Draft Environmental Assessment for the Rehabilitation of Shem Dam

Washington County, Utah
Upper Virgin River Watershed



Sponsoring Local Organization:
Washington County, UT

Prepared By:
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Prepared For:
U.S. Department of Agriculture
Natural Resources Conservation Service

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Lead Agency: U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS)

Cooperating Agency: None

Sponsoring Local Organization: Washington County, UT

Sponsoring Local Tribe: Shivwits Band of Paiutes

Authority: This Draft EA has been prepared under the authority of the Emergency Watershed Protection (EWP) program and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 U.S.C. 4321 et seq.), and the Council on Environmental Quality's regulations at 40 CFR Parts 1500-1508.

Abstract: The original Shem Dam structure was constructed in 1909 as a brush and concrete structure approximately 600 feet upstream from the current dam location. The brush and concrete dam washed out in 1932 during a flood event. A concrete and basalt boulder dam (current dam) was constructed by the Civilian Conservation Corps (CCC) in 1933 that was 42 feet high and more than 300 feet long. Due to the flash flood nature of the Santa Clara River, the dam has been damaged and repaired several times since 1933. Most recently, it was heavily damaged in the flood that occurred in 2011 raising concerns about its structural integrity and ability to withstand future flood events. In accordance with the rehabilitation provisions of USDA-NRCS's EWP program, Shem Dam is eligible for rehabilitation funding due to the 2011 flood damage.

The USDA-NRCS and Washington County have considered numerous conceptual design alternatives for stabilizing the dam. Out of these initial conceptual alternatives, a No Action Alternative and a Stepped Rock Chute Sequence with Energy Dissipaters (Rehabilitate Dam) Alternative have been selected for further environmental analysis in this Draft EA.

Comments: USDA-NRCS has completed this Draft EA in accordance with NEPA and USDA-NRCS guidelines and standards. Reviewers should provide their comments to McMillen, LLC during the allotted public review period. Comments need to be submitted by February 28, 2014. Please send comments to:

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TABLE OF CONTENTS

Acronyms and Abbreviations ..... **vii**

CHAPTER 1. Introduction **1-1**

1.1. Introduction 1-1
1.2. Authority 1-1
1.3. Existing Conditions 1-4
1.3.1. Irrigation System 1-10
1.3.2. Sediment Deposition in Reservoir 1-10
1.4. Purpose and Need of the Project 1-12
1.5. Scope of Draft EA 1-12
1.5.1. Project Planning and Scoping Process History 1-13
1.5.2. Resources Studied In Detail 1-13
1.5.3. Resources Eliminated From Further Study 1-14
1.5.4. Decision Matrix 1-14

CHAPTER 2. Affected Environment **2-1**

2.1. Soil Resources 2-2
2.1.1. Stream Bank Erosion 2-4
2.1.2. Geology 2-5
2.2. Water Resources 2-6
2.2.1. Surface Water Quality/Sedimentation 2-6
2.2.2. Surface Water Quantity (Hydrology) 2-8
2.2.3. Water Rights 2-8
2.2.4. Groundwater 2-9
2.2.5. Floodplains 2-10
2.2.6. Waters of the US including Wetlands 2-10
2.2.7. Climate Change 2-11
2.3. Air Quality 2-11
2.3.1. National Ambient Air Quality Standards 2-11
2.3.2. Climate and Greenhouse Gases 2-12
2.4. Plants 2-13
2.4.1. Vegetation Communities 2-13
2.4.2. Endangered and Threatened Species and Species of Concern 2-13
2.4.3. Invasives 2-14
2.4.4. Riparian Areas 2-15
2.5. Animals 2-15

2.5.1. Fish and Wildlife Habitat 2-15
2.5.2. Terrestrial Endangered and Threatened Species and Species of Concern 2-16
2.5.3. Aquatic Endangered and Threatened Species and Species of Concern 2-19
2.5.4. Invasive Terrestrial and Aquatic Species 2-23
2.5.5. Migratory Birds/Bald and Golden Eagles 2-24
2.6. Human Environment 2-25
2.6.1. Socioeconomics 2-25
2.6.2. Cultural Resources/Historic Properties 2-29
2.6.3. Hazardous, Toxic, and Radioactive Waste (HTRW) 2-31
2.6.4. Recreation 2-32
2.6.5. Visual/Aesthetics and Scenic Beauty 2-34
2.6.6. Land Use 2-37
2.6.7. Infrastructure 2-37
2.6.8. Noise 2-37

CHAPTER 3. Alternatives 3-1

3.1. Formulation Process 3-1
3.2. Alternatives and Options Considered but Eliminated from Detailed Study 3-1
3.3. Alternatives Analyzed 3-3
3.3.1. No Action Alternative 3-3
3.3.2. Stepped Rock Chute Sequence with Energy Dissipaters (Rehabilitate Dam) 3-3
3.4. Past, Present, and Reasonably Foreseeable Projects 3-10
3.4.1. Cumulative Impact Area 3-10
3.5. Preferred Alternative 3-10
3.6. Summary of Mitigation Measures 3-10
3.7. Operation and Maintenance 3-12

CHAPTER 4. Environmental Consequences 4-1

4.1. Summary and Comparison of Alternatives 4-2
4.2. Soil Resources 4-3
4.2.1. Geology, Erosion, and Sedimentation 4-3
4.2.2. Construction Impacts to Soil Resources 4-4
4.3. Water Resources 4-5
4.3.1. Hydrology and Water Quality 4-5
4.3.2. Water Rights 4-7
4.3.3. Groundwater 4-7
4.3.4. Floodplains 4-7
4.3.5. Waters of the US and Wetlands 4-8

4.3.6. Climate Change 4-9
4.3.7. Construction Impacts to Water Resources 4-10
4.4. Air Quality 4-11
4.4.1. Construction Impacts to Air Quality 4-11
4.5. Plants 4-12
4.5.1. Vegetation Communities 4-12
4.5.2. Endangered and Threatened Species and Species of Concern - Plants 4-13
4.5.3. Invasive Plants 4-13
4.5.4. Riparian Areas 4-14
4.5.5. Construction Impacts to Plants 4-15
4.6. Animals 4-15
4.6.1. Habitat 4-16
4.6.2. Endangered and Threatened Species and Species of Concern 4-16
4.6.3. Invasive Species 4-17
4.6.4. Migratory Birds/Bald and Golden Eagles 4-18
4.6.5. Construction Impacts to Aquatic and Terrestrial Animals 4-19
4.7. Human Environment 4-19
4.7.1. Socioeconomics 4-19
4.7.2. Cultural Resources and Historic Properties 4-20
4.7.3. Hazardous Materials 4-21
4.7.4. Recreation 4-22
4.7.5. Visual Quality, Aesthetics and Scenic Beauty 4-22
4.7.6. Land Use 4-23
4.7.7. Infrastructure 4-23
4.7.8. Noise 4-24
4.7.9. Construction Impacts to the Human Environment 4-24
4.8. Cumulative Effects 4-25
4.8.1. Soil Resources 4-25
4.8.2. Water Resources 4-26
4.8.3. Air Quality 4-26
4.8.4. Plants 4-26
4.8.5. Animals 4-26
4.8.6. Human Environment 4-26
4.9. Irreversible and Irretrievable Resource Commitments 4-26
4.9.1. No Action Alternative 4-26
4.9.2. Rehabilitate Dam Alternative 4-27
4.10. Risk and Uncertainty 4-27

CHAPTER 5. Agency, Stakeholder, and Public Involvement 5-1
5.1. Introduction 5-1
5.2. Agency Consultation 5-1
5.3. Project Chronology 5-2
5.4. Public Participation Plan 5-2
5.4.1. Agency Involvement 5-3
5.5. Project Scoping 5-3
5.5.1. Project Scoping Meeting 5-4
5.5.2. Project Scoping Comments 5-4
5.6. Draft EA 5-4

CHAPTER 6. List of Preparers 6-1
6.1. Draft EA Preparers 6-1

CHAPTER 7. Distribution 7-1
7.1. Federal Government 7-1
7.2. Tribal Government 7-1
7.3. State Government 7-1
7.4. Local Government 7-2
7.5. Organizations 7-2
7.6. Businesses 7-2
7.7. Private Parties 7-3

CHAPTER 8. References 8-1

TABLES

Table 1-1. Resources Studied in Detail 1-14
Table 1-2. Resources Eliminated from Further Study 1-14
Table 2-1. Laws and Regulations 2-1
Table 2-2. Water Quality Impairments at Shem Dam 2-6
Table 2-3. Peak Discharges for Various Return Period Santa Clara River, Utah 2-8
Table 2-4. Surface Water Rights in the Study Area 2-9
Table 2-5. Water Quality Results from Public Wells 2-10
Table 2-6. Emissions Inventory, Utah Division of Air Quality (tons/year) 2-12
Table 2-7. Listed Plant Species in Washington County, Utah 2-13
Table 2-8. Noxious Weeds and Other Invasive Plants Potentially Present in the Study Area 2-14
Table 2-9. Federal and State Listed Species in Washington County, Utah 2-16
Table 2-10. Federal and State Listed Aquatic Species in Washington County, Utah 2-20
Table 2-11: Fish Species 2-23
Table 2-12: Invasive Species 2-23

Table 2-13. Land and Products Statistics for Washington County 2-25
Table 2-14. 2010 Population Characteristics 2-26
Table 2-15. Past, Current, and Future Population 2-26
Table 2-16. 2010 Population by Ethnicity 2-27
Table 2-17. 2010 Population by Race 2-27
Table 2-18. Labor Force Characteristics 2-28
Table 2-19. Employment by Industry 2-28
Table 2-20. Median, Mean, and Per Capita Income (in 2011 Inflation-Adjusted Dollars) 2-29
Table 2-21. Poverty Rates 2-29
Table 2-22 Cultural Resources 2-31
Table 2-23 Emergency Services 2-34
Table 4-1. Summary and Comparison of Direct, Indirect, and Short-Term Resource Impacts 4-2
Table 4-2. Cultural Resources Effect Determination 4-21
Table 5-1. Public Outreach Activities 5-2
Table 6-1. List of Preparers 6-1

FIGURES

Figure 1-1. Vicinity Map 1-3
Figure 1-2. Watershed Map 1-5
Figure 1-3. Project Area Map 1-6
Figure 2-1. Soils Map 2-3
Figure 2-2. Water Resources and Floodplains 2-7
Figure 2-3. Recreation 2-33
Figure 3-1. Dam Rehabilitation Demolition Plan 3-5
Figure 3-2. Dam Rehabilitation Alternative 3-6
Figure 3-3. Dam Rehabilitation Profile 3-7
Figure 3-4. Dam Rehabilitation Cross Sections 3-8

PICTURES

Picture 1-1. View from Road at Shem Dam 1-4
Picture 1-2. View Downstream Side of Shem Dam During 2011 Flood Event 1-7
Picture 1-3. View of Right Abutment 1-7
Picture 1-4. Spillway Undercutting 1-8
Picture 1-5. Water Seeping Through Dam 1-8
Picture 1-6. View Looking Northwest at Downstream Face of Dam 1-9
Picture 1-7. View Downstream From Dam Looking Southeast 1-9
Picture 1-8. View of Diversion Box 1-10
Picture 1-9. Sediment Deposited upstream of Shem Dam 1-11
Picture 1-10. Sediment Deposition at the Spillway 1-11
Picture 2-1. View of Stream Bank Erosion Below Dam 2-4
Picture 2-2. Mountain Peak West of Project Area 2-35

Picture 2-3. View of Riparian Zone with Plateaus in Background....2-36
Picture 2-4. View of Flood Damaged Shem Dam....2-36
Picture 3-1. Sediment Stockpile Area looking Southeast....3-4

APPENDICES

A Comments and Responses
Final Shem Dam Rehabilitation Scoping Report
B Conceptual Design
Final Concept Design Report
C Supporting Documentation
Water Rights
Draft Wetland and Stream Delineation Report
Biological Survey Report
USDA-NRCS Shem Dam Geotechnical Explorations USFWS Concurrence Letter

ACRONYMS AND ABBREVIATIONS

ac-ft	acre-feet
ACHP	Advisory Council for Historic Preservation
AMSL	Above Mean Sea Level
APE	Area of Potential Effect
BLM	Bureau of Land Management
BMPs	Best Management Practices
CBD	Center for Biological Diversity
CCS	Center for Climate Strategies
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
cm	centimeter
CWA	Clean Water Act
DAQ	Division of Air Quality
Draft EA	Draft Environmental Assessment
DSR	Damage Survey Report
EA	Environmental Assessment
EDR	Environmental Data Resources, Inc.
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EWP program	Emergency Watershed Protection Program
FEMA	Federal Emergency Management Agency
FR	Federal Register
GHG	greenhouse gas
HTRW	hazardous, toxic, and radioactive waste

kg	kilogram
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MOA	Memorandum of Agreement
MSAT	Mobile Air Source Toxics
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOI	Notice of Intent
NO_x	nitrous oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
USDA-NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NWPM	National Watershed Program Manual
O_3	ozone
PFO	palustrine forested
PM	particulate matter
PMF	Probable Maximum Flood
PSS	palustrine scrub-shrub
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SWPPP	Storm Water Pollution Prevention Plan
T&E	threatened and endangered
TMDL	total maximum daily load
UAC	Utah Administrative Code

UCDC	Utah Conservation Data Center
UDEQ	Utah Department of Environmental Quality
UDNR	Utah Department of Natural Resources
UDWR	Utah Division of Water Resources
UGS	Utah Geological Survey
UPDES	Utah Pollutant Discharge Elimination System
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWCA	Utah Weed Control Association
UWRL	Utah Water Research Laboratory
VOC	volatile organic compound
WCWCD	Washington County Water Conservation District

CHAPTER 1. INTRODUCTION

1.1. Introduction

The United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) is working with Washington County, Utah (Sponsoring Local Organization) through the Emergency Watershed Protection (EWP) program to rehabilitate flood damage to the existing Shem Dam (Figure 1-1). The dam is located on property owned by the Shivwits Band of Paiutes. The dam is also known as Winsor Dam but will be referred to as Shem Dam in this document.

Flood damage from the 2011 flood event on the Santa Clara River heightened concerns that a catastrophic failure of the historic structure could result in significant harm and loss of function to the river downstream from Shem Dam as well as to the adjacent landscape and downstream transportation infrastructure. The effects of recent flooding include cracking and chipping of concrete, undercutting of the downstream foundation, and cracks associated with structural failure. This damage prompted Washington County and, subsequently, the Shivwits Band of Paiutes, to move forward with plans to rehabilitate Shem Dam with financial assistance from the USDA-NRCS.

A National Environmental Policy Act (NEPA) Programmatic Environmental Impact Statement (PEIS) was prepared by NRCS (2004) for the EWP program; however, the rehabilitation needed for Shem Dam does not fit within the analysis parameters of the PEIS. USDA-NRCS has initiated an additional NEPA analysis in the form of this Draft Environmental Assessment (Draft EA) for the rehabilitation of Shem Dam on the Santa Clara River. The primary goal of this document is to analyze impacts to the environment from the proposed project.

1.2. Authority

This Draft EA has been prepared under the authority of the EWP program (authorized by Section 216 of the Flood Control Act of 1950, Public Law 81–516, 33 U.S.C. 701b–1; and Section 403 of the Agricultural Credit Act of 1978, Public Law 95–334, as amended by Section 382, of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104–127, 16 U.S.C. 2203).

This document complies with the requirements of the National Environmental Policy Act of 1969, PL 91-190, as amended (42 U.S.C. 4321 et seq.), and its implementing regulations, which are set forth in the Council on Environmental Quality (CEQ) Regulations 40 CFR Parts 1500-1508; and USDA-NRCS NEPA policy and guidelines 70 CFR Part 650 (NRCS 2006 and 2011a). NEPA requires an evaluation of potential environmental impacts associated with federal actions and will assist USDA-NRCS in determining impacts to the environment from the alternatives considered for detailed study.

EMERGENCY WATERSHED PROTECTION PROGRAM (EWP PROGRAM)

USDA-NRCS provides technical and financial assistance to communities that have been affected by natural disasters, including floods, fires, drought, hurricanes, and other natural disasters. This kind of

assistance is provided through the EWP program, which helps project sponsors and individuals implement emergency recovery measures to relieve imminent hazards to life and property created by a natural disaster that has caused a sudden impairment of a watershed (NRCS 2010).

Rehabilitation of Shem Dam is eligible for funding under the EWP program, which authorizes construction funding (75% of project construction cost) and technical assistance (100% of design/permitting cost) to rehabilitate damage incurred to structures during natural disasters, including flood events.

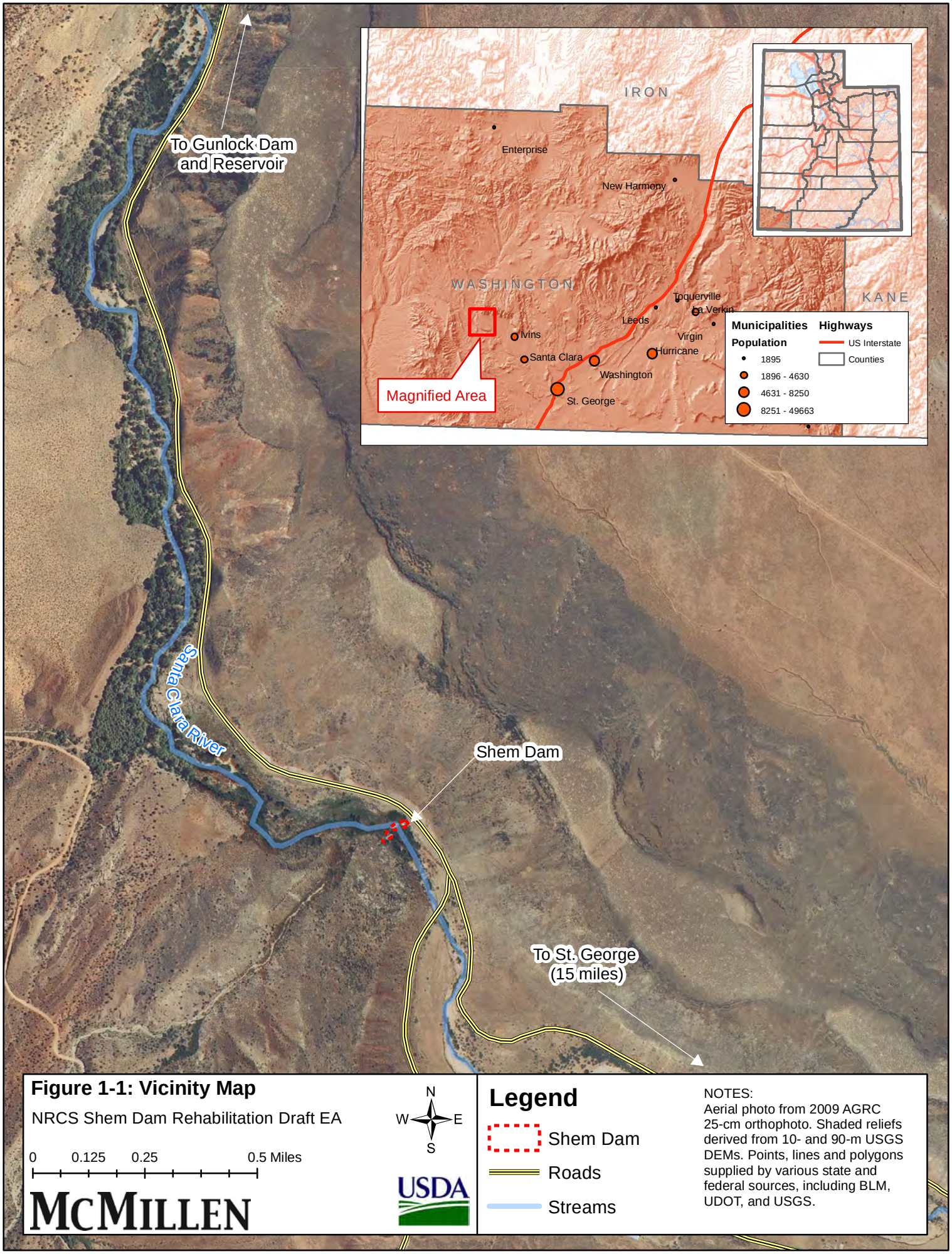


Figure 1-1: Vicinity Map

NRCS Shem Dam Rehabilitation Draft EA

0 0.125 0.25 0.5 Miles

N W E S

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Legend

- Shem Dam
- Roads
- Streams

NOTES:
Aerial photo from 2009 AGRC 25-cm orthophoto. Shaded reliefs derived from 10- and 90-m USGS DEMs. Points, lines and polygons supplied by various state and federal sources, including BLM, UDOT, and USGS.

1.3. Existing Conditions

Shem Dam is located on the Santa Clara River approximately 6 miles upstream of the town of Ivins, Utah. The Santa Clara River Drainage is located within the Upper Virgin River watershed. The Upper Virgin River Watershed serves approximately 145,000 people and nearly 36,000 acres of total irrigated adjudicated water rights in Washington County. Surface waters in the Santa Clara River originate in the Pine Valley Mountains and join the Virgin River approximately 52 miles away, just south of St. George, Utah. The watershed above Shem Dam is approximately 377.5 square miles (Figure 1-2) and consists of a mixture of desert shrub land and forest. The project area is shown on Figure 1-3.



Picture 1-1. View from Road at Shem Dam

Prior to damage caused during recent flood events, the project sponsor, the Shivwits Band of Paiutes, and other affected parties identified a number of deficiencies with the dam including structure deterioration, sediment loading, flooding, and localized scouring below the dam. The existing structure has suffered severe damage from recent flooding above and beyond what was identified prior to the 2011 flood event. This recent damage has brought forth concerns regarding the ability of the structure to withstand another flood event similar to the 2011 flood.

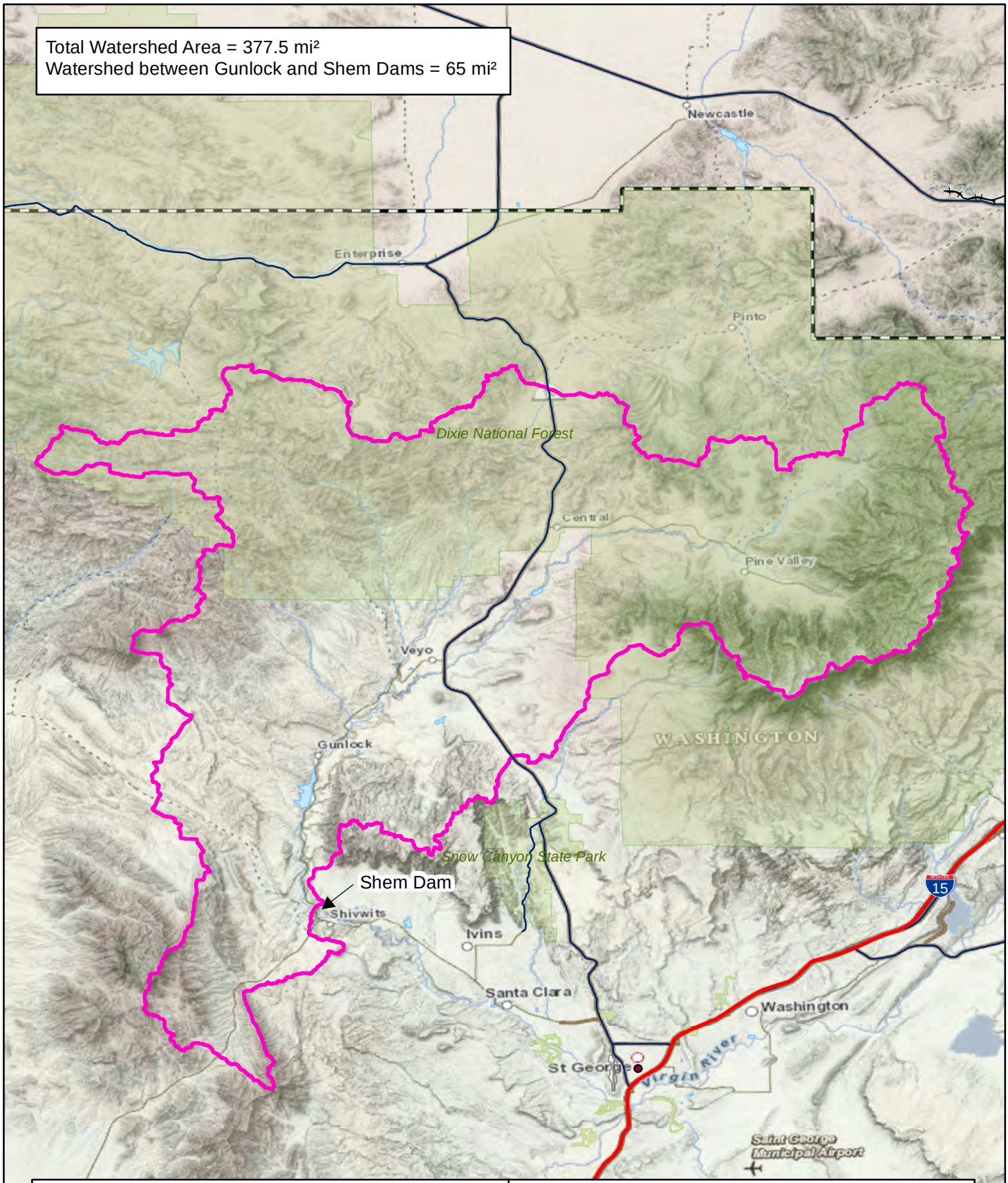


Figure 1-2: Watershed Map

NRCS Shem Dam Rehabilitation Draft EA

NOTES:Points, lines and polygons supplied by various state and federal sources, including BLM, UDOT, and USGS. Watershed boundary approximated using the USGS StreamStats program.

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Legend

- Rivers
- Freeway
- Major Lakes
- State/Nat'l Parks
- Watershed Boundary
- National Forest
- County

0 2.5 5 10 Miles

N W E S

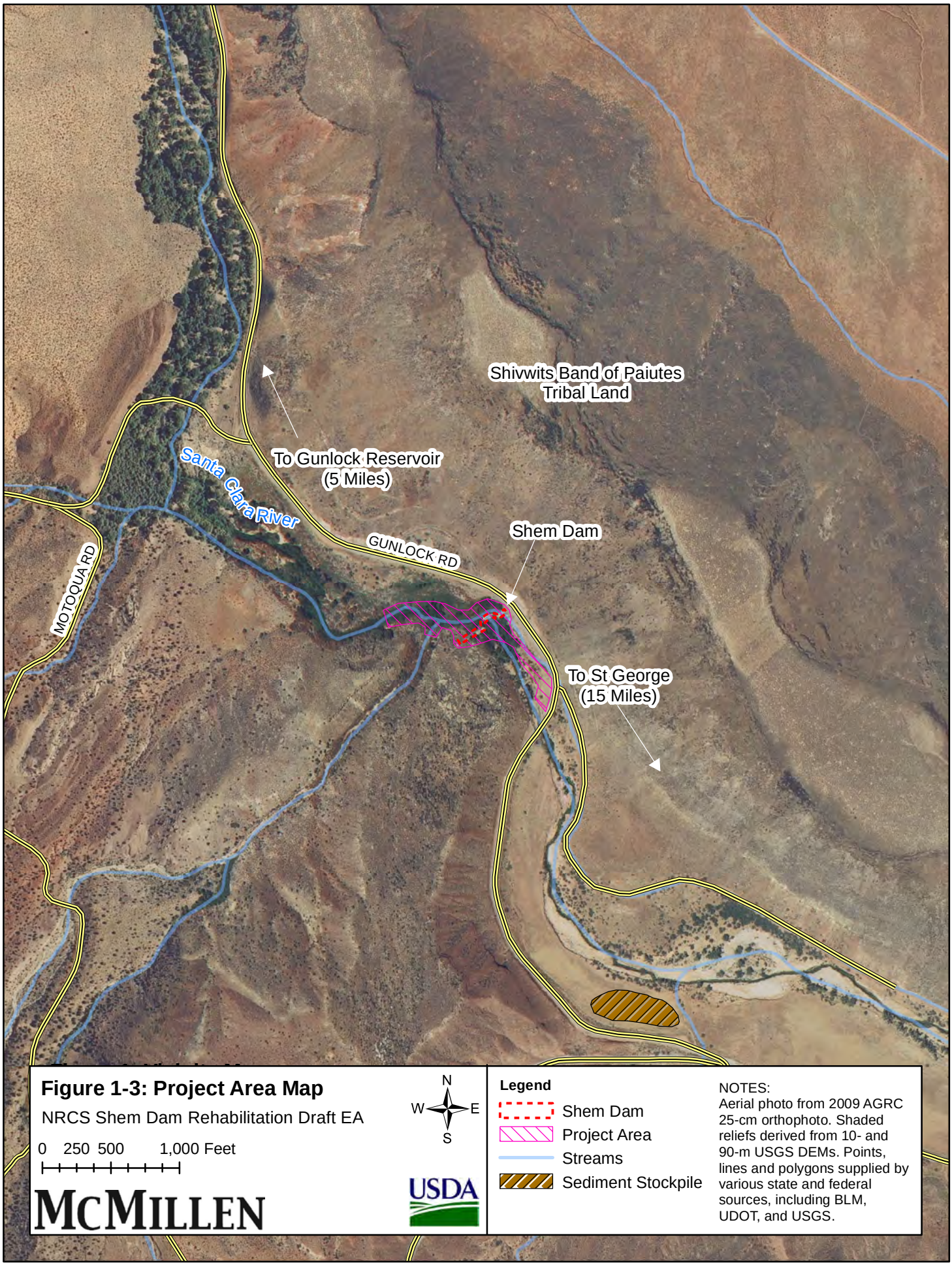


Figure 1-3: Project Area Map

NRCS Shem Dam Rehabilitation Draft EA

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Picture 1-2. View Downstream Side of Shem Dam During 2011 Flood Event



Picture 1-3. View of Right Abutment



Picture 1-4. Spillway Undercutting



Picture 1-5. Water Seeping Through Dam



Picture 1-6. View Looking Northwest at Downstream Face of Dam



Picture 1-7. View Downstream From Dam Looking Southeast

1.3.1. Irrigation System

Historically, Shem Dam was utilized to divert irrigation water to nearby agricultural lands. Records show that the Santa Clara Bench Irrigation Company was the first organization to request official right-of-way access through the Shivwits Indian Reservation. The next was the Ivins Irrigation Company, which was granted an easement for the irrigation canal to the Winsor Diversion (Shem Dam). The most recent easement was on June 9, 2003 granted to the Washington County Water Conservancy District. Its purpose was to allow the installation of a water pipeline from Gunlock Reservoir to Ivins Reservoir. Upon completion of the project, the Ivins Pipeline was in place and thus the easement was terminated. Currently, no water is diverted from Shem Dam for irrigation purposes. The diversion box is still located at the site but is filled in with sediment, overgrown with vegetation, and no longer functioning.



Picture 1-8. View of Diversion Box

1.3.2. Sediment Deposition in Reservoir

The stream reach adjacent to and upstream from Shem Dam up to Gunlock Reservoir is a depositional reach, with large amounts of sediment being deposited behind the dam. Currently, sediment has accumulated up to the top of the spillway and there is no additional sediment storage available in the reservoir. The stream segment below Shem Dam is sediment-starved and stream downcutting and high erosion are major concerns. Based on these site characteristics, it will be important to design any future project with sediment movement as a focal point.



Picture 1-9. Sediment Deposited upstream of Shem Dam



Picture 1-10. Sediment Deposition at the Spillway

1.4. Purpose and Need of the Project

The current Shem Dam was constructed in 1933 and has been modified over the years to maintain the structure and repair damage. The original purpose of the structure was for flood control, sediment retention and irrigation water delivery. Since that time, the reservoir has filled in with sediment and irrigators have ceased using the water delivery system associated with the structure. In accordance with the rehabilitation provisions of USDA-NRCS's EWP program, Shem Dam is eligible for rehabilitation funding due to its flood-damaged infrastructure.

PURPOSE

The Purpose of this project is to rehabilitate Shem Dam to meet current USDA-NRCS and Utah State Dam Safety regulations, current engineering standards, and stabilize the existing dam structure.

NEED

The Need for the project is to stabilize the dam structure so that the large volumes of sediment are not washed downstream that could damage roads and infrastructure in the event of a dam failure.

1.5. Scope of Draft EA

The USDA-NRCS Utah State Office announced its intent to prepare an Environmental Assessment (EA) for the Shem Dam Rehabilitation Project in September 2013. This Draft EA has been prepared by USDA-NRCS to comply with the requirements of the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations. The format of this document follows the outline required for NEPA documents (NRCS 2006 and 2011a).

This Draft EA has been organized into the following chapters:

- Chapter 1.0: Introduction – This chapter describes the purpose and need for the project and provides background information pertaining to the proposed project.
- Chapter 2.0: Affected Environment – This chapter summarizes the past and current conditions of the project area and describes relevant environmental resources that would be affected by the alternatives.
- Chapter 3.0: Alternatives – This chapter provides a summary of the alternatives considered for detailed study as well as alternatives considered for the project but were eliminated from detailed study. It also states which is the preferred alternative and provides a resource impact comparison of all alternatives considered.
- Chapter 4.0: Environmental Consequences – This chapter describes the analysis of impacts to resources from each of the alternatives considered for detailed study. These impacts include direct, indirect and cumulative impacts.

- Chapter 5.0: Agency, Stakeholder, and Public Involvement – This chapter summarizes the steps taken to involve government agencies, tribes and the public in the project. It also presents a summary of anticipated permits and approvals required prior to the start of construction that should be obtained outside of the NEPA process.
- Chapter 6.0: List of Preparers – This chapter contains a list of the document preparers, respective agency or company, and their associated qualifications.
- Chapter 7.0: Distribution – This chapter lists the government entities that the local notice of availability for this document was distributed to for comment.
- Chapter 8.0: References – This chapter lists the references used in support of the information presented in the document.
- Appendices – This section of the document provides supporting documentation for the information presented in the report.

1.5.1. Project Planning and Scoping Process History

After the 2011 flood event receded in the Santa Clara River, damages and deficiencies were identified on Shem Dam by Washington County and the Shivwits Band of Paiutes. Washington County requested financial assistance to rehabilitate through the EWP program in 2011. USDA-NRCS completed a Damage Survey Report (DSR) on the dam and determined that it is eligible for rehabilitation under the EWP program but additional NEPA analysis was required. The planning of the project started in August 2013 with the kick-off of the NEPA EA preparation process.

Agency and stakeholder participation, along with public involvement, are key components that lead the NEPA process. Project information was made available to the public during the first scoping period held by USDA-NRCS from September 10, 2013 to October 9, 2013. Due to the partial government shutdown and consequent inability of agency personnel to participate in the scoping process, a public scoping re-opening was advertised and issued for the period of October 27, 2013 through November 16, 2013. A public scoping meeting was held on September 24, 2013 at Washington County Public Works in St George, Utah. Numerous meetings with agency officials and stakeholders occurred during that time period. Based on the results of these scoping efforts, an EA was determined to be the correct course of action to analyze environmental impacts from the project.

1.5.2. Resources Studied In Detail

Table 1-1 lists the resource considerations that were determined to be relevant to the decisions that must be made concerning the project and require further analysis in this Draft EA. These resources were selected through internal project coordination and public scoping.

Table 1-1. Resources Studied in Detail

Resource Category	Specific Resources Studied	Resource Category	Specific Resources Studied
SOILS	Stream Bank Erosion Geology	PLANTS	Endangered and Threatened Species Invasive Species Riparian Areas
WATERS	Surface Water Quality Sedimentation Hydrology, Water Rights Groundwater, Floodplains Waters of the US/Wetlands Climate Change	ANIMALS	Endangered and Threatened Species Invasive species Fish and Wildlife Habitat
AIR	Air Quality	HUMANS	Cultural Resources Hazardous Toxic and Radiologic Wastes Recreation Public Health and Safety Visual/Aesthetics/Scenic Beauty Land Use, Infrastructure, Noise

1.5.3. Resources Eliminated From Further Study

As directed by Council on Environmental Quality (CEQ) regulations 1500.1(b), 1500.2(b) and other sections, USDA-NRCS eliminated the following resource considerations from detailed study because the proposed action would cause only inconsequential or no effect to occur to these resources. Other than the information presented in Table 1-2 below, this Draft EA contains no further information on these eliminated resource issues.

Table 1-2. Resources Eliminated from Further Study

Resource Category	Specific Resources Eliminated	Resource Category	Specific Resources Eliminated
SOILS	Upland Erosion Prime and Unique Farmlands	PLANTS AND ANIMALS	Natural Areas Essential Fish Habitat Coral Reefs
WATERS	Regional Water Management Plans Coastal Zone Management Areas Wild and Scenic Rivers	HUMANS	Parklands

1.5.4. Decision Matrix

The USDA-NRCS must decide whether to implement the proposed action alternative or the no-action alternative. The USDA-NRCS must also decide if the selected alternative would or would not constitute a major federal action significantly affecting the quality of the human environment. If the USDA-NRCS State Conservationist (responsible official) determines that the selected alternative would not significantly affect the quality of the human environment, then the USDA-NRCS State Conservationist will prepare and sign a Finding of No Significant Impact (FONSI), and the project may proceed. If the USDA-NRCS

State Conservationist determines that the selected alternative would significantly affect the quality of the human environment, then an Environmental Impact Statement (EIS) and a Record of Decision (ROD) must be prepared and signed before the project can proceed.

CHAPTER 2. AFFECTED ENVIRONMENT

The purpose of this chapter is to describe the area that could be affected by the proposed alternatives, including the areas of ecological, cultural, social, aesthetic, and economic resources affected by the proposed action. The purpose of describing the affected environment is to define the context in which the impacts could occur.

In the following sections of this report the *project area* is defined as the resources that occur within one mile of Shem Dam. The term *study area* is often much larger, typically county wide to ensure that all resources are accounted for during project research. The *project site* is synonymous with *project footprint* and only includes the area that would be disturbed during construction.

The environmental analysis process has been conducted in compliance with applicable federal, state, and local regulations. The laws and regulations governing the process for environmental clearance, including those specific to USDA-NRCS policy, are listed in Table 2-1.

Table 2-1. Laws and Regulations

	Regulations
NEPA	7 CFR Part 650-Implementing Regulations for Compliance with NEPA Title 190, General Manual, Part 410, Policy for Compliance with NEPA
Prime, Unique and Important Farmlands Irrigation and Water Rights	Farmland Protection Policy Act of 1981 (7 U.S.C. § 4201, et seq.) Utah Code 73, Water and Irrigation, Water Rights
Emergency/Flood Control Diversion Rehabilitation	7 CFR Part 624—Emergency Watershed Protection Section 216 of the Flood Control Act of 1950, Public Law 81–516, 33 U.S.C. 701b–1 Section 403 of the Agricultural Credit Act of 1978, Public Law 95–334 Section 382, of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104–127, 16 U.S.C. 2203
Watersheds, Water Quality and Floodplains or Floodways Waters of the US, Including Wetlands	Title 390, National Watershed Program Manual (NWPM), Part 500, implementing 7 CFR Part 622 for Watershed Projects under Public Law 83-566, and Flood Prevention Projects under Public Law 78-534 Title 190, NRCS General Manual, Part 410.26, Wetland Policy Executive Order 11988; Floodplain Management 1977 Sections 401, 404 of the Clean Water Act of 1972 (33 U.S.C. § 1251, et seq.) Compensatory Mitigation for Losses of Aquatic Resources 2008 (40 CFR 230) Executive Order 11990; Protection of Wetlands 1977 Utah Code Title 19, Chapter 5; Water Quality Act Utah Administrative Code, Rule R655-13, Stream Alteration Utah Administrative Code, Rule R317-2-3, Antidegradation Policy Utah Administrative Code, Rule R309-600, Drinking Water Source Protection
Point Source Discharge of Pollutants into Surface Waters and Water Quality Certification	Safe Drinking Water Act of 1974 (42 U.S.C. § 300f, et seq.) Utah Code Title 19, Chapter 4; Safe Drinking Water Act

	Regulations
Project-Related Air Quality Compliance	Clean Air Act of 1970 (42 U.S.C. § 7401, et seq.) Utah Code Title 19, Chapter 2, Air Conservation Act Utah Rules, Title R307: Air Quality
Wildlife, Fish and Plants, including Threatened and Endangered Species	Fish and Wildlife Coordination Act of 1934 (16 U.S.C. § 661-667e) Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. § 668-668d) Endangered Species Act of 1973 (16 U.S.C. § 1531, et seq.) Migratory Bird Treaty Act of 1918 (16 U.S.C. § 703, et seq.) Executive Order 13186; Responsibilities of Federal Agencies to Protect Migratory Birds 2001
Potential Impacts to People or Property Easements and Land Acquisitions	Civil Rights Act of 1964 (Title IV, 42 U.S.C. § 2000d, et seq.) Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601, et seq.) Executive Order 12898; Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations 1994 General Manual, Title 190, Part 410.3[b][III]
Cultural Resources	Title 190, National Cultural Resources Procedures Handbook, Part 601 Archaeological and Historic Preservation Act 1974 (16 U.S.C. § 469-469c-2) National Historic Preservation Act of 1966 (16 U.S.C. § 470, et seq.) Archaeological Resource Protection Act 1979 (16 U.S.C. § 470aa-mm) Executive Order 11593; Protection and Enhancement of the Cultural Environment 1971
Disposal of Construction Debris, Impacts Related to Construction Activities	Occupational Safety and Health Act of 1970 (29 U.S.C. § 651, et seq.) Toxic Substances Control Act of 1976 (15 U.S.C. § 2601, et seq.) Utah Code Title 19, Chapter 6; Solid and Hazardous Waste Act
Involvement of Tribal Governments	Executive Order 13175; Consultation and Coordination with Indian Tribal Governments 2000

CFR=Code of Federal Regulations; U.S.C. =United States Code

2.1. Soil Resources

Soil information presented in this section has been summarized from NRCS Web Soil Survey data (NRCS 2013a). Soils in the study area (Figure 2-1) have been mostly derived from the Mancos Shale. The majority of soils found in the project area are class FA, which are sandy fluvaquents and torrifluvents, with a small fraction of riverwash. These are poorly to well drained soils composed of sandy alluvium derived from limestone, sandstone, and shale. These soils are rated as hydric, and therefore may indicate the presence of wetlands. The erodibilities of the soils in the project area are mostly moderate, based on the erosion factors. (Additional details are found in the *Final Concept Design Report*, Appendix B.) These soils are briefly described below.

Fluvaquents and torrifluvents (FA) occur adjacent to the river, for the length of the project area. They are typically comprised of poorly drained, nonsaline to very slightly saline, sandy alluvium derived from limestone, sandstone, and shale. These soils are typical of swales and have a 0 to 2% slope.

The riverbed is composed of stratified, poorly to moderately sorted clay, silt, sand, gravel, and boulder deposits within the project area. Stream banks include similar alluvial deposits up to 10 feet above the

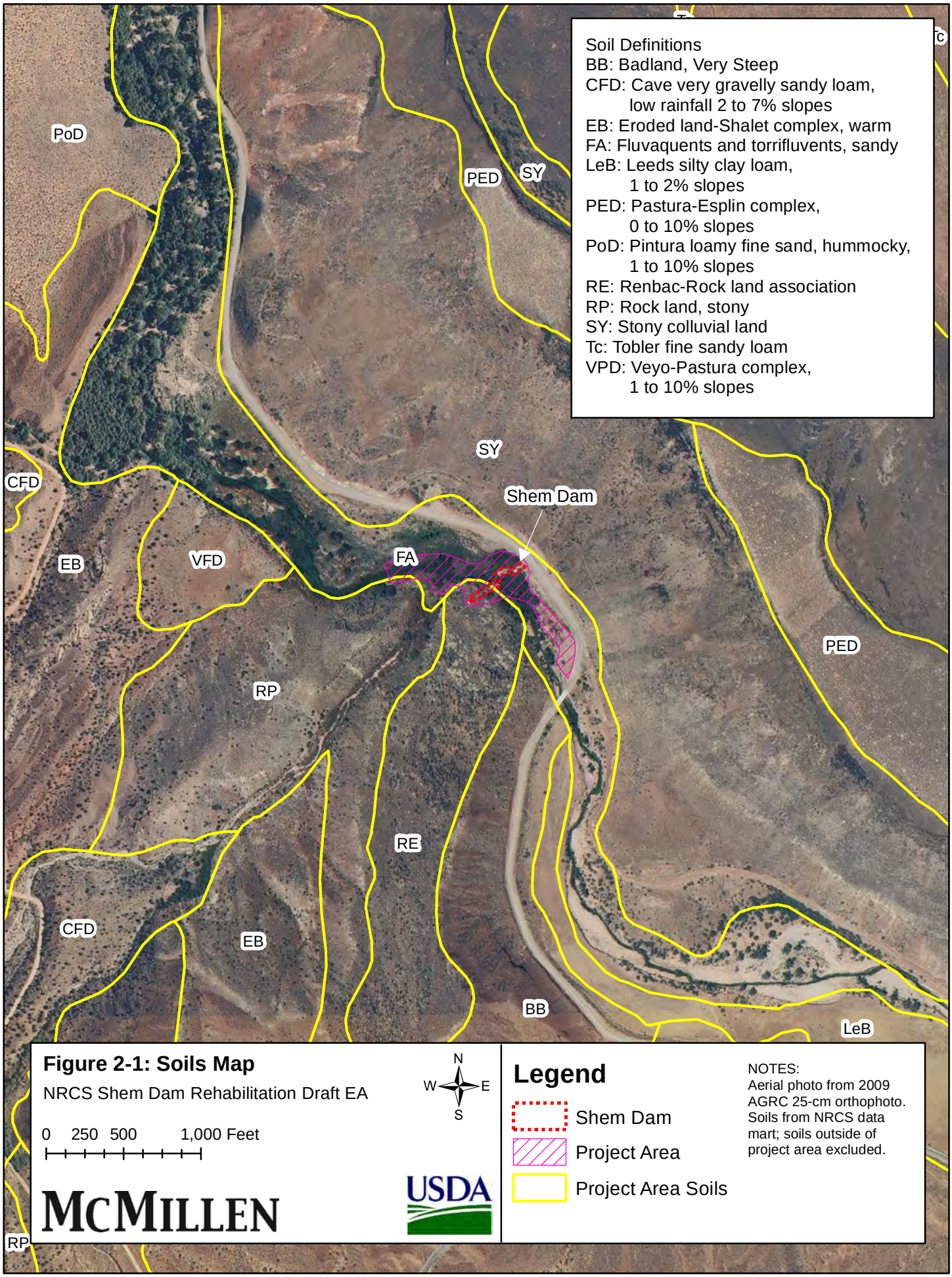


Figure 2-1: Soils Map

NRCS Shem Dam Rehabilitation Draft EA

0 250 500 1,000 Feet

N W E S

McMillen

USDA

Legend

- Shem Dam
- Project Area
- Project Area Soils

NOTES:
Aerial photo from 2009 AGRC 25-cm orthophoto.
Soils from NRCS data mart; soils outside of project area excluded.

channel bed, as well as colluvial deposits from side slopes. The river is underlain primarily with the Petrified Forest Member, which includes bentonitic shale, mudstone, siltsone, and claystone, as well as brightly colored fossilized wood.

It is possible that there could be small inclusions of other soil types within or near the project area, predominantly where construction staging may occur. However, the NRCS Soil Survey does not provide data to that scale. Therefore, care would need to be taken to avoid erosion during staging by implementing Best Management Practices (BMPs) as described in Chapter 4.

2.1.1. Stream Bank Erosion

Thompson and Hardy (2003) indicate that the reach of the Santa Clara River between the Shivwits Reservation and Shem Dam has poor bank stability.

As noted above, local soils are primarily derived from Mancos Shale. These soils are highly erosive and have inconsistent shrink/swell properties (UACD 2012). Runoff from intense summer rainfall events over barren slopes can produce flash floods in the dry washes and canyon bottoms of this region. These floods increase sediment deposition and loading in streams, ultimately causing water quality and flood storage capacity issues. Stream bank erosion occurs naturally but increases when vegetation is removed from the banks.



Picture 2-1. View of Stream Bank Erosion Below Dam

2.1.2. Geology

Shem Dam is situated on the Santa Clara River between Gunlock Reservoir and the City of Ivins, Utah at the base of the Red Mountains. The study area lies in the Basin and Range geologic province. It is characterized by long, straight, north/south-trending mountain ranges and adjacent, internally drained basins (Hurlow, 1998). The geologic units in the immediate vicinity of the dam were identified using a 7.5-minute, interim geologic map of the Santa Clara quadrangle and include the following:

- Quaternary Eolian Sand Deposits (Qes) – mostly quartz sand derived from weathering of the Navajo Sandstone and the Keyenta Formation.
- Quaternary Mixed Alluvial and Colluvial Deposits (Qac) – clay to boulder-sized sediment comprised of stream alluvial deposits and alluvial terrace deposits.
- Jurassic Springdal Sandstone Member (Jks) – mostly moderately sorted, fine to medium grained, medium to very thick bedded ledge to small cliff-forming sandstone.
- Triassic Shinarump Conglomerate Member (TRcs) – medium to coarse grained sandstone with locally well-developed limonite bands.
- Triassic Moenkopi Formation Upper Red member (TRmu) – thin to medium bedded siltstone and very fine grained sandstone with thin gypsum beds and abundant discordant gypsum stringers.
- Triassic Chinle Formation Petrified Forest Member (TRcp) – bentonitic shale, mudstone, siltstone, and claystone with interbeds of sandstone.

The river centerline follows the Gunlock Fault at the project location, with the Shivwits Syncline to the west and the Santa Clara Bench to the east. Gunlock Fault is considered an active fault (USGS 2013). Other geologic hazards include flooding due to expandable soluble and collapsible rock and soil, earthquakes that could result in rock falls and landslides, volcanic eruptions, and radon exposure. The study area is rated as a high hazard area due to soluble and collapsible rock and soil, which have contributed to cracked foundations and walls and other structural damage in the area (Lund et al. 2008). The last geologic hazard that should be noted is that according to Stenner et al. (1999), an earthquake as large as M 6.5-7.0 could occur in the St. George Hurricane area. (Refer to Appendix B *Final Concept Design Report*)

2.2. Water Resources

Figure 2-2 shows the water resources, floodplains, and Waters of the US including wetlands in the study area.

2.2.1. Surface Water Quality/Sedimentation

The Santa Clara River, from the confluence with the Virgin River to Gunlock Reservoir, is listed on Utah's 303(d) listing for exceeding temperature criteria and for excessive concentrations of boron, with the former contaminant having a low total maximum daily load (TMDL) priority, and the latter a medium TMDL priority (UDWQ 2008). The reach is also listed as impaired because it has exceeded limitations for selenium concentration and total dissolved solids (TDS) set by the U.S. Environmental Protection Agency (EPA). EPA also notes the designated use groups affected by these impairments and the possible causes of the impairments (EPA 2010). These impairments are listed in Table 2-2 below, along with the probable sources of the impairment and the use groups affected by them. Natural hillslope erosion, livestock grazing, and dispersed recreational use have also been identified as potential sources of contaminant loading in the reach (Tetra Tech 2004).

Table 2-2. Water Quality Impairments at Shem Dam

Reach of the Santa Clara River, UT (EPA 2010)

Cause of Impairment	Probable Source	Designated Uses
Boron	Unknown	Agricultural
Selenium	Agriculture, Industrial Point Sources, Natural Sources, and Urban Runoff	Warm Water Aquatic Life
Water Temperature	Unknown	Warm Water Aquatic Life
Total Dissolved Solids (TDS)	Agriculture, Industrial Point Sources, Natural Sources, and Urban Runoff	Agricultural

Sedimentation equilibrium of streams is a very important factor of stream health. The sediment transport regime needs to be in equilibrium in order for the stream to be properly functioning. Stated differently, deposition and erosion should be equal or nearly so within a given year. If a stream is not in equilibrium, high erosion upstream can equate to water quality issues downstream. Additionally, the inverse is true: a sediment-starved system upstream can equate to high downstream bank erosion, channel incision and loss of habitat.

The Santa Clara River carries a high suspended sediment load and is characterized as a depositional reach between Gunlock Reservoir and Shem Dam. The alluvial deposits include silty sand, gravel, cobbles, and occasional boulders (Alpha Engineering Company 2010). A large amount of sediment is deposited in this reach which is predominantly red sand. During high flow events, much of the sediment is mobilized and transported downstream. Ivins City officials and Washington County officials fear that in future high flow events, transportation infrastructure that crosses or abuts the Santa Clara River downstream from the Shem Dam could be damaged from excessive sediment yields being transported downstream.

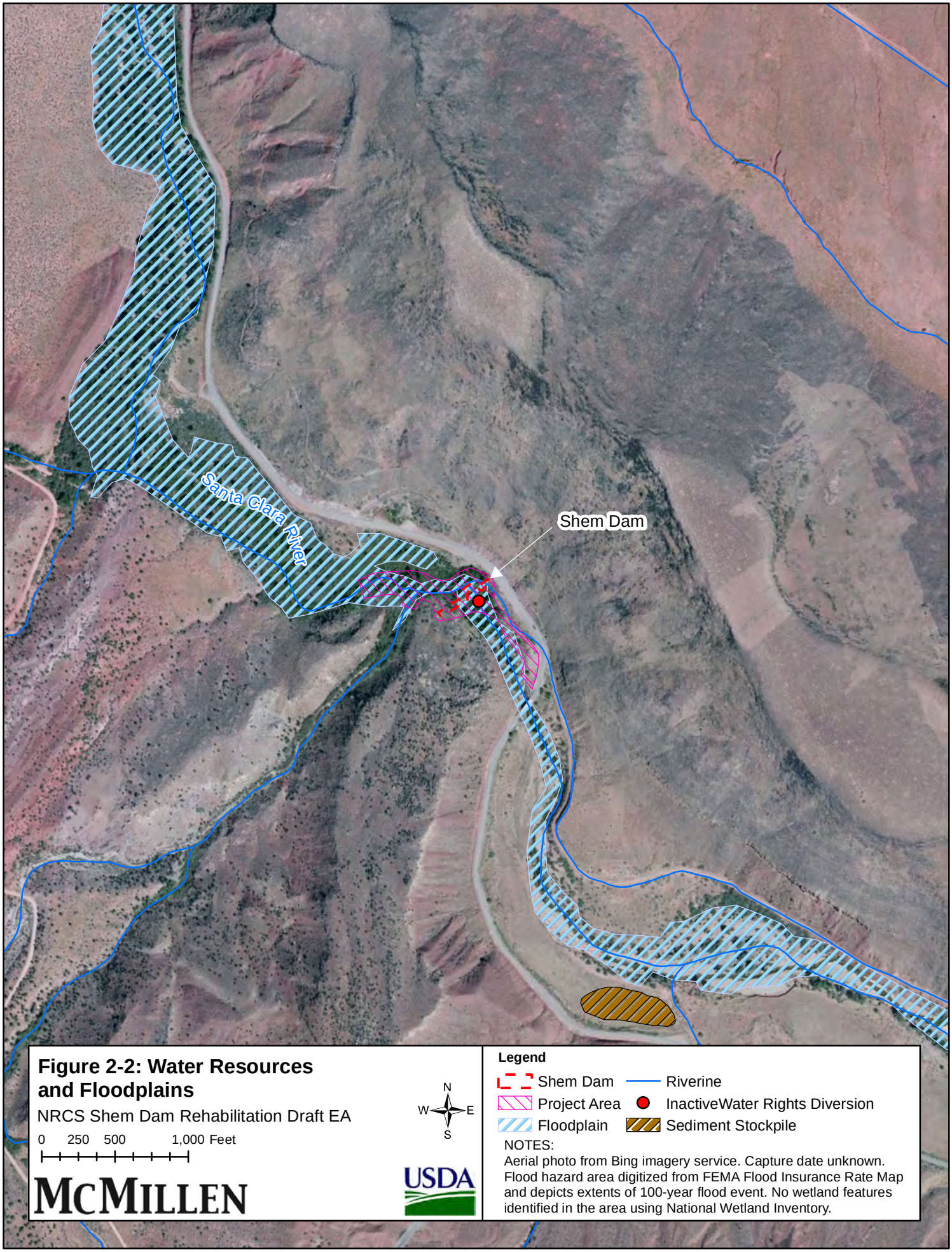


Figure 2-2: Water Resources and Floodplains

NRCS Shem Dam Rehabilitation Draft EA

0 250 500 1,000 Feet

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W E
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McMillen

USDA

Legend

- Shem Dam
- Riverine
- Project Area
- InactiveWater Rights Diversion
- Floodplain
- Sediment Stockpile

NOTES:
Aerial photo from Bing imagery service. Capture date unknown. Flood hazard area digitized from FEMA Flood Insurance Rate Map and depicts extents of 100-year flood event. No wetland features identified in the area using National Wetland Inventory.

2.2.2. Surface Water Quantity (Hydrology)

The Santa Clara River drainage is located within the Upper Virgin River watershed. Surface waters in the Santa Clara River originate in the Pine Valley Mountains and join the Virgin River approximately 52 miles away, just south of St. George. The Upper Virgin River watershed serves approximately 145,000 people and nearly 36,000 acres of total irrigated adjudicated water rights in Washington County.

The hydrology at Shem Dam is regulated by Gunlock Reservoir located approximately 5 miles upstream. The average daily flow rate below Shem Dam is 22 cubic feet per second (cfs) as indicated from a U.S. Geological Survey (USGS) gaging station located just downstream from the project site (Gaging Station 09410100). The average annual peak flow rate for the Santa Clara River at Shem Dam is 666 cfs based on a 29-year period.

The mean annual precipitation for the area is 18.1 inches. Precipitation comes predominantly in the spring months: March through May. It should be noted that high stream flows during these months are favorable for the spawning needs of the Virgin spinedace, which typically spawns from April through June. Table 2-3 summarizes the peak discharge flows in the Santa Clara River (McMillen 2013).

Table 2-3. Peak Discharges for Various Return Period Santa Clara River, Utah

Statistic	Discharge (cfs)
2-year	457
20-year	1,479
50-year	9,762
100-year	15,411

Estimated Using HEC-SSP

2.2.3. Water Rights

Shem Dam (also known as Winsor Dam) is located approximately 5 miles downstream of Gunlock Reservoir. Land holdings along this stretch of river include Gunlock State Park, Bureau of Land Management (BLM) lands, and the Shivwits Band of Paiute Indian Tribe Reservation. The river below Gunlock Reservoir historically ran dry during the winter months when irrigation releases were stopped. However, the completion of the Santa Clara Pipeline Project in 2004 provides for a continuous flow of 3 cfs during the winter months as well as an additional 2 cfs of flow that is currently being leased from the Shivwits Band of Paiutes to augment instream flow (WCWCD 2006).

Water rights in the study area were reviewed using the Utah Division of Water Rights (UDWR) interactive map. Several water rights were identified at the Shem Dam Diversion and upstream along the Santa Clara River. Owners of these water rights include the Ivins Irrigations Company and the Shivwits Band of Paiutes. A list of identified water rights is provided below in Table 2-4 and copies of each water right are located in Appendix C. Currently no water is being diverted from Shem Dam. All water rights associated with the point of diversion were transferred to other points of diversion when the pipeline was installed. The diversion structure is dilapidated and overgrown with vegetation and has not been used in

several years. However, state water right records do not indicate that these water rights have been transferred or canceled. Water resources were analyzed under current conditions with no water being diverted from Shem Dam for irrigation or any other purpose.

Additionally, several water right transfers were identified at Shem Dam. However, a review of the UDWR maps indicated that these transfers are associated with groundwater wells located over 3 miles away from the study area within the City of Ivins.

Table 2-4. Surface Water Rights in the Study Area

Water Right ID	Owner	cfs	acre-ft	Use	Point of Diversion	Notes
Shem Dam Water Rights						
81-7	Ivins Irrigation company	14.9		Irrigation	Surface - Rock/concrete Diversion Dam	Inactive
81-77			1000	Irrigation	Surface - Diversion Dam & Pipeline	Inactive
81-2313	USA in Trust for the Shivwits Band of Paiutes	1.242	399.18	Irrigation	Surface - Diversion Dam	Inactive
81-2425		0.138	100.02	Irrigation	Surface - Diversion Dam	Inactive
Upstream Water Rights						
a13227	USA in Trust for the Shivwits Band of Paiute	1.38	499.2	Irrigation	Woodbury Ditch and Indian Farm Ditch	Amendment to 81-2425 to change the point of diversion to a sump, pump, and pipeline

2.2.4. Groundwater

No site-specific groundwater information exists for the Shem Dam site; however, data does exist for groundwater conditions in the Ivins area approximately 5.5 miles downstream to the southeast (WCWCD 1997). Groundwater in the Gunlock area flows southward through alluvial and fracture pathways. Groundwater in this general area is associated with the Iron Springs formation above the Navajo sandstone outcrop (WCWCD 1997). In the Ivins and Santa Clara areas, alluvial groundwater lies below the Navajo outcrop and flows south and southeast. Groundwater typically moves down through the Santa Clara River valley. The groundwater has an average saturated alluvial depth of 25 feet, as approximated from 1997 mapping produced by the Utah Geological Survey (WCWCD 1997).

WCWCD (1997) reported that high quality groundwater is found in many of the public wells utilized near Shem Dam including those in the communities of Ivins, Santa Clara, and St. George. The aquifers associated with these wells could likely be classified Class IA or “Pristine” according to the Utah Groundwater Quality Protection Regulations. A lesser number of existing public water supply wells that obtain water from aquifers meet the classification of Class II or “Drinking Water Quality”, which is a

lower classification but still acceptable for public water supplies (WCWCD 1997). Table 2-5 provides water quality results from the closest public well for the city of Ivins.

Table 2-5. Water Quality Results from Public Wells

Site	Total Dissolved Solids (mg/L)	Chloride (mg/L)	pH (S.U.)	Sulfate (mg/L)	Nitrate (mg/L)
Ivins –Town Spring	232	20	8.1	69	0.80
Ivins – St. George Well	279	20	7.5	44	0.64

mg/L=milligrams per liter S.U. – standard unit

2.2.5. Floodplains

The Federal Emergency Management Agency (FEMA) flood insurance maps for the study area (Maps 4902320016A and 4900620005B) indicate that the 100-year floodplain extends for approximately 100 feet to 150 feet in width along the Santa Clara River between the Gunlock Reservoir and the City of Santa Clara, UT (FEMA, 2013 and EDR, 2013) as depicted on Figure 2-2.

Flooding is not uncommon on the Santa Clara River, with high flow events produced by storms occurring during any season (NCD 2005); however, the majority of precipitation occurs during the spring months. The Santa Clara River is fed by a large watershed. The catchment area at Gunlock Reservoir (immediately above Shem Dam) is approximately 270 square miles. Gunlock Reservoir is managed to store water for agricultural and domestic uses, not for flood control (NCD 2005).

2.2.6. Waters of the US including Wetlands

Data compiled by the National Wetland Inventory (NWI) shows no formally documented wetlands in the Shem Dam area. According to the Washington County Water Conservation District (WCWCD) (1999), year-round water does exist in the Santa Clara River above and below Shem Dam, although flows may be limited during summer months. Wetlands are present but are very small. They exist as thin bands within riparian areas along the banks of the Santa Clara River are riverine habitats with cobble-gravel, sand, and mud stream bottom. (Cowardin et al., 1979) Riparian lands are areas along streams, rivers, and desert washes where the vegetation reflects the permanent influence of surface or subsurface water. In the Virgin River floodplain, typical riparian vegetation consists of trees or shrubs such as cottonwood, willow, salt cedar, and Russian olive; herbaceous plants including grasses, forbs, rushes, and sedges; and aquatic plants such as watercress and cattails (WCWCD 1999). The Santa Clara River riparian areas are likely similar to nearby Virgin River riparian and wetland areas, which play an important role for resident and migratory game and non-game birds as well as numerous mammals, reptiles, and insects. These wetlands and riparian areas are especially important due to their relative scarcity. There are a number of threatened, endangered, or other important species that are dependent on these habitats (WCWCD 1999).

There are numerous ephemeral washes which intermittently run water which contributes to the Santa Clara River. Only one significant side drainage is an intermittent tributary within the project area and is located on the southwest side of the river. The side drainage does add to the size of the wetlands within the project area, however, there will be little impact to the drainage due to the construction taking place downstream from the convergence of the ephemeral stream with the Santa Clara River.

McMillen and Browne Consulting, LLC completed a wetland and stream delineation within the Project Area in fall 2013. The delineation identified the following jurisdictional waters of the US, including wetlands, as described in the *Draft Wetland and Stream Delineation Report* (McMillen and Browne Consulting 2014) located in Appendix C.

- Santa Clara River
- A high-flow side channel of the Santa Clara River
- Motoqua Wash, an ephemeral tributary
- Riparian Wetlands

2.2.7. Climate Change

A recent report by the Southwest Climate Alliance (Cayan et al. 2013) described an evaluation of the potential future conditions in the Southwestern U.S. based on the latest climate change models. The key findings include the following:

- Air temperatures in the Southwest will rise by more than 3° F over the next 100 years (high confidence).
- Temperature rise will occur more in summer and fall than in winter and spring (medium-high confidence).
- Climate variations in temperature and precipitation will continue to be prominent (year to year and decade to decade; high confidence).
- There will be lower precipitation in the southern portion of the Southwest region and little change in the northern portion of the region (medium-low confidence).
- There will be a reduction in mountain snowpack over the next 100 years (high confidence).
- Substantial areas of the region will have reduced runoff and stream flow over the rest of the century (medium-high confidence).

2.3. Air Quality

2.3.1. National Ambient Air Quality Standards

Pursuant to requirements of the Clean Air Act (42 U.S.C. 7401 et seq), EPA has established health-based National Ambient Air Quality Standards (NAAQS) for six pollutants considered harmful to public health

and the environment known as criteria pollutants. Monitoring of NAAQS pollutants is delegated to state authority and is conducted in Utah by the Utah Department of Environmental Quality's (UDEQ's) Division of Air Quality (DAQ). The following air quality data are summarized from the UDAQ 2012 Annual Report.

NAAQS pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), sulfur dioxide (SO_2), and lead (Pb). DAQ has 26 fixed air quality monitoring stations throughout the state of Utah to monitor the NAAQS pollutants. There is one fixed monitoring station in Washington County. Washington County is not listed as a NAAQS nonattainment or maintenance area.

The nearest air quality monitoring station to the project site is located in the city of Hurricane, approximately 27 linear miles east of Shem Dam, where NO_2, O_3, and SO_2 are monitored. The nearest monitoring station that collects all NAAQS designated criteria pollutants is located in the city of Magna, over 250 miles away. Based on the data reviewed, the study area appears to be in compliance with NAAQS standards.

Under Title R307 of the Utah Administrative Code (UAC), emission inventories must be undertaken to further characterize air quality throughout Utah. Emission inventories are conducted every 3 years, during which DAQ collects information about the types and quantities of compounds released by all emission sources in the state. Sources can be categorized as point (large stationary industrial or commercial facilities), area (smaller stationary sources that are assessed as a group), or mobile (personal or commercial vehicles). The 2011 triennial inventory is the most recent state-wide inventory available. It covers over 440 point sources, 99 area sources, and 12 non- and on-road source categories. The data collected are used by DAQ to review trends over time and manage the air quality program. Results in tons of compound emitted per year are shown in Table 2-6 below.

Table 2-6. Emissions Inventory, Utah Division of Air Quality (tons/year)

County	CO	NO_2	PM_{10}	$PM_{2.5}$	SO_2	VOC
Washington	34,616.162	5,266.240	3,028.793	997.268	79.908	57,435.485

CO=carbon monoxide; NO_2=nitrogen dioxide; PM=particulate matter; SO_2=sulfur dioxide; VOC=volatile organic compound

2.3.2. Climate and Greenhouse Gases

Gases that trap heat in the atmosphere are called greenhouse gases (GHG). Data regarding GHGs, regulations, and emissions sources are summarized from EPA (2013). GHGs include CO_2, methane (CH_4), nitrous oxide (N_2O), and fluorinated gases such as hydroflorocarbons, perflorocarbons, and sulfur hexafloride. In Utah, emissions inventories are conducted every 3 years.

These GHGs are introduced into the atmosphere by a variety of sources including production of electricity, private and commercial transportation, industry practices, commercial and residential practices, agriculture, land use, and forestry. The Center for Climate Strategies (CCS) prepared a report

for UDEQ to evaluate historic and projected GHG emissions in Utah (2005). The CCS report suggested that activities in Utah accounted for about 1% of the total gross GHG emissions in the U.S for the year 2005. However, Utah's gross GHG emissions were reported to be rising faster than those in the rest of the nation; from 1990 to 2005, Utah's GHGs increased by 40% while the national rise was only 16% in the same time period. Analysis of gross GHG emissions by sector showed that in-state production of electricity resulted in 34% of the GHG emissions contribution, while transportation (24%) and industrial fuel use (15%) accounted for the next highest contributors. This was similar to emissions by sector for the rest of the U.S. The CCS report suggested that current trajectories of GHG emissions would result in a 95% increase in emissions from 1990 to 2020. However, the U.S. Energy Information Administration (2013) recently reported that state energy-related CO_2 emissions in Utah had gone down by 1.3% from 2000 to 2010.

2.4. Plants

2.4.1. Vegetation Communities

One predominant community occurs in the general area of Shem Dam. The community is immediately adjacent to the Santa Clara River and described below.

NORTH AMERICAN WARM DESERT LOWER MONTANE RIPARIAN WOODLAND AND SHRUBLAND

This ecological system occurs in mountain canyons and valleys of Utah southern Arizona, New Mexico, and adjacent Mexico and consists of mid- to low-elevation (3,608–5, 905 feet [ft]) riparian corridors along perennial and seasonally intermittent streams. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include various species of poplar and willow, Arizona walnut, Velvet ash, and Wingleaf soapberry. Shrub dominants include various species of willow, alder, Wild cherry, and, Mule fat. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or on annual rise in the water table for growth and reproduction.

2.4.2. Endangered and Threatened Species and Species of Concern

Four threatened or endangered plant species are known to occur within Washington County and two candidate plant species for listing (JBR 2014). A biological survey was completed by JBR Environmental Consultants to determine the presence of suitable habitat in the project area (Appendix C). One listed species may be found within the project area. There have been no formal plant surveys conducted during the flowering season for this project, however, a biological survey was conducted outside of the flowering season to assess suitable habitat (JBR 2014). Informal consultation was also conducted with USFWS for geotechnical explorations at the dam to help determine the final design of the project (USDA-NRCS 2014). This USFWS Concurrence Letter is located in Appendix C.

Table 2-7. Listed Plant Species in Washington County, Utah

Common Name	Scientific Name	Status	Presence
Dwarf Bear Poppy	*Arctomecon humilis*	E	Not found in study area

Common Name	Scientific Name	Status	Presence
Shivwits milkvetch	*Astragalus ampullarioides*	E	May be found in study area
Holmgren milkvetch	*Astragalus holgreniorum*	E	Not found in study area
Siler's Pincushion Cactus	*Sclerocactus sileri*	E	Not found in study area
Las Vegas Buckwheat	*Eriogonum corymbosum* var. *nilesii*	C	Not found in study area
Gierisch Mallow	*Sphaeralcea gierischii*	C	Not found in study area

T=Federally Threatened, E=Federally Endangered, C=Candidate Species for Listing.

SHIVWITS MILKVETCH

The Shivwits milkvetch is restricted to isolated pockets of gypsiferous soils of the Chinle Shale Formation from 2,860 to 3,660 feet in elevation. It grows in the Mohave Desert in creosote and Utah juniper plant communities with other warm desert shrubs on hilltops and side hills. All known populations occur in Washington County, Utah, ranging from Pahcoon Spring Wash to Rockville, Utah. There are populations of Shivwits milkvetch growing on several hills near the west end of the access road where an exclusionary cattle fence protects these populations from trampling.

2.4.3. Invasives

Executive Order 13122 states that "a Federal agency shall not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction and spread of invasive species in the U.S. or elsewhere."

There are a total of 27 plant species classified as noxious weeds in Utah (UWCA 2013). Of these, 15 are reported to occur in Washington County. Noxious weed species that have the potential to occur in the study area are listed in Table 2-8. However, no on-site surveys have been conducted to determine presence or extent of invasive plants in the study area. In addition to the noxious weeds list, Utah Division of Water Resources (UDWR) has developed an invasive aquatic species list of plants, which includes common reed (*Phragmites australis*) and Tamarisk (*Tamarix* spp.) in Washington County (McMillen 2013).

Table 2-8. Noxious Weeds and Other Invasive Plants Potentially Present in the Study Area

Common Name	Scientific Name	Statewide Class
Johnsongrass	*Sorghum halepense*	A
Leafy spurge	*Euphorbia esula*	A
Spotted knapweed	*Centaurea maculosa*	A
Sulfur Cinquefoil	*Potentilla recta L.*	A
Yellow Starthistle	*Centaurea solstitalis*	A
Bermudagrass	*Cynodon dactylon*	B
Hoary cress	*Cardaria draba*	B

Common Name	Scientific Name	Statewide Class
Musk thistle	*Carduus nutans*	B
Perennial pepperweed	*Lepidium latifolium*	B
Russian knapweed	*Centaurea repens*	B
Scotch thistle	*Onopordum acanthium*	B
Canada thistle	*Cirsium arvense*	C
Field bindweed	*Convolvulus arvensis*	C
Quackgrass	*Elytrigia repens*	C
Salt cedar	*Tamarisk* spp.	C

Data compiled from Belliston et al. 2009.

2.4.4. Riparian Areas

Riparian ecosystems are generally defined as those areas adjacent to flowing waterways and standing water bodies that have a distinct plant community different than that of nearby uplands. Riparian plant communities provide essential ecological functions, including stabilization of riverbanks, trapping of nutrients and sediments, buffering flood events, and contributing one of the most diverse and productive habitats available. Undisturbed riparian zones are home to a wide range of resident and migratory wildlife and provide refuge from predators and extreme summer heat.

Where alterations in riparian areas have occurred, non-native and invasive species have become established. In particular, tamarisk, Russian olive, and purple loosestrife have spread through the Santa Clara River's riparian zones, resulting in substantial changes to the ecosystem (UDWR 1996). Today, cottonwoods, tamarisk, and willows are the predominant members of the riparian plant community throughout the length of the Santa Clara River.

2.5. Animals

2.5.1. Fish and Wildlife Habitat

Wildlife species in the study area include a wide range of native and non-native migratory birds, resident birds, mammals, and reptiles. Potential habitat for these species is provided by the thin band of cottonwood/tamarisk riparian areas along the river margin, nearby Gunlock Reservoir, the adjacent upland scrub-shrub habitat, and nearby rock formations along the river and in adjacent land areas. Wildlife populations that are most well documented and understood include those that are listed for protection under the Endangered Species Act (ESA), are a state species of concern, or those that are desired game or furbearers (UDWR 2011).

Limited wetland areas in the ecosystem study area are located within the banks of the Santa Clara River where the winding river channel frequently is braided (UDOT 2012). Sparsely vegetated sand and gravel bars are common between the braided channels. Small fluvial wetlands are present along the riverbanks with typical riverine vegetation.

2.5.2. Terrestrial Endangered and Threatened Species and Species of Concern

Utah recognizes 31 non-aquatic animal species within Washington County as species of special concern (SPC) as presented in Table 2-10. An additional 5 species are identified as federally listed or candidate species under the Endangered Species Act. The listed species most likely to be encountered in the project area are one bird species and one reptile species according to the Biological Survey Report prepared by JBR Environmental Consultants (2014, Appendix C). Informal consultation was also conducted with USFWS for geotechnical explorations at the dam to help determine the final design of the project (USDA-NRCS 2014). This USFWS Concurrence Letter is located in Appendix C. The Southwestern willow flycatcher (endangered) has a slight chance of being present in or close to the ecosystem study area and are discussed in more detail below. The desert tortoise (threatened) also could utilize habitats adjacent to the project and is discussed in more detail below.

Table 2-9. Federal and State Listed Species in Washington County, Utah

Common Name	Scientific Name	Status	Probability
Allen's Big-Eared Bat	*Idionycteris phyllotis*	SPC	Low
American White Pelican	*Pelecanus erythrorhynchos*	SPC	None
Arizona Toad	*Bufo microscaphus*	SPC	Low
Bald Eagle	*Haliaeetus leucocephalus*	SPC	None
Big Free-Tailed Bat	*Nyctinomops macrotis*	SPC	Low
Black Swift	*Cypseloides niger*	SPC	None
Bobolink	*Dolichonyx oryzivorus*	SPC	None
Burrowing Owl	*Athene cunicularia*	SPC	Low
California Condor	*Gymnogyps californianus*	ESA-E	Low
Common Chuckwalla	*Sauromalus ater*	SPC	Low
Desert Iguana	*Dipsosaurus dorsalis*	SPC	None
Desert Night Lizard	*Xantusia vigilis*	SPC	None
Desert Tortoise	*Gopherus agassizii*	ESA-T	Low*
Ferruginous Hawk	*Buteo regalis*	SPC	Low
Fringed Myotis	*Myotis thysanodes*	SPC	Low
Gila Monster	*Heloderma suspectum*	SPC	Low
Kit Fox	*Vulpes macrotis*	SPC	Low
Lewis's Woodpecker	*Melanerpes lewis*	SPC	Low

Common Name	Scientific Name	Status	Probability
Long-Billed Curlew	*Numenius americanus*	SPC	Low
Mojave Rattlesnake	*Crotalus scutulatus*	SPC	None
Mountain Plover	*Charadrius Montanus*	SPC	Low
Northern Goshawk	*Accipiter gentilis*	CS	Low
Pygmy Rabbit	*Brachylagus idahoensis*	SPC	None
Short-Eared Owl	*Asio flammeus*	SPC	Low
Sidewinder	*Crotalus cerastes*	SPC	Low
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	ESA-E	Low*
Speckled Rattlesnake	*Crotalus mitchellii*	SPC	None
Spotted Bat	*Euderma maculatum*	SPC	None
Mexican Spotted Owl	*Strix occidentalis lucida*	ESA-T	Low*
Three-Toed Woodpecker	*Picoides tridactylus*	SPC	None
Townsend's Big-Eared Bat	*Corynorhinus townsendii*	SPC	Low
Western Banded Gecko	*Coleonyx variegatus*	SPC	Low
Western Red Bat	*Lasiurus blossevillii*	SPC	Low
Western Threadsnake	*Leptotyphlops Humilis*	SPC	Low
Yellow-Billed Cuckoo	*Coccyzus Americanus*	ESA-C	Low*
Zebra-Tailed Lizard	*Callisaurus Draconoides*	SPC	Low

This list was last compiled by UDWR (March 2011) using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS), as well as the USFWS Environmental Conservation Online System Species by County report for Washington County, Utah. E=Federally Endangered, T=Federally Threatened, C=Federal Candidate for Listing, SPC=Utah Species of Concern, S-ESA=Federally listed or candidate species under the endangered species act, CS=Species receiving special management under a Conservation Agreement in order to preclude need for federal listing.

DESERT TORTOISE

Three groups of the desert tortoise, Gopherus agassizzi, exist: 1) the California type, which is found in California and southern Nevada; 2) the Sonoran type, which inhabits areas south of the Grand Canyon; and 3) the Beaver Dam Slope type, which occurs in extreme southwestern Utah (UDWR, 2013a). Utah's Beaver Dam Slope population of the desert tortoise is found within the Virgin River Watershed.

Within its range, the desert tortoise resides near water in deserts, semi-arid grasslands, canyon bottoms, and rocky hillsides (UDWR 2013a). Desert tortoises generally construct burrows in compacted sandy or gravelly soil. Females nest under a large shrub or at the mouth of a burrow, and lay one to three clutches

of two to fourteen eggs from May to July; eggs hatch in late summer or fall. Burrows, which may contain many tortoises at once, are used for hibernation during cold winter months. The typical diet of the desert tortoise consists of perennial grasses, cacti, shrubs, and other plant material (UDWR 2013a).

The Project Area occurs outside Designated Critical Habitat for the desert tortoise but does occur in the Upper Virgin River Recovery Unit and provides suitable habitat for the species. The dam is located in the bottom of a river drainage where scouring events appear to be frequent. The bottom of the river and floodplain is composed of loose sand, cobble, and boulders and is not conducive to tortoise burrowing. The Project Area may be used by tortoises for migration purposes primarily. No desert tortoises, burrows, or tortoise sign were observed during a 100% desert tortoise survey of the area (JBR 2014).

SOUTHWESTERN WILLOW FLYCATCHER

The southwestern willow flycatcher is found most frequently in riparian habitats, especially in areas of dense willow. This flycatcher is difficult to distinguish from other related species, though its territorial song is distinctive. This species typically inhabits a fairly broad range, in terms of both elevation and plant community, of healthy riparian habitat. It prefers a mosaic of dense stands of willow and/or salt-cedar communities interspersed with openings and shorter vegetation (UDOT 2012). Nesting habitat this species prefers are riparian areas inundated for large portions of the year with surface water very close to or surrounded by vegetation. The riparian habitat surrounding the confluence of the Santa Clara and Virgin rivers has been used as temporary migratory stopover habitat for the species in recent years (UDOT 2012).

The southwestern willow flycatcher eats insects, seeds, and berries. Breeding occurs during late spring or early summer, with peak breeding activity occurring in June (UDWR 2013b). A nest is constructed in a vertical fork of a willow or other riparian tree. The female then lays and incubates 2 to 4 eggs; the young hatch after 12 or 13 days. The hatchlings are tended by both parents and leave the nest after about 2 weeks. The southwestern willow flycatcher is currently very rare throughout its range. The major factor in the decline of the southwestern willow flycatcher is likely the alteration/loss of the riparian habitat necessary for the species (UDWR 2013b).

The Project Area contains riparian habitat but vegetation is too sparse to provide nesting habitat. The Project Area does provide foraging habitat for the species and it could occur there on a transient basis during certain times of the year (JBR 2014).

MEXICAN SPOTTED OWL

The original range of Mexican spotted owl extended from western Texas into the mountains of north central Mexico. Along the Colorado Plateau, these owls occur in steep canyons, including those in southern Utah (UDWR 2013c). There are no UCDC records of occurrence for this species in the study area. It may be present as a transient. The spotted owl occupies a variety of habitats in different parts of its range, including various forest types and steep rocky canyons, this last habitat being the primary habitat used in Utah. Spotted owls are non-migratory.

Spotted owls feed mainly on rodents but also consume rabbits and some other vertebrates, including birds and reptiles, and insects. Spotted owls do not build their own nests but utilize suitable naturally occurring sites and nests built by other animals. Nests are either in trees (especially those with broken tops), trunk cavities, or on cliffs. One to four eggs are brooded by the female alone and hatch after 28 to 32 days. Both parents care for the young, which fledge 34 to 36 days after hatching.

The Project Area is located approximately 27 miles from Designated Critical Habitat and adjacent to Prime Breeding Habitat predicted by the 1997 habitat model (JBR 2014). The Survey Area is greater than 1.7 miles from "buffered canyon" habitat and 15 miles from GAP habitat as predicted by the 2000 habitat model (JBR 2014). Based on the field survey, it was determined that no suitable breeding/roosting habitat is located near the Project Area (JBR 2014).

YELLOW-BILLED CUCKOO

The Western yellow-billed cuckoo is a medium-sized bird that has become extremely rare in its historic range. USFWS considers cuckoo occurring west of the Rocky Mountain crest to be a distinct population segment. No occurrences within the project area have been documented. The primary threat to the yellow-billed cuckoo is the loss and degradation of habitat, particularly riparian forests (UDWR 2013d). Only one sighting has been documented in Washington County, occurring on June 3, 2012 at Springdale River Park, which is 45+ miles east of the project (UBRC 2012).

Considerable habitat degradation in the Southwest has been caused by the alteration and displacement of native riparian habitat by tamarisk. Tamarisk alters plant community structure, replacing three or four vegetation layers with one indistinct layer. Tamarisk invasion typically coincides with reduction or loss of bird species associated with cottonwood-willow habitat, including the yellow-billed cuckoo. However, in places where tamarisk has created riparian areas where none had previously existed, some cuckoos have chosen to nest (UCDC 2013d).

Suitable habitat was not identified within the Project Area during the survey (JBR 2014).

2.5.3. Aquatic Endangered and Threatened Species and Species of Concern

Washington County has a total of 11 aquatic species that are federally or state listed, species of concern, or managed under a Utah Conservation Agreement to preclude listing (Table 2-11). Only species that are designated as Threatened or Endangered by the USFWS are addressed in detail in this Draft EA. A survey was conducted of the project area for Threatened or Endangered fish species by JBR Environmental Consultants (JBR 2014). Informal consultation was also conducted with USFWS for geotechnical explorations at the dam to help determine the final design of the project (USDA-NRCS 2014). This USFWS Concurrence Letter is located in Appendix C.

Table 2-10. Federal and State Listed Aquatic Species in Washington County, Utah

Common Name	Scientific Name	Status	Likely to Occur in Study Area
Bluehead sucker	*Catostomus discobolus*	CS	No
Bonneville cutthroat trout	*Oncorhynchus clarkia Utah*	CS	No
Desert springsnail	*Pyrgulopsis deserta*	SPC	No
Desert sucker	*Catostomus clarkia*	SPC	Yes
Flannelmouth sucker	*Catostomus latipinnis*	CS	Yes
Relict leopard frog	*Rana onca*	C-extirpated	No
Virgin River chub	*Gila seminude*	ESA-E	No
Virgin spinedace	*Lepidomeda mollispinis*	CS	Yes
Western toad	*Bufo boreas*	SPC	No
Wet-rock physa	*Physella zionis*	SPC	No
Woundfin	*Plagopteus argetissimus*	ESA-E	No

This list was last compiled by UDWR (March 2011) using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS), as well as the USFWS Environmental Conservation Online System Species by County report for Washington County, Utah. E=Federally Endangered, T=Federally Threatened, C=Federal Candidate for Listing, SPC=Utah Species of Concern, S-ESA=Federally listed or candidate species under the endangered species act, CS=Species receiving special management under a Conservation Agreement in order to preclude need for federal listing.

DESERT SUCKER

The desert sucker is native to parts of the Colorado River system of the southwestern United States. In Utah, the species occurs only in the Virgin River system in Washington County (UCDC 2013a) where it has the widest distribution of the six native fishes, occurring in all waters of the basin except the uppermost portions of streams tributary to the mainstem Virgin River (Williams and Deacon 1998). Primary threats to desert sucker populations, similar to those affecting other native fishes in the Santa Clara River basin, include dewatering for development and agriculture, pollution, and the introductions of exotic turtles and fishes (which can impact the desert sucker through predation and/or competition) (UCDC 2013a).

The desert sucker is a moderately-sized sucker, reaching a maximum length of about 13 inches (Williams and Deacon 1998). Desert sucker generally are olive to tan colored, with a blunt rounded snout. Desert suckers are benthic fish occupying riffle areas when small. Adults inhabit primarily pools during the day, moving to riffles at night and in periods of high turbidity (Williams and Deacon 1998). They feed frequently over gravel and cobble substrate, eating mainly algae, although insects and other invertebrates are also occasionally consumed (UCDC 2013a). They prefer a temperatures range of 13 to 22°C. Spawning occurs in riffles during the late winter and throughout spring (Williams and Deacon 1998).

FLANNELMOUTH SUCKER

The flannelmouth sucker is found in moderate to large rivers throughout the entire Colorado River system (UCDC 2013b). It is common throughout the mainstem of the Virgin River as well as the lower reaches

of the North and East forks. It also is found in the lower and middle reaches of the Santa Clara River and the lower reaches of Ash, La Verkin, and North creeks (Williams and Deacon 1998). Flannelmouth suckers are usually absent from impoundments. Utah flannelmouth sucker populations have declined in recent years in both numbers and distribution, and as a result, it is listed as a state Sensitive Species (UCDC 2013b). The primary causes are likely flow alteration, habitat loss/alteration, and the introduction of non-native fishes.

Flannelmouth suckers are a large sucker, generally averaging 12 to 16 inches long. The flannelmouth is silvery-grey in color with a long streamlined body and with large fins and a very narrow caudal peduncle. The flannelmouth sucker is a bottom-dwelling fish found primarily in run and pool habitats over sand, debris, and rubble-cobble substrates, and sometimes riffles (UCDC 2013b). They forage mainly on algae and other plant matter, although invertebrates are also consumed (Williams and Deacon 1998). The species spawns in streams over gravelly areas during the spring and early summer. Their preferred mean temperatures range is approximately 14 to 26°C (Williams and Deacon 1998).

VIRGIN RIVER CHUB

Historical distribution of the Virgin chub has been from the upper reaches of the Virgin River downstream to the Colorado River and included the Moapa River in Nevada (Williams and Deacon 1998). No known collections in the Santa Clara River have been documented and no individual chub has ever been collected from any tributary streams. Currently, the range is restricted downstream to approximately the Mesquite diversion and in the Moapa River upstream of the Narrows (Cross 1975; Williams and Deacon 1998).

The Virgin chub is a medium-sized minnow ranging in length from 4 to 8 inches. They are generally olive on the back and silver on the sides and belly with a pointed snout, developed hump behind the head, and a narrow tapered caudal peduncle that ends in a large forked tail (Williams and Deacon 1998). Virgin chubs occur generally in deep water (run or pool) habitats with slow to moderate current velocities and instream cover. Cross (1978) reported the most common cover included boulders, logs, overhanging vegetation, and undercut banks. Juveniles frequently occur with adults. Larger adults typically are found in deeper pools. Chubs prefer a mean temperature range between about 17 and 28°C depending on the overall stream conditions (Williams and Deacon 1998). Spawning occurs in the spring over rock and gravel substrates (UCDC 2013c). Virgin River chub are omnivorous. Young fish feed almost exclusively on macroinvertebrates, while adults feed almost exclusively on algae and debris (Williams and Deacon 1998).

The Virgin River chub is not present within the Santa Clara River in the Project Area due to fish barriers downstream of the dam.

VIRGIN SPINEDACE

The Virgin spinedace occurs only in the Virgin River basin where it shows a noted preference for the tributaries and upper mainstem (Williams and Deacon 1998; Lentsch et al. 2002). Distribution extends

downstream to at least the mouth of Beaver Dam Wash, but the species is uncommon in the mainstem below Pah Tempe Springs. Virgin spinedace are found throughout much of the Santa Clara River system with the exception of the reservoirs and near the confluence with the Virgin River (Valdez et al. 1990). Due to dewatering, habitat fragmentation, flow alteration, and the introduction of non-native fishes, however, Virgin spinedace populations have been reduced in recent times, and the species is now found only in portions of its historic range (UCDC 2013d).

Virgin spinedace are a medium-sized minnow averaging 2 to 4 inches in length with a broad, flat-sided silvery-colored body spotted with gray/black markings (Williams and Deacon 1998; Lentsch et al. 2002). A notable spine at the leading edge of the dorsal fin gives this species its name. The body is completely covered by small, fine scales. Virgin spinedace typically inhabit clear, cool, swift streams that have interspersed pools, runs, and riffles and mean preferred temperatures varying from 19 to 23°C (Valdez et al. 1990; Williams and Deacon 1998). They tend to prefer pools with cover (e.g., boulders, logs overhanging vegetation, undercut banks, etc.), especially near the transition seams between low and high velocity waters (Lentsch et al. 2002). Virgin spinedace are opportunistic feeders, eating drifting invertebrates and plant matter in midwater and at the surface. The species spawns during spring and late summer, usually during periods of high flows (Lentsch et al. 2002).

WOUNDFIN

The historic range of the Woundfin, *Plagopterus argentissimus*, included the lower Colorado and Gila River drainages of Utah, Arizona, and Nevada (UCDC 2013e). It is one of the most highly specialized minnows in North America (Williams and Deacon 1998). The present range of woundfins has been reduced to the main stream of the Virgin River and one tributary (La Verkin Creek) due to impacts from flow regulation, dewatering, and the introductions of nonnative fishes (Williams and Deacon 1998). Woundfin were collected in the 1950s in the Santa Clara River but have not been found since (Williams and Deacon 1998. Recent efforts by Utah Division of Wildlife Resources to reintroduce hatchery-reared woundfin to the Virgin River have helped reverse their declining numbers (Kuzmanic 2011; WCWCD 2012).

The woundfin is a small (about 2 inches in length) streamlined minnow, with a flat head, barbells on the lips, and a conspicuous, sharp dorsal spine from which its common name was derived (Williams and Deacon 1998). These fish frequent main channel areas of swift, turbid, warm streams (UCDC 2013e) where they prefer foraging over sandy substrates feeding primarily on insects, insect larvae, other invertebrates, algae, and detritus. Juveniles use habitats that are slower and deeper than those characteristic of adults. Larvae are found in backwaters or slowly moving water along the stream margin, and often are associated with dense growths of filamentous algae. The mean preferred water temperatures range from 11 to 24°C (Williams and Deacon 1998). The species spawns during the spring in swift shallow water over gravel substrate. Eggs are fertilized in the water and then fall to the bottom; no parental care is given to the eggs or young (UCDC 2013e).

The woundfin is not present within the Santa Clara River in the Project Area due to fish barriers downstream of the dam.

2.5.3.1. Non-Listed Fish Species

Historic and present day fishes found throughout the Santa Clara watershed are listed in Table 2-9 below. Shem Dam is located in the lower section of the Santa Clara watershed. There are three fish passage barriers below Shem Dam that preclude listed species from utilizing the project area.

Table 2-11: Fish Species

Common Name	Scientific Name	Population Found
Desert Sucker	*Catostomus clarki*	Historically throughout the Santa Clara watershed
Flannelmouth Sucker	*Catostomus latipinnis*	
Virgin Spinedance	*Lepidomeda mollispinis*	
Speckled Dace	*Rhinichthys* osculus	
Woundfin	*Plagopterus argentissimus*	
Rainbow Trout	*Oncorhychus mykiss*	Present day in the upper river section
Brown Trout	*Salmo trutta*	
Green Sunfish	*Lepomis cyanellus*	Present day in the lower Santa Clara River
Largemouth Bass	*Micropterus salmoides*	
Black Bullhead Catfish	*Ameiurus melas*	
Black Crappie	*Pomoxis nigromaculatus*	
Western Mosquitofish	*Gambusia* affinis	

Data compiled from McMillen 2013

2.5.4. Invasive Terrestrial and Aquatic Species

Executive Order 13122 states that “a Federal agency shall not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction and spread of invasive species in the U.S. or elsewhere."

Utah lists a number of aquatic and vertebrate species that are considered invasive and potentially occur in the project area. While some of these species may be native to Utah, they were not historically found in the project area, but habitat changes by humans or transplants may have brought them into Washington County. According to the NRCS-Utah and Utah Aquatic Invasive Species Task Force (UDWR 2009a), they include the species listed in Table 2-12. Non-native mudsnails and mussels are also a concern in Utah, but are not currently reported to be within the study area.

Table 2-12: Invasive Species

Common Name	Scientific Name
Bullfrog	*Rana catesbeiana*
Burbot	*Lota lota*
Gizzard shad	*Dorosoma cepedianum*
House sparrow	*Passer domesticus*
European starling	*Sturnus valgaris*

Common Name	Scientific Name
Mosquitofish	*Gambusia affinis*
Red fox	*Vulpes vulpes*
Rock pigeon	*Columba livia*
Eurasian collared-dove	*Streptopelia decaocto*
Raccoon	*Procyon lotor*

2.5.5. Migratory Birds/Bald and Golden Eagles

Wintering, year-round, or breeding populations of bald and golden eagles have the potential to be present in the study area. These birds are afforded particular protection under two separate Acts of Congress. Under authority of the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712), it is unlawful to take, kill, or possess migratory birds, their parts, nests, or eggs. "Take" is defined as any attempt or success at pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting. Migratory Bird Permits must be obtained through the USFWS Migratory Bird Permit Office for any unavoidable violation of the MBTA.

The Eagle Protection Act (16 U.S.C. 668) provides specific protection for bald and golden eagles. The act makes it illegal to take, possess, sell, purchase, barter, or transport any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. "Take" includes pursuing, shooting, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing.

Utah is home to one the largest state populations of wintering bald eagles, with more than 1,200 eagles counted in Utah in recent years (UDWR 2009b). According to UDWR, 25 to 30% of bald eagles wintering in the lower 48 states spend the winter in Utah, indicating the value of habitat in the state (2009b). Wintering range includes the study area. During winter, bald eagles roost communally in sheltered stands of trees, typically selecting roosts near an open water body. The Center for Biological Diversity notes that breeding bald eagle pairs were known to be present in Washington County. Breeding bald eagles prefer to establish nests in large conifer trees near open water, but will also select cliff faces or ground sites if available (Cornell Lab of Ornithology 2013). Clutches are typically 1 to 3 eggs, incubation lasts 34 to 36 days, and the nesting period can run from 56 to 98 days, typically starting in April. Cottonwood trees along Utah's rivers, lakes, and reservoirs are considered critical for roost and nest sites (UDWR 2009b).

According to UCDC information, high-value habitat for golden eagles is predicted to be present surrounding the study area (UCDC 1997). High-value habitat includes areas that provide for intensive use by wildlife species. Golden eagles live in Utah year-round and typically forage in open grassland or shrubland habitat, tending to avoid agricultural areas. Prey primarily includes rabbits, hares, ground squirrels, and prairie dogs. During the breeding season, golden eagles occur primarily in areas of mountain cliffs or canyons. In the west, the golden eagle is often associated with rimrock terrain adjacent to open desert or grassland areas. In Utah, golden eagles nest in grasses, shrubs, pinyon-juniper woodland, and aspen-conifer habitats (Peterson 1988; Bates and Moretti 1994). The nesting season is longer than

that of typical birds, with more than 6 months between the times eggs are laid until young reach independence. Nesting begins as early as January, but typically occurs in March or later. Golden eagles typically raise an average of only one young per year, though two young are not uncommon when prey is abundant, and may breed for up to 15 years (Kochert et al. 2002).

2.6. Human Environment

This section describes the socioeconomics; cultural resources; potential for hazardous materials in the area; recreation and public health and safety; visual quality, aesthetics, and scenic beauty; land use; infrastructure; and noise within the project vicinity.

2.6.1. Socioeconomics

The county seat and largest city in Washington County is St. George. Ivins City, to the northwest of St. George along Old Highway 91, is the closest incorporated place to the project area. Gunlock and Shivwits are smaller, unincorporated communities in the project vicinity. Shivwits, about 10 miles west of St. George, was established as a reservation for the Paiutes. Both Ivins City and Santa Clara City (located between Ivins City and St. George) are part of the St. George Metropolitan Statistical Area (i.e., they are suburbs).

2.6.1.1. Lands and Products

Table 2-13 lists 2002 and 2007 statistical data on land and products for Washington County (USDA 2007).

Table 2-13. Land and Products Statistics for Washington County

Statistic	Year		Percent Change
	2007	2002	
Number of farms	593	481	+23
Land in farms	174,192 acres	217,147 acres	-20
Average size of farm	294 acres	451 acres	-35
Market value of products sold	$9,836,000	$7,256,000	+36
Crop sales 39%			
Livestock sales 61%			
Average per farm	$16,587	$15,085	+10

Livestock inventory numbers were dominated by cattle and calves, followed by horses and ponies, layers, colonies of bees, and sheep and lambs. The number of acres used for forage (i.e., the land used for all hay and haylage, grass silage, and greenchop) constituted the “top crop item”, followed by the number of acres used for peach growing (USDA 2007).

Sales from many farms (233) were less than $1,000; only six farms had sales exceeding $250,000. Less than a third (31%) of principal farm operators considered farming their primary occupation, and the average age of principal operators was 60.6 (USDA 2007).

2.6.1.2. Population

Table 2-14 compares 2010 population statistics for Ivins City, St. George City, Washington County, Utah, and the U.S.

Table 2-14. 2010 Population Characteristics

Socioeconomic Criteria		Ivins City[a]	St. George City[a]	Washington County[a]	Utah[a]	U.S.[b]
Total Population		6,753	72,897	138,115	2,763,885	308,745,538
Gender	Female	3,449	37,243	69,823	1,375,568	156,964,212
	Male	3,304	35,654	68,292	1,388,317	151,781,326
Age	Under 18	1,874	20,460	41,686	871,027	74,181,467
	18 & over	4,879	52,437	96,429	1,892,858	234,564,071
	20-24	269	5,678	9,131	226,519	21,585,999
	25-34	730	9,850	18,020	445,687	41,063,948
	35-49	1,081	10,241	20,324	487,306	63,779,197
	50-64	1,307	10,259	20,866	392,374	58,780,854
	65+	1,335	13,824	23,826	249,462	40,267,984

Sources: UCSB 2010a and 2010b

Table 2-15 compares past, current, and projected future population for Ivins City, St. George City, Washington County, Utah, and the U.S.

Table 2-15. Past, Current, and Future Population

Population Year	Ivins City	St. George City	Washington County	Utah	U.S.
Total Population 1990	1,630	28,502	48,560[e]	1,722,850[c]	248,709,873
Total Population 2000	4,450 (173% increase)	49,728 (74% increase)	90,354[d] (86% increase)	2,233,169[c] (30% increase)	281,421,906 (13% increase)
Total Population 2010	6,753[b] (52% increase)	72,897[b] (47% increase)	138,115[b] (53% increase)	2,763,885[c] (24% increase)	308,745,538 (10% increase)
Projected Population 2020	9,620[b] (42% increase)	103,851[b] (42% increase)	196,762[a] (42% increase)	3,309,234[a] (20% increase)	339,540,606[a] (10% increase)
Projected Population 2050	23,106[b] (140% increase)	249,421[b] (140% increase)	472,567[a] (140% increase)	5,257,239[a] (59% increase)	438,600,626[a] (29% increase)

[a]GOPB 2012a

[b]GOPB 2012b

[c]GOPB 2011

[d]PlaceNames.com 2013

[e]USCB 1995

Some demographic facts (GOPB 2011)):

- Utah's population grew more than twice as fast as the U.S. population from 2000 to 2010 (23.8% versus 9.7%, respectively).
- Utah ranked third among states, behind Nevada and Arizona, in population growth rate.
- Utah was the youngest state in the nation with a 2010 median age of 29.2, compared to the national median of 37.2.
- Washington County was the second fastest growing county in Utah (behind Wasatch County).

2.6.1.3. Race and Ethnicity

Race and ethnicity data from the 2010 census are provided in Table 2-16. Table 2-17 shows the population by race in Ivins City, St. George City, Washington County, Utah, and the U.S.

Table 2-16. 2010 Population by Ethnicity

Ethnicity	Ivins City	St. George City	Washington County	Utah	U.S.
Hispanic or Latino	387	9,302	13,486	358,340	50,477,594 (16.3%)
Non Hispanic or Latino	6,366	63,595	124,629	2,405,545	258,267,944 (83.7%)

Sources: USCB 2010a and 2010b

Table 2-17. 2010 Population by Race

Race	Ivins City[a]	St. George City[a]	Washington County[a]	Utah[a]	U.S.[b]
White	6,303	63,565	123,914	2,379,560	223,553,265 (72.4%)
African American	39	530	790	29,287	38,929,319 (12.6%)
Asian	18	582	982	55,285	14,674,252 (4.8%)
American Indian and Alaska Native	87	1,124	1,869	32,927	2,932,248 (0.9%)
Native Hawaiian and Pacific Islander	30	741	1,078	24,554	540,013 (0.2%)
Other	107	4,451	6,313	166,754	19,107,368 (6.2%)
Identified by two or more	169	1,904	3,169	75,518	9,009,073 (2.9%)

Source: USCB 2010a and 2010b

2.6.1.4. Employment and Income

Overall, the labor market in Utah has slowly recovered from 2008–2009 recession lows, while conditions have remained poor or worsened in some localities. Utah's unemployment rate reached a 20-year high of 8.4% in 2009 and had dropped significantly to 4.6% in April of 2013 (UBLS 2013). Table 2-18 shows labor force characteristics from the U.S. Census 2007–2011 American Community Survey. Table 2-19 shows employment by industry, and Table 2-20 shows the median, mean, and per capita income.

Table 2-18. Labor Force Characteristics

Characteristic	Ivins City	St. George City	Washington County	Utah
Population 16 years and older	5,065	54,125	99,610	1,948,759
Civilian labor force	2,829	31,445	59,152	1,338,755
Employed	2,678	28,369	54,003	1,251,302
Unemployed	151	3,076	5,149	87,453
Percent unemployed	3%	9.8%	8.7%	6.5%

Source: USCB 2013

Table 2-19. Employment by Industry

Industry Sector	Ivins City	St. George City	Washington County	Utah
Agriculture, forestry, fishing and hunting, and mining	13	220	464	25,048
Construction	195	2,865	5,682	93,672
Manufacturing	286	1,389	3,044	134,568
Wholesale trade	83	522	1,188	35,332
Retail trade	389	4,491	8,625	154,277
Transportation and warehousing, and utilities	131	1,431	3,019	60,667
Information	86	399	773	28,896
Finance and insurance, and real estate and rental and leasing	106	1,951	3,328	84,919
Professional, scientific, and management, and administrative and waste management services	258	2,489	4,548	136,460
Educational services, and health care and social assistance	649	6,621	12,396	264,705
Arts, entertainment, and recreation, and accommodation and food services	220	3,738	6,592	107,641

Industry Sector	Ivins City	St. George City	Washington County	Utah
Other services, except public administration	159	1,587	2,690	55,600
Public administration	103	666	1,654	69,517

Source: USCB 2013

Table 2-20. Median, Mean, and Per Capita Income (in 2011 Inflation-Adjusted Dollars)

Characteristic	Ivins City	St. George City	Washington County	Utah
Median Household Income	$51,768	$48,510	$50,307	$57,783
Mean Household Income	$66,561	$60,828	$62,844	$72,305
Per Capita Income	$25,515	$21,457	$21,467	$23,650

Source: USCB 2013

2.6.1.5. Poverty

Poverty statistics are provided in Table 2-21.

Table 2-21. Poverty Rates

Characteristic	Ivins City	St. George City	Washington County	Utah
Percent all people living below poverty level	12.1%	12.2%	11.9%	11.4%
Percent people living below poverty level (18 years and older)	8.8%	11.5%	10.1%	10.7%
Percent families living below poverty level	11.0%	8.9%	9.7%	8.9%

Source:USCB 2013

2.6.2. Cultural Resources/Historic Properties

2.6.2.1. Archaeological Resources

The Bureau of Land Management (BLM) has identified the Santa Clara/Gunlock area as an Area of Critical Environmental Concern. This 1,998 acre area is located 11 miles northwest of the city of St. George and extends along the Santa Clara River from the Gunlock Reservoir to the Shivwits Indian Reservation. It contains numerous prehistoric Ancestral Puebloan (also known as Virgin Anasazi) riverine sites, Southern Paiute sites, and rock art localities (BLM 2011).

The BLM's Santa Clara River Reserve brochure includes a map that shows the location of a prehistoric farmstead and petroglyphs along the Santa Clara River near the Anasazi Valley Trailhead; accessed via

Old Highway 91. The Santa Clara River Reserve was established through an interlocal agreement between the BLM, Santa Clara City, and Ivins City (Ivins City 2008).

Cultural and historic resources are protected by a variety of laws and regulations, including the National Historic Preservation Act (NHPA), as amended. Section 106 of the NHPA and implementing regulations (36 CFR 800) outline the procedures to be followed in the documentation, evaluation, and mitigation of impacts on cultural resources. The Section 106 process applies to any Federal undertaking that has the potential to impact cultural resources.

As a Federal undertaking, the Shem Dam Rehabilitation project has the potential to adversely affect cultural resources along the Santa Clara River. In 2013, the NRCS completed a cultural resources inventory to identify cultural resources present within and surrounding the project area. This inventory resulted in the identification of five archaeological sites, summarized in Table 2-22. Of the five sites, one is a prehistoric habitation site, while the other four are historic sites. The historic archaeological sites in the vicinity of the project area include an old alignment of the road to Gunlock and a series of historic stone pillars that once held a metal pipe that carried irrigation water across the Santa Clara River.

Two of the more prominent archaeological sites are the scant remains of the copper smelting town of Shem, and the clearly visible Shem Dam itself. The town of Shem operated a copper smelter that processed ore from the Dixie-Apex Mine from approximately 1902 to 1908 (Deseret News 1908). To cool one of the blast furnaces in the smelter operation, water was diverted from the Santa Clara River two miles upstream and carried to the site via an earthen ditch. The smelter and town were abandoned after costs to maintain operations exceeded the quantity of copper produced. Today, little remains of the short-lived copper smelting town of Shem.

The most significant site within the project area is Shem Dam, which was designed by irrigation engineer Luther M. Winsor and constructed by the Civilian Conservation Corps (CCC) in 1933. It represents one of the largest dam projects undertaken by the CCC in Utah at that time (Baldridge 1971: 89). As it stands today, it is over 300 feet long and 42 feet high, constructed from an earth core, surrounded by roughly hewn basalt boulders, and capped with a masonry veneer. Two abutments flank a lower center crest, and the eastern abutment includes a headgate, and irrigation diversion that connects into a concrete-lined canal on the eastern bank of the Santa Clara River. Shem Dam is as much a shining example of CCC engineering and construction techniques as it is a symbol of the struggles involved with taming the Santa Clara River. The one weakness of the dam is the lack of a solid foundation, which lead to the frequent need for repairs from undercutting after floods. The dam has been repaired at least twice since construction, once in 1939, and again in 1958.

All of the archaeological sites have been evaluated for inclusion in the National Register of Historic Places (NRHP) based on their significance and integrity. The USDA-NRCS has determined that all of the sites are eligible (Table 2-22).

Table 2-22 Cultural Resources

Site Type	National Register of Historic Places Eligibility
Prehistoric Habitation Site	Eligible
Historic Road	Eligible
Historic Copper Smelter	Eligible
Historic Piers	Eligible
Historic Dam	Eligible

2.6.2.2. Historic Properties

The Utah Division of State History has developed a viewer that can be used to view the historic building database (UDSH 2013). Over 100 properties are listed in Santa Clara, 88 of which are listed on the National Register. No properties were listed in Ivins.

The Century Register of Historic Places in Utah lists properties in Utah over 100 years old. Five properties are listed in Washington County: three in St. George, one in Pine Valley, and one in Toquerville (UDSH 1988a). None are near the project area. The Utah Register of Historic Sites lists properties on the now-inactive state register. The list includes 23 properties, including the Jacob Hamblin house in Santa Clara and the Virgin River Drainage Archaeology Area (UDSH 1988b).

2.6.2.3. Tribes

The Shivwits Band of the Paiutes holds land in the project area. The Shivwits settlement in Shem has changed over the years, most of the early homes are gone and newer homes have been built east of the old site. The cemetery is still in use and the Shivwits Band building is located west of Ivins City.

2.6.3. Hazardous, Toxic, and Radioactive Waste (HTRW)

Hazardous, toxic, and radioactive waste (HTRW) includes any liquid, solid, gas, or sludge that poses a hazard to human health or the environment because of its quantity, concentration, or physical or chemical characteristics. To determine whether HTRW sites occur within the study area, an online review of hazardous sites was requested from Environmental Data Resources, Inc. (EDR 2013). The EDR field check results show that there are no known HTRW sites within the ASTM International established search radius of a quarter-mile from Shem Dam. This comprehensive online survey of potential HTRW sites does not certify the current condition or location of named sites and does not verify that potentially hazardous sites are absent from the study area.

2.6.4. Recreation

2.6.4.1. Parks

Outdoor recreation is the primary component of Utah's tourism industry. In 2011, tourists spent $6.87 billion in tourism-related activities and the tourism industry employed over 124,000 people (Governor's Council on Balanced Resources 2013). There were 4.8 million visits reported to Utah's state parks in 2011, raising revenue from day-use, camping, golf, and other fees. The number one employer by percent in Utah is the outdoor/sporting goods industry.

There are no parks within the Shem Dam Rehabilitation project area. Abundant recreational opportunities are available in the project vicinity. Gunlock State Park, the closest reservoir to the project area, provides opportunities for boating, water sports, and fishing for bass and catfish (USPR 2013). Other state parks in the vicinity include Snow Canyon, Sand Hollow, Quail Creek and the Red Cliffs Desert Reserve. The Reserve allows hiking, biking, and equestrian activities.

The Ivins City Parks and Trails Master Plan Map shows equestrian, improved, and natural trails; trailheads; open space; a fitness course; areas proposed for annexation; and the Red Cliff Reserve. Ivins City has three large city parks and two smaller parks, and bikeway systems are considered important parts of the community development plan (Ivins City 2008).

Regional recreational resources include four national parks (Zion, Bryce Canyon, Grand Canyon [north rim], and Great Basin), Cedar Breaks National Monument, Dixie National Forest, Glen Canyon National Recreation Area, and Lake Mead National Recreation Area.

2.6.4.2. General Recreation

Land around the site is owned by the Shivwits Band of Paiutes with no developed amenities. Non Band members are not allowed to recreate on property owned by the Shivwits Band of Paiutes. There is, however, a large scour hole downstream from the dam where Band members enjoy swimming and fishing. There is an existing conservation agreement to utilize practices that will enhance native fish habitat in the Santa Clara River and it is possible that fishing may become more prevalent in the future if this effort is successful. The Utah Division of Wildlife Resources regulates hunting and fishing throughout the state and has a field office in Hurricane.

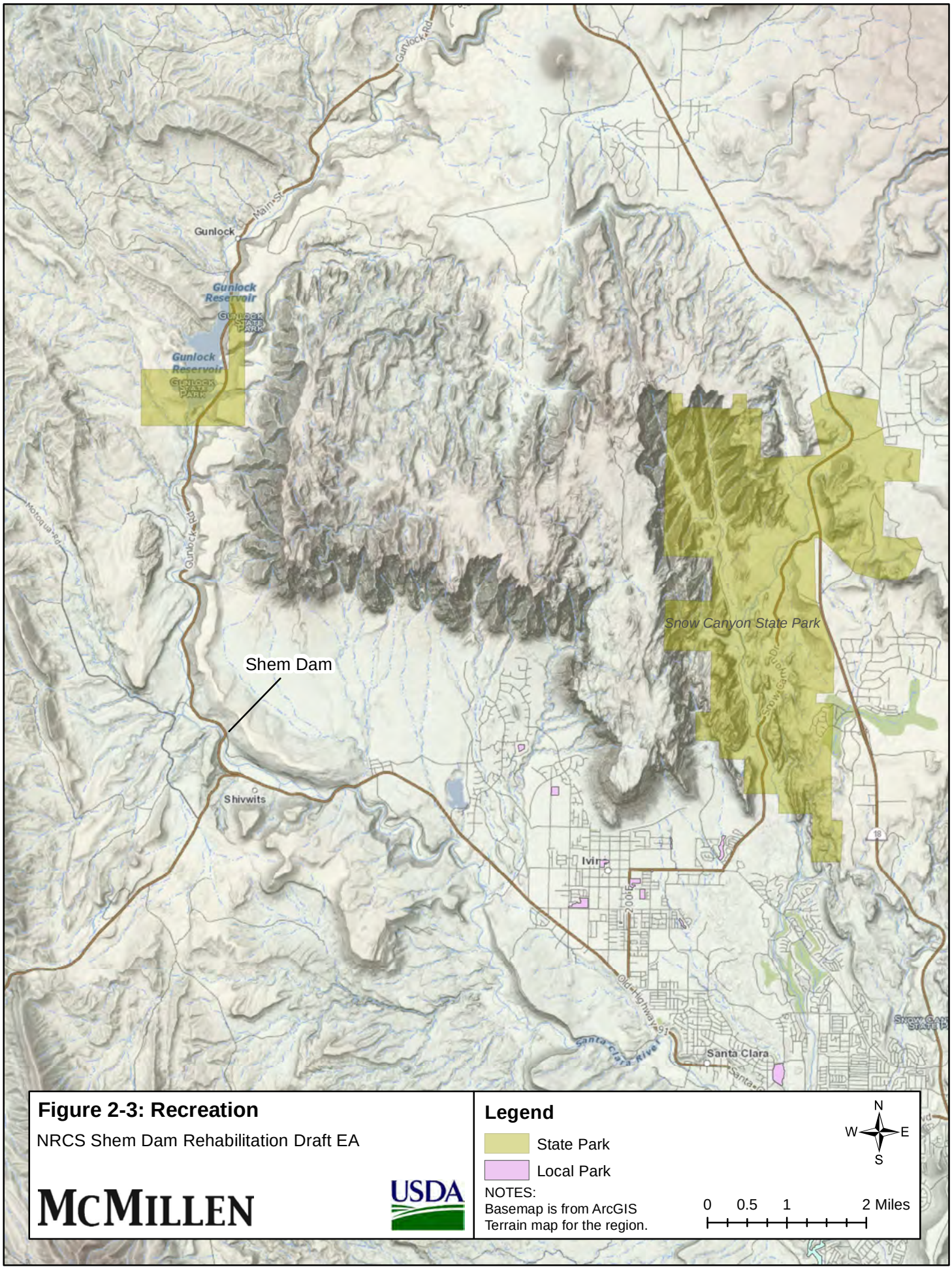


Figure 2-3: Recreation

NRCS Shem Dam Rehabilitation Draft EA

McMillen

USDA

Legend

State Park

Local Park

NOTES:
Basemap is from ArcGIS
Terrain map for the region.

2.6.4.3. Public Health and Safety

Table 2-23 Emergency Services

Law Enforcement	Santa Clara – Ivins (SCI) Police Department	2603 Santa Clara Drive Santa Clara, UT 84765 90 West Center Street Ivins, UT 84738	435-652-1101 435-674-5503
	Washington County Sherrif's Office	750 South 5300 West Hurricane, UT 84737	435-656-6500
	Utah Department of Public Safety Highway Patrol	620 South 5300 West Suite 216 Hurricane, UT 84737	435-634-2890
Fire Protection	Ivins City Fire Department	90 West Center Street	435-674-5503
	Gunlock Fire Department	411 North Main Gunlock, UT 84733	911
	Santa Clara Volunteer Fire Department	2365 Rachel Drive Santa Clara, UT 84765	435-673-6712
Health Care/ Emergency Services	Dixie Regional Medical Center	1380 South Medical Center Drive St. George, UT 84790	435-251-2100

SOLID AND HAZARDOUS WASTE

Washington County has a Class I landfill operated by the Utah Department of Environmental Quality, Division of Solid & Hazardous Waste. The landfill is located approximately 15 miles away near the City of Washington and excludes hazardous waste.

2.6.5. Visual/Aesthetics and Scenic Beauty

Washington County is well known for its red rock scenery, a major source of tourism, particularly in the area near Zion National Park. The Tuacahn Amphitheatre and Center for the Arts near Snow Canyon State Park includes a 1,200-seat outdoor amphitheater built into a canyon surrounded by red rocks (Utah.com 2013).

Snow Canyon Road through Snow Canyon State Park between Ivins City and Highway 18 is considered a scenic backway. The National Scenic Byway closest to the project area is the Brian Head/Panquitch Lake byway in Iron County, north of Washington County. The Utah Scenic Byway closest to the project area is in Zion National Park.

As part of the Colorado Plateau in the desert southwest, the study area is rich in stark contrasts. Gently undulating lowlands through the Santa Clara River Valley give way to the abrupt rise of table mesas and rocky buttes that characterize the mountains to the west, and northwest, of the study area such as West Mountain Peak and Jackson Peak (Picture 2-2).



Picture 2-2. Mountain Peak West of Project Area

Dominating the horizon to the northeast of the project area is Red Mountain with its steep cliffs and canyons. The city of Ivins comprises the lowland elevations to the southeast.

During summer, grasses, shrubs, and trees create a green ribbon along the river margin, separating the lush lowlands of the river from the barren cliffs of the rising plateau (Picture 2-3). Riparian vegetation is most abundant and provides the visual softening of the river valley during summer with native species of cottonwood and willow. Tamarisk and Russian olive are also present in the study area. These non-native species have the potential to substantially compromise the visual quality of the vegetation with dense monocultures. During winter, the primarily deciduous trees of the riparian zone lose their leaves and the green margin of the river disappears (Picture 2-3).



Picture 2-3. View of Riparian Zone with Plateaus in Background

The river is relatively wide and sinuous upstream of the dam and gets narrower downstream of the dam. At lower flows, cobble bars and debris are exposed in the middle of the river. The diversion dam is a rock structure extending across the river. Recent flood events caused substantial damage to the dam and cracks in the structure are now visible (Picture 2-4).



Picture 2-4. View of Flood Damaged Shem Dam

2.6.6. Land Use

There are several different land covers within the designated study area. The banks of the Santa Clara River and land immediately adjacent to Shem Dam are categorized as Riparian Area. Land cover then transitions to undeveloped Shrubland with small pockets of Barren Rockland (UACD 2012).

The entire project area and surrounding lands are owned by the Shivwits Band of Paiutes and are located within the Shivwits Reservation.

2.6.7. Infrastructure

The original structure that diverted water from the Santa Clara River was located 600 feet upstream from the current location of the dam at the old town site of Shem. It was constructed in 1909 and made of brush and straw and its purpose was to provide irrigation water to the Santa Clara Bench area. The structure was continuously damaged during high water events and was always replaced with brush, straw, and even some concrete. In the spring of 1933 the dam was completely washed out. After the structure failed the Santa Clara Bench Irrigation Water Board partnered with prominent irrigation engineer, Luther M. Winsor to construct a concrete and basalt boulder dam. Thus the reason the dam is known by both Shem Dam and Winsor Dam. It was at that time that the dam became a Civilian Conservation Corps, (CCC) project. In 2004 a secondary diversion pressurized pipeline was constructed connecting Gunlock Reservoir to Ivins Reservoir and is operated by the Washington County Water Conservancy District (WCWCD). This diversion was constructed as a replacement to existing diversions and open water delivery systems along the Santa Clara River. Additionally, it provided increased water volume to settle open water rights claims pursuant to the Shivwits Band of Paiute Indian Tribe of Utah Water Rights Settlement Act, delivered water to the St. George Field Canal Company, the Santa Clara Field Canal Company, and the City of Ivins. Three release points were also constructed along the pipeline path to meet the current water right needs. The first is located at the base of Gunlock Reservoir, the second is located approximately 2.35 miles downstream, and the third is located on the Shivwits Reservation just south of Shem Dam.

Damage associated with 2011 flood events has compromised the structural integrity of the dam. Dam failure could result in large volumes of sediment flowing downstream and causing major stream degradation.

Shem Dam is accessed via Old Highway 91from the east or west. From the east, traffic exits north on an unidentified paved county road located approximately 5.5 miles west of Ivins, Utah. The county road crosses the Santa Clara River once, using a two-lane, concrete bridge approximately 880 feet south of Shem Dam.

2.6.8. Noise

Applicable noise laws for the project area are provided in the Noise Control Act of 1972 (42 U.S.C. 4901 et seq.), amended by the Quiet Communities Act of 1978 (42 U.S.C. 4913), which promotes the

development of state and local noise control programs. The State of Utah has not developed a statewide noise law. The Washington County Code addresses nuisances but does contain a noise ordinance.

Noise-sensitive receptors are those facilities, land areas, or wildlife populations that require lower noise levels for health and function. Examples include residential neighborhoods, medical facilities, schools, churches, research facilities, parks, and open space. There are no noise-sensitive receptors within the immediate project area.

CHAPTER 3. ALTERNATIVES

3.1. Formulation Process

The process of formulating alternatives for rehabilitation of Shem Dam followed procedures outlined in the USDA-NRCS National Environmental Compliance Handbook (NRCS 2011a), USDA-NRCS EWP Manual (NRCS 2012) and the USDA-NRCS EWP PEIS (NRCS 2004). Numerous alternatives were developed by the project team based on the ability of each to address the Purpose and Need of the project. Some of the initial alternatives were eliminated from further analysis due to high cost or other critical factors. The project team developed a series of questions and filters to help formulate alternatives:

Initial Screening Questions (first filter):

– Does the concept design meet Purpose and Need?

Secondary Post-Scoping Screening Questions (second filters):

– Is it consistent with established design criteria, engineering practices, etc.?

– Is it reasonable and feasible, and within the established USDA-NRCS EWP program scope of work?

Final Scoping Screening Question (final filters):

– Option: Does it retain the historic nature and character of the original structure?

3.2. Alternatives and Options Considered but Eliminated from Detailed Study

A range of alternatives and options were considered for study early in the project scoping phases, as presented in the *Final Concept Design Report* (Appendix B; McMillen 2013). The analysis included the following general types of diversion alternatives, which were eliminated from detailed study since they were either considered infeasible, did not meet the purpose and need, or were deemed too costly for the project:

- Sheet Pile Weir: Remove the existing spillway and excavate sediment to 15 feet of depth. Repair the left abutment and reinforce the right abutment. Regrade the channel upstream at 1.5% and reorient the approach to make the channel more perpendicular to the dam spillway. Install a sheet pile weir to the middle section of the dam with the new crest 15 feet below the existing crest. Install a new rock reinforced plunge pool below the sheet pile weir spillway. This alternative was not aesthetically pleasing to the project sponsor and Shivwits Band of Paiutes; therefore, it was eliminated from detailed study.
- Complete Decommissioning and Channel Regrading: Demolish the existing dam in its entirety and remove from the site. Excavate the sediment behind dam and regrade the channel upstream and downstream of the dam to catch the existing ground at 2%. Install stabilization features such as riffle-

pool sequences, barbs, etc., in order to dissipate energy in the river during elevated flows and reduce erosion. This alternative was not preferable to the Shivwits Band of Paiutes since they wanted portions of the structure to remain in place; therefore, it was eliminated from detailed study.

- Downstream Grade Control with Natural Erosion: Completely remove the spillway notch and stabilize the abutments for structural stability. Stabilize the channel downstream of existing dam with a riprap apron and bank protection. The river would be allowed to headcut into the upstream sediment pool and carve a natural channel while carrying the sediment downstream. This alternative would potentially result in increased turbidity levels downstream which could impair water quality; therefore, it was eliminated from detailed study.

- Rehabilitate Dam, Excavate Sediment and Divert Water for Municipal/Agricultural Use: Rehabilitate the dam to ensure structural stability during flood events. Excavate the upstream sediment pool to provide water storage, construct a new diversion works, and rehabilitate the Ivins Canal for supply of municipal and agricultural water to the surrounding community. This alternative was not selected as there are no parties that are interested in reestablishing water rights at the dam to transport water; therefore, it was eliminated from detailed study.

- Rehabilitate Dam and Raise Crest for Hydropower Installation: Rehabilitate the dam to ensure structural stability during flood events. Raise the dam crest height in order to provide more hydraulic head, excavate the upstream sediment pool for flood and hydropower storage, and install penstocks and turbines to run a hydropower facility. This alternative is not approved under the EWP program; therefore, it was eliminated from detailed study.

- Controlled Breach with Channel Regrade: Demolish the existing spillway notch, repair the left abutment to mimic the right abutment, and add reinforcement to both abutments for structural stability. Sediment behind the dam would be excavated in order to regrade a channel upstream at 3%. The channel and banks would be lined for protection and an energy dissipation basin would be added to the bottom of the regraded reach (near the existing dam). The channel would be reoriented in order to be more perpendicular to the abutments. This alternative was not aesthetically pleasing to the project sponsor and Shivwits Band of Paiutes; therefore, it was eliminated from detailed study.

- Stepped Rock Chute with Energy Dissipator: Demolish the existing spillway and excavate sediment behind the dam to approximately 8 feet of depth. Repairs would be made to the left abutment to make it vertical, mimicking the right abutment. Reinforcement would be applied to the right abutment to stabilize it. A stepped rock chute would be added in the place of the existing spillway. The top of the chute would be approximately 8 feet below the existing spillway crest. The pool behind the dam would be excavated as necessary, and the channel would be lined and regraded at 2.5% for approximately 350 upstream of the existing spillway. The channel approach would be reoriented in order to make the channel more perpendicular to the spillway. A rock-reinforced energy dissipator would be added to the bottom of the new spillway. This alternative does not provide enough flood control protection to the river channel; therefore, it was eliminated from detailed study.

3.3. Alternatives Analyzed

A No Action Alternative and one Action Alternative were selected by USDA-NRCS and the project team to be analyzed in detail as described in this Draft EA. In accordance with the NEPA, a No Action Alternative must be analyzed.

The rehabilitation project was initiated with several potential alternatives that were developed by the team as a starting point for discussions at the initial Public Scoping Meeting and have since been screened out or modified to the degree that they were considered a separate alternative. They consisted of: 1) stabilizing the dam, creating rock chute/steps with plunge pools, patching the left and right dam abutments, excavating sediment, 2) returning the stream segment to a natural setting by breaching the dam and re-grading the stream segment, providing grade control upstream and downstream of the dam, 3) stabilize the dam, install rip rap along left abutment for road protection, removing recent rock from dam structure and installing a plunge pool at the base of the dam.

At the Public Scoping Meeting the above described alternatives were simplified and discussed in the context of 1) dam decommissioning, 2) partial dam decommissioning, 3) full dam rehabilitation, 4) partial dam rehabilitation, 5) dam stabilization, 6) sediment removal, 7) no action, and 8) other alternatives.

A follow up meeting presentation was requested by the Shivwits Band of Paiutes Council. To help portray the concepts and catalyze discussion illustrations were handed out at the Council Meeting on November 8, 2013 and are presented in the *Final Concept Design Report* (Appendix B; McMillen 2013).

As a result of the initial alternatives screening and coordination with the Project Sponsor and stakeholders, a No Action Alternative and one Action Alternative were selected to be analyzed in this Draft EA.

3.3.1. No Action Alternative

The No Action Alternative would consist of using no Federal money to rehabilitate Shem Dam. Due to the cost associated with the rehabilitation of the dam, it is likely that no repairs would be made by the Project Sponsor or stakeholders to the severely damaged structure; it would not be upgraded to current engineering standards and technology, and would not provide flood control. This alternative, therefore, represents the scenario in which the diversion may likely fail during an extreme flood event in the future.

3.3.2. Stepped Rock Chute Sequence with Energy Dissipaters (Rehabilitate Dam)

Under this alternative, herein referred to as the Rehabilitate Dam Alternative, the following actions would be performed:

- Demolish the existing spillway and fill in the existing scour pool,
- Repair left abutment (looking downstream) and reinforce both the left and right abutments with grouted rock similar to existing material and color,

- Install a stepped rock chute upstream of the upstream stilling basin,
- Excavate a stilling basin (energy dissipater) upstream of the dam and line with riprap,
- Install a stepped rock chute in the demolished spillway location (some of the existing spillway rock may be used),
- Excavate a stilling basin (energy dissipater) downstream of the dam and line with riprap,
- Install cross-vane weirs downstream of the lower still basin to prevent head cutting in the river channel,
- Excavate sediment in the upstream reservoir area and directly downstream of the dam, regrade, and plant with native vegetation,
- Deposit the excavated sediment in an upland agricultural field approximately 0.5 miles downstream of the dam that will be 2.7 acres and 1.2 feet tall (3.2 acre-feet); install BMPs and seed with native grass to control erosion, and
- Demolish the abandoned irrigation infrastructure.

Figures 3-1 through 3-5 depicts the layout of this Rehabilitate Dam Alternative.

3.3.2.1. Sediment Stockpile Area

The sediment excavated out of the reservoir will be hauled offsite and deposited approximately 0.5 miles downstream of the dam. The area is located in the right bank of the Santa Clara River in an abandoned agricultural field owned by the Shivwits Band of Paiutes.



Picture 3-1. Sediment Stockpile Area looking Southeast



Figure 3-1: Dam Rehabilitation Demolition Plan

NRCS Shem Dam Rehabilitation Draft EA

0 60 120 240 Feet

McMILLEN

USDA

Legend

- Stream
- Vegetation and Sediment Removal
- Abutments
- Spillway Demolition

NOTE: Existing spillway material to be used on channel regrade and/or rock chute sequence, as appropriate; excess diposed offsite.

N S E

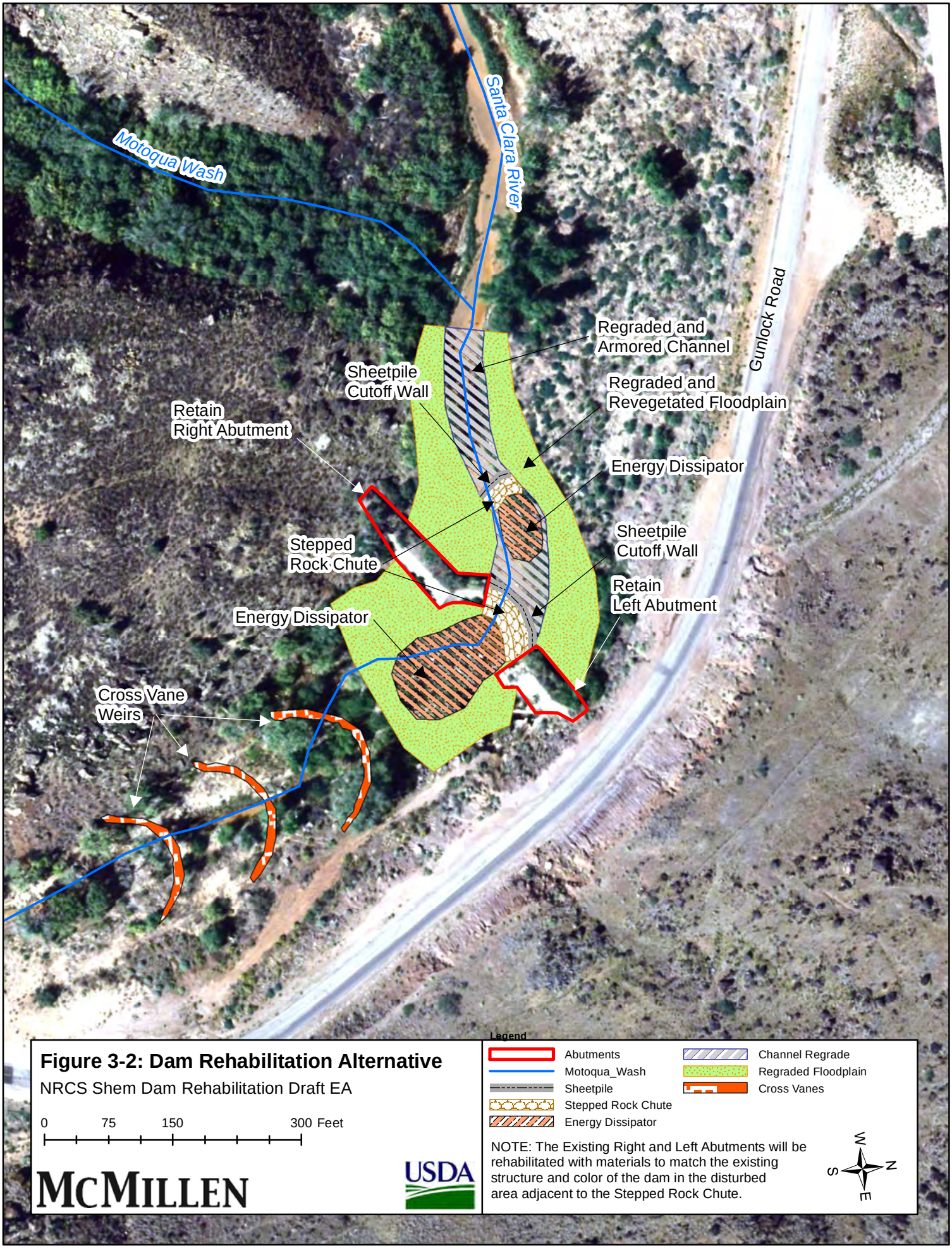


Figure 3-2: Dam Rehabilitation Alternative

NRCS Shem Dam Rehabilitation Draft EA

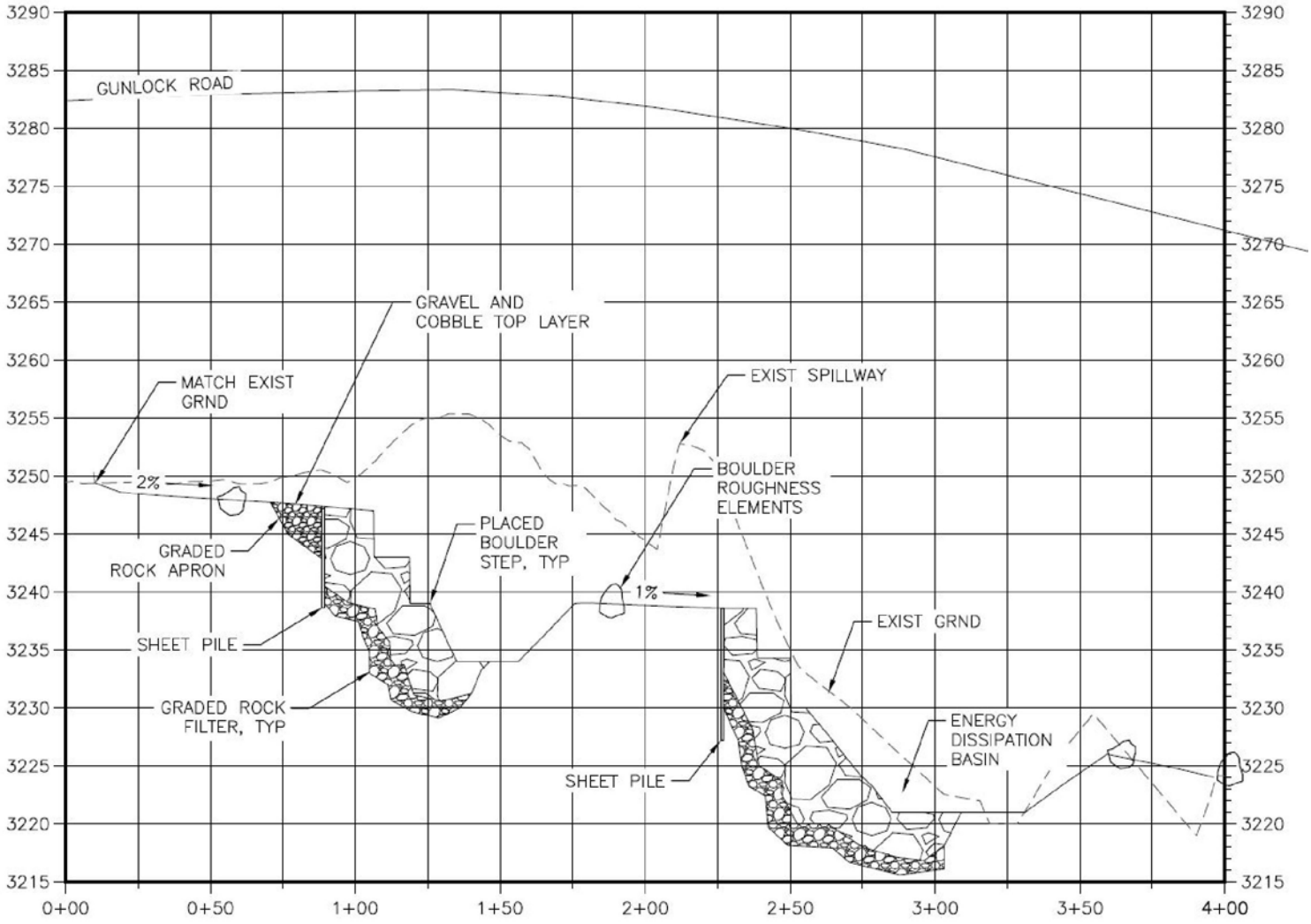


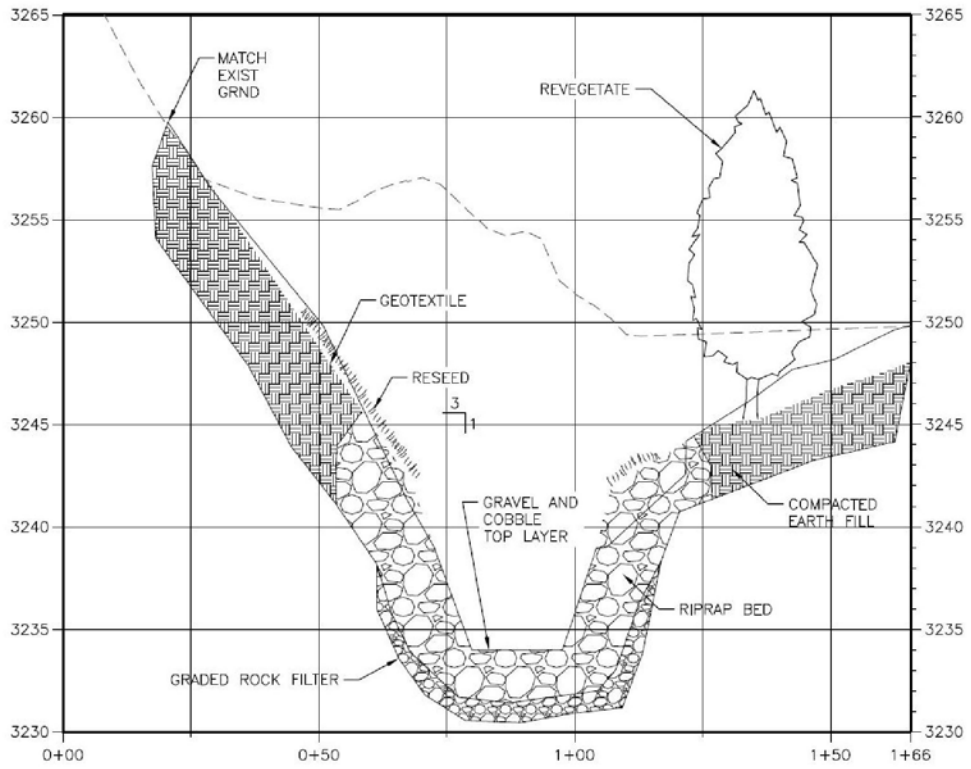
Figure 3-3: Dam Rehabilitation Profile

NRCS Shem Dam Rehabilitation Draft EA

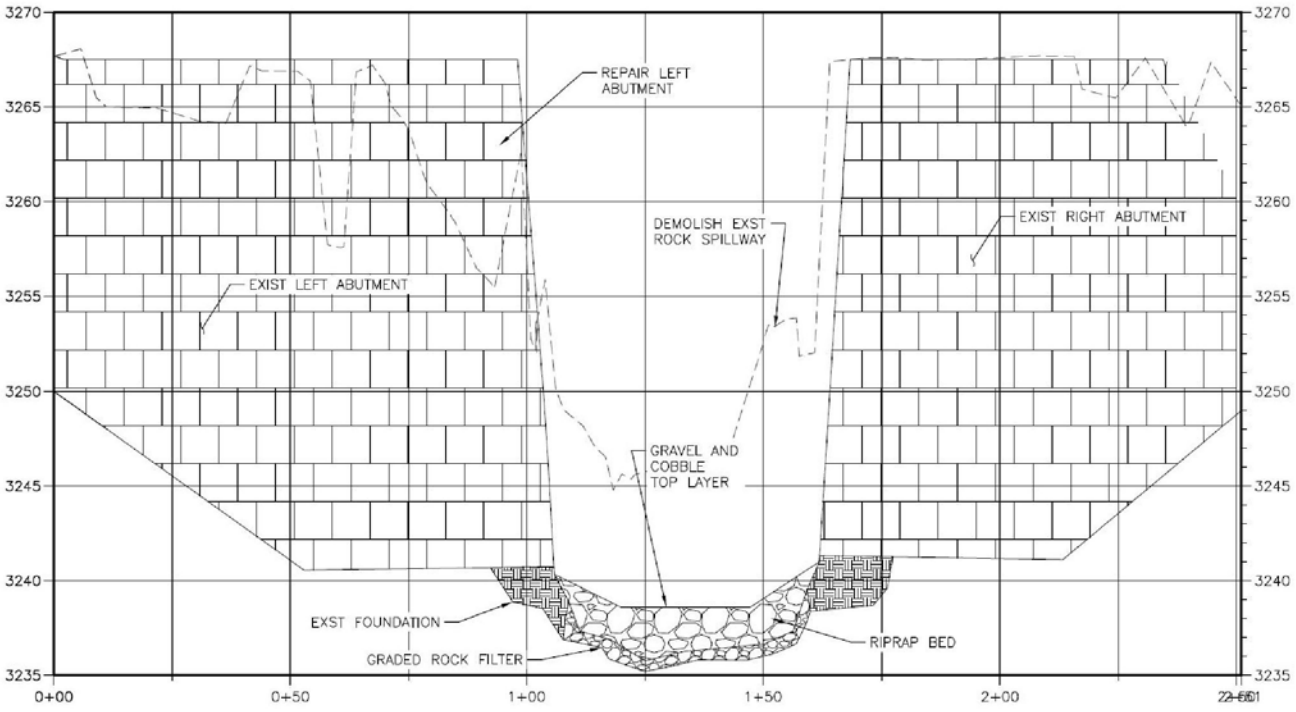
McMILLEN

USDA

NOTE: Profile section taken along presumed centerline of Santa Clara River. Hatching, sheet pile and rock elements shown are not to scale.



Cross Section Taken through First Energy Dissipation Pool, Approx. 75 Feet Upstream of Exisitng Spillway



Cross Section Taken through Dam Abutments

Figure 3-4: Dam Rehabilitation Cross Sections

NRCS Shem Dam Rehabilitation Draft EA

McMILLEN

USDA

NOTE: Hatching, trees, grass and rock elements shown are not to scale.

Figure 3-5: Dam Rehabilitation Construction Access and Sediment Disposal

NRCS Shem Dam Rehabilitation Draft EA

McMillen

USDA

Legend

- Stream
- Construction Access
- Project Area
- Sediment Stockpile

N

0 100 200 400 Feet

Gunlock Road

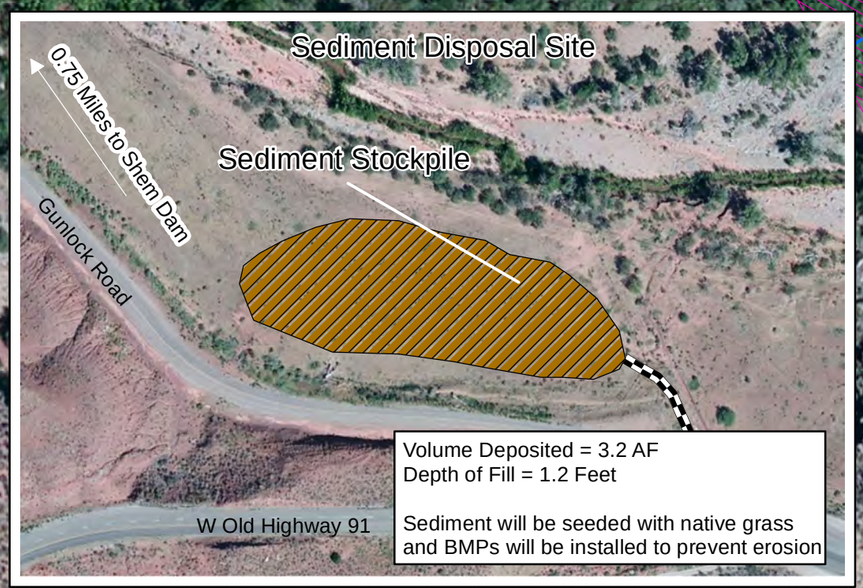
Due to the steepness of the road embankment, a temporary switchback road is recommended for this access site

Shem Dam

Santa Clara River

Motoqua Wash

Continue approx. 2/3 mile to turnoff road from Old Highway 91



3.4. Past, Present, and Reasonably Foreseeable Projects

- Past
  - Rehabilitated bridge abutments with riprap below dam
  - Santa Clara Pipeline Installation
- Present
  - Upstream revegetation efforts
- Future
  - Invasive species control predominantly through revegetation

3.4.1. Cumulative Impact Area

The Cumulative Impact Area ranges from Gunlock Dam on the upstream side, due to its hydrologic influence on Shem Dam, to approximately two miles downstream from Shem Dam. The downstream extent ends where the highway cross the Santa Clara River just outside of the city of Ivins. This is due to a change in geology which results in constraining the stream as well as the bridge constraining the hydrology of the stream and Shem Dam no longer being a large influencing factor.

3.5. Preferred Alternative

The USDA-NRCS NEPA manual states that the EA should identify the agency's preferred alternative. A preferred alternative is the alternative that the lead agency (USDA-NRCS) believes would fulfill its statutory mission and responsibilities considering economic, environmental, technical, and other factors (46 Federal Register [FR] 18026). In identifying the preferred alternative, USDA-NRCS carefully considered the requirements and intent of the EWP program and the expected beneficial and adverse environmental consequences of each alternative (described in Chapter 4, Environmental Consequences).

The Preferred Alternative for the project is the Stepped Rock Chute Sequence with Energy Dissipaters Alternative (Rehabilitate Dam) based on the ability to meet the Purpose and Need for the project. Through the analysis of environmental and social resources in the Environmental Consequences Chapter (4.0), it was determined that the Rehabilitate Dam Alternative would also provide the least negative and most beneficial effects for the project.

The Shivwits Band of Paiutes also selected the Rehabilitate Dam Alternative as their preferred alternative since this alternative would retain the historical significance of the dam to their tribe.

3.6. Summary of Mitigation Measures

Mitigation includes all measures undertaken to avoid, minimize, or compensate for potential adverse environmental impacts.

SOILS

Erosion may occur on disturbed and cleared areas within the project boundary during precipitation events. Proper BMPs would be installed to prevent and control soil erosion during and post construction.

STREAMS AND WETLANDS

The preferred alternative would involve structure repairs that would impact the river channel (bed and bank) as well as small wetland sites within the riparian fringe. Coordination with USACE is being performed to determine if compensatory mitigation will be required for impacts to jurisdictional waters of the US.

VEGETATION

All disturbed areas not associated with direct structure repair would be re-vegetated with approved UDWR plant species. Special precautions would be taken to avoid spreading common reed grass on- or off-site during construction.

No specific mitigation recommendations have been made at this time. Discussions with participating agencies are ongoing and decisions will be made in the near future as required.

Methodology for integration of an overall strategy will be formalized into a Post Construction Rehabilitation Plan.

FISH

There are no mitigation measures proposed for impacts to fish species.

WILDLIFE

There are no mitigation measures proposed for impacts to wildlife species.

CULTURAL/HISTORICAL RESOURCES

In accordance with 36 CFR Part 800.6, USDA-NRCS will resolve the adverse effects to Shem Dam through the development of a treatment plan specifying measures to minimize and mitigate the effects to the historic property. The treatment plan will be developed through consultation between the USDA-NRCS, the Utah SHPO, the Washington County Commission, the Shivwits Band of Paiute Indians of Utah, the Bureau of Indian Affairs, and other participating parties. Consultation will also occur with representatives of the Paiute Indian Tribe of Utah, the Kaibab Band of Paiute Indians, the Moapa Band of Paiute Indians, and the Las Vegas Tribe of Paiute Indians. The Advisory Council for Historic Preservation (ACHP) will be invited to participate in the consultation process as well. Once the treatment plan and measures to minimize and mitigate the adverse effects are agreed upon by the consulting parties, a Memorandum of Agreement (MOA) will be executed and implemented pursuant to compliance with Section 106 of the National Historic Preservation Act. Once the conditions of the MOA have been

executed, it will be the recommendation of the USDA-NRCS that development be allowed to proceed as planned.

If unknown cultural/historical resources were encountered during excavation activities, construction would stop and the appropriate agencies would be notified.

3.7. Operation and Maintenance

Operation of the dam includes the administration, management, and performance of non-maintenance actions needed to keep the dam safe and functioning as designed. Maintenance includes performance of work, preventing deterioration of the dam, and repairing damage or replacement of the dam as-needed to prevent failure. Damages to completed structures caused by normal deterioration, droughts, flooding, or vandalism are considered maintenance. Maintenance includes both routine and as-needed measures which include:

- Annual control of woody species on or near the structures.
- Restoration of river channel or rock that is displaced during flood events.
- Other specific items that will be identified during final design.

Inspection of the dam is necessary to verify that the dam is safe and functioning properly. Inspection reports will be supplied to the USDA-NRCS following each inspection. Inspections and the associated reports will assess the following items:

- The adequacy of O&M activities,
- Identify needed O&M work,
- Specify ways of relieving unsafe work or performing other needed work, and
- Set action dates for performing corrective actions.

Washington County and the Shivwits Band of Paiutes will be responsible for the operation, maintenance, and future modifications to the dam. A specific O&M Plan will be prepared by the USDA-NRCS, Washington County, and Shivwits Band of Paiutes that will govern the use of the dam. This plan and agreement will be entered into by all parties prior to the start of construction activities.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

The purpose of this chapter is to provide a description of how the resources identified would be directly or indirectly and individually or cumulatively affected by the proposed action. The following describes the type of effects and impacts analysis used in this chapter (NRCS 2011a). This analysis forms the scientific and environmental basis for the comparisons of alternatives presented in the previous chapter. Environmental impact of the proposed action and alternatives include, but are not limited to, the following:

- *Direct Effect*. Impacts (or effects) caused by a proposed action and that occur at the same time and place.
- *Indirect Effect*. Impacts (or effects) caused by a proposed action and that appear later in time or farther removed in distance, but still reasonably foreseeable.
- *Cumulative Effect*. This refers to the impact on the environment that results from the incremental effect of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.
    - Past and present actions may involve construction activities at and near the site, soil contamination, downstream sediments, fish and wildlife habitats, and recreation activities. Cumulative effects are related to downstream flooding as well as the need for irrigation storage in the watershed. Foreseeable future actions also include additional commercial and residential development, and related reduction of crops in the area (refer to Section 3.4).
    - The assessment of cumulative impacts is not substantially different from the assessment of direct or indirect impacts. The same types of considerations are made to determine the environmental consequences of the alternatives for direct, indirect, or cumulative impacts. Cumulative impact assessment, however, generally entails a broader perspective (or broader scale) such as what else is happening in the area and/or downstream.

Table 4-1 provides a summary comparison of the impacts associated with each alternative. The alternatives proposed for consideration and analyzed in detail in this Draft EA have been compared to discern the merits and disadvantages of each alternative. This information is presented in summary, and further detail is provided in subsequent sections. The chapter concludes with an evaluation of construction impacts, detail on construction activities (where applicable), a summary of cumulative impacts per resource, and where impacts would be unavoidable, mitigation commitments will be made.

4.1. Summary and Comparison of Alternatives

Table 4-1. Summary and Comparison of Direct, Indirect, and Short-Term Resource Impacts

Effects	No Action	Rehabilitate Dam
Soils, Geology, and Sediment	*Direct Impacts*: Continual migration of stream segment adjacent to dam *Indirect effect*: Transport of sediment and scouring of soil downstream of dam from dam failure.	*Direct Impacts*: Relocate 5,100 cubic yards of sediment to the stockpile area. *Short-Term*: Potential soil disturbance and sediment into Santa Clara River during construction.
Surface Water Quality	*Direct Impacts*: Continued high sediment load at dam site *Indirect* effect during dam failure – high sediment loading (short-term). *Short-Term*: Construction activities would temporarily affect sediment levels in river channel.	*Direct Impacts*: Allows sluicing of sediment *Short-Term*: Temp disturbance to project area vegetation, soils and river channel.
Waters of US including Wetlands	*Direct Impacts*: No long term establishment of wetlands due to rapidly moving top layers of soil *Indirect* effects to streams; Stream channel altered and wetlands washed away or filled with sediment from dam failure.	*Direct Impacts*: 2.5 acres of jurisdictional waters impacted. Attain proper functioning condition of the stream and riparian area. *Short-Term*: Temp disturbance to project area vegetation, soils and river channel.
Climate Change	*Direct Impacts*: None	*Direct Impacts*: None
Air Quality/ Noise/ Light	*Direct Impacts*: None *Indirect and Short-Term*: Air quality/noise/light resources would experience temporary effects from emergency services responding to a flood event as well as cleanup services, which would create additional emissions, noise and light.	*Direct Impacts*: None *Short-Term*: Construction activities would temporarily affect air quality and generate additional noise and light in the project area.
Riparian and Vegetated areas	*Direct Impacts*: Few vegetative species due to highly fluctuating flows and laterally moving stream segment *Short-Term*: Damage to vegetation downstream of dam from failure.	*Direct Impacts*: Increased riparian vegetative diversity *Short-Term*: Loss of riparian vegetation.
Threatened and Endangered Species	*Direct Impacts*: None *Short-Term*: Damage to species and habitat downstream of dam from failure.	*Direct Impacts*: None; no fish or wildlife kills anticipated. *Short-Term*: Temp disturbance to project area.
Fish	*Direct Impacts*: None *Short-Term*: Possible destruction or modification of fish habitat in the channel downstream.	*Direct Impacts*: None *Short-Term*: Temp disturbance to project area.
Wildlife	*Direct Impacts*: None *Short-Term*: Injury or fatality, as well as extreme habitat modifications, in the inundation area from dam failure.	*Direct Impacts*: 1.2 acres of wildlife habitat impacted *Short-Term*: Temp disturbance to project area

Effects	No Action	Rehabilitate Dam
Cultural/Historic	*Direct Impacts*: None *Indirect and/or Short-Term*: In the event of dam failure, the historic dam structure would be adversely affected.	*Direct Impacts*: Unknown at this time *Short-Term: Unknown at this time*
Land Use/Rights	*Direct Impacts*: None	*Direct Impacts*: None *Short-Term*: Temporary easement/agreement for access during const.
Recreation	*Direct Impacts*: None *Indirect and/or Short-Term*: Adverse effect from dam failure.	*Direct Impacts*: None *Indirect and/or Short-Term*: more easily to transverse via walking
Scenic Beauty/ Visual Quality/ Aesthetics	*Direct Impacts*: Site will remain weed infested *Indirect and/or Short-Term*: Construction site would degrade the area temporarily.	*Direct Impacts*: Increase beauty, visual quality and aesthetics *Indirect and/or Short-Term*: Construction site would degrade the area temporarily.
Transportation/ Infrastructure	*Direct Impacts*: None *Indirect and/or Short-Term*: Adverse effects from damage to roads from a dam failure. Loss of access during floods.	*Direct Impacts*: None *Indirect and/or Short-Term*: Temporary affects to road during construction

4.2. Soil Resources

Construction impacts would be temporary in nature, and due to the potential for these impacts, all soil resources are described in Section 4.2.2, Construction Impacts to Soil Resources.

4.2.1. Geology, Erosion, and Sedimentation

4.2.1.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would have a direct impact on the soil resources in the vicinity of the project. Currently, the stream segment adjacent to and directly above the dam rapidly migrates during high flows due to the small sediment size of the soil particles. The current rate of lateral migration of the stream in this segment is not typical of properly functioning natural processes.

INDIRECT IMPACTS

In the event of a dam failure, this alternative would have an indirect impact on the soils within the Santa Clara River drainage downstream; soils would potentially be washed downstream from the high volumes of water exiting the diversion structure. These soils would settle out of the water column in slower velocity areas covering existing stream, riparian, and wildlife habitat.

In the event of a dam failure, scouring in the channel below the dam would occur. The extent of channel scour would be dependent upon the degree of the dam failure. A complete failure of the dam could result

in appreciable erosion of the Santa Clara River channel as well as clearing of the majority of vegetation in the flow path immediately downstream.

4.2.1.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

The river soils in the stream segment directly upstream of the dam would be directly impacted by this alternative. The reconstruction of the spillway notch would naturally transport sediment in the bottom of the river downstream. Sediment accumulated from behind the dam (5,100 cubic yards) would be moved during excavation for placement on the downstream embankment of the dam for structural fill. Grading of the stream channel will be necessary. In order to ensure adequate engineering design of the project components, geotechnical investigations will be necessary to ascertain depth to refusal. Sediment samples of the drilling will be sent to a lab to be analyzed for presence and concentration of harmful metals due to the presence of a historic smelter just upstream from the dam. Additionally, direct impacts to soils would also be associated with re-grading along streambanks in disturbed areas. Excess sediment will be hauled and stockpiled at the sediment stockpile area downstream of the dam. The stockpile location is outside of the 100-year floodplain and will not negatively affect any sensitive habitat.

Best Management Practices (BMPs) will be implemented during construction to minimize impacts to banks. These practices are listed in Section 4.2.2. Construction Impacts to Soil Resources.

INDIRECT IMPACTS

The proposed action would not have an indirect impact on soil or geologic resources.

4.2.2. Construction Impacts to Soil Resources

Temporary impacts to soils in the area could occur during construction. Soils dredged from the large deposition area above the dam would be utilized to provide fill for grading purposes. The soils would be separated and filtered for appropriate size and composition of material, with the top layer of sediment discarded due to the high density of fine material.

Short-term construction impacts would include bank erosion until vegetation was established. BMPs including, but not limited to, the following would be implemented during construction to minimize these impacts.

- Rock rip-rap would be placed upstream and downstream of the dam.
- Water bodies adjacent to construction and staging areas will be identified, and such measures as straw bales, silt fences, and other appropriate sediment control BMPs would be implemented to prevent the entry of sediment and other contaminants into waters.
- Following construction, all sediment control BMPs will be removed along with any accumulated sediment and disposed of in an off-site location at the appropriate time.

4.3. Water Resources

Activities related to water resources are regulated by EPA, the U.S. Army Corps of Engineers (USACE), and the Utah Department of Environmental Quality (UDEQ). Appropriate permits will need to be obtained for any activities regulated by the Clean Water Act (CWA), and include the following:

- Section 404 Permit: for discharge of fill into waters of the US (jurisdictional wetlands)
- Section 401 Water Quality Certification: certification for activity that is subject to authorization under Section 404 of the CWA
- Section 402 of the CWA for construction activities: National Pollutant Discharge Elimination System (NPDES) permit (for construction over 1 acre), as administered by the Utah Pollutant Discharge Elimination System (UPDES)
- Stream alteration permits: required for any work in or near streams in the State of Utah

Coordination with participating agencies is ongoing. Specific area management plans may exist that the project will need to comply with to meet the requirements set forth as part of those plans. Construction impacts to water resources are temporary in nature and are described in Section 4.8, Construction Impacts.

A stream and wetland delineation was performed in November 2013. The delineation indicates that a total of 3.06 acres of wetlands will be impacted as a result of the dam rehabilitation project.

4.3.1. Hydrology and Water Quality

During construction an effective Storm Water Pollution Prevention Plan with appropriate BMPs would be implemented to avoid and minimize water quality impacts and sedimentation.

4.3.1.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative does have a direct impact on hydrology and water quality of the Santa Clara River. Existing conditions would remain as they are currently, which is as a well-known problem area.

The hydrologic condition at the Shem Dam site if left untouched will continue to be extremely dynamic affecting both the project area and downstream from the project area. High flows will continue to deposit large amounts of sediment directly upstream from the dam and the channel will continue to rapidly move and expand and contract with each event. Downstream from the dam the channel will continue to incise and armor itself.

INDIRECT IMPACTS

In the event of a dam failure, this alternative would have an indirect impact on water quality due to excess sediment washing downstream. In this event, a large volume of water and stored sediment would flow downstream over a short period of time. The water quality in the river would be degraded from fill material, upland soils, and destruction of vegetation, violating federal and state water quality rules and regulations.

Indirect effects to the pool area and downstream of the dam on the Santa Clara River would include bed and bank erosion to the river channel from gradual erosion until the banks became stabilized over time. Local hydrology will be altered each time the channel is modified by either moving laterally or downcutting.

4.3.1.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

Constructing a stepped rock chute with two energy dissipaters may provide an overall net benefit in water quality in the Santa Clara River at least in the local vicinity by providing for more efficient sediment sluicing at the dam structure and thus a more natural sediment transport balance at the site. The water quality in the project area is currently listed as "impaired" for exceeding standards for concentrations or limitations of boron, selenium, temperature and Total Dissolved Solids (TDS). Contributors of the non-point source pollution are listed as natural hillslope erosion, livestock grazing, and recreation. The proposed action would not permanently alter the hydrology or water quality of this segment of the Santa Clara River.

During construction activities, water quality of the Santa Clara River could be impacted due to mobilizing some sediment; however, implementation of construction BMPs would minimize this potential. Further, increases in runoff would not be expected to result in changes to the total maximum daily load (TMDL) for sediment. Construction projects are required to have storm water permits and also to address storm water and sediment management as part of local and state ordinances and regulations.

INDIRECT IMPACTS

The hydrology at the dam and pool area would be stabilized. This would be accomplished by engineering the site so that it can more effectively transport sediment through the area rather than continually place large deposits behind the dam and then during flood events either move them through the system or move them laterally at the site which often also results in the channel moving.

4.3.2. Water Rights

4.3.2.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not have direct impacts to water rights from the loss of water delivery if the dam failed whereas the water delivery infrastructure is not being utilized and there are no future plans to rehabilitate it.

INDIRECT IMPACTS

In the event of a dam failure, this alternative would have an indirect impact on water rights downstream. Excess sediment would travel downstream and potentially damage irrigation delivery system infrastructure.

4.3.2.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would have no direct impact on water rights.

INDIRECT IMPACTS

This alternative would have no indirect impact on water rights.

4.3.3. Groundwater

4.3.3.1. No Action Alternative

DIRECT IMPACTS

This alternative would have no direct impact to existing groundwater supply and levels.

INDIRECT IMPACTS

This alternative would have no indirect impact on groundwater supply or levels.

4.3.3.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would have no direct impacts on groundwater.

INDIRECT IMPACTS

This alternative would have no indirect impacts on groundwater.

4.3.4. Floodplains

The project would need to secure a Floodplain Development Permit from Washington County.

4.3.4.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would result in direct changes to the function of the 100-year floodplain downstream of the dam. Impacts downstream to the 100-year floodplain are a result of the channel currently actively incising and becoming armored which disconnects the river from the floodplain and diminishes proper functioning condition.

INDIRECT IMPACTS

The No Action Alternative would potentially result in changes to the function of the existing floodplain in the event of dam failure. Over the short-term, this alternative would likely result in an increased flood hazard. Properties within Santa Clara River floodplain downstream of the dam structure would potentially experience high volumes of water exiting the dam structure and dispersing onto the floodplain.

4.3.4.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

Direct impacts would occur to the floodplain in the immediate vicinity of the dam. Lowering the spillway elevation and regrading the channel immediately upstream of the dam would result in a decreased floodplain extent during high volume flood events.

INDIRECT IMPACTS

Hydraulic modeling was conducted to analyze for impacts to floodplains and the results are documented in the *Final Conceptual Design Report* (Appendix B). This alternative will likely provide greater connectivity to the floodplain both in the project area and downstream resulting in increased sediment deposition and improving the overall function of the floodplain.

4.3.5. Waters of the US and Wetlands

Waters of the US, including wetlands, have been assessed in accordance with the 1987 USACE Wetlands Delineation Manual and 2008 Arid West Region Supplement. The *Wetland and Stream Delineation Report* (Appendix C) describes the jurisdictional and non-jurisdictional waters of the US and wetlands in the project area.

USACE and the Utah Division of Water Resources will be provided copies of the Joint Application for Permit for comment and approval. USACE NWP 37 specifically addresses the USDA-NRCS EWP program activities. When EWP program recovery efforts require working in “waters of the U.S. and/or near navigable waters of the U.S.”, all EWP program activities and any needed mitigation will be coordinated with USACE. All necessary permits must be obtained prior to construction commencement.

4.3.5.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would have no direct impact to waters of the US or wetlands.

INDIRECT IMPACTS

The No Action Alternative would likely have an impact to wetlands and waters of the US. If the dam were to fail, sediment would be transported downstream and fill in wetlands altering their current function.

4.3.5.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

The excavation of soil from adjacent wetlands and placement of fill associated with the construction of the proposed action would directly impact 2.5 acres of jurisdictional waters of the US including wetlands. The type of wetland that would be impacted is riverine -open water and riparian wetlands. All permits will be procured prior to construction. As a result of dam rehabilitation, impacted wetlands would be returned to a higher functioning level than prior to construction. By notching the dam, installing step pools (energy dissipaters) and glides (chutes), the site will more closely mirror natural conditions.

INDIRECT IMPACTS

This alternative would indirectly impact waters of the US or wetlands by mimicking natural conditions and therefore move closer to proper functioning condition. As a result of this transformation, new floodplain wetlands may be created downstream of the dam naturally. Currently, the slope of the stream is greater below the dam than above the dam, effectively narrowing the band of riparian wetlands. The stream is more entrenched below the dam which has lowered the water table to the surrounding lands effectively lessening the amount of riparian wetlands that currently exists.

4.3.6. Climate Change

4.3.6.1. No Action Alternative

DIRECT IMPACTS

Climate change in Utah is resulting in declining snowpack and an increase in droughts. The No Action Alternative would have no direct impact on climate change.

INDIRECT IMPACTS

No indirect effects would be anticipated from climate change.

4.3.6.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative will have no direct effects on climate change.

INDIRECT IMPACTS

This alternative would not be expected to have any effect on climate change.

4.3.7. Construction Impacts to Water Resources

Erosion control and sediment removal are very important temporary and permanent design considerations because soils within the project area are highly susceptible to erosion in certain locations. Aggressive temporary erosion control and sediment removal measures would need to be implemented during construction until permanent slope stabilization and water quality improvement facilities were constructed.

Project design elements, including BMPs, would be used and would be implemented to reduce the quantity of sediment flowing downstream and violating any federal or state water quality rules and regulations. The dam rehabilitation would also meet UPDES and Utah antidegradation requirements. Construction BMPs that may be utilized include, but are not limited to, the following:

- A Storm Water Pollution Prevention Plan (SWPPP) that contains erosion and sediment control and pollution prevention BMPs, such as, but not limited to, silt fences, fiber wattles, and/or earth berms.
- Construction activities impacting irrigation will be coordinated with the managing entity to ensure no interruption of service and to minimize adverse impacts.
- Water bodies adjacent to construction and staging areas will be identified, and such measures as straw bales, silt fences, and other appropriate sediment control BMPs will be implemented to prevent the entry of sediment and other contaminants into waters.
- To ensure that accidental spills do not enter waters, the storage of petroleum-based fuels and other hazardous materials and the refueling of construction machinery will not occur outside of approved designated staging/batch plant areas. Furthermore, the project will comply with state and federal water quality standards and toxic effluent standards to minimize any potential adverse impacts from discharges to waters of the US.
- No construction materials shall be stockpiled or deposited in or near any water bodies.
- A Hazardous Materials Spill Prevention/Contingency Plan shall be developed and approved prior to construction.

4.4. Air Quality

Neither the No Action Alternative nor the Rehabilitate Dam Alternative would have direct or indirect impacts to air quality.

4.4.1. Construction Impacts to Air Quality

Construction activities would temporarily emit several air pollutants. PM_{10} emissions are associated with the dust created from demolition, land clearing, ground excavation, cut-and-fill operations, and road construction. All other pollutants ($PM_{2.5}$, CO, SO_x, NO_x, MSAT, and GHG) are generated from heavy-duty diesel engines used by the construction equipment. Construction emissions are greatest during the earthwork phases because of the dust associated with this activity. Fugitive dust can also be produced by winds blowing through the construction site and by trucks carrying uncovered loads. Additionally, mud tracked out onto paved roads leading to and from the construction site creates a source of fugitive dust (i.e., road dust) after it dries.

Emissions from trucks and construction equipment powered by heavy duty diesel engines would be temporary and concentrated around the construction site. Delays associated with travel through construction zones would increase emissions from on-road vehicles. However, these temporary delays would only result in a small amount of additional pollutant emissions when compared with the usual traffic experienced around the construction site.

UDEQ requires the control of fugitive dust from all construction sites. Fugitive dust, Mobile Air Source Toxics (MSAT), and GHG emissions increases associated with construction would be minimized by implementation of applicable BMPs. Construction BMPs that may be utilized include, but are not limited to, the following:

- Spraying the soil on-site with water, or other similar approved dust suppressant/soil binder.
- Wetting materials hauled in trucks, providing adequate freeboard (space from the top of the material to the top of the truck), or covering loads to reduce emissions during material transportation/handling.
- Providing wheel washers, or similar BMP, at construction site accesses to reduce track-out of site materials onto the adjacent roadway network.
- Removing tracked-out materials deposited onto adjacent roadways.
- Wetting material stockpiles to prevent wind-blown emissions.
- Establishing vegetative cover on bare ground as soon as possible after grading to reduce wind-blown dust.
- Requiring appropriate emission-control devices on all construction equipment.
- Requiring the use of cleaner burning fuels.

- Using only properly operating, well-maintained construction equipment.

4.5. Plants

This section describes the impacts of the alternatives on the biological resources in the project area.

Necessary consultation will be performed as required by Section 7 of the ESA and related USDA-NRCS guidelines as a result of ESA listed plants being present adjacent to the project area. Section 7(a)(2) of the ESA requires that all federal agencies ensure that their actions to authorize, permit, or fund a project do not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of critical habitat of listed species.

One plant species listed as Endangered by the US Fish and Wildlife Service occurs adjacent to the study area. A request was made to the Utah Natural Heritage Division of Wildlife Resources to provide information pertaining to all listed species within the project area. The only listed plant species within a mile of the project area is Shivwits Milkvetch, which is categorized as Endangered.

4.5.1. Vegetation Communities

4.5.1.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not impact specific vegetation communities.

INDIRECT IMPACTS

In the event of dam failure, indirect impacts to specific plant communities would occur generally associated with erosion and ground disturbance on the adjacent riparian corridor and floodplain on both banks of the river.

4.5.1.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would disturb and/or remove 1.3 acres of vegetation on the east and west banks of the river, riparian fringe, and adjacent floodplains. The typical vegetation community within the impacted area consists of willows, cottonwoods, Russian olive, wild rose and tamarisk along the banks of the river. Vegetation disturbed from construction activities outside of the rehabilitation footprint would be restored using native plant species. During construction and until the restoration area was fully established, the area would be maintained on a regular basis to prevent the establishment of noxious weeds and invasive plant species. Non-desirable plant species would be controlled by cleaning equipment prior to delivery to the project site, eradicating these species before the start and during construction as discovered, and routine monitoring would take place after construction completion.

4.5.2. Endangered and Threatened Species and Species of Concern - Plants

4.5.2.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not impact the threatened or endangered plant species that occur at the dam site.

INDIRECT IMPACTS

It is unknown if any listed plants occur downstream from the dam within the riparian corridor. If they occur within the floodplain area and within a distance that would be impacted in the event of a dam breach then there is potential for harm.

4.5.2.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

Shivwits milk-vetch occurs adjacent to the project area. The plants are fenced off and will not be disturbed during or after construction. Conservation measures (watering roads within 300 feet of documented plants) will be used to reduce fugitive dust if construction activities will be performed during the flowering season. Additionally, a survey will be conducted on areas of the project footprint that have the required characteristics for the plant to survive prior to construction. USDA-NRCS will consult with the USFWS regarding potential impacts to Shivwits milk-vetch.

All other documented ESA listed plant species occurrences in Washington County are greater than 1 mile away from the project area.

INDIRECT IMPACTS

There are no indirect effects anticipated to threatened or endangered plant species.

4.5.3. Invasive Plants

The project area is in a location where invasive plant species, or "noxious weeds", are known to occur or where risk of an invasion exists. A disturbed area, such as a construction site with access roads, would be considered an area at risk.

4.5.3.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not change the land use or existing dam structure; therefore, this alternative would have no direct impacts to invasive plants.

INDIRECT IMPACTS

The dynamic nature of the river, recurring floods and sediment deposition allows natural vegetation little time to establish in the upstream reservoir area. As a result, invasive plants have continued to establish in the area and outcompete native vegetation. This area will continue to be altered over time from flood events allowing invasive plants to continue to flourish in this area.

4.5.3.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would put the project area at risk for future invasion of noxious weeds. Construction BMPs (listed below) would be implemented to minimize the short-term impacts associated with ground disturbance.

INDIRECT IMPACTS

Long-term negative impacts will be managed with re-planting, and various methods of weed control.

4.5.4. Riparian Areas

4.5.4.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would directly impact the riparian communities in the project area. Currently there are relatively few vegetative species present due to the rapidly changing nature of the riparian area. As a result of the stream moving during flood events, native vegetation has not had time to establish and the riparian area is comprised of relatively few tree and shrub species and weeds. The No Action Alternative retains the current altered state of the site.

INDIRECT IMPACTS

The No Action Alternative presents a potential for the existing dam to fail, which could have an indirect impact on trees within the riparian zone. In the event of dam failure many trees would be uprooted and washed downstream.

4.5.4.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would impact 1.5 acres of riparian fringe vegetation along the banks of the river. Over time, the site should move toward greater vegetative diversity and establishment of native species. Treatment will call for removal of tamarisk and replanting post construction as well as follow up monitoring and invasive species treatment.

INDIRECT IMPACTS

The riparian area upstream and downstream of the dam will be stabilized over time from the establishment of a stabilized stream channel and vegetation growth resulting in indirect impacts.

4.5.5. Construction Impacts to Plants

ENDANGERED AND THREATENED PLANTS

Shivwits milk-vetch is located near the county road which will be utilized for ingress/egress. There is no suitable habitat for Shivwits milk-vetch within the project area. Best Management Practices such as dust abatement during construction may need to be utilized to minimize any adverse effects to the listed species.

INVASIVE PLANT SPECIES

During construction activities, area roads would be utilized by trucks and equipment to access the site; however, implementation of construction BMPs would minimize the potential for transport of invasives into the area. Throughout construction and until vegetation is fully established, it would be maintained on a regular basis to prevent the establishment of noxious weeds and invasive plant species. Non-desirable plant species would be controlled by cleaning equipment prior to delivery to the project site, eradicating them before the start and during construction as discovered, and routine monitoring after construction completion.

RIPARIAN COMMUNITIES

During construction activities, implementation of construction BMPs would minimize the potential for impacts to riparian areas.

4.6. Animals

Necessary consultation will be performed as required by Section 7 of the ESA and related USDA-NRCS guidelines. Section 7(a)(2) of the ESA requires that all federal agencies ensure that their actions to authorize, permit, or fund a project do not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of critical habitat of listed species.

Biological resources include the presence and habitat of fish and wildlife found in the project area. The Migratory Bird Treaty Act of 1918 made it illegal for people to "take" migratory birds, their eggs, feathers, or nests. “Take” is defined in the Act to include by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof. In addition, the Bald and Golden Eagle Protection Act affords additional protection against “taking” of bald and golden eagles.

4.6.1. Habitat

4.6.1.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not impact fish or wildlife habitat.

INDIRECT IMPACTS

In the event of dam failure, indirect impacts to habitat would occur, generally associated with erosion and ground disturbance on the east and west banks of the river. Water quality would also be temporarily impaired due to sediment movement in the water column.

4.6.1.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would directly impact 1.3 acres of fish habitat and 1.2 acres of wildlife habitat. Potential impacts to habitat areas, such as those riparian vegetative communities along the banks that shade the river, would be short-term because project-related disturbance would be during construction only and would not change current conditions over the long-term. Vegetation that is impacted by the project will be replanted with native species (see Section 4.6.5, Construction Impacts). In addition, the proposed action would not result in additional habitat fragmentation.

This alternative would impact small areas of habitat along the east and west banks of the river. The typical vegetation community within the impacted area consists of willows, cottonwoods and tamarisk with few native herbs. These communities (and thus habitat) will be temporarily negatively impacted during construction due to removal of vegetation.

INDIRECT IMPACTS

Vegetation composition will improve in the project area over the long-term by moving from an early State in Transition community to a later seral state community due to replanting efforts and ongoing invasive species management.

4.6.2. Endangered and Threatened Species and Species of Concern

4.6.2.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative will not affect special status fish species. Currently, there is no fish passage over Shem dam and there are 3 fish passage barriers downstream. There is approximately 25 feet elevation change between the crest of the dam and the water elevation at the base of the dam. The Upper Virgin River Recover Program calls for connectivity in the Santa Clara River to support species survival for spawning migration, drifting of newly produced young-of-year fish, and home-range expansion of juveniles.

Terrestrial listed species are not negatively impacted with the No Action Alternative.

INDIRECT IMPACTS

In the event of dam failure, indirect impacts to habitat could occur, generally associated with erosion and ground disturbance on the east and west banks of the river.

4.6.2.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative is unlikely to directly impact listed fish species due to the fact that they do not occupy the project area. There are a minimum of three fish passage barriers below Shem Dam which keep listed fish from accessing the site. Any increased levels of suspended sediment instream due to construction will be attenuated by the time the water reaches stream segments that are occupied by listed species.

The project may affect but is not likely to adversely affect the Southwestern Willow Flycatcher due to their potential occurrence within or near the project area. A biological survey was conducted by JBR Environmental Consultants, Inc. on January 22, 2014. The survey revealed that while some vegetative habitat exists on the site that may be utilized by the Flycatcher during migration periods, the canopy thickness and understory density are not sufficient for nesting. It is possible that the species may utilize the area for occasional foraging on a migratory basis.

To minimize turbidity and sediment mobilization during dredging and construction, silt curtains would be installed around work areas.

Project components have been developed to enhance opportunities for species in accordance with USFWS policy and in conjunction with the Virgin River Recovery Program.

INDIRECT IMPACTS

This alternative would provide beneficial indirect impacts to wildlife by stabilizing the stream channel and riparian corridor in the dam area.

4.6.3. Invasive Species

4.6.3.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not change the use of the existing dam structure; therefore, this alternative would not allow the introduction of additional invasive species.

INDIRECT IMPACTS

The potential failure of the dam may create fish passage conditions past the dam that would allow invasive fish species to inhabit areas upstream that were not previously inhabited.

4.6.3.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative includes components that increase streambed and streambank stabilization which positively impacts fish habitat. These components would be developed in accordance with USFWS policy and in conjunction with the Virgin River Recovery Program.

INDIRECT IMPACTS

Indirect impacts to invasive fish species would not be anticipated.

4.6.4. Migratory Birds/Bald and Golden Eagles

4.6.4.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not directly impact migratory birds or bald and golden eagles. However, there is a potential for the existing dam to fail, which could have an indirect impact on trees within the riparian zone. This has the potential to result in an unintentional take of a migratory bird, nest, or egg.

INDIRECT IMPACTS

There is a potential for the existing dam to fail, which could have an indirect impact on trees within the riparian zone. This has the potential to result in an unintentional take of a migratory bird, nest, or egg.

4.6.4.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would not have a direct impact on migratory birds or bald and golden eagles.

INDIRECT IMPACTS

This alternative would impact the riparian zone of the project area, which may then result in the unintentional “take” to a potential bird, eagle, nest, or egg. Large cottonwood trees occur within the riparian zone which is primary habitat for these species. While some vegetative habitat exists on the site, the canopy thickness and understory density are not sufficient for nesting. It is possible that the area may be used for occasional foraging on a migratory basis.

4.6.5. Construction Impacts to Aquatic and Terrestrial Animals

FISH HABITAT

Fish habitat would be temporarily obstructed and degraded due to in-channel work; however, implementation of the Environmentally Preferable Alternative would minimize this impact. Implementation of construction BMPs would minimize this potential.

To minimize turbidity and sediment mobilization during dredging and construction, silt curtains would be installed around work areas.

Reestablishment of vegetation would be expected to occur within 2 years of project completion.

MIGRATORY BIRDS, BALD AND GOLDEN EAGLES

It is unlikely that clearing and grubbing activities would impact the nest sites of birds protected by the Migratory Bird Treaty Act. Temporary construction-related effects also include construction noise, increased human activity, and heavy equipment operations, all of which may temporarily disrupt wildlife activities.

During construction activities, water quality of the Santa Clara River could be impacted due to some mobilization of sediment; however, implementation of construction BMPs would minimize this potential. This could have a temporary impact on the habitat and foraging and nesting capabilities in the short term. Construction noise and vibration would be a temporary nuisance to all wildlife in the vicinity.

4.7. Human Environment

4.7.1. Socioeconomics

USDA-NRCS guidance states that USDA-NRCS should administer its programs in a way that considers environmental quality equal to economic, social, and other factors in decision-making (General Manual, Title 190, Part 410.3[b][III]). This section describes the consequences of each alternative on the social and economic resources within the project vicinity. The impact analysis area for each resource is the project area and those properties immediately adjacent to it.

As part of the public participation process, the plan seeks to meaningfully engage minority, low-income, and traditionally under-represented populations during the NEPA process. Documents, notices, and meetings are concise, understandable, and readily accessible to the public; notices of meetings are provided in non-English languages for targeted public audiences, affected landowners, and stakeholders when appropriate; informational material will be made available through a variety of outlets; and, all public events will be scheduled at convenient, accessible locations.

4.7.1.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would have no direct impact on the social and economic resources of the area.

INDIRECT IMPACTS

In the event of a dam failure, this alternative would have an indirect impact on the properties downstream

4.7.1.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative poses minimal impacts to social resources. Public facilities and services would be minimally impacted during construction.

The Shivwits Band of Paiutes, a minority population in the project vicinity, is the sole owner of the property to be impacted by the Shem Dam project. The Band, considered a minority population in Washington County, is a proponent of the project and has participated in the NEPA process. Therefore, this alternative would not have disproportionately high and adverse effects on this minority population per Executive Order 12898.

INDIRECT IMPACTS

There are no indirect impacts anticipated from this alternative.

4.7.2. Cultural Resources and Historic Properties

As per Section 106 of the National Historic Preservation Act (NHPA), consultation has been initiated with the Utah SHPO, the Washington County Commission, the Shivwits Band of Paiute Indians of Utah, the Paiute Indian Tribe of Utah, the Kaibab Band of Paiute Indians, the Moapa Band of Paiute Indians, the Las Vegas Tribe of Paiute Indians, and the Bureau of Indian Affairs. Section 106 sets up a review process for Federal undertakings that may adversely affect historic properties. The USDA-NRCS has determined that there will be an adverse effect to Shem Dam. Through consultation, the Utah SHPO and other consulting parties are asked for concurrence on the determination of site eligibility for the NRHP and determination of project effects.

4.7.2.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would have no potential direct impacts on cultural resources.

INDIRECT IMPACTS

The No Action Alternative would have a potential indirect impact on cultural resources. The existing dam is severely damaged, and without repair or replacement, the structure could fail during a flood event. This would result in an adverse effect to the dam itself and cultural resources upstream and downstream.

4.7.2.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

Table 4-2 below summarizes the eligibility determinations made in the Draft Cultural Resources Report and shows direct impacts and management recommendations for each of the sites found in the project APE.

Table 4-2. Cultural Resources Effect Determination

Site Type	NRHP Eligibility	Project Effects	Management Recommendations
Prehistoric habitation site	Eligible	No effect	Area will be avoided
Historic road	Eligible	No effect	Area will be avoided
Historic copper smelter	Eligible	No effect	Site will be avoided
Historic piers	Eligible	No effect	Structures will be avoided
Historic dam	Eligible	Adverse effect	Mitigation through treatment plan

INDIRECT IMPACTS

There are no indirect impacts anticipated to cultural resources under this alternative.

4.7.3. Hazardous Materials

4.7.3.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would have no direct impact on hazardous materials or HTRW sites.

INDIRECT IMPACTS

The No Action Alternative would have no indirect impact on hazardous materials or HTRW sites.

4.7.3.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

No sites have been identified in the immediate project vicinity that would be directly impacted by the project.

INDIRECT IMPACTS

No sites have been identified in the immediate project vicinity that would be indirectly impacted by the project.

4.7.4. Recreation

4.7.4.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would have no direct impact on local recreation.

INDIRECT IMPACTS

Without repair or replacement, the existing structure could fail during a flood event, possibly creating indirect negative effects on recreational users and the public downstream of the dam.

4.7.4.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would have no direct impacts to recreation.

INDIRECT IMPACTS

The project area may become more utilized for recreation upon completion as a result of decreased presence of invasive vegetation which will provide a site that is more aesthetically pleasing and easier to walk.

4.7.5. Visual Quality, Aesthetics and Scenic Beauty

4.7.5.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not directly alter the aesthetic quality of the dam area.

INDIRECT IMPACTS

An extreme event such as dam failure would alter the dam structure itself, as well as the vegetated areas on the banks and properties downstream.

4.7.5.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

Short-term moderate visual impacts would occur at staging and laydown areas and temporary construction easements. Long-term negative visual impacts to would consist of a change in the dam

spillway aesthetics. Long-term positive impacts may be significant as a result of replanting efforts upon construction completion.

INDIRECT IMPACTS

There are no indirect impacts anticipated to aesthetics and visual quality.

4.7.6. Land Use

4.7.6.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not directly impact land use in the project area.

INDIRECT IMPACTS

Without repair or replacement, the existing structure could fail during a flood event, possibly creating indirect negative effects on land uses downstream.

4.7.6.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would not directly impact land use in the project area.

INDIRECT IMPACTS

This alternative would not indirectly impact land use in the project area.

4.7.7. Infrastructure

4.7.7.1. No Action Alternative

DIRECT IMPACTS

The No Action Alternative would not directly impact infrastructure in the project area.

INDIRECT IMPACTS

The No Action Alternative has the potential to indirectly impact infrastructure. It has been determined that the existing dam is severely damaged; therefore, during a flood event the structure could fail, impacting infrastructure such as culverts, canals, roads, and utilities downstream.

4.7.7.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

This alternative would have minimal impact on existing infrastructure since both the right and left abutments would be retained. It would not create an overall increase in infrastructure and the proposed action would not impact utilities.

INDIRECT IMPACTS

This alternative would not directly impact infrastructure in the project area.

4.7.8. Noise

4.7.8.1. No Action Alternative

INDIRECT IMPACTS

The No Action Alternative would not directly impact any sensitive noise receptors in the area.

INDIRECT IMPACTS

The No Action Alternative would not indirectly impact any sensitive noise receptors in the area.

4.7.8.2. Rehabilitate Dam Alternative

DIRECT IMPACTS

There are several noise-sensitive receptors (wildlife and humans) in the immediate project area; however, the proposed action would have no direct long-term impact on noise-sensitive receptors.

INDIRECT IMPACTS

This alternative would not indirectly impact any sensitive noise receptors in the area.

4.7.9. Construction Impacts to the Human Environment

CULTURAL RESOURCES

Construction activities, staging of equipment and materials, and river access may result in temporary effects to the cultural resources. This will be determined upon completion of the cultural resource inventory (will be complete in 2014). Adverse effects to these sites would be averted through implementation of avoidance measures, pre-selection of staging areas, and the use of alternative access routes to minimize effects to historically significant sites.

HAZARDOUS MATERIALS

General construction impacts that could occur include potential impacts from contaminated soil or groundwater. There is also the potential impact to the environment from the release of a hazardous material brought on-site during construction activities.

- USDA-NRCS requires that contractors comply with all federal, state, and local laws and regulations pertaining to pollution and contamination of the environment to prevent pollution of surface water, groundwater, soil, and air with any hazardous materials.
- USDA-NRCS provisions regarding hazardous materials will be included in the event hazardous materials are encountered during construction.

RECREATION

The project site is on private property owned by the Shivwits Band of Paiutes. During construction the site will be posted with warning signs stating that it is closed for recreation.

LAND USE AND UTILITIES – EASEMENTS

During construction activities, there may be some temporary impact to area properties and/or infrastructure (utilities). The land uses would not be altered; however, temporary construction easements or access agreements could be necessary in order to provide access and staging for construction equipment and resources.

Existing infrastructure may be temporarily moved or demolished and rebuilt for the Rehabilitate Dam Alternative.

NOISE

During construction activities, noise will be generated however there are no dwellings in the local vicinity, thus noise should not constitute a nuisance. Any noise would be temporary in nature.

4.8. Cumulative Effects

NO ACTION ALTERNATIVE

It is possible that there would be detrimental cumulative effects to some of the resources identified from implementation of the No Action Alternative because there would be no change to the existing environment. Much of the existing environment is not in proper functioning condition and therefore floodplains, wetlands and riparian areas, surface water quality and soils are subject to further degradation.

Cumulative present and potential foreseeable future effects downstream can add to the effects that have taken place in the past. Sediment deposition from dam failure would likely fill culverts and drainages in the valley, potentially creating additional flooding issues which may damage transportation infrastructure.

4.8.1. Soil Resources

The Rehabilitate Dam Alternative would not have cumulative or long-term impacts on soil or geologic resources.

4.8.2. Water Resources

The Rehabilitate Dam Alternative may have a positive cumulative or long-term impact on water quality as a result of sediment moving more efficiently through the system.

4.8.3. Air Quality

The Rehabilitate Dam Alternative would not have cumulative or long-term impacts on air quality.

4.8.4. Plants

Cumulative impacts to vegetation communities in the project area would be related to increased development (unforeseen), human activity, and increased recreational use of stream banks.

4.8.5. Animals

Cumulative impacts to migratory birds and bald and golden eagles would be related to habitat loss within the riparian zone due to increased development and human activity. Recreational use of stream banks contributes to habitat loss as well.

Cumulative impacts to fish and their habitat would include potential sediment deposition during construction activities from other projects.

4.8.6. Human Environment

Exposing hazardous materials that have contaminated the soil in the vicinity during excavation and construction is the most likely impact associated with hazardous materials and is common to all projects. However, cumulative impacts are based on the net impacts, or those impacts left over after mitigation has been applied; therefore, because mitigation is recommended where impacts would occur, no cumulative impacts would be anticipated.

4.9. Irreversible and Irretrievable Resource Commitments

NEPA requires that environmental analysis include identification of "… any irreversible and irretrievable commitments of resource which would be involved in the Proposed Action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects this use could have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural resource).

4.9.1. No Action Alternative

The No Action Alternative would involve no changes to the project area; therefore, there would be no commitment of additional resources associated with the proposed action. However, physical and financial resources would still be required to maintain the current infrastructure. Over time, these resources could

resemble the commitments for the action alternatives as a result of damage caused by flood events. It is realistic that some transportation infrastructure would be damaged such as the bridge directly below the dam.

4.9.2. Rehabilitate Dam Alternative

Implementing the proposed action would involve a commitment of a range of natural, physical, human, and fiscal resources. Considerable amounts of fossil fuels, labor, and construction materials (such as cement, aggregate, and bituminous material) would be expended. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable. They are not, however, in short supply and their use would not have an adverse effect upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of federal and cost-share funds that would not be retrievable.

The commitment of these resources would be based on the premise that residents in the immediate area, the state, and the region would benefit by the improved stability of the dam and the stream from a safety and an ecological perspective. These benefits generally are anticipated to outweigh the permanent commitment of resources.

4.10. Risk and Uncertainty

A variety of factors contribute to the potential for dam failure, including the intensity of a storm event, construction materials and techniques, and operation and maintenance (O&M) activities. Shem Dam has operated for over 60 years with numerous problems, and therefore there is risk or uncertainty that the dam would not continue to operate as intended. Dams are inherently hazardous structures, but with updated design that meets state dam regulations and standards and improved and continued maintenance, it should cease to contribute to stream degradation below the site and not be in danger of damaging transportation infrastructure in the event of a breach.

Estimating project costs and benefits involves a certain degree of risk and uncertainty. Land uses could change from existing conditions, as the City of Ivins has grown and development has moved to the northwest closer to in the past 50 years. During the aging dam rehabilitation planning process, decisions are made with information that is uncertain including errors in measurements and climatic changes that could alter rainfall storm events. Assumptions made during the planning process are based on the best available science, technology and information. Extended delays between the planning process and construction increase the degree of risk and uncertainty. Estimated project costs are based on computed work quantities multiplied by the appropriate unit cost for that type of work. Unit costs are based on current market prices from similar projects. Costs can be influenced by economic factors that cannot be predicted between the planning process and construction that could increase the actual cost and decrease the availability of materials.

Economic benefits from projects are based on material values of floodplain property, infrastructure and agricultural land. Such property is expected to become more valuable in the future but it can be difficult

to predict future economic conditions. There is also uncertainty in estimating the social and environmental costs associated with each alternative because interested party values, judgments and opinions may shift over time.

CHAPTER 5. AGENCY, STAKEHOLDER, AND PUBLIC INVOLVEMENT

5.1. Introduction

This chapter describes the public and agency coordination efforts for the Shem Dam Rehabilitation Project. The Shem Dam was constructed in 1933 and has been modified over the years to maintain the structure and repair damage. The original purpose of the structure was for flood control, sediment retention, and irrigation water delivery. Since that time, irrigators have ceased using the water delivery system associated with the structure. During the 2011 flood events, flows in the Santa Clara River caused severe damage to the dam, compromising its structural integrity. If the dam fails, large amounts of sediment will flow downstream and would likely cause major stream degradation and possible transportation infrastructure damage. The intent of the proposed action is to implement a solution that would stabilize the existing dam structure which would directly result in the flood water dissipation, sediment retention, and stream morphology intactness.

Washington County requested financial assistance from the USDA-NRCS to repair flood damage incurred in 2011 through Standard Form 424 – Application for Federal Assistance in 2011. Initial coordination was conducted between the USDA-NRCS and Washington County regarding the project through the preparation of a DSR. The DSR documented the eligibility of the damaged structure for inclusion in the EWP program. USDA-NRCS, through the preparation of the DSR, concluded that the project was eligible for funding under the EWP program but would require additional analysis under NEPA. Meetings were conducted with the USDA-NRCS, Washington County, and Shivwits Band of Paiutes to discuss the project and identify potential concerns relating to the project. The results of these meetings and discussions have been incorporated into this Draft EA.

5.2. Agency Consultation

The USFWS and UDWR were invited to comment on the project during the Scoping public comment period. No comments were received from either agency for this project. Additional coordination will be performed with the USFWS and UDWR during the Draft EA public comment period and informal/formal Section 7 consultation.

USDA-NRCS will be coordinating with Utah SHPO regarding the project under formal consultation. The reports prepared for the project describing the results of the literature review and pedestrian survey concluded that there are five cultural or historical resources of significant value within the project area that are eligible for listing on the National Register of Historic Places. Section 106 Consultation with SHPO will be initiated and the results of this consultation will be documented in the Final EA.

The Rehabilitate Dam Alternative would require work within jurisdictional waters of the U.S. A USACE Section 404 permit (Nationwide Permit 37 – Emergency Watershed Protection and Rehabilitation) would be been obtained by the project Sponsor to complete the dam rehabilitation project.

5.3. Project Chronology

Table 5-1 lists the project's public outreach activities. The public was notified of each activity listed below and provided with opportunities to comment on the project.

Table 5-1. Public Outreach Activities

Date	Purpose	Type
September 10, 2013	Scoping Period Open	
September 10, 2013	Scoping Meeting Notice	Scoping Notice Mailed
September 11, 2013	Scoping Meeting Notice	Posters sent to public libraries for display
September 11, 2013	Scoping Meeting Notice	Local Newspapers
September 20, 2013	Scoping Meeting Notice	Local Newspapers
September 24, 2013	Scoping Meeting	Public Meeting in St. George, UT
October 9, 2013	Scoping Period Closed	
October 27, 2013	2nd Scoping Period Open	USDA-NRCS Project Website
November 16, 2013	2nd Scoping Period Closed	
January 29, 2014	Draft EA Public Comment Period Open	Mailed, published in local newspaper, sent to public library, published to USDA-NRCS project website
February 28, 2014	Draft EA Public Comment Period Close	
TBD	Final EA Notice of Availability	Will be mailed, published in local newspapers, sent to public library, published to USDA-NRCS project website
TBD	Finding of No Significant Impact	Will be mailed, published in local newspapers, sent to public library, published to USDA-NRCS project website

5.4. Public Participation Plan

The *Public Participation Plan* dated October 14, 2013 was prepared to provide effective procedures that define outreach to the general public, recreationists, local businesses, associations, stakeholders, the Shivwits Band of Paiutes which are the only affected landowners, and affected government agencies. The main goal of public participation is to involve a diverse group of public and government agency participants to solicit input and provide timely information throughout the NEPA review process. In order to best accomplish this, the following objectives were utilized:

- Establish ongoing, inclusive, and meaningful two-way communication with stakeholders, affected landowners, agencies, and the general public.

- Educate the public about the environmental review process and each party's role.
- Evaluate the effectiveness of public participation activities on a continual basis in order to refine the public participation plan, as necessary, and utilize the most effective techniques throughout the NEPA process.
- Document all public and government agency input.

As part of the public participation process, the plan will seek to meaningfully engage minority, low-income, and traditionally under-represented populations during the NEPA review process. As a general rule, the following principles will be adopted to support involvement of "environmental justice" populations:

- Documents, notices and meetings will be made concise, understandable, and readily accessible to the public.
- Notices of meetings will also be provided in non-English languages for targeted public audiences, affected landowners, and stakeholders when appropriate.
- Informational material will be made available through a variety of outlets.
- All public events will be scheduled at convenient, accessible locations.

5.4.1. Agency Involvement

The Shem Dam Rehabilitation Project stems from public and agency meetings and presentations held in late fall 2013. As a result of these efforts, USDA-NRCS, the Shivwits Band of Paiutes, and county and local officials used public input to determine the conceptual design of the proposed action. Together with the USDA-NRCS, McMillen, LLC has managed the coordination and public involvement process for the project. The participating agencies are as follows:

- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- Washington County
- Utah Division of Wildlife Resources
- The Shivwits Band of Paiutes

5.5. Project Scoping

Project scoping questions, comments, and concerns were requested from the public and government agencies during the preliminary scoping period, both orally at public meetings and via written submittal of comments. The main goal of public participation during the scoping period was to involve a diverse group of public and government agency participants to solicit input and provide timely information regarding their concerns pertaining to the project and the proposed alternatives.

The original scoping period officially opened on September 10, 2013 and ended on October 9, 2013 for a total of 30 days. The second scoping period opened on October 27, 2013 and ended on November 16, 2013 for a total of 21 days. Official comments received during the original and second scoping periods are included in Appendix A – *Final Shem Dam Rehabilitation Scoping Report*.

5.5.1. Project Scoping Meeting

A scoping notice was prepared and sent to interested parties and regulatory agencies on September 10, 2013. The distribution list, as presented in Section 7.0, was prepared by the USDA-NRCS. The scoping notice gave a description of the project, location and overview, purpose and need, identified preliminary scoping issues, and requested public participation. The scoping notice also identified the location of public meetings, contact information to submit written comments, and the scoping period closure date. The public scoping meeting was conducted on September 24, 2013. Written comments could have been submitted via mail, e-mail, facsimile, or comment card, and oral comments could have been submitted over the phone or in person. There was one (1) written comment received for the Shem Dam Rehabilitation Project during the scoping period.

5.5.2. Project Scoping Comments

All comments including those from the general public, government, landowners, and stakeholders were sent to McMillen, LLC's office in Boise, Idaho for tracking and were scanned and delivered to the USDA-NRCS during the comment period.

5.6. Draft EA

Official comments of the Draft EA will be documented and incorporated into the Final as appropriate.

CHAPTER 6. LIST OF PREPARERS

6.1. Draft EA Preparers

Table 6-1 lists the people who participated in the preparation of this Draft EA.

Table 6-1. List of Preparers

Name	Title (Years Experience)	Education	Other
USDA-NRCS – Utah			
Norm Evenstad	Water Resources Coordinator (25)	B.S. – Geology	Utah PG
Bronson Smart	State Engineer (14)	B.S. – Civil and Environmental Engineering M.S. – Civil Engineering	Utah PE
Tara Hoffmann	Archaeologist (7)	B.S. – Interdisciplinary Studies M.A. - Archaeology	
Anthony Beals	EWP Resource Conservationist (20)	B.S. - Agronomy	
McMillen, LLC			
Greg Allington	Project Manager/Biologist (9)	B.S – Wildlife Ecology	
Dan Axness	Engineer (21)	B.S. – Agricultural Engineering M.S. – Bioresource Engineering	
Kevin Jensen	Engineer in Training (4)	B.S – Civil Engineering	
Aimee Hill	NEPA Specialist (15)	B.S. – Environmental Health	
Browne Consulting, LLC			
Peggy Browne	Ecologist (16)	B.S. – Rangeland Ecology	
Sara Haynes	Project Engineer (8)	B.S. – Civil Engineering	

CHAPTER 7. DISTRIBUTION

A notice of availability for the Draft EA was distributed to the following government agencies/staff and organizations.

7.1. Federal Government

- Bureau of Land Management
- Federal Energy Regulatory Commission
- National Park Service
- Natural Resources Conservation Service
- U.S. Bureau of Reclamation
- U.S. Forest Service – Dixie National Forest
- U.S. Fish & Wildlife Service
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency

7.2. Tribal Government

- Northwestern Band of Shoshone
- Shivwits Band of Paiutes
- Skull Valley Band Confederated Tribes
- Ute Indian Tribe

7.3. State Government

- Congressman Jim Matheson
- Congressman Rob Bishop
- Representative Jason Chaffetz
- Senator Mike Lee
- Senator Orin Hatch
- Bureau of Environmental Health Services
- State of Utah - Office of the Governor
- Utah Association of Conservation Districts
- Utah Department of Agriculture
- Utah Department of Community and Culture
- Utah Department of Environmental Quality
- Utah Department of Heritage and Arts
- Utah Department of Natural Resources
- Utah Department of Public Safety
- Utah Department of Transportation
- Utah Division of Drinking Water
- Utah Division of Environmental Health
- Utah Division of Forestry, Fire & State Lands
- Utah Division of Water Rights
- Utah Division of Wildlife Resources
- Utah Division State Land and Forest

- Utah Environmental Congress
- Utah Natural Heritage Program
- Utah Reclamation Mitigation & Conservation Commission

7.4. Local Government

- Washington County Bureau of Air Quality
- Washington County Bureau of Environmental Health Services
- Washington County Commission
- Washington County Community Development, Washington County Planner
- Washington County Engineering Department
- Washington County Fire Marshal
- Washington County Government
- Washington County Health Department
- Washington County Parks & Recreation
- Washington County Public Works
- Washington County Search & Rescue
- City of Ivins
- City of St. George
- City of Hurricane
- City of Gunlock
- City of Santa Clara
- City of Veyo
- City of Dammeron Valley
- Community Emergency Response Team (CERT)

7.5. Organizations

- Back Country Horsemen
- Back Country Horsemen of Utah
- Living Rivers
- Sierra Club
- Southwest Utah Back Country Horsemen
- Sportsman For Habitat, Inc.
- Utah Council of Trout Unlimited
- Utah Four Wheel Drive Association
- Utah National Parks Council
- Utah Rivers Council
- Utah Wildlife Federation
- Western Land Exchange Project
- Wild Utah Project

7.6. Businesses

No local businesses have been identified for distribution.

7.7. Private Parties

The names and addresses of private parties who received notice of the Draft EA are not listed in this section for privacy.

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APPENDIX A – COMMENTS AND RESPONSES

Final Shem Dam Rehabilitation Scoping Report

NRCS

Shem Dam Rehabilitation

Scoping Report

Final

Contract No. AG-8D43-D-13-0016

December 6, 2013

McMILLEN, LLC

TABLE OF CONTENTS

SECTION 1 INTRODUCTION 1
1.0 Introduction 1
1.1 Project Purpose and Need 1
1.2 Scoping Goals and Objectives 1
SECTION 2 SCOPING PROCESS SUMMARY 2
2.0 Scoping Overview 2
2.1 Scoping Terms 2
2.2 Scoping Schedule 2
2.3 Scoping Notice 2
2.4 Scoping Meeting 3
2.5 Scoping Mailing List 3
SECTION 3 SCOPING COMMENTS 4
3.0 Scoping Meeting 4
3.1 Written Comments 4
3.2 Comment Categories 4

APPENDICES

Appendix A Scoping Notice
Appendix B Newspaper Scoping Notices
Appendix C Scanned Sign-In Sheets and Comments
Appendix D Scoping Meeting Presentation

SECTION 1
INTRODUCTION

1.0 Introduction

The Natural Resources Conservation Service (NRCS) and Washington County, as the project sponsor, are analyzing alternatives to repair damage to the Shem Dam on the Santa Clara River that occurred from the late 2010 and early 2011 (2010/2011) flood events.

NRCS, as the lead federal agency, is initiating the NEPA analysis in the form of an Environmental Assessment (EA) to analyze impacts to the natural and human environment from this project. The EA will comprise of the following elements:

- Alternatives analysis of potential options for structure rehabilitation;
- Detailed analysis of resources that may be affected for each of the alternatives that may satisfy the purpose and need for the project;
- Identification of potential mitigation measures to reduce or eliminate potential impacts; and
- A plan of public participation and government agency coordination throughout development of the EA.

The participation of the public is a vital component of the project so that those who are interested in or potentially affected by proposed alternatives have an opportunity to share their concerns and provide input regarding the EA during the initial stages of the process. This Scoping Report outlines the comments received from the agencies and general public during the scoping process.

1.1 Project Purpose and Need

The Shem Dam was constructed in the 1930's and has been modified over the years to maintain the structure and repair damage. The original purpose of the structure was for flood control, sediment retention and irrigation water delivery. Since that time, irrigators have ceased using the water delivery system associated with the structure. During the 2010/2011 flood events, flows in the Santa Clara River caused severe damage to the dam, compromising its structural integrity. If the dam fails, large amounts of sediment will flow downstream and would likely cause major stream degradation and possible transportation infrastructure damage. Dam rehabilitation to some degree would directly result in the flood water dissipation, sediment retention, and stream morphology intactness.

1.2 Scoping Goals and Objectives

The main goal of public participation is to involve a diverse group of public and government agency participants in order to solicit input and provide timely information throughout the NEPA review process regarding their concerns for the project and the proposed alternatives. The main goals are to 1) establish ongoing communication with stakeholders, agencies and the general public, 2) educate the public about the environmental review process and each party's role, 3) evaluate the effectiveness of public participation activities on a continual basis and utilize the most effective techniques throughout the NEPA process, and 4) document all public and government agency input.

SECTION 2
SCOPING PROCESS SUMMARY

2.0 Scoping Overview

Scoping questions, comments and concerns were requested from the public and government agencies during the preliminary scoping period via written submittal of comments. The following summarizes the scoping process and efforts made to engage the public and government agencies.

2.1 Scoping Terms

The following terms were used during the scoping process to identify specific actions:

- Comment: A distinct statement or question about a topic or issue relating to the project.
- Comment Category: A topic to which a comment is addressed.
- Comment Document: A written version of comment(s) submitted by a commenter. One comment document may contain multiple comments.
- Commenter: An individual, organization or agency providing one or more comments.

2.2 Scoping Schedule

The following dates outline the milestones for the scoping process:

- September 10, 2013: Scoping Notice Mailed, Posted to Website, and Scoping Period Opened
- September 11, 2013: Public Notice Published in The Spectrum Newspaper
- September 20, 2013: Public Notice Published in The Spectrum Newspaper
- September 24, 2013: Scoping Meeting
- October 9, 2013: Scoping Period Closed
- October 27, 2013: Scoping Notice Posted to Website and Scoping Public Comment Period Re-opened Due to Partial Government Shutdown
- November 16, 2013: Scoping Public Comment Period End

Agency and stakeholder participation, along with public involvement, are key components that lead the NEPA process. Project information was made available to the public during the first scoping period from September 10, 2013 to October 9, 2013. Due to the partial government shutdown and consequent inability of agency personnel to participate in the scoping process, a public scoping re-opening was advertised and issued for the period of October 27, 2013 through November 16, 2013.

2.3 Scoping Notice

A scoping notice was prepared and sent to interested parties and regulatory agencies on September 10, 2013. The list of recipients was prepared by McMillen with input and direction from NRCS, Washington County and the Shivwits Band of Paiutes. The scoping notice gave a description of the project, location and overview, purpose and need, identified preliminary scoping issues, and requested public participation. The scoping notice also identified the location of public meetings, contact information to submit written comments, and the scoping period

closure date. A copy of the scoping notice is attached in Appendix A. The scoping notice was also posted on the NRCS website.

Two public notices were published in The Spectrum newspaper announcing the project and public meeting. Copies of the newspaper scoping notices are attached in Appendix B.

2.4 Scoping Meeting

The primary purpose of the scoping meeting was to gather input and feedback on the project's purpose and need statement, potential alternatives for consideration, environmental issues to be addressed in the EA, methodologies to be used to evaluate impacts, and the overall public participation process. To gather as broad an audience as possible, a combined government agency and general public scoping meeting was held September 24, 2013 from 6:00 PM to 9:00 PM (MST) at Washington County Public Works in St. George, Utah. The scoping meeting presentation can be found in Appendix D.

There were 12 attendees at the public meeting. Participants were invited to submit comments in writing either at the meeting or subsequently by mail, fax, or e-mail during the scoping comment period. Attendance at the meeting was counted using the sign-in sheet located in Appendix C. Comment cards handed out at the meeting also provided a blank space to submit written comments.

2.5 Scoping Mailing List

The mailing list was prepared by McMillen with input and direction from the NRCS, Washington County, and the Shivwits Band of Paiutes to inform the general public and government agencies about the scoping process for the project. A total of 108 mailings were distributed.

SECTION 3
SCOPING COMMENTS

3.0 Scoping Meeting

The combined agency/public scoping meeting was conducted on September 24, 2013 from 6:00PM to 9:00PM (MST). There were 12 project personnel attendees and 0 government/public attendees at this meeting and there was one (1) written comment submitted.

The following project personnel were in attendance for the public meeting:

Name	Organization	Title
Kyle McFee	Land Resource Manager	Shivwits Band of Paiutes
Lawrence Snow	Land Resource	Shivwits Band of Paiutes
Ron Whitehead	Washington County	Public Works Director
Todd Edwards	Washington County	County Engineer
Bronson Smart	NRCS	State Engineer
Tony Beals	NRCS	EWP Specialist
John Nelson	NRCS	Engineer
Tara Hoffman	NRCS	Cultural Resource Specialist
Steve Meismer	Virgin River Program	Program Director
Dan Axness	McMillen, LLC	Project Manager
Greg Allington	McMillen, LLC	NEPA Specialist
Kevin Jensen	McMillen, LLC	EIT

3.1 Written Comments

The scoping period officially opened on September 10, 2013 and ended on October 9, 2013. The scoping public comment period re-opened on October 27, 2013 due to partial government shutdown, and ended on November 16, 2013. Written comments could have been submitted via mail, e-mail, facsimile, or comment card.

There was one (1) written scoping comment received from a commenter via comment document during the scoping period for the Shem Dam Rehabilitation project. Written comments and a scanned sign-in sheet are presented in Appendix C.

3.2 Comment Categories

Methodology for categorizing and addressing public and agency comments is to separate each of the comments into comment categories in order to identify the nature of the comment. The following category was created for scoping purposes and is listed below.

- Fish Passage and Habitat

APPENDIX A

SCOPING NOTICE

USDA Natural Resources Conservation Service-Utah
Wallace F. Bennett Federal Building
125 S. State Street – Room 4010
Salt Lake City, UT 84138-1100

September 10, 2013

Dear Interested Parties:



The Natural Resources Conservation Service (NRCS), in cooperation with Utah Department of Agriculture and Food as the project sponsor, are proposing to address rehabilitating Shem Dam (aka Winsor Dam) on the Santa Clara River in Washington County, Utah, due to flood damage. The proposed project is located approximately 13 miles northwest of the city of St George adjacent to N Gunlock Road. **You are invited to attend a public meeting** where a wide range of conceptual alternatives addressing damage rehabilitation to the Shem Dam will be presented and discussed at the meeting.

Scoping Period
Open: Tuesday, September 10, 2013
Close: Wednesday, October 9, 2013



Scoping Meeting
When: Tuesday, September 24, 2013
Time: Formal Presentation: 6 p.m. – 6:45 p.m.
Informal Open House: 6:45 p.m. –9 p.m.
Where: Washington County Public works
197 East Tabernacle
St George, Utah 84770

More project specific information is available by contacting Greg Allington (McMillen, LLC) with the project team by phone at 208-342-4214 or email at shemdam@mcmillen-llc.com.

……..

Environmental Assessment Introduction

The NRCS is proposing to partially fund, through the Emergency Watershed Protection (EWP) program, a project to address damage to Shem Dam, and increase public safety downstream from the dam. The National Environmental Policy Act (NEPA) and the Council on Environmental Quality's regulations at 40 CFR Parts 1500-1508 require an evaluation of potential environmental impacts associated with federal projects and actions. The project will require an environmental analysis and the environmental impacts will be documented in the form of an Environmental Assessment (EA) for the project.

Project Purpose and Need

In accordance with the rehabilitation provisions of the NRCS's EWP program, the area is eligible for rehabilitation funding due to recent flood damage in 2011. The purpose of the project is to assess various actions that will lead to a viable solution.

Public Participation

The participation of the public is a vital component of the project so that those who are interested in or potentially affected by the proposed project have an opportunity to share their comments, ideas, and concerns regarding actions during the initial scoping stage of the NEPA process. You are encouraged to attend the public meeting and express your comments, ideas, and concerns. You may also submit your comments via letter, email or fax anytime during the public comment period. For comments to be considered and to become part of the public record for the projects, **we need to receive them by close-of-business on October 9, 2013**.

Please mail your written comments to:

Shem Dam Rehabilitation Project
c/o McMillen, LLC – Greg Allington
1401 Shoreline Drive
Boise, ID 83702

You may also submit comments by email, phone or fax to McMillen:

Email: shemdam@mcmillen-llc.com
Phone: 208-342-4214
Fax: 208-342-4216

After receiving comments by close-of-business on October 9, 2013, the NRCS will begin reviewing the comments and reviewing conceptual alternatives for analysis in the EA. Preliminary resource concerns identified during this initial project scoping process will also be addressed in the EA.

You may also visit the project website at http://www.nrcs.usda.gov/wps/portal/nrcs/main/ut/programs/planning/ewpp/ or perform an internet search for NRCS EWP projects and select the appropriate project to check on the status of the project and download project related documents during the course of the NEPA analysis.

The project team values your feedback and encourages you to attend the public meeting on September 24, 2013.

Sincerely,

Bronson Smart
NRCS State Engineer

cc: Tony Beals – NRCS
Ron Whitehead –Washington County
Kyle McFee –Shivwits Band of Paiutes
Dan Axness – McMillen, LLC
Greg Allington – McMillen, LLC

APPENDIX B

NEWSPAPER SCOPING NOTICES

THE SPECTRUM

LEGAL NOTICES

PUBLIC SCOPING MEETING

The Natural Resources Conservation Service (NRCS), in cooperation with Washington County as the project sponsor, are proposing to address rehabilitating Shem Dam (AKA Winsor Dam) on the Santa Clara river due to flood damage. It will be under the purview of the Emergency Watershed Protection program. The proposed project is located approximately 13 miles northwest of the City of St George, Utah on N Gunlock Rd. The National Environmental Policy Act (NEPA) and the Council on Environmental Quality's regulations at 40 CFR Parts 1500-1508 require an evaluation of potential environmental impacts associated with federal projects and actions with input from the public.

You are invited to attend a public scoping meeting where a wide range of conceptual alternatives addressing damage rehabilitation to the Shem Dam will be presented and discussed at the meeting.

When: September 24, 2013 - Tuesday
Time: 6:00 PM to 7:00 PM (MDT)
Where: Washington County Public Works
197 East Tabernacle
St George, Utah 84770

Comments may be submitted during the public scoping period starting September 10, 2013 and ending on October 9, 2013 to:

Mail: Shem Dam Rehabilitation Project
c/o McMillen, LLC
1401 Shoreline Drive
Boise, Idaho 83702
Email:shemdam@mcmillen-llc.com
Fax: (208) 342-4216
Phone:(208) 342-4214 ext. 318

An electronic copy is available at http://www.nrcs.usda.gov/wps/portal/nrcs/main/ut/programs/planning/ewpp/ or by searching for NRCS EWP projects and selecting the appropriate project.

Pub#L8784
published
Sept. 11 & 18, 2013
The Spectrum
UPAXLP

PROOF
OF
PUBLICATION

STATE OF UTAH SS.
COUNTY OF WASHINGTON

I Cindy Bundy, being duly sworn, deposes and says that I am the advertising representative of The Spectrum, a newspaper of general circulation published daily at Saint George, Washington County, State of Utah, also distributed in Iron County, and placed on Utahlegals.com; and that the notice:

P UB # : L8784

is a true copy of which is here to attached, was published in its issue dated the **11** day of **September** 2013 and was published again in the issues of said newspaper and Utahlegals.com dated: **9/18, 2013** for a total of **2** insertion(s) and per Utahlegals.com will remain on Utahlegals.com for a total of 30 days.

Cindy Bundy

Subscribed and sworn before me this 18th day of September 2013.

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AT WASHINGTON COUNTY

BONNIE THOMPSON
Notary Public
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Comm No. 659439
My Comm. Expires Nov. 10 2016

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CEDAR CITY OFFICE
369 N. 100 W. - Cedar City, UT 84720
Office (435) 586-7646 FAX 586-7471

APPENDIX C

SCANNED SIGN-IN SHEETS AND COMMENTS

Shem Dam (aka Winsor Dam), Washington County, Utah
Shem Dam Rehabilitation
Public Scoping Meeting
September 24, 2013

No.	Name	Organization	Phone Number	Email Address
1	Ron Whitehead	Washington Co.	435-634-5730	ron.whitehead@washco.utah.gov,
2	Tara Hoffmann	NRCS	435-896-6441	tara.hoffmann@ut.usda.gov
3	Steve Meismer	Virgin R. Program	435-673-3617	smmeismer@utah.gov
4	Lawrence Snow	Shivwits Paiute	435 6900 3614	
5	Dan Axness	McMillen	2088699918	dan.axness@mcmillen-llc.com
6	Greg Allington	McMillen	2083424214	
7	Todd Edwards	Wash. Co.	435-673-3599	todd.edwards@washco.utah.gov
8	Kyle McFee	Shivwits Band of Paiute	435.817.3737	mcfee.kyb@gmail.com
9	John Nelson	NRCS	801-907-7873	john.d.nelson@ut.usda.gov
10	Branson Smart	NRCS	801 710 5387	branson.smart@ut.usda.gov
11	Tony Beals	NRCS		
12	Kevin Jensen	McMillen, LLC		
13				
14				
15				
16				
17				
18				
19				
20				

NRCS Natural Resources Conservation Service | McMillen, LLC DESIGN with Vision. BUILD with Integrity.

Shem Dam Rehabilitation
Environmental Assessment

Public Scoping Meeting Comment Card

September 24, 2013

Name: Steve Meismer - Virgin River Program

Address: 533 E Waterworks Dr

Email: smmeismer@wlch.gov

Phone: 435-673-3617

Comments:

- Concerns about effects of channel cutting on upstream fish habitat
- Downstream sediment transport.
- Fish passage

You can also provide comments by emailing them to shemdam@mcmillen-llc.com, faxing them to 208-342-4216, or by calling 208-342-4214.

NRCS Natural Resources Conservation Service

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APPENDIX D

SCOPING MEETING PRESENTATION

NRCS Shem Dam Rehabilitation Environmental Assessment

Public Scoping Meeting

September 24, 2013

NRCS Natural Resources Conservation Service | McMillen, LLC DESIGN with Vision. BUILD with Integrity.

Project Team

Natural Resources Conservation Service
(NRCS)
Lead Funding Agency

Washington County
Project Sponsor

McMillen, LLC
NEPA Project Manager/Concept Design

Project Review

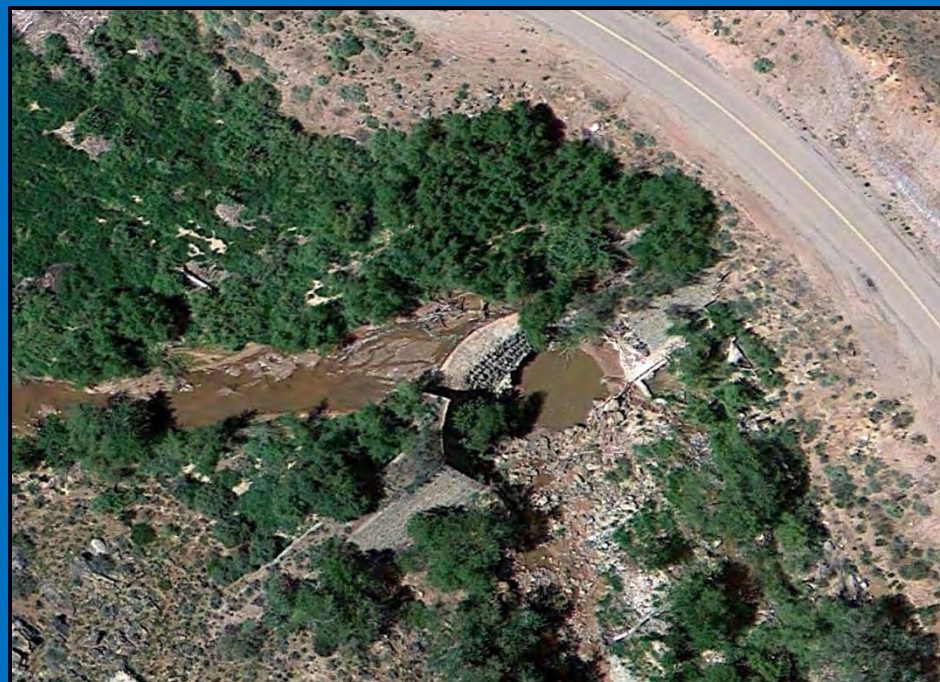
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Dan Axness – McMillen, LLC

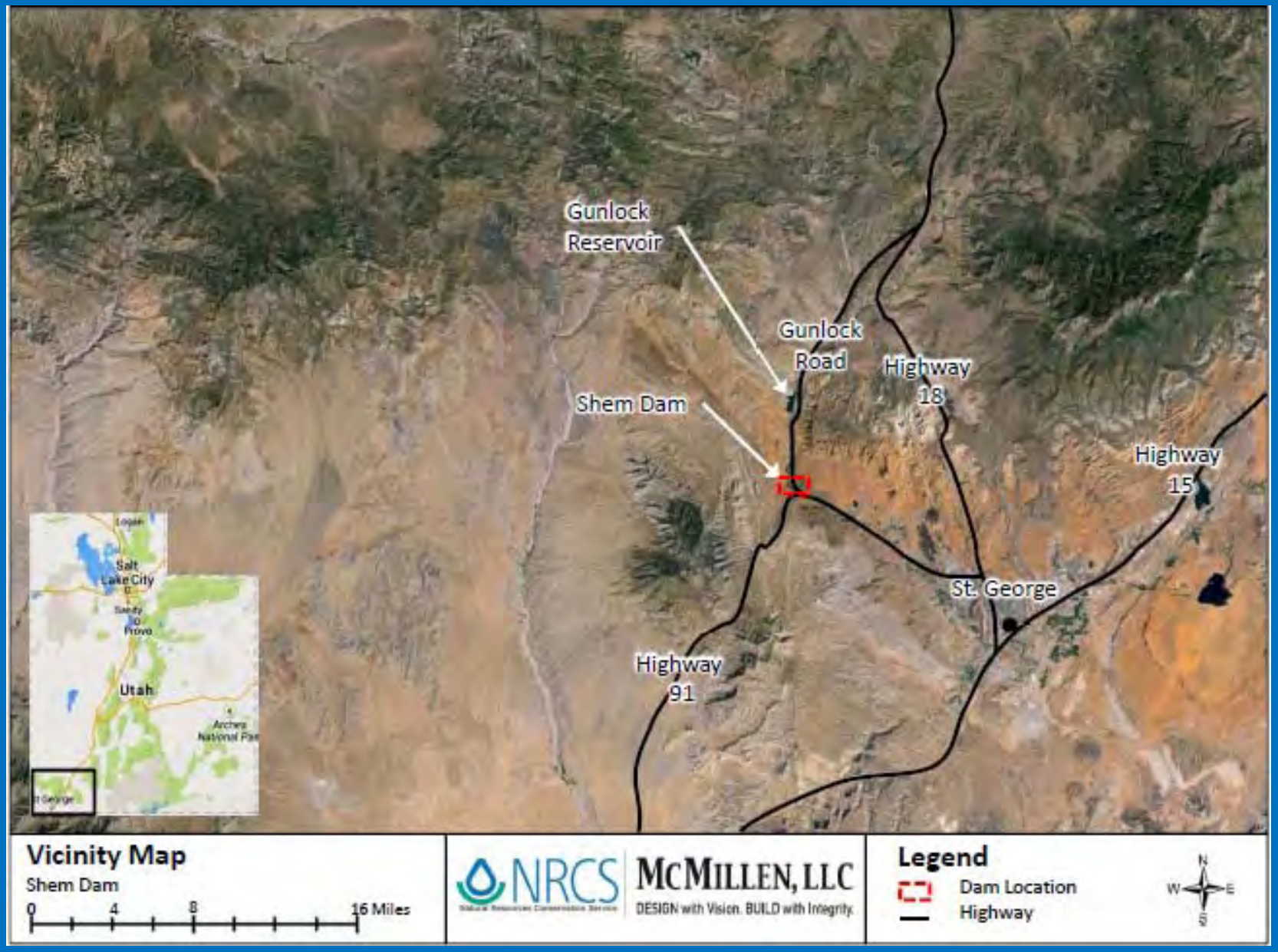
– Concept Design Project Manager

Shem Dam History

- Original Diversion Constructed in 1909
- Designed for
  - Flood Retention
  - Sediment Retention
- Washed Out Spring of 1932 and was Reconstructed
- 1955 Flood Destroyed Downstream Side of Crest and Damaged East Abutment
- 1958 Dam Repaired
- 2011 Structure Damaged by Flood



Project Vicinity Map



Project Purpose and Need

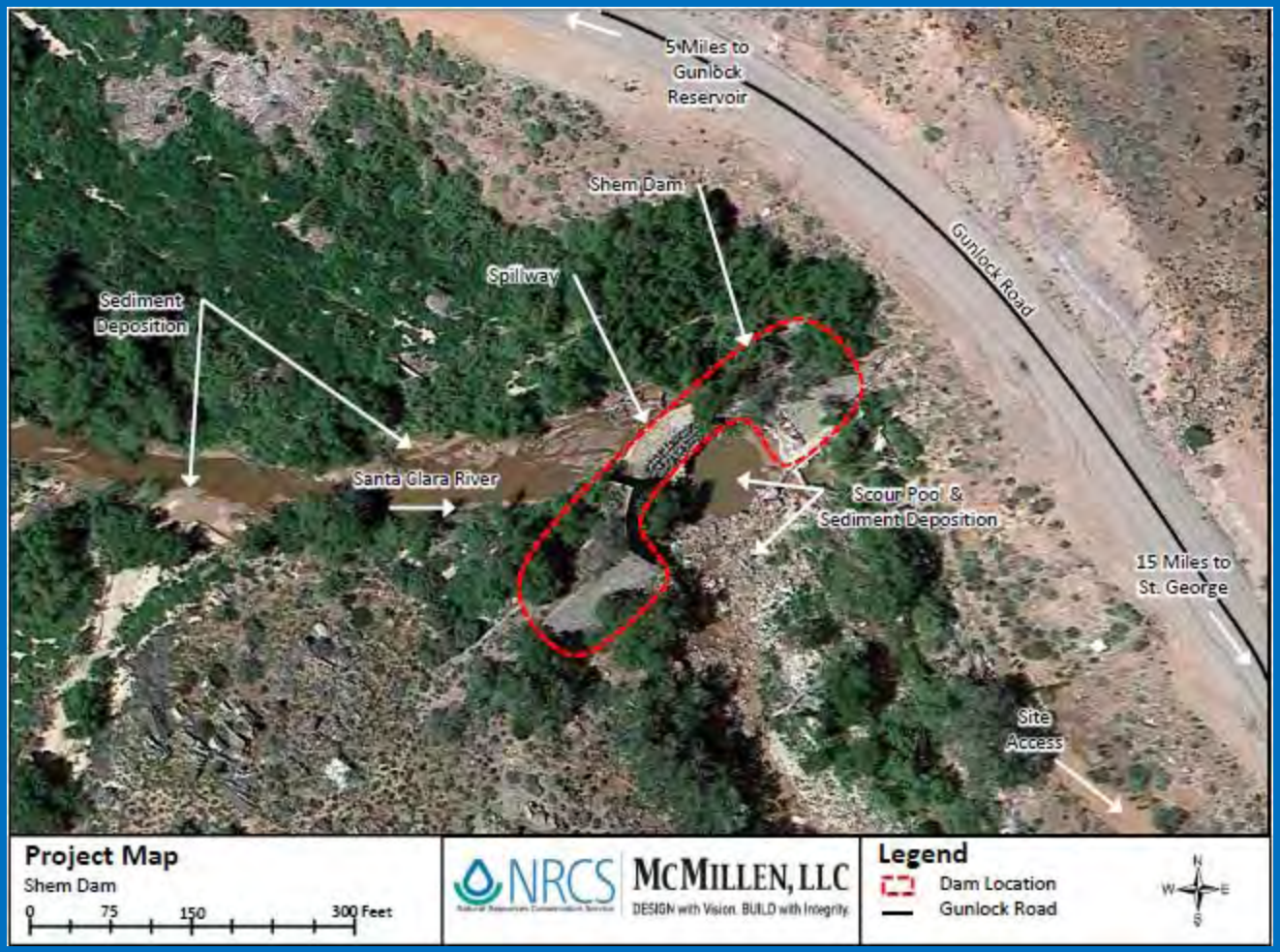
- Address Flood Damage and Dam Stability
- Meet Utah Dam Safety Regulations and Engineering Standards



Project Map

Project Concerns

-Dam Capacity -Sediment Accumulation -Flood Retention



Photos



Shem Dam AKA Winsor Dam



Downstream of Dam

Photos



Water Running Parallel to Structure



Water Eroding Below Dam Structure

Photos



Damage to Structure



Soil Eroded Behind Structure

Photos



Sediment Deposition Upstream of Dam



Sediment Laden Stream

Conceptual Project Alternatives

- No Action
- Dam Decommissioning
- Partial Dam Decommissioning
- Dam Rehabilitation
- Partial Dam Stabilization
- Sediment Removal
- Other Alternatives

Construction Operations

- Monday-Friday (Excluding Federal, State, and Local Holidays)
- Preliminary Construction Schedule
  - Start: Summer 2014
  - End: Fall 2014

National Environmental Policy Act

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http://www.nrcs.usda.gov/wps/portal/nrcs/main/ut/programs/planning/ewpp/

Greg Allington – McMillen, LLC

– NEPA Project Manager

National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190) and the Council on Environmental Qualities regulations at 40 CFR Parts 1500-1508

NRCS NEPA

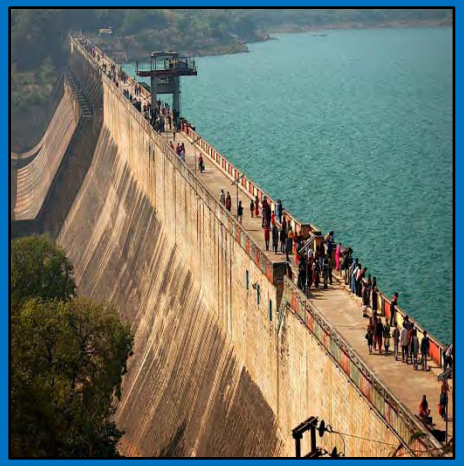
- Environmental analysis required for major federal actions.
- The NRCS is the funding agency for the dam rehabilitation project (65%).
- The project sponsor provides the remaining 35% cost-share for the dam rehabilitation project.



NEPA Requirements

- Environmental Assessment (EA)
  - NRCS NEPA requirements
  - Analysis looks at potential impacts to the natural and man-made environment





NEPA Requirements

- NEPA Process
  - Scoping
    - Express initial concerns and suggest alternatives to be considered
  - Draft EA
    - Public review of alternatives and environmental impacts
  - Final EA
    - Proposed alternative published to public
  - Finding of No Significant Impact (FONSI)
    - Project approval by NRCS

Typical Scoping Concerns

- Project Purpose and Need
- Design Alternatives Include
  - A No-Action Alternative
  - Dam Decommissioning Alternative
  - Action Alternatives
- Natural Environment
- Man-made Environment
- Mitigation



Scoping Comments

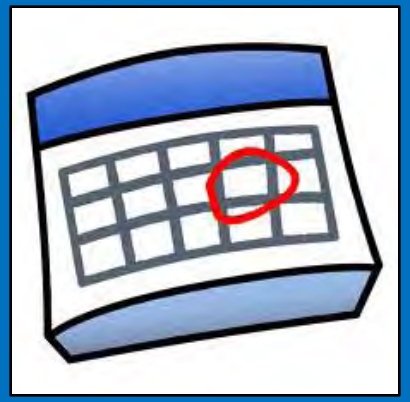
- Formal comments may be submitted by:
  - Email
  - Written Letter
  - Comment Card
  - Oral



- Scoping Report: Summarizes issues, alternatives and concerns from the public

Schedule

- NEPA Environmental Assessment
  - Start: August 2013
  - **Public Scoping Comment End: October 9, 2013**
  - Draft EA Public Comment: February 2014
  - FONSI: Spring 2014



NEPA Contact Information

- Please contact Dan Axness or Greg Allington with McMillen with questions and comments:


Phone: 208-342-4214


Fax: 208-342-4216


Email: shemdam@mcmillen-llc.com


Address: 1401 Shoreline Drive
Boise, ID 83702

Questions

???

Shem Dam



APPENDIX B – CONCEPTUAL DESIGN

Final Concept Design Report

NRCS, Utah

Shem (Winsor) Dam Restoration Project

Concept Design Report

Final

Dan Axness, PE
Project Manager

McMILLEN, LLC

January 2014

TABLE OF CONTENTS

SECTION 1 INTRODUCTION 1

1.0 INTRODUCTION 1

1.1 BACKGROUND 1

1.2 SCOPE 2

1.3 SITE INFORMATION 2

1.4 ALTERNATIVE DESCRIPTIONS 2

1.4.1 Alternative 1— Controlled Breach with Channel Regrade 2

1.4.2 Alternative 2—Stepped Rock Chute with Energy Dissipator 2

1.4.3 Alternative 3— Stepped Rock Chute Sequence with Energy Dissipator 3

1.4.4 Alternatives Considered but Eliminated from Further Study 3

SECTION 2 SITE ANALYSIS 5

2.0 INTRODUCTION 5

2.1 SURFACE WATER 5

2.1.1 Surface Water Flow 5

2.1.2 Surface Water Quality 7

2.1.3 Surface Water Rights 7

2.1.4 Flooding 8

2.1.5 Sediment Transport 8

2.1.6 Design Decisions—Surface Water 9

2.2 GROUND WATER 10

2.2.1 Ground Water Flow 10

2.2.2 Ground Water Quality 10

2.2.3 Ground Water Rights 10

2.2.4 Design Decisions—Ground Water 11

2.3 GEOLOGY 11

2.3.1 General Geologic Setting 11

2.3.2 Soils 11

2.3.3 Bank Erosion 14

2.3.4 Design Decisions—Geology 14

SECTION 3 HYDRAULIC ANALYSES 15

3.0 INTRODUCTION 15

3.1 MODELING APPROACH 15

3.1.1 2D Hydrodynamic Modeling 15

3.1.2 Energy Dissipation Basin Design 15

3.2 MODEL RESULTS 15

3.2.1 Downstream Flooding 16

3.2.2 Structural Stability 16

3.2.3 Upstream Fish Passage 17

SECTION 4 PROPOSED ALTERNATIVE 20
4.0 PROPOSED ALTERNATIVE 20
SECTION 5 CONCLUSION 21
5.0 CONCLUSION 21
SECTION 6 REFERENCES 22
6.0 REFERENCES 22

LIST OF TABLES

Table 1-1. Shem Dam Site Information 2
Table 1-2. Alternatives Considered but Eliminated from Further Study 4
Table 2-1. Basin Characteristics of the Santa Clara River Watershed above Shem Dam 5
Table 2-2. Peak Discharges for Various Return Periods, Estimated Using HEC-SSP 6
Table 2-3. Mean Monthly Discharge at Shem Dam (from USGS Gage 09410100) 7
Table 2-7. Surface Water Rights on the Green River near the Project Location 7

LIST OF FIGURES

Figure 2-1. Flow Rates along the Santa Clara River by Month 6
Figure 2-2. Long Profile of Santa Clara River near Shem Dam Showing Slope Breaks 9
Figure 2-3. Soils Classes Found in and around the Project Area 13
Figure 3-1. Comparison of 100-Year Downstream Water Depths for Alternatives 1 and 2 16
Figure 3-2. Virgin Spinedace Spawning Month Depths 18
Figure 3-3. Virgin Spinedace Spawning Month Velocities 19

APPENDICES

Appendix A Concept Design Drawings
Appendix B FEMA Flood Maps

SECTION 1
INTRODUCTION

1.0 Introduction

The Natural Resources Conservation Service (NRCS) - Utah has contracted McMillen, LLC (McMillen) to provide engineering services to plan and prepare a concept design for the restoration of Shem (Winsor) Dam (hereafter Shem Dam), located in Washington County, Utah. The following report consists of project alternative descriptions and a detailed analysis of the existing physical site resources. The report also describes the hydraulic evaluations conducted in order to compare the performance of each of the project alternatives against existing conditions. Finally, the report includes an economic evaluation of the various alternatives and offers a Proposed Alternative for the project. The purpose of the report is to present information that supports the formulation, evaluation and conclusions of the concept design project.

1.1 Background

Shem Dam is located along the Santa Clara River approximately five miles upstream of the town of Ivins, Utah. The dam is situated on the Shivwits Band of Paiutes tribal land, and is downstream of Gunlock Dam and Reservoir. The dam was constructed between 1933 and 1935 by the Zion Civilian Conservation Corps (CCC) and was intended to divert clean (de-silted) water to the Ivins Canal, which provided water to the Ivins Bench community along its 8-mile-long length (WCWCD 2012). The dam was constructed of large boulders with a veneer face and concrete cores for stabilization purposes. Features of the dam include a large, central spillway and diversion outlet works that once fed irrigation water to the Ivins Canal. Much of the veneer has since fallen off the face of the dam, and a large undercutting scour hole has formed in the tailwater of the spillway. The undercutting of the spillway poses a threat to the stability of the dam, and would put the communities in Shivwits and in Ivins at risk, were the dam to fail. The purpose of the project, therefore, is to restore the dam site by rehabilitating the dam, or to decommission the dam and restore the channel, or to implement some combination thereof in order to protect the health and safety of downstream communities.

NRCS and the Utah Department of Agriculture and Food (UDAF), as the project sponsor, are analyzing alternatives to restore the area surrounding Shem Dam. The Proposed Alternative consists of a sequence of stepped rock chutes and energy dissipators intended to emulate the look of the existing structure while improving the overall structural integrity of the project. The overall design of the Proposed Alternative includes the following detailed objectives:

1. Repair the left abutment and grout the surfaces of both the left and right abutments.
2. Demolish the existing spillway; demolish/decommission abandoned Ivins Canal irrigation outlet works.
3. Construct a riprap-lined stilling basin just downstream of the existing spillway.
4. Construct stepped rock chute just upstream of new stilling basin.
5. Regrade channel upstream of rock chute; excavate sediment pool to required depth
6. Construct a second energy dissipation stilling basin upstream of channel regrade, followed by a second stepped rock chute.
7. Line new channel with properly sized riprap and revegetate banks.

1.2 Scope

McMillen was contracted to provide the following scope of services for the project:

- Prepare an Environmental Assessment to include the completion of the necessary environmental and economic impact analyses per NEPA requirements.
- Develop the following Shem Dam Restoration alternatives in accordance with the Emergency Watershed Protection Program requirements:
    - No action
    - Structural rehabilitation of the existing dam
    - Additional alternatives developed from the scoping meeting
- Provide concept design plans for each of the alternatives.

1.3 Site Information

Table 1-1 lists pertinent information regarding the Shem Dam location.

Table 1-1. Shem Dam Site Information

Item	Information
Existing Dam Centerline Length	370 ft
Existing Spillway Elevation	3250 ft
Location	37.1922 North Latitude 113.7698 West Longitude
County	Washington
Nearest Towns	Shivwits, UT and Ivins, UT

1.4 Alternative Descriptions

The following section includes descriptions of the alternatives selected for detailed study, as well as descriptions of those alternatives that were considered, but eventually eliminated from consideration for further study

1.4.1 Alternative 1— Controlled Breach with Channel Regrade

This alternative would demolish the existing spillway notch, repair the left abutment to mimic the right abutment, and add reinforcement to both abutments for structural stability. Sediment behind the dam would be excavated in order to regrade a channel upstream at 3%. The channel and banks would be lined for protection and an energy dissipation basin would be added to the bottom of the regraded reach (near the existing dam). The channel would be reoriented in order to be more perpendicular to the abutments.

1.4.2 Alternative 2—Stepped Rock Chute with Energy Dissipator

This alternative would demolish the existing spillway and excavate sediment behind the dam to approximately 8’ of depth. Repairs would be made to the left abutment to make it vertical, mimicking the right abutment. Reinforcement would be applied to the right abutment to stabilize it. A stepped rock chute would be added in the place of the existing spillway. The top of the chute would be approximately 8’ below the existing spillway crest. The pool behind the dam would be excavated as necessary, and the

channel would be lined and regraded at 2.5% for approximately 350 upstream of the existing spillway. The channel approach would be reoriented in order to make the channel more perpendicular to the structures. A rock-reinforced energy dissipator would be added to the bottom of the chute.

1.4.3 Alternative 3— Stepped Rock Chute Sequence with Energy Dissipator

This alternative is similar in design to Alternative 2 described above, except it includes two stepped rock chutes and two energy dissipation basins. This alternative would demolish the existing spillway and excavate sediment behind the dam to approximately 12’ of depth. Repairs would be made to the left abutment to make it vertical, mimicking the right abutment. Reinforcement would be applied to the right abutment to stabilize it. A stepped rock chute would be added in the place of the existing spillway. The top of the chute would be approximately 12’ below the existing spillway crest. The pool behind the dam would be excavated as necessary, and the channel would be lined and regraded at 1.0% for approximately 65 feet upstream of the existing spillway. At that location a second energy dissipation basin would be constructed, followed by a second stepped rock chute. Beyond this second stepped rock chute the channel would be lined and regraded at 2.0% for approximately 100 feet. Each rock chute would drop approximately 12 feet into each energy dissipation basin. The channel approach would be reoriented in order to make the channel more perpendicular to the existing abutments.

1.4.4 Alternatives Considered but Eliminated from Further Study

The alternatives provided in the following table were considered but not chosen for additional study and development because of the disadvantages listed.

Table 1-2. Alternatives Considered but Eliminated from Further Study

Alternative	Description	Advantages	Disadvantages
Sheet Pile Wier	Remove the existing spillway and excavate sediment to 15’ of depth; repair left abutment and reinforce right abutment; regrade channel upstream at 1.5% and reorient approach to make more perpendicular; add a sheet pile weir to the middle section of the dam with crest 15’ below existing; add a rock reinforced plunge pool	This alternative would retain both abutments, which is beneficial for cultural and historical reasons.	This alternative would provide no fish passage, and it could be prohibitively expensive in order to ensure structural stability. It may be detrimental to aesthetics as well.
Complete Decommissioning and Channel Regrading	Demolish existing dam in its entirety; excavate sediment behind dam; regrade channel upstream and downstream to catch existing ground at 2%; add stabilization features such as riffle-pool sequences, barbs, etc., in order to dissipate energy.	This alternative may allow fish passage and could be affordable. It would restore fish and wildlife habitat and it would reestablish a natural environment.	Shem Dam is an historic structure and desire to retain at least part of the structure has been expressed.
Downstream Grade Control with Natural Erosion	Remove the spillway notch and stabilize the abutments for structural stability; stabilize downstream of existing dam with riprap apron and bank protection; allow river to headcut into sediment pool and carve a natural channel; coordinate operation of Gunlock Dam to convey sediment downstream.	Because of the natural headcutting into the sediment pool, construction costs for this alternative would be lower. This alternative may also allow fish passage. It would restore fish and wildlife habitat and it would reestablish a natural environment.	Transport of sediment from natural headcutting into the sediment pool could potentially create downstream water quality issues, particularly if the sediment is contaminated.
Rehabilitate Dam, Excavate Sediment and Divert Water for Municipal/Agricultural Use	Rehabilitate dam to ensure structural stability; excavate sediment pool to provide water storage; construct new diversion works and rehabilitate Ivins Canal for provision of municipal and agricultural water.	Water storage could benefit local agriculture and could protect against downstream flooding to some extent.	This alternative may lead to water quality and habitat issues downstream of the dam, particularly if flows were diverted during period of low flow. Several existing water rights at the dam have been transferred over to instream flow allocations in order to enhance habitat for the Virgin spinedace. This alternative would provide no fish passage, and may be prohibitively expensive to build conveyance works (e.g. pipes, canals, outlet works, fish screens, etc.).
Rehabilitate Dam and Raise Crest for Hydropower Installation	Rehabilitate dam to ensure structural stability; raise the dam crest height in order to provide more hydraulic head; excavate sediment pool for flood and hydropower storage; install penstocks and turbines to run hydropower.	Hydropower could supply enough energy to power a handful of homes. Also, an excavated pool would provide some flood storage.	The benefit/cost ratio for such a project is probably less than unity. Furthermore, the alternative would provide no fish passage. Finally, the aesthetics of the site might be compromised by the required hydropower appurtenances.

SECTION 2
SITE ANALYSIS

2.0 Introduction

The following section provides an analysis of the existing physical resources located within the project area that would be affected by the project alternatives. The resources analyzed include:

- Surface Water
- Ground Water
- Geology

2.1 Surface Water

Shem Dam is approximately 25 feet tall and includes a 62-foot long notched spillway that extends approximately 15 feet in the direction of flow. The abutments on either side of the spillway rise 15 feet above the spillway crest, with the left abutment extending roughly 100 feet to the east, and the right abutment extending nearly 200 feet to the west. The dam was designed to back up and divert water into the now-defunct Ivins Canal. Since its construction in the 1930s, the reservoir behind Shem Dam has filled in with fine sediment and flow over the spillway has severely undercut the toe of the dam.

This section describes the surface water resource in the project area, and includes a hydrologic analysis of the watershed, as well as discussions of surface water quality, the existing water rights in the project area, and sedimentation.

2.1.1 Surface Water Flow

The Santa Clara River Watershed is partly located in the Dixie National Forest in the southwest corner of Utah. The watershed drains areas of the Bull Valley Mountains to the west, the Pine Valley Mountains to the east, the Beaver Dam Mountains to the southwest, and the Red Mountains to the southeast. Table 2-1 gives important basin characteristics of the Santa Clara River Watershed above Shem Dam. Surface waters of the Santa Clara River originate across a 378 mi^2 basin that straddles the Basin and Range Province and the Colorado Plateau Province. Watershed vegetation is characterized by mixed conifer forests, aspen, muhly, needlegrass, timothy, dandelion, clover, cinquefoil, yarrow, fleabane, snowberry, and serviceberry.

Hayden and Willis (2011) estimate an average daily flow through the Santa Clara River "just west" of the St. George quadrangle of 20 cfs. For comparison, the average daily flow rate is 22 cfs based on 30 years of gage data collected at USGS gaging station 09410100 downstream of Shem Dam. These flows are regulated by Gunlock Dam, which is located a little over five miles upstream.

Table 2-1. Basin Characteristics of the Santa Clara River Watershed above Shem Dam

Basin Parameter	Value
Area (sq. mi.)	378
Mean Basin Elevation (ft)	5,730
Mean Annual Precipitation (in.)	18.1
Average Basin Slope (%)	26.4

The average peak annual flow rate for the Santa Clara River near Shem Dam is 666 cfs, based on a 29-year period of record at USGS gaging station 09410100. This record began in 1973, three years after Gunlock Dam had been completed. Therefore, the record represents regulated flows in the Santa Clara River. Average daily flows in the Santa Clara River are provided in Figure 2-1 by month. From the figure, the hydrograph appears unimodal, with one peak occurring in the early spring. This is consistent with the mean basin elevation of 5,730 feet, which is probably not high enough to develop a deep snowpack that would melt in the later spring and early summer.

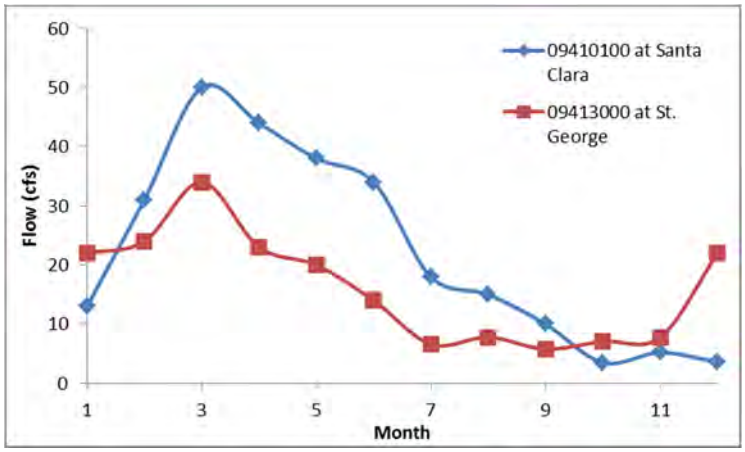


Figure 2-1. Flow Rates along the Santa Clara River by Month

Peak discharges above Shem Dam were estimated using the HEC-SSP program (USACE 2010) for the years 1970 through 2012 using data obtained from USGS gaging station 09409880. This gaging station is located above Gunlock Dam and records the unregulated flow of the Santa Clara River into Gunlock Reservoir. This dataset was used because it assumes, conservatively, that Gunlock Reservoir is completely full at the time of the flood event of interest, and therefore that all flows above Gunlock Dam are routed directly to the Shem Dam site. HEC-SSP applies the methods outlined in Bulletin #17B (USGS 1982) to a time series of flow data in order to calculate the discharge for various annual return periods. Results are given in Table 2-2 for the 2-, 25-, 50-, and 100-yr events.

Table 2-2. Peak Discharges for Various Return Periods, Estimated Using HEC-SSP

Statistic	Discharge (cfs)
2-Yr	405
25-Yr	2,737
100-Yr	4,675

Due to the interest expressed regarding passage of Virgin spinedace (*Lepidomeda mollispinus)* past the Shem Dam site, flow rates during the spawning season were investigated. As noted in Lentsch et al. (2000), the months of spawning for Virgin spinedace run from April through June. Average monthly discharges for these months are provided in Table 2-3 below.

Table 2-3. Mean Monthly Discharge at Shem Dam (from USGS Gage 09410100)

Month	Mean Monthly Discharge (cfs)
April	44
May	38
June	34

2.1.2 Surface Water Quality

The Santa Clara River, from the confluence with the Virgin River to Gunlock Reservoir, is listed on Utah's 303(d) listing for temperature and boron, with the former contaminant having a low TMDL priority, and the latter a medium TMDL priority (UDWQ 2008). The reach is also listed as impaired due to selenium and total dissolved solids (TDS) by the EPA. The EPA also notes the use groups affected by these impairments, and the possible causes of the impairments (EPA 2010). These impairments are listed in Table 2-6 below, along with the probable sources of the impairment and the use groups affected by them. Natural hillslope erosion, livestock grazing, and dispersed recreational use have also been identified as potential sources of contaminant loading in the reach (Tetra Tech 2004). As a result, the following BMPs have been recommended for the reach:

- Grazing Management: Exclude livestock from grazing adjacent to the river, offsite watering, prescribed grazing
- Fencing: Exclude livestock from grazing adjacent to the river
- Silt Fencing: Control erosion during construction projects

Table 2-6. Water Quality Impairments of the Shem Dam Reach of the Santa Clara River, UT (EPA 2010)

Cause of Impairment	Probable Source	Designated Uses
Boron	Unknown	Agricultural
Selenium	Agriculture, Industrial Point Sources, Natural Sources, and Urban Runoff	Warm Water Aquatic Life
Water Temperature	Unknown	Warm Water Aquatic Life
Total Dissolved Solids (TDS)	Agriculture, Industrial Point Sources, Natural Sources, and Urban Runoff	Agricultural

2.1.3 Surface Water Rights

Several water rights exist on the Santa Clara River near the project location. A list of the existing water rights at Shem Dam is provided in Table 2-7.

Table 2-7. Surface Water Rights on the Green River near the Project Location

Name of Water Right Owner	Water Right Number	Flow (cfs)	Notes
Shivwits Band of Paiute	81-2425	0.138	Irrigation of approximately 17 acres.
Shivwits Band of Paiute	81-2313	1.242	Irrigation of approximately 66.5 acres.
Utah Division of Wildlife Resources	81-4920	3.0	Instream flow provision for the Virgin Spinedace based on the Santa Clara Project Agreement and a Conservation Agreement with the State of Utah

Name of Water Right Owner	Water Right Number	Flow (cfs)	Notes
			Division of Wildlife Resources Wildlife Resources
Ivins Irrigation Company	81-77	1.38	Original use was irrigation; use has since changed to instream.
Ivins Irrigation Company	81-7	14.9	Original use was irrigation; use has since changed to instream.

NOTE: Data obtained from Utah Division of Water Rights, available at http://www.waterrights.utah.gov/. Data accessed 11/20/2013.

2.1.4 Flooding

The area surrounding the Santa Clara River is prone to hazardous flood events that have in the past caused damage to property and infrastructure, and that have posed a risk to public health and safety. Flooding of the Santa Clara River occurred in 2005, and again in 2013, which collectively led to hundreds of millions of dollars in damage. Due to the hydrology of the region, the river sometimes sees extremely high flows compared with its 20 cfs average daily flow. FEMA Flood Insurance Rate Maps (FIRMs) are provided in Appendix B, and indicate the expected extent of flooding in the area due to the 100-year flow. Also, moderately to highly erodible soils in the area increase the possibility of flood flows carrying debris, and can directly impact infrastructure by undercutting roads, breaching levees, and so on. This increases the hazard potential due to flooding in the area.

2.1.5 Sediment Transport

Although no quantitative dataset has been found regarding the sediment transport characteristics of the Santa Clara River downstream of Shem Dam, anecdotal evidence suggests that the river is "sediment-starved" below the structure. The Santa Clara's long profile, depicted in Figure 2-2, bears this out, showing a slope break below the dam. The slope below the dam is twice that of the far upstream reaches. Because stream power is a linear function of slope, the stream power below the dam is twice that above the dam. This situation is indicative of downcutting, which leads to channel armoring and incision. A field investigation of the area below the dam was conducted in November, 2013 in order to assess the sediment characteristics below the dam. Observations made during this field visit indicate that the sediment below the dam is poorly sorted, with large areas composed of mainly large cobbles and boulders, and other areas composed of mainly silts and sands. Cobbles and boulders below the dam are likely the results of both downstream erosion and exposure of alluvial deposits and the contributions from the dam itself as it has deteriorated over the years. The silt and sand components downstream of the dam are due in part to the transport of finer material over the dam itself, as well as contributions from downstream bank and hillslope erosion processes. Downstream armoring could affect Virgin spinedace habitat, as it is thought that they broadcast spawn over gravel substrate (Cavendish 2001). In the reach immediately below Shem Dam, an absence of gravel substrate is apparent. In contrast, just upstream of the dam at Motoqua Wash, a pebble count was conducted during the November, 2013 field visit. Results indicated a D50 at the mouth of the wash of 15 mm (~0.6 inches), which corresponds with the medium gravel size class of the sedimentological scale (Vanoni 2006). Another pebble count was conducted approximately 1.3 river miles upstream of the dam and presumably outside the influence of the dam. At this location, the measured D50 of the substrate was 63 mm (~2.5 inches), which corresponds with the very coarse gravel/small cobble size class. Thus, in both cases upstream of the dam, the grain size distribution was dominated by particles that may be more conducive to spinedace habitat. This suggests that the presence of the dam limits habitat below the dam by trapping sediment otherwise beneficial to spawning fish.

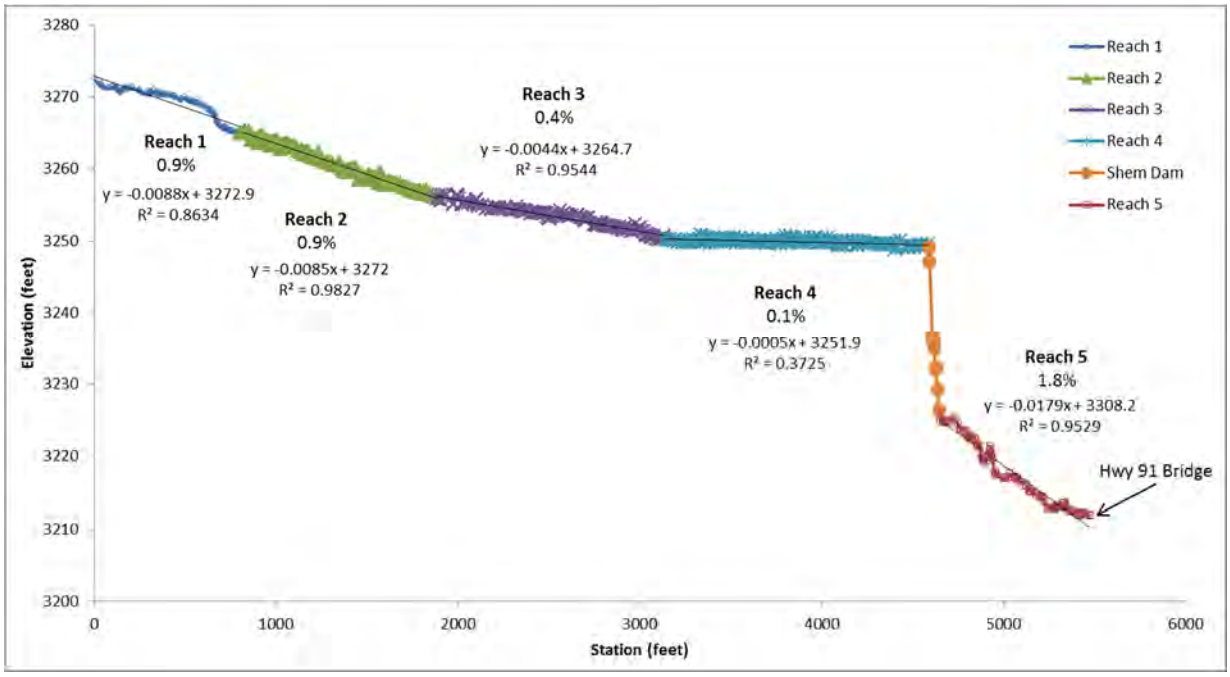


Figure 2-2. Long Profile of Santa Clara River near Shem Dam Showing Slope Breaks

2.1.6 Design Decisions—Surface Water

Due to the concern for Virgin spinedace habitat in the reach encompassing the project area, it is important that surface water flows be maintained or enhanced through the project design. Furthermore, flow rates should not be diminished so that downstream water rights can be maintained.

Project stakeholders have expressed concern that the project alternatives, depending on the design, could exacerbate downstream water quality issues due to potentially high levels of TDS. In order to prevent potential rises in TDS during construction, construction activities should be conducted "in the dry" in order to minimize entrainment of sediment in disturbed areas. Additionally, BMPs should be employed throughout all phases of construction in order to mitigate for potential impacts to environmental quality. Finally, in the case that dam decommissioning is chosen as the proposed alternative, it is recommended that mechanized removal or stabilization of the reservoir sediment be chosen over river erosion (ASCE 1997), due to the implications to downstream water quality.

Because the flow characteristics of the Santa Clara River are so variable, flooding is expected within the basin. In an effort to curb this flooding, however, the project alternatives will strive to attenuate flood waves either by providing storage or roughness. Storage can be achieved by excavating a storage pool behind the dam, while roughness can be added by reconnecting the river with a vegetated floodplain.

It is recommended that the project design improve upon the flow-through characteristics at the site for certain sediment classes in order to provide more suitable spawning habitat for Virgin spinedace (and other species) downstream of the existing dam.

Design decisions regarding surface water flow are further investigated in Section 3—Hydraulic Analyses.

2.2 Ground Water

Although Shem Dam affects primarily surface water of the Santa Clara River, because the river is hydraulically connected to the underlying water table, changes to surface water initiated by the dam will effect changes in the ground water below. The following section describes ground water within the project area and beyond.

2.2.1 Ground Water Flow

The area surrounding Shem Dam is underlain with the Navajo aquifer system, which itself is a combination of water-bearing parts of the Navajo Sandstone and the Kayenta Formation. Within the Shem Dam project area, the Navajo Sandstone overlays the Kayenta Formation. The Navajo aquifer is between 400 and 2,400 feet thick, and consists of well-sorted, fine grained sandstone, siltstone, and silty mudstone. Most of the municipal water in southwestern Utah is provided by the Navajo aquifer system. Development of the aquifer has led to withdrawals of ground water that have in the past exceeded the amount of recharge entering the aquifer, such that total water storage in the system has declined. Another major source of loss from the aquifer is infiltration out of the system and into perennial streams during the receding limb of the hydrograph. However, according to Hurlow (1998), the Santa Clara River may be the primary source of recharge in the area, other than precipitation. Recharge through the Santa Clara River presumably occurs around the peak of the hydrograph. Hydraulic conductivities at a site just upstream of Shem Dam were estimated using a three-dimensional ground water flow model to be 0.3 feet per day in the east-west direction, and 1.0 feet per day in the north-south direction.

2.2.2 Ground Water Quality

Ground water at the project location is presumed to be of at least moderate quality, due to the fact that there are no sites in Washington County found on the National Priorities List (NPL), nor are there any Corrective Action Superfund Sites nearby. Although the Santa Clara River is listed on the Utah State 303(d) list for several contaminants, Santa Clara River recharge of the Navajo aquifer system is considered so slight in comparison to overall ground water flow and basin-wide recharge (less than 0.5% of total ground water flow [Cordova et al. 1972]), that total dilution of these contaminants is expected within the aquifer. Furthermore, due to the current paucity of drinking water wells in the project area, no population is expected to be at risk due to any ground water contamination that may occur.

Cordova et al. (1972) found that dissolved solids concentrations within the Santa Clara River between Gunlock and Santa Clara are generally low (i.e. below 1000 mg/L). However, across the Virgin River basin as a whole, ground water quality standards have on occasion not been met for various salts and other dissolved solids, heavy metals, and organic compounds, as well as for temperature, taste, odor, acidity, and hardness (SUWA 1993). Nevertheless, no evidence of water quality issues could be found for the area immediately encompassing the project site.

2.2.3 Ground Water Rights

Only one provisional well is located within the project area. The well is situated on the left overbank of the river, approximately ½ mile upstream of the dam. The intended use of the well is not known, but the likelihood of potable end uses is small given the fact that no residences are located within a mile of the site. Other than this well, no other wells exist within the Shem Dam project area, and no other wells exist within a mile of the dam (UDWR 2013). However, other sites do exist downstream, particularly in the Kayenta development northwest of Ivins, where many of the wells are used for geothermal heat exchangers, as well as for irrigation, stockwater, and domestic uses.

2.2.4 Design Decisions—Ground Water

Because of the existing ground water rights in the project vicinity, the final concept design should not measurably affect ground water recharge in the area. Rather, the project design should make every effort to maintain the underlying aquifer in the project area.

Every effort should be made to ensure that ground water quality in the project area is not hindered. Because no toxic materials are anticipated as part of the concept design, protection of ground water quality would likely be accomplished through the application of Best Management Practices during construction.

2.3 Geology

This section describes the geologic resource in the project area, and includes a description of the general geologic setting, soils, and bank erosion.

2.3.1 General Geologic Setting

Shem Dam is located along the eastern boundary of the Basin and Range Province, and is adjacent to the Colorado Plateau Province in southwest Utah. The river centerline follows the Gunlock Fault at the project location, with the Shivwits Syncline to the west and the Santa Clara Bench to the east. The river bed is composed of stratified, poorly to moderately sorted clay, silt, sand, gravel and boulder deposits within the project area. Stream banks include similar alluvial deposits up to 10 feet above the channel bed, as well as colluvial deposits from side slopes. The river is underlain primarily with the Petrified Forest Member, which includes bentonitic shale, mudstone, siltsone, and claystone, as well as brightly colored fossilized wood.

Geologic hazards in the area include flooding, expandable, soluble and collapsible rock and soil, earthquakes, slope failures (e.g. rock falls and landslides), volcanic eruptions, and radon exposure.

A high hazard in the area is the preponderance of soluble and collapsible rock and soil, which have contributed to cracked foundations and walls and other structural, architectural and landscape damage in the region (Lund et al. 2008).

Earthquakes as large as M 6.5-7 could occur in the St. George-Hurricane area, according to Stenner et al. (1999); however, this is not necessarily indicative of the Gunlock Fault, but represents the capacity of the neighboring, larger Hurricane Fault. The Gunlock Fault is a normal fault (UGS 2013), which are typically geologically young, and therefore still capable of producing earthquakes. The Gunlock Fault is therefore considered an active fault and a geologic hazard.

Although slope failures do occur in the region, they are not anticipated in the project area, nor is there any evidence of recent rock falls or landslides near the dam. Slope failures are therefore considered nominal hazards.

2.3.2 Soils

Soils in and around the project area were obtained from the NRCS Soil Data Mart, and are summarized in Figure 2-3 below. The figure also shows an area to the southwest of the project site which that contains expansive soil or rock. However, this area is far enough outside the project footprint to not pose any hazrd to the project. The majority of soils found in the project area are class FA, which are sandy fluvaquents

and torrifluvents, with a small fraction of riverwash. These are poorly to well drained soils composed of sandy alluvium derived from limestone, sandstone and shale. These soils are rated as hydric, and therefore may indicate the presence of wetlands. The erodibilities of the soils in the project area are mostly moderate, based on the erosion factors provided in Table 2-8 below. The table also provides the hazard of erosion on roads and trails in the project area. From the table, most of the soil classes represent slight to moderate hazards of erosion on roads and trails due to overland sheet flow. In the case of soil class RE, however, the hazard is severe. It is important to note that this soil class is adjacent to the right abutment of the existing dam, and just upstream and downstream along the right bank.

Table 2-8. Project Area Soils and Their Erosion Potential

Soil Symbol	Erosion Factor, Kw (top layer)	Hazard of Erosion on Roads and Trails
BB	-	Not Rated
CFD	0.10	Moderate
EB	0.24	Not Rated
FA	0.17	Slight
LeB	0.37	Slight
PED	0.20 – 0.37	Slight-Moderate
PoD	0.17	Moderate
RE	0.10	Severe
RP	-	Not Rated
SY	-	Not Rated
Tc	0.28	Moderate
VPD	0.15	Slight

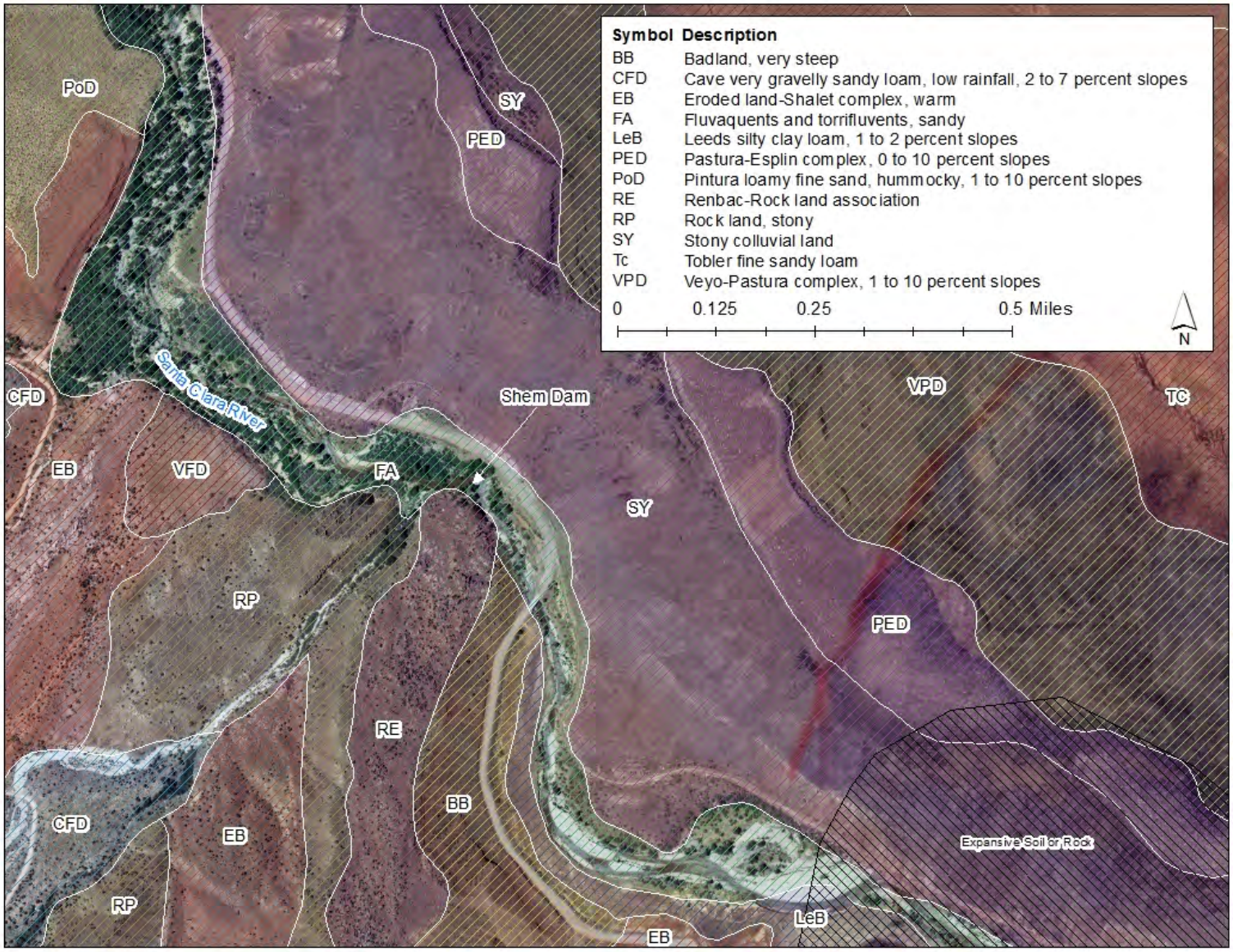


Figure 2-3. Soils Classes Found in and around the Project Area

2.3.3 Bank Erosion

Runoff from intense summer rainfall events over barren slopes can produce flash floods in the dry washes and canyon bottoms of this region, particularly in areas where soils are derived from highly erodible shale. Thompson and Hardy (2003) indicate that the reach between the Shivwits Reservation and Shem Dam has poor bank stability. Banks are even more susceptible to erosion do to the force of gravity acting on soil particles resting on slopes. Bank erosion can be minimized through a number of means, including reduction of the erosional force of water (e.g. slowing the water down, or redirecting the water away from tangent to the banks), lessening the bank slopes, and revegetating barren banks.

2.3.4 Design Decisions—Geology

The restoration alternatives will incorporate features to minimize bank erosion downstream of the existing dam. This will include revegetation of disturbed areas and lowering the stream power of the river as much as practicable.

Due to the proximity of the Gunlock Fault to the project, every effort will be made to ensure the structural and seismic stability of the design. Because all three alternatives examined would retain the left and right abutments, stability measures would be applied to these components (e.g. masonry veneer; doweling) in all three cases.

Provided that the depth to bedrock is reasonable, sheet pile cutoff walls will be driven and anchored to bedrock for the alternatives.

SECTION 3
HYDRAULIC ANALYSES

3.0 Introduction

The following section discusses the hydraulics at and around Shem Dam under the conditions of the three alternatives investigated for this project.

This section outlines the model approach adopted to analyze the hydraulics at and around the dam, and discusses several areas of concern, including:

- downstream flooding
- structural stability
- upstream fish passage

3.1 Modeling Approach

The following section describes the modeling approach undertaken to simulate the hydraulic response of the system under design conditions. Specifically, the section discusses the choice of the model, and the efforts undertaken to simulate conditions representative of the three alternatives under investigation.

3.1.1 2D Hydrodynamic Modeling

Due to the flow constriction and expansion at the dam under each of the alternatives, the hydraulics at and around the dam lends itself to a 2-dimensional analysis. For this reason, the 2-dimensional finite element hydrodynamic model RiverFLO-2D was chosen to simulate various flow scenarios passing through the project for each of the alternatives.

Each alternative was modeled by using the CAD surfaces developed for the drawing sheets as the model topographies. The element size of the mesh was set to between 5 and 10 feet, depending on the flow scenario being simulated. Manning's *n* values were set to 0.04 across the model, and a no-slip condition was applied in order to solve the St. Venant equations.

The model was run beginning with a low-flow condition of 44 cfs, which corresponds with the average flow for April, which is the spawning month with the highest average flow. The model was then run with a high-flow condition of 11,000 cfs, which is the structure design flow on the Santa Clara River at Shem Dam. The downstream boundary condition was assigned the slope at normal flow (1.8%), and was calculated by regressing bed elevation onto thalweg station (see Figure 2-2).

3.1.2 Energy Dissipation Basin Design

The design method for the riprap energy dissipation basin for Alternatives 1 through 3 was provided by FHA (2006). The method was developed in a spreadsheet program and simulated with the 100-year event.

3.2 Model Results

The following section provides results of the model related to downstream flooding, the structural stability of the dam, and upstream fish passage.

3.2.1 Downstream Flooding

Water depths during the 100-year flow event were compared across all alternatives. Results indicate very little difference in downstream flooding from one alternative to the next. As an example, Figure 3-1 provides depth results for Alternatives 1 and 2 downstream of the dam. From the figure, the mean depth below the dam is slightly greater for Alternative 1 than it is for Alternative 2. This may be due to the slightly deeper energy dissipator for Alternative 1 and its location further downstream. However, beyond the immediate downstream vicinity of the dam these differences even out and can be considered negligible. Similar results were obtained for Alternative 3.

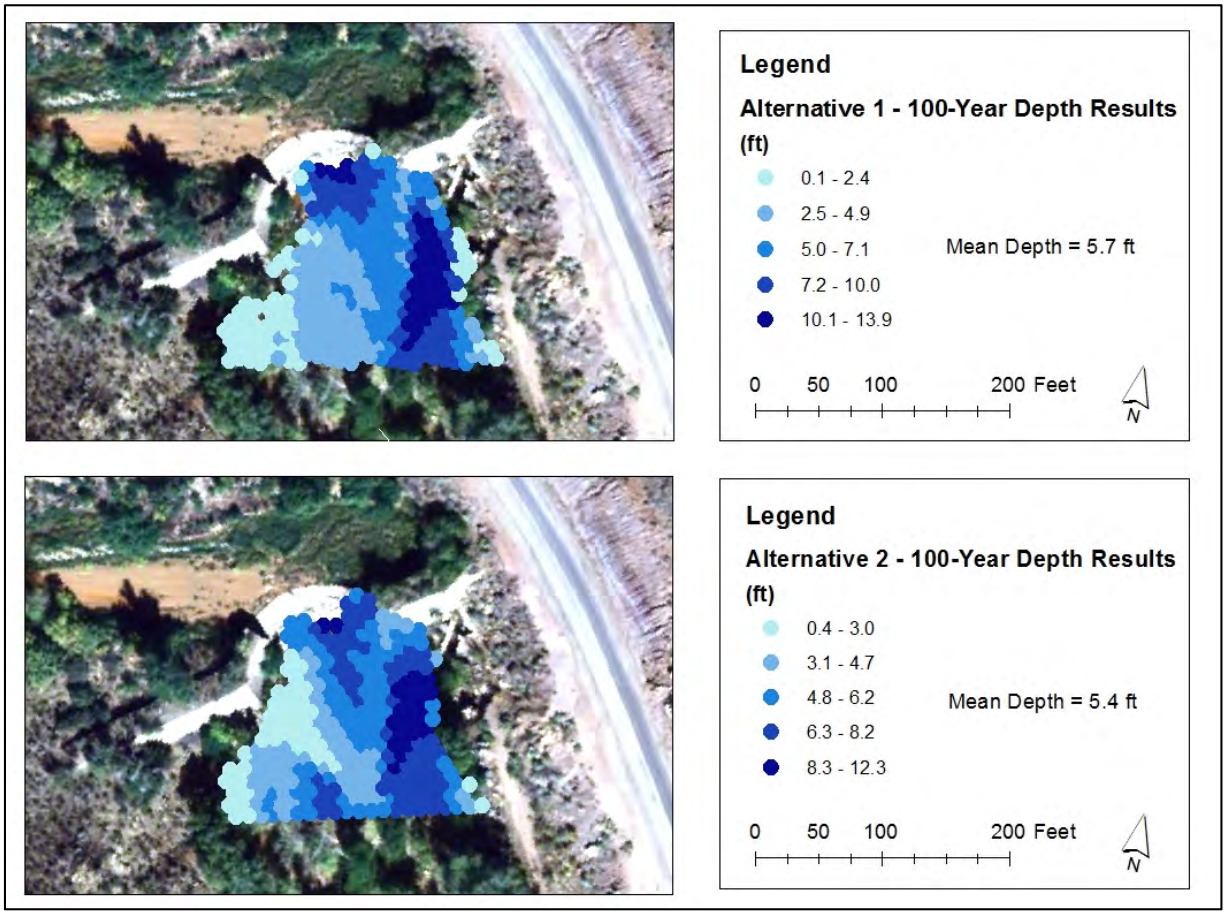


Figure 3-1. Comparison of 100-Year Downstream Water Depths for Alternatives 1 and 2

3.2.2 Structural Stability

The structural stability of the alternatives is based on the tractive force on the bed during the 100-year flow and the capacity of the bed particles (boulders in this case) to resist those tractive forces. Table 3-1 presents results for each of the alternatives in terms of the maximum D50 and the mean D50 particle sizes required for stability. From the table, Alternative 1 generally requires the smaller rock, followed by Alternative 2 and then Alternative 3. The maximum D50 sizes indicated are required in the primary energy dissipation basin downstream of the existing spillway. In the case of Alternative 1, slightly higher grain sizes are needed at the riffles. Finally, for Alternative 3, slightly higher grain sizes are needed in the first chute and energy dissipation basin. It is assumed that all of the grain sizes given in Table 3-1 can be locally sourced.

Table 3-1. Comparison of D50 Particles Sizes Required for Stability

Alternative	Maximum D50 (ft)	Mean D50 (ft)
Alt 1: Controlled Breach	5.6	0.8
Alt 2: Rock Chute	6.0	1.4
Alt 3: Rock Chute Sequence	7.1	1.9

3.2.3 Upstream Fish Passage

In an effort to reduce or eliminate the threats that would warrant federal listing of the Virgin spinedace (*Lepidomeda mollispinus*) under the Endangered Species Act (ESA), a Conservation Agreement was drawn up in 1995, and amended in 2000, which outlined voluntary approaches to habitat enhancement and instream flow allocation for the species (Lentsch et al. 2000). The area surrounding Shem Dam was identified in the agreement as an area of historic habitat for the Virgin spinedace, and therefore was designated a priority area for the re-establishment of suitable flows for the species. Since that time, flows have been allocated to the Santa Clara River from Gunlock Reservoir and water rights have been leases from the Shivwits Tribe in order to provide instream flows.

Virgin spinedace are found in clear, cool, swift streams with interspersed pools, runs and riffles. They are often noted near refugia, such as boulders or debris, and they are known to spawn from April through June. Although it has been noted that Virgin spinedace appear to prefer lower velocities (10 cm/s), definitive data regarding burst speeds, jumping heights, fatigue speeds, and other information pertinent to fish passage design is lacking. It is therefore not possible at this time to incorporate concrete fish passage velocity criteria into the design. However, it is still useful to calculate the velocities and depths during the spawning months and to assess them qualitatively. In the case of Alternatives 2 and 3, it is assumed that the Virgin spinedace cannot surmount the rock chute(s) to migrate upstream.

Figure 3-2 depicts the water depths during the highest average monthly flow (44 cfs) for the assumed spawning months of the Virgin spinedace (April through June). The figure is limited to depths greater than 0.29 feet, which is the assumed depth required for passage of adult spinedace upstream. From the figure, it appears that several possible routes upstream exist, and that shallow stretches are interspersed with deeper pools, which would act as refugia for migrating fish. Figure 3-3 depicts the water velocity during the same event. From the figure, the highest velocity is 11 fps, and occurs just upstream of the stilling basin near the existing dam. Although it is not likely that spinedace can burst through this current, it is important to note that at lower flows (e.g. 44 cfs), boulder roughness elements throughout the constructed reach would serve as refugia and would act to slow the water down to such an extent that fish passage might be possible. This is not captured in the 2D model, however, because the model does not allow for flow obstructions in its computations.

Because fish passage is not required in order for the project to meet its purpose and need, nor is it required by any federal, state, or local regulations, and because of the dearth of information concerning fish passage criteria for the Virgin spinedace, fish passage is hereby dismissed as a concrete design component. Further research is recommended, however, in order that fish passage might be incorporated into a possible later project.

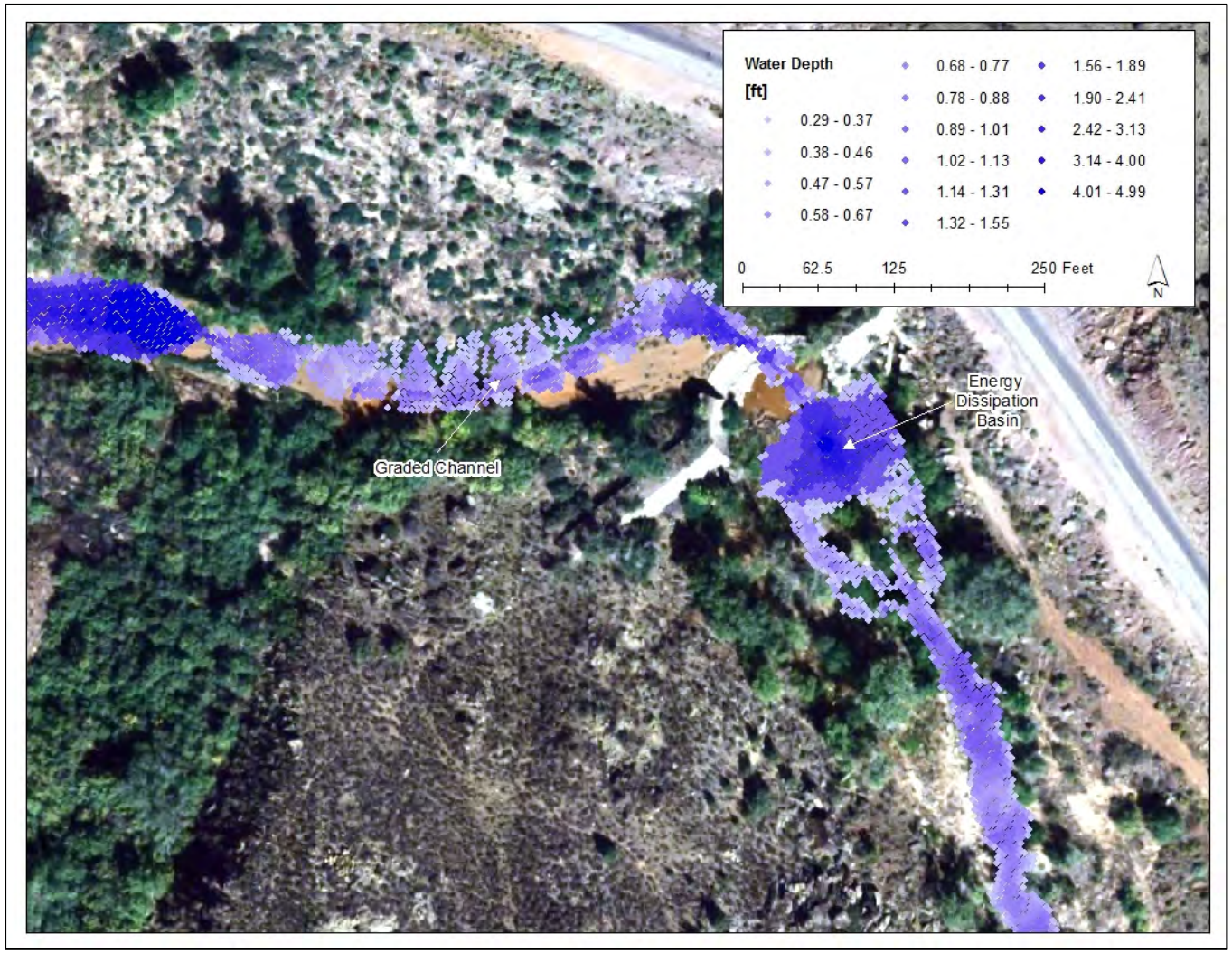


Figure 3-2. Virgin Spinedace Spawning Month Depths

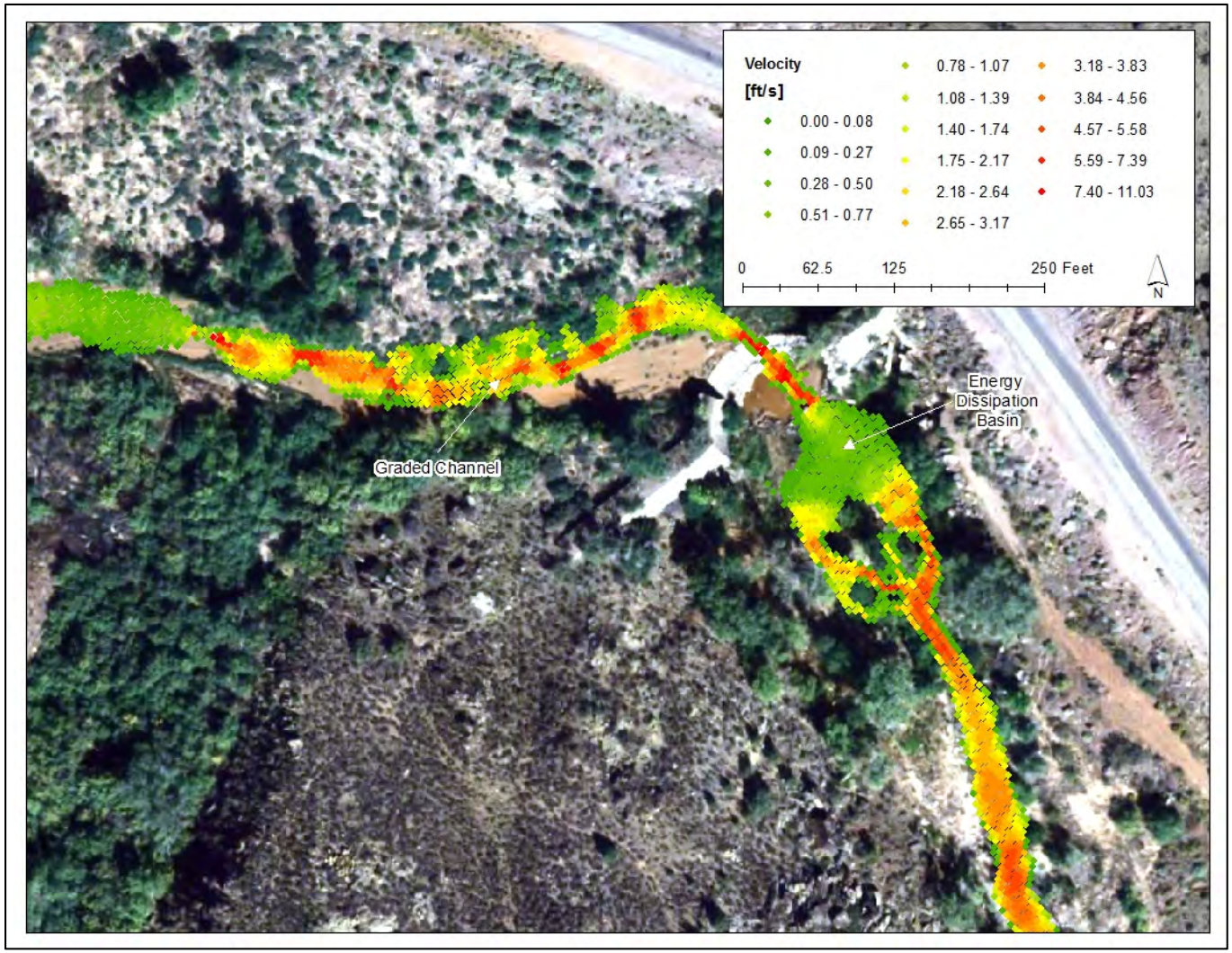


Figure 3-3. Virgin Spinedace Spawning Month Velocities

SECTION 4
PROPOSED ALTERNATIVE

4.0 Proposed Alternative

Alternative 1—Controlled Breach with Channel Regrade would affect nearly 1,000 feet of the existing river, and would require large amounts of sediment excavation that could be cost prohibitive. Furthermore, this alternative does not meet the Shivwits Band's stated desire for the project to resemble the existing stonework currently in place at the dam. Finally, although the potential for this alternative to provide fish passage does exist, it is neither clear at this time what the required hydraulic conditions would be for fish passage to be realized, nor is it required by any federal, state, or local entities that the project be passable to Virgin spinedace or other species. Therefore, due to the high cost and its failure to meet the wishes of project stakeholders, Alternative 1 is not the Proposed Alternative.

Alternative 2—Stepped Rock Chute would allow sediment to pass through the existing dam site and would provide energy dissipation below the existing spillway. This alternative would therefore improve downstream habitat and would help ease the downcutting currently observed at the site. In addition, Alternative 2 contains a stepped rock chute at the location of the existing spillway, which is intended to resemble the existing spillway per the wishes of the Shivwits Band. Also, the cost of Alternative 2 is expected to be less than Alternative 1 due to the less extensive excavation needed. Alternative 3—Stepped Rock Chute Sequence has similar attributes to Alternative 2. However, it is thought that a sequence of energy dissipators (rather than a single energy dissipator at the existing spillway location, will improve the hydraulic stability of the final project, particularly at moderately high flows (e.g. the 2-year event). For this reason, Alternative 3 is the Proposed Alternative.

The Proposed Alternative would demolish the existing spillway and excavate sediment behind the dam to approximately 12' of depth. Repairs would be made to the left abutment to make it vertical, mimicking the right abutment. Reinforcement would be applied to the right abutment to stabilize it. A stepped rock chute would be added in the place of the existing spillway. The top of the chute would be approximately 12' below the existing spillway crest. The pool behind the dam would be excavated as necessary, and the channel would be lined and regraded at 1.0% for approximately 65 feet upstream of the existing spillway. At that location a second energy dissipation basin would be constructed, followed by a second stepped rock chute. Beyond this second stepped rock chute the channel would be lined and regraded at 2.0% for approximately 100 feet. Each rock chute would drop approximately 12 feet into each energy dissipation basin.

SECTION 5
CONCLUSION

5.0 Conclusion

The Proposed Alternative for the Shem Dam Restoration Project is Alternative 3—Stepped Rock Chute Sequence, which consists of rehabilitating the left and right abutments, demolishing the existing spillway, and constructing a sequence of two stepped rock chutes upstream of the dam. Water entering each of the chutes would exit into an energy dissipation basin. Sediment in the middle size classes (e.g. gravel; cobble) would be allowed to pass through the project, providing potential spawning habitat to Virgin spinedace downstream. The river upstream of the dam would be connected with a revegetated floodplain, and would be lined with riprap, and interspersed with boulder roughness elements. Sheet pile cutoff walls would protect the channel against headcutting and downcutting, and rock filters would prevent winnowing.

The Proposed Alternative for this project meets the stated purpose and need of the project and is expected to fall well within the Emergency Watershed Protection budget.

SECTION 6
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APPENDIX A

CONCEPT DESIGN DRAWINGS

NRCS

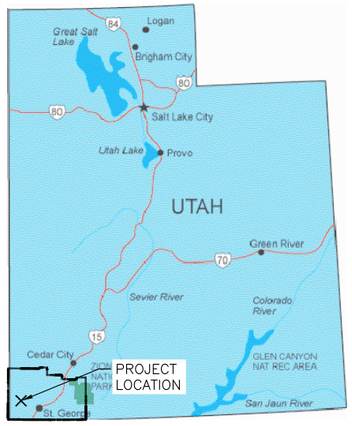
McMILLEN, LLC

NRCS - UTAH
SHEM DAM REHABILITATION PROJECT
CONCEPTUAL DESIGN ALTERNATIVES ANALYSIS
WASHINGTON COUNTY, UTAH

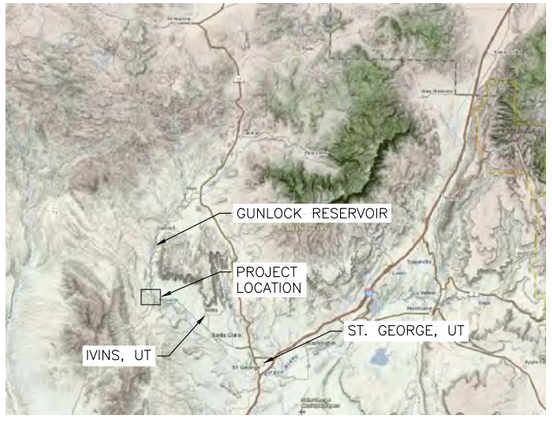
FINAL CONCEPT DESIGN
JANUARY 22, 2014

NATURAL RESOURCES CONSERVATION SERVICE

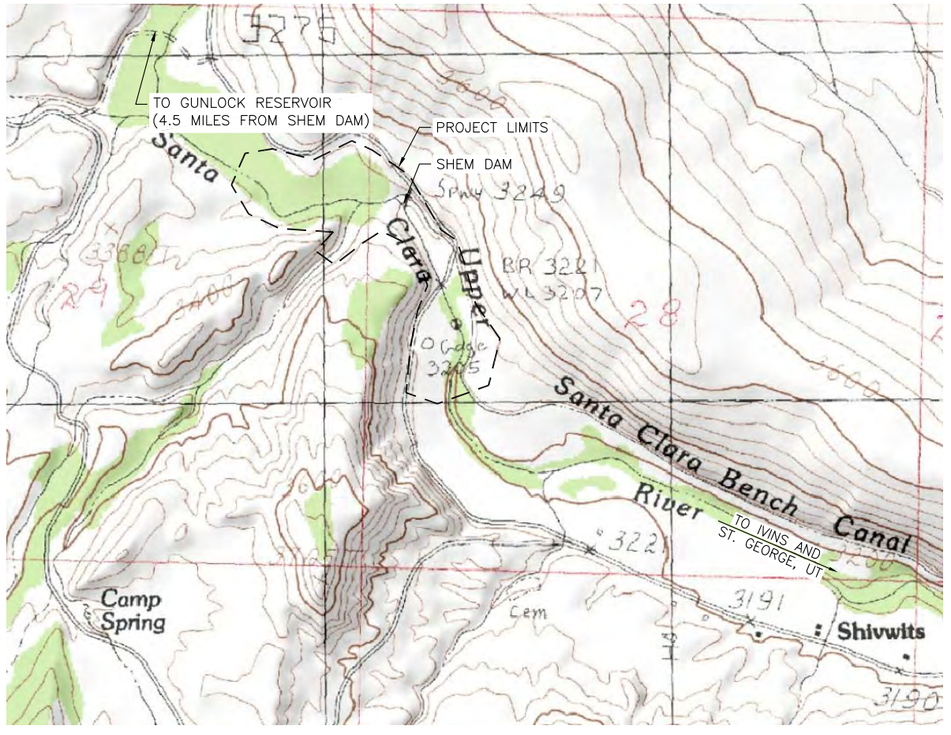
SHEM DAM REHABILITATION
FINAL CONCEPT DESIGN
WASHINGTON COUNTY



LOCATION MAP
NTS



VICINITY MAP
NTS



PROJECT LIMITS

SECTION 28, TOWNSHIP 41S, RANGE 17W
WASHINGTON COUNTY, UTAH
LATITUDE - 37°11'31.87"N
LONGITUDE - 113°46'11.15"W

GENERAL NOTES:

1. ELEVATIONS ARE NAVD 88 AND SHOWN IN FEET.
2. NO REPRESENTATION IS MADE AS TO THE EXISTENCE OR NON-EXISTENCE OF ANY UTILITIES, PUBLIC OR PRIVATE. WHERE BURIED UTILITIES ARE SHOWN ON THE DRAWINGS, THE LOCATION AND DEPTH MUST BE DETERMINED BY THE UTILITY COMPANY PRIOR TO ANY EXCAVATION IN THE VICINITY OF THE UTILITY. NO WORK SHALL BE DONE WITHIN TEN FEET OF ANY POWER LINES OR POLES WITHOUT THE POWER COMPANY BEING NOTIFIED. EXCAVATION OPERATIONS SHALL COMPLY WITH UTAH STANDARDS.
3. JURISDICTIONAL BOUNDARIES ARE APPROXIMATE AND DISPLAYED AS DOWNLOADED FROM UTAH GIS PORTAL (2012).

SHEET INDEX

DRAWING NO.	TITLE
	GENERAL
	COVER
G001	LOCATION MAP, VICINITY MAP, AERIAL PHOTO AND DRAWING INDEX
G002	STANDARD ABBREVIATIONS
G003	STANDARD SYMBOLS
G004	EXISTING SITE AND OVERALL KEY PLAN
G005	EXISTING HYDRAULIC PROFILE AND DESIGN CRITERIA
	CONSTRUCTION PHASING
EC100	EROSION AND SEDIMENT CONTROL PLAN
	CIVIL
GC001	CIVIL STANDARD DETAILS 1
C100	ALT 1 – CONTROLLED BREACH WITH CHANNEL REGRADE
C101	ALT 1 – CONTROLLED BREACH WITH CHANNEL REGRADE PROFILE
C102	ALT 1 – CONTROLLED BREACH WITH CHANNEL REGRADE SECTIONS
C200	ALT 2 – STEPPED ROCK CHUTE WITH ENERGY DISSIPATER
C201	ALT 2 – STEPPED ROCK CHUTE WITH ENERGY DISSIPATER PROFILE
C202	ALT 2 – STEPPED ROCK CHUTE WITH ENERGY DISSIPATER SECTIONS
C300	ALT 3 – STEPPED ROCK CHUTE SEQUENCE WITH ENERGY DISSIPATER
C301	ALT 3 – STEPPED ROCK CHUTE SEQUENCE WITH ENERGY DISSIPATER PROFILE
C302	ALT 3 – STEPPED ROCK CHUTE SEQUENCE WITH ENERGY DISSIPATER SECTIONS

NRCS

DATE: JANUARY 22, 2014
CAD FILENAME: _G001.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:
DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

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UTAH
UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
LOCATION MAP, VICINITY MAP, AERIAL
PHOTO AND DRAWING INDEX

SHEET
G001

A/C	AIR CONDITIONING
A/E	ARCHITECT/ENGINEER
A	ARCHITECTURAL (DWG DISCIPLINE), AMP
AB	ANCHOR BOLT
ABC	AGGREGATE BASE COURSE
ABAN	ABANDON
AC	ALTERNATING CURRENT
ACK	ACKNOWLEDGE
ACP	ACOUSTIC CEILING PANEL, ASPHALTIC CONCRETE PAVEMENT
ACST	ACOUSTIC
AD	ADDENDUM, AREA DRAIN
ADDL	ADDITIONAL
ADH	ADHESIVE
ADJ	ADJUSTABLE, ADJACENT
AF	AMP FRAME, AMP FUSE
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
AGGR	AGGREGATE
AI	AREA INLET
AIC	AMPS INTERRUPTING CAPACITY
ALIG	ALIGNMENT
ALUM	ALUMINUM
ALT	ALTERNATE, ALTITUDE
AM	ACOUSTICAL MATERIAL
AMB	AMBIENT
ANC	ANCHOR
AP	ACCESS PANEL
APRX	APPROXIMATE
APVD	APPROVED
ARCH	ARCHITECTURAL
ASSY	ASSEMBLY
AT	AMP TRIP
ATC	ACOUSTICAL TILE CEILING
ATM	ATMOSPHERE
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWG	AMERICAN WIRE GAGE
AWT	ACOUSTICAL WALL TILE
B/B	BACK TO BACK
BAL	BALANCE
BBD	BULLETIN BOARD
BC	BASE CABINET, BOTTOM CHORD, BOLT CENTER, BOLT CIRCLE
BD	BOARD
BE	BOTH ENDS, BELL END
BF	BOTH FACES, BOTTOM FACE, BLIND FLANGE, BOARD FEET
BITUM	BITUMINOUS
BKG	BACKING
BL	BASE LINE
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BENCHMARK, BEAM
BOC	BACK OF CURB
BOD	BOTTOM OF DUCT
BOG	BOTTOM OF GRILLE
BOL	BOTTOM OF LOUVER
BOP	BOTTOM OF PIPE
BOR	BOTTOM OF REGISTER
BOT	BOTTOM
BOU	BOTTOM OF UNIT
BP	BASE PLATE
BRG	BEARING
BRGP	BEARING PLATE
BRKT	BRACKET
BS	BOTH SIDES
BTU	BRITISH THERMAL UNIT
BTW	BETWEEN
BTWLD	BUTT WELD
BU	BELL UP, BUILT UP
BUR	BUILT-UP ROOFING
BW	BOTH WAYS
BYP	BYPASS
C TO C	CENTER TO CENTER
C&G	CURB & GUTTER
C	CHANNEL, SHAPE, CENTIGRADE, CONDUIT, CIVIL (DRAWING DISCIPLINE)
CAB	CABINET
CAP	CAPACITY
CAT	CATALOG
CAV	CAVITY
CB	CATCH BASIN
CCB	CONCRETE BLOCK
CCW	COUNTER CLOCKWISE
CDF	CONTROLLED DENSITY FILL
CE	CONCRETE EDGE
CER	CERAMIC
CF	CUBIC FEET (FOOT)
CFL	COUNTER FLASHING
CHFR	CHAMFER
CHBD	CHALKBOARD
CHD	CHORD
CHH	COMMUNICATION HANDHOLE
CI	CURB INLET
CIP	CAST-IN-PLACE
CIPB	CONCRETE INTERLOCKING PAVER BALLAST
CIRC	CIRCULATION, CIRCULAR
CJ	CONSTRUCTION JOINT
CKT	CIRCUIT
CL	CENTERLINE, CLASS, CLOSE
CLG	CEILING
CLJ	CONTROL JOINT
CLKG	CAULKING
CLR	CLEAR
CMH	COMMUNICATION MANHOLE
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT, CONCRETE OPENING
COL	COLUMN
COM	COMMON
COMB	COMBINATION
COMM	COMMUNICATION
COMP	COMPOSITION, COMPRESSIBLE, COMPOSITE
CONC	CONCENTRIC, CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
COOR	COORDINATE
CORR	CORROSIVE, CORRUGATED
CP	CHECKER PLATE, CONTROL POINT
CPLG	COUPLING
CRL	
CSC	

CSK	COUNTERSINK
CSS	CLINIC SERVICE SINK
CT	CERAMIC TILE
CTR	CENTER
CTRL	CONTROL
CVT	CULVERT
CU	COPPER, CUBIC
CW	CLOCKWISE
CY	CUBIC YARD
d	PENNY (NAIL MEASURE)
D	DEEP, DIFFUSER
DB	DUCT BANK, DECIBEL, DRY BULB
DBA	DEFORMED BAR ANCHOR
DBL	DOUBLE
DC	DIRECT CURRENT
DEG	DEGREE
DEG C	DEGREE CENTIGRADE
DEG F	DEGREE FAHRENHEIT
DEMO	DEMOLITION
DEP	DEPRESSED
DEPT	DEPARTMENT
DET	DETAIL
DI	DROP INLET, DUCTILE IRON
DIA	DIAMETER
DIAG	DIAGONAL, DIAGRAM
DIFF	DIFFERENTIAL, DIFFERENCE
DIM	DIMENSION
DISCH	DISCHARGE
DIST	DISTANCE, DISTRIBUTION
DIV	DIVISION
DL	DEAD LOAD
DMJ	DOUBLE MECHANICAL JOINT
DMPF	DAMP PROOFING
DN	DOWN
DO	DISSOLVED OXYGEN, DITTO
DP	DEPTH
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
DR	DRAIN, DIMENSION RATIO
DS	DOWN SPOUT
DT	DOUBLE TEE, DRIP TRAP ASSEMBLY
DUP	DUPLICATE
DWG	DRAWING
DWL	DOWEL
DWR	DRAWER
E	EAST, ELECTRICAL (DWG DISCIPLINE)
EA	EACH, EXHAUST AIR
EC	ELECTRICAL CONTRACTOR
ECC	ECCENTRIC
ED	EQUIPMENT DRAIN
EDB	ELECTRICAL DUCT BANK
EE	EACH END
EF	EACH FACE
EFF	EFFLUENT, EFFICIENCY
EHH	ELECTRICAL HANDHOLE
EIFS	EXTERIOR INSULATION & FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELBOW, ELEVATION
ELEC	ELECTRICAL
EMBD	EMBEDDED
EMER	EMERGENCY
EMH	ELECTRICAL MANHOLE
ENCL	ENCLOSURE
ENGR	ENGINEER
ENTR	ENTRANCE
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQUIP	EQUIPMENT
EQUIV	EQUIVALENT
ES	EACH SIDE, EQUAL SPACE, EMERGENCY SHOWER
ESEW	EMERGENCY SHOWER AND EYE WASH
EST	ESTIMATE
EW	EACH WAY, EMERGENCY EYE/FACE WASH
EWC	ELECTRIC WATER COOLER
EWEF	EACH WAY, EACH FACE
EWTB	EACH WAY, TOP AND BOTTOM
EXC	EXCAVATION
EXH	EXHAUST
EXST	EXISTING
EXP	EXPANSION, EXPOSED
EXT	EXTERIOR, EXTERNAL, EXTENSION
F&B	FACE & BYPASS
F TO F	FACE TO FACE
FAB	FABRICATE
FB	FLOOR BEAM
FBD	FIBERBOARD
FBG	FIBERGLASS
FBM	BOARD FOOT MEASURE
FBO	FURNISHED BY OWNER
FC	FLUSHING CONNECTION
FCA	FLANGED COUPLING ADAPTER
FD	FLOOR DRAIN
FDC	FLEXIBLE DUCT CONNECTION
FDTN	FOUNDATION
FDR	FEEDER
FE	FLANGED END
FEC	FIRE EXTINGUISHER CABINET
FES	FLARED END SECTION
FEXT	FIRE EXTINGUISHER
FF	FAR FACE, FACTORY FINISH, FLAT FACE
FG	FINISHED GRADE
FIG	FIGURE
FH	FIRE HYDRANT
FIN	FINISH
FJT	FLUSH JOINT
FL	FLOW, FLOW LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLOR	FLUORESCENT
FLR	FLOOR
FLS	FLASHING, FLUSH
FN	FENCE
FO	FINISHED OPENING
FOB	FENCE FLAT ON BOTTOM
FOC	FACE OF CONCRETE, FACE OF CURB
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOT	FLAT ON TOP
FPT	FEMALE PIPE THREAD
FR	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FRTM	FIRE RETARDANT TREATED MATERIAL
FS	FLOOR SINK, FAR SIDE

FT	FEET, FOOT
FTG	FOOTING, FITTING
FUR	FURRED, FURRING
FURN	FURNITURE, FURNISH
FUT	FUTURE
FV	FACE VELOCITY
FW	FIELD WELD, FIRE WALL
FWD	FORWARD
FWE	FURNISHED WITH EQUIPMENT
FXTR	FIXTURE
G	GRILLE, GROUND, GENERAL (DWG DISCIPLINE)
GA	GAGE (METAL THICKNESS)
GAL	GALLON
GALV	GALVANIZED
GB	GRAB BAR, GRADE BREAK
GC	GROOVED COUPLING
GD	GUARD
GEN	GENERAL
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFMU	GROUND FACE MASONRY UNIT
GG	GUTTER GRADE
GJ	GROOVED JOINT
GL	GLASS
GLB	GLASS BLOCK
GND	GROUND
GP	GUY POLE
GR	GRADE
GRTG	GRATING
GSB	GYPSUM SHEATHING BOARD
GT	GREASE TRAP
GVL	GRAVEL
GWB	GYPSUM WALLBOARD
GYP	GYPSUM HARDBOARD
H	HIGH
HB	HOSE BIB
HBD	HARDBOARD
HC	HANDICAPPED, HOLLOW CORE, HORIZONTAL CURVE
HC	HORIZONTAL CENTERLINE
HDR	HEADER
HDW	HARDWARE
HEX	HEXAGONAL
HGR	HANGER
HH	HANDHOLE
HID	HIGH INTENSITY DISCHARGE
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HP	HIGH POINT, HORSEPOWER
HPC	HORIZONTAL POINT OF CURVATURE
HPS	HIGH PRESSURE SODIUM
HPT	HORIZONTAL POINT OF TANGENCY
HR	HOSE REEL, HOUR
HS	HEADED STUD, HIGH STRENGTH
HSS	HOLLOW STRUCTURAL SHAPE
HT	HEIGHT
HTG	HEATING
HV	HIGH VOLTAGE
HVAC	HEATING, VENTILATION & AIR CONDITIONING
HWD	HARDWOOD
HWL	HIGH WATER LEVEL
HYD	HYDRAULIC
HZ	HERTZ, CYCLES PER SECOND
I	INSTRUMENTATION (DWG DISCIPLINE)
ID	INSIDE DIAMETER, INTERIOR DIMENSION
IE	INVERT ELEVATION
IF	INSIDE FACE
IH	INTAKE HOOD
IMP	IMPACT
IN	INCH
INC	INCLUDE, INCANDESCENT
INF	INFLUENT
INSTR	INSTRUMENTATION
INSUL	INSULATION
INT	INTERIOR, INTERSECTION
INTR	INTERMEDIATE, INTERIOR
INV	INVERT
IPS	IRON PIPE SIZE
IPT	INTERNAL PIPE THREAD
IR	INSIDE RADIUS
IRR	IRRIGATION
ISO	ISOMETRIC
JB	JUNCTION BOX
JCT	JUNCTION
JF	JOINT FILLER
JST	JOIST
JT	JOINT
K	KIP
KB	KNEE BRACE
KCMIL	THOUSAND CIRCULAR MILS
KD	KNOCK DOWN
KO	KNOCK OUT
KSI	KIPS PER SQUARE INCH
L	ANGLE, LENGTH, LAVATORY
LAD	LADDER
LAM	LAMINATE
LATL	LATERAL
LB	LAG BOLT, POUND
LCTB	LIQUID CHALK AND TACK BOARD
LDG	LANDING
LDR	LEADER
LE	LIFTING EYE
LF	LINEAR FOOT
LG	LONG
LH	LEFT HAND
LIN	LINEAR
LIQ	LIQUID
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LMLU	LIQUID MARKER LECTURE UNIT
LNG	LONGITUDINAL
LOC	LOCATION
LP	LOW POINT
LPS	LOW PRESSURE SODIUM
LR	LONG RADIUS
LT	LEFT
LTD	LIMITED
LTG	LIGHTING
LTL	LINTEL
LTNG	LIGHTNING

LV	LOW VOLTAGE
LVR	LOUVER
LW	LIGHTWEIGHT
LWC	LIGHTWEIGHT CONCRETE
LWL	LOW WATER LEVEL
M	MECHANICAL (DWG DISCIPLINE)
MA	MIXED AIR
MACH	MACHINED
MAINT	MAINTENANCE
MAN	MANUAL
MATL	MATERIAL
MAX	MAXIMUM
MB	MACHINE BOLT
MBR	MEMBER
MC	MECHANICAL CONTRACTOR, MECHANICAL COUPLING
MCB	METAL CORNER BEAD
MCJ	MASONRY CONTROL JOINT
MDMJ	MODIFIED DOUBLE MECHANICAL JOINT
MECH	MECHANICAL
MED	MEDIUM
MFR	MANUFACTURER
MH	MANHOLE, METAL HALIDE
MIN	MINIMUM
MIR	MIRROR
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MLO	MAIN LUGS ONLY
MMB	MEMBRANE
MO	MASONRY OPENING
MOD	MODULAR, MODIFY
MON	MONUMENT
MPT	MALE PIPE THREAD
MRGWB	MOISTURE RESISTANT GYPSUM WALLBOARD
MS	MOP SINK
MSL	MEAN SEA LEVEL
MT	MOUNT
MU	MASONRY UNIT
MULL	MULLION
MV	MEDIUM VOLTAGE
MW	MONITORING WELL
N	NORTH, NEUTRAL
NA	NOT APPLICABLE
NAT	NATURAL
NC	NORMALLY CLOSED
NEG	NEGATIVE
NF	NEAR FACE, NON-FUSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NOM	NOMINAL
NPS	NOMINAL PIPE SIZE
NPT	NATIONAL PIPE THREAD
NS	NEAR SIDE
NTS	NOT TO SCALE
NWL	NORMAL WATER LEVEL
O TO O	OUT-TO-OUT
OA	OUTSIDE AIR, OVERALL
OC	ON CENTER
OCPD	OVER CURRENT PROTECTION DEVICE
OD	OUTSIDE DIAMETER
OED	OPEN END DUCT
OF	OUTSIDE FACE, OFFICE FURNISHING
OG	ORIGINAL GROUND
OH	OVERHEAD
OPNG	OPENING
OPP	OPPOSITE
OPT	OPTIONAL
OR	OUTSIDE RADIUS
ORD	OVERFLOW ROOF DRAIN
ORIG	ORIGINAL
OVFL	OVERFLOW
OVHG	OVERHANG
OZ	OUNCE
P	PAINT, PROCESS (DWG DISCIPLINE)
PA	PUBLIC ADDRESS
PAR	PARALLEL, PARAPET
PB	PANIC BAR, PULL BOX
PBD	PARTICLE BOARD
PC	POINT OF CURVE, PIECE, PRECAST
PCC	POINT OF COMPOUND CURVATURE
PCF	POUNDS PER CUBIC FOOT
PCT	PERCENT
PE	PLAIN END
PED	PEDESTAL
PEN	PENETRATION
PERF	PERFORATED
PERM	PERMANENT
PERP	PERPENDICULAR
PF	POWER FACTOR
PFMU	PREFACED MASONRY UNIT
PH	PHASE
PI	POINT OF INTERSECTION
PKG	PACKAGE
PL	PLATE, PROPERTY LINE
PLAS	PLASTER
PLAT	PLATFORM
PLBG	PLUMBING
PLF	POUNDS PER LINEAR FOOT
PNEU	PNEUMATIC
POL	POLISH
POS	POSITIVE, POSITION
PP	POLYPROPYLENE, POWER POLE
PRC	POINT OF REVERSE CURVATURE
PREF	PREFINISHED
PREFAB	PREFABRICATED
PRELIM	PRELIMINARY
PREP	PREPARE
PRES	PRESSURE
PRI	PRIMARY
PROP	PROPERTY
PROT	PROTECTION
PS	PIPE SUPPORT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAGE
PST	PRESTRESSED
PT	POINT, POINT OF TANGENCY
PTN	PARTITION
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PWD	PLYWOOD
PWJ	PLYWOOD WEB JOIST
PZ	PIEZOMETER

Q	RATE OF FLOW
QT	QUARRY TILE
QTR	QUARTER
QTY	QUANTITY
QUAL	QUALITY
R&R	REMOVE AND REPLACE
R&S	REMOVE AND SALVAGE
R	RADIUS, REGISTER, RISER
RA	RETURN AIR
RB	RESILIENT BASE, ROCK BERM
RCPT	RECEPTACLE
RD	ROOF DRAIN
REC	RECESS
RECD	RECEIVED
RECT	RECTANGULAR
RED	REDUCER
REF	REFERENCE
REINF	REINFORCING
REM	REMOVE
REQD	REQUIRED
RESIL	RESILIENT
RET	RETAINING, RETURN
REV	REVISION, REVERSE
RF	RESILIENT FLOORING
RFG	ROOFING
RFL	REFLECTED, REFLECTOR
RGH	ROUGH
RGS	RIGID GALVANIZED STEEL
RGS-PVC	PVC COATED RGS
RH	RELIEF HOOD, RIGHT HAND, RELATIVE HUMIDITY
RL	REQUIRED LAP
RLFA	RELIEF AIR
RND	ROUND
RNG	RUNNING
RO	ROUGH OPENING
ROW	RIGHT OF WAY
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RSP	ROCK SLOPE PROTECTION
RT	RIGHT
RVT	RESILIENT VINYL TILE
RY	READY
S	SOUTH, SINK, STRUCTURAL (DWG DISCIPLINE)
SA	SUPPLY AIR
SAMU	SOUND ABSORBING MASONRY UNIT
SAN	SANITARY
SB	SPLASH BLOCK
SC	SOLID CORE
SCH	SCHEDULE
SCHEM	SCHEMATIC
SCN	SCREEN
SE	STEEL/ALUMINUM EDGE
SEC	SECONDARY, SECONDS
SECT	SECTION
SEP	SEPARATE
SF	SQUARE FOOT
SG	SHEET GLASS, SEALANT GROOVE
SH	SHOWER
SHT	SHEET
SHTG	SHEATHING
SIL	SILENCE
SIM	SIMILAR
SL	SLOPE
SLTD	SLOTTED
SLV	SLEEVE
SMLS	SEAMLESS
SOG	SLAB ON GRADE
SP	SOUNDPROOF, STANDPIPE
SPA	SPACING
SPEC	SPECIFICATION
SPLY	SUPPLY
SPST	SINGLE POLE SINGLE THROW
SPT	SET POINT
SQ	SQUARE
SR	SHORT RADIUS
SS	SERVICE SINK
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STIF	STIFFENER
STIR	STIRRUP
STL	STEEL
STOR	STORAGE
STR	STRUCTURAL, STRAIGHT
SUB	SUBSTITUTE
SUC	SUCTION
SUSP	SUSPENDED
SY	SQUARE YARD
SYM	SYMBOL
SYMM	SYMMETRICAL
SYN	SYNTHETIC
SYS	SYSTEM
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
T	TILE, TREAD
TA	TOILET ACCESSORY, TEMPERED AIR
TAN	TANGENT
TBM	TEMPORARY BENCHMARK
TCE	TEMPORARY CONSTRUCTION EASEMENT
TEF	TROWELED EPOXY FLOORING
TEMP	TEMPORARY, TEMPERATURE
THD	THREAD
THK	THICK
THRESH	THRESHOLD
THRU	THROUGH
TKBD	TACK BOARD
TOB	TOP OF BOLT, TOP OF BANK, TOP OF BEAM
TOC	TOP OF CURB, TOP OF CONCRETE
TOD	TOP OF DUCT
TOF	TOP OF FOOTING
TOG	TOP OF GRATING
TOL	TOLERANCE, TOP OF LEDGER
TOM	TOP OF MASONRY
TOP	TOP OF PLATE
TOPO	TOPOGRAPHY
TOS	TOP OF SLAB, TOP OF STEEL
TOW	TOP OF WALL
TP	TOILET PARTITION, TELEPHONE POLE, TOE PLATE, TRAP PRIMER
TPD	TOILET PAPER DISPENSER
TPG	TOPPING
TR	TRANSOM
TRANS	TRANSITION

TRD	TRENCH DRAIN
TYP	TYPICAL
U	URINAL
UG	UNDERGROUND
ULT	ULTIMATE
UNFN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UTIL	UTILITY
V	VENT, VELOCITY, VOLT
VA	VOLT AMPERE
VAC	VACUUM
VAR	VARNISH, VARIABLE, VOLT AMPERES REACTIVE
VB	VAPOR BARRIER, VINYL BASE, VALVE BOX
VC	VERTICAL CURVE
VCT	VINYL COMPOSITION TILE, VERTICAL CENTERLINE
VEL	VELOCITY
VENT	VENTILATION
VERT	VERTICAL
VG	VERTICAL GRAIN
VIF	VERIFY IN FIELD
VIN	VINYL
VS	VERSES, VAPOR SEAL
VOL	VOLUME
VPC	VERTICAL POINT OF CURVATURE
VPI	VERTICAL POINT OF INTERSECTION
VPT	VERTICAL POINT OF TANGENCY
VTR	VENT THROUGH ROOF
VWC	VINYL WALL COVERING
W/	WITH
W/O	WITHOUT
W	WATT, WEST, WIDE, WINDOW, WIRE, WIDE FLANGE BEAM
WB	WOOD BASE
WC	WATER CLOSET, WATER COLUMN
WD	WOOD, WIDTH
WF	WIDE FLANGE, WASH FOUNTAIN
WG	WIRE GLASS, WATER GAGE
WH	WALL HYDRANT, WEEP HOLE
WI	WROUGHT IRON
WL	WATER LEVEL
WLD	WELDED
WM	WIRE MESH
WP	WATERPROOF, WORKING POINT
WTHP	WEATHERPROOF
WS	WATERSTOP, WATER SURFACE
WSCT	WAINSCOT
WT	WEIGHT, WATER TIGHT
WWF	WELDED WIRE FABRIC
XP	EXPLOSION PROOF
XS	EXTRA STRONG
XXS	DOUBLE EXTRA STRONG
XSECT	CROSS SECTION
YH	YARD HYDRANT
YS	YIELD STRENGTH

GENERAL NOTES:

1. THESE ABBREVIATIONS APPLY TO THE ENTIRE SET OF CONTRACT DRAWINGS.
2. LISTING OF ABBREVIATIONS DOES NOT IMPLY ALL ABBREVIATIONS ARE USED IN THE CONTRACT DRAWINGS.
3. ABBREVIATIONS SHOWN ON THIS SHEET INCLUDE VARIATIONS OF THE WORD. FOR EXAMPLE, "MOD" MAY MEAN MODIFY OR MODIFICATION; "INC" MAY MEAN INCLUDED OR INCLUDING; "REINF" MAY MEAN EITHER REINFORCE OR REINFORCING.
4. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.

NRCS

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS
DATE: JANUARY 22, 2014
CAD FILENAME: _G002.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4010
SALT LAKE CITY, UT 84138-1100

McMILLEN, LLC
1401 SHORELINE DR.
BOISE, ID 83702
OFFICE: 208.342.4214
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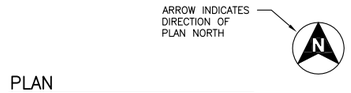
UTAH

UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
STANDARD ABBREVIATIONS

SHEET
G002

SHEET SYMBOLS



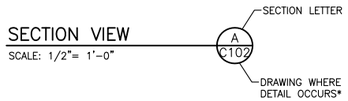
PLAN
SCALE: 1/2"= 1'-0"

SECTION IDENTIFICATION

(1) SECTION CUT ON DRAWING C102:

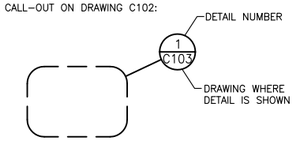


(2) ON DRAWING C103 THIS SECTION IS IDENTIFIED AS:

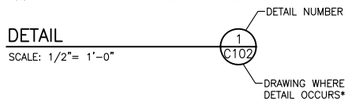


DETAIL IDENTIFICATION

(1) DETAIL CALL-OUT ON DRAWING C102:



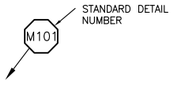
(2) ON DRAWING C103 THIS SECTION IS IDENTIFIED AS:



*NOTE: IF PLAN AND SECTION (OR DETAIL CALL-OUT AND DETAIL) ARE SHOWN ON SAME DRAWING. DRAWING NUMBER IS REPLACED BY A LINE.

STANDARD DETAIL IDENTIFICATION

(1) DETAIL CALL-OUT ON PLAN OR SECTION:



(2) ON DETAIL DRAWINGS, IDENTIFIED AS:



SITE PLAN LINE TYPES

X X	FENCE LINE
P P	OVERHEAD POWER
455	MAJOR CONTOUR
456	MINOR CONTOUR
. . .	EDGE OF WATERLINE
TOE	TOE OF SLOPE
TOB	TOP OF BANK
SS SS	SANITARY SEWER
SD SD	STORM DRAIN
EP EP	EDGE OF PAVEMENT
EG EG	EDGE OF GRAVEL
W	WATTLE
SF SF	SILT FENCE
CF CF	CONSTRUCTION FENCE
GAS	GAS LINE

SITE PLAN SYMBOLS

	CONIFER TREE: FIR, SPRUCE, LARCH OR PINE, 8" DIAMETER OR LARGER.
	DECIDUOUS TREE: COTTONWOOD, HAWTHORN, ASPEN, 8" DIAMETER OR LARGER.
MH	MANHOLE
EB	ELECTRIC BOX
	STORM DRAIN MANHOLE
FH	FIRE HYDRANT
YH-X	YARD HYDRANT
	SURVEY CONTROL POINT, AS NOTED.
	POLE ANCHOR
	POWER POLE
	LIGHT POLE
	SIGN

HATCH SYMBOLS

	ROCK, TYPE AS NOTED (PLAN/SECTION)
	BED ROCK
	EXISTING GRADE (SECTION)
	NEW SOIL (SECTION)
	CONCRETE (SECTION/PLAN)
	SAND, GROUT (PLAN/SECTION)
	STEEL (SECTION)
	GRATING (PLAN)
	MASONRY (PLAN)
	WOOD, SIZE/TYPE AS NOTED (PLAN)
	WOOD, SIZE/TYPE AS NOTED (SECTION)
	RIP RAP (PLAN/SECTION)
	RIGID INSULATION (SECTION)
	ASPHALT CONCRETE PAVEMENT SURFACE (PLAN/SECTION)
	GRASS (PLAN)
	BATT INSULATION (SECTION)

GENERAL NOTES:

1. ALL SYMBOLS ARE NOT NECESSARILY USED THIS IS A STANDARD DRAWING SHOWING COMMON SYMBOLS ON THIS PROJECT.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH DRAWING FOR USAGE.

NRCS

DATE: JANUARY 22, 2014
CAD FILENAME: _G003.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4010
SALT LAKE CITY, UT 84138-1100

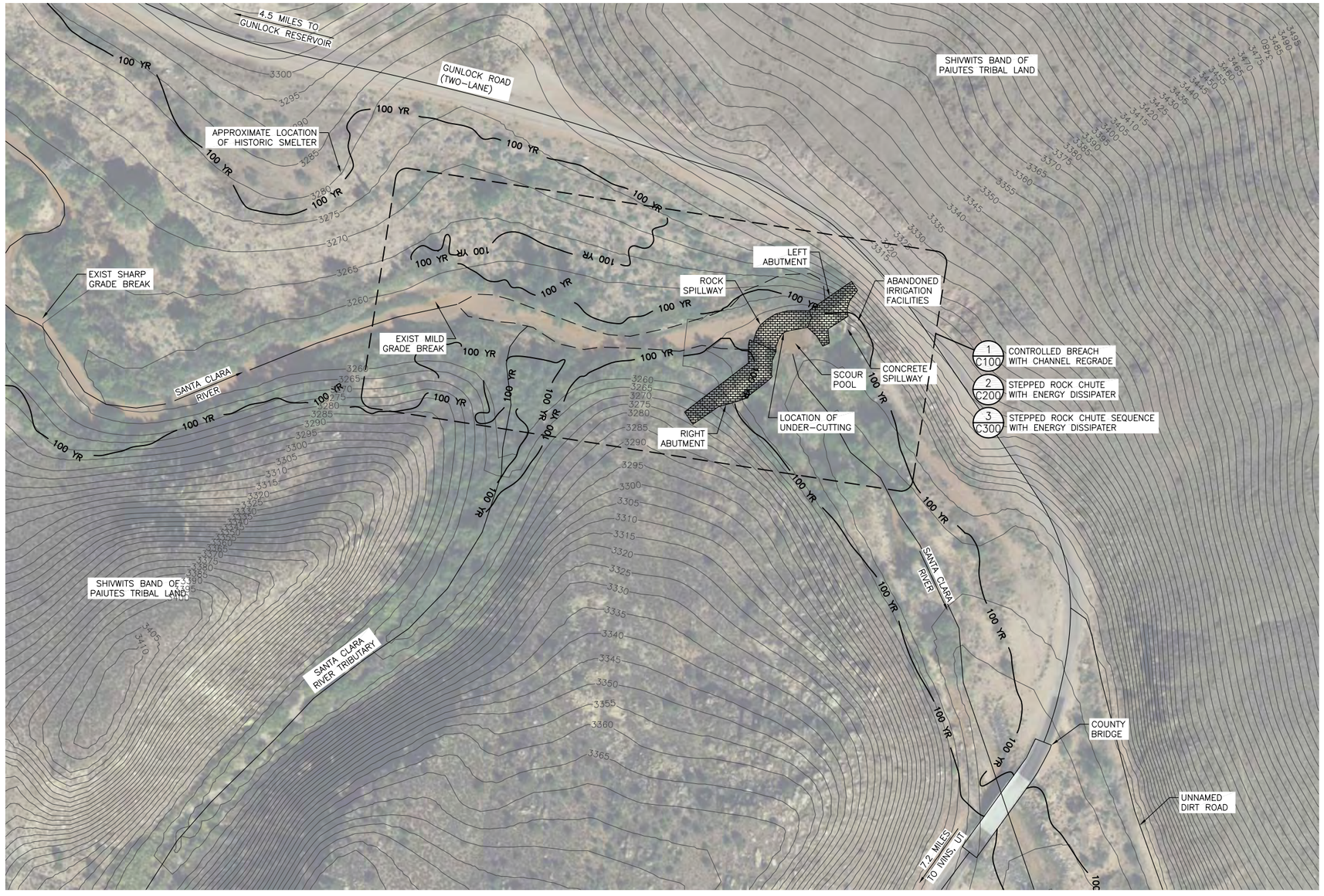
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UTAH

UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
STANDARD SYMBOLS

SHEET
G003



SHEET NOTES:

1. ELEVATION CONTOURS FROM 10-METER RESOLUTION NATIONAL ELEVATION DATASET (NED). ELEVATIONS ASSUMED IN FEET.
2. 100-YEAR WATER SURFACE EXTENTS PROVIDED BY FEMA.

LEGEND:

100 YR — 100-YR WATER SURFACE EXTENTS

EXISTING SITE AND OVERALL KEY PLAN

SCALE: 1" = 100'

0" 100' 200'

N

NRCS

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

DATE: JANUARY 22, 2014
CAD FILENAME: _0604.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

NATURAL RESOURCES CONSERVATION SERVICE
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SALT LAKE CITY, UT 84138-1100

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UTAH

UTAH COUNTY

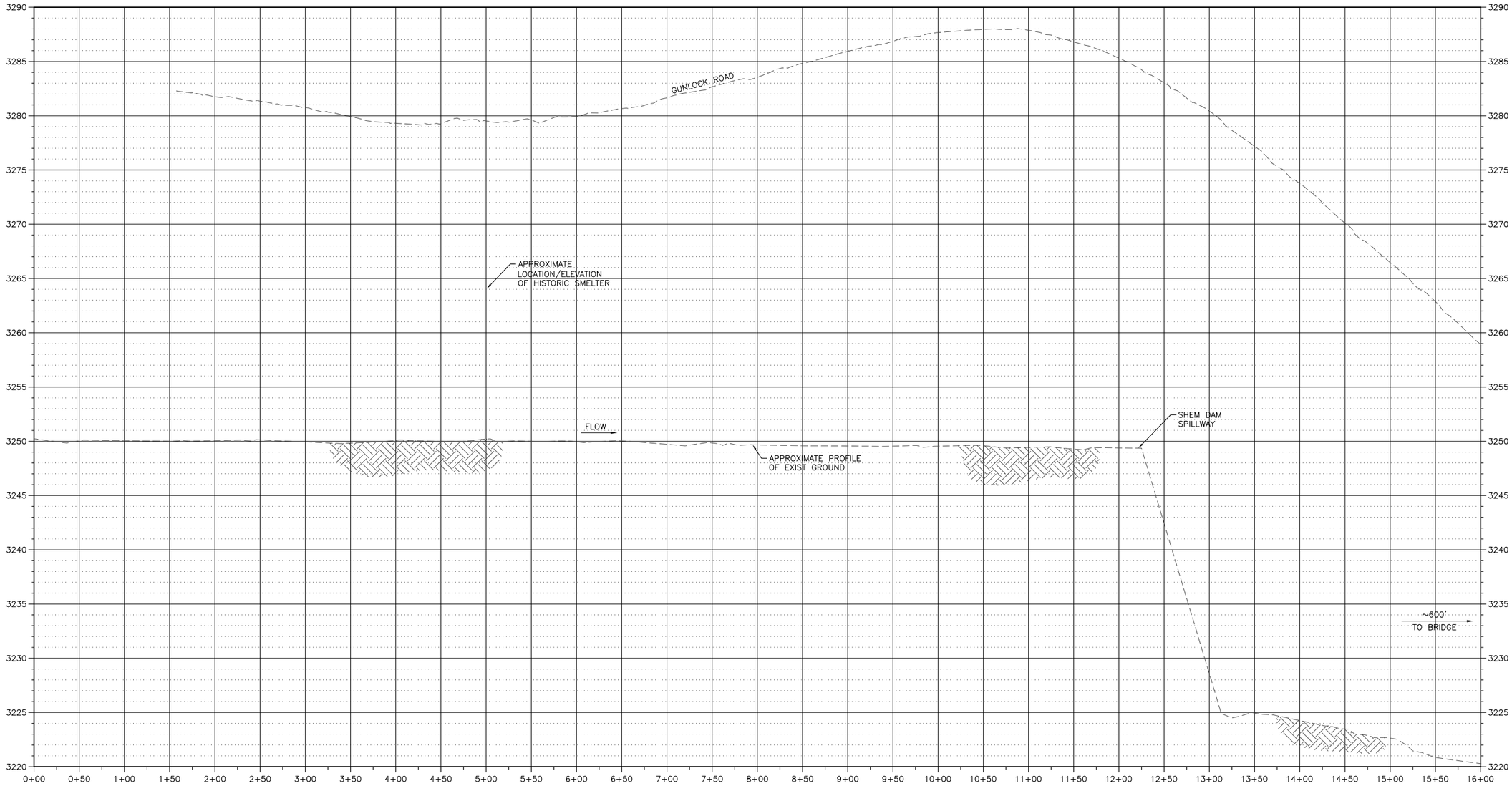
NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
EXISTING SITE AND
OVERALL KEY PLAN

SHEET
G004

PROJECT DESIGN CRITERIA					
CRITERIA	VALUE	CRITERIA	VALUE	CRITERIA	VALUE
DRAINAGE BASIN		**RESERVOIR**		**HYDROLOGY**	
TOTAL WATERSHED AREA (SQ MI)	378	HISTORIC CHANNEL SLOPE	0.0055	2-YR FLOW (CFS)	405
WATERSHED ABOVE GUNLOCK RESERVOIR (REGULATED) (SQ MI)	313	ESTIMATED TOTAL SEDIMENT VOLUME IN POOL (AF)	121	25-YR FLOW (CFS)	2,737
WATERSHED BETWEEN GUNLOCK AND SHEM DAMS (SQ MI)	65	ESTIMATED SEDIMENT VOLUME TO BE EXCAVATED (FT^3)		100-YR FLOW (CFS)	4.675
MEAN ANNUAL PRECIPITATION (IN)	18.1			STRUCTURE DESIGN FLOW (CFS)	11,000
MEAN BASIN ELEVATION (FT)	5730				

SHEET NOTES:

1. EXISTING GROUND ELEVATION FROM NRCS-SUPPLIED LIDAR DATASET. ELEVATIONS ARE IN FEET.
2. EXCEEDANCE FLOWS ARE 100-YEAR = 4,675 CFS, 25-YEAR = 2,737 CFS, AND 2-YEAR = 405 CFS.
3. HYDROLOGY BASED ON BULLETIN 17B PROCEDURE USING HISTORICAL FLOWS OUT OF GUNLOCK RESERVOIR COMBINED WITH USGS STREAMSTATS PROCEDURE USING SUB-WATERSHED BETWEEN SHEM DAM AND GUNLOCK DAM.



EXISTING HYDRAULIC PROFILE AND HYDRAULIC CRITERIA

HORIZ SCALE: 1"= 60'
VERT SCALE: 1"= 5'

0" 60' 120'
0" 5' 10'

NRCS

DATE: JANUARY 22, 2014
CAD FILENAME: _G005.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

NATURAL RESOURCES CONSERVATION SERVICE
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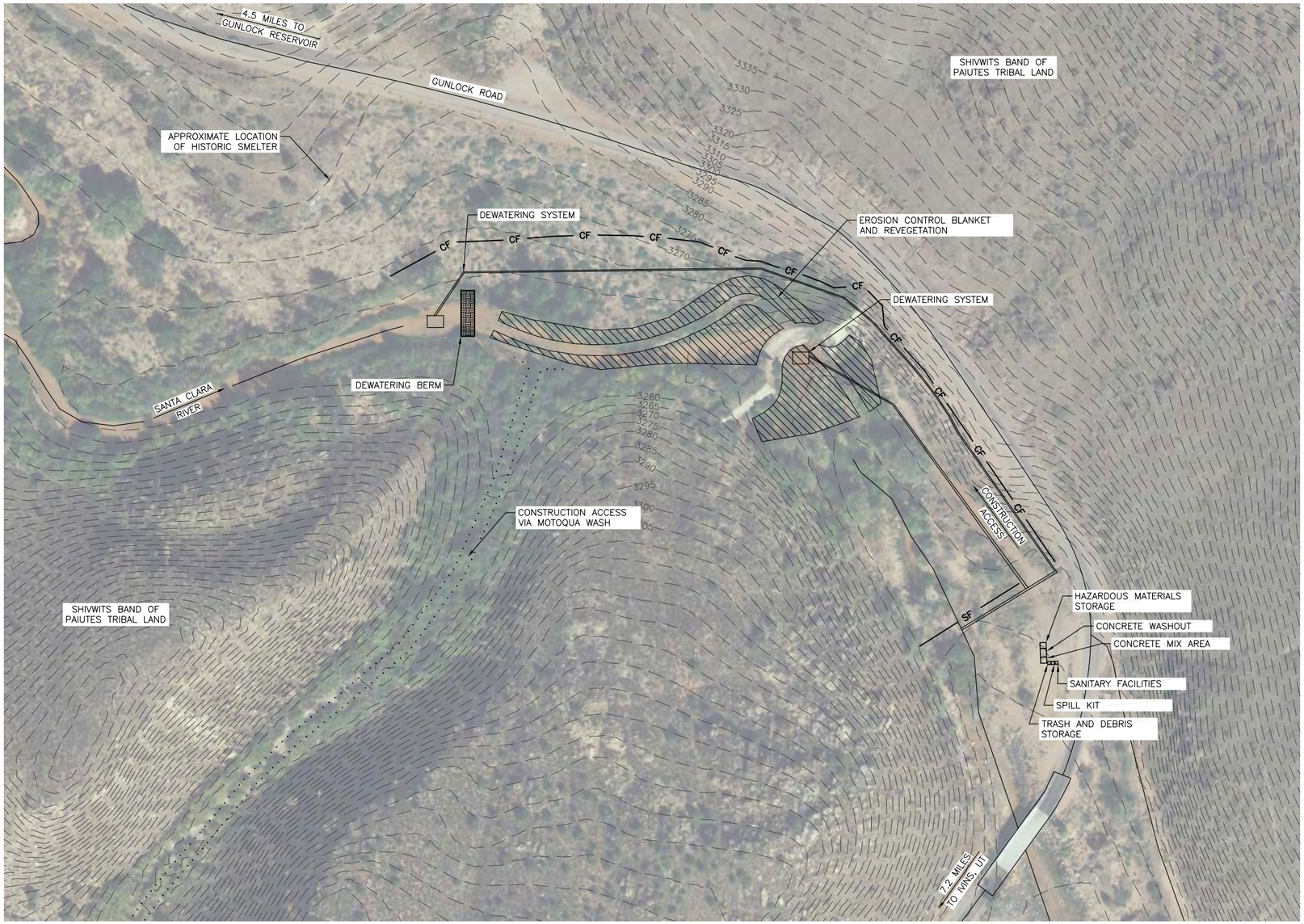
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UTAH

UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
EXISTING HYDRAULIC PROFILE
AND HYDRAULIC CRITERIA

SHEET
G005



EROSION AND SEDIMENT CONTROL PLAN

SCALE: 1" = 100'

0" 100' 200'

N

EROSION CONTROL NOTES:

1. ENSURE ALL EQUIPMENT IS CLEAN AND FREE OF OIL/FUEL LEAKS, DIRT, PLANTS AND ANIMALS OR FRAGMENTS OF PLANTS, ANIMALS, AQUATIC INVASIVE SPECIES, AND OTHER VEGETATIVE MATTER PRIOR TO BEGINNING WORK.
2. INSTALL TEMPORARY CONCRETE WASHOUT FACILITY AND SIGNAGE AT LEAST 50-FT FROM OPEN DITCHES AND WATER BODIES.
3. VEHICLE AND EQUIPMENT MAINTENANCE SHALL FOLLOW BEST MANAGEMENT PRACTICES (BMPS). RE-FUELING SHALL OCCUR AS FAR AWAY FROM WATER BODIES AS POSSIBLE. SECONDARY CATCHMENT PROCEDURES ARE REQUIRED FOR RE-FUELING.
4. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON SITE WITHIN THE LIMITS OF CONSTRUCTION AREA. LARGE COBBLES AND BOULDERS SHALL BE RE-USED FOR RIPRAP AND BANK PROTECTION WHERE APPROPRIATE. REMAINING MATERIAL SHALL BE GRADED ON SITE AND USED FOR BACKFILL WHERE SUITABLE, OR TRANSPORTED OFFSITE TO A LOCAL DISPOSAL FACILITY.
5. ALL TOPSOIL SHALL BE STRIPPED AND PLACED IN A SEPARATE STOCKPILE UPON COMPLETION OF CONSTRUCTION. THE BANKS WILL BE GRADED TO FINISH GRADELINES, TOPSOIL PLACED, AND RE-SEEDED.

SHEET KEY NOTES:

A ACTUAL CONSTRUCTION LIMITS MAY VARY, DEPENDING ON THE PROJECT ALTERNATIVE IMPLEMENTED.

B CONTRACTOR SHALL CLEAR AND GRUB ONLY THAT AREA WITHIN THE LIMITS OF CONSTRUCTION NECESSARY TO SUPPORT REHABILITATION.

C THE DAM WILL BE REHABILITATED IN ONE SEASON. CONSTRUCTION ACCESS WILL BE PROVIDED TO THE SOUTH, NEAR THE PULLOUT ALONG HIGHWAY 91, AND VIA MOTOQUA WASH TO THE SOUTHWEST. STAGING WILL BE PROVIDED AS NECESSARY.

LEGEND:

- CF — CONSTRUCTION FENCE
- SF — SILT FENCE
- EROSION CONTROL BLANKET
- CONSTRUCTION ACCESS

NRCS

DATE: JANUARY 22, 2014
CAD FILENAME: EC100.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

DESIGNED BY: K. JENSEN
DRAWN BY: J. JOHNSON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

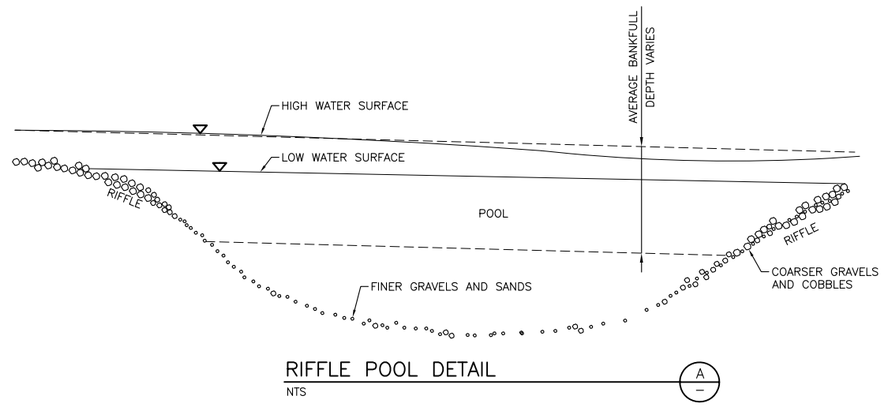
NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4010
SALT LAKE CITY, UT 84138-1100

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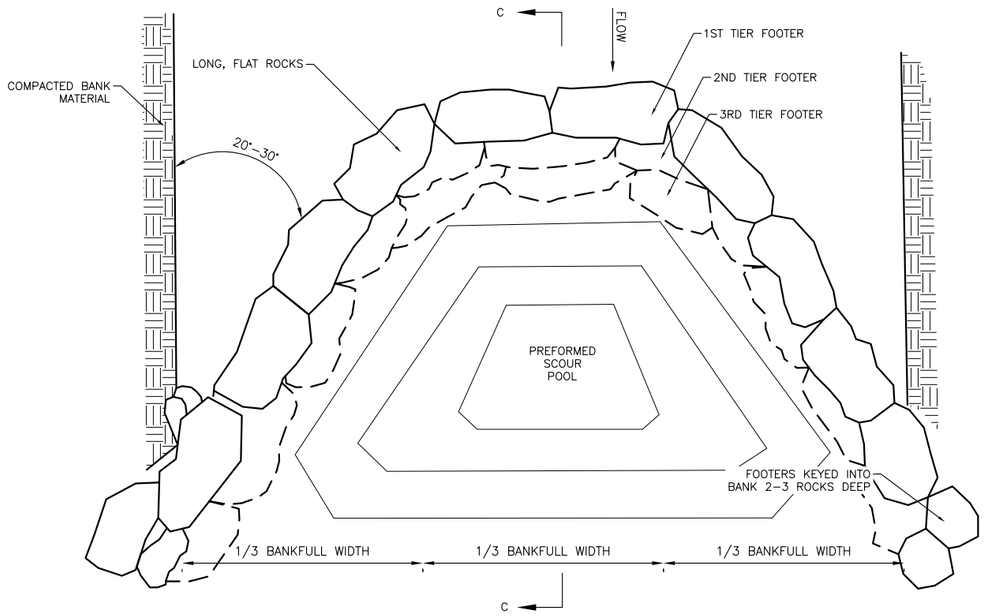
UTAH COUNTY UTAH

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
EROSION AND SEDIMENT CONTROL PLAN

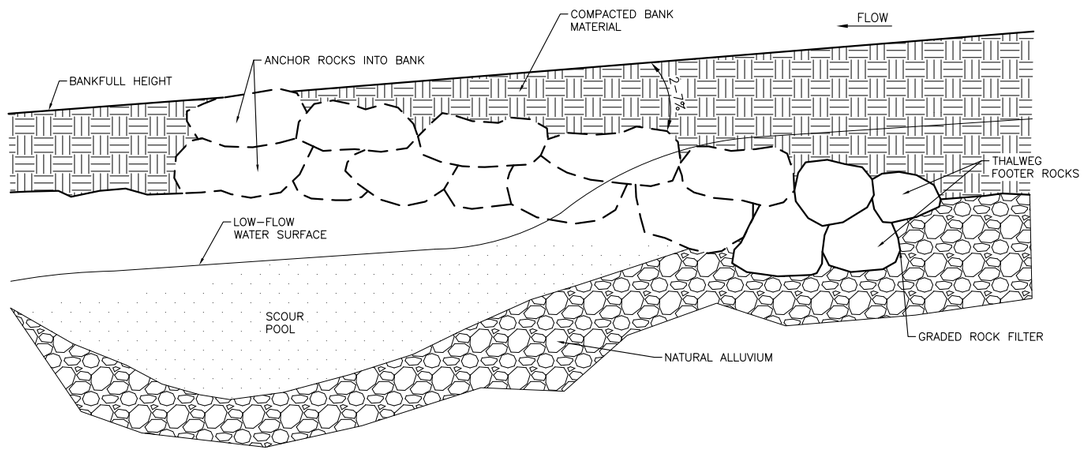
SHEET
EC100



RIFFLE POOL DETAIL
NTS
A
–



ROCK CROSS VANE PLAN DETAIL
NTS
B
–



ROCK CROSS VANE PROFILE DETAIL
NTS
C
–

NRCS

DATE: JANUARY 22, 2014
CAD FILENAME: _GC001.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

NATURAL RESOURCES CONSERVATION SERVICE
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UTAH
UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
CIVIL STANDARD DETAILS 1

SHEET
GC001

SHEET NOTES:

1. ELEVATION CONTOURS FROM 1-METER LIDAR DATASET PROVIDED BY NRCS. ELEVATIONS ASSUMED IN FEET.

LEGEND:

DEMOLITION AREA

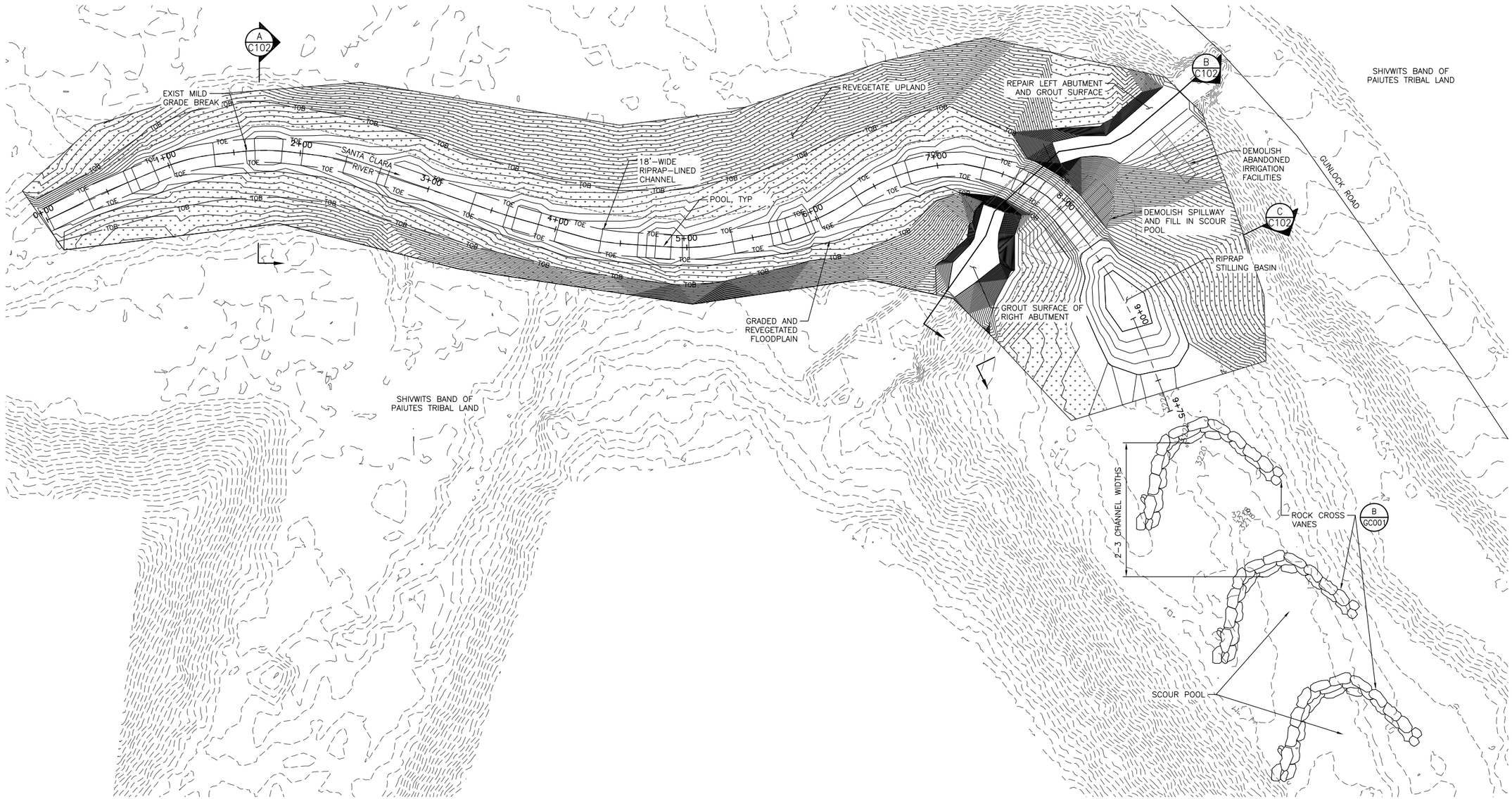
REVEGETATION AREA

TOB — TOP OF BANK

TOE — TOE OF BANK

GENERAL NOTES:

ALTERNATIVE 1 – CONTROLLED BREACH WITH CHANNEL REGRADE: THIS ALTERNATIVE BEGINS APPROXIMATELY 800 FT UPSTREAM OF THE EXISTING DAM. THE CHANNEL WILL BE REGRADED AT APPROXIMATELY A 3% SLOPE, AND THE REGRADING WILL CONTINUE TO APPROXIMATELY 200 FEET DOWNSTREAM OF THE EXISTING DAM. THE PLANFORM OF THE NEW CHANNEL WILL MEANDER SLIGHTLY IN ORDER TO RUN ROUGHLY PARALLEL WITH GUNLOCK ROAD AT THE EXISTING DAM SITE. A GRADED FLOODPLAIN WILL BE ACTIVATED AT THE 2-YEAR FLOW, WHERE POSSIBLE. THE FLOODPLAIN AND OVERBANK AREA WILL CONTAIN A GEOTEXTILE FOR EROSION CONTROL AND WILL BE RESEEDED WITH NATIVE GRASSES, SHRUBS AND TREES. THE EXISTING LEFT ABUTMENT AND SPILLWAY WILL BE REPAIRED. BOTH ABUTMENTS WILL BE STRUCTURALLY REINFORCED. USEABLE BOULDERS FROM THE SPILLWAY DEMOLITION WILL BE USED IN BANK REVETMENT AND CHANNEL REGRADING, WHERE APPROPRIATE. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON SITE WITHIN THE LIMITS OF THE CONSTRUCTION AREA. EXCAVATED MATERIAL SHALL BE GRADED ON SITE AND USED FOR BACKFILL WHERE SUITABLE, OR TRANSPORTED OFFSITE TO A LOCAL DISPOSAL FACILITY.



ALT 1 - CONTROLLED BREACH WITH CHANNEL REGRADE

SCALE: 1" = 40'

0" 40' 80'

N

NRCS

DATE: JANUARY 22, 2014
CAD FILENAME: _C100.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

NATURAL RESOURCES CONSERVATION SERVICE
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SALT LAKE CITY, UT 84138-1100

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UTAH

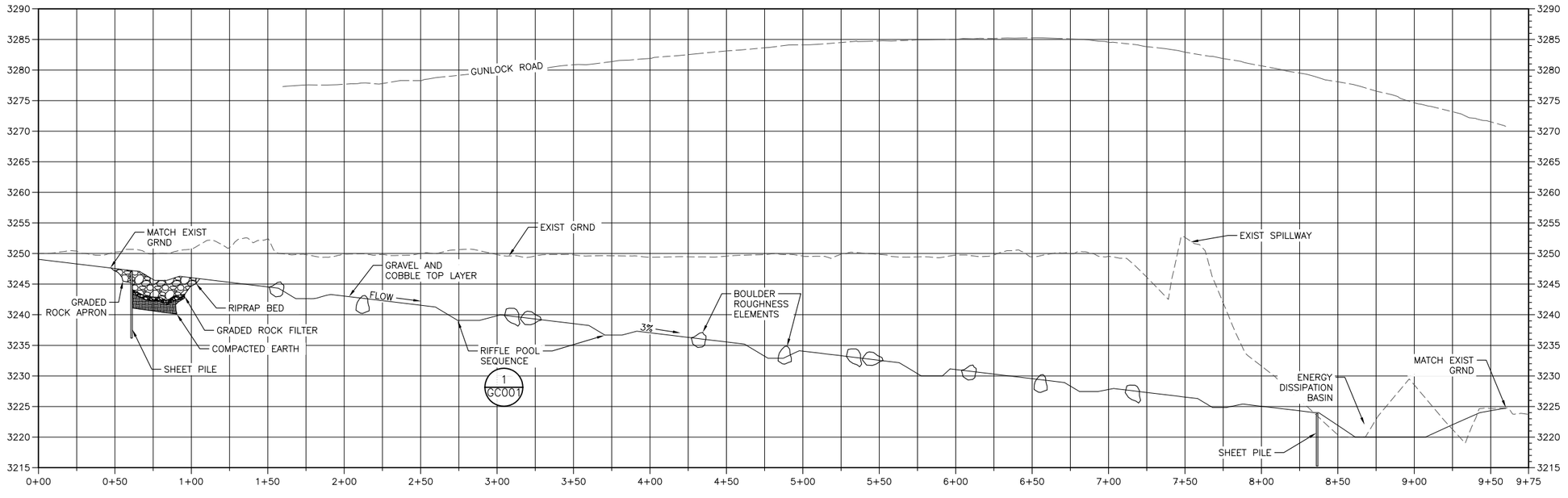
UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
ALT 1 - CONTROLLED BREACH
WITH CHANNEL REGRADE

SHEET
C100

SHEET NOTES:

1. GRADE CHANNEL AT APPROX 3% SLOPE; INCLUDE RIFFLE POOL SEQUENCE WITH PERIOD OF APPROX 3 CHANNEL WIDTHS.
2. DEMOLISH EXIST LEFT ABUTMENT AND SPILLWAY.
3. LINE NEW CHANNEL WITH GRADED ROCK FILTER, RIPRAP BED, AND GRADED COBBLE AND GRAVEL LAYER; ADD BOULDER ROUGHNESS ELEMENTS INTERMITTENTLY..
4. DRIVE THREE SHEET PILE CUTOFF WALLS EXTENDING TO 100-YEAR FLOOD EXTENTS.



ALT 1 – CONTROLLED BREACH WITH CHANNEL REGRADE PROFILE

SCALE: HORIZ 1" = 40'
VERT 1" = 5'

0" 5' 10'

NRCS

DATE: JANUARY 22, 2014
CAD FILENAME: _C101.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4010
SALT LAKE CITY, UT 84138-1100

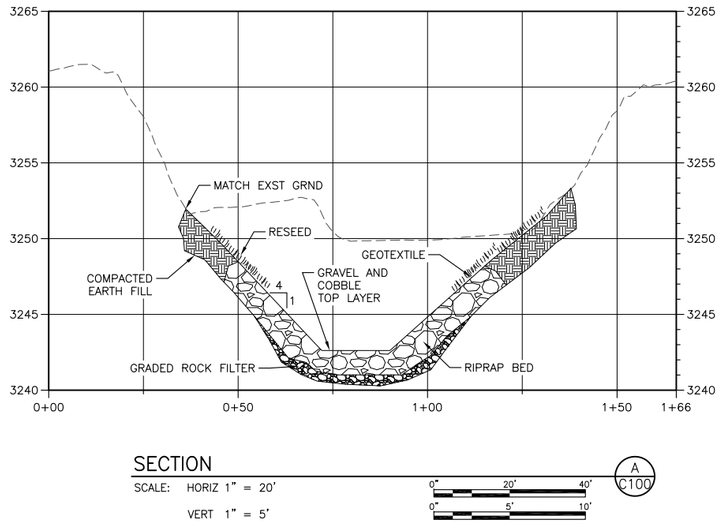
McMILLEN, LLC
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UTAH

UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
ALT 1 - CONTROLLED BREACH WITH CHANNEL REGRADE PROFILE

SHEET
C101

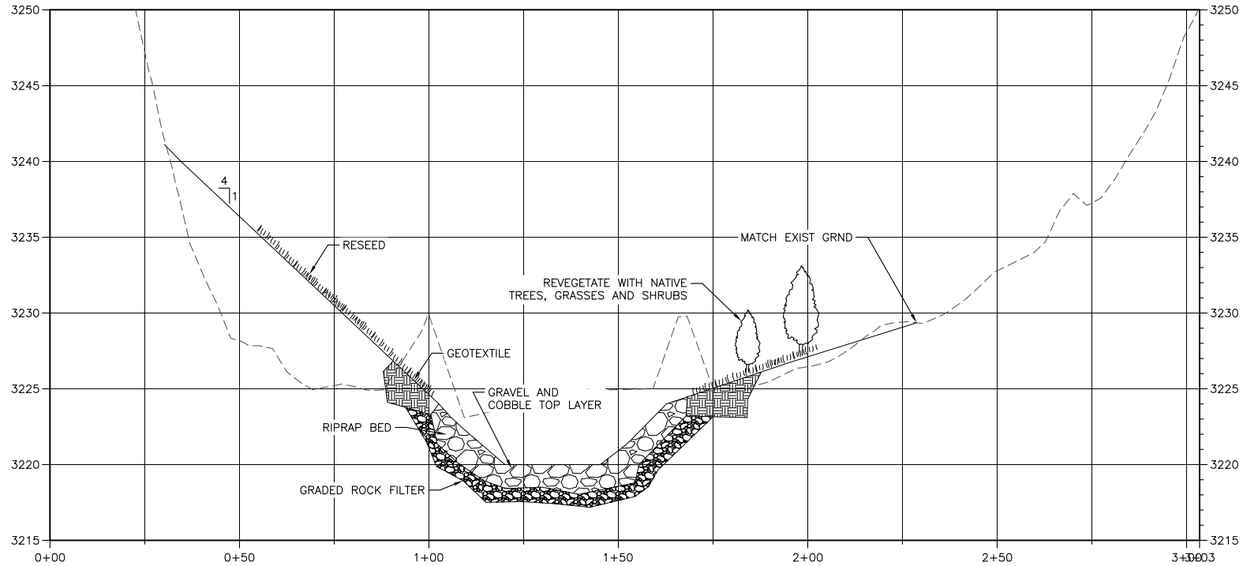


SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

A C100

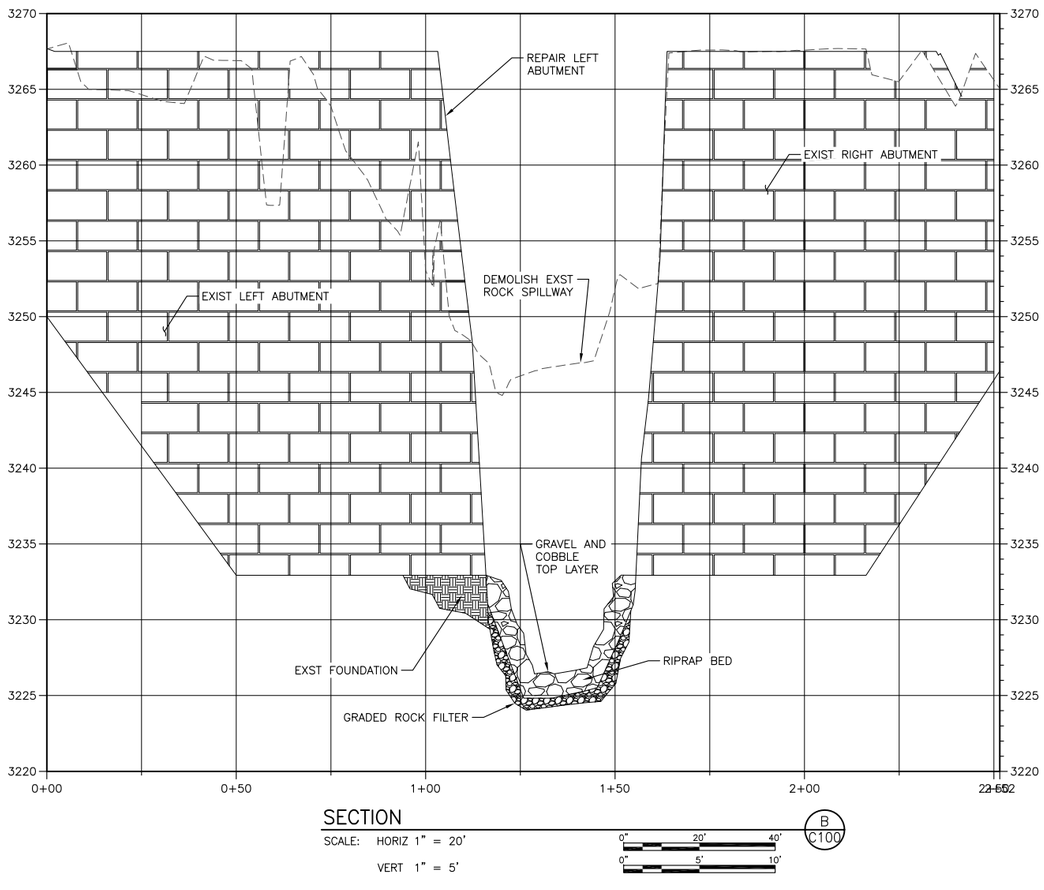


SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

C C100



SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

B C100

NRCS

DESIGNED BY: K. JENSEN

DRAWN BY: J. LAMMON

CHECKED BY: D. AXNESS

SUBMITTED BY: D. AXNESS

DATE: JANUARY 22, 2014

CAD FILENAME: _C102.DWG

CONTRACT NUMBER:

TASK ORDER NUMBER:

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4010
SALT LAKE CITY, UT 84138-1100

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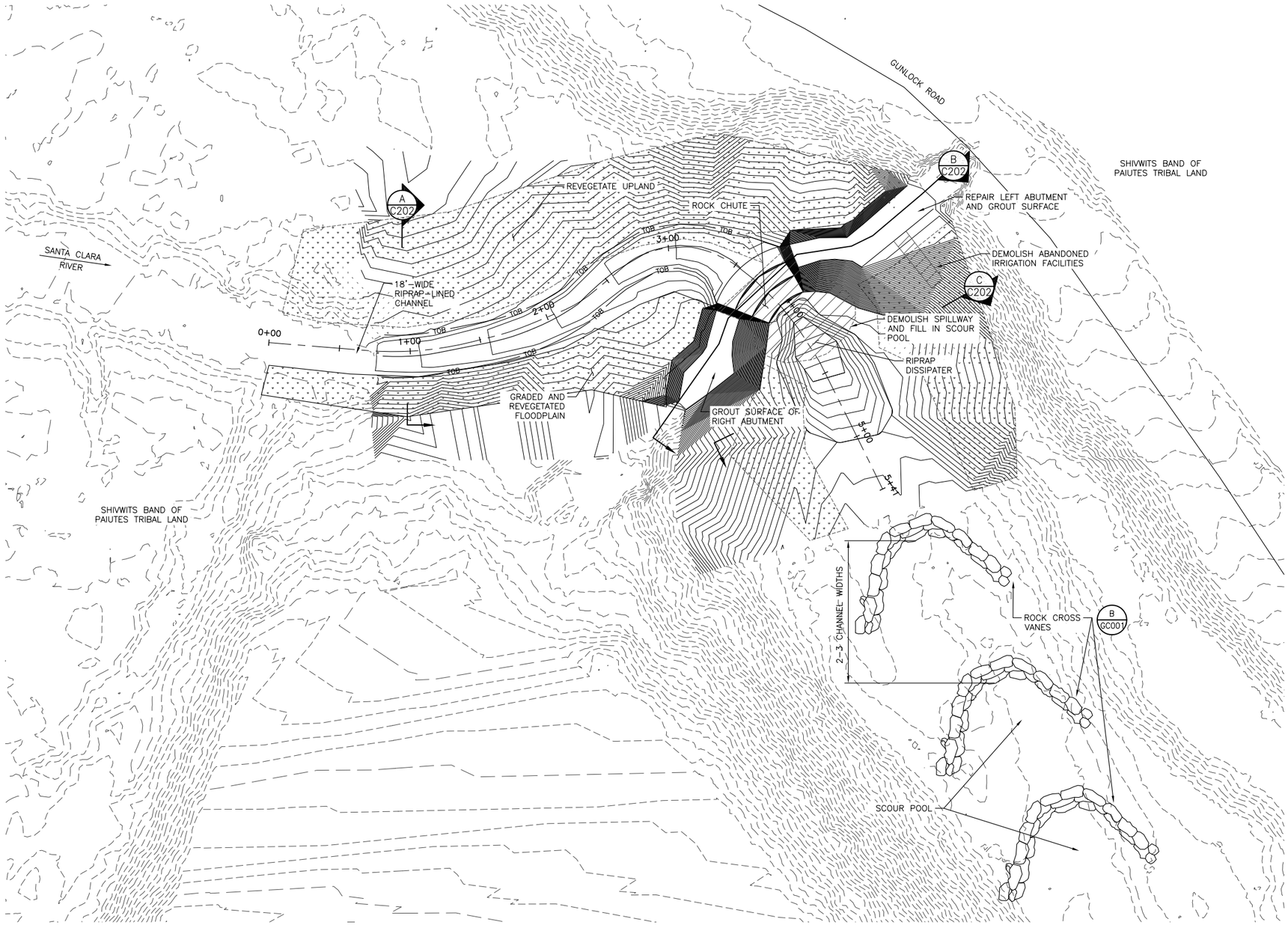
UTAH

UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
ALT 1 - CONTROLLED BREACH WITH
CHANNEL REGRADE SECTIONS

SHEET

C102



ALT 2 - STEPPED ROCK CHUTE WITH ENERGY DISSIPATOR

SCALE: 1" = 40'

0' 40' 80'

N

SHEET NOTES:

1. ELEVATION CONTOURS FROM 1-METER LIDAR DATASET PROVIDED BY NRCS. ELEVATIONS ASSUMED IN FEET.

GENERAL NOTES:

ALTERNATIVE 2 – STEPPED ROCK CHUTE WITH ENERGY DISSIPATER: THIS ALTERNATIVE BEGINS APPROXIMATELY 350 FT UPSTREAM OF THE EXISTING DAM. THE CHANNEL WILL BE REGRADED AT APPROXIMATELY A 2.5% SLOPE UPSTREAM AND WILL LEAD INTO A STEPPED ROCK CHUTE WITH AN ENERGY DISSIPATER AT THE SITE OF THE EXISTING SPILLWAY. A GRADED FLOODPLAIN WILL BE ACTIVATED AT THE 2-YEAR FLOW, WHERE POSSIBLE. THE FLOODPLAIN AND OVERBANK AREA WILL CONTAIN A GEOTEXTILE FOR EROSION CONTROL AND WILL BE RESEEDED WITH NATIVE GRASSES, SHRUBS AND TREES. THE EXISTING LEFT ABUTMENT AND SPILLWAY WILL BE REPAIRED. BOTH ABUTMENTS WILL BE STRUCTURALLY REINFORCED. USEABLE BOULDERS FROM THE SPILLWAY DEMOLITION WILL BE USED IN BANK REVETMENT AND CHANNEL REGRADING, WHERE APPROPRIATE. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON SITE WITHIN THE LIMITS OF THE CONSTRUCTION AREA. EXCAVATED MATERIAL SHALL BE GRADED ON SITE AND USED FOR BACKFILL WHERE SUITABLE, OR TRANSPORTED OFFSITE TO A LOCAL DISPOSAL FACILITY.

LEGEND:

- DEMOLITION AREA
- REVEGETATION AREA
- TOB — TOP OF BANK
- TOE — TOE OF BANK

NRCS

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS
DATE: JANUARY 22, 2014
CAD FILENAME: _C200.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

NATURAL RESOURCES CONSERVATION SERVICE
125 S. STATE STREET, ROOM 4010
SALT LAKE CITY, UT 84138-1100

McMILLEN, LLC
1401 SHORELINE DR.
BOISE, ID 83702
OFFICE: 208.342.4214
FAX: 208.342.4216

UTAH

UTAH COUNTY

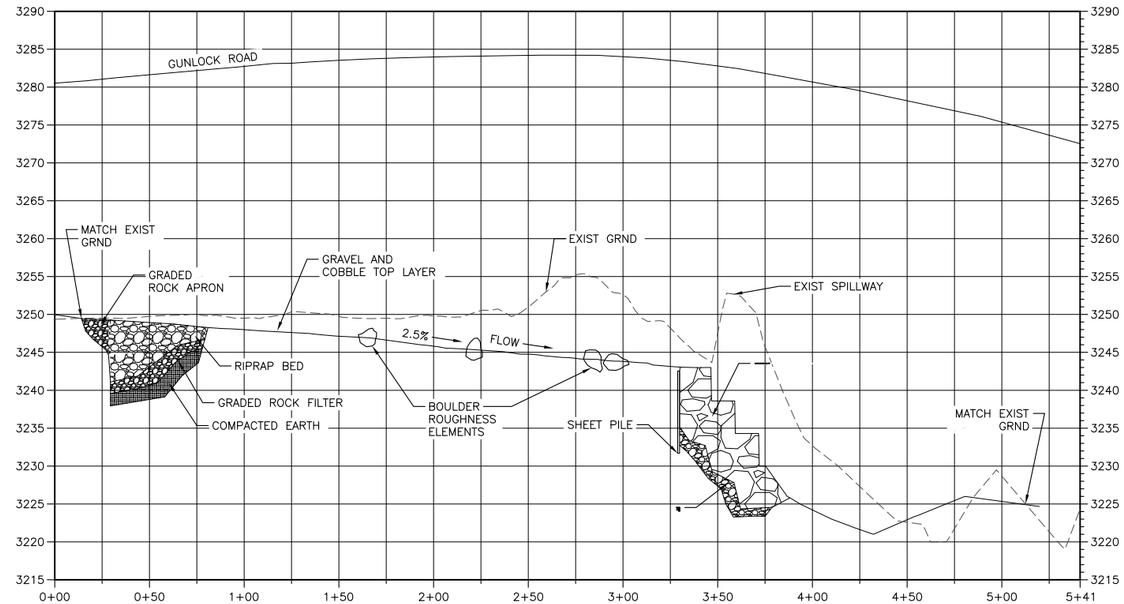
NRCS - SHEM DAM REHABILITATION PROJECT WASHINGTON COUNTY, UTAH ALT 2 - STEPPED ROCK CHUTE WITH ENERGY DISSIPATOR

SHEET

C200

SHEET NOTES:

1. GRADE CHANNEL AT APPROX 2.5% SLOPE TO STEPPED ROCK CHUTE AT EXIST SPILLWAY.
2. DEMOLISH EXIST SPILLWAY.
3. LINE NEW CHANNEL WITH GRADED ROCK FILTER, RIPRAP BED, AND GRADED COBBLE AND GRAVEL LAYER; ADD BOULDER ROUGHNESS ELEMENTS INTERMITTENTLY..
4. DRIVE TWO SHEET PILE CUTOFF WALLS: ONE UPSTREAM OF EXIST GRND CATCH LINE AND ONE UPSTREAM OF STEPPED ROCK CHUTE.



ALT 2 – STEPPED ROCK CHUTE WITH ENERGY DISSIPATOR PROFILE

SCALE: HORIZ 1" = 40'
VERT 1" = 5'

0" 40' 80'
0" 5' 10'

NRCS

DATE: JANUARY 22, 2014
CAD FILENAME: _C201.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4402
SALT LAKE CITY, UT 84138-1100

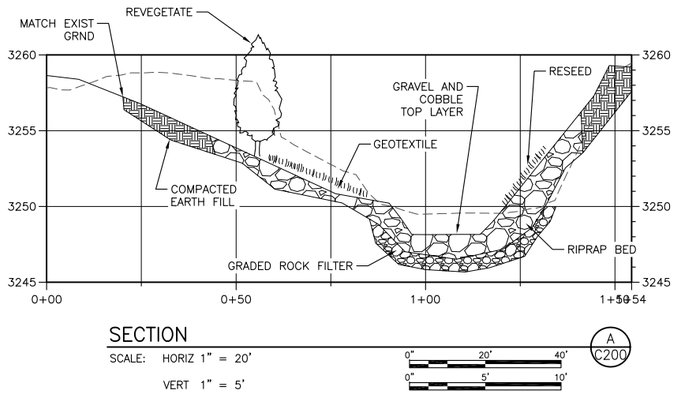
McMILLEN, LLC
1401 SHORELINE DR.
BOISE, ID 83702
OFFICE: 208.342.4214
FAX: 208.342.4216

UTAH

UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
ALT 2 - STEPPED ROCK CHUTE WITH
ENERGY DISSIPATOR PROFILE

SHEET
C201

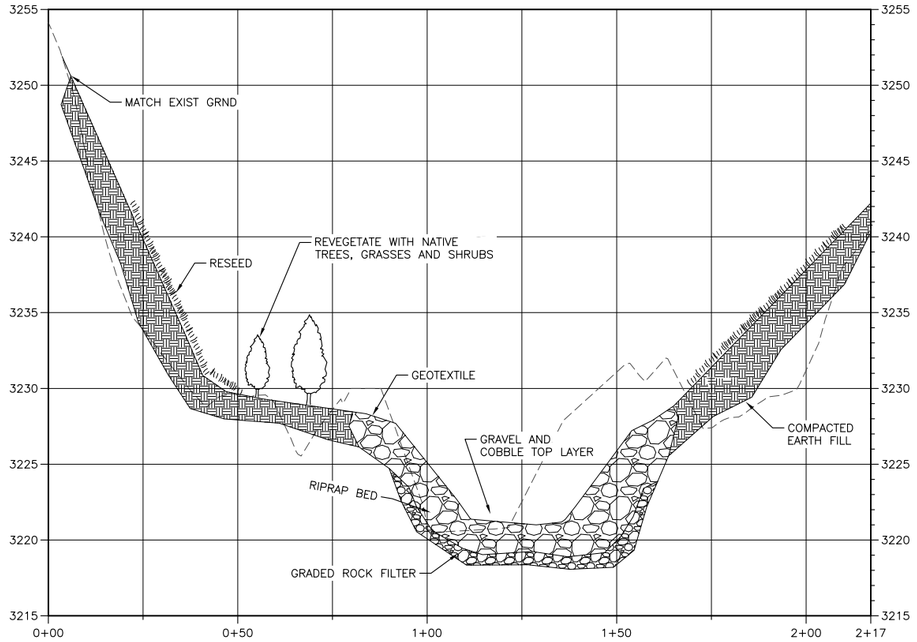


SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

A C200

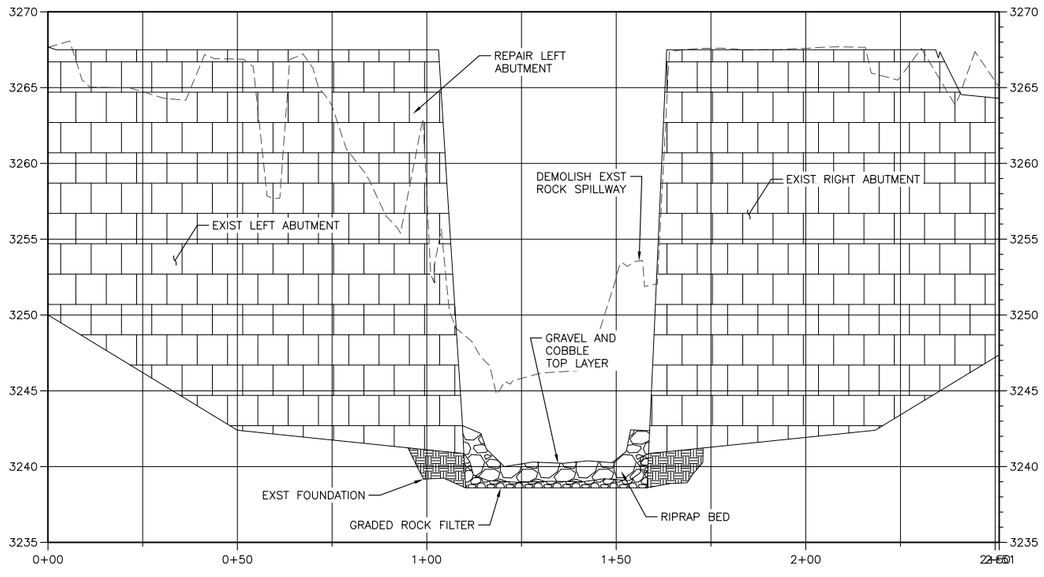


SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

C C200



SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

B C200

NRCS

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

DATE: JANUARY 22, 2014
CAD FILENAME: _C202.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4010
SALT LAKE CITY, UT 84138-1100

McMILLEN, LLC
1401 SHORELINE DR. BOISE, ID 83702
OFFICE: 208.342.4214
FAX: 208.342.4216

UTAH

UTAH COUNTY

NRCS - SHEM DAM REHABILITATION PROJECT WASHINGTON COUNTY, UTAH ALT 2 - STEPPED ROCK CHUTE WITH ENERGY DISSIPATOR SECTIONS

SHEET

C202

SHEET NOTES:

1. ELEVATION CONTOURS FROM 1-METER LIDAR DATASET PROVIDED BY NRCS. ELEVATIONS ASSUMED IN FEET.

LEGEND:

DEMOLITION AREA

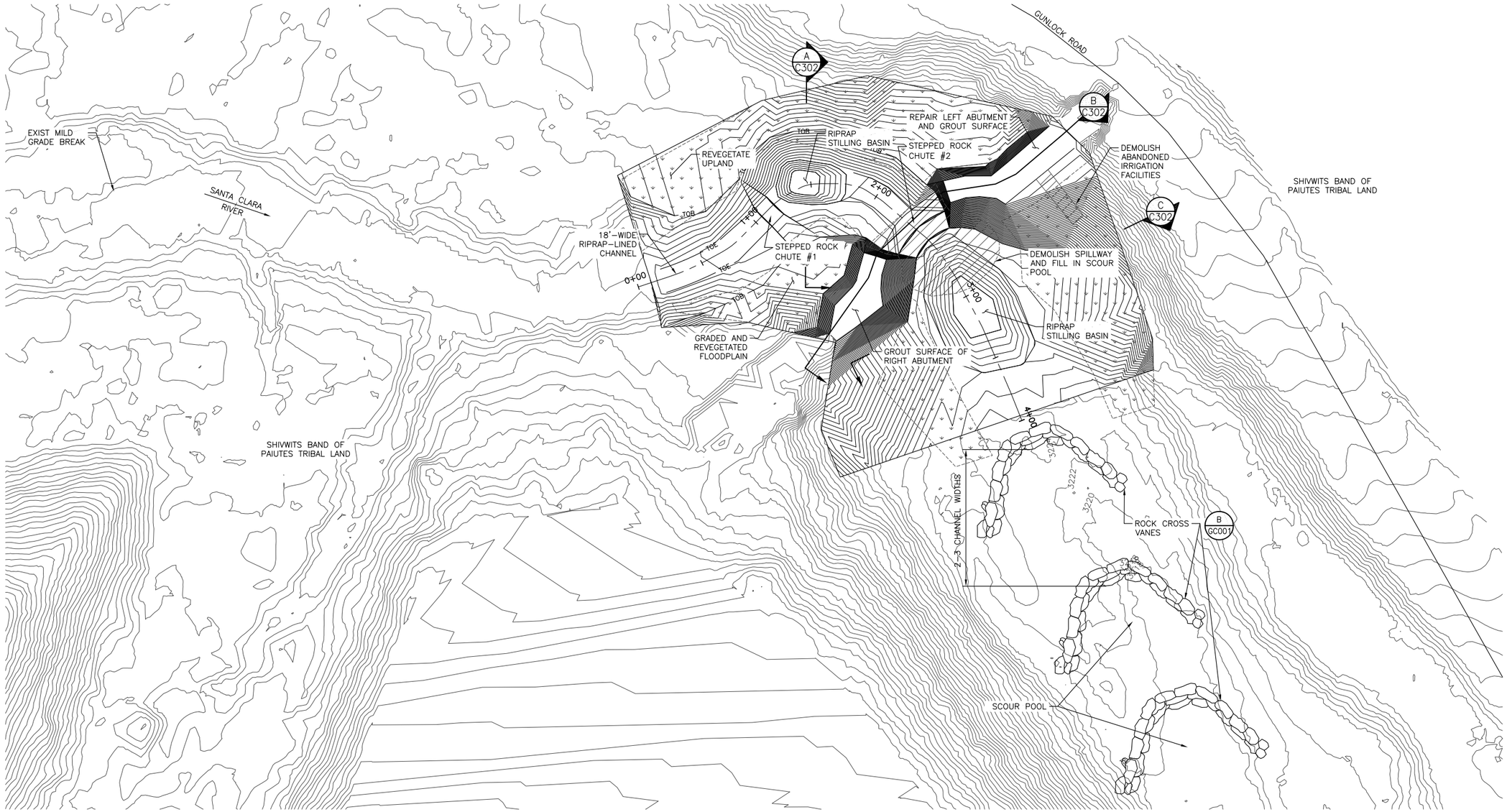
REVEGETATION AREA

TOB — TOP OF BANK

TOE — TOE OF BANK

GENERAL NOTES:

ALTERNATIVE 3 – STEPPED ROCK CHUTE SEQUENCE WITH ENERGY DISSIPATERS: THIS ALTERNATIVE BEGINS APPROXIMATELY 230 FT UPSTREAM OF THE EXISTING DAM. THE CHANNEL WILL BE REGRADED AT APPROXIMATELY A 2% SLOPE UPSTREAM AND WILL LEAD INTO A STEPPED ROCK CHUTE WITH AN ENERGY DISSIPATER AT THE TAILRACE. THE CHANNEL THEN CONTINUES AT APPRXIMATELY A 1% SLOPE AND AGAIN CASCADES OVER A STEPPED ROCK CHUTE AND INTO A FINAL ENERGY DISSIPATION BASIN. A GRADED FLOODPLAIN WILL BE ACTIVATED AT THE 2-YEAR FLOW, WHERE POSSIBLE. THE FLOODPLAIN AND OVERBANK AREA WILL CONTAIN A GEOTEXTILE FOR EROSION CONTROL AND WILL BE RESEEDED WITH NATIVE GRASSES, SHRUBS AND TREES. THE EXISTING LEFT ABUTMENT AND SPILLWAY WILL BE REPAIRED. BOTH ABUTMENTS WILL BE STRUCTURALLY REINFORCED. USEABLE BOULDERS FROM THE SPILLWAY DEMOLITION WILL BE USED IN BANK REVETMENT AND CHANNEL REGRADING, WHERE APPROPRIATE. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON SITE WITHIN THE LIMITS OF THE CONSTRUCTION AREA. EXCAVATED MATERIAL SHALL BE GRADED ON SITE AND USED FOR BACKFILL WHERE SUITABLE, OR TRANSPORTED OFFSITE TO A LOCAL DISPOSAL FACILITY.



ALT 3 - STEPPED ROCK CHUTE SEQUENCE WITH ENERGY DISSIPATER

SCALE: 1" = 40'

0" 40' 80'

N

NRCS

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

DATE: JANUARY 22, 2014
CAD FILENAME: _C300.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4010
SALT LAKE CITY, UT 84138-1100

McMILLEN, LLC
1401 SHORELINE DR.
BOISE, ID 83702
OFFICE: 208.342.4214
FAX: 208.342.4216

UTAH

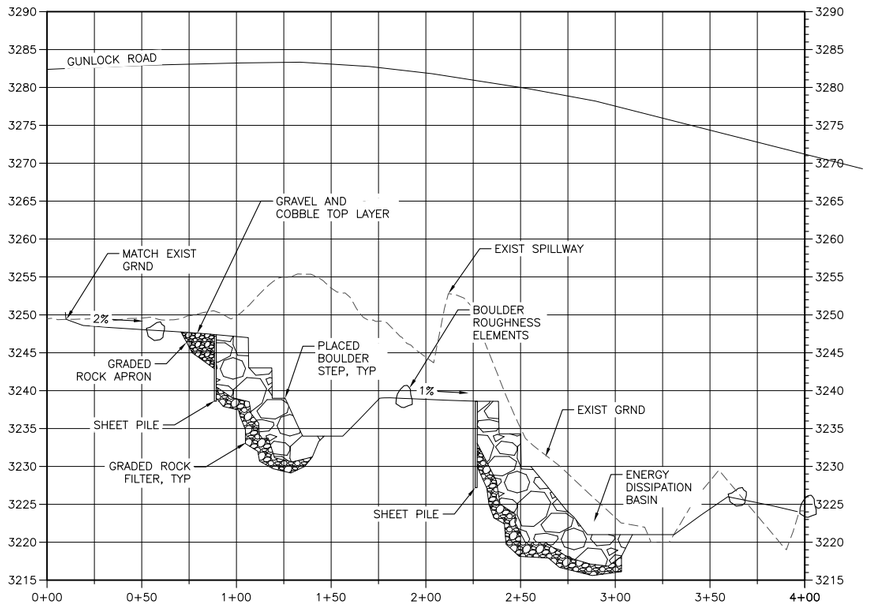
UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
ALT 3 - STEPPED ROCK CHUTE
SEQUENCE WITH ENERGY DISSIPATER

SHEET
C300

SHEET NOTES:

1. GRADE CHANNEL AT APPROX 2% SLOPE UPSTREAM OF ROCK CHUTE #1 AND AT 1% UPSTREAM OF ROCK CHUTE #2.
2. DEMOLISH EXIST SPILLWAY.
3. LINE NEW CHANNEL WITH GRADED ROCK FILTER, RIPRAP BED, AND GRADED COBBLE AND GRAVEL LAYER; ADD BOULDER ROUGHNESS ELEMENTS INTERMITTENTLY..
4. DRIVE TWO SHEET PILE CUTOFF WALLS; ONE UPSTREAM OF EACH STEPPED ROCK CHUTE.



ALT 3 – STEPPED ROCK CHUTE SEQUENCE ENERGY DISSIPATER PROFILE

SCALE: HORIZ 1" = 40'
VERT 1" = 5'

0" 5' 10'

NRCS

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

DATE: JANUARY 22, 2014
CAD FILENAME: _C301.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4402
SALT LAKE CITY, UT 84138-1100

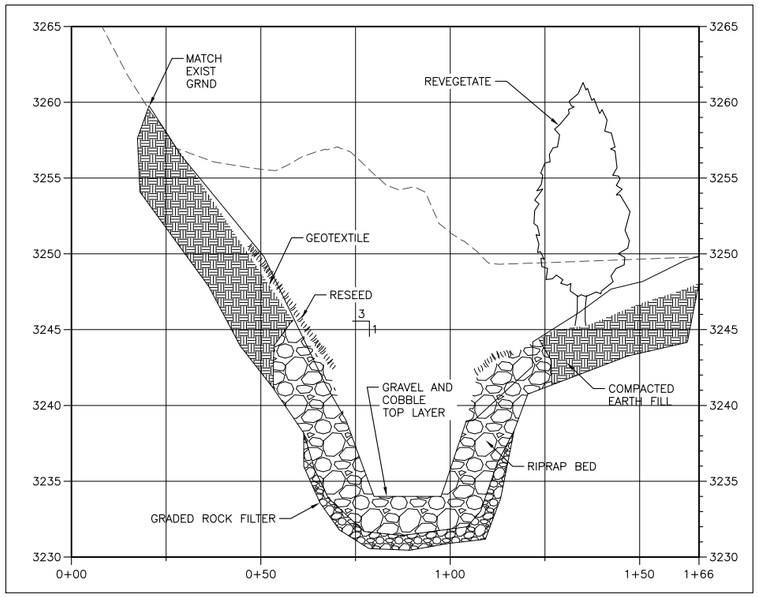
McMILLEN, LLC
1401 SHORELINE DR.
BOISE, ID 83702
OFFICE: 208.342.4214
FAX: 208.342.4216

UTAH

UTAH COUNTY

NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
ALT 3 - STEPPED ROCK CHUTE SEQUENCE
ENERGY DISSIPATER PROFILE

SHEET
C301

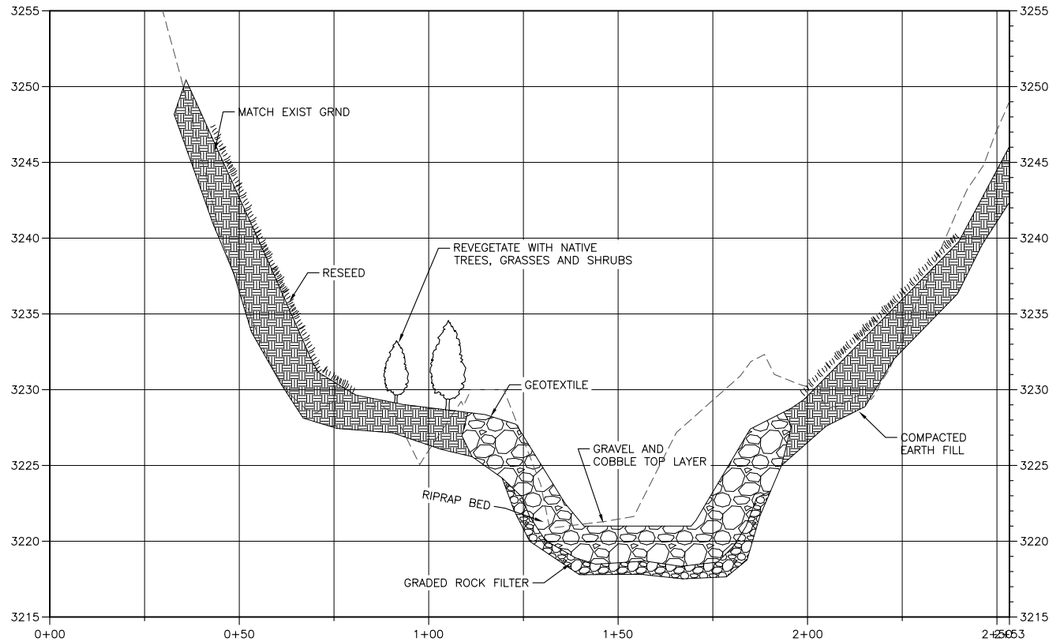


SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

A C300

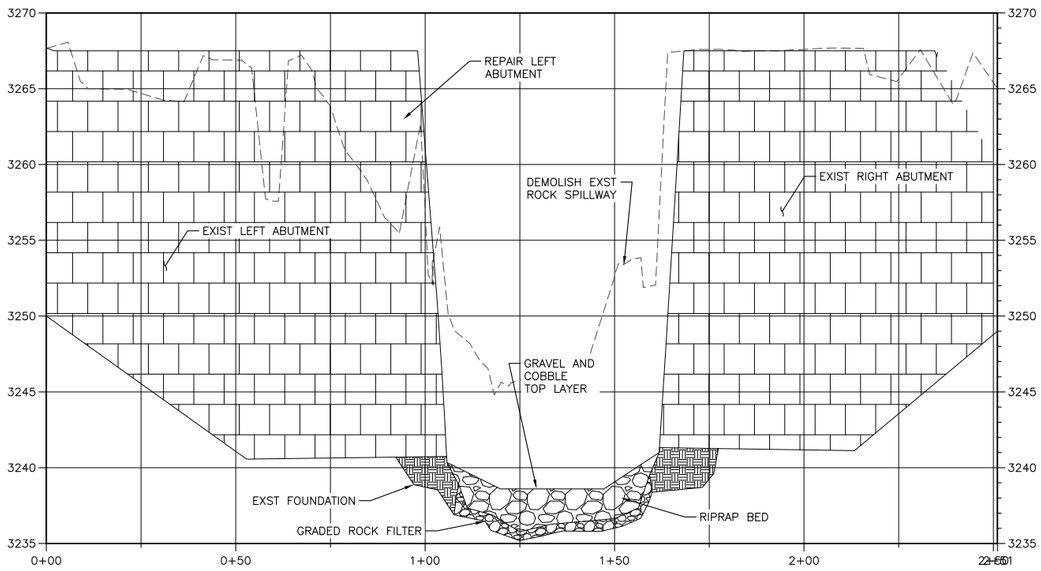


SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

B C300



SECTION

SCALE: HORIZ 1" = 20'

VERT 1" = 5'

C C300

NRCS

DESIGNED BY: K. JENSEN
DRAWN BY: J. LAHMON
CHECKED BY: D. AXNESS
SUBMITTED BY: D. AXNESS

DATE: JANUARY 22, 2014
CAD FILENAME: _C302.DWG
CONTRACT NUMBER:
TASK ORDER NUMBER:

NATURAL RESOURCES CONSERVATION SERVICE
125 SOUTH STATE STREET, ROOM 4402
SALT LAKE CITY, UT 84138-1100

McMILLEN, LLC
1401 SHORELINE DR.
BOISE, ID 83702
OFFICE: 208.342.4214
FAX: 208.342.4216

UTAH

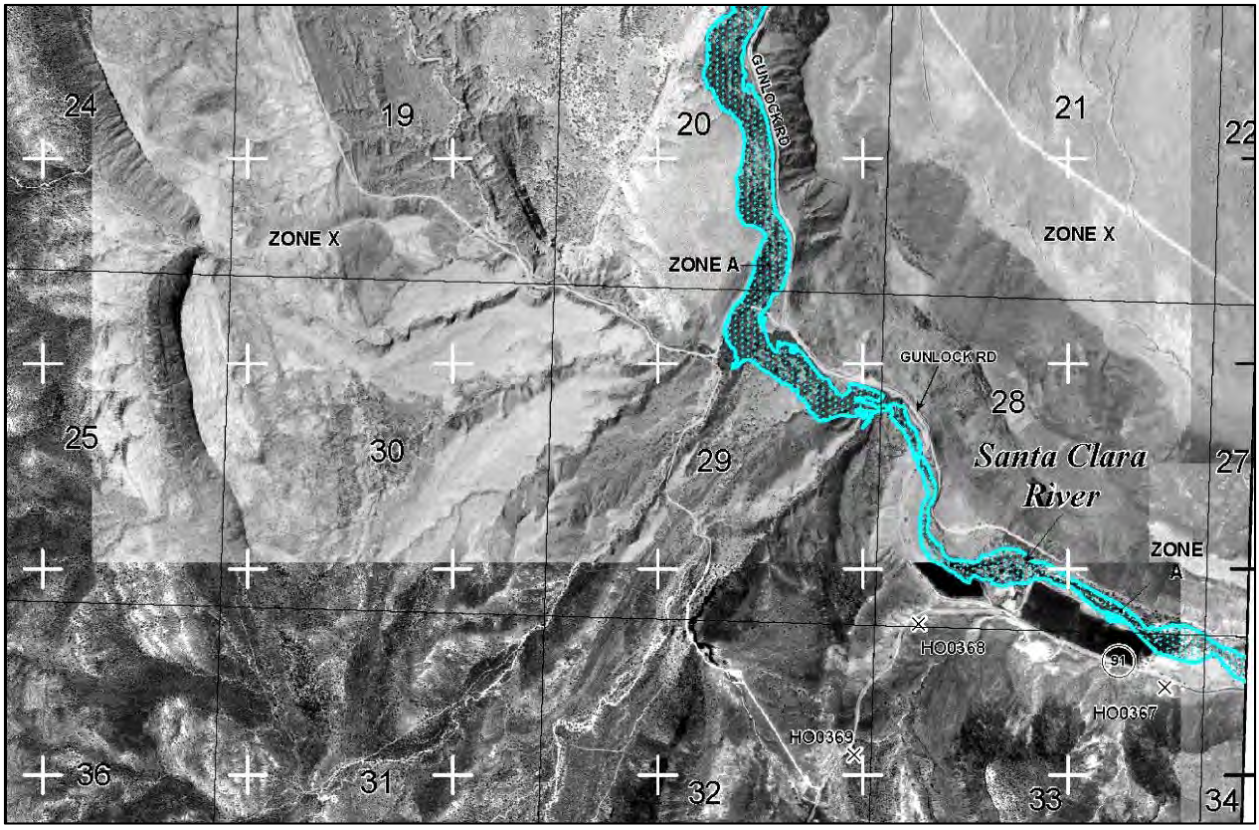
UTAH COUNTY

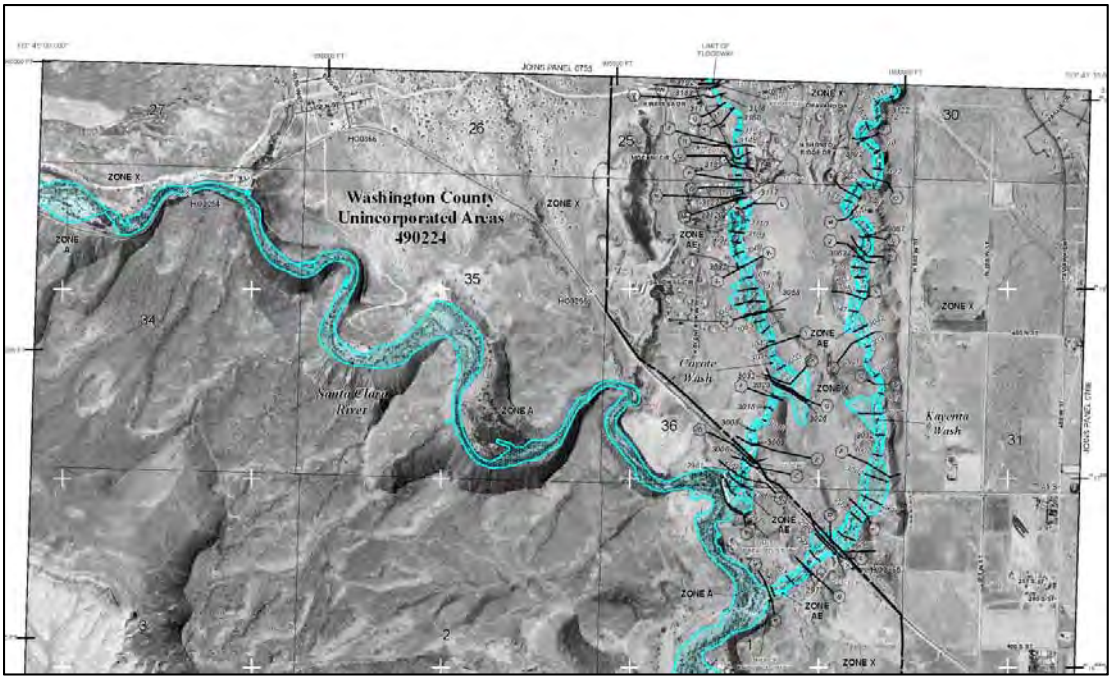
NRCS - SHEM DAM
REHABILITATION PROJECT
WASHINGTON COUNTY, UTAH
ALT 3 - STEPPED ROCK CHUTE SEQUENCE
ENERGY DISSIPATER SECTIONS

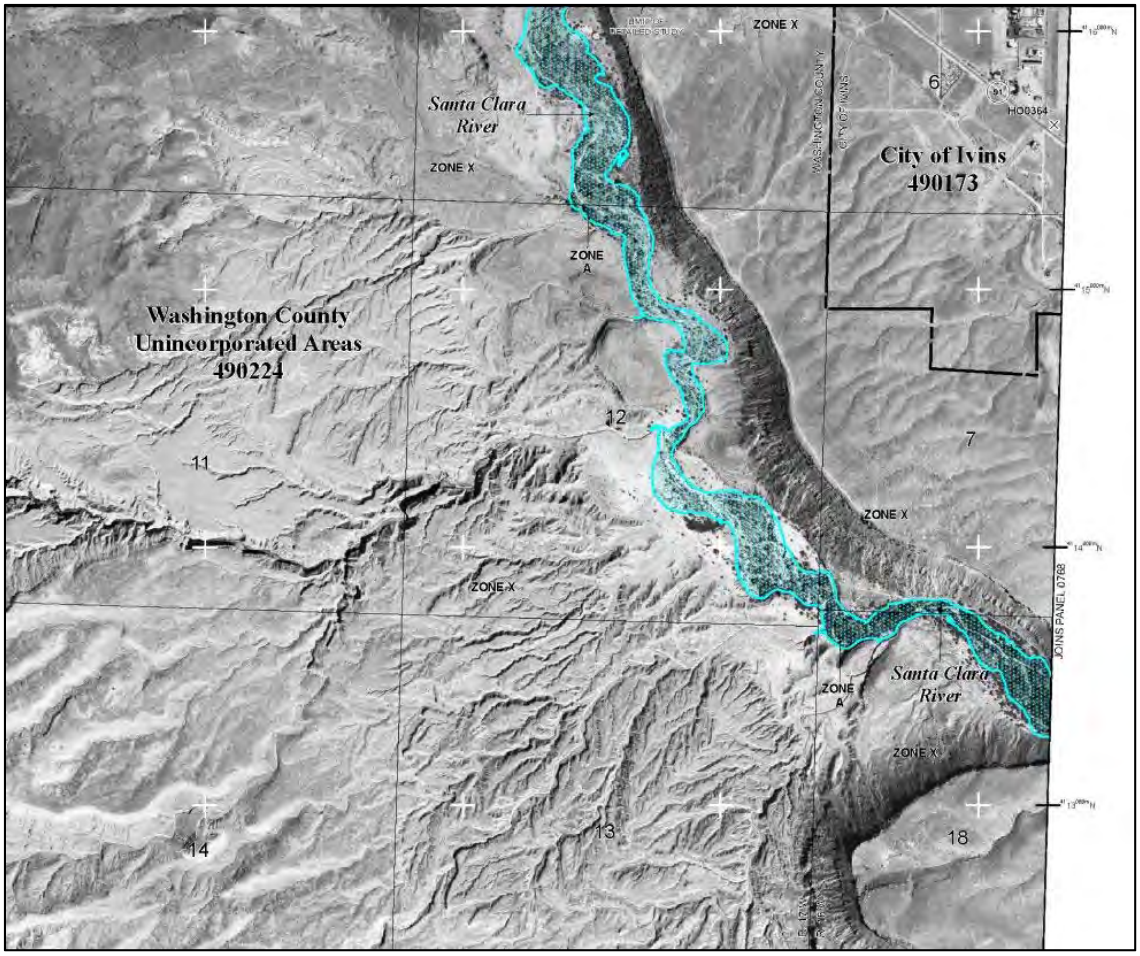
SHEET
C302

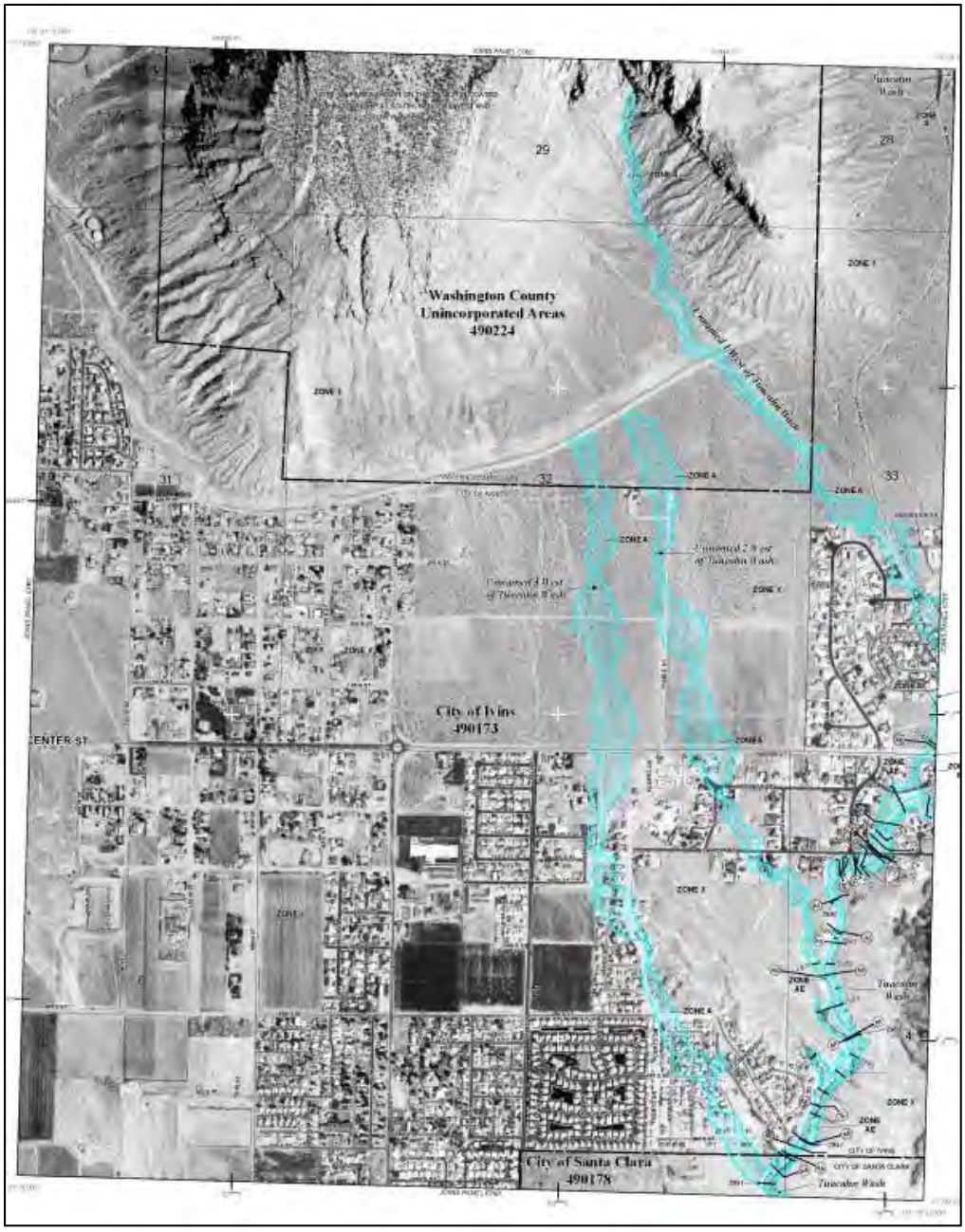
APPENDIX B

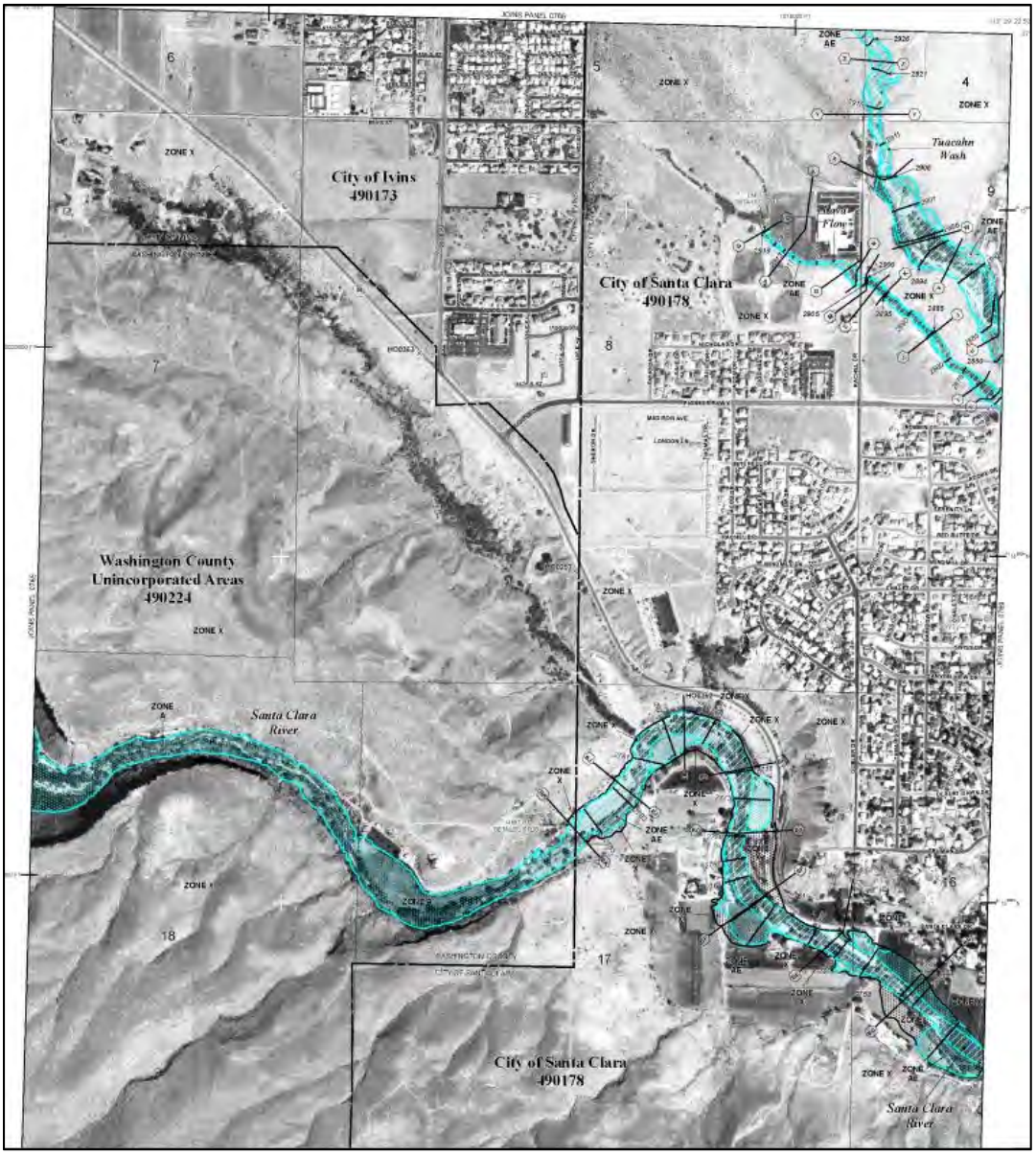
FEMA FLOOD INSURANCE RATE MAPS


24
19
20
21
22
ZONE X
ZONE A
ZONE X
GUNLOCK RD
GUNLOCK RD
28
25
30
29
Santa Clara
River
27
ZONE
A
HO0368
31
HO0367
HO0369
36
31
32
33
34


JOINS PANEL 0755
27
26
25
30
ZONE X
HO0366
Washington County
Unincorporated Areas
490224
ZONE X
ZONE
A
35
34
ZONE AE
ZONE X
Santa Clara
River
ZONE A
Coyote
Wash
36
Kayenta
Wash
31
ZONE AE
ZONE A
ZONE
AE
3
2
1
ZONE X


ZONE X
Santa Clara River
ZONE X
ZONE A
Washington County Unincorporated Areas 490224
City of Ivins 490173
6
HO0364
12
7
11
ZONE X
ZONE X
JOINS PANEL 0768
Santa Clara River
ZONE A
ZONE X
14
13
18


Washington County
Unincorporated Areas
490224
City of Irvine
490173
City of Santa Clara
490178
CENTER ST
Unnamed Wash of Tuscarora Wash
Tuscarora Wash
ZONE A
ZONE X
ZONE AE
29
28
31
32
33


City of Ivins
490173
City of Santa Clara
490178
Washington County
Unincorporated Areas
490224
Santa Clara
River
Tuacahn
Wash
City of Santa Clara
490178
Santa Clara
River

APPENDIX C – SUPPORTING DOCUMENTATION

Water Rights

Draft Wetland and Stream Delineation Report

Biological Survey Report

USDA-NRCS Shem Dam Geotechnical Explorations USFWS Concurrence Letter

utah.gov Online Services Agency List Business Search
Utah Division of Water Rights

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 11/14/2013

WATER RIGHT: **81-7** APPLICATION/CLAIM NO.: **A2368** CERT. NO.: 2139
CHANGES: a26546 (Filed: 04/15/2002) Approved

OWNERSHIP

NAME: Ivins Irrigation Company
ADDR: Ivins UT
INTEREST: 0%
REMARKS: held by State of Utah Board of Water Resources

NAME: State of Utah Board of Water Resources
ADDR: 1594 West North Temple, Ste 310
Salt Lake City UT 84114-6201
INTEREST: 100%
REMARKS: held for Ivins Irrigation Company

DATES, ETC.

LAND OWNED BY APPLICANT? COUNTY TAX ID#:
FILED: 04/13/1909|PRIORITY: 11/15/1930|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate:01/15/1910|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 05/02/1983|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD BOOK: [81-1]|MAP: [116b]|PUB DATE:

***TYPE -- DOCUMENT -- STATUS**

Type of Right: Application to Appropriate Source of Info: Proposed Determination **Status: Water User's Claim**

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)********MAP VIEWER***GOOGLE VIEW***

FLOW: 14.9 cfs
SOURCE: Santa Clara Creek
COUNTY: Washington COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) N 774 ft E 270 ft from W4 cor, Sec 28, T 41S, R 17W, SLBM
Diverting Works: Rock/concrete diversion dam Source: Santa Clara River

Stream Alt Required?: No

USES OF WATER RIGHT****** *ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family*

SUPPLEMENTAL GROUP NO.: 608920. Water Rights Appurtenant to the following use(s):
81-7(WUC),77(CERT),1047(WUC)

IRRIGATION: Sole Supply: UNEVALUATED acres Group Total: 1.06 PERIOD OF USE: 02/01 TO 11/30

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAS	
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE
Sec 06 T 42S R 16W SLBM								1.0600						

GROU

SUPPLEMENTAL GROUP NO.: 608952. Water Rights Appurtenant to the following use(s):
81-7(WUC),77(CERT),1077(WUC)

IRRIGATION: Sole Supply: UNEVALUATED acres Group Total: 1.09 PERIOD OF USE: 01/01 TO 12/31

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAS	
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE
Sec 06 T 42S R 16W SLBM								1.0900						

GROU

SUPPLEMENTAL GROUP NO.: 609379. Water Rights Appurtenant to the following use(s):
81-7(WUC),77(CERT),1497(WUC),1626(WUC),1663(WUC)
1665(WUC),1666(WUC),2112(WUC),2113(WUC)

IRRIGATION: Sole Supply: UNEVALUATED acres Group Total: 524.2 PERIOD OF USE: 03/01 TO 11/30

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAS	
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE
Sec 31 T 41S R 16W SLBM													9.3600	0.1800
Sec 31 T 41S R 16W SLBM *LOT 2														
Sec 31 T 41S R 16W SLBM *LOT 3														
Sec 31 T 41S R 16W SLBM *LOT 4														
Sec 31 T 41S R 16W SLBM *LOT 5														
Sec 31 T 41S R 16W SLBM *LOT 6														

```
 Sec 31 T 41S R 16W SLBM *LOT 7
 Sec 32 T 41S R 16W SLBM *_______|_______|_______|_______*_______|_______|_______|_______* 0.0900|_______|_______|_______*_______|_______|
 Sec 32 T 41S R 16W SLBM *LOT 1
 Sec 32 T 41S R 16W SLBM *LOT 2
 Sec 32 T 41S R 16W SLBM *LOT 4
 Sec 25 T 41S R 17W SLBM *_______|_______|_______|_______*_______|_______|_______|_______* 0.0700|_______|_______|_______*_______|_______|
 Sec 05 T 42S R 16W SLBM *12.6200|_______|24.2100|22.8200*_______|_______|18.5600|_______*_______|_______|_______| 5.1700*_______|_______|
 Sec 05 T 42S R 16W SLBM *LOT 2
 Sec 06 T 42S R 16W SLBM *_______|_______|_______|39.0700*_______|25.1000|11.4000|25.0600*_______|37.6900|_______|10.0800*29.5300| 9.4600|
 Sec 06 T 42S R 16W SLBM *LOT 3
 Sec 06 T 42S R 16W SLBM *LOT 4
 Sec 06 T 42S R 16W SLBM *LOT 5
 Sec 06 T 42S R 16W SLBM *LOT 6
 Sec 07 T 42S R 16W SLBM *_______|_______|_______|_______*_______| 4.1900|_______|_______*_______|_______|_______|_______*_______|_______|
 Sec 08 T 42S R 16W SLBM *24.7400|23.8200|_______| 8.3300*_______|_______|_______|_______*_______|_______|_______|_______*_______|_______|
                                                                                                                                    GROU
================================================================================================================================================
This Right (81-7) has an evaluated sole-supply total for irrigation of 0.0000 acres.
================================================================================================================================================
This Right (81-7) is a member of 3 supplemental water right groups with irrigated acreage totaling 526.3500 acres.
================================================================================================================================================
OTHER COMMENTS**************************************************************************************************************************
================================================================================================================================================
     TYPE OF RIGHT:  Santa Clara River Decree, Award 15
================================================================================================================================================
SEGREGATION HISTORY*********************************************************************************************************************
================================================================================================================================================
This Right as originally filed:
                        FLOW IN       QUANTITY IN *------------------------------W A T E R   U S E S------------------------------*
                          CFS          ACRE-FEET   IRRIGATED     STOCK     DOMESTIC  MUNICIPAL    MINING      POWER       OTHER
                                                     ACREAGE      (ELUs)    (FAMILIES)(*-----------------ACRE-FEET-----------------*)
                         14.9
================================================================================================================================================
================================================================================================================================================
The following Water Rights have been Segregated from 81-7:
(   1) WRNUM: 81-4903
       APPL#: A2368
       NAME:  State of Utah Division of Wildlife Resources
       FILED: 04/15/2002 STATUS: PERF
       APPR:
              Use is IN STREAM FLOW.  See Change a26548 and Santa Clara Project Agreement.
================================================================================================================================================
================================================================================================================================================
                          CFS          ACRE-FEET   IRRIGATED     STOCK     DOMESTIC  MUNICIPAL    MINING      POWER       OTHER
                                                     ACREAGE      (ELUs)    (FAMILIES)(*-----------------ACRE-FEET-----------------*)
81-7 currently has: ---  14.9                          ERROR
       All IRR-WR but NOT SE has been SEGREGATED OFF.
************************************************************************************************************************************
*****************************************************END OF DATA********************************************************************
************************************************************************************************************************************
```

utah.gov | Online Services | Agency List | Business | Search
Utah Division of Water Rights
Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 11/14/2013

WATER RIGHT: **81-77** APPLICATION/CLAIM NO.: **A7838** CERT. NO.: 3689
CHANGES: a14045 (Filed: 09/26/1986) Rejected

OWNERSHIP

NAME: Ivins Irrigation Company
ADDR: Ivins UT
INTEREST: 0%
REMARKS: Held by State Of Utah Board of Water Resources

NAME: State of Utah Board of Water Resources
ADDR: 1594 West North Temple, Ste 310
Salt Lake City UT 84114-6201
INTEREST: 100%
REMARKS: Held for Ivins Irrigation Company

DATES, ETC.

LAND OWNED BY APPLICANT? COUNTY TAX ID#:
FILED: 08/21/1918|PRIORITY: 08/21/1918|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [Approved]|ActionDate:05/06/1919|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 05/02/1983|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD BOOK: [81-1]|MAP: [116b]|PUB DATE:

***TYPE -- DOCUMENT -- STATUS**

Type of Right: Application to Appropriate Source of Info: Proposed Determination **Status: Certificate**

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)********MAP VIEWER***GOOGLE VIEW***

FLOW: 1000.0 acre-feet
SOURCE: Santa Clara River
COUNTY: Washington COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) N 774 ft E 270 ft from W4 cor, Sec 28, T 41S, R 17W, SLBM
Diverting Works: Diversion dam & pipeline Source: Santa Clara River

Stream Alt Required?: No

USES OF WATER RIGHT****** *ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family*

SUPPLEMENTAL GROUP NO.: 608920. Water Rights Appurtenant to the following use(s):
81-7(WUC),**77(CERT)**,1047(WUC)

IRRIGATION: Sole Supply: UNEVALUATED acres Group Total: 1.06 PERIOD OF USE: 02/01 TO 11/30

###PLACE OF USE:	NORTH WEST QUARTER NW	NE	SW	SE	NORTH EAST QUARTER NW	NE	SW	SE	SOUTH WEST QUARTER NW	NE	SW	SE	SOUTH EAS NW	NE
Sec 06 T 42S R 16W SLBM								1.0600						

GROU

SUPPLEMENTAL GROUP NO.: 608952. Water Rights Appurtenant to the following use(s):
81-7(WUC),**77(CERT)**,1077(WUC)

IRRIGATION: Sole Supply: UNEVALUATED acres Group Total: 1.09 PERIOD OF USE: 01/01 TO 12/31

###PLACE OF USE:	NORTH WEST QUARTER NW	NE	SW	SE	NORTH EAST QUARTER NW	NE	SW	SE	SOUTH WEST QUARTER NW	NE	SW	SE	SOUTH EAS NW	NE
Sec 06 T 42S R 16W SLBM								1.0900						

GROU

SUPPLEMENTAL GROUP NO.: 609379. Water Rights Appurtenant to the following use(s):
81-7(WUC),**77(CERT)**,1497(WUC),1626(WUC),1663(WUC)
1665(WUC),1666(WUC),2112(WUC),2113(WUC)

IRRIGATION: Sole Supply: UNEVALUATED acres Group Total: 524.2 PERIOD OF USE: 03/01 TO 11/30

###PLACE OF USE:	NORTH WEST QUARTER NW	NE	SW	SE	NORTH EAST QUARTER NW	NE	SW	SE	SOUTH WEST QUARTER NW	NE	SW	SE	SOUTH EAS NW	NE
Sec 31 T 41S R 16W SLBM													9.3600	0.1800
Sec 31 T 41S R 16W SLBM *LOT 2														
Sec 31 T 41S R 16W SLBM *LOT 3														
Sec 31 T 41S R 16W SLBM *LOT 4														
Sec 31 T 41S R 16W SLBM *LOT 5														
Sec 31 T 41S R 16W SLBM *LOT 6														

Sec 31 T 41S R 16W SLBM	*LOT 7												
Sec 32 T 41S R 16W SLBM								0.0900					
Sec 32 T 41S R 16W SLBM	*LOT 1												
Sec 32 T 41S R 16W SLBM	*LOT 2												
Sec 32 T 41S R 16W SLBM	*LOT 4												
Sec 25 T 41S R 17W SLBM								0.0700					
Sec 05 T 42S R 16W SLBM	12.6200		24.2100	22.8200			18.5600				5.1700		
Sec 05 T 42S R 16W SLBM	*LOT 2												
Sec 06 T 42S R 16W SLBM				39.0700		25.1000	11.4000	25.0600		37.6900		10.0800	29.5300	9.4600
Sec 06 T 42S R 16W SLBM	*LOT 3												
Sec 06 T 42S R 16W SLBM	*LOT 4												
Sec 06 T 42S R 16W SLBM	*LOT 5												
Sec 06 T 42S R 16W SLBM	*LOT 6												
Sec 07 T 42S R 16W SLBM						4.1900							
Sec 08 T 42S R 16W SLBM	24.7400	23.8200		8.3300									

GROU

SUPPLEMENTAL GROUP NO.: 631890. Water Rights Appurtenant to the following use(s):
81-77(CERT),203(CERT),323(CERT),562(WUC),793(WUC)
1101(CERT),1148(DEC),1149(DEC),1497(WUC),1626(WUC)
1660(WUC),1663(WUC),1665(WUC),1666(WUC),2112(WUC)
2113(WUC),2313(FEDR),2425(DEC),3893(CERT),3894(CERT)
3895(CERT),3896(DEC)

!!!BAD TYPE CODE PERIOD OF USE: / 0 TO / 0

Acre Feet Contributed by this Right for this Use: 0.0

###PLACE OF USE:	NORTH WEST QUARTER NW	NORTH WEST QUARTER NE	NORTH WEST QUARTER SW	NORTH WEST QUARTER SE	NORTH EAST QUARTER NW	NORTH EAST QUARTER NE	NORTH EAST QUARTER SW	NORTH EAST QUARTER SE	SOUTH WEST QUARTER NW	SOUTH WEST QUARTER NE	SOUTH WEST QUARTER SW	SOUTH WEST QUARTER SE	SOUTH EAS NW	SOUTH EAS NE
Sec 05 T 41S R 17W SLBM														
Sec 08 T 41S R 17W SLBM														
Sec 17 T 41S R 17W SLBM														
Sec 20 T 41S R 17W SLBM														
Sec 28 T 41S R 17W SLBM														
Sec 29 T 41S R 17W SLBM														
Sec 33 T 41S R 17W SLBM														
Sec 34 T 41S R 17W SLBM														
Sec 35 T 41S R 17W SLBM														
Sec 36 T 41S R 17W SLBM														
Sec 07 T 42S R 16W SLBM														
Sec 16 T 42S R 16W SLBM														
Sec 17 T 42S R 16W SLBM														
Sec 18 T 42S R 16W SLBM														
Sec 21 T 42S R 16W SLBM														
Sec 22 T 42S R 16W SLBM														
Sec 26 T 42S R 16W SLBM														
Sec 27 T 42S R 16W SLBM														
Sec 35 T 42S R 16W SLBM														
Sec 36 T 42S R 16W SLBM														
Sec 01 T 42S R 17W SLBM														
Sec 12 T 42S R 17W SLBM														
Sec 06 T 43S R 15W SLBM														
Sec 01 T 43S R 16W SLBM														

GROU

This Right (81-77) has an evaluated sole-supply total for irrigation of 0.0000 acres.

This Right (81-77) is a member of 4 supplemental water right groups with irrigated acreage totaling 526.3500 acres.

Storage from 01/01 to 12/31, inclusive, in Ivins Reservoir with a maximum capacity of 540.000 acre-feet, located in:

	Height of Dam: 50 / Area Inundated: 36.00	NORTH-WEST¼ NW	NORTH-WEST¼ NE	NORTH-WEST¼ SW	NORTH-WEST¼ SE	NORTH-EAST¼ NW	NORTH-EAST¼ NE	NORTH-EAST¼ SW	NORTH-EAST¼ SE	SOUTH-WEST¼ NW	SOUTH-WEST¼ NE	SOUTH-WEST¼ SW	SOUTH-WEST¼ SE	SOUTH-EAST¼ NW	SOUTH-EAST¼ NE	SOUTH-EAST¼ SW	SOUTH-EAST¼ SE
Sec 25 T 41S R 17W SLBM		*	:	:	: *	*	:	:	: *	*	:	: X:	*	*	:	:	: *
Sec 26 T 41S R 17W SLBM		*	:	:	: *	*	:	:	: *	*	:	:	: *	*	:	:	: X*
Sec 35 T 41S R 17W SLBM		*	:	:	: *	*	: X:	:	X*	*	:	:	: *	*	:	:	: *
Sec 36 T 41S R 17W SLBM		* X:	:	X:	*	*	:	:	: *	*	:	:	: *	*	:	:	: *

Small Dam Required?: No

OTHER COMMENTS

TYPE OF RIGHT: Santa Clara River Decree, Award 27

SEGREGATION HISTORY

This Right as originally filed:

FLOW IN CFS	QUANTITY IN ACRE-FEET	WATER USES: IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER
	1000.0							

The following Water Rights have been Segregated from 81-77:

(1) WRNUM: 81-4904
APPL#: A7838
NAME: State of Utah Division of Wildlife Resources
FILED: 04/15/2002 STATUS: PERF
APPR:
Use is In Stream Flow. See Change a26548 and Santa Clara Project Agreement.

	CFS	ACRE-FEET	IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER
						(*----------ACRE-FEET----------*)			
81-77 currently has: --		1000.0	ERROR						

All IRR-WR but NOT SE has been SEGREGATED OFF.

****

**********END OF DATA**********

****

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(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 11/14/2013 Page 1

CHANGE: **a14045** WATER RIGHT: 81-77 CERT. NO.: COUNTY TAX ID#: AMENDATORY? No
BASE WATER RIGHTS: 81-77
RIGHT EVIDENCED BY: 81-77 (A7838), Cert. 3689 Award 23, Santa Clara River Decree
CHANGES: Point of Diversion [X], Place of Use [ ], Nature of Use [ ], Reservoir Storage [ ].

NAME: State of Utah Board of Water Resources
ADDR: 1594 West North Temple, Ste 310
Salt Lake City UT 84114-6201
INTEREST: 100% REMARKS:

FILED: 09/26/1986|PRIORITY: 09/26/1986|ADV BEGAN: 10/23/1986|ADV ENDED: |NEWSPAPER: Washington County News
ProtestEnd:12/06/1986|PROTESTED: [Yes]|HEARNG HLD: |SE ACTION: [Rejected]|ActionDate:04/28/1987|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: |LAP, ETC: 04/28/1987|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
Status: **Rejected**

HERETOFORE

FLOW: 1000.0 acre-feet
SOURCE: Santa Clara River
COUNTY: Washington

POINT(S) OF DIVERSION ------> MAP VIEWER*GOOGLE VIEW**

Point Surface:
(1) N 774 ft E 270 ft from W4 cor, Sec 28, T 41S, R 17W, SLBM
Dvrting Wks: Diversion dam & pipeline
Source: Santa Clara River

Point Rediversion:

PLACE OF USE ------>

	NW¼			NE¼			SW¼			SE¼		
	N	W	E	N	W	E	N	W	E	N	W	E
Sec 31 T 41S R 16W SLBM		X			X			X			X	
Sec 32 T 41S R 16W SLBM		X			X			X			X	
Sec 25 T 41S R 17W SLBM		X			X			X			X	
Sec 05 T 42S R 16W SLBM		X			X			X			X	
Sec 06 T 42S R 16W SLBM		X			X			X			X	
Sec 07 T 42S R 16W SLBM		X			X			X			X	
Sec 08 T 42S R 16W SLBM		X			X			X			X	

NATURE OF USE ------>

IRR = values are in acres.

HEREAFTER

FLOW: 1000.0 acre-feet
SOURCE: Santa Clara River
COUNTY: Washington COM DESC:

By this application Applicant is only seeking approval to change its point of diversion and store a portion of its water in the Lower Gunlock Reservoir. Applicant will establish its legal right to Lower Gunlock Reservoir in common with Lower Gunlock Reservoir Company through an action now pending in the Fifth Judicial District Court of Washington County, State of Utah, Civil Number 86-0901 entitled Ivins Irrigation Company, Plaintiff, vs. Lower Gunlock Reservoir Company, Defendant. Through this action Applicant is seeking the right to use the excess storage capacity in said reservoir.

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:
(1) S 2453 ft W 1533 ft from NE cor, Sec 05, T 41S, R 17W, SLBM
Dvrting Wks: Axis of Gunlock Dam
Source:

Stream Alt?: No

Point Rediversion:
(1) N 774 ft E 270 ft from W4 cor, Sec 28, T 41S, R 17W, SLBM
Dvrting Wks:
Source: Santa Clara River

SAME AS HERETOFORE

SAME AS HERETOFORE

STK = values are in ELUs meaning Cattle or Equivalent.
DOM = values are in EDUs meaning Equivalent Domestic Units (or Families).

SUPPLEMENTAL to Other Water Rights: Yes

IRR: 526.3500 acres. USED 01/01 - 12/31

RESERVOIR STORAGE -->

Storage 01/01 to 12/31, in Ivins Reservoir
with a maximum capacity of 540.000 acre-feet, located in:

	--NW¼-- --NE¼-- --SW¼-- --SE¼--
Height of Dam: 50 ft	N N S S||N N S S||N N S S||N N S S
Area Inundat 36.000 acs	W E W E||W E W E||W E W E||W E W E
Sec 25 T 41S R 17W SLBM	* : : : ** : : : ** : :X: ** : : : *
Sec 26 T 41S R 17W SLBM	* : : : ** : : : ** : : : ** : : :X*
Sec 35 T 41S R 17W SLBM	* : : : ** :X: :X** : : : ** : : : *
Sec 36 T 41S R 17W SLBM	*X: :X: ** : : : ** : : : ** : : : *

SUPPLEMENTAL to Other Water Rights: No

SAME AS HERETOFORE

Storage 01/01 to 12/31, in Lower Gunlock Reservoir
with a maximum capacity of 10880.000 acre-feet, located in:

	--NW¼-- --NE¼-- --SW¼-- --SE¼--
Height of Dam: 103 ft	N N S S||N N S S||N N S S||N N S S
Area Inundat acs	W E W E||W E W E||W E W E||W E W E
Sec 28 T 40S R 17W SLBM	* : : : ** : : : ** : :X: ** : : : *
Sec 29 T 40S R 17W SLBM	* : : : ** : : : ** : : : ** :X: :X*
Sec 32 T 40S R 17W SLBM	* : : : ** :X: :X** : : : **X:X:X:X*
Sec 33 T 40S R 17W SLBM	* :X: :X** : : : ** : : : ** : : : *
Sec 05 T 41S R 17W SLBM	*LOT 1
Sec 05 T 41S R 17W SLBM	*LOT 2
Sec 05 T 41S R 17W SLBM	*LOT 3
Sec 05 T 41S R 17W SLBM	*LOT 6
Sec 05 T 41S R 17W SLBM	*LOT 7
Sec 05 T 41S R 17W SLBM	*LOT 8
Sec 05 T 41S R 17W SLBM	*LOT 9
Sec 05 T 41S R 17W SLBM	*LOT 10

Small Dam Permit Required?: No

**********E N D O F D A T A**********

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(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 11/14/2013

WATER RIGHT: **81-2313** APPLICATION/CLAIM NO.: CERT. NO.:
CHANGES: a26547 (Filed: 04/15/2002) Lapsed

OWNERSHIP

NAME: USA In trust for the Shivwits Band of Paiute Indian Tribe
ADDR: P. O. Box 821
Cedar City UT 84720
INTEREST: 100%

DATES, ETC.

LAND OWNED BY APPLICANT? COUNTY TAX ID#:
FILED: |PRIORITY: / /1890|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 10/29/1984|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD BOOK: [81-1]|MAP: [116b]|PUB DATE:
TYPE -- DOCUMENT -- STATUS
Type of Right: Federal Reserved Water Right Source of Info: Decree **Status:**

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)********MAP VIEWER***GOOGLE VIEW***

FLOW: 1.242 cfs OR 399.18 acre-feet
SOURCE: Santa Clara River
COUNTY: Washington COMMON DESCRIPTION: Shivwits Indian Reservation

POINTS OF DIVERSION -- SURFACE:
(1) N 774 ft E 270 ft from W4 cor, Sec 28, T 41S, R 17W, SLBM
Diverting Works: Diversion dam Source: Santa Clara River
(2) N 510 ft E 735 ft from W4 cor, Sec 35, T 41S, R 17W, SLBM
Diverting Works: Diversion dam Source: Santa Clara River

Stream Alt Required?: No

USES OF WATER RIGHT****** *ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family*

SUPPLEMENTAL GROUP NO.: 609939. Water Rights Appurtenant to the following use(s):
81-2313(FEDR),2425(DEC)

IRRIGATION: Sole Supply: 66.53 acres of the Group Total of 100.35 PERIOD OF USE: 01/01 TO 12/31

###PLACE OF USE:	NORTH WEST QUARTER NW	NE	SW	SE	NORTH EAST QUARTER NW	NE	SW	SE	SOUTH WEST QUARTER NW	NE	SW	SE	SOUTH EAS NW	NE
Sec 28 T 41S R 17W SLBM									7.0400		8.4200	13.0000		
Sec 33 T 41S R 17W SLBM		0.1800			10.0800	13.9900								
Sec 34 T 41S R 17W SLBM	8.5200	4.5600												
Sec 35 T 41S R 17W SLBM									3.5200				4.9200	

GROU

SUPPLEMENTAL GROUP NO.: 609940.
81-2313(FEDR)

STOCKWATER: Sole Supply: UNEVALUATED ELUs Group Total: 50.0000 PERIOD OF USE: 01/01 TO 12/31

SUPPLEMENTAL GROUP NO.: 631890. Water Rights Appurtenant to the following use(s):
81-77(CERT),203(CERT),323(CERT),562(WUC),793(WUC)
1101(CERT),1148(DEC),1149(DEC),1497(WUC),1626(WUC)
1660(WUC),1663(WUC),1665(WUC),1666(WUC),2112(WUC)
2113(WUC),**2313(FEDR)**,2425(DEC),3893(CERT),3894(CERT)
3895(CERT),3896(DEC)

!!!BAD TYPE CODE PERIOD OF USE: / 0 TO / 0
Acre Feet Contributed by this Right for this Use: 0.0

###PLACE OF USE:	NORTH WEST QUARTER NW	NE	SW	SE	NORTH EAST QUARTER NW	NE	SW	SE	SOUTH WEST QUARTER NW	NE	SW	SE	SOUTH EAS NW	NE
Sec 05 T 41S R 17W SLBM														
Sec 08 T 41S R 17W SLBM														
Sec 17 T 41S R 17W SLBM														
Sec 20 T 41S R 17W SLBM														
Sec 28 T 41S R 17W SLBM														
Sec 29 T 41S R 17W SLBM														
Sec 33 T 41S R 17W SLBM														
Sec 34 T 41S R 17W SLBM														
Sec 35 T 41S R 17W SLBM														

Sec 36 T 41S R 17W SLBM	*				*				*			
Sec 07 T 42S R 16W SLBM	*				*				*			
Sec 16 T 42S R 16W SLBM	*				*				*			
Sec 17 T 42S R 16W SLBM	*				*				*			
Sec 18 T 42S R 16W SLBM	*				*				*			
Sec 21 T 42S R 16W SLBM	*				*				*			
Sec 22 T 42S R 16W SLBM	*				*				*			
Sec 26 T 42S R 16W SLBM	*				*				*			
Sec 27 T 42S R 16W SLBM	*				*				*			
Sec 35 T 42S R 16W SLBM	*				*				*			
Sec 36 T 42S R 16W SLBM	*				*				*			
Sec 01 T 42S R 17W SLBM	*				*				*			
Sec 12 T 42S R 17W SLBM	*				*				*			
Sec 06 T 43S R 15W SLBM	*				*				*			
Sec 01 T 43S R 16W SLBM	*				*				*			

GROU

OTHER COMMENTS

TYPE OF RIGHT: Santa Clara River Decree, Award 5

SEGREGATION HISTORY

This Right as originally filed:

FLOW IN CFS	QUANTITY IN ACRE-FEET	IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER
					ACRE-FEET			
1.38	499.182	83.1970						

The following Water Rights have been Segregated from 81-2313:

(1) WRNUM: 81-2425 0.138 OR 100.0 16.6700
APPL#: a13227
NAME: Shivwits Band of Paiute Indians
FILED: / / 0 STATUS: APP
APPR:

(2) WRNUM: 81-4920
APPL#: a26547
NAME: State of Utah Division of Wildlife Resources
FILED: 04/15/2002 STATUS: PERF
APPR:
Use is IN STREAM FLOW. See Change a26548 and Santa Clara Project Agreement.

	CFS	ACRE-FEET	IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER
						ACRE-FEET			
81-2313 currently has:	1.242	399.182	66.5270	ERROR					

All STOCK-WR but NOT has been SEGREGATED OFF.

END OF DATA

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Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 11/14/2013

WATER RIGHT: **81-2425** APPLICATION/CLAIM NO.: CERT. NO.:
CHANGES: a13227 (Filed: 06/11/1984) Lapsed
a26547 (Filed: 04/15/2002) Lapsed

OWNERSHIP

NAME: USA In trust for the Shivwits Band of Paiute Indian Tribe
ADDR: P. O. Box 986
Cedar City UT 84720
INTEREST: 100%

DATES, ETC.

LAND OWNED BY APPLICANT? COUNTY TAX ID#:
FILED: 06/11/1984|PRIORITY: / /1890|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 10/29/1984|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD BOOK: [81-1]|MAP: [116b]|PUB DATE:

***TYPE -- DOCUMENT -- STATUS**

Type of Right: Decree Source of Info: Proposed Determination **Status:**

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)*********MAP VIEWER***GOOGLE VIEW***

FLOW: 0.138 cfs OR 100.02 acre-feet
SOURCE: Santa Clara River
COUNTY: Washington COMMON DESCRIPTION: Shivwits Indian Reservation

POINTS OF DIVERSION -- SURFACE:
(1) N 774 ft E 270 ft from W4 cor, Sec 28, T 41S, R 17W, SLBM
Diverting Works: diversion dam Source: Santa Clara River
(2) N 510 ft E 735 ft from W4 cor, Sec 35, T 41S, R 17W, SLBM
Diverting Works: diversion dam Source: Santa Clara River

Stream Alt Required?: No

USES OF WATER RIGHT****** *ELU -- Equivalent Livestock Unit (cow, horse, etc.)* ******** *EDU -- Equivalent Domestic Unit or 1 Family***

SUPPLEMENTAL GROUP NO.: 609939. Water Rights Appurtenant to the following use(s):
81-2313(FEDR),**2425(DEC)**

IRRIGATION: Sole Supply: 16.667 acres of the Group Total of 100.35 PERIOD OF USE: 01/01 TO 12/31

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAS	
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE
Sec 28 T 41S R 17W SLBM									7.0400		8.4200	13.0000		
Sec 33 T 41S R 17W SLBM		0.1800			10.0800	13.9900								
Sec 34 T 41S R 17W SLBM	8.5200	4.5600												
Sec 35 T 41S R 17W SLBM									3.5200				4.9200	

GROU

SUPPLEMENTAL GROUP NO.: 631890. Water Rights Appurtenant to the following use(s):
81-77(CERT),203(CERT),323(CERT),562(WUC),793(WUC)
1101(CERT),1148(DEC),1149(DEC),1497(WUC),1626(WUC)
1660(WUC),1663(WUC),1665(WUC),1666(WUC),2112(WUC)
2113(WUC),2313(FEDR),**2425(DEC)**,3893(CERT),3894(CERT)
3895(CERT),3896(DEC)

!!!BAD TYPE CODE PERIOD OF USE: / 0 TO / 0
Acre Feet Contributed by this Right for this Use: 0.0

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAS	
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE
Sec 05 T 41S R 17W SLBM														
Sec 08 T 41S R 17W SLBM														
Sec 17 T 41S R 17W SLBM														
Sec 20 T 41S R 17W SLBM														
Sec 28 T 41S R 17W SLBM														
Sec 29 T 41S R 17W SLBM														
Sec 33 T 41S R 17W SLBM														
Sec 34 T 41S R 17W SLBM														
Sec 35 T 41S R 17W SLBM														
Sec 36 T 41S R 17W SLBM														
Sec 07 T 42S R 16W SLBM														
Sec 16 T 42S R 16W SLBM														
Sec 17 T 42S R 16W SLBM														
Sec 18 T 42S R 16W SLBM														

Sec 21 T 42S R 16W SLBM													
Sec 22 T 42S R 16W SLBM													
Sec 26 T 42S R 16W SLBM													
Sec 27 T 42S R 16W SLBM													
Sec 35 T 42S R 16W SLBM													
Sec 36 T 42S R 16W SLBM													
Sec 01 T 42S R 17W SLBM													
Sec 12 T 42S R 17W SLBM													
Sec 06 T 43S R 15W SLBM													
Sec 01 T 43S R 16W SLBM													

GROU

OTHER COMMENTS

TYPE OF RIGHT: Santa Clara River Decree, Award 5

SEGREGATION HISTORY

This Right as originally filed:

FLOW IN CFS		QUANTITY IN ACRE-FEET	IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER
						ACRE-FEET			
0.138	OR	100.02	16.6670						

The following Water Rights have been Segregated from 81-2425:

(1) WRNUM: 81-4921
APPL#: a13227
NAME: State of Utah Division of Wildlife Resources
FILED: 04/15/2002 STATUS: PERF
APPR:
Use is IN STREAM FLOW. See Change a26548 and Santa Clara Project Agreement.

	CFS	ACRE-FEET	IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER
						ACRE-FEET			
81-2425 currently has:	0.138	100.02	16.6670						

END OF DATA

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Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 11/14/2013 Page 1

CHANGE: **a13227** WATER RIGHT: 81-2425 CERT. NO.: COUNTY TAX ID#: AMENDATORY? No
BASE WATER RIGHTS: 81-2425
RIGHT EVIDENCED BY: Award 5 Santa Clara Decree dated 11/6/22
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Shivwits Paiute Band
ADDR: P. O. Box 595
Santa Clara UT 84765
REMARKS:

FILED: 06/11/1984	PRIORITY: 06/11/1984	ADV BEGAN: 09/20/1984	ADV ENDED:	NEWSPAPER:
ProtestEnd:	PROTESTED: [No]	HEARNG HLD:	SE ACTION: [ ]	ActionDate:11/14/1984
EXTENSION:	ELEC/PROOF:[ ]	ELEC/PROOF:	CERT/WUC:	LAP, ETC: 11/30/1990
RUSH LETTR:	RENOVATE:	RECON REQ:	TYPE: [ ]	

PROOF DUE: 11/30/1990 LAPS LETTER:

Status: **Lapsed**

********HERETOFORE********	********HEREAFTER********
FLOW: 1.38 cfs OR 499.2 acre-feet	FLOW: 0.138 cfs OR 100.0 acre-feet
SOURCE: Santa Clara River	SOURCE: Santa Clara River
COUNTY: Washington	COUNTY: Washington COM DESC: Near Windsor Dam
	The remainder under Award 5 Santa Clara Decree shall be limited to the flow of 1.242 CFS for the irrigation of 66.53 acres and limited to a total of 399.2 acre feet (duty @6.0 AF/ac). The water under Change Application a-13227 (81-2425) is to be used under agreement by the St. George Mining Corporation.
POINT(S) OF DIVERSION ------> MAP VIEWER*GOOGLE VIEW**	**CHANGED AS FOLLOWS: (Click Location link for WRPLAT)**
Point Surface:	Point Surface:
(1) 0 ft E 1320 ft from W4 cor, Sec 09, T 41S, R 17W, SLBM	(1) S 950 ft W 2100 ft from NE cor, Sec 29, T 42S, R 17W, SLBM
Dvrting Wks: Woodbury Ditch	Dvrting Wks: Sump, pump & pipeline
Source: Santa Clara River	Source: Santa Clara River
(2) S 2000 ft W 200 ft from NW cor, Sec 28, T 41S, R 17W, SLBM	
Dvrting Wks: Indian Farm Ditch	
Source: Santa Clara River	
(3) S 1320 ft	
Dvrting Wks: 5 Mile Ditch	
Source: Santa Clara River	
	Stream Alt?: No

PLACE OF USE ------>

	--NW¼-- --NE¼-- --SW¼-- --SE¼--	
	N N S S N N S S N N S S N N S S	N N S S N N S S N N S S N N S S
	W E W E W E W E W E W E W E W E	W E W E W E W E W E W E W E W E
Sec 09 T 41S R 17W SLBM	*X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*	Sec 05 T 42S R 17W SLBM * : : : ** : :X:X** :X: :X**X:X:X:X*
Sec 28 T 41S R 17W SLBM	*X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*	Sec 08 T 42S R 17W SLBM * : : : **X: : : ** : : : ** : : : *
Sec 33 T 41S R 17W SLBM	*X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*	
Sec 34 T 41S R 17W SLBM	*X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*	
Sec 35 T 41S R 17W SLBM	*X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*	

NATURE OF USE ------>

IRR = values are in acres.	
STK = values are in ELUs meaning Cattle or Equivalent.	
DOM = values are in EDUs meaning Equivalent Domestic Units (or Families).	
SUPPLEMENTAL to Other Water Rights: No	SUPPLEMENTAL to Other Water Rights: No
IRR: 83.2000 acres. USED 01/01 - 12/31	
	MIN: District: USED 01/01 - 12/31

		Name:	Apex
		Ores:	UNKNOWN
OTH: !!!BAD TYPE CODE Culinary, domestic, stockwatering, irrigation		USED 01/01 - 12/31	

**********E N D O F D A T A**********

Wetland and Stream Delineation Report for Shem Dam Rehabilitation Project

McMillen, LLC

Draft

Contract No. AG-3A75-C-10-0025
Task No. AG-8D43-D-13-0016

Browne Consulting
Natural Resource • Land Use • Agriculture

January 28, 2014

SIGNATURE PAGE

We have appreciated the opportunity to work with NRCS on this project. If you have any questions or concerns regarding this report, please contact Peggy Browne (541-523-5170 or peggy@browneconsulting.biz).

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TABLE OF CONTENTS

SECTION 1 INTRODUCTION 1
1.0 Introduction 1
1.1 Purpose 1
1.2 Project Location 1
1.3 Scope of Work 1
1.4 Conditions at Time of Delineation 2
SECTION 2 METHODS 3
2.0 Document Review 3
2.1 Wetland Delineation Methodology 3
2.1.1 Vegetation 3
2.1.2 Soils 4
2.1.3 Hydrology 5
2.2 Stream Delineation Methodology 6
2.3 Wetland and Stream Characterization 7
2.4 Field Methods 8
SECTION 3 RESULTS 9
3.0 Document Review 9
3.1 Field Investigation and Site Description 9
3.1.1 Precipitation and Stream Flow Data 10
3.1.2 Soil Survey Data 11
3.2 Wetlands 12
3.3 Streams 12
3.3.1 Open Water – Santa Clara River 13
3.3.2 High Flow Side Channel 13
3.3.3 Ephemeral Tributary 13
3.3.4 Riparian Wetland 13
SECTION 4 CONCLUSION 14
4.0 Conclusion 14
SECTION 5 REFERENCES 15

LIST OF TABLES

TABLE 1-1. LEGAL DESCRIPTION 1
TABLE 2-1. PLANT INDICATOR STATUS CATEGORIES 4
TABLE 3-1. NOAA 30-YEAR AVERAGE PRECIPITATION AT GUNLOCK DAM 10
TABLE 3-2. USGS GAGING STATIONS ON THE SANTA CLARA RIVER NEAR SHEM DAM 11
TABLE 3-3. SHEM DAM SOILS SUMMARY 11
TABLE 3-4. WETLAND CLASSIFICATION AND SIZE 13
TABLE 4-1. DELINEATED FEATURES 14

APPENDICES

Appendix A Wetland Data Sheets
Appendix B Figures and Drawing
Figure 1 Vicinity Map
Figure 2 Watershed Map
Figure 3 Soils Map
Drawing 1 Wetland and Stream Delineation
Appendix C Site Photographs

SECTION 1
INTRODUCTION

1.0 Introduction

McMillen, LLC (McMillen) was retained by the Natural Resources Conservation Service (NRCS) to complete wetland and stream delineation services at Shem (Winsor, hereafter "Shem Dam") in Washington County, UT (Figure 1). This report describes in detail the wetland features and stream segments identified during the delineation. The wetland and streams described in this report were observed within the potential dam rehabilitation construction boundaries, which will herein be referred to as the "Survey Area".

1.1 Purpose

This wetland and stream delineation report was completed to assist NRCS in identifying potential construction constraints related to critical aquatic features that occur within the Survey Area.

1.2 Project Location

Shem Dam is located on Shivwits tribal land, and spans the width of the Santa Clara River downstream of Gunlock Dam and Reservoir, and upstream of the towns of Santa Clara, Ivins, and St. George, UT. The dam is located within the Santa Clara River Watershed (Figure 2), which drains into the Virgin River south of St. George, UT. The site is situated at an approximate elevation of 3,250 feet above mean sea level (AMSL). Table 1-1 identifies the legal description of the Survey Area.

Table 1-1. Legal Description

Township and Range	Section	Coordinates (WGS84)	Washington County Parcel ID
41 S, 17 W	28 and 29	37.192° lat / -113.77° long	8227-3-A-NP 8227-4-NP

The dam is located approximately 2 ½ miles east-northeast of the town of Shivwits and nearly 5 river miles east of Kayenta, UT. The dam lies adjacent to Gunlock Road/Highway 91 and is located almost 900 feet upstream of a bridge crossing over the Santa Clara River. The area is identified as an Interior desert land resource region (LRR D) due to its long dry summer season and annual evapotranspiration exceeding precipitation (ACOE 2008).

1.3 Scope of Work

The scope of work associated with this wetland and stream delineation includes the following elements:

1. Review background information pertaining to the Survey Area including relevant and readily available documents to evaluate the conditions;
2. Conduct a pedestrian survey within the proposed construction, operations and maintenance boundaries (Survey Area) and delineate wetland and stream features identified according to the appropriate wetland and stream delineation manuals; and

3. Prepare a draft and final report describing the methods used and the results of the delineation. This report includes a description of wetlands and streams delineated, the appropriate classification according to reviewing agencies, and a wetland and stream delineation map that depicts the locations of delineated aquatic features.

1.4 Conditions at Time of Delineation

This report is based on conditions that existed at the time the delineation was performed. The field visit made to collect delineation data occurred on November 25 and 26, 2013. If changes are made to the Survey Area after the date of this report, a wetland biologist should be consulted to review the investigation and recommendations so that written amendments or affirmation can be provided as appropriate.

SECTION 2
METHODS

2.0 Document Review

A review of available documents pertaining to the project was conducted prior to visiting Shem Dam. This review assisted with directing the focus of the wetland and stream delineation to potential critical aquatic features. The following documents were reviewed:

- Historical and current aerial photos,
- United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps (USFWS 2013),
- NRCS soil data (NRCS 2013), (Figure 3),
- United States Geological Survey (USGS) 1:24,000-scale 7.5-minute topographic map (USGS 1983),
- Other available general background information provided by NRCS and the UT Automated Geographic Reference Center (UAGRC).

2.1 Wetland Delineation Methodology

McMillen and Browne Consulting conducted formal wetland and stream delineation. This formal delineation effort followed the guidance set forth in the following documents:

- 1987 USACE Wetland Delineation Manual (Environmental Laboratory 1987),
- 2008 USACE Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0),
- 2010 Field Indicators of Hydric Soils in the United States (NRCS 2010), and
- 2007 Clean Water Act Jurisdiction – Rapanos vs. United States and Carabell vs. United States (Rapanos 2007).

The U.S. Army Corps of Engineers (USACE) wetland delineation manual and supplement listed above follow the three-parameter approach for making wetland determinations, such that positive indicators of wetlands must be present for each of the following parameters: 1) vegetation, 2) soils and 3) hydrology. Each of these three parameters is described in detail in the following sections.

2.1.1 Vegetation

The 2010 USACE manual defines hydrophytic vegetation as the community of macrophytes that occurs in areas where inundation or soil saturation is either permanent or of sufficient frequency and duration to exert a controlling influence on the plant species present. Hydrophytic plant species have the ability to grow, compete, and sustain in areas where anaerobic (oxygen-deprived) conditions exist due to the presence of surface or groundwater. In 1988, the USACE and USFWS developed plant indicator categories that describe the probability of vegetation occurring in wetlands (Reed 1988). This list was updated in 1993 (Reed *et al.*1993) and in 2013 (Lichvar 2013), and each plant observed within the Survey Area was categorized according to the Arid West Region indicator status. Table 2-1 below defines the indicator status categories.

Table 2-1. Plant Indicator Status Categories

Indicator Category	Indicator Symbol	Description
Obligate Wetland Plants	OBL	Plants that occur in wetlands, under natural conditions, greater than 99 percent of the time.
Facultative Wetland Plants	FACW	Plants that occur in wetlands, under natural conditions, between 67 to 99 percent of the time.
Facultative Plants	FAC	Plants that occur in wetlands, under natural conditions, between 34 to 66 percent of the time.
Facultative Upland Plants	FACU	Plants that occur in wetlands, under natural conditions, between 1 to 33 percent of the time.
Obligate Upland Plants	UPL	Plants that occur in wetlands, under natural conditions, less than 1 percent of the time.
No Indicator	NI	Indicator status has not been identified for the species.
No Occurrence	NO	No known occurrence of the plant in the region.

The prevalence of wetland vegetation is characterized by the dominant species comprising the plant community or communities. A dominant species is considered any plant species that is represented by 20 percent or greater total aerial coverage for each vegetative stratum (tree, shrub, herbaceous or aquatic bed). If more than 50 percent of the dominant plant species in a wetland is categorized as OBL, FACW, or FAC, then the plant community for the wetland can be classified as hydrophytic. Other indicators of hydrophytic vegetation include visual observations of plant species growing in areas of prolonged inundation and/or soil saturation, morphological adaptations, physiological adaptations, and reproductive adaptations.

Wetland vegetation communities within the Survey Area were classified according to the Cowardin classification system (Cowardin *et al.* 1979). Vegetation nomenclature described in this report follows the format outlined in the book entitled *Intermountain Flora* (Cronquist *et al.*1972).

2.1.2 Soils

Hydric soils are soils that formed under conditions of saturation, flooding or ponding for a long enough period of time during the growing season that anaerobic conditions develop in the upper portion of the soil profile (USACE 2010). These anaerobic conditions exhibit certain characteristics that can be identified in the field and that are associated with a wetland complex. Prolonged anaerobic soil conditions eventually lead to a chemically reduced state where soil components (iron, manganese, sulfur, and carbon compounds) develop soil colors and other physical characteristics that are indicative of hydric soils. These chemically-reduced soil components persist when the soil is either wet or dry. Specific hydric soil characteristics include:

- Reduced iron resulting in a soil color that is known as gley (bluish-gray or greenish-gray),
- Loss of iron resulting in a soil color that is known as redox depletion (gray or reddish-gray),
- Loss of iron resulting in concentrated soil patches known as redoximorphic concentrations (orange or red),
- Sulfidic odor, and/or
- High organic matter content (peat or muck) in the upper 32 inches of the soil profile.

Soil colors were determined using the Munsell® Soil-Color Charts (Munsell Color 2009) and their corresponding *hue* (spectral colors, e.g. 10YR), *value* (degree of lightness, e.g. 2/) and *chroma* (strength or purity of color, /1). Soil profiles must either have a dominant chroma of 2 or less, or the layer with a dominant chroma of more than 2 must be less than 6 inches thick to meet any hydric soil indicators. Hydric soil indicators commonly found in wetlands are identified in the technical document *Field Indicators of Hydric Soils in the United States* (NRCS 2010). These indicators help identify soils that were formed under saturated, flooded or ponded conditions long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile.

Numerous undocumented soil pits were dug throughout the Survey Area to a depth of approximately 18 inches, or until refusal. The soil was analyzed visually and physically to determine its texture, and locate hydric indicators.

2.1.3 Hydrology

Hydrologic patterns in a wetland can be influenced by precipitation, stratigraphy, topography, soil permeability, plant cover and human disturbance. Wetland hydrology encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. Wetland hydrology is sometimes difficult to determine during the summer months when precipitation has stopped, groundwater tables have dropped, stream flows have receded and springs or seeps have dried. Hydrologic indicators can be used during the wet spring months as well as the dry summer and fall months to identify primary and/or secondary indicators within the soil profile. Primary indicators include the following (USACE 2010):

- Surface water or inundation,
- High water table or saturated soil within 12 inches of the ground surface for 14 or more consecutive days at a minimum frequency of 5 years out of 10,
- Water marks,
- Sediment and drift deposits,
- Algal mat or crust,
- Iron deposits,
- Surface soil cracks,
- Salt crust,
- Inundation visible on aerial photography,
- Sparsely vegetated concave surface,
- Aquatic invertebrates,
- Water-stained leaves,
- Hydrogen sulfide odor,
- Oxidized rhizospheres along living roots,
- Presence of reduced iron, and
- Stunted or stressed plants.

Secondary indicators include (USACE 2010):

- Drainage patterns,
- Dry-season water table,
- Saturation visible on aerial photography,
- Geomorphic position,
- Shallow aquitard,

- FAC-neutral test,
- Raised ant mounds, and
- Frost-heave hummocks.

The growing season for a region is dependent upon climate, precipitation and topography. The beginning and ending dates of the growing season are examined for an area to determine if wetland hydrology was present for the required time period. Wetland hydrology must be present for at least 14 consecutive days within 12 inches of the ground surface during the growing season in order for an area to be considered a wetland. Two indicators that the growing season has begun include: 1) a soil temperature that is at least 41 degrees Fahrenheit (°F), measured at least 12 inches below the ground surface, and/or 2) aboveground growth and development of vascular plants (USACE 2010).

The growing season has begun on a site when two or more types of non-evergreen vascular plants exhibit one or more of the following indicators of biological activity:

- Emergence of herbaceous plants,
- New growth on vegetative crowns,
- Coleoptiles/cotyledon emergence from seed,
- Bud burst on woody plants,
- Emergence or elongation of woody plant leaves, and/or
- Emergence or opening of flowers.

The growing season has ended when woody deciduous species lose their leaves and/or the last herbaceous plants cease flowering and their leaves become dry or brown. Additional information may be collected from the WETS tables available from the USDA NRCS National Water and Climate Center (USDA 2002). These tables summarize the air temperature from National Weather Service meteorological stations throughout the United States for a specific area. The growing season dates in the WETS tables are an estimate of when air temperatures average above 28°F.

2.2 Stream Delineation Methodology

Streams, lakes and reservoirs were delineated according to their ordinary high water mark (OHWM) in accordance with the guidance set forth by the USACE in their Regulatory Guidance Letter titled *Ordinary High Water Mark Identification* (USACE 2005). The OHWM is defined by the USACE as:

> …that line on the shore established by the fluctuations of weather and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Physical characteristics that are present on the shoreline of a watercourse may vary depending on the type of water body and conditions of the area. There are no required physical indicators that must be present to make an OHWM determination. However, the following physical characteristics were considered when making the determination:

- Natural line impressed on the bank,
- Shelving or topographic breaks,
- Changes in the character of soil,
- Destruction of terrestrial vegetation,

- Presence of litter or debris (drift lines),
- Wracking,
- Vegetation matted down, bent, or absent,
- Sediment sorting,
- Leaf litter disturbed or washed away,
- Scour,
- Deposition,
- Multiple observed flow events,
- Bed and banks,
- Water staining, and
- Change in plant community.

Other methods for determining the OHWM that do not include physical observation:

- Lake and stream gage data,
- Elevation data,
- Spillway height,
- Flood predictions,
- Historic records of water flow, and
- Statistical evidence.

Combinations of physical characteristics and other methods should be used when available for determining the OHWM. As a result, many types of water bodies occur with varying conditions, including topography, channel morphology and flow dynamics. Other physical characteristics indicative of the OHWM may also be used that are not identified in the USACE guidance.

2.3 Wetland and Stream Characterization

The delineations conducted for this project were characterized according to their Cowardin (Cowardin *et al.*1979) classification. The Cowardin classification system categorizes wetlands and deepwater habitats according to five separate systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. These systems are then stratified into subsystems based on the plant community type. These systems are further stratified into classes and subclasses based on substrate material. Each class and subclass is then annotated with specific modifiers for water regimes, water chemistry, soil, and other special characteristics. The USFWS uses this classification system on their National Wetland Inventory (NWI) maps and it is used in this report to describe the general structure of wetlands and streams.

The wetlands and streams identified in this project were also classified according to their hydrogeomorphic (HGM) characteristics in order to determine their location and function within the watershed. HGM classifications include the following:

- Depressional,
- Riverine,
- Lake-fringe,
- Slope,
- Flats, and
- Freshwater tidal.

2.4 Field Methods

The Survey Area was investigated for indicators of wetland parameters. If one of the three wetland parameters (hydrophytic vegetation, hydric soils, or wetland hydrology indicators) were observed, a more detailed examination of the area was performed. Upon discovery of all three wetland parameters adjacent to an upland area, the boundary line of the wetland was identified and followed until the delineation was complete. In general, the presence of hydrophytic vegetation and/or wetland hydrology indicators was the primary visual indicator used to determine the boundaries of the wetland, with hydric soil indicators used secondarily to confirm the wetland boundary. If a point on the wetland boundary was not clearly identifiable by either hydrophytic vegetation or wetland hydrology indicators, then soil pits were dug in order to determine the wetland boundary line. Soil pits extended approximately 18 inches below ground surface and were left open for a minimum of five minutes during the examination. Not all of the soils pits dug during the wetland delineation were recorded. The unrecorded soil pits were used to compare the soil and wetland hydrology indicators of the recorded soil pits. The boundary of the wetland unit was identified by collecting GPS points using a Topcon GRS-1 rover with an approximate error of ± 1.0 feet in the horizontal.

Paired sample plots were established at various locations along the wetland perimeter to aid in the wetland determination. The sample plots consisted of examining the vegetation, soils and wetland hydrology indicators. The vegetation was assessed within an approximate 10-20 foot radius (depending on the characteristics of the surroundings) of the sample plot for trees, shrubs, and herbaceous species. The radius around each plot that was sampled is specifically listed on each data form (see Appendix A). Soils were classified according to the Munsell® Soil-Color Chart and wetland hydrology indicators were examined for presence within 12 inches of the ground surface. Typically, one paired sample plot was established within the wetland unit for each vegetation community or hydrologic regime observed at the time of the delineation. The results of the sample plots were recorded and are attached in Appendix A.

The site was also investigated for indicators of stream characteristics. If flowing water or a dry streambed was observed, additional investigations were performed upstream and downstream to locate the source of the water and/or the confluence with another stream. Specific physical characteristics of the streams were examined in order to facilitate locating the OHWMs, which were recorded with the GPS unit.

The Wetland and Stream Delineation maps of the site is presented in Drawing 1. A photographic record of the wetlands, streams, sample plots and various other portions of the site are attached in Appendix C.

SECTION 3
RESULTS

3.0 Document Review

The following information was obtained during the document review prior to the wetland and stream delineation:

- Historical and current aerial photos,
    - The historical and current aerial photographs were examined to determine changes in land use and hydraulic patterns, vegetated areas and possible locations of standing water or saturated soils.
    - There have been minimal changes to the dam and reservoir area since the dam was modified in the 1950s.
    - Those changes to the dam that have taken place recently were caused by natural flooding.
- USFWS NWI maps (USFWS 2012),
    - Data identify wetlands within, and in the vicinity of the Survey Area, as well as general types of plant community structures present. There were no wetlands identified in the Survey Area according to the NWI maps.
- NRCS soil data (NRCS 2012), (Figure 3),
    - The soil data identifies the presence of soil types within, and in the vicinity of the Survey Area. Data from this source indicates the following dominant soil types within the Survey Area:
        - FA: Sandy fluvaquents and torrifluvents.
        - RE: Renbac-Rock land association.
        - RP: Stony rock land.
- USGS 1:24,000 scale 7.5-minute topographic map (USGS 1975 and 1993),
    - This map identifies the general topography and important site features within, and in the vicinity of the Survey Area.
    - The dam, bridge, roads and surrounding topography were illustrated on this map.
- Other available general background information provided by NRCS.

3.1 Field Investigation and Site Description

The objective of the wetland and stream delineation was to determine the extent of jurisdictional wetlands within the Survey Area based on the presence of hydrophytic vegetation, hydric soils and wetland hydrology indicators for wetlands and the presence of an OHWM along the streams. McMillen and Browne Consulting conducted the formal wetland and stream delineation on November 25 and 26, 2013. The weather was sunny during the delineation, with temperatures ranging from 40°F to 50°F.

The Survey Area was examined for signs of wetland and stream indicators. The results of the investigation revealed the presence of riparian wetland and deepwater habitat according to the Cowardin classification system (Cowardin *et al.* 1979). An illustration of these results are provided in Drawing 1, Wetland and Stream Delineation map. The Wetland Delineation Map is the Local Wetland Inventory (LWI) and was produced from the interpretation of aerial photographs that require field verification. Wetlands were identified based on field verification and are depicted on the Wetland and Stream Delineation Map created by McMillen.

The wetland and stream delineation consisted of determining the boundary between wetland and upland areas. The approximation of this boundary line typically consisted of identifying a topographic break and correlating the break with shifts in vegetation from hydrophytic to upland species and verifying groundwater depth. The dominant upland plant species within the tree stratum were unidentified willow (*Salix* spp.). Willows are typically rated a FACW or OBL species according to the USDA Plants Database. However, in many sites in the arid west, willows will grow both in the upland near a groundwater source as well as within wetland soils. This site depicted the situation where willow species occupied both wetlands and uplands. Within the herbaceous stratum, the dominant species were Bermuda grass, prickly weed and sweet clover. All of these species are upland plants. This fact along with the lack of soil saturation or water table presence in the associated soil pits verified lack of hydrology and rendered the site upland.. The presence or absence of these plant species served to indicate the approximate location of the wetland boundary line. Upon observation of this approximate line, transitions to hydrophytic species in the herbaceous stratum were either verified or not. The dominant hydrophytic species observed within the tree stratum was willow, while in the herbaceous stratum it was horsetail and bulrush. Soil pits were then established to determine the presence or absence of hydric soils and wetland hydrology indicators (if not visible on the ground surface) to further verify wetland conditions.

3.1.1 Precipitation and Stream Flow Data

Monthly precipitation for the thirty-year period between 1981 and 2010 was obtained from Gunlock Powerhouse station near Gunlock Dam (GHCND USC00423506) from the NOAA National Climatic Data Center and is presented in Table 3-1. The station is located approximately 6.5 miles north-northeast of Shem Dam between the communities of Gunlock and Dammeron Valley, UT.

Table 3-1. NOAA 30-Year Average Precipitation at Gunlock Dam

Month	Gunlock Powerhouse 1981-2010 (Inches)
January	1.62
February	1.77
March	1.82
April	0.94
May	0.45
June	0.33
July	0.66
August	1.08
September	0.88
October	1.24
November	0.96
December	1.44

Several U.S. Geological Service (USGS) river gaging stations have been operated on the Santa Clara River in the past. Each of these is presented in Table 3-2, along with the period of record associated with each station. Although the gaging station at Gunlock Dam (09109880) is current, the daily data provided by this station does not account for the streamflows added to the Santa Clara River between Gunlock Reservoir and Shem Dam. For similar reasons, and due to the age of the datasets, data from the stations far upstream (09410000) and far downstream (09410400) of Shem Dam are not entirely representative of the flows seen in the project area. Therefore, flow

data provided at station 09410100 was analyzed. Data from this station indicate an average daily flow rate of 22 cfs. The historic peak flow is 3,460 cfs and occurred on March 12, 1995. The river runs dry, particularly in the late summer months during the receding limb of the hydrograph, such that the flow rates register zero.

Table 3-2. USGS Gaging Stations on the Santa Clara River near Shem Dam

Station Number	Location	Begin Date	End Date
09409880	0.5 miles downstream of Gunlock tailrace	August 1969	Current
09410000	2.4 miles upstream of Shem Dam	April 1942	October 1971
09410400	Several miles downstream of Shem Dam near Ivins, UT	May 1965	October 1974
09410100	0.6 miles downstream of Shem Dam	November 1971	October 2001

3.1.2 Soil Survey Data

The soils in the vicinity of the dam are typical of river floodplains, with sand, gravel, and cobbles interspersed in silty sand. The geofluvialmorphology of the area contributes greatly to the soils located in each stream section. During the data collection at the site it became clear that there are two distinct stream segments within the survey area. The pool area above Shem Dam and the braided stream segment below the Dam. Upstream of Shem Dam the soils are heavily influenced from the presence of the dam and are not typical of the stream segment between the Shem Dam pool and Gunlock Reservoir or below Shem Dam. The stream slope in the dam pool area is 0.4% and dominated by fine soil particles predominantly sand, silt and clay. Downstream from the dam the stream slope changes to 1.8%, a significant change from the slight slope of the stream at the pool above the dam. Upstream of the dam above the dams influence the stream slope is approximately 0.9%. The stream segments upstream of the pool and downstream of the dam represent the historical nature of the stream with larger sized substrate in the streambed and would meet Rosgen classification of a 'B' streamtype. (Rosgen 2007) These segments are dominated by cobble and gravel substrate. The stream segment below the dam is more incised than other segments surveyed and has a less developed floodplain. This segment is moving away from a 'B' type stream to a more entrenched stream type predominantly due to the influence of the dam. Table 3-3 below provides a summary of the soils survey data gathered for the Survey Area, (Figure 3).

Table 3-3. Shem Dam Soils Summary

Soil Name	Description	Hydric Soil	Survey Area Location
FA	Sandy fluvaquents and torrifluvents	Yes and No	Located within the Santa Clara River riparian corridor
RP	Stony rock land	No	Located within Motoqua Wash to the southwest of Shem Dam
RE	Renbac-Rock land association	No	Located along the hillslope south of Shem Dam

3.2 Wetlands

The wetland delineation identified two distinct wetland types within the Survey Area. The first type are open water wetlands; which include the Santa Clara River. The second type of wetlands identified within the survey area are narrow ribbons of riparian wetland concentrated within approximately two feet of the water's edge along the Santa Clara River as is common in the Arid West. The wetlands adjacent to the stream are considered challenging due to problematic soils and vegetation. Willow plants can be categorized as either Obligate or Fac depending on the water table and the substrate. Due to these facts, the water table was depended upon to verify hydrology and plant wetland status. In soil sample pits where the water table occurred at 12 inches or less, the site was identified as a wetland. In sample pits where the water table was greater than 12 inches deep and lacked clear hydric vegetation, the site was considered upland.

Soils at Shem Dam proved extremely problematic for wetland determination usage. In the majority of the streambed and adjacent floodplain, seasonal and annual deposition of new soil material occurs. Therefore, soils are "new" and have not had the time necessary to have anaerobic conditions present themselves (such as redox concentrations consisting of iron/manganese bodies as soft masses or pore linings). Soil chroma on this site ranges from 3-6 and, as a consequence, would not be considered indicative of anaerobic conditions. Furthermore, the site has predominantly sandy soils with red parent material. Limited guidance is available pertaining to sites with these conditions. However, where there was greater than 3 inches of clay-dominated soil present in the top of the profile, the area was considered wetland (Environmental Laboratory 1987). A map of the identified wetlands on the site is provided in Drawing 1. Open water wetlands contribute 1.3 acres within the project area and riverine wetlands contribute 1.20 acres and both are jurisdictional.

3.3 Streams

The Santa Clara River is a perennial stream system and a tributary of the Virgin River. The hydrograph upstream of Shem Dam is regulated by Gunlock Dam and fluctuates with precipitation and snowmelt events. A stream delineation was conducted above and below Shem Dam, as depicted in Appendix B. The stream delineation was performed when stream flows were below the OHWM. The OHWM was synonymous with the riparian wetland both above and below the dam. Photographs of the stream delineation OHWM are shown in Appendix C and signs of the OHWM included the following:

- Natural line impressed on the bank,
- Shelving,
- Absence of terrestrial vegetation,
- Scouring,
- Exposed roots, and
- Water marks on large boulders, concrete structures and trees.

The stream delineation identified four distinct segments of the Santa Clara River system. Two of these segments were located along the mainstem of the Santa Clara River proper, the third was located along a high flow side channel of the Santa Clara River, and the fourth was located along an ephemeral tributary wash to the southwest of Shem Dam. Between the mainstem of Santa Clara River and the high flow side channel is an upland island. These segments were classified according to the Cowardin system as presented in Table 3-4. A detailed map showing the location of these stream segments is located in Drawing 1.

Table 3-4. Wetland Classification and Size

Stream Segment	Cowardin Classification				Size (Acres)
	System	Subsystem	Class	Subclass	
Open Water	Riverine (R)	Lower Perennial	Unconsolidated Bottom (UB)	Sand and Mud (2 and 3)	1.30
High Flow Side Channel	Riverine (R)	Intermittent	Unconsolidated Bottom (UB)	Sand and Mud (4 and 5)	0.33
Ephemeral Tributary	Riverine (R)	Intermittent	Streambed (SB)	Cobble-Gravel (3)	0.23
Riparian Wetland	Riverine (R)	Intermittent	Riparian Wetland	Mixed Soils	1.20

3.3.1 Open Water – Santa Clara River

The water line, riparian wetland, and OHWM of the Santa Clara River was delineated above Shem Dam starting at the spillway and continuing upstream for approximately 1,190 feet (Drawing 1). This segment of the river contains the sediment pool behind the dam and is hydraulically affected by the presence of the dam. For this reason, this segment is characterized by a very shallow slope and contains very small sediment size classes (e.g. silt and sand).

The OHWM of the Santa Clara River was delineated below Shem Dam starting just below the rock spillway and continuing downstream approximately 830 feet to the Gunlock Road Bridge (Drawing 1). This segment of the river is characterized by a moderately sloping, heavily armored channel interspersed with vegetated islands and debris from deterioration of the dam.

3.3.2 High Flow Side Channel

The OHWM of an intermittent side channel of the Mainstem Santa Clara River was delineated above Shem Dam. The side channel is only activated during high water events, it converges with the mainstem approximately 460 feet upstream of Shem Dam. The survey was conducted from this confluence until approximately 740 feet upstream. This segment is characterized by a very shallow slope, and contains very small sediment size classes (e.g. silt and sand) interspersed with some gravels. There is an upland island that is located between the high flow side channel and the mainstem Santa Clara River that is not a wetland.

3.3.3 Ephemeral Tributary

The OHWM of Motoqua Wash was delineated above its confluence with the Santa Clara River. Motoqua Wash enters the Santa Clara River to the east of Shem Dam, approximately 275 feet upstream of the spillway. This stream segment is characterized by a moderately sloping, well-sorted ephemeral channel interspersed with some herbaceous and tree-stratum vegetation. Upstream of the confluence, the wash contains a burn site, with a large area denuded of tree-stratum vegetation. This is presumed to be the results of tamarisk removal and invasive species management efforts.

3.3.4 Riparian Wetland

Areas designated as riparian wetlands exhibited some hydric vegetation, soils ranging from sandy loam to cobble and gravel, and are located adjacent to open water. These wetlands were typically within two feet of the waters edge, located along the east and west banks as well as between two channels below the dam. Herbaceous stratum was relied upon to verify hydric vegetation.

SECTION 4
CONCLUSION

4.0 Conclusion

Employees from McMillen and Browne Consulting performed a wetland and stream delineation on November 25 and 26, 2013 within the Survey Area for the Shem Dam project in Washington County, UT. The delineation was performed to help NRCS identify potential design and construction constraints related to critical aquatic features that occur within the project area. The boundaries of these aquatic features are depicted in Drawing 1.

A total of 3.06 acres of wetlands were delineated within the study area. The table below identifies the size, Cowardin class, and the likely jurisdictional status of each wetland identified.

Table 4-1. Delineated Features

Feature	Acreage	Cowardin Class	Potential Jurisdiction
Santa Clara River	1.30	Water	Yes
Riparian Wetland	1.20	Riverine	Yes
Ephemeral Tributary	0.23	Water	Yes
High-Flow Side Channel	0.33	Sand	Yes
Upland Island	1.90	Sand	No

According to USACE regulations pertaining to wetland and stream delineation reports, this report is valid for five years from the date the delineation was performed.

SECTION 5
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APPENDIX A

WETLAND DATA SHEETS

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Shem City/County: Washington Co. Sampling Date: 11/26/13
Applicant/Owner: Washington County State: UT Sampling Point: SP 125
Investigator(s): Browne & Jensen Section, Township, Range: T41S R17W Sec28
Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____
Subregion (LRR): D Lat: 10042 032.27 Long: 978158.3 Datum: Northing/Easting State plane/Utah South
Soil Map Unit Name: FA NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes _____ No _____
Are Vegetation _____, Soil ✓, or Hydrology ✓ naturally problematic? Yes (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20')	Absolute % Cover	Dominant Species?	Indicator Status
1. none			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: 20')			
1. none			
2. Sapling willows beyond 20'			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: 20')			
1. Prickly weed	5%		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: 20')			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 95% % Cover of Biotic Crust _____

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
Total Number of Dominant Species Across All Strata: _____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species _____	x 1 =	_____
FACW species _____	x 2 =	_____
FAC species _____	x 3 =	_____
FACU species _____	x 4 =	_____
UPL species _____	x 5 =	_____
Column Totals: _____ (A)		_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: 125

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.) in historic channel

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3"	5YR 5/6	95%					Sandy loam	
3"-16"	5YR 5/6	100%					Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks: > 2" Sandy loam = hydric

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ✓ Water Marks (B1) (**Riverine**)
- ✓ Sediment Deposits (B2) (**Riverine**)
- ✓ Drift Deposits (B3) (**Riverine**)
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Shem Dam City/County: Washington Co Sampling Date: 11/26/13

Applicant/Owner: Washington Co State: UT Sampling Point: 12A

Investigator(s): Browne & Jensen Section, Township, Range: T41S R17W Sec. 28

Landform (hillslope, terrace, etc.): toe slope Local relief (concave, convex, none): convex Slope (%): _____

Subregion (LRR): D Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: FA NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation Y, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No _____	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20')	Absolute % Cover	Dominant Species?	Indicator Status
1. None			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 20')			
1. None			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 20')			
1. Prickly Weed	20%	Y	
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
Woody Vine Stratum (Plot size: 20')			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 80 % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: 12A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-2"	5YR 4/6	90%					clay/silt/sand	
2-18"	5YR 5/6	2%					Sand/silt	95% sand

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): none

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks: >2" = hydric soil

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

upstream from dam on low terrace

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Shem Dam City/County: Washington Co Sampling Date: 11/25

Applicant/Owner: Washington Co. State: UT Sampling Point: SPwet 100

Investigator(s): Browne & Jensen Section, Township, Range: T41S R17W Sec 28

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): Convex Slope (%): _____

Subregion (LRR): D Lat: 37 11 32.55 Long: 113 46 26.83 Datum: _____

Soil Map Unit Name: FA NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation ✓, Soil ✓, or Hydrology ✓ naturally problematic? Yes (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Willow	5%		
2.			
3.			
4.			
5.			
	5% = Total Cover		
Herb Stratum (Plot size: 15')			
1. Cattails - Typha latifolia	15%		
2. Beckmania	10%		
3. weed - see photo	50%		
4.			
5.			
6.			
7.			
8.			
	75% = Total Cover		
Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 20% % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

SOIL

Sampling Point: SP wet 100

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6"	2.5YR3/3	100					silty/clay	standing H2O @ 14"
6-18"	sand	80%						sand
	2.5YR3/3	20%						

silty clay

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks: no redox features; Material seems quite mobile

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ✓ Water Marks (B1) **(Riverine)**
- ✓ Sediment Deposits (B2) **(Riverine)**
- ✓ Drift Deposits (B3) **(Riverine)**
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ✓ No ___ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Shem Dam City/County: Washington Co. Sampling Date: SPUP 101
Applicant/Owner: Washington Co. State: UT Sampling Point: 11/25/13
Investigator(s): Browne & Jensen Section, Township, Range: T41S R17W S28
Landform (hillslope, terrace, etc.): side slope Local relief (concave, convex, none): Concave Slope (%): _____
Subregion (LRR): D Lat: 37 11 32.91 Long: 113.46 21.55 Datum: _____
Soil Map Unit Name: FA NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes Y No _____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. none			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Salsola iberica	10%		
2.			
3.			
4.			
5.			
	10% = Total Cover		
Herb Stratum (Plot size: 15')			
1. weed (annual)			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 90% % Cover of Biotic Crust _____

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
Total Number of Dominant Species Across All Strata: _____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals:	(A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: SPUP 101

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18"	2.5YR 6/4	100%					Sand	100% red sand

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): none

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

11/25/13

Project/Site: Shem Dam City/County: Wash County Sampling Date: below dam

Applicant/Owner: Washington Co. State: UT Sampling Point: SP wet 7

Investigator(s): Jensen & Browne Section, Township, Range: T41S R17W S28

Landform (hillslope, terrace, etc.): toe slope Local relief (concave, convex, none): Concave Slope (%): _____

Subregion (LRR): D Lat: 37°11'30.35" Long: -113° 46' 9.02 Datum: State plane Utah S. NAD 83

Soil Map Unit Name: FA NWI classification: N/A Unit DT #6

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation n, Soil n, or Hydrology n significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes _____	No _____	
Wetland Hydrology Present?	Yes _____	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10')	Absolute % Cover	Dominant Species?	Indicator Status
1. willow	25%	Y	FAC
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 10')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 10')			
1. Epilobium	2%	N	FACU
2. Melilotus officinalis	2%	N	FACU
3. grass	30%	Y	FAC
4. cattail - Typha latifolia	10	Y	OBL
5. bulrush - Scirpus spp	5%	N	OBL
6.			
7.			
8.			
	49% = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 3 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	0	x 2 =	
FAC species	55	x 3 =	165
FACU species	4	x 4 =	8
UPL species		x 5 =	
Column Totals:	74 (A)		188 (B)

Prevalence Index = B/A = 2.54

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

Y Prevalence Index is ≤3.0[1]

Y Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

SOIL

Sampling Point: SPWP 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
5"	5YR 5/4	100%						
6"	rock refuse							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: rock refuse 6"

Depth (inches): 6"

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ✓ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ✓ Sediment Deposits (B2) (**Riverine**)
- ✓ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): ? rock refuse @ 4"

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No _____ Depth (inches): 2"

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: ≈ 2.5' from water's edge
estimate wetland is greenline to greenline

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Shem Dam City/County: Washington Co Sampling Date: SD UP #1
Applicant/Owner: Washington Co. State: UT Sampling Point: 11/25/13
Investigator(s): Browne & Jensen Section, Township, Range: T41S R17W Sec 28 point 16
Landform (hillslope, terrace, etc.): toe slope Local relief (concave, convex, none): Convex Slope (%): _____
Subregion (LRR): D Lat: 37° 11' 30.09 Long: 113 46 9.30 Datum: _____
Soil Map Unit Name: FA NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No _____	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. willow	10%		
2.			
3.			
4.			
	10% = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. willow [Likely Salix exigua]	15%		
2.			
3.			
4.			
5.			
	15% = Total Cover		
Herb Stratum (Plot size: 15')			
1. Bermuda grass	50%		
2. sweet clover- Melilotus officinalis	10%		FACU
3.			
4.			
5.			
6.			
7.			
8.			
	60% = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 15% % Cover of Biotic Crust _____

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
Total Number of Dominant Species Across All Strata: _____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: SPUP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6"	5YR 5/4							
6"-10"	5YR 4/3	100%						
10"	rock refusal							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3) @ 6"
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 6"

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: no hydric, Plants herbaceous

APPENDIX B

FIGURES AND DRAWING

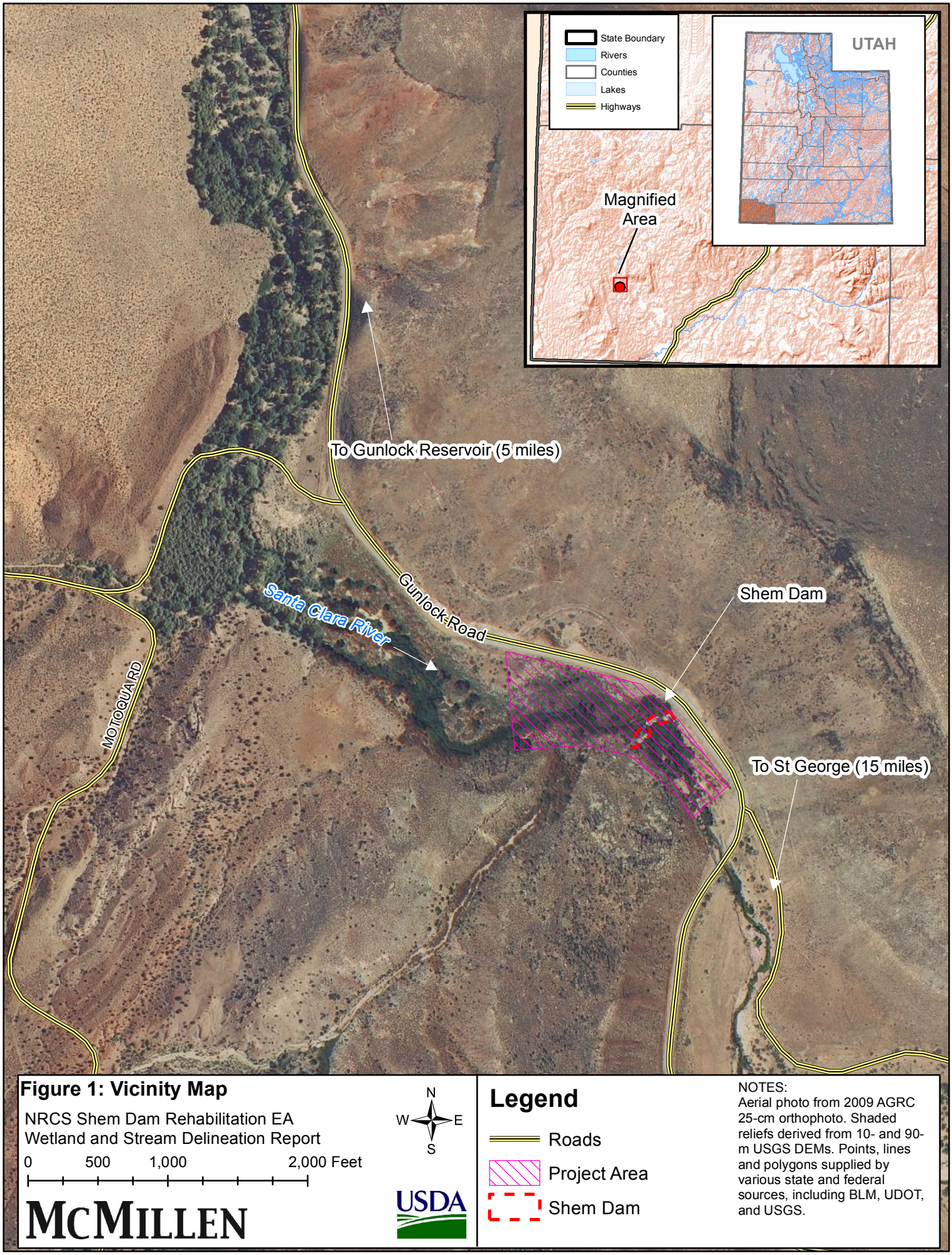


Figure 1: Vicinity Map

NRCS Shem Dam Rehabilitation EA
Wetland and Stream Delineation Report

0 500 1,000 2,000 Feet

N W E S

McMillen

USDA

Legend

- Roads
- Project Area
- Shem Dam

NOTES:
Aerial photo from 2009 AGRC 25-cm orthophoto. Shaded reliefs derived from 10- and 90-m USGS DEMs. Points, lines and polygons supplied by various state and federal sources, including BLM, UDOT, and USGS.

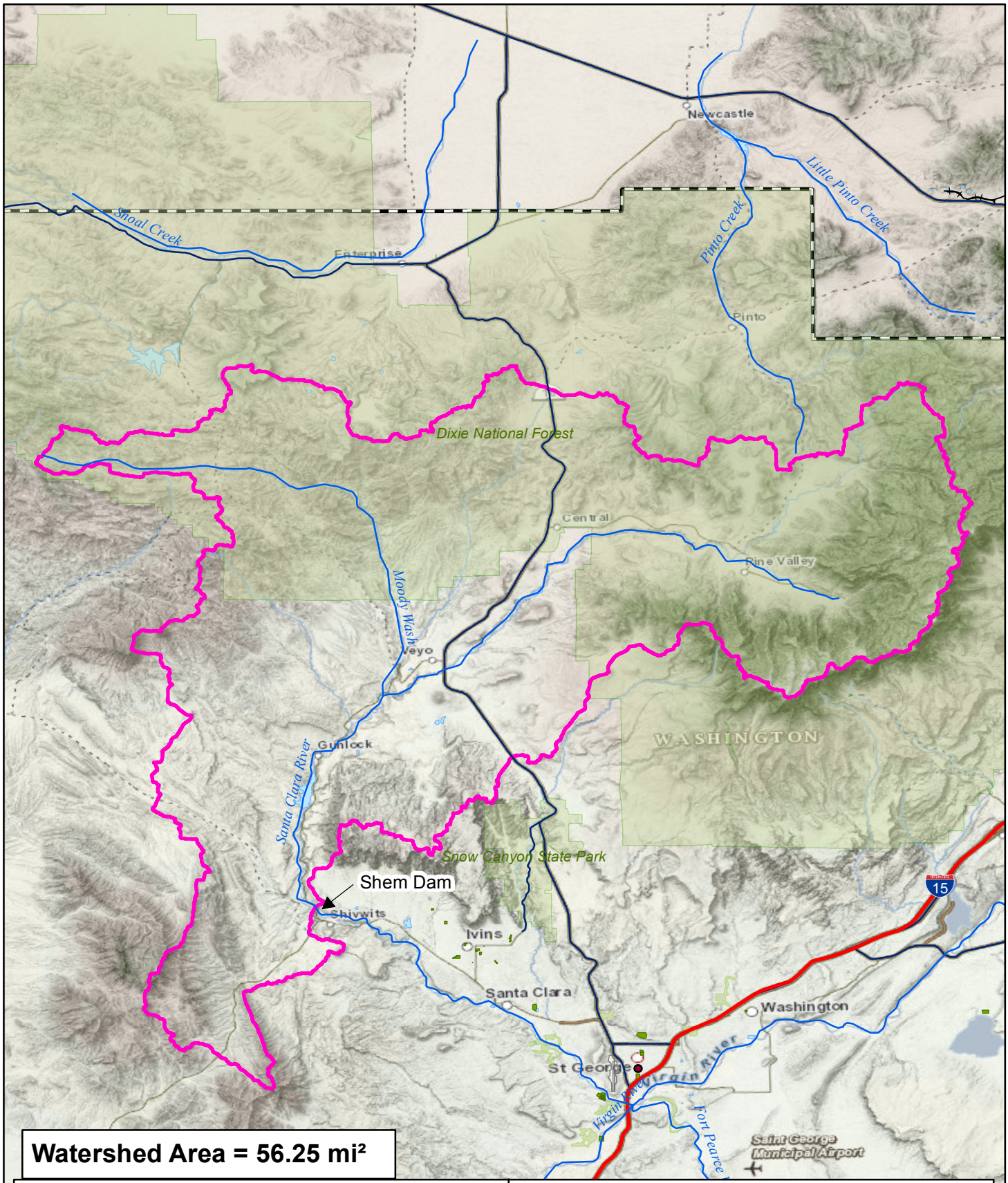


Figure 2: Watershed Map

NRCS Shem Dam Rehabilitation EA
Wetland and Stream Delineation Report

NOTES:
Points, lines and polygons supplied by various state and federal sources, including BLM, UDOT, and USGS. Watershed boundary approximated using the USGS StreamStats program.

McMILLEN

USDA

Legend

- Rivers
- Watershed Boundary
- Freeway
- Major Lakes
- State/Nat'l Parks
- National Forest
- County

0 2.5 5 10 Miles

N W E S

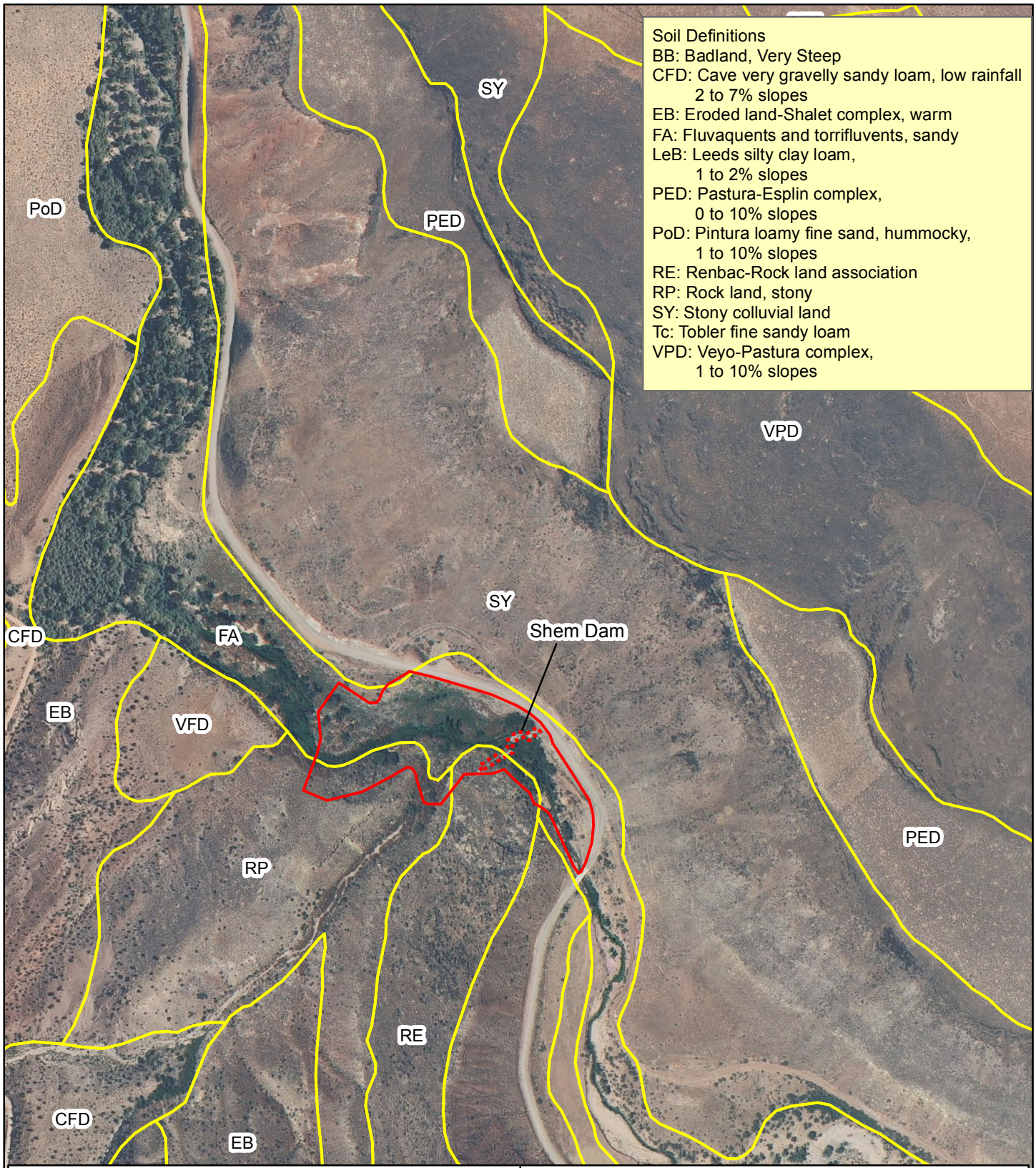


Figure 3: Soils Map

NRCS Shem Dam Rehabilitation EA
Wetland and Stream Delineation Report

N
W E
S

0 500 1,000 2,000 Feet

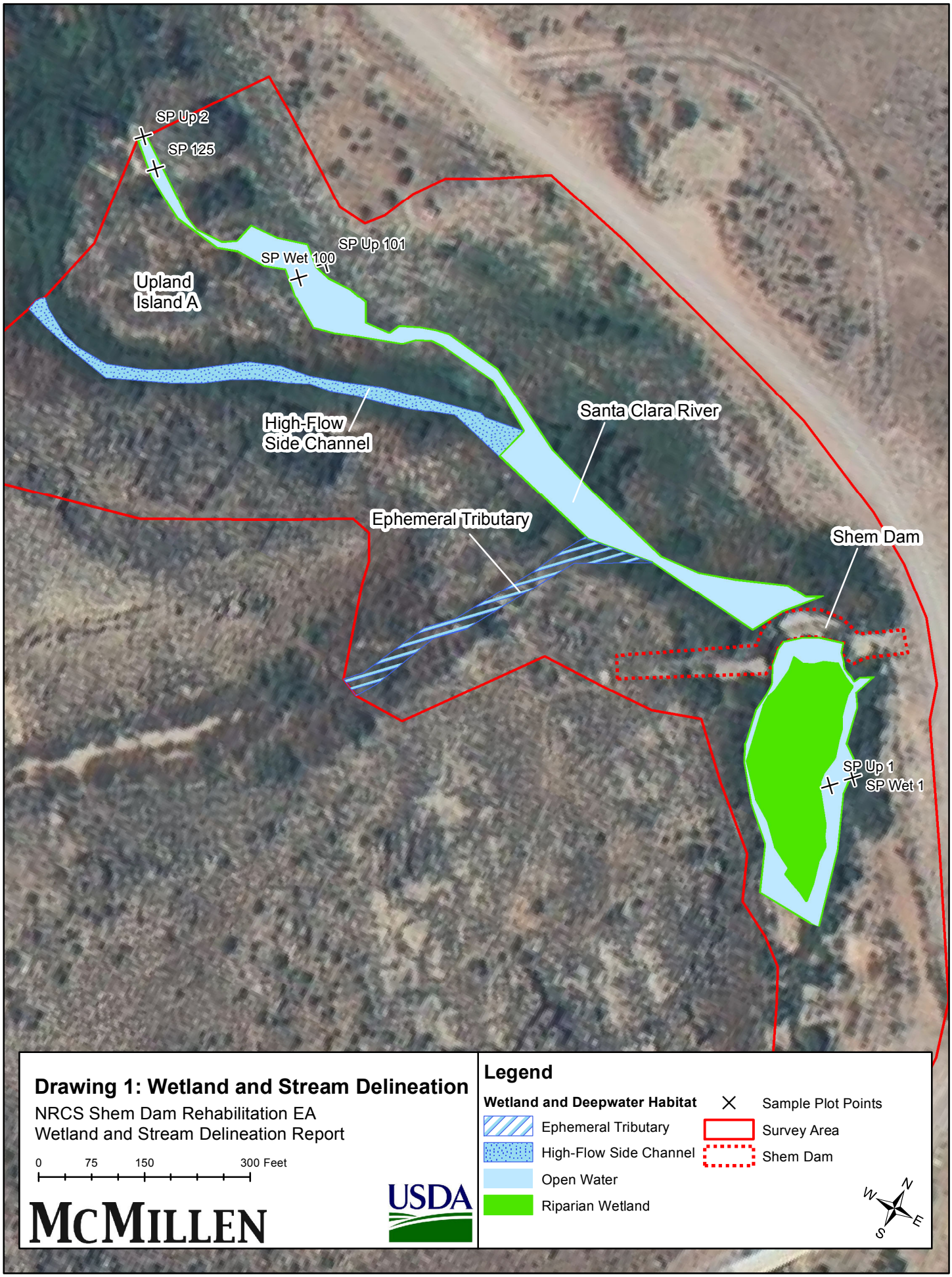
McMillen

USDA

Legend

- Survey Area
- Project Area Soils
- Shem Dam

NOTES:
Aerial photo from 2009 AGRC 25-cm orthophoto. Soils from NRCS data mart; soils outside of project area excluded.



Drawing 1: Wetland and Stream Delineation

NRCS Shem Dam Rehabilitation EA
Wetland and Stream Delineation Report

0 75 150 300 Feet

McMillen

USDA

Legend

Wetland and Deepwater Habitat

- Ephemeral Tributary
- High-Flow Side Channel
- Open Water
- Riparian Wetland

- Sample Plot Points
- Survey Area
- Shem Dam

N W E S

APPENDIX C

SITE PHOTOGRAPHS



Soil Pit SPUP#1



Soil Pit SWET 1



Soil Pit SPUP 101 (General Area of Sample)



Soil Pit SPWET 100 (General Area of Sample)



Soil Pit SPWET 125



Soil Pit SPUP 124

BIOLOGICAL SURVEY REPORT
Shem Dam



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January 24, 2014

SHEM DAM BIOLOGICAL SURVEY REPORT

Introduction

On January 22, 2013 JBR Environmental Consultants, Inc (JBR) biologist Seth Topham conducted a site visit of the proposed Shem Dam (Dam) Soil Boring Project. The project is located on the Shivwits Indian Reservation in Washington County, Utah, north west of St. George, along the Santa Clara River (River). The Dam is historic and located on the River adjacent to Gunlock Road near the Gunlock Road and Highway 91 intersection. The project consists of four soil boring locations along the Dam and approximately 3,920 feet of access road (Survey Area). The access road is mostly located in a drainage bottom dominated by riparian vegetation and showing signs of frequent scouring events. The Dam is located within the banks of the Santa Clara River. The drainage contains a small two track road (**Photo 4**) cleared by the Tribe to access the area for salt cedar (*Tamarisk ramosissima*) removal and treatment. **Figure 1** (figures provided in **Appendix A**) shows the location of the Survey Area.

Species Accounts

The US Fish and Wildlife Service (USFWS) lists 13 fish, wildlife, and plant species as Threatened, Endangered, or Candidate that could occur in Washington County (USFWS 2014). Habitat and status descriptions for these species are provided in **Table 1**. Of these species, 4 have the potential to occur within the Survey Area: Mojave desert tortoise (*Gopherus agassizii*), southwestern willow flycatcher (*Empidonax traillii extimus*), Mexican spotted owl (*Strix occidentalis lucida*) and Shivwits milkvetch (*Astragalus ampullarioides*). Other species that do not occur or do not have suitable habitat in or near the Survey Area are also identified in **Table 1**.

Survey Area

The Survey Area is composed of mostly riparian vegetation with some Great Basin and Mojave Desert upland species growing just outside of the Survey Area on steep-sloped hillsides. Vegetation in the Survey Area is dominated by salt cedar (*Tamarisk ramosissima*), sand bar willow (*Salix exigua*), and cotton wood (*Populus fremontii*). A complete list of plant species observed is provided in **Appendix D**.

Soils in most of the Survey Area consist of small amounts of sand dispersed around a bed of gravel, cobbles, and boulders. Soils are more developed along the Santa Clara River where scouring events area less frequent and sandy soils have accumulated in the Survey Area (**Photo 1**).

Table 1. Federally listed species that could occur in Washington County, Utah, their potential to occur in the Survey Area, and consideration in this Survey Report

Species	Status	Species Occurrence In The Survey Area And Consideration
Birds		
California Condor ***Gymnogyps californianus***	Endangered	**Not Considered.** Condors are not expected to occur in the area except as occasional visitors. Condors have been released from captive breeding programs into the Grand Canyon area as recently as March 3, 2007. Sightings of condors have been documented in Washington County. Nesting has not occurred in Utah. Marginal foraging habitat is available within the vicinity of the Survey Area; however, it is unlikely that this species would be found there on a regular basis.
Mexican Spotted Owl ***Strix occidentalis lucida***	Threatened	**Not Considered.** Mexican spotted owls commonly use mesa tops, benches, and warm slopes above canyons in fall and winter and relatively cool canyons in the summer. Canyon habitat is usually associated with uneven-aged stands of mixed-conifer forests that have experienced minimal human disturbance. The Survey Area is located approximately 27 miles from Designated Critical Habitat (not shown on Figure 3) and adjacent to Prime Breeding Habitat predicted by the 1997 habitat model (**Figure 3**). The Survey Area is greater than 1.7 miles from "buffered canyon" habitat (**Figure 3**) and 15 miles from GAP habitat (not shown on Figure 3) as predicted by the 2000 habitat model. Based on this site visit, it was determined that no suitable breeding/roosting habitat is located near the Survey Area. Further, in general, the juniper-blackbrush community found within the Survey Area does not provide suitable wintering and juvenile dispersal habitat (e.g., marginal overstory and prey base). The nearest known recorded observation is greater than 41 miles east of the Survey Area.
Southwestern Willow Flycatcher ***Empidonax traillii extimus***	Endangered	**Considered.** The southwestern willow flycatcher is a riparian obligate species, nesting in dense clumps of willow or shrubs with similar structure (alder, some tamarisk) along low-gradient streams, wetlands, beaver ponds, wet meadows, and rivers. The Survey Area contains riparian habitat but vegetation is too sparse to provide nesting habitat. The Survey Area does provide foraging habitat for the species and it could occur there on a transient basis.
Western Yellow-Billed Cuckoo ***Coccyzus americanus occidentalis***	Candidate	**Not Considered.** The western yellow-billed cuckoo requires dense, deciduous riparian forest for breeding. In the west, habitat generally contains tall cottonwoods and willows in at least 25-acre patches. Suitable habitat is not available in the Survey Area.
Reptiles and Amphibians		
Desert Tortoise ***Gopherus agassizii***	Threatened	**Considered.** Desert tortoises inhabit semi-arid grasslands, canyon bottoms, and rocky hillsides where they construct burrows in compacted sandy or gravelly soil. The Survey Area occurs outside Designated Critical Habitat for the desert tortoise but does occur in the Upper Virgin River Recovery Unit and provides suitable habitat for the species. The access road portion of the Survey Area is located in the bottom of a large wash where scouring events appear to be frequent. The wash bottom is composed of cobble and boulders and is not conducive to tortoise burrowing. The wash may be used, however, by tortoises for travel. No desert tortoises, burrows, or tortoise sign was observed during a 100% desert tortoise survey of the area.

Species	Status	Species Occurrence In The Survey Area And Consideration
Fish		
Virgin River Chub ***Gila seminuda***	Endangered	**Not Considered.** The Virgin River chub is endemic to the Virgin River system of southeastern Utah, southern Nevada, and northwestern Arizona. The species is now restricted to the Virgin River mainstem from La Verkin downstream to the Mesquite diversion near the Arizona – Nevada border.
Woundfin ***Plagopterus argentissimus***	Endangered	**Not Considered.** The woundfin was once found throughout the Virgin and Gila River drainages. Woundfin are presently found only from La Verkin Spring on the mainstem of the Virgin River and the lower portion of La Verkin Creek downstream to Lake Mead, Nevada.
Plants		
Dwarf bear-poppy ***Arctomecon humilis***	Endangered	**Not Considered.** The dwarf-bear poppy is a narrow endemic to Washington County, Utah where it is found on gypsiferous clay soils derived from the Moenkopi Formation. This poppy typically occurs on rolling low hills and ridge tops, often on barren, open sites in warm desert shrub communities, at elevations ranging from 2,300 to 4,600 feet. It is currently only known to exist on isolated sites within a 6.2-mile radius of St. George, Utah. The Survey Area does not provide habitat for this species.
Gierisch Mallow ***Sphaeralcea gierischii***	Candidate	**Not Considered.** Gierisch mallow is found only on gypsum outcrops associated with the Harrisburg member of the Kaibab formation in warm desert scrub communities in northern Mohave County, Arizona and closely adjacent Washington County, Utah. The Survey Area does not provide habitat for this species.
Holmgren milkvetch ***Astragalus holmgreniorum***	Endangered	**Not Considered.** The Holmgren milkvetch grows on shallow, sparsely vegetated soils derived primarily from the Virgin limestone member of the Moenkopi geological formation in Washington County, Utah. The Survey Area does not provide habitat for this species.
Las Vegas buckwheat ***Eriogonum corymbosum* var. *nilessi***	Candidate	**Not Considered.** The Las Vegas buckwheat grows on gypsum outcrops, often forming low mounds or outcrops in washes and drainages, or in areas of generally low relief in Clark County, Nevada, and closely adjacent portions of Washington County, Utah. The Survey Area does not provide habitat for this species.
Shivwits (Hermit) Milkvetch ***Astragalus ampullarioides***	Endangered	**Considered.** The Shivwits milkvetch grows on the unstable clay soil of the Chinle Shale Formation in warm desert shrub and pinyon-juniper communities at elevations ranging from 2,860 to 3,660 feet in Washington County, Utah. Well documented populations of Shivwits milkvetch grow on several hills near the west end of the access road where an exclusionary cattle fence protects these populations from trampling. While Shivwits milkvetch utilizes the hilltops and side hills at the west end of the access road, the Survey Area itself is located in a wash bottom that experiences frequent scouring events. Due to these frequent flood events, there are no soils in the Survey Area suitable to support Shivwits milkvetch.
Siler Pincushion ***Pediocactus sileri***	Threatened	**Not Considered.** This small cactus is found on gypsiferous and calcareous sandy or clay soils derived from the various members of the Moenkopi Formation. It is also sometimes found on the Kaibab Formation. It typically occurs on rolling hills in warm desert shrub, sagebrush-grass, and, at its upper limits, pinyon-juniper communities, at elevations ranging from 2,640 to 5,410 feet. The Survey Area does not contain habitat for this species.

METHODS

The Mojave desert tortoise is listed as Threatened under the Endangered Species Act and the Survey Area is located in the Upper Virgin River Recovery Unit for the species. For this reason, prior to the site visit on January 22, 2014, JBR contacted the Utah Division of Wildlife Resources (UDWR) about any records of desert tortoise being found in or near the Survey Area.

> Ann McLuckie, Wildlife Biologist (UDWR): "I checked our database and we have one observation June 1, 1995 of a desert tortoise at UTM 254125, 4119893, near your project area (the description states tortoise was observed at "Santa Clara Bench, 210 m NNW of Shem" and "14 miles west of St. George, Jackson Wash, NNW of SHEM"). We have a cluster of tortoises (3 observations) observed 2,000 meters NE of this observation [closest observation to your project area is UTM 255522 E, 4121193 N and the description states "Native (not translocated) Female was observed, Burrow #578 on 8/31/1999 - which leads me to believe this observation was associated with the U of Nevada-Reno translocation study), an observation 3800 m S-SE, an observation 6700 m SW, and another observation 7700 m W-SW. Overall, tortoise sightings in this area are pretty spotty. We did have a woman several years ago drop off an adult tortoise that was apparently in the road within the Shivwits Indian Reservation as well but that is well east of your project area."

Though the timing of the survey is outside the recommended survey season outlined in the survey protocol (USFWS 2010), a JBR USFWS-certified desert tortoise biologist, Seth Topham, conducted a protocol desert tortoise surveys for the entire Survey Area. As required by the protocol, Seth walked parallel transects spaced 30 feet apart to achieve 100% coverage of the area. The Survey Area was mapped in a GIS and uploaded to a GPS prior to the survey. The GPS was used to locate the boundaries of the Survey Area in the field. Seth walked parallel transects, spaced approximately 30 feet apart, to achieve coverage of the Survey Area. During the survey, special attention was given to the identification of desert tortoises and their sign (e.g., burrows, scat, carcasses, etc.). Survey information was recorded on established data sheets (**Appendix B**). JBR did not survey adjacent transects paralleling the Survey Area at 200 and 400 meters as outlined in the survey protocol.

While the Survey Area is not located in Designated Critical Habitat for the southwestern willow flycatcher, it does contain a large riparian vegetation component which could be utilized by the species. For this reason, JBR contacted UDWR concerning possible records of this species in or around the Survey Area.

> Christian Edwards, Wildlife Biologist (UDWR): "The Santa Clara River from Pine Valley to the Virgin River is included in the SWFL (southwestern willow flycatcher) recovery plan but we do not have any records of SWFLs at your project area. However, we have never had access to the tribal property. We have captured SWFL on the Santa Clara between Gunlock Dam and the tribe's property, but have never found resident birds defending territories."

During the site visit, Seth (a USFWS-certified southwestern willow flycatcher surveyor, (Mexican spotted owl trained surveyor, and BLM-approved Mojave Desert botanist) assessed habitat in and around the Survey Area for the potential occurrence of southwestern willow flycatcher, Mexican spotted owl, and Shivwits milkvetch, along with other Threatened, Endangered, or otherwise sensitive species. While the timing of the survey was not conducive to finding migratory birds and flowering plants, habitats were assessed for suitability. Further, a BLM Southwestern Willow Flycatcher Riparian Habitat Classification Worksheet was completed (**Appendix C**) and all wildlife species (**Table 2**) and plants (**Appendix D**) observed were recorded.

JBR visited the population of Shivwits milvetch located at the west end of the access road with members of the Tribe to look at the soils and habitat preferences of the species and to see the current state of the plant (**Photo 5**). Neither the JBR biologist or members of the Tribe could locate any dormant plants during the visit, but observations were made of the species' habitat requirements.

RESULTS

Desert Tortoise

The greater project area is within the range of the desert tortoise and provides marginal and suitable habitat for the species. Well-documented populations of tortoises exist to the southwest in the area of Beaver Dam, Mohave County, Arizona and to the east on the Red Cliffs Desert Reserve, Washington County, Utah. Seth did not encounter any desert tortoises or their sign during the survey event. The Survey Area is located in a wash bottom and along the Santa Clara River where scouring events are sufficient to remove soils leaving gravel, cobble, and boulders (**Photo 3**) that are not conducive to burrowing by any species. Seth did not encounter any burrows of any kind during the survey event. Adjacent side slopes contain better habitat for desert tortoises, but these areas are not within the Survey Area and would not be impacted by the project. While tortoises may use the greater project area, the Survey Area itself does not provide preferred foraging habitat or burrowing opportunities and would only be used by tortoises as a possible travel corridor.

Southwestern Willow Flycatcher

Documented occurrences of southwestern willow flycatcher exist along the Santa Clara River and according to the Southwestern Willow Flycatcher Riparian Habitat Classification Worksheet, the Survey Area contains Potential Habitat for the species (**Photo 2**). The vegetation is a mix of native and exotic species and Stand Height, Width, Distance to Water, and Patch Size are Suitable per the worksheet . However, the Canopy Thickness and Understory Density are not sufficient for nesting. The Survey Area could be used by southwestern willow flycatcher as a foraging area and the species could be found in the Survey Area on a migrant basis.

Shivwits Milk-vetch

While Shivwits milkvetch are known in the greater area, soils in the Survey Area itself are not suitable for the species. The Survey Area is located in a wash with frequent

scouring events and soils of any kind are scarce to non-existent. The gravel, cobble, and boulders making up the wash substrate would not support Shivwits milkvetch.

Mexican Spotted Owl

Based on Mexican spotted owl GIS habitat models (Willey and Spotskey 1997 and 2002), Breeding Habitat is located in close proximity of the Survey Area (**Figure 3**). The GIS models used to predict MSO habitat are "a conceptual hypotheses (and spatial prediction), and were intended to be a first-cut evaluation of project areas for the possible location and extent of owl habitat. Both models were field tested and proved to be valuable for identifying regions where spotted owl nesting and breeding habitat are likely to occur, but they do not replace on-site visits nor were they intended for fine-grained determination of habitat suitability for management planning (USFWS 2002)." For this reason, Seth assessed the Survey Area for the potential presence of Mexican spotted owl habitat and it was determined that habitat in and surrounding the Survey Area was not sufficient for Mexican spotted owl nesting or breeding and that the area did not provide habitat for the species (**Photo 6**).

Other Wildlife

No reptiles or mammals were seen during the survey event. One large stick nest, possibly raptor, was found near the Survey Area (**Figure 2**).

Table 2. Bird species encountered during the survey.

Scientific Name	Common Name
Pipilo aberti	Abert's Towhee
Thryomanes bewickii	Bewick's Wren
Catherpes mexicanus	Canyon Wren
Junco hyemalis	Dark-eyed Junco
Anas platyrhynchos	Mallard
Colaptes auratus	Northern Flicker
Salpinctes obsoletus	Rock Wren
Regulus calendula	Ruby-crowned Kinglet
Pipilo maculatus	Spotted Towhee
Aphelocoma californica	Western Scrub-Jay
Troglodytes troglodytes	Winter Wren

References

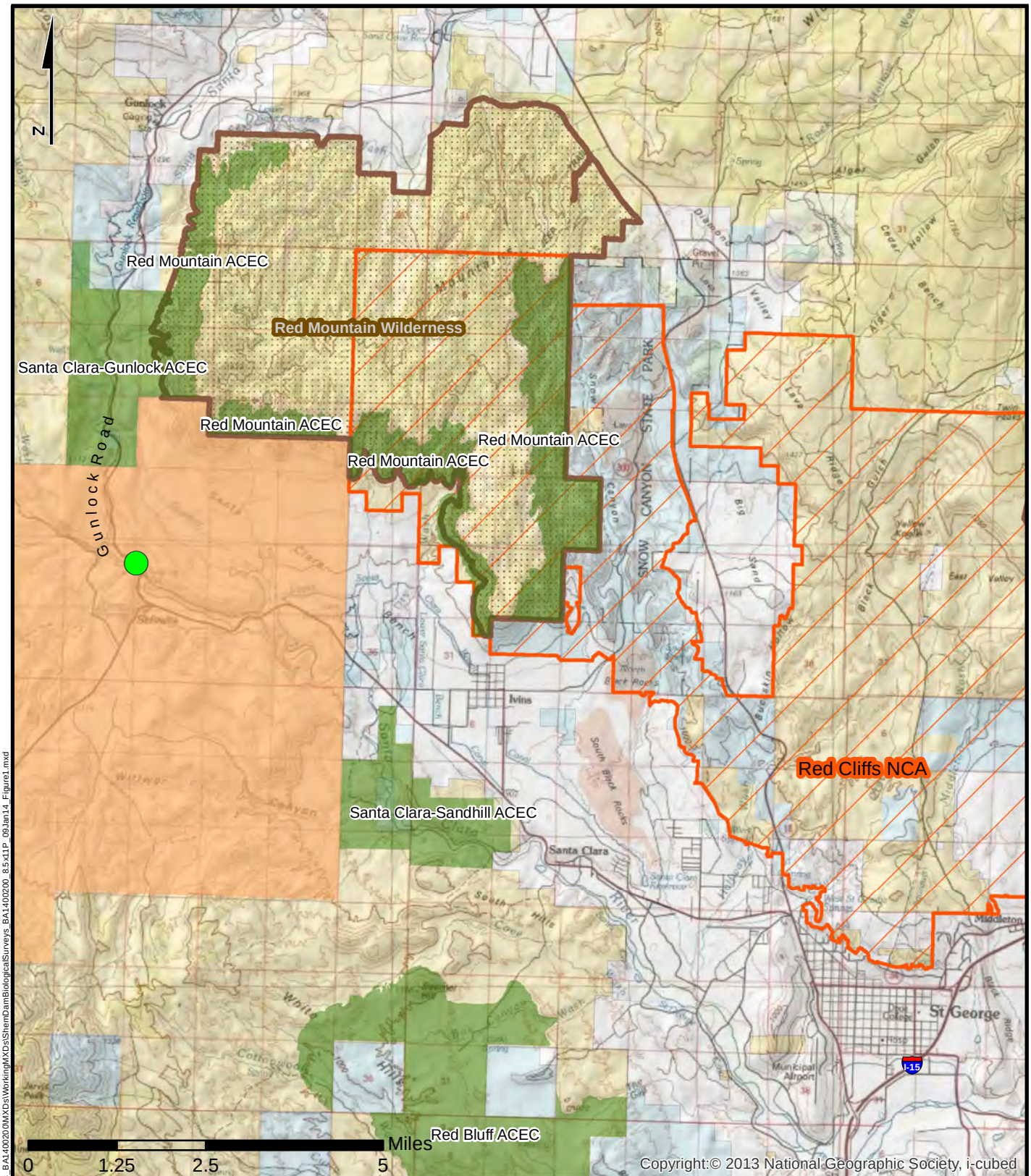
US Fish and Wildlife Service (USFWS). 2002. Project evaluation and Section 7 consultation recommendations for Mexican spotted owl habitat using available habitat models. Letter from USFWS Utah Field Office to the Utah State Director of the BLM. 21 November 2002.

US Fish and Wildlife Service (USFWS). 2010. Preparing for any action that may occur within the range of the Mojave desert tortoise (*Gopherus agassizii*). 2010 field season. Ventura Office. Ventura, California

Willey, Dave and Daniel Spotskey. 1997. Mexican spotted owl habitat model with surveyed area. GIS data. Grand Canyon National Park, National Park Service and Colorado Plateau Research Station, US Geological Service.

Willey, Dave and Daniel Spotskey. 2000. Utah Mexican spotted owl habitat model. GIS data. Grand Canyon National Park, National Park Service and Colorado Plateau Research Station, US Geological Service.

Appendix A
Figures and Photos



Shem Dam
BLM Area of Critical Environmental Concern
Wilderness
Red Cliffs National Conservation Area
Bureau of Land Managment
Private
State
Indian Reservation



MCMILLEN, LLC
SHEM DAM BIOLOGICAL SURVEY

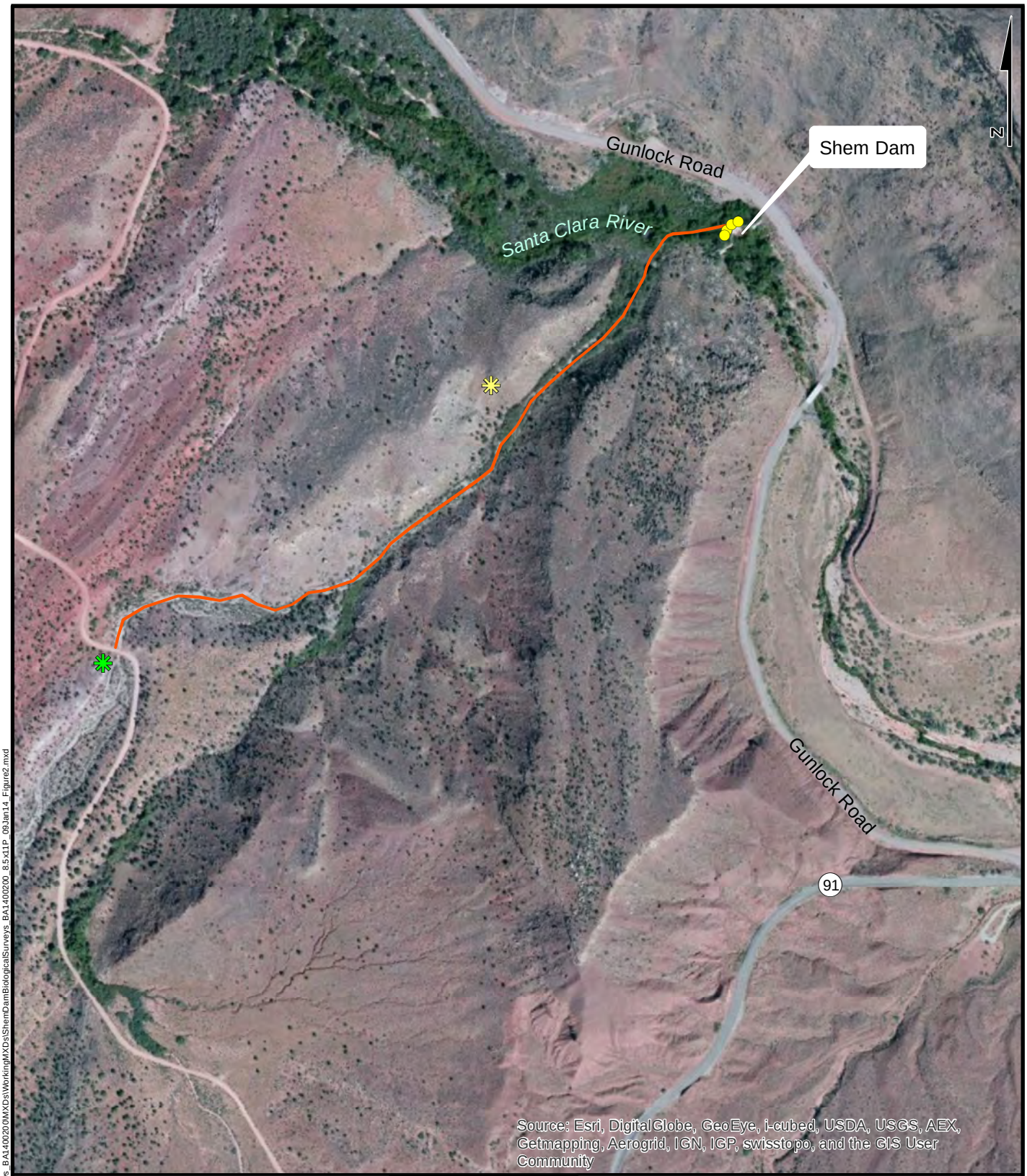
FIGURE 1
BIOLOGICAL SURVEY RESULTS

JBR

DRAWN BY	ST
DATE DRAWN	1/24/2014
SCALE	1 in = 2 miles
PROJECT	B.A14002.00

X:\UT\Clients\McMillen,LLC\ShemDamBiologicalSurveys_BA140020\MXDs\WorkingMXDs\ShemDamBiologicalSurveys_BA1400200_8.5x11P_09Jan14_Figure1.mxd

This document is for reference purposes only and should not be used as a legal document. JBR makes no guarantees to the accuracy of the data contained herein or any loss resulting therefrom.



Shivwith Milkvetch Exclosure

Large Stick Nest

Proposed Drill Holes

Proposed Access

0 305 610 1,220 Feet



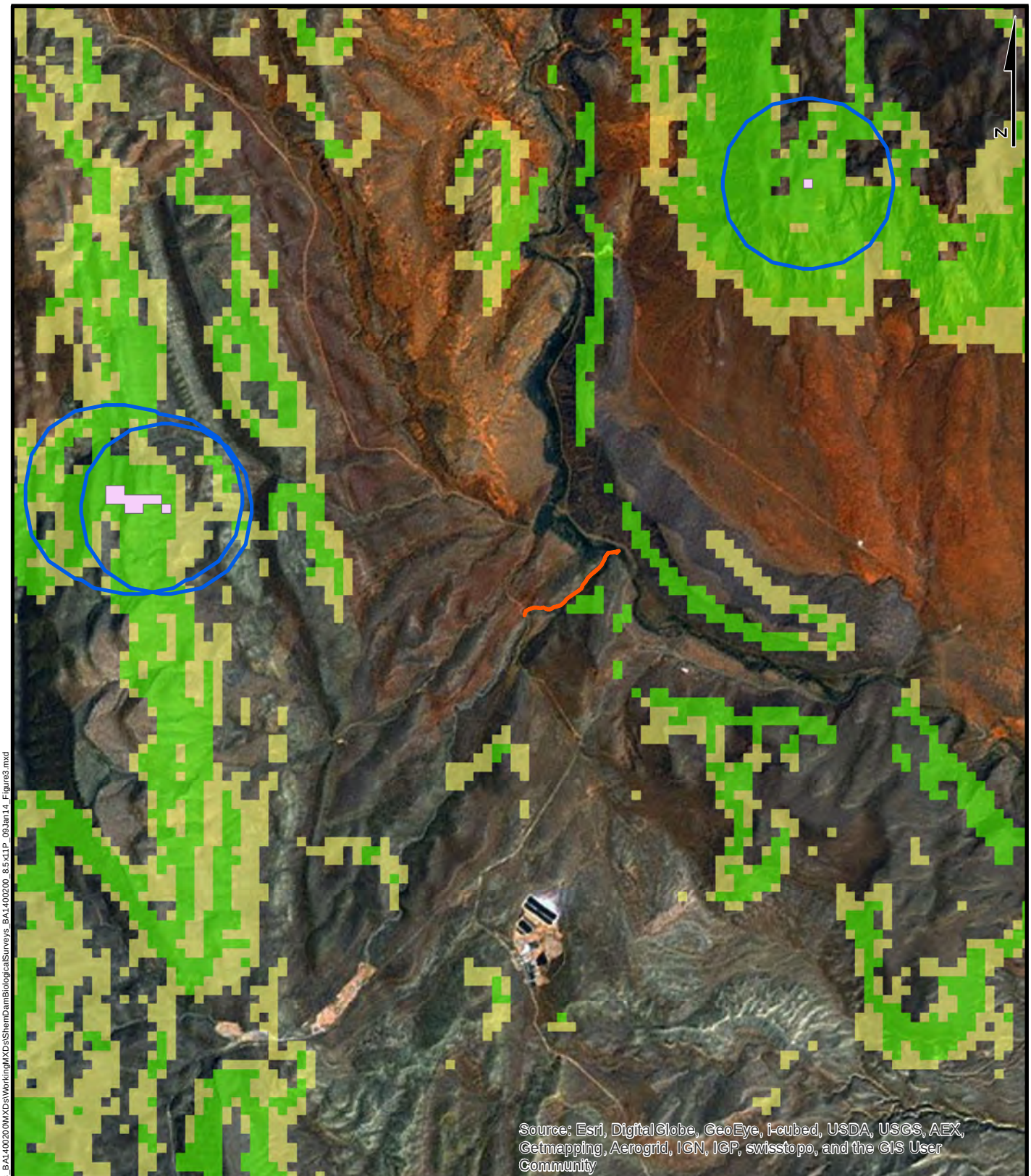
MCMILLEN, LLC
SHEM DAM BIOLOGICAL SURVEY

FIGURE 2
BIOLOGICAL SURVEY RESULTS

DRAWN BY	ST	DATE DRAWN	1/24/2014
SCALE	1 in = 690 feet		
PROJECT	B.A14002.00		

X:\UT\Clients\McMillen,LLC\ShemDamBiologicalSurveys_BA1400200\MXDs\WorkingMXDs\ShemDamBiologicalSurveys_BA1400200_8.5x11P_09Jan14_Figure2.mxd

This document is for reference purposes only and should not be used as a legal document. JBR makes no guarantees to the accuracy of the data contained herein or any loss resulting therefrom.



2000 Canyon Habitat

2000 Buffered Canyon Habitat

Proposed Access

1997 Prime Breeding Habitat

1997 Marginal Habitat

0 0.375 0.75 1.5 Miles



MCMILLEN, LLC
SHEM DAM BIOLOGICAL SURVEY

FIGURE 3
MEXICAN SPOTTED OWL HABITAT MODELS

DRAWN BY	ST	DATE DRAWN	1/24/2014
SCALE	1 in = 4,600 feet		
PROJECT	B.A14002.00		

X:\UT\Clients\McMillen,LLC\ShemDamBiologicalSurveys_BA140020\MXDs\WorkingMXDs\ShemDamBiologicalSurveys_BA1400200_8.5x11P_09Jan14_Figure3.mxd

This document is for reference purposes only and should not be used as a legal document. JBR makes no guarantees to the accuracy of the data contained herein or any loss resulting therefrom.



(Photo 1) Santa Clara River directly above Shem Dam.



(Photo 2) Looking down on the Survey Area from Gunlock Road, photo depicts potential SWFL habitat.



(Photo 3) Looking east down the access drainage towards the Santa Clara River, photo depicts evidence of frequent scouring events along with limited soils to support vegetation and burrowing by animals.



(Photo 4) Looking down the access drainage from the west end of the Survey Area, photo depicts two track road used by the Tribe during tamarisk removal.



(Photo 5) Shivwits milkvetch cattle fenced exclosure area depicting habitat for the species.



(Photo 6) Hillside predicted by the MSO model to be MSO habitat, photo shows lack of cliff/canyon habitat and sparse Utah juniper trees.

Appendix B

Tortoise Survey Data Sheets

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 22, 01, 2014 (day, month, year) Survey biologist(s): SETH TOPHAM, STOPHAM@JBREW.COM, 435-668-9723 (name, email, and phone number)

Site description: SHEM DAM, 3.34 ACRES, ALONG SANTA CLARA ~~CREEK~~ RIVER ON NAVAJO RES. (project name and size; general location)

County: WASHINGTON Quad: SHIVWITS QUAD Location: 12 S. 254118E 4119849 N (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: ~~100% coverage~~ or Sampling Area size to be surveyed: ~~2~~ 3.34 ACRES Transect #: 1, 2 Transect length: 4,089 FT

GPS Start-point: 254157 4119799 3036 FT ELEV. (easting, northing, elevation in meters) Start time: 10:30 am/pm

GPS End-point: 252233 4119171 ~~3100~~ 3106. ELEV (easting, northing, elevation in meters) End time: 11.45 am/pm

Start Temp: 49 °F End Temp: 51 °F

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

NONE

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

NONE

2010 Field Season

Appendix C

Southwestern Willow Flycatcher Riparian Habitat Classification Worksheet

Southwestern Willow Flycatcher
Riparian Habitat Classification Worksheet
St. George Field Office, May 2008

Field Office ST. GEORGE Date 01/22/14 Overall Classification POTENTIAL
Location SHEM DAM Elevation 3036
Riparian Area SANTA CLARA CREEK Topo Map Name SHIVWITS Patch Size 14 ACRES
Observer(s) SETH TOPHAM
SWIFL Detected NONE Tamarisk Present YES Cowbirds Detected NONE
Notes: STAND LACKS DENSITY & CANOPY TO BE NESTING TERRITORY, HABITAT SUITABLE FOR FORAGE AND OTHER SOME USE BY SWFL,

Site Capability

Floodplain width	Is the floodplain wide enough that a minimum size habitat patch* could develop to support a breeding pair of willow flycatchers? Yes X or No____ If No, the site is Unsuitable as SWIFL habitat
Frequency of Scouring Flood Events	Does the site show signs of scouring floods of sufficient frequency (<10 growing seasons) and magnitude to prevent the maturation and maintenance of suitable habitat? Yes____ or No X If yes, the site is Unsuitable as SWIFL habitat
Availability of Surface Water	Is surface water or saturated soils present (within 280 feet) during the Spring growing season (May to June) to maintain riparian vegetation? Yes X or No____ If No, the site may be Unsuitable as SWIFL habitat

*Minimum: block patch size= 0.5 acres or linear patch size= 15ft. X 200 ft.

Habitat Evaluation

Select the habitat type that best represents the segment or patch you are evaluating. Cross off habitat types not applicable to the segment or patch. Examine the attributes listed for that habitat type. Write the existing condition in the appropriate column. Circle the habitat classification you determine is most appropriate for each attribute as suitable (S), potential (P), or unsuitable (Un) based upon comparison with the listed criteria.

Habitat: **Monotypic Exotic**	Nearly monotypic dense stands of exotics such as saltcedar or Russian olive					
Attributes	Suitable	Potential	Existing	Classification		
Height	12-35 ft. with no distinct overstory layer	2-12 ft. with or without overstory		S	P	Un
Width	≥3 trees wide (≥15 ft.)	≤2 trees wide; <15 ft.		S	P	Un
Canopy Density	Nearly continuous closed canopy	Canopy mostly open		S	P	Un
Understory Density	Lower 6 ft. mostly impenetrable	Lower 6 ft. with openings		S	P	Un
Distance to Water	Up to 300 ft.	≥ 300 ft. from available water		S	P	Un
Patch Size	≥ 0.5 acres	< 0.5 acres		S	P	Un

Habitat: **Native Broadleaf Dominated**	Single species of Gooding or other willow or mixtures of native broadleaf trees and shrubs including cottonwood, willows, ash, etc.					
Attributes	Suitable	Potential	Existing	Classification		
Height	9-50 ft. with trees of different ages / heights	2-9 ft. trees of uniform age / height		S	P	Un
Width	≥15 ft.	<15 ft.		S	P	Un
Canopy Density	Distinct canopy of broadleaf species with subcanopies (multi-layered)	Canopy mostly open		S	P	Un
Understory Density	Dense and of mixed (mostly native) species; lower 6 ft. mostly impenetrable	Less dense and/or with exotics; lower 6 ft. with openings		S	P	Un
Distance to Water	<300 ft.	≥ 300 ft. from available water		S	P	Un
Patch Size	≥ 0.5 acres	< 0.5 acres		S	P	Un

Habitat: **Mixed Native/Exotic**	Dense mixtures of native broadleaf trees (cottonwood, willows, ash, etc.) mixed with exotics (saltcedar, Russian olive, etc.). Exotics most often in understory.					
Attributes	Suitable	Potential	Existing	Classification		
Height	9-50 ft. with trees of different ages / heights	2-9 ft. trees of uniform age / height	MIXED COTTONWOOD, WILLOW, TAMARISK,	(S)	P	Un
Width	≥15 ft.	<15 ft.	PATCH VERY LARGE	S	(P)	Un
Canopy Density	Distinct canopy of mostly broadleaf species mixed exotics with many layers.	Canopy mostly open	CANOPY GAPS DENSITY AT UPPER LEVELS, LOWER LEVELS MODERATE	S	(P)	Un
Understory Density	Dense and of mixed (mostly exotic) species; lower 6 ft. mostly impenetrable	Less dense; lower 6 ft. with openings	DENSITY VARIABLE WILLOW / TAMARISK.	S	(P)	Un
Distance to Water	<300 ft.	≥ 300 ft. from available water	ON SANTA CLARA CREEK	(S)	P	Un
Patch Size	≥ 0.5 acres	< 0.5 acres	APPROX 10 ACRES	(S)	P	Un

Habitat: **Monotypic High Elevation Willow**	Nearly monotypic, dense stands of willow above 7,000 feet elevation. Often associated with sedges, rushes, nettles, and other herbaceous wetland species.					
Attributes	Suitable	Potential	Existing	Classification		
Height	9-25 ft. with trees of different ages / heights	2-9 ft. trees of uniform age / height		S	P	Un
Width	≥15 ft.	<15 ft.		S	P	Un
Canopy Density	No distinct overstory layer	Canopy mostly open		S	P	Un
Understory Density	Dense; lower 6 ft. mostly impenetrable	Less dense; lower 6 ft. with openings		S	P	Un
Distance to Water	<300 ft.	≥ 300 ft. from available water		S	P	Un
Patch Size	≥ 0.5 acres	< 0.5 acres		S	P	Un

Southwestern Willow Flycatcher Riparian Habitat Classification Worksheet

Date 01/22/14
Location SHEM DAM
Drainage SANTA CLARA RIVER Topo Map Name SHIVWITS Patch Size 14 ACRES
Observer(s) SETH TOPHAM
SWIFL Detected? NO Tamarisk Present? YES Cowbirds Detected? NO Overall Classification POTENTIAL

Select the habitat type that best represents the segment or patch you are evaluating. Cross off habitat types not applicable to the segment or patch. Examine the attributes listed for that habitat type. Write the existing condition in the appropriate column. Circle the habitat classification you determine is most appropriate for each attribute as suitable (S), potential (P), or unsuitable (Un) based upon comparison with the listed criteria. Habitats that do not fit any of the listed descriptions should be written into the Other block.

Habitat: **Monotypic Exotic**	Nearly monotypic dense stands of exotics such as saltcedar or Russian olive					
Attributes	Suitable	Potential	Existing	Classification		
Height	12-35 ft. with no distinct overstory layer	2-12 ft. with or without overstory		S	P	Un
Width	≥3 trees wide (≥15 ft.)	≤2 trees wide; <15 ft.		S	P	Un
Canopy Density	Nearly continuous closed canopy	Canopy mostly open		S	P	Un
Understory Density	Lower 6 ft. mostly impenetrable	Lower 6 ft. with openings		S	P	Un
Distance to Water	Up to 300 ft.	≥ 300 ft. from available water		S	P	Un
Patch Size	≥ 0.5 acres	< 0.5 acres		S	P	Un

Habitat: **Mixed Native/Exotic**	Dense mixtures of native broadleaf trees (cottonwood, willows, ash, etc.) mixed with exotics (saltcedar, Russian olive, etc.). Exotics most often in understory.					
Attributes	Suitable	Potential	Existing	Classification		
Height	9-50 ft. with trees of different ages / heights	2-9 ft. trees of uniform age / height	MIXED COTTONWOOD, WILLOW, TAMARISK. 9-50 FT TALL	(S)	P	Un
Width	≥15 ft.	<15 ft.	APPROX 150 FT	S	(P)	Un
Canopy Density	Distinct canopy of mostly broadleaf species mixed exotics with many layers.	Canopy mostly open	CANOPY LACKS DENSITY DUE TO SPARSITY OF COTTONWOOD AND TALLER PLANTS.	S	(P)	Un
Understory Density	Dense and of mixed (mostly exotic) species; lower 6 ft. mostly impenetrable	Less dense; lower 6 ft. with openings	LACKS UNDERSTORY DENSITY TAMARISK & WILLOWS ARE NOT THICK ENOUGH.	S	(P)	Un
Distance to Water	<300 ft.	≥ 300 ft. from available water	ADJACENT TO SANTA CLARA RIVER.	(S)	P	Un
Patch Size	≥ 0.5 acres	< 0.5 acres	14 ACRES.	(S)	P	Un

Habitat: **Native Broadleaf Dominated**	Single species of Gooding or other willow or mixtures of native broadleaf trees and shrubs including cottonwood, willows, ash, etc.					
Attributes	Suitable	Potential	Existing	Classification		
Height	9-50 ft. with trees of different ages / heights	2-9 ft. trees of uniform age / height		S	P	Un
Width	≥15 ft.	<15 ft.		S	P	Un
Canopy Density	Distinct canopy of broadleaf species with subcanopies (multi-layered)	Canopy mostly open		S	P	Un
Understory Density	Dense and of mixed (mostly native) species; lower 6 ft. mostly impenetrable	Less dense and/or with exotics; lower 6 ft. with openings		S	P	Un
Distance to Water	<300 ft.	≥ 300 ft. from available water		S	P	Un
Patch Size	≥ 0.5 acres	< 0.5 acres		S	P	Un

Habitat: **Monotypic High Elevation Willow**	Nearly monotypic, dense stands of willow above 7,000 feet elevation. Often associated with sedges, rushes, nettles, and other herbaceous wetland species.					
Attributes	Suitable	Potential	Existing	Classification		
Height	9-25 ft. with trees of different ages / heights	2-9 ft. trees of uniform age / height		S	P	Un
Width	≥15 ft.	<15 ft.		S	P	Un
Canopy Density	No distinct overstory layer	Canopy mostly open		S	P	Un
Understory Density	Dense; lower 6 ft. mostly impenetrable	Less dense; lower 6 ft. with openings		S	P	Un
Distance to Water	<300 ft.	≥ 300 ft. from available water		S	P	Un
Patch Size	≥ 0.5 acres	< 0.5 acres		S	P	Un

Habitat: **Other**	Description:			
Attributes	Existing	Classification		
Height		S	P	Un
Width		S	P	Un
Density		S	P	Un
Distance to Water		S	P	Un
Patch Size		S	P	Un

Notes:

Appendix D

Plant List

Plant Species Observed in the Survey Area.

Common Name	Genus	Species
Indian rice grass	*Achnatherum*	*hymenoides*
big sage	*Artemisia*	*tridentata*
4 wing salt brush	*Atriplex*	*canescens*
emory baccharis	*Baccharis*	*emoryi*
cheat grass	*Bromus*	*tectorum*
rabbit brush	*Ericameria*	*nauseosa*
filaree	*Erodium*	*cicutarium*
Utah juniper	*Juniperus*	*osteosperma*
cotton wood	*Populus*	*fremontii*
Dixie live oak	*Quercus*	*turbinella*
sandbar willow	*Salix*	*exigua*
tumbleweed	*Salsola*	*tragus*
tamarisk	*Tamarix*	*ramosissima*
common cocklebur	*Xanthium*	*strumarium*

USDA

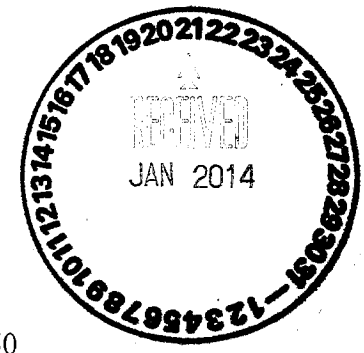
United States Department of Agriculture

Natural Resources
Conservation Service

Utah State Office

125 So. State Street
Room 4010
Salt Lake City, UT
84138-1100

Voice: 801-524-4550
Fax: 801-524-4403



January 21, 2014

Mr. Larry Crist
Field Supervisor
U.S. Fish and Wildlife Service
Utah Field Office
2369 West Orton Circle, Suite 50
West Valley City, Utah 84119

☐ Concur No Effect

☒ Concur Not Likely to Adversely Affect

☐ No Comment

U.S.F.W.S. – Utah Field Supervisor

Date 1/22/14

Reference: NRCS Shem Dam Geotechnical Explorations

Dear Mr. Crist:

INTRODUCTION

The Natural Resources Conservation Service (NRCS) along with Washington County, the Shivwits Band of Paiutes and the Army Corps of Engineers are working together to rehabilitate the Shem Dam (aka Winsor Dam) on the Santa Clara River in Washington County, Utah (Vicinity Map). McMillen, LLC, is preparing a National Environmental Policy Act (NEPA) Environmental Assessment (EA) for NRCS, and we hope to begin construction of the dam rehabilitation in the late summer of 2014. The overall dam rehabilitation is being funded through the NRCS Emergency Watershed Protection (EWP) program.

PROPOSED ACTION

Geotechnical explorations at the dam are being proposed to support the NEPA EA, final design and construction efforts. They are warranted to investigate subsurface conditions at the existing dam to determine the dam integrity as well as identify appropriate measures to rehabilitate the dam and river, and withstand future flood events. We will also be testing sediment for regulated chemical constituents due to the potential for contamination from a historic smelter upstream of the dam. NRCS desires that these geotechnical explorations should commence as soon as possible to keep the project moving forward. The estimated time frame to complete the geotechnical explorations is the first week of February 2014.

We have enclosed a Geotech Map depicting the associated footprint, the proposed ingress/egress, and drilling locations for test holes. A total of four test holes are proposed using a track mounted drill rig, which should limit onsite exploration to less than 2 days barring inclement weather or site conditions. If the soil surface is disturbed to the degree that tire ruts are created, they will be smoothed by hand upon the completion of onsite explorations.

SPECIES

Research indicates that threatened or endangered species in Washington County may occur within or near the project area and they are identified in the following table. The following species were identified in Washington County but are not expected to occur in the project area due to lack of habitat and there would be **No Effect** to these species or their critical habitat: California condor (*Gymnogyps californianus*), yellow-billed cuckoo (*Coccyzus americanus*), dwarf bear-poppy (*Arctomecon humilis*), siler pincushion cactus (*Pediocactus sileri*), Gierisch mallow (*Sphaeralcea gierischii*), and Las Vegas buckwheat (*Eriogonum corymbosum var. nilesii*).

Common Name	Status	Critical Habitat/ Project Area
Virgin River Chub *Gila seminuda*	Endangered	Yes/ No
Woundfin *Plagopterus argentissimus*	Endangered	Yes/ No
Shivwits milk-vetch *Astragalus ampullarioides*	Endangered	Yes/ No
Holmgren milk-vetch *Astragalus holmgreniorum*	Endangered	Yes/ No
Southwestern Willow Flycatcher *Empidonax traillii extimus*	Endangered	Yes/ No
Mexican Spotted Owl *Strix occidentalis lucida*	Threatened	Yes/ No
Desert Tortoise *Gopherus agassizii*	Threatened	Yes/ No

EFFECTS DETERMINATION

Virgin River Chub and Woundfin

Steve Meismer, Upper Virgin River Recovery Program Manager, has indicated that neither the Virgin River Chub nor the Woundfin are present in the Santa Clara River within the project area. Turbidity from the geotechnical explorations is expected to attenuate to background levels within 1 mile downstream of Shem Dam and not reach waters that would contain either fish species or their critical habitat. Therefore, there would be **No Effect** to these two fish species or their critical habitat.

Shivwits Milk-vetch

A band member of the Shivwits Band of Paiutes has indicated that there is a patch of Shivwits milk-vetch located near the proposed ingress/egress (see enclosed Geotech Map). This area is currently fenced off and this area will be avoided during the

geotechnical explorations access to the dam. The proposed action is planned to occur prior to the flowering season in spring; therefore, there is no dust anticipated from construction activities that could impact the plant during the flowering season. If the project is delayed and would occur during the flowering season, water will be applied to the road in the area of the Shivwits milk-vetch (300-foot buffer) to reduce the amount of dust that may become airborne from construction traffic.

Shivwits milk-vetch is typically found on soils derived from the Chinle and Moenave Formations at elevations between 3,018 and 4,367 feet. Shem Dam is located on soils derived from the Kayenta Formation and the site is at 3,250 feet elevation. The access route and geotechnical exploration locations will be in soils not derived from the Chinle and Moenave Formations as they are part of river and wash systems that contain sandy soils instead of clays. There may be Shivwits milk-vetch in the project area, but since the geotechnical explorations are proposed prior to flowering season, the effect determination is **May Affect, Not Likely to Adversely Affect**. There will be **No Effect** to Shivwits milk-vetch critical habitat from the proposed action.

Holmgren Milk-vetch

Holmgren milk-vetch is unlikely to be found on the project site since it is typically located at elevations between 2,480 and 2,999 feet elevation as well as on soils derived from Moenkopi and Chinle Formation. Shem Dam is located on soils derived from the Kayenta Formation and the site is at 3,250 feet elevation. Therefore, it is not expected to occur in the project area and there would be **No Effect** to Holmgren milk-vetch or its critical habitat.

Southwestern Willow Flycatcher

There is no critical habitat for southwestern willow flycatcher on the Santa Clara and there is no known nesting occurring in the area based on correspondence with Melissa Burns, US Fish and Wildlife Service (USFWS). The geotechnical explorations will be completed prior to their nesting period (April 15 through August 15). Suitable habitat may be present at the site due to the presence of riparian vegetation. This riparian vegetation is sporadic and considered low quality suitable habitat. The effect determination for the southwestern willow flycatcher is **May Affect, Not Likely to Adversely Affect**. There will be **No Effect** to southwestern willow flycatcher critical habitat from the geotechnical explorations.

Desert Tortoise

The desert tortoise may be present within the vicinity of the project area. Geotechnical explorations are proposed during their dormant period (prior to April). A qualified desert tortoise biologist will clear the ingress/egress route and the exploration locations for signs of desert tortoises. Accessing the dam and/or explorations will not be performed if signs of tortoises are observed in the immediate project area. By following this methodology, the effect determination for the desert tortoise is **May Affect, Not Likely to Adversely**

Affect. There will be **No Effect** to desert tortoise critical habitat from the geotechnical explorations.

CONCLUSION

In conclusion, based on the short duration, limited scope, and no permanent impacts from geotechnical investigations at Shem Dam project site, the following effect determinations have been made for the Endangered Species Act (ESA) listed species in Washington County that may be in the project area:

- Virgin River Chub: **No Effect**
- Virgin River Chub Critical Habitat: **No Effect**
- Woundfin: **No Effect**
- Woundfin Critical Habitat : **No Effect**
- Shivwits Milk-vetch: **May Affect, Not Likely to Adversely Affect**
- Shivwits Milk-vetch Critical Habitat: **No Effect**
- Holmgren Milk-vetch: **No Effect**
- Holmgren Milk-vetch Critical Habitat: **No Effect**
- Southwestern Willow Flycatcher: **May Affect, Not Likely to Adversely Affect**
- Southwestern Willow Flycatcher Critical Habitat: **No Effect**
- Desert Tortoise: **May Affect, Not Likely to Adversely Affect**
- Desert Tortoise Critical Habitat: **No Effect**

NRCS is requesting concurrence with these determination of effects to ESA listed species in the project area.

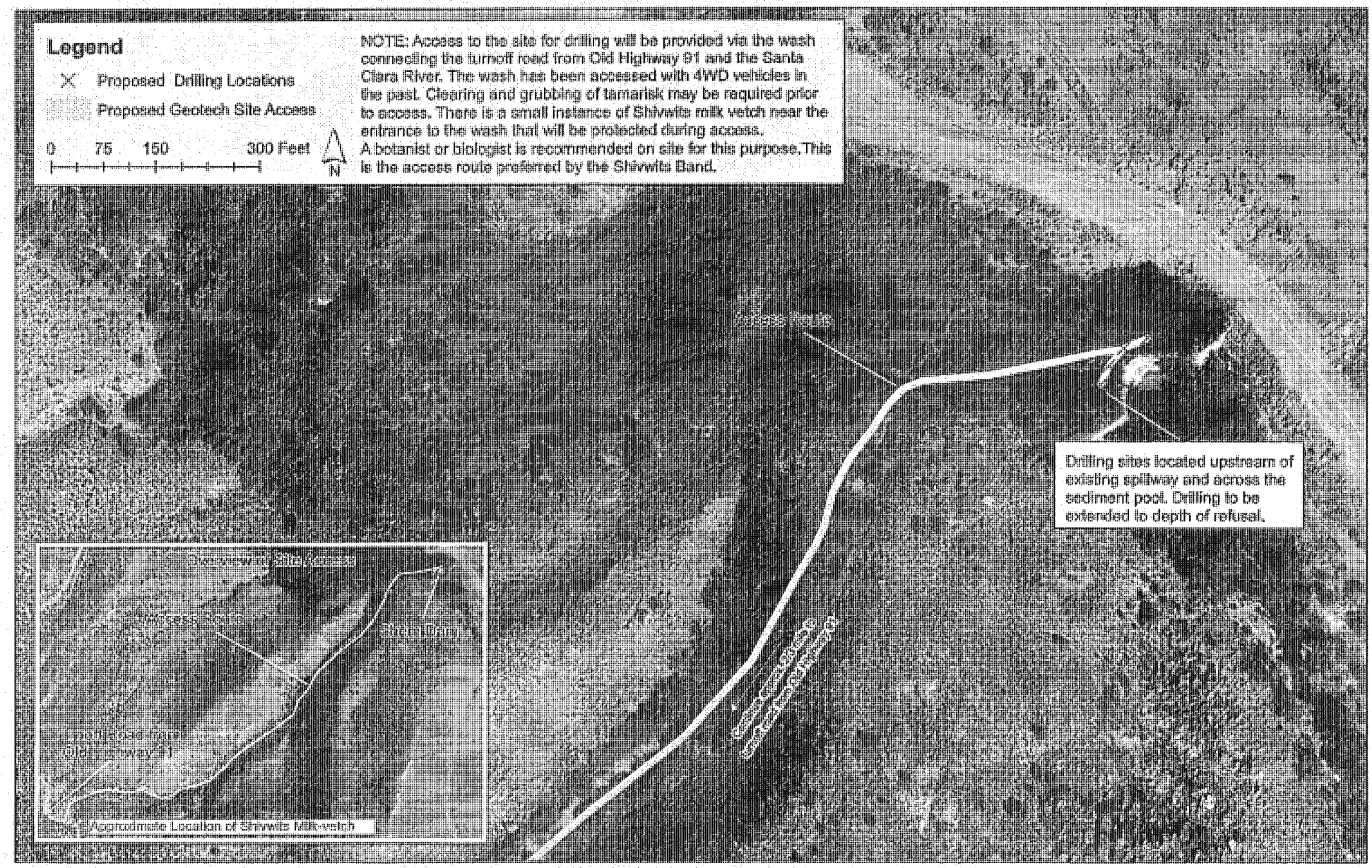
NRCS would like to conduct these geotechnical explorations as soon as possible (first week of February). Section 7 consultation for the dam rehabilitation proposed action will be performed separately after the Draft EA public comment period has ended which is anticipated to occur in the spring 2014. If you have any questions, please contact Derek Hamilton, EWP biologist, at (801) 524-4560.

Sincerely,

Acting For Bronson

BRONSON SMART
State Engineer

Enclosures


Legend
Proposed Drilling Locations
Proposed Geotech Site Access
0 75 150 300 Feet
N
NOTE: Access to the site for drilling will be provided via the wash connecting the turnoff road from Old Highway 91 and the Santa Clara River. The wash has been accessed with 4WD vehicles in the past. Clearing and grubbing of tamarisk may be required prior to access. There is a small instance of Shivwits milk vetch near the entrance to the wash that will be protected during access. A botanist or biologist is recommended on site for this purpose.This is the access route preferred by the Shivwits Band.
Access Route
Drilling sites located upstream of existing spillway and across the sediment pool. Drilling to be extended to depth of refusal.
Overview of Site Access
Access Route
Sheet Dam
Approximate Location of Shivwits Milk-vetch