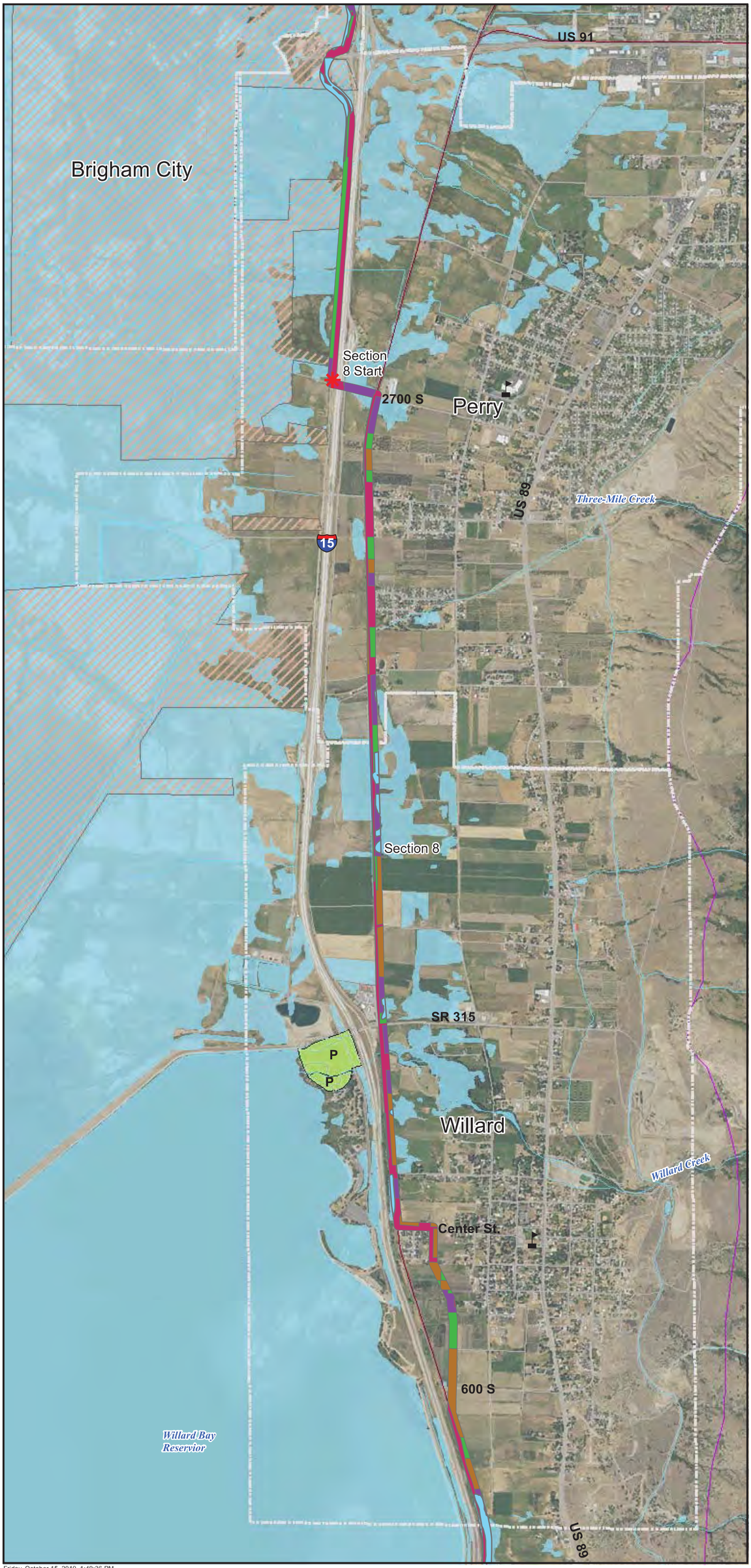

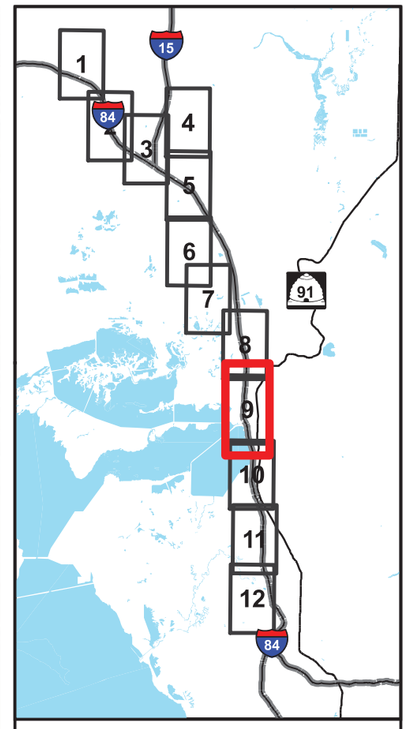

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 9

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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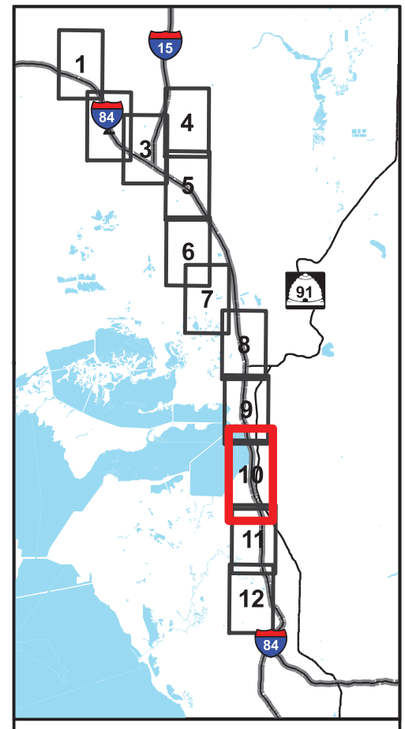

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 10

BEAR RIVER DEVELOPMENT

BOWEN COLLINS & ASSOCIATES

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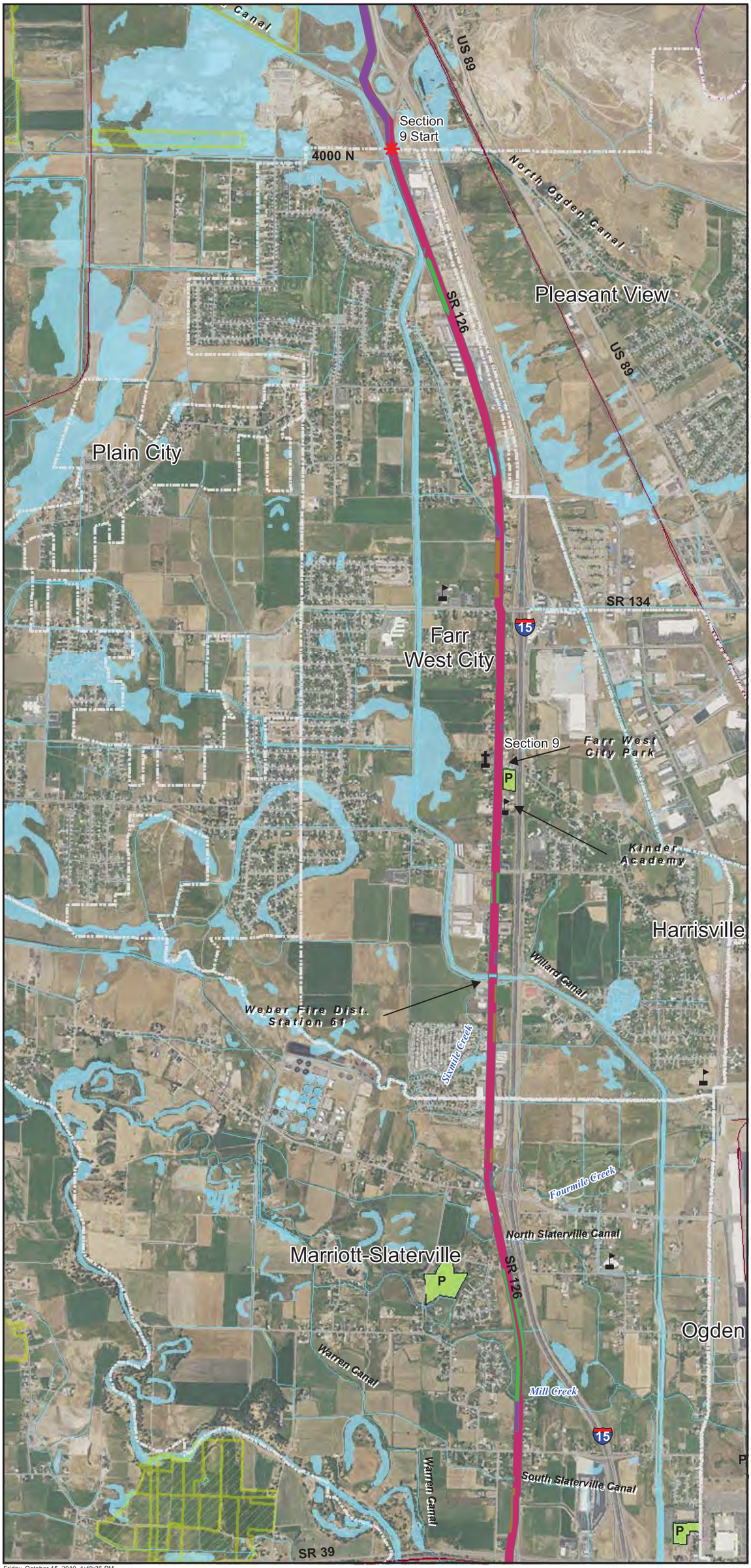

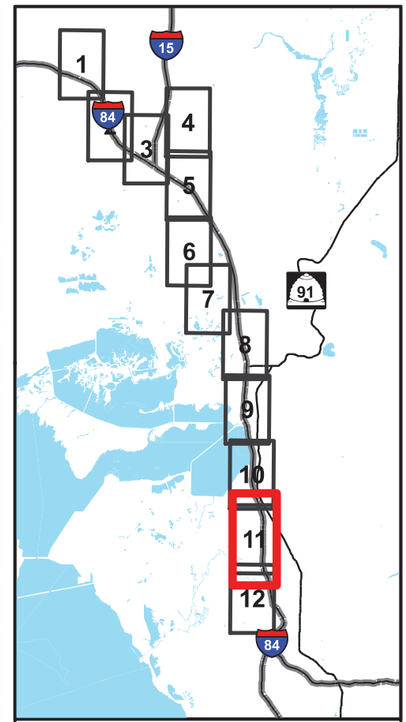

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 11

BEAR RIVER DEVELOPMENT

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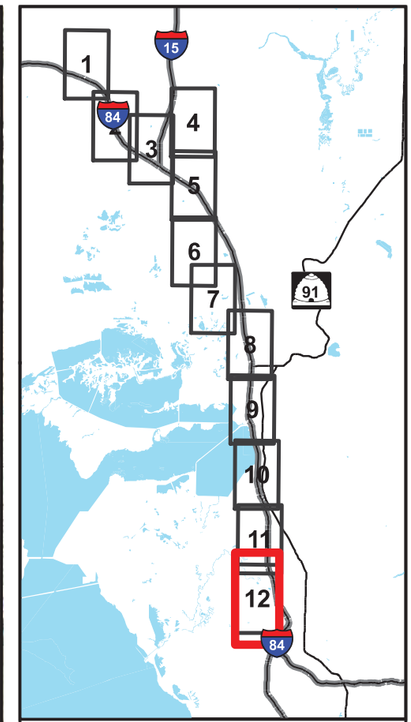

LEGEND

- Section Junctions

Habitat Types

- Agriculture/Crop
- Hayfields
- Pasture
- Shrubland
- Urban
- Wetlands & Waters
- Schools
- Church
- Streams and Canals
- Railroads
- Public Roads
- Agricultural Protection Areas
- Parks
- Wetlands & Waters (outside of study area)
- Bear River Migratory Bird Refuge

N

0 0.5 1

Miles

Recommended Alignment
Environmental Considerations

Figure 12 - 12

BEAR RIVER DEVELOPMENT

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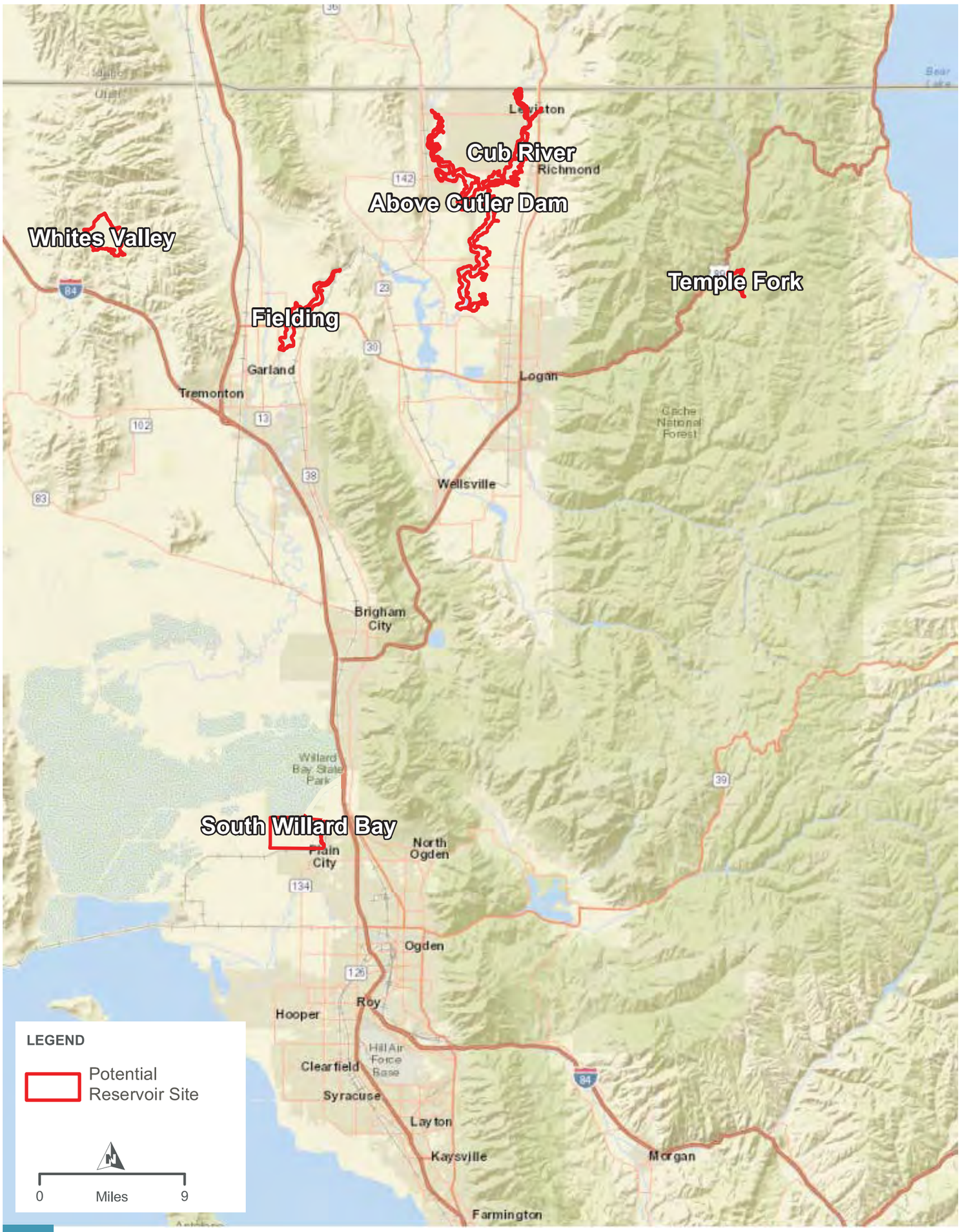

POTENTIAL RESERVOIR SITES
WETLANDS MAPPING OVERVIEW
FIGURE 12-13

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154 East 14075 South
Draper, Utah 84020
Phone: (801) 495-2224
Fax: (801) 495-2225

Eagle, Idaho Office:
776 East Riverside Drive
Suite 250
Eagle, Idaho 83616
Phone: (208) 939-9561
Fax: (208) 939-9571

St. George, Utah Office:
20 North Main
Suite 107
St. George, Utah 84770
Phone: (435) 656-3299
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