



A resource issue approach to landscape level watershed management planning. This CRMP includes resource goals and concerns of local, federal, and state shareholders.

Ash Creek Watershed Coordinated Resource Management Plan-2016

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Acknowledgments

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BLM: St. George Field Office Resource Management Plan

Cedar Band of Paiute Tribe Resource Management Plan

Dixie Conservation District Resource Management

Dixie National Forest: Resource Management Plan

Utah State Climate Change Action Plan

Washington Water Conservancy District Resource Management Plan

Washington County Resource Management Plan

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Document Abbreviations

ACE	American Conservation Experience
AF	Acre Feet
AUM	Animal Unit Measure
BCT	Bonneville Cutthroat Trout
BLM	Bureau of Land Management
CAC	Citizen Advisory Committee
CD	Conservation District
CO	Carbon Monoxide
CRMP	Coordinated Resource Management Plan
CWMA	Cooperative Weed Management Area
CWMU	Cooperative Wildlife Management Unit(s)
DNF	Dixie National Forest
EDDR	Early Detection Rapid Response
EPA	Environmental Protection Agency
FRCC	Fire Regime Condition Class
FWS	Fish and Wildlife Services
HUC	Hydrological Unit Code
IAP	Intermountain Adaptation Partners
I and E	Information and Education
NASU CWMA	Northern Arizona-Southern Utah Coordinated Weed Management Area
NFS	National Forest Service
NPS	National Park Service
NO	Nitrous Oxide
Pb	Lead
PM¹⁰-PM^{2.5}	Particulate Matter
PVRD	Pine Valley Ranger District
RMP	Resource Management Plan
RWA	Rapid Watershed Assessment
SC	Steering Committee
TAC	Technical Advisory Committee
T and E	Threatened and Endangered Species
TSS	Total Suspended Solids
UACD	Utah Association of Conservation Districts
UDAF	Utah Department of Agriculture and Food
UDW	Utah Division of Wildlife
USGS	Utah State Geological Society
USA	United States of America

Chapter 1: Introduction

I remain an astounded witness to a vast mystery arranged in remarkable order. Poe Ballantine

The Ash Creek Watershed Coordinated Resource Management Plan (CRMP) is a collaborative effort that addresses resource issues within the magnificent landscapes of south-western Utah. The watershed boundaries encompass a national park, state and federal forests and two counties. It's future preservation, conservation and stewardship is congruously guided by land-managers, area leaders and citizens who are concerned about the future of the watershed and its natural resources.

How the project began

In 2014, the Utah Department of Agriculture and Food (UDAF) recognizing the importance of landscape level watershed management plans, awarded a development grant to the Dixie Conservation District, a member of the Utah Association of Conservation Districts (UACD). After the initial assessment phase, the diverse group of stakeholders that included federal, state, county, tribal and other local interests identified the major resource issues.

In 2015, the governing bodies contributed the following agenda items toward completion of the CRMP. Their major recommendations discussed the importance of;

- 1) Identifying the major resource issues.
- 2) Prioritizing the identified treatments.
- 3) Designing the assessments.
- 4) Creating feasible time-lines for project(s) completion.
- 5) Identifying funding sources and data gaps.
- 6) Implementing the assessments.

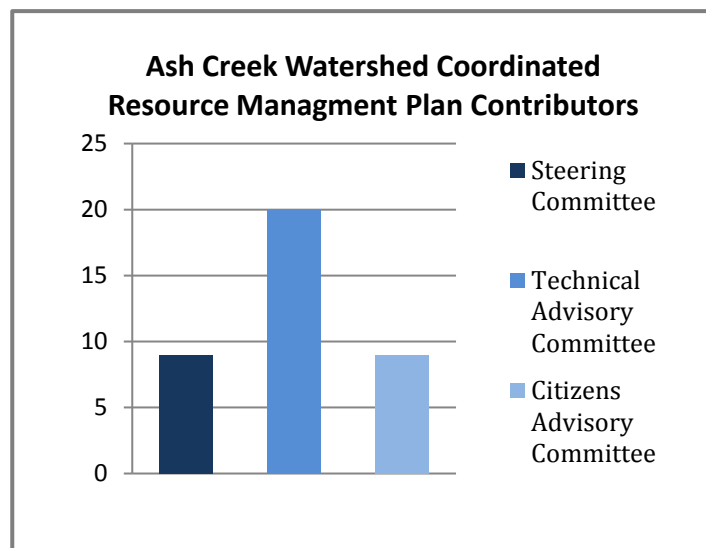


Figure 1.1: Ash Creek Watershed CRMP contributors. 2016

Ash Creek CRMP: Resource Issues and Frequency

In 2015, meetings were held at several locations throughout Washington County; primarily to introduce the Ash Creek Coordinated Resource to the area land-managers and to receive their recommendations for Technical Advisory Committee, (TAC) members. These individuals were chosen based on their expertise in natural resources, cultural, civil engineering, information and education qualifications.

The many contributions by TAC members were an integral component in the overall success of the CRMP. Moreover, their support will also determine the long-term viability of the CRMP. TAC recommendations guide the decisions of the steering committee members (SC) for treatment implementation and their assessments. A supportive citizen advisory committee (CAC) was also formed—primarily from the New Harmony Planning and Zoning Council and interested community members, with various interests and expertise.

CRMP members are likened to the interconnected components of the ecosystem. Consequently, every member is critical to the CRMP planning process, future treatments, assessment of the projects, and the identification of funding opportunities. While the watershed has more fire-vegetation concerns, than water quality; the TAC members were divided into resource group types recommended by the Environmental Protection Agency

(EPA). These guidelines are outlined within the *'Nine Essential Elements'* for Watershed Management plans (Fig. 1.2). The primary TAC groups included:

- 1) Agriculture and Rangeland
- 2) Fire, Vegetation and Noxious Weeds
- 3) Water, Air Quality and Oil Gas and Mining
- 4) Cultural Resources, Education, Information
- 5) Wildlife, Threatened and Endangered Species

Technical (TAC), and Citizens Advisory (CAC) meetings were held every three months from September, 2015 through June, 2016. The Steering



Figure 1.2: EPA Watershed Nine Essential Planning Elements



Technical Advisory Committees

Technical advisory committees are comprised of stakeholders within the watershed who may have an interest, or provide an area of expertise. Technical advisory committee members may be recommended by the steering committee, or by other stakeholders that share a mutual interest concerning resources within the Kanab Watershed.

The Technical Advisory Committees will:

Be responsible for resource assessments and overall project development.

Be comprised of resource specialists, private landowners, and interested stakeholders that are knowledgeable about resource issues.

*Ash Creek Watershed
Memorandum of Understanding
excerpt.*

Committee (SC) meetings were held as needed. A distinct list of resource issues, began to emerge from these planning meetings. In addition to the identified resource issue recommendations and assessments, all groups identified that greater coordination of noxious weed management was needed by all participating state, federal and private agencies.

During the cultural, information and education (IE) TAC discussions it was repeatedly expressed that more cooperative inter-agency educational events needed to occur. Moreover, it was recommended that more historically accurate educational programs needed to be made available to the public through a variety of educational methodologies; including social media. Other concerns about cultural and historical resources issues identified; 1) the need to present a more accurate pre-history of the Paiute within the watershed; 2) recent historical accounts of early settlers' water-ditch projects, and their preservation.

While the Cedar Band of Paiute Indian Band does not manage any lands within the watershed boundaries, their lands are located within the adjacent county. It was also emphasized that increased tribal involvement and evaluation of both treatment projects and educational events would positively contribute to the preservation of prehistory, cultural and historical resources.

It was also emphasized that inter-agency educational events could be instrumental in reducing incidents harmful to the natural and cultural resources within the watershed. In addition to explaining the different treatment methodologies, increase public support of resource projects and facilitate better communication between land-users, and the various land managers.

Funding sources that support multiple agency or landscape resilient projects was listed as another high priority. Questions were also frequent such as; "What agency (ies) will facilitate the treatment projects?" and, "How can we ensure that the

inter-agency treatment projects will receive an identical proficiency—primarily if the projects

are sub-contracted?” “What agency (ies) will be responsible for data management and evaluating treatment assessments?” Lastly, “How will the former be funded?”

Furthermore, most identified that increasing the evaluation and monitoring processes for identified treatments were needed. This was coupled with the importance of increasing maintenance and verification on the effectiveness of past treatments (ground-truthing) and yearly assessments.

Other identified resource issues included: long-term funding for habitat rehabilitation of both upland, and lowland habitats; protecting springs and other important hydrological zones; wildlife and their winter ranges; enacting more stringent Early Detection Rapid Response (EDDR) practices against noxious weed infestations; and impacts on ephemeral and perennial flows within the watershed after the Ash Creek Reservoir upgrades are completed by the Washington County Water Conservancy District —held equal importance for most TAC teams.

Moreover, the non-regulatory status of the CRMP was also discussed on multiple occasions; primarily at New Harmony Town Council and CAC meetings. The CRMP was also described as a ‘living document,’ whose purpose is to foster multiple-agency cooperation, through grant proposals; thus ensuring that identified treatment plans will enhance the watersheds health for perpetuity.

Additional resource issues concerns are tabulated in Table 1.1, and a more detailed presentation of each resource concern is discussed in Chapter 5. As some of the major resource issues within the Ash Creek Watershed are management concerns of the land-users, they frequently over-lap the primary groups. Results were ranked based on the frequency they were listed as a concern.

For instance, in the discussions led by the Fire and Vegetation (TAC, SC, and CAC members), management concerns, and challenges from noxious weeds were listed multiple times; hence their ranking. Moreover, in that same category both the Wildlife, and Agriculture and Range CRMP team also ranked, noxious weeds multiple times. Whereas, in the Forestry category Information and Education concerns were listed it as high priority, yet not within as many sub-categories. Lastly, the categorical questions, ranked responses, maps, locations and many identified treatments are listed in greater detail in Chapter 5.

The most frequent resource issues included: vegetation enhancement, pinion-juniper encroachment, upland vegetative treatments, public education and outreach, road closures, mapping of current and past noxious weed populations, wildlife corridor vegetation treatments, and emergency fire and fuel plans.

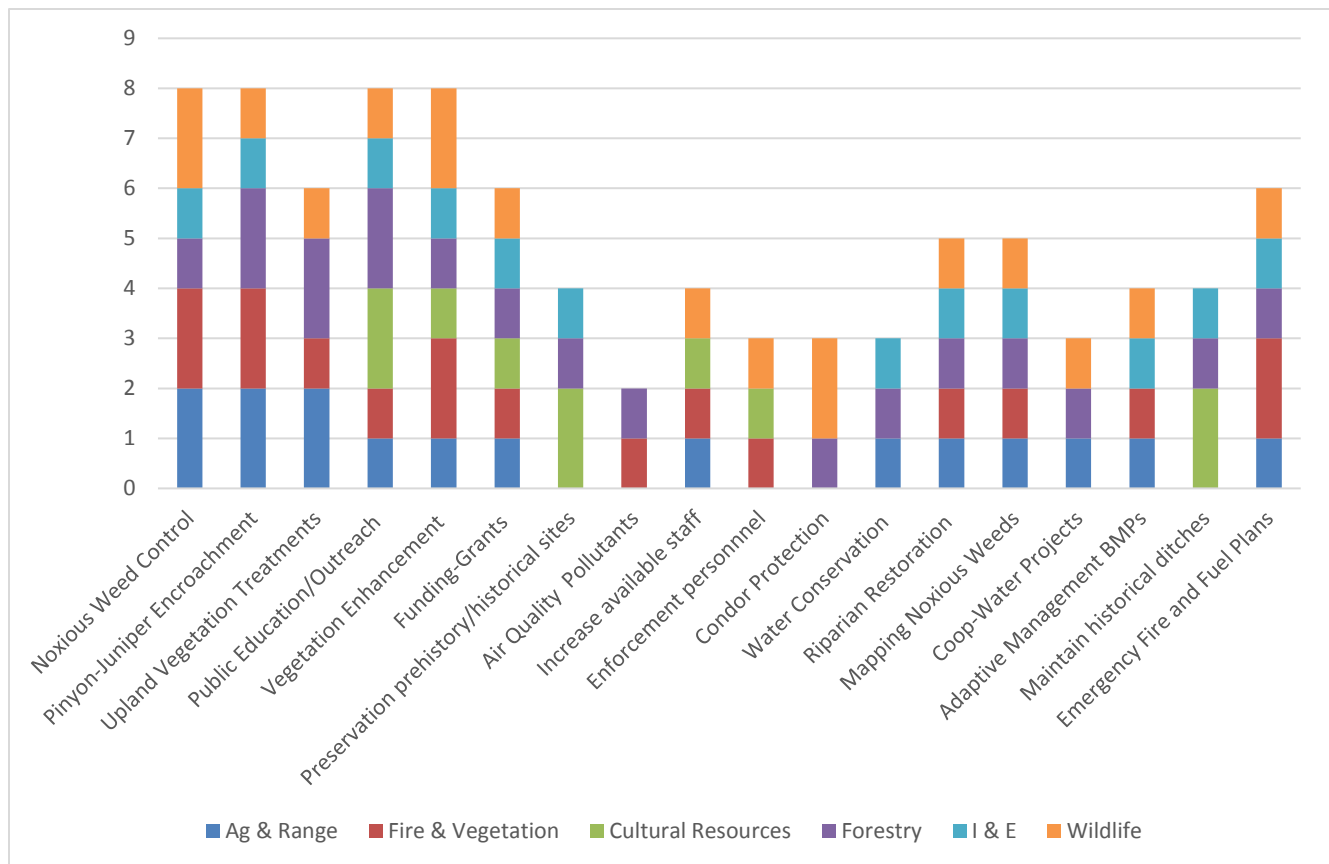


Table 1.1: A summary of the most frequently discussed natural resource and cultural issues of the Ash Creek Watershed are listed within this table. While five main teams were established, sub-committees were formed. Consequently, resource issues were ranked more than once; hence the greater values reflected in some categories.

Technical Advisory Committees were categorized by:

- (1. What are the main resource issue(s)?
- (2. Where are they located within the watershed?
- (3. What organization's and land-users are involved?
- (4. What is the timeline for project completion?
- (5. How will the goals and assessments be determined?

In addition, to the HUC 6 level watershed treatments project locations, continued assessments and utilization of special data for a variety of resource issues was emphasized as management goals for most of the identified projects. Moreover, it is important to recall that the Ash Creek Watershed Coordinated Resource Management Plan (CRMP) is a 'living document.' The tables and resource issues will be periodically amended; either upon a projects completion, or when additions are

required. A more through discussion of resource issues are discussed in Chapter Five. Many are also identified within state, federal, public Ash Creek land-users resource management plans.

The Utah Association of Conservation Districts

Conservation Districts grew from the “Dust Bowl” days of the 1930’s, when soil erosion created a national ecological disaster. In response, President Franklin D. Roosevelt recommended that all states pass legislation allowing for the creation of conservation districts. Several years later, Utah passed the states Soil Conservation District Law in March, 1937—and the Utah Association of Conservation Districts (UACD) was officially recognized.



Figure 1.3: A yearly educational event sponsored by the UACD is the Utah Enviro-thon

In Washington County, the conservation district (CD) is called the Dixie Conservation District. Throughout the state of Utah, the UACD’s thirty-eight districts support and work closely with the Utah Department of Agriculture and Food. Evidence of this support occurred in 2014, when the Dixie Conservation District received the developmental grant for the Ash Creek Coordinated Resource Management Plan from the UDAF.

Each district also has 501c status, with elected board members, entrusted of finding conservation solutions with other area land managers. This 501c status also allows the Dixie CD to partner with any state, federal or private members through the Ash Creek Memorandum of Understanding; a non-regulatory cooperative

agreement between the CRMP participants. In addition to the development of the Ash Creek Watershed CRMP, the Dixie CD is a vibrant presence in Washington County supporting a myriad of conservation programs; 1) at the Enviro-thon, a predetermined natural resource issue, its solution and treatments are discussed by high school teams at a yearly convention; 2) conservation tree program; 3) agricultural and natural resource area scholarships; 4) support of the UACD and agricultural lobbyists—the Agriculture Protection Area APA law-Title 17. Ch. 41; 5) technical support for conservation grants and projects listed below in Table 1.2.

CONSERVATION AND GRANT PROGRAMS	
Agriculture Resource Development Loan (ARDL)*	Conservation Reserve Program (CRP)
Environmental Quality Incentives Program (EQIP)*	Wildlife Habitat Incentives Program (WHIP)
Water Conservation Field Services Program	Colorado River Salinity Control Program
Partners for Fish and Wildlife	Non-point Source Implementation Grants
Area Scholarships and Enviro-thon Programs*	Yearly Conservation Tree and A.C.E.S Program*

Table 1.2: Multiagency statewide conservation programs. A (*) identifies grants and programs support by the Dixie CD. 2016.

The Steering, Technical and Citizens Advisory Committees:

Steering, Technical and Citizen Advisory Committee Participants			
ORGANIZATION	TAC	SAC	CAC
American Conservation Experience			X
Cedar Band of Paiute Indians	X		
Central Weed Management Area-N. Arizona-S. Utah (NASU)	X		
Color Country Field Office-Bureau of Land Management	X	X	
Dixie Conservation District	X	X	
Dixie National Forest-USFS (Pine Valley Ranger District)	X	X	
National Resource Conservation Service-UT (Beaver Office)	X		
New Harmony Planning and Zoning Committee	X		X
New Harmony Town Council		X	X
St. George Field Office-Bureau of Land Management	X	X	
UT-School and Institution State Lands Administration	X		
Utah State Extension- Washington County-UT	X		
Utah Department of Agriculture and Food	X		
Utah Division of Wildlife Resources	X	X	
Washington County Commissioners Office-UT		X	
Washington County Water Conservancy District	X		

Table 1.3: Ash Creek CRMP participants and the organization they represent.

Numerous changes have occurred in the Ash Creek Watershed since the late 1800's. Indigenous hunter-gatherer communities were replaced by predominantly Anglo-European populations—who introduced practices in natural resource use that greatly differed from the former. These changes have all affected the use and management of natural resources within the watershed.

Consequently, the Ash Creek Watershed Coordinated Resource Management Plan (CRMP) addresses and prioritizes these resource issues; through the expertise of the Technical Advisory Committees (TAC) members.

These individuals were recommended by Steering Committee (SC) members and represent the primary land-use decision makers within the watershed. Additional developmental support was supplied by members of the

Citizen Advisory Committees (CAC), representing a microcosm of the greater community; from private business, non-profit and other area organizations. In addition, the New Harmony Planning and Zoning Council generously partnered with the CAC, providing valuable insights about local resource issues, and assessments for the CRMP.

Moreover, the New Harmony Town Council also provided support by sending mailers on resource issues surveys, hosted numerous public comment meetings and partnered with other CRMP members in several information and educational events. These included: watershed educational booths at the New Harmony, Apple Days; Ash Creek-New Harmony Arbor Day Festival.



New Harmony Tree City, USA

New Harmony is recognized by the National Arbor Day Foundation as being urban foresters. This status also supports the mission statement of the New Harmony Planning Commission that states:

“To inform and provide services in support of the short and long-term comprehensive planning, quality of life, environmental and economic development of the town of New Harmony.”



Figure 1.4: Presenters and community guests enjoying the New Harmony-Ash Creek Watershed celebration.

Chapter 2: Executive Summary

No river can return to its source, yet all rivers must have a beginning. American Indian Proverb

Hydrological resources of the United States are divided into 21 expansive geographical regions that are further sub-divided into successively smaller hydrological units. These are further classified into four areas: regions, sub-regions, accounting units, and cataloging units. Each hydrological unit is identified by a unique hydrological unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrological unit system.

Ash Creek near New Harmony, Utah is located in Washington County, Utah at 37.4124809 degrees' latitude and -113.2368937 degrees' longitude using the datum NAD83, with an elevation of 4,450.0 ft. Ash Creek is monitored by the USGS Utah Water Science Center, and is identified by name: "Ash Creek near New Harmony, UT," and USGS-09406500. Ash Creek is also part of the Upper Virgin River drainage which is identified by the 8-digit Hydrologic Unit Code (HUC) 15010008.

As a tributary of the Virgin River, the intermittent/ephemeral waters of Ash Creek are located in the eastern portion of the Pine Valley Ranger District. The total watershed acreage is approximately 137,577 acres, of which approximately 59,520 acres are located on Dixie National Forest managed lands. There are approximately 18.8 miles of fish-bearing streams and no acres of fish-bearing lakes within the Ash Creek watershed. Several fires within the watershed have contributed to reducing native fish populations. These fire events have also impacted upland and lowland habitat, and increased noxious weeds acreage within the watershed.

Water Body	HUC 6	Species Present	Comments
South Ash Creek	150100080405	Bonneville Cutthroat Trout	Good BCT habitat in isolated canyon.
Mill Creek	150100080405	Bonneville Cutthroat Trout	Limited BCT distribution.
Harmon Creek	15010008040	Bonneville Cutthroat Trout	Limited BCT distribution.
Leap Creek	1501000804	Bonneville Cutthroat Trout	Limited BCT distribution.

Table 2.1: Bonneville Cutthroat Trout (BCT) populations affected by Sequoia fire. UT Division of Wildlife (UDW). 2002.

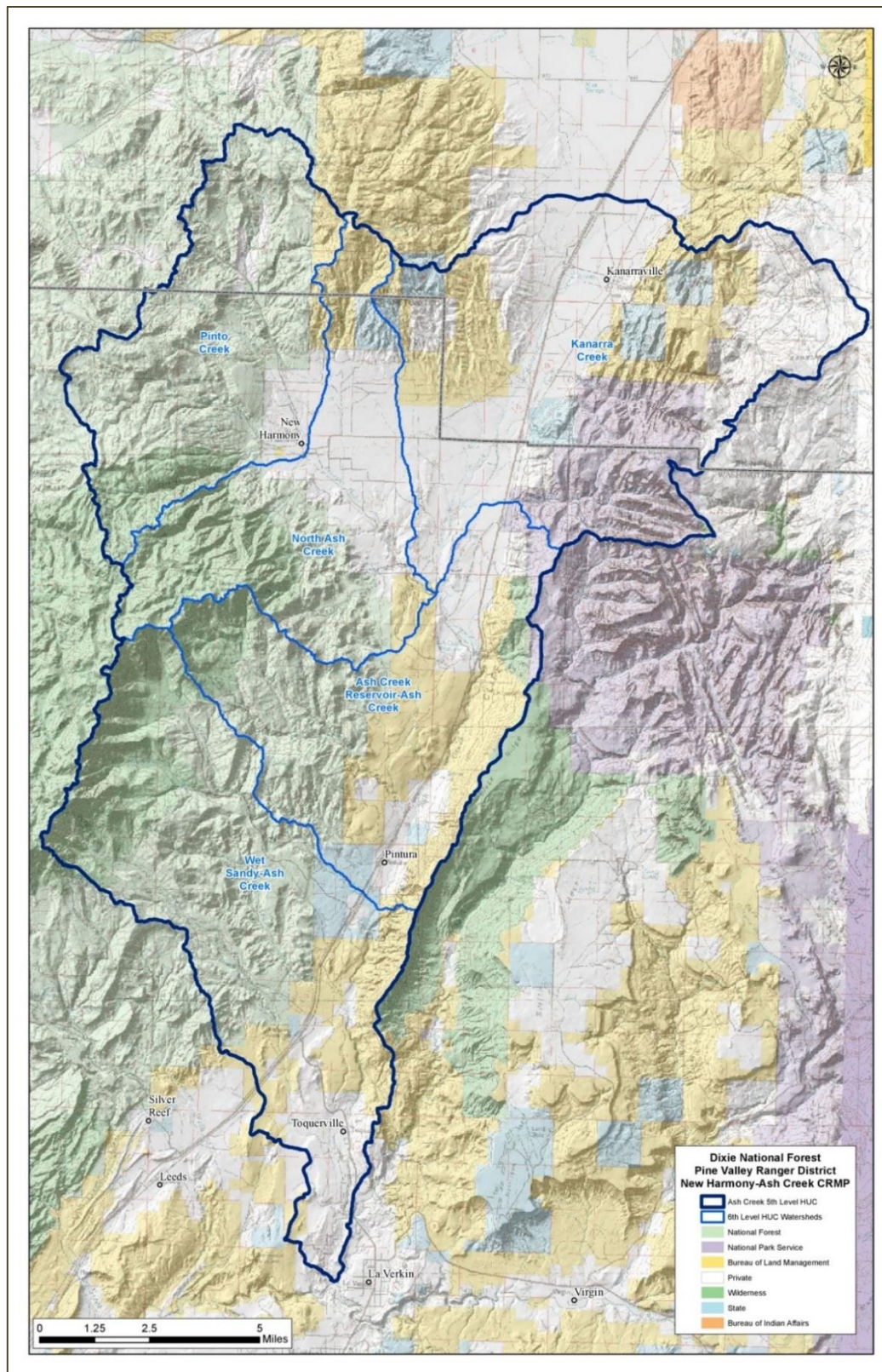


Figure 2.1: Ash Creek Watershed Vicinity map. USFS map credit: Laurie Parry-GIS. 2016

Ash Creek Watershed Map Types	HUC 6
Hydrology	Ash Creek Watershed
Rangeland	Ash Creek Watershed
Vegetation	Ash Creek Watershed
Vicinity of watershed	Ash Creek Watershed
Wildlife-includes Threatened and Endangered	Ash Creek Watershed
Fire History	Ash Creek Watershed
Noxious Weed Populations	Ash Creek Watershed
New Harmony Fuel Break	Ash Creek Watershed

Table 2.2: Ash Creek Watershed Coordinated Resource Management treatment and natural resource maps. 2016.



Figure 2.2: Ash Creek. Image credit: H. Hadley. USFS.

Many of the resource issues concerns for the watershed were identified by referring to maps, on-the-ground site visits, and local expertise. The HUC maps listed in Table 2.2 were simultaneously developed, and updated during the reviewing process. A complete list of maps is contained as part of the project record, and housed by the Zone 5 UDAF Field Offices, Ash Creek Watershed, and Dixie Conservation District website.

In addition to HUC numerical assignments the Environmental Protection Agency also assigns a unique ID to each states water-body or segment. The first two characters are the state abbreviation, followed by characters that are the water's Water-body System ID, another state-derived ID, or an arbitrary ID assigned by the state.

Several sites within the watershed are tested for water quality; collected data reflects slight-moderate impairment. Additional water-body information is discussed in the water quality section of the CRMP. Other water concerns are listed in the Sustainable Forestry Initiative-USFS, and will be presented in the water quality section of the CRMP.

While the boundaries of the Ash Creek watershed are primarily within Washington County, a northern portion extends into Iron County. Natural resource treatments and issues are managed by the state of Utah, Washington County, Color Country Bureau of Land Management Field Office, St. George BLM, Field Office, Zion National Park, Utah Department and Forestry, SITLA, Washington County Water Conservancy District and Dixie National Forest. As previously mentioned, the headwaters of Ash Creek are located within the Pine Valley Ranger District boundaries of the Dixie National Forest.

Chapter 3: Land Ownership

Put your faith in the two inches of humus that will build under the tress every thousand years. Wendell Berry

Federal lands and their natural resources have been important throughout American history. They provide revenue for transportation, schools, national defense and other state and local needs. The federal government owns roughly 635-640 million acres, 28% of the 2.27 billion acres of land in the United States. This land is managed by specific federal agencies.

Four agencies administer 609 million acres of this land: Department of Agriculture manages the Forest Service (USFS) and National Park Service (NPS). While the Department of the Interior (DOI), manages the Bureau of Land Management (BLM), and Fish and Wildlife Service (FWS). The majority of federally managed lands are in the West and Alaska. In addition, the Department of Defense administers 19 million acres in military bases and training ranges. Numerous other agencies administer the remaining federal acreage (CRS Report 2012). In Utah, federal agencies are the predominant land managers.

Within the boundaries of the Ash Creek Watershed the land-ownership is divided between federal agencies, state and private entities. Table: 3.1 describes the land status and acreage of each major HUC. Land management also reflects land-use. While the majority of land within Washington County is managed by federal agencies, there remains a strong agricultural presence. Major land uses in the county include range, alfalfa and grass hay, corn and small grains crops, fruit and nut orchards, forest production, industrial and urban areas. Recreational uses occur on private and public lands.

Land Status	Ash Creek Reservoir	Kanarra Creek	N. Ash Creek	Pinto Creek	Wet Sandy	Grand Total	Total %
BLM	8,383.60	7,759.18	2,515.69	962.74	5,908.02	25,529.23	18.6
National Forest	7,181.52	N/A	4,739.62	16,014.79	12,994.01	40,929.95	29.7
National Park Service	945.35	7,613.90	N/A	N/A	N/A	8,559.25	6.22
Private	4,532.10	20,366.14	6,472.47	2,202.83	4,644.17	38,217.71	27.77
State	806.08	2,863.71	576.27	N/A	1,220.41	5,456.46	0.15
Wilderness	3,082.45	34.89	5,799.41	2,890.39	7,076.85	18,883.98	13.72
Grand Total	24,931.10	3,8627.8	20,103.5	22,070.76	31,843.45	13,7576.59	N/A

Table 3.1: Acreage of land use by HUC within the Ash Creek watershed. 2016.

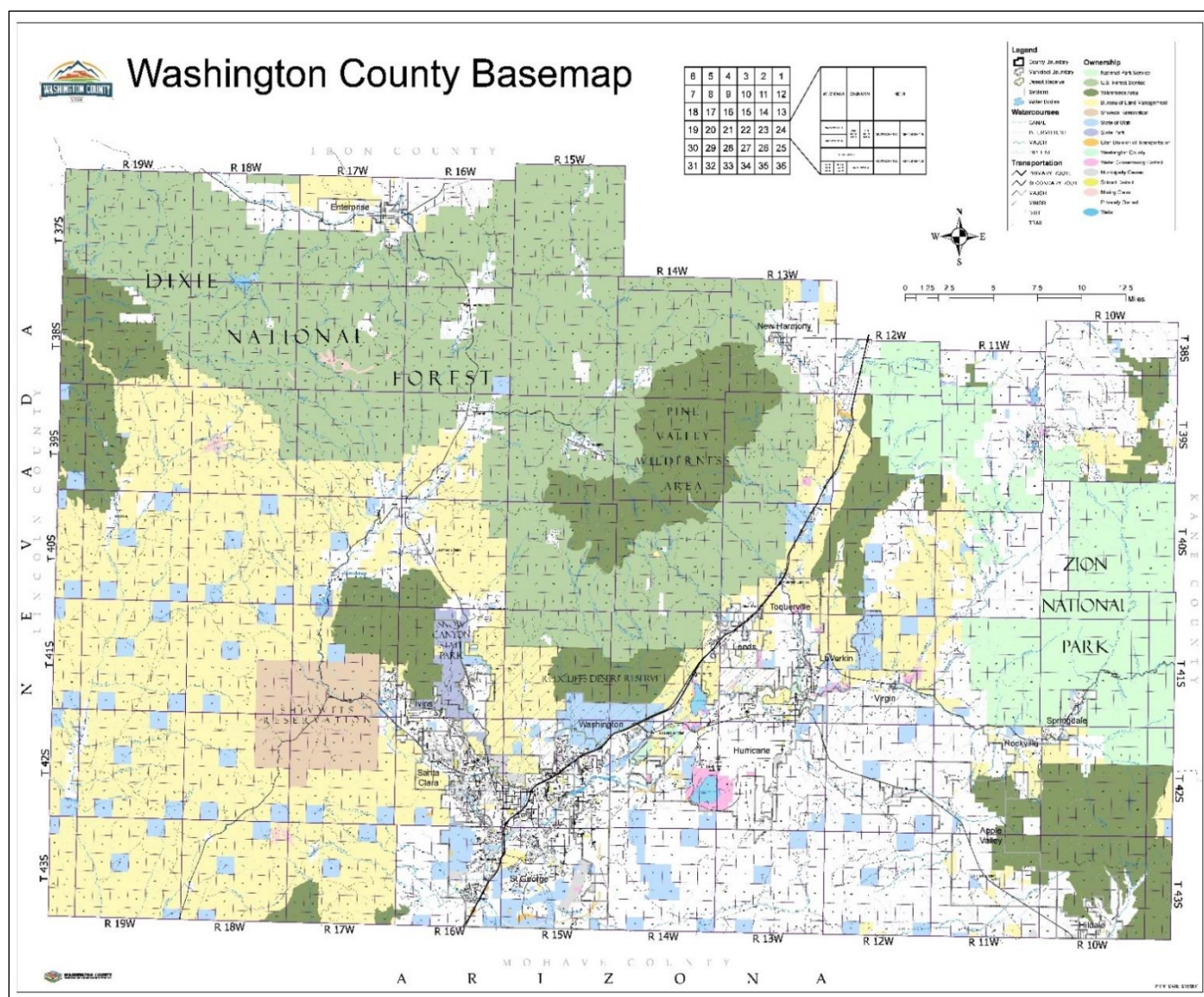


Figure 3.1: Washington County land management base map. Map credit: Washington County GIS Department.

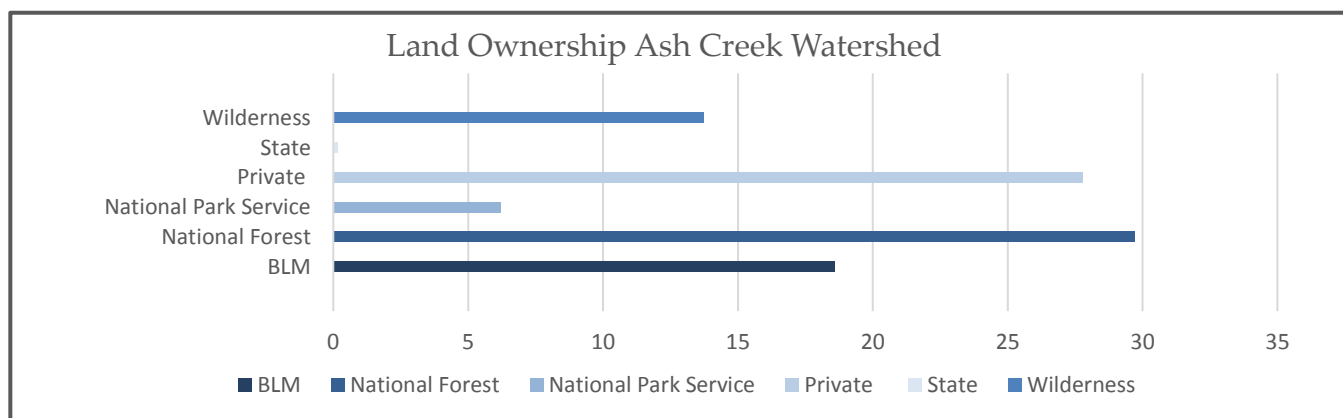


Table 3.2: Percentage of Land Ownership in Ash Creek Watershed.

Washington County Demographics



Figure 3.2: Ancestral Paiute wickiup dwelling in Iron County.

A pre-history census of Washington County would be much different than the most recent United States census. The predominant race would have been the Southern Paiutes, living descendants of the ancient Numic speakers; also the Northern Paiute, Southern Paiute, Goshute, Ute and Shoshone people. Archeological findings, and oral traditions shared from tribal elders collaborate that the Numic speaking people arrived to Utah approximately 1,000 years ago.

Migrating from southwest Nevada and southern California (Death Valley area); when they first interacted with Euro-Americans they lived from the Rocky Mountains to northern California and from central Idaho south to the Colorado River. For the Paiute, all life is considered sacred. Their intimate, hunter-gatherer relationship with the

landscape gradually changed after contact with the European explorers. The initial exchanges between the early Spanish explorers interested in trade routes, and natural resources were followed by Mormon Pioneers interested in homesteading the area. Both groups were

harbingers of massive demographic change—for the Paiute and their culture.

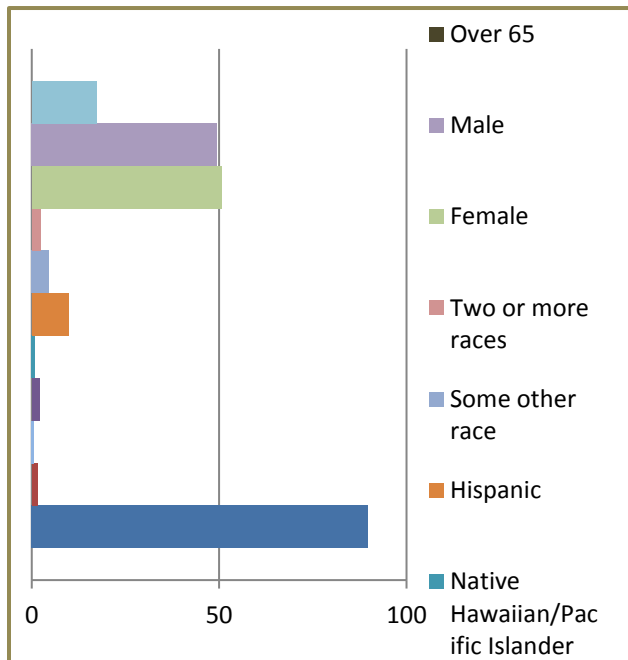


Table 3.3: Washington County age and race demographics. US Census. 2010.

When the influx of settlers continued to increase, the predominant hunter-gathering lifestyle of the Paiute proportionately decreased as the new settlements grew. The new arrivals also brought livestock, and different types of agricultural practices. Soon the new settlements began to spread across the landscape, replacing the Paiute wickiup, or shelters under rocky ledges. Availability of water was another challenge. The Paiute had extensively used the springs, rivers and even irrigated some crops; however, acquisition of their tribal lands reduced their access to this vital resource.

Current Demographic and Economic Baseline of Washington County

Population- 2010	138,115	
Average Annual Growth Rate (1990-2007)	6.5%	
Net In-Migration, (1970–2007)	99,453	
Median Age (2006)	30.0	
Households (2007)	49,504	
Employment		
Median Household Income (2007)	\$37,212	
Total Farm, Nonfarm and Proprietor Employment (2005)	64,095	
Average Annual Growth Rate, 1970–2007	8.0%	
Farm Employment as a Share of Total Employment	0.8%	
Nonagricultural Employment (2006)	51,527	
Average Annual Growth Rate, 1970–2006	7.7%	
Employer Firms (2007)	4,851	
Major Nonagricultural Employment Sectors (2007)	Number	Share
Construction	8,289	16.1%
Retail Trade	7,747	15.0%
Health Care and Social Service	6,739	13.1%
Government	6,141	11.9%
Accommodations and Food Services	5,684	11.0%
Taxable 2006 Retail Sales (millions)	\$11,991	
Average Annual Inflation-Adjusted Growth Rate, 1980–2007	8.3%	
Major Retail Categories (millions)	Amount	Share
General Merchandise	\$377.5	23.0%
Motor Vehicles	\$330.3	20.4%
Building and Garden	\$241.3	14.9%
Per Capita Retail Sales (2006)	\$8,630	
Wages and Income		
Total Nonagricultural Wages (2007, millions)	\$1,431.6	
Average Annual Inflation-Adjusted Growth Rate, 1970–2006	7.6%	
Average Monthly Wage (2007)	\$2,235	
Total Personal Income (2005, millions)	\$2,689.4	
Housing, New Construction, and Real Estate Total Housing Units (2008)	Number	Share
Total Occupied Units (share of total housing units)	54,576	
Owner-Occupied (share of total occupied)	32,643	
Renter-Occupied (share of total occupied)	13,691	14.8%
Recreation or Seasonal Units (share of total housing units)	11,400	34.1%
Median Sales Price of Existing Single-Family Homes (2006)	\$152,220	
New Permit-Authorized Dwelling Units (2007)	151	
Value of Residential Construction (2007, millions)	\$30.1	

Table 3.4: United States census demographics (percent of total population) data for Washington County, Utah, 2010

Inevitably, the demographics and water-use needs of the county continued to change, and the settlers, after numerous challenges including flash-floods, and failed water resources infrastructures, managed to create successful water delivering features. These new water resources enhanced deliverable water, and the current demographics for Washington County began to emerge.

The current demographic and economic baseline data of Washington County are based on the United States Department of Commerce, 2010 reports. Consideration of an area’s population projections is important for future land use planning; particularly, when considering impacts upon a watersheds natural resources; furthermore, it is important to consider how Washington County’s projected growth will proceed in the future. While the majority of towns within the Ash Creek Watershed have smaller populations they have also experienced a similar increase in growth.

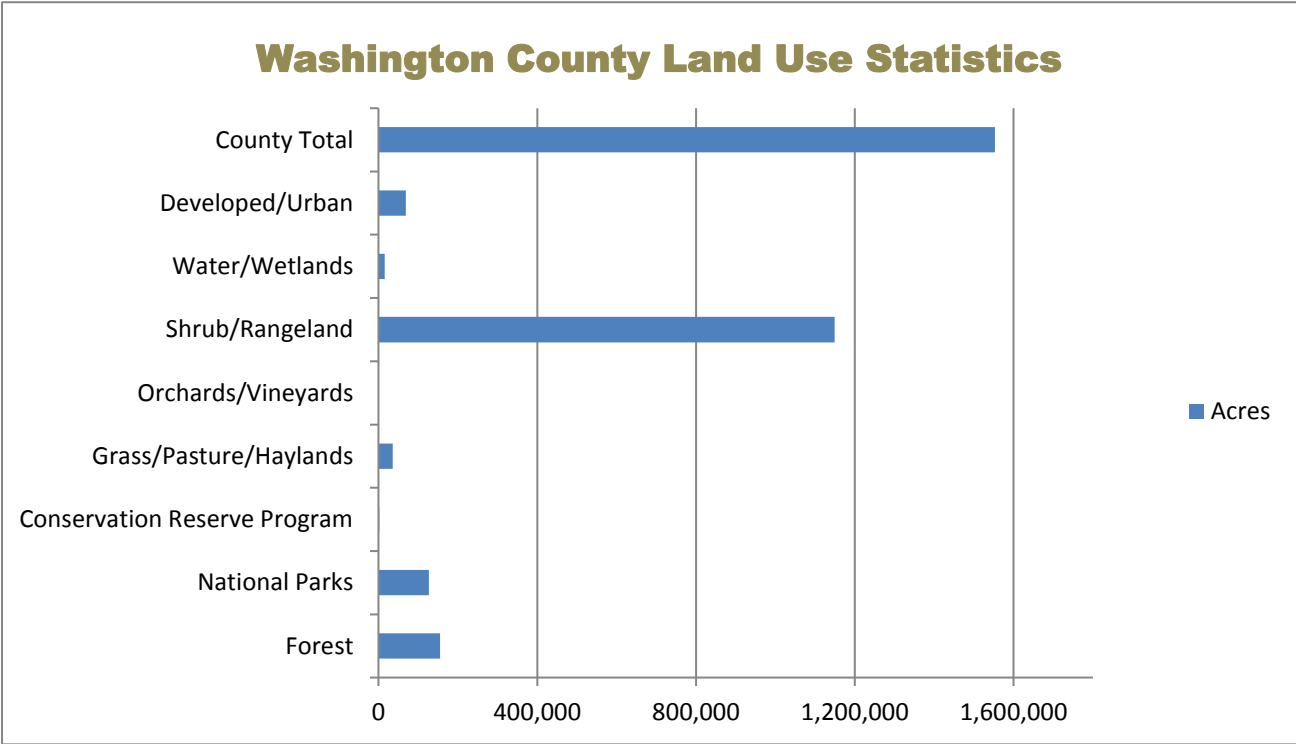


Table 3.5: Washington County land use and statistics. NRCS 2010.

Ash Creek Watershed is also a vital utilities corridor for the southern portions of Washington County. Natural gas, water and telecommunication lines follow the corridor of interstate I-15, and traverse a portion of the watershed. Past concerns have been in regards to fire events. Resource management and energy management plans include guidelines for protection and further development.

Chapter 4: Physical & Natural Features

I was born upon thy bank, river; My blood flows in thy stream, And thou meanders' forever; At the bottom of my dream. Henry David Thoreau

Introduction

Washington County is one of the fastest-growing counties in the southern-utah region. Considered to be a “suburb” of the sun-belt cities of Phoenix, Las Vegas and Los Angeles the county is 17.6 percent privately owned, and 74.7 percent federally owned. As previously mentioned, the majority of the land is owned by the BLM (40.8 percent of the total), but there are also about 400,000 acres of national forest that comprise over one-quarter of the county. The population of the county has doubled every ten years since the 1970’s, and is considered the fastest growing county in Utah.

A portion of the 135,000-acre Zion National Park, 2,860 acres located within Iron County, makes up 8.5 percent of the Washington County. State-owned lands account for a nominal 5.8 percent of the county, with most of that managed and owned by Utah School and Institutional Trust Lands Administration (SITLA). An additional 10,000 acres are managed by Utah state parks. This also includes 850 acres of wildlife reserve, and a 2.5-acre UDOT parcel along I-15 at the northeast corner of Washington City. Northwest of St. George, the Shivwits Band of Paiute tribe has a 28,000-acre reservation; however, this makes up less than 2 percent of the county.

Air Quality: Washington County

Air quality in Washington County is typical of other rural communities in Utah. Due to the lack of industrial pollutants, the main air quality concern derives from combustion vehicles, and other off-road vehicle use. Some exceptions include, short duration, localized concentrations of total suspended solids (TSS). The source is generally from highly erodible sand-stone which results in wind-blown dust. As communities continue to grow and traffic increases, there has also been an increase in carbon dioxide (CO₂), and ozone; particularly around Hurricane, and St. George. The Utah Division of Air Quality monitors the air quality of the county. There are no air quality measurement devises in New Harmony; however, there is a unit in Hurricane, Utah.

Station	CO ₂	NO ₂	Hg	O ₃	PM ₁₀	PM _{2.5}	SO ₂	Pb	Met
Hurricane		X		X	X	X			X

Air quality standards are designated by the Environmental Protection Agency and the Utah Division of Air Quality. Criteria area pollutants include:

- Carbon monoxide (CO): A colorless and odorless gas formed by the incomplete combustion of carbon-based fuel, or wood burning.
- Nitrogen Dioxide (NO₂): During high temperature combustion, nitrogen in the air reacts with oxygen to produce various oxides of nitrogen, or NO_x a reddish-brown gas.
- Ozone (O₃): A clear, colorless gas composed of molecules of three oxygen atoms. Ground level ozone can be inhaled and is considered a pollutant. Summer months' highest impact.
- Particulate Matter (PM₁₀): A particulate suspended in the air that is less than ten micrometers in diameter, which is about one-seventh the width of a strand of human hair. Dust and sand sources.
- Particulate Matter (PM_{2.5}): Fine particulate, is a subset of P10 that measures 2.5 micrometers in diameter or less. Source is residue from burning of fossil fuels, can become embedded in lungs.
- Sulfur Dioxide (SO₂): It is emitted primarily from stationary sources that burn fossil fuels (mainly coal and oil) such as power plants and refineries. SO₂ is also a byproduct of copper smelting. Diesel fuel and, to a lesser extent, gasoline contain sulfur and are considered contributors to sulfur dioxide in the atmosphere.
- Lead (Pb): Primary source of lead emissions in Utah is the extraction and processing of metallic ores; leaded gasoline was phased out in 1995.

Climate and Precipitation

The weather breeder of earth's atmosphere, called the troposphere, exhibits specific physical properties that contribute to the local weather. Throughout the Ash Creek watershed these determining factors include: 1) temperature, 2) pressure, 3) humidity, 4) precipitation, 5) radiant energy (sunshine), 6) cloud-cover, 7) wind direction and speed. These generally short-lived events create the local weather. Climate however, differs from weather as it represents a region's general pattern of weather over an extended period.

Climate variations or trends were considered by the advisory committees as influential forces to the resource issues within the Ash Creek Watershed. Though climate concerns were not directly addressed, references were listed, and resource management plans from the major land management agencies were discussed.

Many agencies are preparing for climate change events. One such endeavor is sponsored by the USFS, and is called the Intermountain Adaptation Partners (IAP); which in an Adaptation Partners Project. IAP is a Forest Service science-management collaboration embracing the following goals:



Figure 4.1: Weather forming near Ash Creek-New Harmony. 2015.

1. Increase climate change awareness;
2. Assess the vulnerability of natural resources and ecosystem services to climate change; and
3. Develop science-based adaptation strategies that can be used by national forests to understand and mitigate the effects of climate change.

Their research summarizes present scientific understanding of climate change and its potential impacts on Utah and the western United States. Moreover, their research also identifies areas within the watershed most vulnerable to climate change, and recommends actions that could be implemented by land managers (IAP).

CULTURAL RESOURCES: Bands of Paiute Indian Tribes of Utah

The Cedar Band of Paiutes, located in southwest Utah is one of five constituent Bands of the Paiute Indian Tribes of Utah. Their Paiute name of ‘Suh’dutsing,’ which means Cedar, is derived from the areas cedar trees. While the name cedar is used locally to describe an evergreen tree, they are actually Utah Junipers (*Juniperus osteosperma*) and are predominant across the region.

Currently, the tribal boundaries are in Iron County, rather than Washington; however, there are both archeological and historical accounts of Paiute presence within the Ash Creek watershed. Early Southern Paiutes were excellent hunter-gathers and lived close to both perennial and ephemeral rivers, seeps and springs—the source of life in their arid landscape.

The Southern Paiute language is not a written language—but is part of the Numic language, which belongs to the Uto-Aztecan language family. This American Indian language type is found in Mexico and United States. Unfortunately the language is not widely spoken, however there are efforts to revive the language (NPS).

They were premier ethnobotanists—with an intimate knowledge about the many uses of local plants. Moreover, there are numerous testimonials from tribal elders, early pioneer settlers, and other European travelers about their simple agricultural and irrigation techniques, utilized in many locations throughout the present-day boundaries of the watershed.

The southern Paiutes differed from the northern Paiute tribes as they combined hunter-gatherer techniques with irrigated agricultural practices—growing squash and corn. They proved to the early Mormon settlers who soon traversed the width and breadth of their tribal lands, in the mid-1800's that raising food was possible in this arid environment. From their first contacts with Spanish explorers in 1776, the harbingers of change blew. By the late 1800's their life-style and culture was dramatically altered by the different groups of people who travelled through, or settled across their lands.

The tribes' current abundance has been both lengthy and arduous, and after many delays and broken half-promises, they finally received tribal recognition in 1985. In an excerpt from "Beneath These Red Cliffs", by Dr. Ron Holt, professor of Anthropology, their sacrifices and resiliency are described:



Figure 4.2: Little dancer. Cedar Band of Paiute Indians Pow-Wow event. Photo credit: Gaylord Robb.

Neither the written word nor the courses of historical events have been kind to the Southern Paiutes. Theirs is a story of resiliency under great pressure and of disappointment after many promises. With the encroachment of Euro-American settlers into the area came the destruction of much of their traditional culture, religion, economy, and the title to their ancestral homeland. It took less than twenty-five years of contact with the Mormon settlers to reduce the Paiute population by 90 percent and turn them from being peaceful, independent farmers and foragers into destitute, landless people who survived by doing seasonal and part time work for the white settlers. Some Paiute groups even ceased to exist.

To further the official demise of the Paiutes, the federal government and the Mormon Church made only feeble attempts to provide needed services. These attempts implemented many ill-conceived policies purported to "help the Indian tribes." In spite of all this, the majority of Paiutes never left their ancestral lands--they remained and survived the barrage of acculturation, relocation, and termination policies and practices. The Paiutes survived challenges that would have overwhelmed a less flexible people. They adapted to

their changing environment yet retained their distinct identity and deep roots in southern Utah (Holt).

As the CRMP is a collaborative document between many land-users, it is important to acknowledge the Paiute tribal members contributions that continue to benefit the communities within the Ash Creek Watershed. Furthermore, recognition is also extended to the contributions of many other individuals from both the past and present that foster cooperation amongst the diverse land-users.

CULTURAL RESOURCES: Pioneers and others

The following excerpt is from a historical account about the development of water in the Ash Creek Watershed, since the emigration of Mormon settlers in the mid-1800's. In the research document titled, "New Harmony's Historic Water Ditches," by Holly Hadley, a member of the New Harmony Planning and Zoning Committee—a timeline of water resource events unfolds; describing the early civil engineering of the Anglo-European settlers. Who delivered water to the new homesteads, via earthen-rock ditches. Their ingenuity and hard labor ensured their communities successes, then and today:

When the Mormons came to Utah in 1847, they began building settlements. These settlements moved southward in 1849 under the direction of a man named Parley P. Pratt. The Cedar City area was a prime spot because of the mineral Iron ore. John D. Lee led a group of people there in 1851 and one of the first things they did was build an irrigation system to water their fields. These pioneers divided into groups working to produce food and iron.

The Mormons were experts at building communities quickly. "No group of people in the West since the coming of the whites has been more aware of the importance of water, more cohesive and diligent in searching, capturing, and distributing it, or more suitably adapted to preserving and perpetuating a water-dependent culture in an arid land than the Mormons (Fradkin)." They spread out from Parowan south to Ash Creek. The settlement near Ash Creek was named Harmony. Because of water issues, this community moved from their location right near the creek up further north. Here they had more arable land for agriculture and access to Harmony and Kanarra Creeks.

Fort Harmony was established in 1854, and water was one of their main concentrations. The settlers of the fort had to work together to build canals and share the water. Missionaries began arriving and with more people came the need for more water shares. "All things pertaining to irrigation were administered within the structure of the local church hierarchy. The water masters and "captains" were designated for the irrigation season. When disputes arose, they were adjudicated by the Bishop. Work groups were also called from the pulpit."

In 1857, more people came to the area as part of a militia called by the Prophet Brigham Young. Their job was to protect the Mormons from an expedition ordered by President James Buchanan. The Iron County District camped northwest of Fort Harmony and while there they constructed a water ditch called “dry field ditch.” This ditch is very important because it was used by two military divisions, and is still used by the town today. This was the beginning of Main Canyon and Comanche canyon water ditches.

In 1860 to 1862, Fort Harmony was hit by an earthquake and then horrible rains that basically destroyed it. At this time the settlers divided into two groups, one going to Kanarraville, the other to the base of the mountains to settle the town of New Harmony. “The decision was made by drawn lots and influenced largely on the abundance of irrigation water for the Kanarraville group (Spencer).

The New Harmony settlers quickly went to work building houses, planting gardens, and digging irrigation canals. Farming and ranching would continue for the next one hundred and fifty years. Sheldon Grant, a resident of New Harmony wrote in his history, “When the town was first settled, water came from springs or wells. You would dig until you found water, and then line the hole—usually 8 feet across—with rocks, leaving a cavity 3-4 feet wide. After reaching ground level, the rocks would extend a foot or higher. A wooden frame – box – type would be built and covered the well. On this frame was a “windless” – a wooden pole – like a drum with a handle on the right end. Wrapped around the drum would be a rope with a bucket tied to the end – long enough to reach the water.

One could drop the bucket down the well but would have to use the handle to raise the filled bucket. Well water and spring water were usually “cool” and were preferred. Water, if clear, could be taken out of an open ditch for washing clothes, or, if “boiled” could be used for drinking. In the lower part of town, the water table was about 8-10 feet down—another reason the Saints first settled there (Grant).”



Figure 4.3: New Harmony trail kiosk describing the development and location of historical ditches.

Today, many of the historic ditches are still utilized by the community. An informative kiosk built near a USFS trail system in New Harmony was recently installed to share these important events. In addition, there are references about their continued preservation that are discussed outlined in Chapter 5: Cultural and Historic Resources.

New Harmony Nature Park Trails

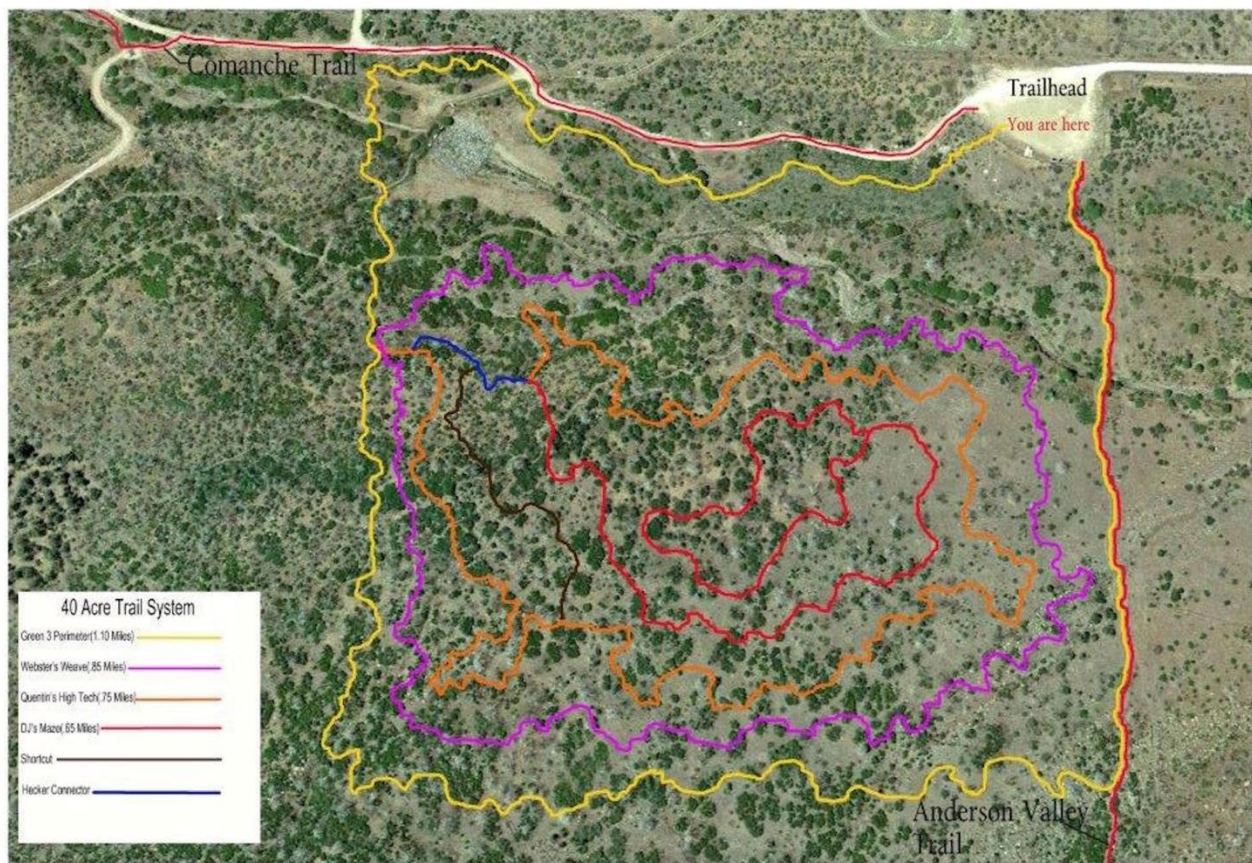


Figure 4.4: Map of New Harmony Trail System, and some of the historic ditch boundaries. Map credit: USFS.

Fire and Vegetation

Ash Creek watershed is part of the Upper Virgin River Watershed. Within the boundaries there are five different types of riparian vegetation communities occur within the Upper Virgin River Watershed. Riparian areas encompass approximately 10,743 acres (17 sq.mi.) or less than 1.0% of the entire watershed.

The majority of the riparian areas are made up of four riparian vegetation communities. Moreover, Ash Creek and North Creek-Virgin River Watersheds have the greatest amount of riparian vegetation with 2,311 acres (22%) and 2,275 (21%), respectively. Riparian vegetation communities have been impacted by many area fires, Pinyon-Juniper encroachment, habitat loss from general land use, and other noxious weed species.

Riparian Community	Acreage	Percent of Watershed	Ash Creek Total
Riparian Woodland and Shrub-land-upland habitat.	7,473 acres	70%	2,092
Invasive Southwest Riparian Woodland and Shrub-land and Cottonwood Willow	1,363 acres	13%	86
North American Warm Desert Riparian Mesquite Bosque	599 acres	5%	126

Table 4.1: Description of riparian community types in Ash Creek watershed.

Ash Creek flows through sections of steep lava rock canyons where the canopy alternates from stretching across the entire channel in certain segments; to areas of only sparse vegetation when the gorge opens out. Due to the influence of humans and weather, some sections of stream are dewatered below diversion dams, while at other times of the year the channels are scoured by flash floods. Summer lows for Ash Creek are 6.5 cfs (USGS.) More often, the lower stretches are completing dewatered during months of irrigation, due to diversion flows to the Ash Creek Reservoir.

On average, 78% of the stream flow is diverted for irrigation; consequently, what remains are stretches a sandy or rock-strewn stream bottom (USDA 1997). An immediate consequence to the habitat is that riparian vegetation is subjected to extremes of flooding and drought conditions. The headwaters of Ash Creek are located within the Dixie National Forest. Portions of Ash Creek also flow through private property with varying degrees of impact from livestock and human communities.

The predominant plant communities through which it flows are dominated cottonwood, ash, and willow. In some areas noxious weed populations of scotch thistle and both perennial and annual invasive species are dominant. Many projects within the natural resource issues discussions of the CRMP strategize and rank projects for vegetation treatments.

Other contributors to the health of the creek are geomorphological and weather related. Both affect the overall health of the riparian community. As Ash Creek flows from riparian woodlands within the Dixie National Forest to warm desert riparian mesquite and cottonwood-willow habitat, there is a change in elevation, and consequently vegetation communities. This also affects the climate of the streams, and temperature gradients.

Moreover, most precipitation occurs during winter and early spring when storms from the Pacific Ocean move across the intermountain area. A secondary precipitation event occurs in summer during July and August when occasional thunderstorms (monsoon) develop because of the moist air moving northward across the region from the Gulf of Mexico (USDA 1997).

Common Vegetation-Ash Creek Watershed		
Vegetation Type	Common Name	Genus Species
Tree(s)	cottonwood	<i>Populus fremontii</i>
	willow	<i>Salix</i>
	alder leaf mountain-mahogany	<i>Cercocarpus ledifolius</i>
Shrub-Perennials-Annuals	snowball sand verberna	<i>Albonia fragrans</i>
	desert needle grass	<i>Acantharum speciosum</i>
	Indian rice grass	<i>Acantharum hymenoides</i>
	big sage	<i>Artemesia tridentata</i>
	sand sagebrush	<i>Artemisia filifolia</i> Torr.
	four-wing salt brush	<i>Atriplex canescens</i> . (Pursh) Nutt.
	desert marigold	<i>Baileya multiradiata</i> Harv. & A.
	red brome	<i>Bromus rubens</i>
	cheat grass	<i>Bromus tectorum</i>
	Rattlesnake weed	<i>Hieracium venosum</i> L.
	yellow rabbitbrush	<i>Chrysothamnus viscidiflorus</i> (Hook.) Nutt.
	black brush	<i>Coleogyne ramosissima</i> Torr.
	croton	<i>Croton texensis</i> (Klotzsch) Müll. Arg. var. <i>utahensis</i> Cronquist
	forget-me-not	<i>Myosotis</i> L.
	wing-nut cryptantha	<i>Cryptantha pterocarya</i> (Torr.) Greene
	bulbous spring parsley	<i>Cymopterus bulbosus</i> A. Nelson
	larkspur	<i>Delphinium</i> L.
	hedge-hog cactus	<i>Echinocereus</i> Engelm.
	Virgin river brittlebush	<i>Encelia virginensis</i> A. Nelson
	Mormon tea	<i>Ephedra viridis</i> Coville
	red stem filaree	<i>Erodium cicutarium</i>
	Apache plume	<i>Fallugia paradoxa</i> (D. Don) Endl. ex Torr.
	broom snakeweed sticky	<i>Amphiachyris</i> (A. DC.) Nutt.
	snakeweed sticky	<i>Gutierrezia texana</i> (DC.) Torr. & A. Gray var. <i>glutinosa</i> (S. Schauer)
	Juniper-Utah	<i>Juniperus utahensis</i>
	winter fat	<i>Krascheninnikovia lanata</i> (Pursh.) A.D.J. Meeuse & Smit
	pepper weed	<i>Lepidium fremontii</i> S. Watson
	smooth desert dandelion	<i>Malacothrix glabrata</i> (A. Gray ex D.C. Eaton) A. Gray
	horehound	<i>Marrubium</i> L.
	evening primrose	<i>Oenothera</i> L.
	Porters muhly	<i>Muhlenbergia curtifolia</i> Scribn.
	pale evening primrose	<i>Oenothera pallida</i> Lindl.
	Mojave prickly-pear	<i>Opuntia erinacea</i>
	galleta grass	<i>Pleuraphis</i> Torr.
	desert almond	<i>Prunus fasciculata</i> (Torr.) A. Gray
	indigo bush	<i>Psorothamnus arborescens</i> (Torr. ex A. Gray) Barneby
	stansbury cliffrose	<i>Purshia stansburiana</i> (Torr.) Henrickson

Table 4.2: Vegetation inventory of Ash Creek watershed. USFS and WCWCD. 2014

Fire Regimes, Ecology and Response

Landscape and ecological changes, combined with prolonged drought cycles have resulted in severely altered fire regimes. Plant communities within the western US, including the Ash Creek Watershed have experienced severe fire events that have increased both in frequency, temperature and duration. Numerous ecological studies across the Southwest have documented the decline in herbaceous vegetation (grasses and non-woody flowering plants) while forests thicken and brush invades. Evidence supports that these patterns are tied to changes in land-use history, noxious weeds infestations (in particular non-native grasses), historical over-grazing, an extensive history of fire suppression, and drought.

In recent years, many federal and state agencies have recognized the need for more pro-active fire management and have used tools such as the **Fire Regime Condition Class** (FRCC) classification system to rank existing ecosystem conditions and prioritize areas for fuels treatments. The FRCC describes the amount of departure of an area or landscape from historic to present conditions.

Condition classes are a function of the degree of departure from historic fire regimes. This results in alternations of key ecosystem components such as species composition, structural stage, stand-age and canopy closure. The following activities may have facilitated this departure:

- Fire exclusion
- Timber harvesting



The installation of fuel breaks has been instrumental in providing fire-fighters a space to combat fires from. Several different vegetation treatments were used to construct the Ash Creek Fuels Reduction Project, near New Harmony, located within the Ash Creek Watershed. Primarily because the community has experienced several large scale fires in the past decade. A recent fire in the watershed, called the Mill Flat Fire resulted in 11,465 acres of burned habitat, including homes. An in-depth, interagency evaluation of the fire event revealed many insights and improvements in wildlife response.

The project was initiated by the Color Country BLM Field Office (FO). Other fires on forest service land have employed similar fire breaks. A summary of recommendations can be found within the report on the Mill Flat Fire (USFS-Pine Valley Ranger District).

- Grazing
- Introduction and establishment of exotic plant species
- Insects and disease (either introduced or native)
- Other past management activities.

Fire Regime Condition Class (FRCC)		
Condition Class	Attributes	Management Options
Condition Class 1	a. Fire regimes are within or near an historical range. b. The risk of losing key ecosystem components is low. c. Fire frequencies have departed from historical frequencies by no more than one return interval. d. Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2	a. Fire regimes have been moderately altered from their historical range. b. The risk of losing key ecosystem components has increased to moderate. c. Fire frequencies have departed (either decreased or increased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: Fire size, frequency, intensity, severity, or landscape patterns. d. Vegetation attributes have been moderately altered from their historical range.	Where appropriate these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	a. Fire regimes have been significantly altered from their historical range. b. The risk of losing key ecosystem components is high. c. Fire frequencies have departed from historical frequencies by multiple return intervals. d. This results in dramatic changes to one or more of the following: Fire size, frequency, intensity, severity, or landscape patterns.	Where appropriate these areas may need high levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.

Table 4.3: Fire Regime Condition Class (FRCC). The condition classes of FRCC are delineated by condition class, their unique attributes and management options associated with condition class 1-3. Classification system is utilized by the majority of stakeholders within the Ash Creek Watershed.

Many area fires have altered the vegetation communities, and have contributed to an influx of invasive species throughout the watershed. These noxious weed concerns will be examined and addressed more thoroughly in Chapter 5: Resources Issues and Concerns.

Forestry

The Dixie National Forest lies within five of Utah’s Counties: Garfield, Washington, Iron, Kane, and Piute. These counties economies are driven by government (Iron), tourism (Garfield, Kane, and Wayne), agriculture (Garfield and Paiute), mining (Paiute), and trade/transportation/utilities (Washington). While there are four main ranger districts, only the Pine Valley Ranger district manager the lands located in the Ash Creek Watershed boundaries.

Active mixing of air and average precipitation for Utah, along with an absence of major air pollution sources results in low pollutant background values for the Dixie National Forest. Both prescribed burns and wildfires are a source of air pollution, but in general, the air quality within the Forest is considered good to excellent. Recreational use, residential heating for support facilities, and limited vehicle traffic constitute the main sources of emissions (Dixie National Forest Oil, Gas and Mining FEIS.2015).

Many local communities obtain culinary and agricultural water from sources located on the Dixie National Forest-Pine Valley Ranger District. The quality of the water is generally good, with water quality issues arising from use, downstream within the communities, rather than at the head-waters. Extensive water developments such as reservoirs, diversions, and ditches have been constructed in the Pine Valley Ranger District to support these and other uses. The primary consumptive uses of surface water include: off-forest irrigation and culinary water supply. On forest uses include domestic water supplies for campgrounds and livestock/wildlife watering, and non-consumptive in-stream flows for aquatic habitat maintenance and recreation.

The Dixie National Forest contains many wildlife species, including small and large mammals, reptiles, and migratory birds that are protected by the Migratory Bird Treaty Act and other legislation. Migratory bird nests can be found in wet habitats as well as ponderosa pine/woodland, aspen, pinyon juniper, and conifer forest; most nests are found on the ground but may also occur in trees or shrubs. Native fisheries can be found in the 400 miles of aquatic habitat (streams, lakes, and reservoirs) on the Dixie National Forest (DNF 2015).

Land Cover -Ash Creek Watershed- HUC 10	
Sparsely Vegetation/Barren	3%
Woody Wetlands	2%
Deciduous Forest	3%
Evergreen Forest	47%
Mixed Forest	1%
Shrub/Scrub	32%
Grassland/ Herbaceous	3%
Emergent Herbaceous Wetland	1%
Open Water	1%
Developed, Open Space- Low Intensity	1%
Developed, Medium-High Intensity	1%
Agriculture	6%
Altered or Disturbed Area	1%

Table 4.4: Percent land cover Ash Creek HUC 10. SW Reg. GAP.



Figure 4.5: Young owl in foliage. Photo credit: Zion NPS

Six threatened, endangered, or candidate (TEC) species are known or suspected to occur in the Dixie National Forest, or in waters that flow from the Dixie National Forest. In the Ash Creek Watershed these species include two endangered fishes: Virgin River Chub -*Gila seminuda* and Woundfin-*Plagopterus argentissimus*; two birds: California condor-*Gymnogyps californianus* and the Mexican spotted owl-*Strix occidentalis lucida*. Designated critical-habitat for Mexican spotted-owls is located in the watershed boundaries, and on the border of Zion National Park. Eyries for

peregrine falcons (*Falco peregrinus anatum*) populations are also present.

Additional aquatic species are also prevalent along the entire length of Ash Creek; Desert Sucker and Speckled Dace. Moreover, after a large flood event in 2005, hydrological conductivity occurred between the Virgin River and Ash Creek. Consequently, many species previously observed only in the Virgin River are now present in the lower reaches of Ash Creek, and depending on the amount of precipitation may be also located further upstream:

Virgin Spinedace	Virgin Chub	Woundfin	Flannelmouth Sucker
			

Figure 4.6: Species of endemic fish found within the Virgin River and some tributaries. Virgin River Program.

Other General Species

In addition to the threatened and endangered species discussed above, a rapid watershed assessment survey (RWA) conducted by the NRCS, and the University of Arizona-Water Resource Center of the Upper Virgin watershed observed approximately 64 different species (Table 4.5). In 1989, one important historical specie, the wild turkey (*Meleagris gallopavo*) was reintroduced into the Ash Creek watershed. At the turn of the 20th century, they were almost extirpated from North America, because of over-hunting and habitat loss. Today, in Washington County and other suitable areas across the state, the wild turkeys are flourishing. There are some concerns in the watershed over minor crop damages. The Utah Division of Wildlife Resources has responded with educational outreach, and removals to new areas.

Species Name	Common name	USEA (1)	ST (2)	USFS (3)
<i>Accipiter gentilis</i>	Northern Goshawk		CS	KH
<i>Asclepias welshii</i>	Welsh's Milkweed	LE		
<i>Asio flammeus</i>	Short-eared Owl		SPC	
<i>Astragalus ampullarioides</i>	Shivwits Milkvetch	LE		
<i>Astragalus holmgreniorum</i>	Paradox Milkvetch	LE		
<i>Athene cunicularia</i>	Burrowing Owl		SPC	
<i>Brachylagus idahoensis</i>	Pygmy Rabbit		SPC	KH
<i>Bufo boreas</i>	Western Toad		SPC	
<i>Bufo microscaphus</i>	Arizona Toad		SPC	
<i>Buteo regalis</i>	Ferruginous Hawk		SPC	
<i>Callisaurus draconoides</i>	Zebra-tailed Lizard		SPC	
<i>Canis lupus</i>	Gray Wolf	LE	S-ESA	
<i>Catostomus clarkii</i>	Desert Sucker		SPC	
<i>Catostomus discobolus</i>	Bluehead Sucker		CS	
<i>Catostomus latipinnis</i>	Flannelmouth Sucker		CS	
<i>Centrocercus urophasianus</i>	Greater Sage-grouse		SPC	SPH
<i>Charadrius montanus</i>	Mountain Plover		SPC	
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	C	S-ESA	
<i>Coleonyx variegatus</i>	Western Banded Gecko		SPC	
<i>Corynorhinus townsendii</i>	Townsend's Big-eared Bat		SPC	KH
<i>Crotalus cerastes</i>	Sidewinder		SPC	
<i>Crotalus mitchellii</i>	Speckled Rattlesnake		SPC	
<i>Cynomys parvidens</i>	Utah Prairie-dog	LT	S-ESA	KH
<i>Cypseloides niger</i>	Black Swift		SPC	
<i>Dolichonyx oryzivorus</i>	Bobolink	LE	S-ESA	KH
<i>Gila robusta</i>	Roundtail Chub	CS		
<i>Euderma maculatum</i>	Spotted Bat		SPC	
<i>Empidonax traillii extimus</i>	Southwestern Willow Flycatcher	LE	S-ESA	KH
<i>Gila seminuda</i>	Virgin Chub	LE	S-ESA	
<i>Gopherus agassizii</i>	Desert Tortoise	LT	S-ESA	SPH
<i>Haliaeetus leucocephalus</i>	Bald Eagle		SPC	KH
<i>Heloderma suspectum</i>	Gila Monster		SPC	
<i>Idionycteris phyllotis</i>	Allen's Big-eared Bat		SPC	
<i>Lasiurus blossevillei</i>	Western Red Bat		SPC	
<i>Lepidomeda mollispinis</i>	Virgin Spinedace		CS	
<i>Leptotyphlops humilis</i>	Western Threadsnake		SPC	
<i>Melanerpes lewis</i>	Lewis's Woodpecker		SPC	
<i>Myotis thysanodes</i>	Fringed Myotis		SPC	
<i>Numenius americanus</i>	Long-billed Curlew		SPC	
<i>Nyctinomops macrotis</i>	Big Free-tailed Bat		SPC	

Species Name	Common name	USEA (1)	STATE (2)	USFS (3)
<i>Oncorhynchus clarkii</i>	Utah Bonneville cutthroat trout	CS		KH
<i>Pediocactus sileri</i>	Siler pincushion cactus	LT		
<i>Pelecanus erythrorhynchos</i>	American white pelican			SPC
<i>Picoides dorsalis</i>	American three-toed woodpecker		SPC	
<i>Plagopterus argentissimus</i>	Woundfin	LE	S-ESA	
<i>Pyrgulopsis deserta</i>	Desert spring snail			SPC
<i>Rana onca</i>	Relict leopard frog	C	S-ESA	
<i>Sauromalus ater</i>	Common chuckwalla			SPC
<i>Sphaeralcea gierischii</i>	Gierisch's globemallow	C		
<i>Strix occidentalis</i>	Spotted owl		S-ESA	KHC
<i>Vulpes macrotis</i>	Kit fox			SPC
<i>Ursus arctos</i>	Brown bear	LT	S-ESA	
<i>Xantusia vigilis</i>	Desert night lizard	SPC		

Table 4.5: Upper Virgin River Watershed species of concern classifications. Data Sources: Utah Automated Geographic Reference Center (AGRC 2009)

(1) USEA Federal U.S. Status

LE Listed Endangered: imminent jeopardy of extinction.

LT Listed Threatened: imminent jeopardy of becoming endangered.

C Candidate species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity.

(2) State Status Utah Sensitive Species List (2007) Utah Division of Wildlife Resources

CS Species receiving special management under a conservation agreement in order to preclude the need for federal listing.

S-ESA Federally-listed or candidate species under the U.S. Endangered Species Act.

SPC Wildlife species of concern in Utah

(3) USFS U.S. Forest Service US Department of Agriculture, Intermountain Region Proposed, Endangered, Threatened and Sensitive Species (2008)

KH Known distribution species and/or habitat.

SPH Suspected or potential habitat

Geology and Soils

Soils within the Upper Virgin River Watershed are diverse and formed as the result of differences in climate, vegetation, geology, and physiography. Detailed soils information for the watershed is available from the Natural Resources Conservation Service (NRCS) within the following Soil Surveys: “Soil Survey of Washington County Area, UT” and “Soil Survey of the Iron-Washington Area, UT.”

One concern within the watershed is soil erosion. The easily erodible soils are due to many different factors. Wind erosion of soil is a concern for much of the cropland in the watershed. New Harmony experiences winds that are constant and strong in many locations. High wind conditions coupled with soils that are naturally susceptible to erosion makes this a concern for human safety as well as livestock health, crop damages, difficulty in reseeding at certain sites and environmental stability. Soil erosion from water, particularly in areas lacking vegetation is a concern within many parts of the Ash Creek watershed (NRCS. 2007).

Geologic Formation Descriptions In Upper Ash Creek Watershed					
AGE	GEOLOGIC UNIT		THICKNESS (FEET)	LITHOLOGIC CHARACTER	AQUIFER
Quaternary	Quaternary		0-1,500	sediments boulder gravel, sand, and silt	Basin fill
	Quaternary basalt		0-500	Fractured, broken basalt	
	Alluvial-fan deposits		0-150	Poorly sorted boulder conglomerate	
Tertiary	Alluvial-fan deposits	Upper	0-700	Unconsolidated boulder gravel	Alluvial fan
		Middle	0-450	Siltstone with conglomerate beds	
		Lower	Lower 350	Cemented breccia, sandstone, and siltstone	
	Racer Canyon Tuff		1,000	Fractured monzonite and latite	
	Pine Valley monzonite				
	Stoddard Mountain Intrusion				
	Quichapa Group		1,000	Cemented to partially cemented volcanic ash	Pine Valley monzonite
	Claron Formation		700-1,000	Sandstone, limestone, shale, and conglomerate	
Cretaceous	Iron Springs Formation		3,800	Sandstone, shale, and conglomerate	

Table 4.6: Description of the geological formations in the upper Ash Creek watershed. from Heilweil, et al., 2000 adapted from Hurlow, 1998.

Hydrology: Surface and Ground Water

Designated Uses and Protection						
Stream	1C* Drinking needing treatments	2B Boating or wading	3A Cold water fish	3B Warm water fish	3C Non-game fish	4 Irrigation or stock
Ash Creek and tributaries from Virgin River to reservoir	NA	X	X	NA	NA	X
Ash Creek from Ash Creek reservoir to head waters.	NA	X	X	NA	NA	X

Table 4.7: Ash Creek designated uses and protection categories (DEQ). 2016.



Figure 4.7: Ash Creek diversion through historical ditch. Photo credit: Holly Hadley. USFS

Recharge from the Upper Ash Creek watershed contributes greatly to local water supplies. Groundwater generally follows the surface contours, in the watershed the water flows in a southerly pattern (USFS). The area of recharge is further bounded on the east by the Hurricane fault and on the west by the topographic divide. Surface water also travels southward until it enters into the Ash Creek reservoir.

Due to a highly fractured substrate these surface waters will be diverted into a new canal, designed by Washington County Water Conservancy District. Flowing south until it is eventually stored in the new reservoir near Tocqueville. Considered a critical aquifer, it includes a plethora of springs located especially throughout the Wet Springs Sandy-Ash Creek area (Figure 4.9).

As the water flows through the unconsolidated deposits it moves from high to low topographic areas in a manner similar to surface water. Upon reaching the former Ash Creek Reservoir area, it is believed that the ground water flows southward along the Ash Creek drainage which moves the water southward towards Tocqueville (Heilweil, et al., 2000). It is now estimated that the total recharge for the Upper Ash Creek aquifer is 6,100 to 18,800 acre-feet (AF/year) and discharge for the valley is between 3,000 and 28,000 AF/year.

Another concern pertains to water quantity within the watershed. The aquifer has been documented as declining for many years and many operators have needed to deepen wells and increase pump size to obtain access to the available well water. This situation has decreased the economic viability of farming and ranching operations. In other areas of the watershed, where surface water is utilized, the primary concern is also related to water availability. Climate conditions are variable and can result in both reduced reservoir storage and amounts of water available to agricultural producers (NRCS-Utah, 2007). Water resources of the Ash Creek watershed supply both area municipalities and other communities of Washington County. Irrigation companies, agriculture, wildlife, riparian coordinators, and other developments also rely on these water resources.

Water development projects currently in progress within the watershed, and the greater Washington county area have elicited some concerns. Residents in the watershed boundaries have questioned how the upgrades to the new reservoir, and its amended pipe-line will affect their available water (Figure 4.8). Public outreach meetings, and other educational venues have been presented by the Washington County Water Conservancy District in regards to these concerns; further meetings are needed. Water education and a water conservation plan have been developed by WCWCD. Any water right concerns will need to be presented to appropriate state or federal agencies, as they are neither addressed, nor resolved by this CRMP document.

Estimated Upper Ash Creek Groundwater Budget Recharge Flow Component Rate AF/yr		
Recharge Flow Component	Conceptual	Base-line
Infiltration of precipitation	2,100 to 9,200	10,410
Seepage from ephemeral streams	3,500	2,650
Infiltration of unconsumed irrigation	0 to 5,000	880
Total	500 to 1,100	380
	6,100 to 18,000	14,320
Discharge Flow Component	Conceptual	Base-line
Well Discharge	1,200 to 1,5000	1,400
Evapotranspiration	1,100 to 15,000	8,410
Spring Discharge	200 to 1,000	340
Seepages to Ash, Sawyer and Kanarra Creek	500 to 3,000	1,630
Subsurface Outflow	0 to 7,500	2,500
Total	3,000 to 28,000	14,320

Table 4.8: Values used in the USGS baseline model of Upper Ash Creek aquifer. Heilweil, et al., 2000.

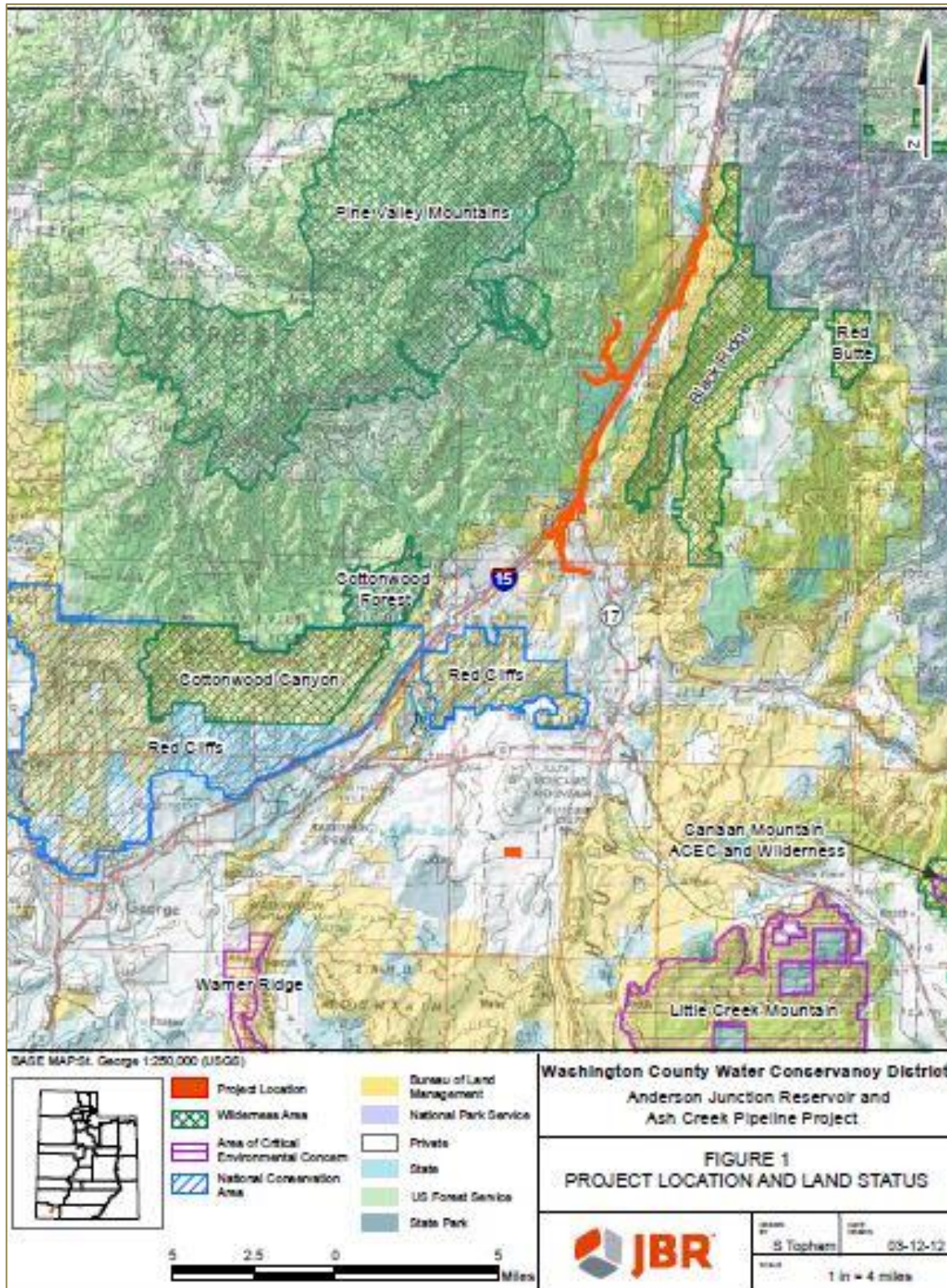


Figure 4.8: WCWCD Anderson Junction Reservoir and Ash Creek Pipeline Project. JBR 2012.

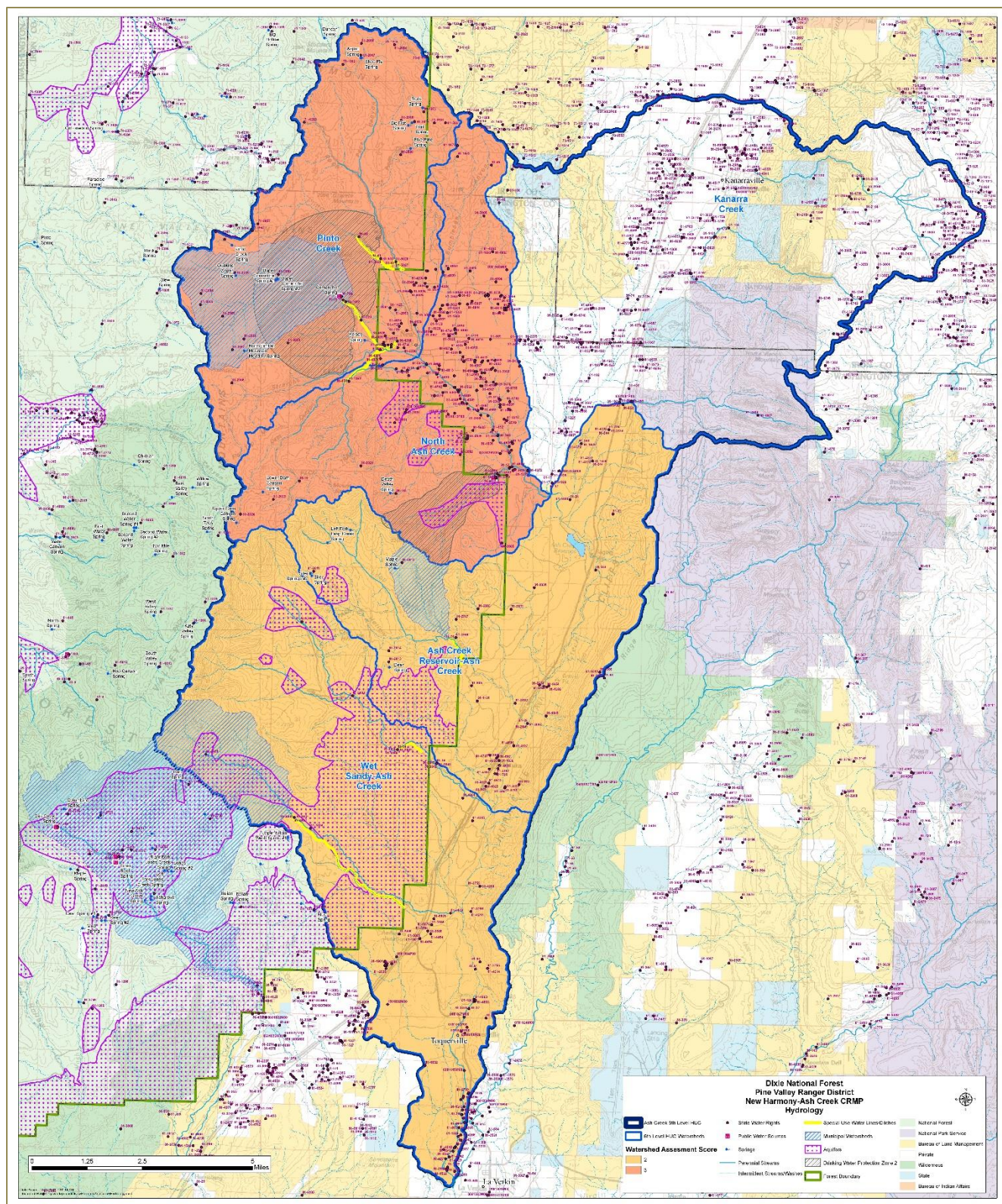


Figure 4.9: Dixie National Forest-New Harmony and Ash Creek watershed hydrology. Map credit: Laurie Parry DNF. 2016

Noxious Weeds

Noxious weeds have often been likened to a wild-fire, as their dominance in a landscape effects the area's biodiversity, water quality, increases soil erosion and often water quantity. Definitions of habitat categories can be found in the Utah Comprehensive Wildlife Conservation Strategy. Noxious Weed Management Best Management Practices (BMP's), state weed lists and resource concerns from all TAC groups are more thoroughly addressed, in Chapter 5: Resource Issues and Concerns. All TAC members ranked noxious weeds were ranked as a top resource concern.

BMP 1: Mapping and Inventory of Weed Populations

Successful management includes documenting any *current* and *future* populations of noxious weed infestation using GPS technologies. Correct identification and labeling of populations with the appropriate designated symbol as determined by the USDA Natural Resource Conservation Service Database.

BMP 2: Early Detection & Rapid Response Methodology

Adoption of an Early Detection and Rapid Response (ED & RR) program is a viable approach to weed control that emphasizes the control of new, invading weeds (Utah, PCD, 2009). This method focuses upon the eradication of invasive species populations when they are small. Cost associated for ED & RR methods are typically far less than those associated with containing vast populations of weeds. The adoption of this method is more likely to impede unmanageable and fast spreading weed populations. This method has been adopted by many states and counties and is excellent in controlling infestations before the associated cost in equipment, personnel and treatment methods are excessive. Definitions of classes:

BMP 3: Northern Arizona-Southern Utah CWMA

Cooperative Weed Management Areas (CWMA) link geography and shared boundaries. The benefits are numerous and include: (1) *technical expertise* (2) *personnel* (3) *equipment* (4) *grant availability* and (5) *management* of noxious weed infestations that do not adhere to delineations established by federal, state or other methods. Weeds do not recognize state or county boundaries. Consequently, the work of CWMA groups is an essential contributor to the control and eradication of noxious weed infestations.

Resource management plans from the major stakeholders in the watershed contain sections pertaining to the control and eradication of noxious weed populations. Cooperative projects are also initiated by partners of the Cooperative Weed Management Area partners (CWMA)-

the local chapter is called the Northern Arizona-Southern Utah CWMA. In Spring of 2013, they received an invasive species grant from the Department of Agriculture for weed eradication and habitat restoration at Deseret Holdings Ranch and Farm, in New Harmony. This project in cooperation with CWMA partners is nearing completion. One important aspect was to employ Early Detection and Rapid Response methodologies that aligned with the county, state and federal noxious weed control guidelines; thus ensuring the Desert Holdings project long-term success.

CLASS 1A WEEDS	CLASS B WEEDS	CLASS C WEEDS
Relatively low population size within the State and are of highest priority being an Early Detection Rapid Response (EDRR) weed.	Moderate population throughout the State and generally are thought to be controllable in most areas.	Found extensively in the State and are thought to be beyond control. Statewide efforts would generally be towards containment of smaller infestations.

Table 4.9: General description of Class 1A, 1B and Class C weeds. 2015.

ED & RR Stages for Success

- *Implementation:* Determine what actions need to be facilitated for the most effective and ecologically sensitive management of the invasive species.
- *Identify:* Correct identification of invasive species (genus species).
- *Inventory:* Mapping of the infestation, and photo-documentation of before and post-treatment, and determine establishment of a control perimeter.
- *Partnerships:* Utilization of technical and professional expertise through partnering with the Weber River CWMA (Central Weed Management Area).
- *Management:* Development of Environmental Scientist of Weed Specialist position

Rangeland

Range and shrublands' are predominant vegetation types in Washington County and are managed by federal, state, and private organizations. The history of their use, after the emigration of European settlers into the area is well documented. Current rangeland resource management plans are derived from both positive and negative experiences gained since the late 1800's. In addition to livestock, area wildlife, both permanent and migratory also rely upon rangeland resources. Moreover, recreational activities are enjoyed in these areas, too.

The varying types of range and shrub habitats, in addition to early challenges with reliable water developments, contributed to livestock production becoming an important commodity in many regions of Washington County and other suitable locations throughout the state. In

Utah Department of Agriculture and Food

Strengthen Utah's Livestock Industry

Improve the sustainability of livestock grazing through science based management principles

Work cooperatively with federal agencies and partners to promote efficient multiple-use management of public lands.

Work with federal agencies and Congress to implement policies and procedures that allow maximum flexibility when addressing grazing and environmental issues.

Curtail the decline of public lands grazing opportunity by using sustainable management practices

Improve Rural Economies

Maintain viable ranches as a critical contributor to the economy by using sustainable management practices.

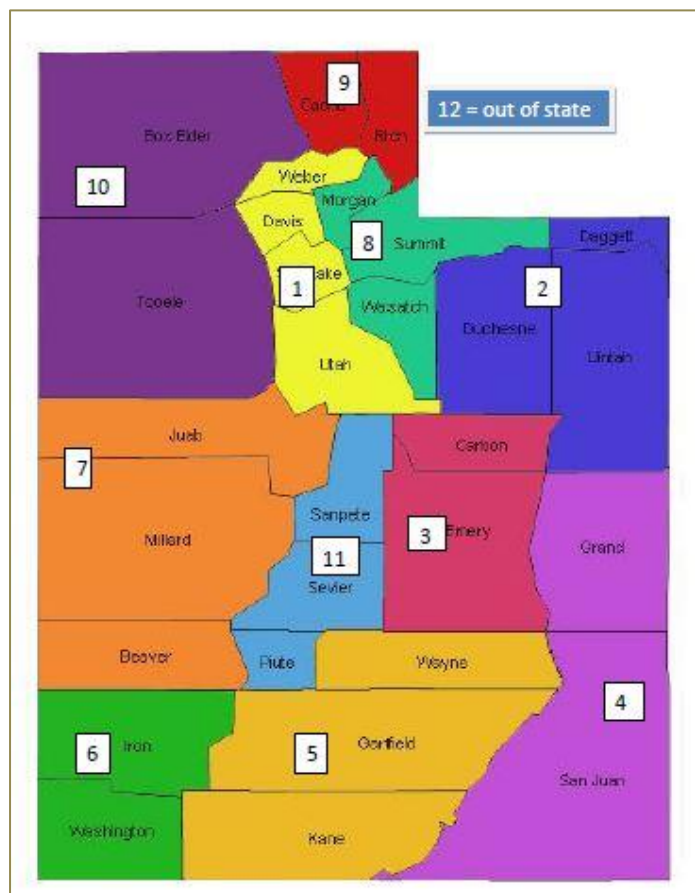
Enhance the Environment

Maintain viable ranches as a critical contributor to the economy, customs and culture of rural Utah.

Plan and implement rangeland improvement projects that improve grazing management.

most rural counties, livestock production continues to be an important economic resource. As a result, there are many support industries that rely upon the areas agricultural success.

The BLM, and USFS manage the federal rangelands within the watershed boundaries. Utah's Standards for Rangeland Health and Guidelines for Grazing Management were developed in accordance with 43 CFR-4180 to provide for conformance with the Fundamentals of Rangeland Health. Through conformance and attainment of Utah's Standards and Guidelines, Utah BLM assures that the Fundamentals of Rangeland Health are met. Dixie National Forest guidelines are similar, and discussed in the Dixie National Forest: Resource Management Plan.



State of Utah Noxious Weed List-Presence in Ash Creek Watershed			
Common Name	Scientific Name	Code	Presence (Y,N,UK)
Bermuda grass	<i>Cynodon dactylon</i>	CNDA	Y
Johnson grass	<i>Sorghum halepense</i>	SOHA	X
Medusa head	<i>Taeniatherum caput-medusae</i>	TACA	UK
Quack grass	<i>Elytrigia repens</i>	ELRE	UK
Field bindweed	<i>Convolvulus arvensis</i>	COAR	Y
Sulfur cinquefoil	<i>Potentilla recta</i>	SUCI	UK
Hoary Cress	<i>Cardaria draba</i>	CADR	Y
Japanese knotweed	<i>Polygonum cuspidatum</i>	POCU	UK
Oxeye Daisy	<i>Leucanthemum vulgare</i>	LEVU	UK
Poison Hemlock	<i>Conium maculatum</i>	COMA	Y
Black Henbane	<i>Hyoscyamus niger</i>	HYNI	Y
Hounds tongue	<i>Cynoglossum officinale</i>	CYOF	N
St. Johnswort	<i>Hypericum perforatum</i>	HYPE	N
Diffuse Knapweed	<i>Centaurea diffusa</i>	CEDI	Y
Russian Knapweed	<i>Centaurea repens</i>	CERE	Y
Spotted Knapweed	<i>Centaurea maculosa</i>	CEMA	Y
Purple Loosestrife	<i>Lythrum salicaria</i>	LYSA	UK
Perennial Pepperweed	<i>Lepidium latifolium</i>	LELA	UK
Salt Cedar	<i>Tamarix ramosissima</i>	TARA	Y
Leafy Spurge	<i>Euphorbia esula</i>	EUES	Y
Yellow Starthistle	<i>Centaurea solstitialis</i>	CESO	Y
Canada Thistle	<i>Cirsium arvense</i>	CIAR	N
Musk Thistle	<i>Carduus nutans</i>	CANU	Y
Scotch Thistle	<i>Onopordum acanthium</i>	ONAC	Y
Dalmatian Toadflax	<i>Linaria genistifolia</i>	LIGE	Y
Dyer's Wold	<i>Isatis tinctoria</i>	ISTI	Y
Buffalo Burr	<i>Solanum rostratum</i>	SORO	UK
Common Burdock	<i>Arctium minus</i>	ARMI	Y
Camel Thorn	<i>Alhagi pseudalhagi</i>	ALPS	UK
Puncture Vine	<i>Tribulus terrestris</i>	TRTE	Y
Goatsrue	<i>Galega officinalis</i>	GAOF	UK
Jointed goatsgrass	<i>Aegilops cylindrica</i>	AECY	Y
Blue Lettuce	<i>Lactuca pulchella</i>	LATAP	UK
W. Whorled Milkweed	<i>Asclepias subverticillata</i>	ASSU2	Y
Silverleaf Nightshade	<i>Solanum elaeagnifolium</i>	SOEL	Y
Yellow Nutsedge	<i>Cyperus esculentus</i>	CYESE2	UK
Russian Olive	<i>Elaeagnus angustifolia</i>	ELAN	Y

Table 4.10: State of Utah list of recognized noxious weeds and presence in the Ash Creek Watershed. NASU CWMA. 2016

Wildlife: Ash Creek Watershed



Figure 4.10: Canadian geese. Photo-credit-Gaylord Robb

Human populations whether they are indigenous aboriginal tribes, contemporary hunters, wildlife biologists, researchers, or nature enthusiasts have followed the movements, and enjoyed the Ash Creek watersheds wildlife. Whether observing song-birds, avian population flying through for a respite, or deer following timeless seasonal movements—our creative inspiration and sometimes even our livelihood is derived from their management.

The arrival of Anglo-settlers to the Ash Creek watershed forever altered wildlife populations due to increases in human, livestock populations and other forestry activities. Many executive directives, such as the development of state and national forests have also influenced wildlife’s management and care. More recent legislation extended even greater protections, such as the Endangered Species Act.

Wildlife are present in all of Utah’s’ five physiographic regions that are delineated by their topography, geologic structure, and elevation: Basin and Range Region (western one-third of state); Mojave Desert (extreme southwest); Utah Mountains (Uinta and Wasatch mountain ranges); Colorado Plateau (southeastern portion of state); and Wyoming Basins (northeast portion). These habitats support diverse wildlife communities and approximately 700 species of vertebrate wildlife, and thousands of species of invertebrate life have been identified in

Abundance and Status Codes for Utah Avian Species				
Common	Uncommon	Rare	Occasional	Accidental
Found consistently in appropriate habitat and season	Present but inconsistently found in appropriate habitat and season	Found infrequently but annually in appropriate habitat and season	Not observed annually. Occurs some years in appropriate habitat and season	Not expected and out of normal range (few records)
Permanent Resident	Summer Resident	Winter Resident	Transient	
P = Found year round	S= Present during the nesting season	W = Winter Resident (Non-breeding visitor)	Migrates through Washington County in spring and/or fall	

Table 4.11: Avian abundance and status (residency) codes for Utah Division of Wildlife. R. Fridell. SCSF

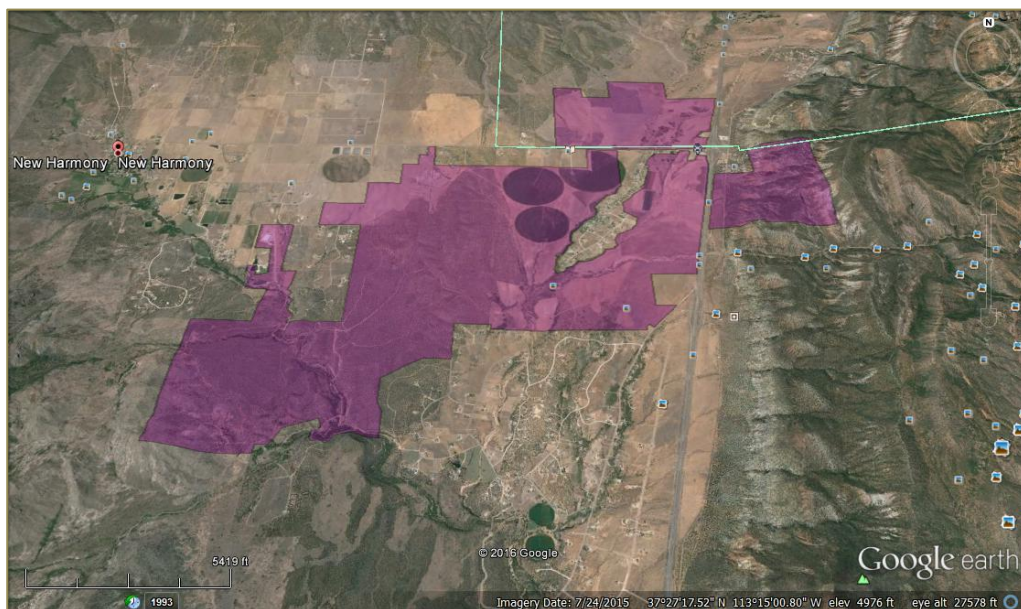
Utah since the mid-1800. This also includes species that are extinct, extirpated, or introduced (UWCS). In regards to avian species, almost 369 have been identified in Washington County alone. A yearly snapshot is categorized by abundance and status-residency (Table 4.11). In Utah, the wildlife community has changed dramatically in the last one-hundred and fifty

years, primarily due to the introduction of non-native species (e.g., plants, livestock, game animals) and changes in land management practices; such as, changes associated with agriculture, mining, and urban development. Conservation efforts for declining species have been limited primarily by the lack of adequate funding appropriated for restorative treatments (UDWR).

Threatened and Endangered Species

As of July 2015, Utah contained 43 endangered and threatened species under the federal Endangered Species Act. In Utah, the Utah Division of Wildlife Resources manages the wildlife populations in the Ash Creek Watershed. In addition to other federal area wildlife partners, they also work with State Parks, and SITLA concerning wildlife management concerns. In particular, those concerning Threatened and Endangered Species (T and E). The Ash Creek Watershed is also critical habitat for big game. Consequently, any treatment projects that create diversification of the age class of vegetation, will assist in sustaining mule deer throughout the winter months. Moreover, some of the developed fuel breaks created by the BLM and Forest Service will prevent the majority of this habitat from succumbing to any single fire event(s).

A direct consequence of these actions will improve the forbs and grasses providing better forage for both wildlife and livestock. A Coordinated Wildlife Management Unit-CWMU



(Fig. 4.11) is also located in the watershed. In addition to providing additional sites for the mule deer hunts, it also supports migratory routes, forage and water sources for area wildlife.

Figure 4.11: New Harmony Cooperative Wildlife Management Unit within the vicinity of Ash Creek Watershed. 2016

FEDERALLY LISTED	Common Name	Group	1° Habitat	2° Habitat
Endangered	California Candor	Bird	Cliff	-
	Kanab Amber Snail	Mollusk	Water-Lentic	Wetland
	Bonytail	Fish	Water - Lotic	-
	Colorado Pike minnow	Fish	Water-Lotic	-
	Humpback Chub	Fish	Water - Lotic	-
	Razorback Sucker	Fish	Water - Lotic	-
	SW Willow Flycatcher	Bird	Low Riparian	Mtn. Riparian
Threatened	Mexican Spotted Owl	Bird	Cliff	Low Riparian
	Bald Eagle	Bird	Low Riparian	Agriculture
	Utah Prairie Dog	Mammal	Grassland	Agriculture
Candidate*	Coral Pink Sand Tiger Beetle	Insect	Dunes	-
	Yellow-billed Cuckoo	Bird	Low Riparian	Agriculture
	Gierisch Mallow	Plant	Desert	-
Conservation Agreement Species	Northern Goshawk	Bird	Conifer/Aspen	
	Bonneville Cutthroat Trout	Fish	Water - Lotic	Mtn. Riparian
	Bluehead Sucker	Fish	Water - Lotic	Mountain
	Riparian Roundtail Chub	Fish	Water - Lotic	-
	Flannel mouth Sucker	Fish	Water - Lotic	-
Species of Concern UTAH	Common Name	Group	1° Habitat	2° Habitat
	Allen's Big-Eared Bat	Mammal	Low Riparian	-
	American White Pelican	Bird	Water - Lentic	-Wetland
	Arizona Toad	Amphibian	Low Riparian	Wetland
	Big Free-tailed Bat	Mammal	Low Riparian	Cliff
	Burrowing Owl	Bird	High Desert	Grassland
	Common Chuckwalla	Reptile	High Desert	Low Desert
	Desert Night Lizard	Reptile	Low Desert	P & J
	Desert Sucker	Fish	Water - Lotic	-
	Ferruginous Hawk	Bird	Pinyon-Juniper	Shrub steppe
	Fringed Myotis	Mammal	Northern Oak	P and J
	Greater Sage-grouse	Bird	Shrub steppe	-
	Lewis's Woodpecker	Bird	Ponderosa Pine	Low Riparian
	Kit Fox	Mammal	High Desert	-
	Long-billed Curlew	Bird	Grassland	Agriculture
	Spotted Bat	Mammal	Desert Scrub	Cliffs
	Siler Pincushion Cactus	Plant	Desert Scrub	-
	Three-toed Woodpecker	Bird	Sub-Alpine Cnfr	Lodge-pole
	Townsend's Big-eared Bat	Mammal	Pinyon-Juniper	Mtn. Shrub
	Western Toad	Amphibian	Wetland	Mtn. Riparian

Table 4.12: Utah Wildlife Comprehensive Strategy (UWCS) vertebrates of concern. October 2005-2015.
http://wildlife.utah.gov/cwcs/11-03-09_utah_cwcs_strategy.pdf

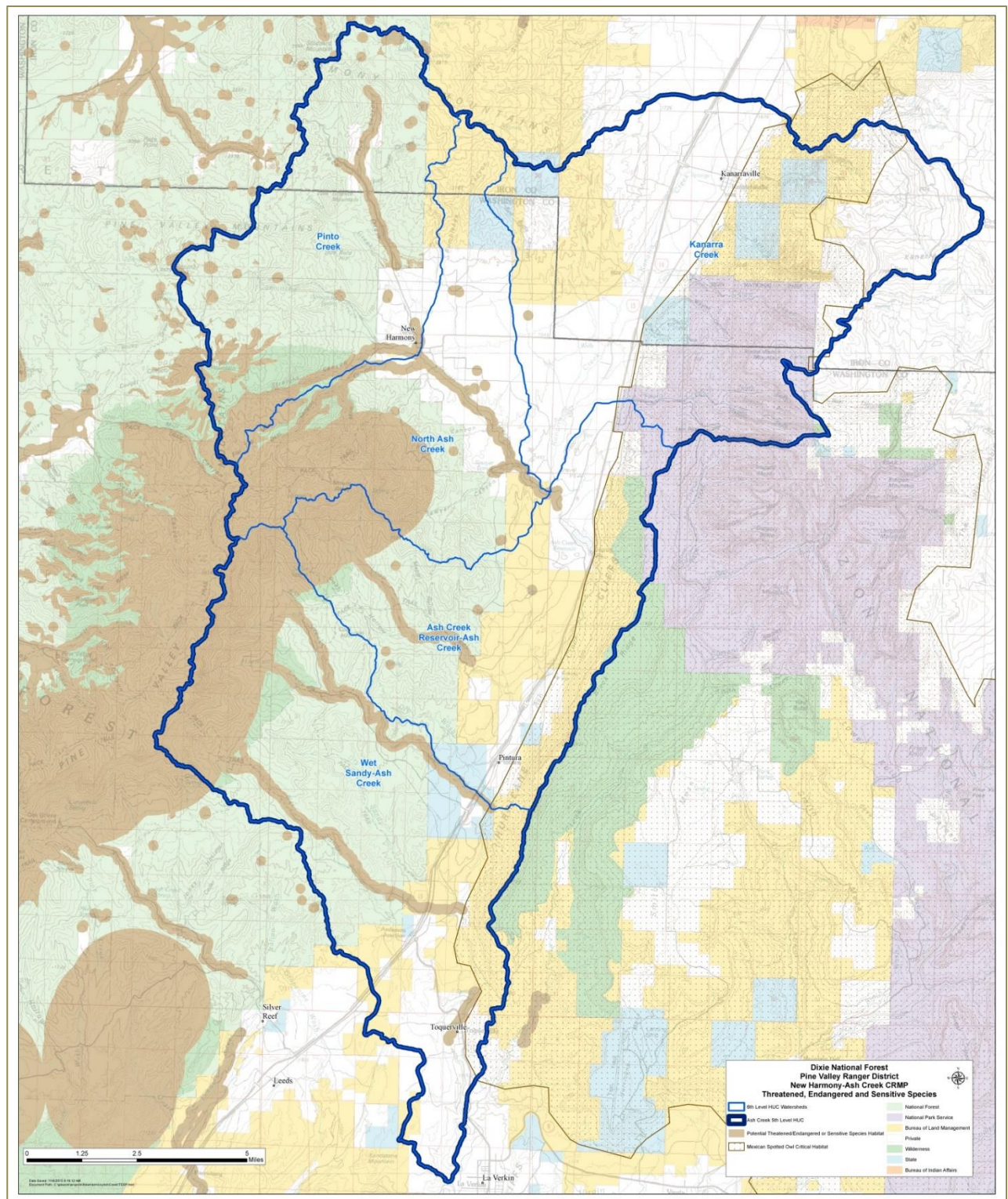


Figure 4.12: Threatened and Endangered species within Ash Creek Watershed. Map Credit: L. Parry. DNF. 2016.

Chapter 5: Natural Resource Issues

“We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.” Aldo Leopold

Throughout the development of the CRMP and resource issue evaluation process the advisory committee members identified resource issues of concern, timeline for their completion, funding options and assessment methodologies for the identified treatments. The remainder of this section presents the recommendations from the technical advisory, steering and citizen advisory committees. Locations of projects and additional partners are also identified. Funding strategies were discussed, and a pre-grant workshop yielded additional partnerships and goals for treatment projects.

Technical Advisory Committees were delineated into the following categories:

- 1) Agriculture and Rangeland
- 2) Noxious Weeds
- 3) Forests
- 4) Water Quality
- 5) Education and Information
- 6) Cultural
- 7) Wildlife
- 8) Vegetation and Fire

Additional information was also gathered from the general community, who provided their natural and cultural resource concerns, through the completion of a questionnaire. The questions were primarily developed by the UDAF-Zone 5 field office. Results were gathered in a variety of methods; through a community wide water bill mailing; public outreach at the New Harmony Apple Days; Washington County Library-New Harmony branch; New Harmony City Council meetings, and New Harmony Planning and Zoning Committee meetings. These results are tabulated in Tables 5.2-5.5. Afterwards, the Technical and Steering committee recommendations are listed by resource categories.

COUNTY		GENDER	AGE			AGRICULTURIST		ETHNICITY	
Washington	79%	Male	40%	18-24	0%	Yes	20%	Caucasian	90%
Beaver	1%	Female	60%	25-38	5%	No	80%	Native Am.	0%
Iron	18%		39-50		12%			Latino	4%
Other	2%		51-65		80%			Other	5%
Cedar Paiute	0%		66+		3%			African American	1%

Table 5.1: Demographics of community natural resource questionnaire. 2016.

Natural Resource Survey Summary:

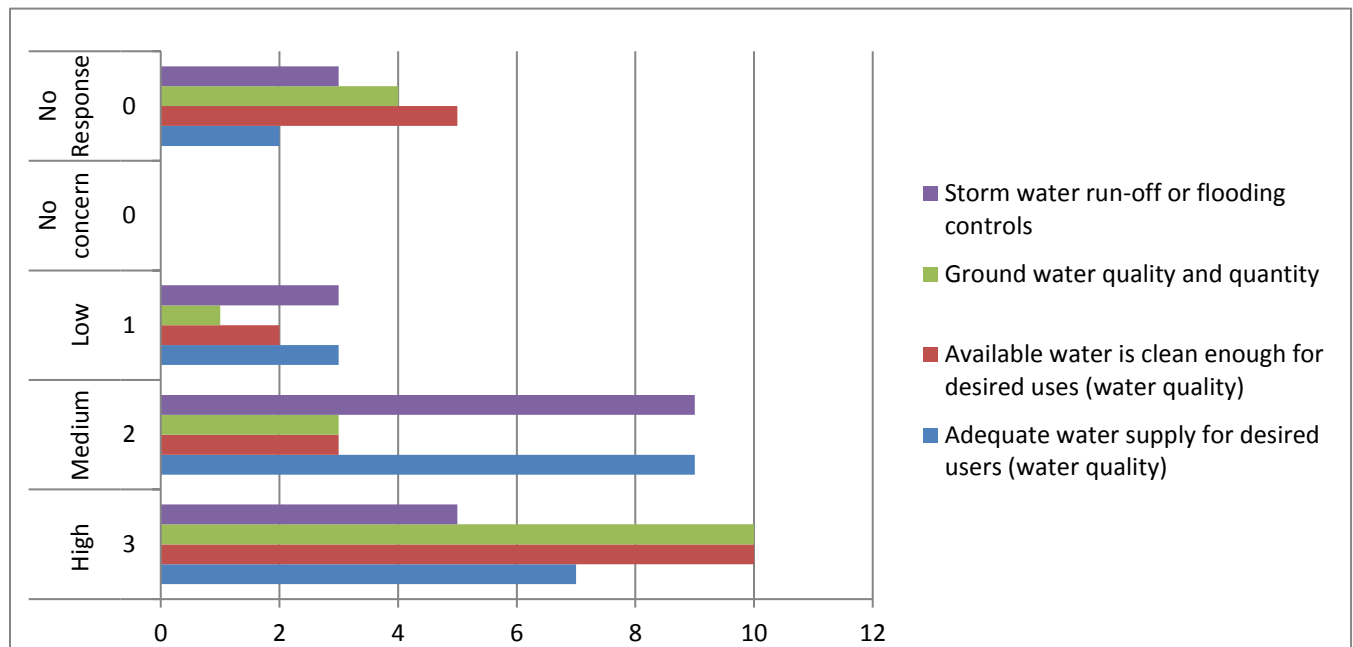


Table 5.2: Summary of Ash Creek survey results for flooding controls, ground water, and water quantity. 2015-2016.

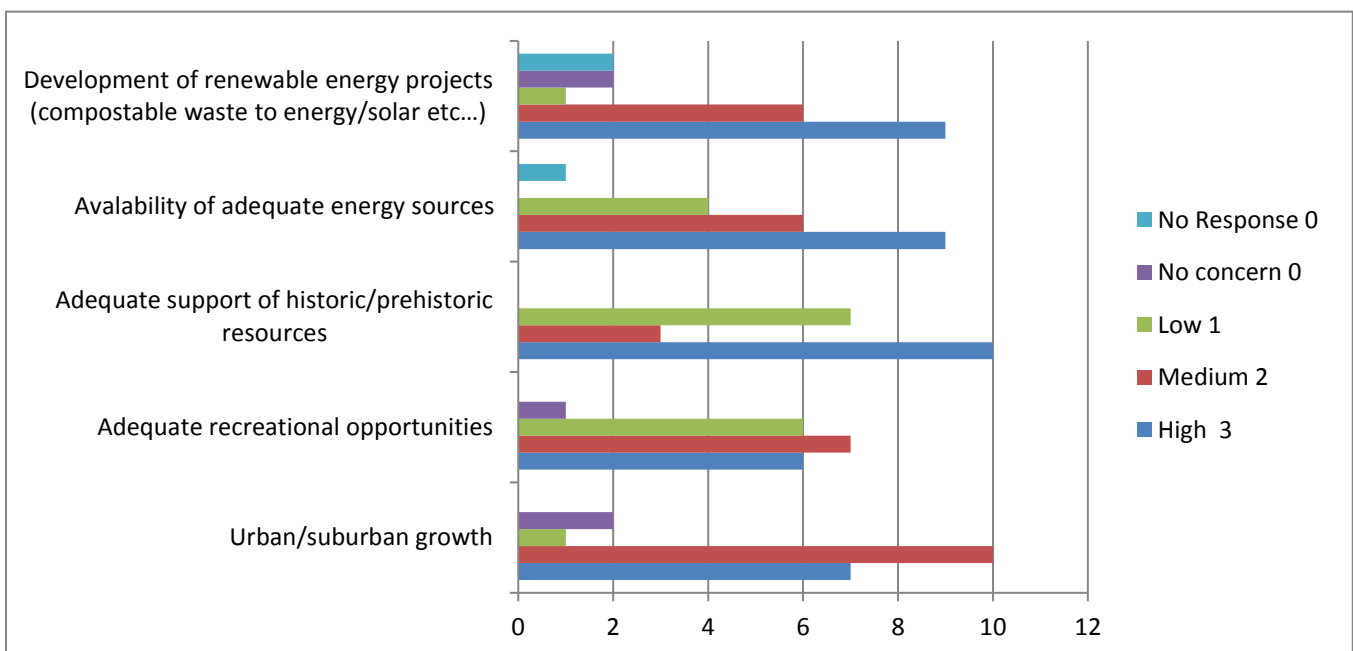


Table 5.3: Summary of Ash Creek survey results for energy, recreation and cultural history related issues. 2015-2016.

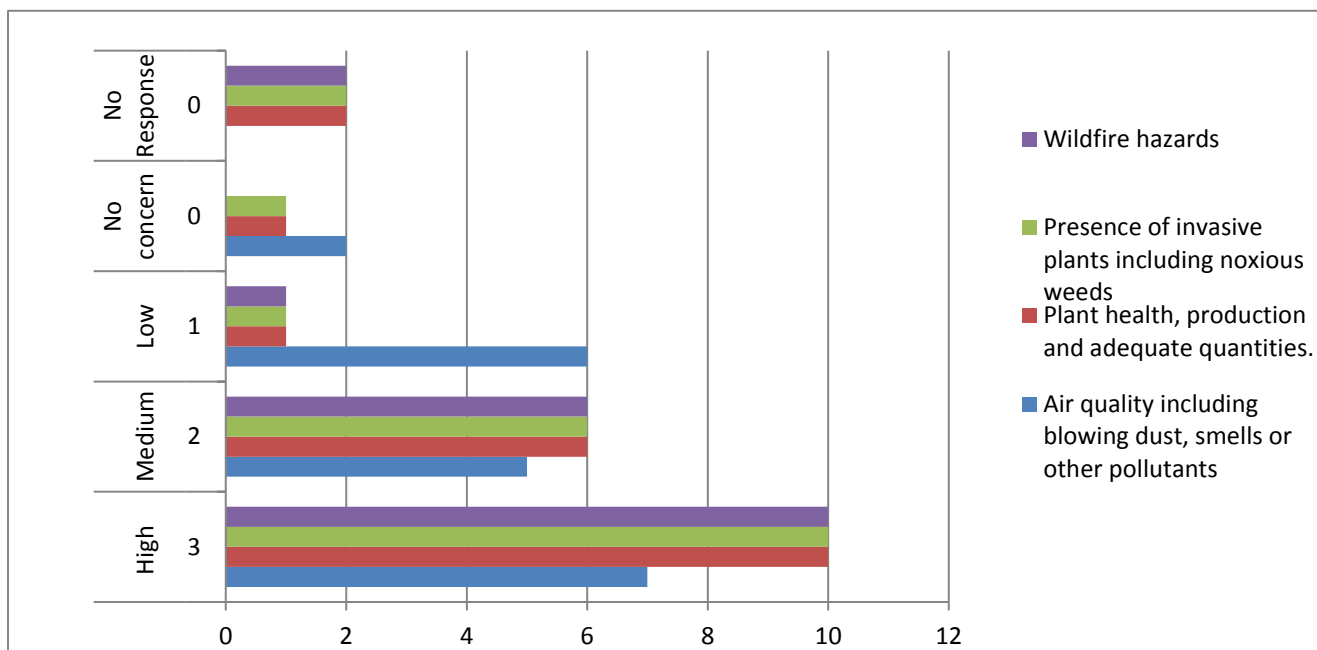


Table 5.4: Summary of Ash Creek survey results for wildfires, invasive plants, plant health, and air quality.2015-2016.

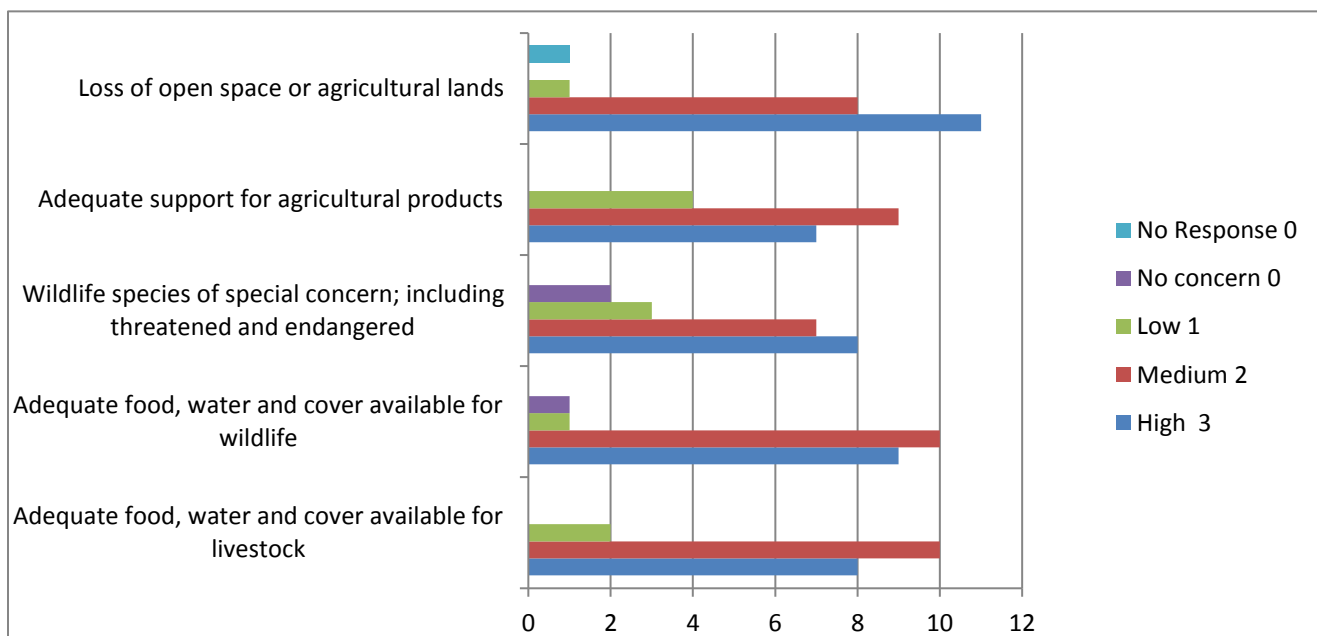


Table 5.5: Summary of Ash Creek survey results for agricultural space loss, wildlife concerns; livestock concerns. 2015-2016

Summary of Natural Resource Questionnaire:

The majority of the natural resource questionnaire responders were aged 50-64+ and predominantly Anglo-Saxon (Table 5.1). Though natural resource issues are the impetus for the CRMP, consideration was also given to social, and economic health of the watershed. Many questions inquired about growth rates and habitat loss from urban sprawl and development of agricultural and rangeland in the county (Table 5.5). Questions were ranked using a simple system: 1) Low Concern, 2) Medium Concern, 3) High Concern and 0) No Concern. Each questionnaire was tallied and totals for each question are cumulative.

Agriculture and farming are no longer a predominant source of employment in the Ash Creek watershed, and these occupations provide a minor source of income in Washington County (Socio-Economic Report 2015); and while many larger acres of formerly ranch and agricultural lands are being parceled into smaller acreages, there remains in the majority of the responders, a great concern about the decrease in agricultural lands (Table 5.5).

Water resource issues garnered some of the highest rankings, from greatest to least: available water clean enough for desired uses, ground water quality and quantity scored the highest. Followed by adequate water supply for desired uses in regards to water quality and storm-water run-off or flooding (Table 5.2). The flashiness of this watershed is contributed to the natural topography and highly erodibility of native rock, combined with anthropogenic negative influences. Consequently, the questions concerning plant health, production and adequate control of invasive plants, and wildfire hazards all contribute to both water quality and quantity (Table 5.4).

A concern for the well-being of area wildlife and livestock brought in moderate to high rankings (Table 5.4). Particularly, survey questions that included a consideration for threatened and endangered species (5.4). Similar concerns are listed later in Chapter 5 in the summaries of the TAC, CAC and SC committee members.

Some of the lower ranked answers were in regards to renewable energy and its development (Table 5.3). Increase in Washington County population and some industrial practices are contributing to lower air-quality standards, and this decrease in air quality is reflected in the high concern expressed by the responders (Table 5.4)

The changing economics of the county is reflected in the main employment opportunities that includes the service and construction industries. Consequently, recreational opportunities were also ranked in the 2-3 categories (Table 5.3). Moreover, the preservation of pre-historical and cultural sites were also ranked in a similar higher category (Table 5.3).

Technical, Steering and Citizen Committee Recommendations:

In Chapter 5: Natural Resource recommended treatments are listed, along with the technical advisory team and their associated agencies. The areas containing the majority of the identified resource issues are also identified; in addition to their treatment plans, timeline and project assessments. Additional information and future grant application information will be amended into this CRMP as needed.

Agriculture and Rangeland:



Figure 5.1: Local apples for sale at the New Harmony Apple Days.

Most of the agricultural and rangelands in the Ash Creek Watershed are managed by the Bureau of Land Management (BLM), Dixie National Forest (USFS) and private entities. Many of the natural resource management recommendations discussed throughout the CRMP and their treatments are also well documented within the major land-users resource management plans.

In their annual report, the Utah Department of Agriculture and Food estimates vegetative and animal product yields by county (Table 5.6). One of the primary crops in Washington County are alfalfa, and alfalfa mix hay. While its primary use is for area livestock, it is also sold outside of the county. Though agriculture and farming are no

longer a predominant economic provider in Washington County, agricultural gains have remained constant (Figure 5.2).

Agricultural Estimates of Washington County Annual Report 2015			
Primary Crop	Yields	Total Harvested Acres	
Alfalfa & Alfalfa Mix Hay	22,000 tons	10,000-39,000	
All cattle and calves (head)	14,500	NA	
Beef cows	9,000	NA	
Milk cows	1,000	NA	
Sheep and lambs	600	NA	
Cash receipts (1,000)	Livestock	Farms	TOTAL
	7,621	6,092	13,713
Number of Farms (2012 census)	579	Land in farms (AC)	147,991
Harvested Cropland	8,712	Irrigated Cropland	14,781

Table 5.6: Agricultural estimates of Washington County from UDAF annual report. 2015

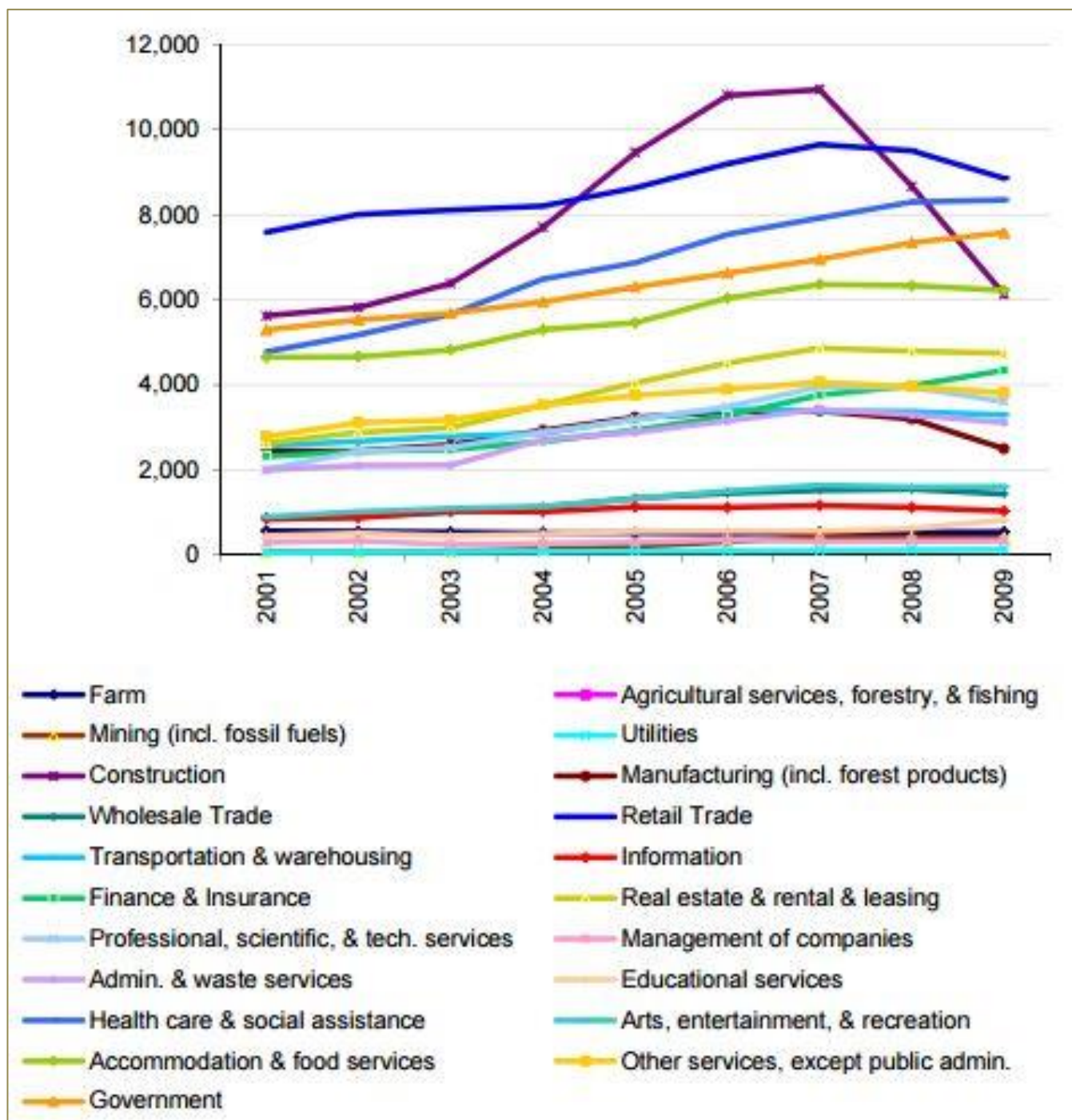


Figure 5.2: Examination of the major economic trends in Washington County from 2001-2009.
http://www.blm.gov/style/medialib/blm/ut/st_george_fo/planning/background_documents.Par.4155.File.dat/SGFO_Socioeconomic_Baseline_Report_2012_web.pdf

Ash Creek Watershed CRMP: Current Projects

Watershed Restoration Projects	Agency	Project Description and Objective(s)
Kanarra Ridge Fuels Reduction	<i>Utah Division of Forestry Fire and State Lands</i>	<u>Duration of funds:</u> Three years and the expected completion is 2018 for STV funds and 2019 for SFA funds. <u>Objective:</u> Hazardous fuels reduction. <u>Method:</u> Mastication, cut /pile/burn, and cut/pile/chip will be used to break up the continuity of fuels and reduce the likelihood that a large wildfire. <u>Other resource considerations:</u> Are taken into account as the project leaders plan the treatments. <u>Assessment:</u> Project begins summer-fall 2016. No assessment available.
Desert Holdings Noxious Weeds & Restoration	<i>Northern Arizona-Southern Utah Central Weed Management</i>	<u>Duration of Funds:</u> Deseret Holding-Spendlove Farm and Livestock (lease) is located in New Harmony, Utah. 2012-2015 <u>Objectives:</u> 1) Monitor and map noxious weed species within the 2,000 acre project, portions of Kanarra Creek, Camp Creek and thirteen ephemeral drainages, in the treatment areas. <u>Assessment Activity 1:</u> The mapping of the project has not completed, nor has the updated monitoring and mapping of the adjacent drainages. 2) Mapping, monitoring and treatment of Scotch thistle, <i>Cardaria draba</i>, stands of <i>Chrysothamnus</i> ssp, and other invasive populations on 360 acres adjacent to Zion National Park. After mechanical and chemical removal of above species, the post-treatment reseeding with species that will enhance the habitat; reseed with native or naturalized grass and brush species. <u>Assessment Activity 2:</u> The project has not been reseeded with native seed as outlined. 3) Protect and enhance agriculture land use and area watershed through, mechanical removal of approximately 370 acres of <i>Artemisia tridentata</i> infested with <i>Cardaria draba</i> and <i>Onopordum acanthium</i>. Biological control using rotational grazing of calf-cow pairs and utilize appropriate chemical treatments as needed prior to reseeding with naturalized wild rye, <i>Psathyrostachys juncea</i> (or small grains) in 2013. <u>Assessment Activity 3:</u> This portion of the project has not been completed.

Table 5.7: Current agricultural and watershed vegetation, and noxious weed control enhancement projects. Ash Creek Watershed. 2012-2016.

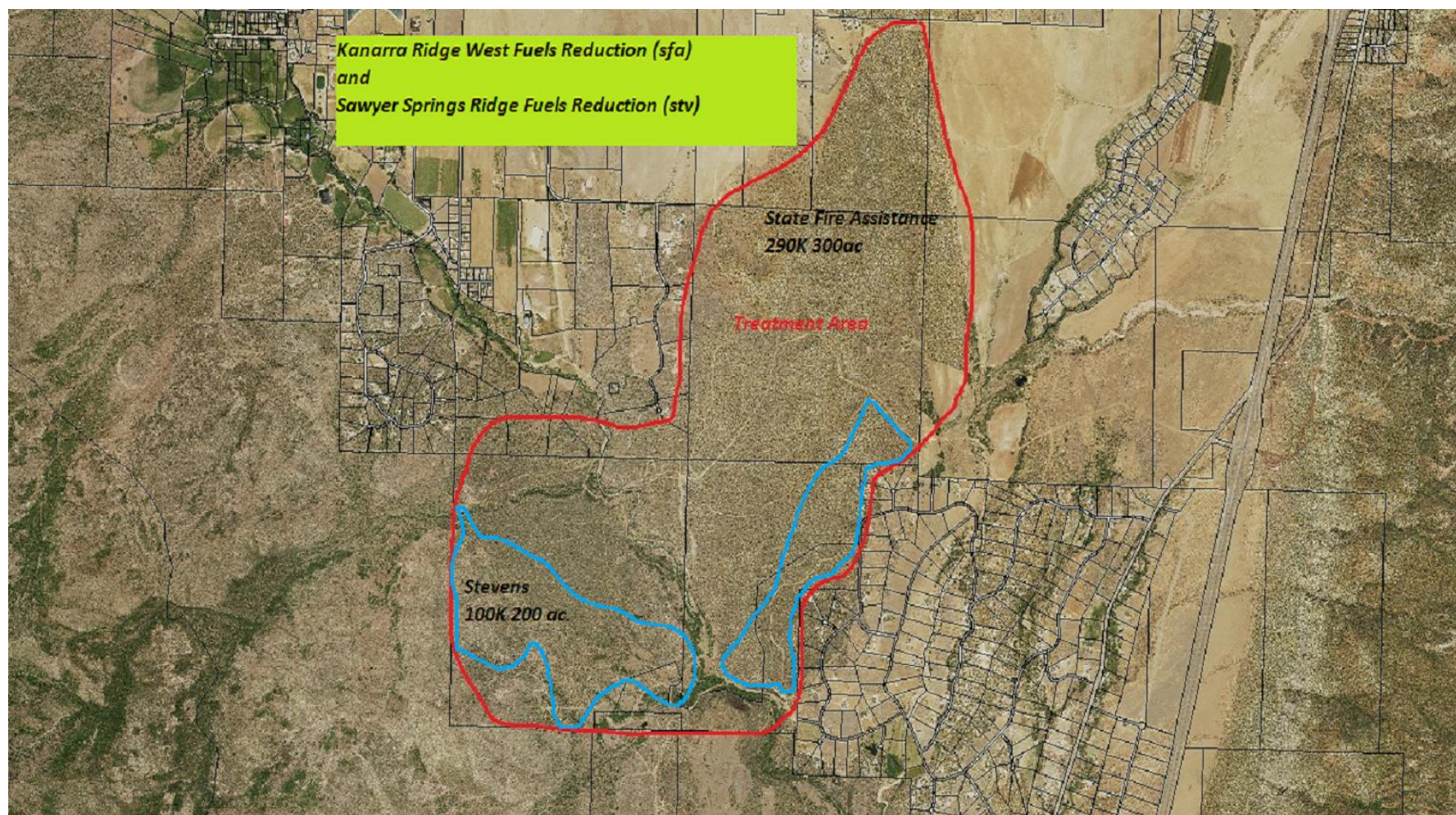


Figure 5.3: Project boundaries for Kannarra Ridge West Fuels reduction (SFA) and Sawyer Springs Ridge Fuels reduction (STV). Utah Division of Forestry and Fire and State Lands. 2016.

Agriculture and Rangeland: Ash Creek Watershed-1

Advisory Committee	Resource Issues	Location-HUC 6	Project and Assessment Goals	Time-Line
Dixie Conservation District, Dixie National Forest: Pine Valley Ranger District, Utah Department of Agriculture: Zone 5, Utah Division of Wildlife	1) <i>Noxious weed infestations.</i> <i>Management and treatment plans for: white-top, scotch thistle, and cheat-grass in disturbed areas.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek	a) Support additional cooperative noxious weed projects as identified by the Technical I Advisory Committee. b) Continue supporting the Northern-Arizona-Southern-Utah Cooperative Weed Management Area (NASU-CWMA) spray events.	Immediate through ten years.
	2) <i>Monitor and treat when applicable, Pinyon-Juniper encroachment.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek	a) Identify treatment areas within Dixie National Forest Service managed lands.	Immediate through ten years.
	3a) <i>Identify and boundaries of rangeland improvement projects.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek	a) Maintain current treatments within federal, state and privately managed lands. b) Identify and quantify rangeland treatments and rehabilitation opportunities.	Immediate through ten years.
	3b) <i>Identify Agricultural-Wildlife cooperative water projects.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek	a) Maintain existing projects, and consider guzzler sites not located within rugged terrain. b) Maintenance currently on the existing projects is a challenge; primarily due to rugged terrain.	Immediate through ten years.

Table 5.8a: Agriculture and Rangeland natural resource concerns within the Ash Creek watershed. CRMP 2015-2016

Agriculture and Rangeland: Ash Creek Watershed-2

Advisory Committee	Resource Issues	Location-HUC 6	Project and Assessment Goals	Time-Line
Dixie Conservation District, Dixie National Forest: Pine Valley Ranger District, Utah Department of Agriculture: Zone 5, Utah Division of Wildlife	3c) <i>Identify livestock water availability, and upgrades to distribution.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek	a) Rank future projects and consider technologies to overcome lack of reliable water sources. North and South Sawyer Canyon: Northern edge of watershed near Cedar City and the New Harmony Allotment.	Immediate through ten years.
	4) <i>Identify strategies to continue sustainable grazing practices (BMP).</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek	a) Utilize the <i>Utah Grazing Guidelines</i> (BLM), and other generic grazing guidelines.	Immediate through ten years.
	5) <i>Identify additional vegetation rangeland treatments and project.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek	a) Quantify and rank sagebrush treatments within South Ash Creek b) Identify primary reason(s) for closure of Prince Allotment. c) Restore head cuts within the upper portions of the watershed. d) Partner with Color Country and St. George on joint agency projects/treatments. e) Identify high priority habitat alterations within the allotments. f) Continue to work with private land-owners on project development and grant partnerships.	Immediate through ten years.

Table 5.8b: Agriculture and rangeland natural resource concerns within the Ash Creek watershed. 2016

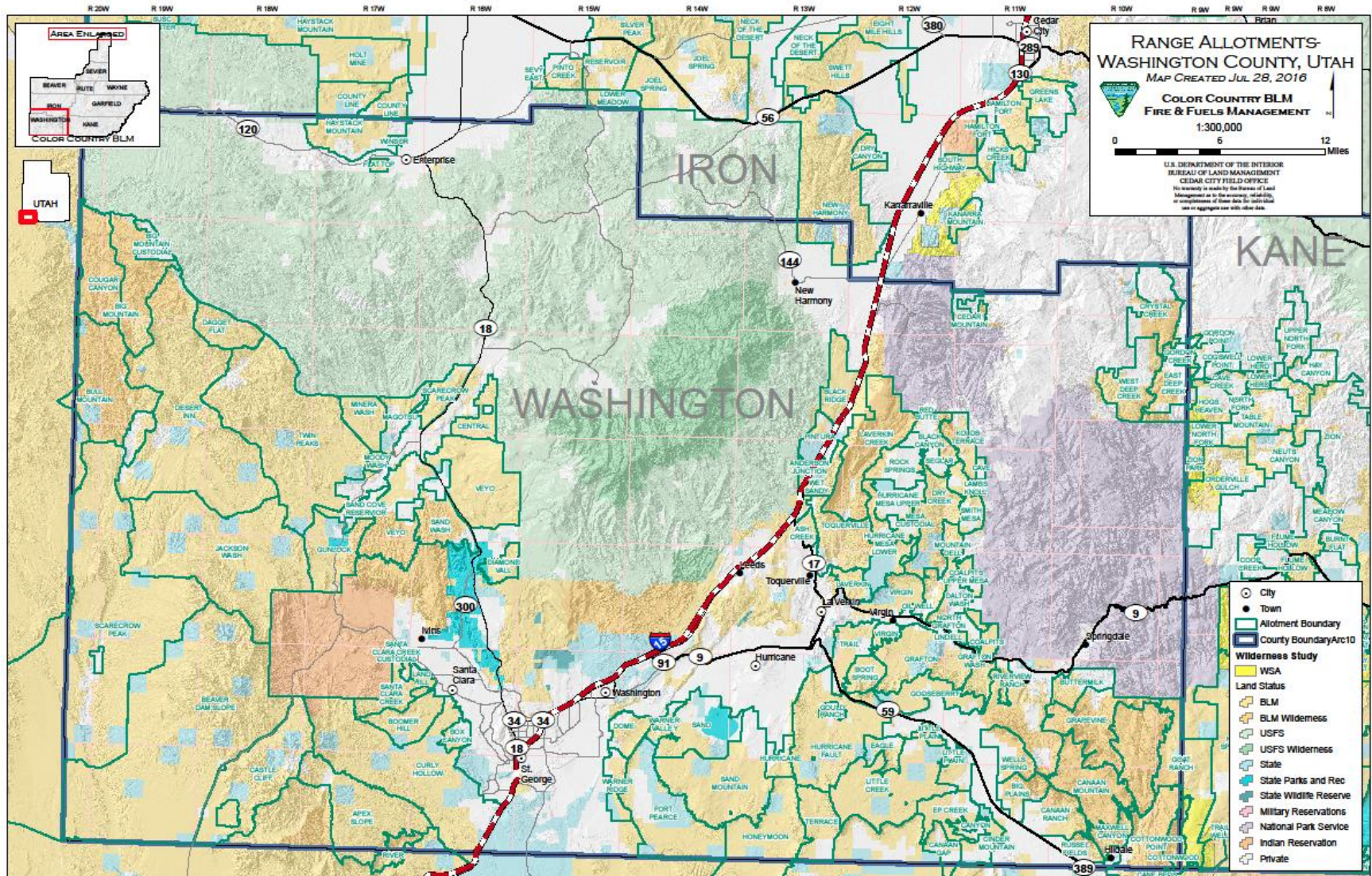


Figure 5.4: Rangeland allotments in Washington County Utah. Map Credit Color Country. BLM. 2016.

Air Quality: Ash Creek Watershed

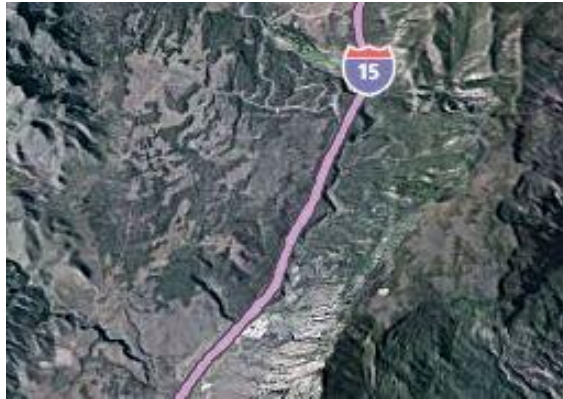


Figure 5.5: I-15 corridor passing through the Ash Creek Watershed. UDOT. 2016

Though the TAC, SC and CAC members did not categorize specific air quality concerns, discussions did center upon continuing to ensure that current data is being utilized; particularly, as growth continues to increase throughout the county, and state. Since the watershed encompasses a portion of the main N-S transportation corridor for the state of Utah (I-15); air quality associated with the combustion of fossil fuels, and other air quality standards associated with transportation needs to be monitored.

Advisory Committee	Resource Issues	Location-HUC 6	Project and Assessment Goals	Time-Line
Pine Valley Ranger District, Dixie Conservation District	1) Identify air quality pollutants and their sources within the watershed.	West Sandy Creek Ash Creek Reservoir North Ash Creek Pinto Creek Kanarra Creek Ash Creek	a. Ensure that current data is being utilized.	Immediate through five years.
	2) Categorize air quality standards with Utah Division of Air Quality and federal guidelines.	West Sandy Creek Ash Creek Reservoir North Ash Creek Pinto Creek Kanarra Creek Ash Creek	a. Identify air quality within watershed boundaries and quantify emissions from permitted sources.	Immediate through five years.

Table 5.9: Air quality natural resource concerns within the Ash Creek watershed. CRMP. 2015-2016.

Cultural and Historical Resources: Ash Creek Watershed



Figure 5.6: Cedar Band of Paiute elders. Photo credit: Gaylord Robbs. 2016

Preservation of the cultural and historical resource sites in the Ash Creek Watershed, retains high priority; moreover, continued diligence in communication with the Cedar Band of Paiute, and adherence to state and federal archeological statutes will ensure that these sites are protected, and given ample respect. In addition to the development of educational programs/projects that enlighten the community about the many contributions of indigenous populations. Also the preservation of the historical sites of the early settlers, and support of New Harmony's commitment to their maintenance and future developments.

Advisory Committee	Resource Issues	Location-HUC 6	Project and Assessment Goals	Time-Line
<i>Cedar City Band of Paiute Indians, Dixie National Forest-Archeologist</i>	1) Maintenance of tribal sacred sites within the watershed.	West Sandy Ash Creek Ash Creek Res. North Ash Pinto Creek Kanarra Creek	Monitor current and future construction projects to ensure protection of Chief Toquer burial site. Decrease and monitor habitat degradation, particularly at springs. Educate about importance of petroglyph protection.	Continue negotiations with Washington County Water Conservancy District.
	2) Reestablish Ash Creek riparian corridor to natural state when applicable.	West Sandy Ash Creek Ash Creek Reservoir Pinto Creek Kanarra Creek	Decrease degradation of riparian corridor, and associated tributaries.	Immediate through ten years.
	3) Support Cedar City Paiute bands historical	West Sandy Ash Creek Reservoir North Ash	Increase tribal consultation within the watershed.	Not identified.

	and ancient presence within the watershed.	Pinto Creek Kanarra Creek	Develop educational literature that illuminates the correct information about tribal history.	
	4) Develop K-12 educational programs that disseminate appropriate historical cultural information; and cease perpetuating incorrect information.	West Sandy Ash Creek Reservoir North Ash Creek Pinto Creek Kanarra Creek	Facilitate joint agency regulation of OHV use. Increase tribal consultation for accuracy. Educate how cultural heritage sites are being damaged by ill-legal OHV use.	Immediate.
	5) Increase protections or modify new road ways.	West Sandy Ash Creek Reservoir North Ash Pinto Creek Kanarra Creek	Monitor and adjust the construction projects damaging Chief Toquer burial site. Reduce degradation of springs and increased vandalism at petroglyph sites.	Current negotiations occurring with Washington County Water Conservancy District
	6) <i>Maintain historic irrigation ditches/water channels and farmsteads within New Harmony and boundaries of Ash Creek Watershed.</i>	• West Sandy • Ash Creek Reservoir • North Ash • Pinto Creek • Kanarra Creek	a) Continue with preservation efforts of the historic water channels within the watershed. b) Maintain current trails. c) Identify additional funding sources for future projects.	Immediate through twenty years.

Table 5.10: Cultural-Information and Education concerns within the Ash Creek watershed. CRMP. 2015-2016.

BLM: Fire and Vegetation: Ash Creek Watershed

The Color Country Interagency Fire Center Fuels Committee, New Harmony Focus area is defined by ownership, vegetation, firefighting access concerns, community and habitat risks and potential treatment recommendations. These focus areas also support the county fire plans—an general overview of the area fire risk concerns is contained within the Table 5.9.

New Harmony Focus Area	
Area Boundaries	Ash Creek Watershed HUC5: Composed of state, private, BLM, and Forest Service lands.
Communities at Risk	Chekshani, Kannaraville, Black Ridge Ranches, New Harmony Heights, Pintura
Vegetation & Fuel Concerns	Pinyon-juniper woodlands, chaparral, and grasslands interspersed with agricultural lands.
Firefighting Concerns	Strong diurnal winds along Black Ridge, fueled by dense stands of pinyon-juniper, chaparral and oak along steeper slopes can increase rapid fire spread.
Urban Interface Concerns	Continual growth in urban interface areas increases human caused fire potential.
Firefighting Access Concerns	Ingress/egress into developed sub-division is limited, with many individual properties having only a single dead-end road with limited/or no turn-around.
Community Values at Risk	• Residential Structures. The average market value of residential structures in focus area: \$222,755. • Watershed and Wildlife resources • Cultural resources and Recreational resources
Treatment Recommendations (1)	Continue ongoing mechanical fuels treatments and maintenance of existing fuel breaks through interagency fuels committee coordination.
Treatment Recommendations (2)	Work with new communities and volunteer fire departments to identify risks in WUI areas.
Treatment Recommendations (3)	Encourage landowner mitigation and defensible space work.
Treatment Recommendations (4)	Increase fuels reduction along I-15 to decrease fire starts off the interstate. Such measures could include mowing and establishing fuel breaks/green stripping.
Table 5.11 New Harmony Focus Area boundaries, concerns and treatment recommendations. Color Country BLM. 2016.	

Fire and Vegetation: Ash Creek Watershed



Figure 5.7: Pine Valley wilderness adjacent to the community New Harmony, Utah. CRMP 2015-2016. Photo-credit: newharmonyutah.net.

While the Bureau of Land Management, SITLA, Washington County (townships) and National Parks all supervise land within the Ash Creek Watershed; the majority of vegetation concerns are managed by the Dixie National Forest.

The largest national forest in Utah, one hundred and seventy miles of forest are located within southern Utah, and are managed by the Pine Valley Ranger District. The forest has both elevation and climate extremes ranging from the riparian basin and washes of Ash Creek, to the lower peaks of Pine Valley Mountain to the west.

Vegetation is also varied; from sparse desert-community plants, changing to strands of low growing pinyon pine and juniper trees dominating the mid-range elevations.

Management and restoration of these plant communities are of great concern in regards to

urban-suburban fire regimes. Vegetation and fire resource priorities were ranked from greatest to least; vegetation treatments-

particularly in stand replacing fires; noxious weed management mapping and control; riparian enhancement projects, and identification of noxious weed populations using EDRR protocols.

Fire and Vegetation: Ash Creek Watershed

Advisory Committee	Resource Issues	Location-HUC 6	Project and Assessment Goals	Time-Line
Color Country, BLM, Pine View Ranger District-USFS, St. George Field Office BLM, Northern Arizona-Southern Utah Central Weed Management Area (CWMA), Washington County.	1) <i>Prioritize upland vegetation treatment; particularly areas frequented by stand-replacing fires.</i>	- West Sandy - Ash Creek Res. - North Ash - Pinto Creek - Kanarra Creek - Ash Creek	a) Evaluate area 'Condition Class' categories. b) Utilize spatial data that illustrates where fires and treatments have occurred. c) Support all local Community Fire plans. d) Evaluate emergency stabilization efforts and vegetation enhancement projects, including: their impact towards the reduction of fire hazard throughout much of the area. e) Continue to monitor high density urban interface residencies that continue to make this area susceptible to fire. f) Coordinate with the local fire communities recommended fuel treatments and maintenance of fuels treatments; especially in and around private property. g) Increase the public education and outreach. h) Maintain existing fuel breaks.	Immediate through twenty years. (BLM Color Country District Fire and Fuels has no plans for additional fuel breaks in this area.)
	2) <i>Control, identify and map noxious weed populations.</i>	- West Sandy - Ash Creek Res. - North Ash - Pinto Creek - Kanarra Creek	a) Coordinate multiple agency noxious weed mapping and treatment efforts. b) Update noxious weed data. c) Monitor and treat Class A, B and C weeds. d) Implement current land management treatment goals.	Immediate through ten years.
	3) <i>Riparian enhancement projects.</i>	- West Sandy - Ash Creek Res. - North Ash - Pinto Creek	a) Continue to implement treatments for areas of Ash Creek watershed that received low ratings in the IAP Vulnerability/Adaptation Assessment.	Immediate through ten years.

Table 5.12: Fire and vegetation natural resource concerns within the Ash Creek watershed. CRMP. 2015-2016.

Oil, Gas and Mining Resource Issues: Ash Creek Watershed



Figure 5.8: Dixie power employees and maintenance of area power lines.

Oil, gas and mining issues in the Ash Creek watershed are primarily concerned about the protection of existing energy infrastructures from future fire events, because the watershed is an important energy corridor for Washington County. Other discussions focused upon the necessity to apply the most appropriate BMP's, design and installation protocols for new developments. In Washington County there are 309 operations registered with the Utah Division of Oil, Gas and Mining. They are categorized as being either abandoned, active or combined.

Advisory Committee	Resource Issues	Location-HUC 6	Project and Assessment Goals	Time-Line
Utah SITLA, Color Country BLM, Washington Water Conservancy District, Citizens Advisory Committee	1) Ash Creek Watershed is a critical corridor for area utilities and transportation.	• West Sandy Creek • Ash Creek Reservoir • North Ask Creek • Pinto Creek • Kanarra Creek • Ash Creek	a) Continue maintenance and inter-agency participation of this important energy corridor. b) Establish specific routes for new developments: transportation, fiber optics, natural gas and water. c) Follow guidelines of natural resource management plans of area land management agencies.	Immediate.

Table 5.13: Oil, gas and mining natural resource concerns within the Ash Creek watershed. CRMP. 2015-2016.

Water Resources: Ash Creek Watershed



Figure 5.10: Upper Ash Creek, and spring flows. Dixie National Forest. 2012.

While the TAC, SC and CAC members identified that the Ash Creek watershed is a vegetative driven watershed, rather than, water quality driven; there are several water quality harbingers that need to be considered. Of those contributing to water quality, riparian vegetation rehabilitation, noxious weed control and their management garnered equal concern.

Furthermore, parameters that are measured by the Utah Department of Environmental Quality-Division of Water quality, Environmental Protection Agency and other organizations responsible for monitoring water quality continue to protect ground and surface waters. Although, Ash Creek watershed is not listed as an impaired waterbody, the Dixie National forest has reported several years of exceedances of phosphate-phosphorus levels on two creeks in the watershed (Table 5.12c).

Waterbodies that are not meeting their designated uses are assessed as impaired in this report. After a waterbody is listed, a restoration plan or Total Maximum Daily Load (TMDL) is then developed for each pollutant causing the impairment in that waterbody. A TMDL defines the total amount of pollutant that can be contained in the waterbody and still meet water quality standards. A TMDL includes the sum of pollutant loads from point sources (waste load allocations), non-point sources (load allocations), and a margin of safety (MOS) that accounts for uncertainty in the dataset and its analysis (Dewy-Utah Division of Water Quality). Data gathered by the Dixie National Forest supports the conclusion that geology is a major contributor to TMDL values (5.12c)

Water Resources Ash Creek Watershed-1

Advisory Committee	Resource Issues(s)	Location-HUC 6	Project and Assessment Goals	Time-line
Pine Valley Ranger District, Washington County Water Conservancy District	<i>1) Identify any locations for Total Maximum Daily Load reductions (TMDL).</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek - Ash Creek	a) Ensure that current data is being used. b) Begin protocol of collecting samples in summer and fall. DEQ. c) Determine areas where point-source water quality issues may arise. d) Identify head-cut areas that would benefit from reforestation and/or reseeded projects. e) Identify industrial impacts.	Immediate through five years.
	<i>a) Watershed received a low to moderate watershed condition rating: Watershed Condition Class (Class 2) rating from DNF framework project assessment.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek - Ash Creek	a) Instigate projects to increase watershed health as it received a low-moderate. b) Continue to work with DNF area hydrologist to identify restoration projects.	Immediate through five years.
	<i>b) Evaluate current K-12 and community watershed education programs.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek - Ash Creek	a) Coordinate water education efforts with any established water education programs. b) Develop Watershed/water fair program for the local community.	Immediate through five years.
	<i>c) Identify funding strategies for water quality enhancement projects.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ash Creek - Pinto Creek - Kanarra Creek	a) Communicate with private landowners/municipalities to identify water quality, and water resource projects.	Immediate through five years.

Table: 5.14a: Water resource issues, treatment goals and assessments for the Ash Creek watershed. CRMP. 2015-2016.

Water Resources and Water Quality: Ash Creek Watershed-2

Advisory Committee	Resource Issues(s)	Location-HUC 6	Project and Assessment Goals	Time-line
Pine Valley Ranger District, Washington County Water Conservancy District, Utah Department of Agriculture (Zone 5)	5. <i>Quantify water resource concerns within the watershed.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ask Creek - Pinto Creek - Kanarra Creek	a) Evaluate reasons for the lack of water in Pinto Creek, Ash Creek and Toquerville area. b) Collect water right information. c) Monitor the Ash Creek Reservoir Project: Water will be collected, stored; eventually pressurized irrigation will be provided.	Immediate through five years.
	6. <i>Water conservation projects with local communities.</i>	- West Sandy Creek - Ash Creek Reservoir - North Ask Creek - Pinto Creek - Kanarra Creek	a) Inform the public concerning water rights and status of water resource projects. b) Address water rights issues when they arise.	Immediate through ten years.

Table 5.14b: Water resources and water quality concerns within the Ash Creek watershed. 2015-2016

Methods	Variation	Site Location	Results	Conclusion
Monthly baseline water quality monitoring sampling.	Violation of Utah Water Quality Standards	South Fork Ash Creek (STORET 4950743), tributary to the Virgin River	In 2014, eleven samples were taken, and of these none exceeded phosphate-phosphorous levels. Turbidity increase from 2-4 NTU's to 28 NTU's-August only.	Multiple sampling at differing times of the year, support that native geology contributing to phosphorus levels.
		Main Canyon-New Harmony (STORET 4950743)	In 2014, eleven field samples were taken and six exceeded state standards for phosphate-phosphorus levels.	Phosphorus exceedances may be contributed to wildland fires in 2012. Also geology is a contributor.

Table 5.14c: Water quality report from Dixie National Forest Land and Resource Evaluation report. 2014. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3845484.pdf

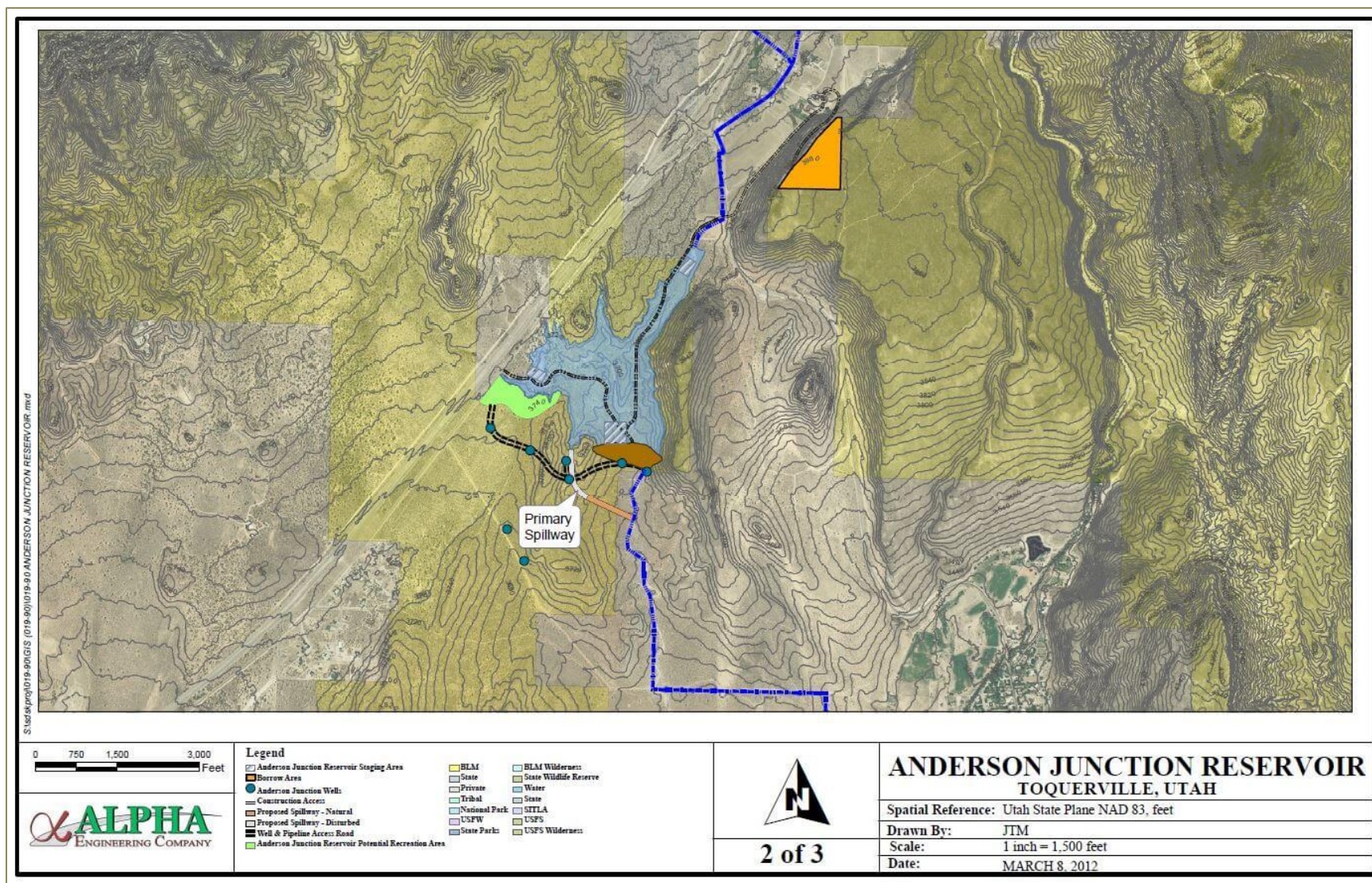


Figure 5.11: Anderson Junction Reservoir, and upgrades to existing infrastructure. Ash Creek Watershed. Project sponsor. Washington County Water Conservancy District. 2015.

Wildlife Resource: Ash Creek Watershed



Figure 5.12: Female elk. Ash Creek Watershed. Photo credit. G. Robbs. 2015

Wildlife resources are managed by several federal, and state agencies. The health of area wildlife both within and adjacent to the Ash Creek watershed are interconnected and dependent upon natural resource management efforts of many. In addition to good stewardship practices of the citizens who live within its boundaries.

Education on the importance of wildlife protection complements overall management goals, and informs locals and visitors alike, on the importance of wise-use. Moreover, it ensures the continued presence of robust wildlife populations.

Another wildlife management tool being considered for the health of the Ash Creek Watershed is utilizing the Utah Beaver Restoration Assessment Tool (BRAT). This statewide project is a collaboration between researchers from Utah State University, and the Utah Division

of Wildlife Management. The backbone to BRAT is to identify and model the upper limits of riverscapes that may support beaver dam-building activities. Both existing and potential capacity can also be estimated with readily available spatial datasets used to evaluate five key lines of evidence:

1) a perennial water source; 2) availability of dam building materials; 3) ability to build a dam at base-flow; 4) likelihood of dams to withstand a typical flood, and 5) likelihood that stream gradient would limit or completely eliminate dam building by beaver. This efficient management tool has been utilized at other watershed sites not only in Utah, but at other locations throughout the nation. (J. Wheaton, USU).

Wildlife Resource: Ash Creek Watershed-1

Advisory Committee	Resource Issues(s)	Location-HUC 6	Project and Assessment Goals	Time-line
Pine Valley Ranger District, UT, Utah Division of Wildlife Resources	1a) <i>Evaluate and manage noxious weeds and annual non-native grasses.</i>	- West Sandy - Ash Creek Res - North Ash - Pinto Creek - Kanarra Creek	a) Emphasize the management of noxious weeds concerns that drive area wildlife challenges.	Immediate through ten years.
	1b) <i>Protect and manage the mule deer crucial summer and winter range habitat. Continue to protect and manage elk and wild turkey habitat(s).</i>	- West Sandy - Ash Creek Reservoir - North Ash - Pinto Creek - Kanarra Creek - Ash Creek	a) Increase public education and interpretation strategies for wildlife, Threatened & Endangered species. b) Utilize appropriate methodologies for habitat restoration including: fire treatments, and beaver re-introduction for fisheries enhancement.	Immediate through five years.
	1c) <i>Protect and manage Bonneville Cut-Throat trout populations in Leap Creek, South Ash Creek, Mill Creek, Harmon Creek.</i>	- West Sandy Creek - Ash Creek Res. - North Ash Creek - Pinto Creek - Kanarra Creek - Ash Creek	a) Continue to monitor sedimentation in streams. b) Maintain riparian vegetation (flooding events post fires). c) Rehabilitate and/or minimize critical habitat fragmentation. d) Evaluate and utilize appropriate fuel and vegetation treatments to prevent/mitigate high severity wildfires.	Immediate through five years.

Table 5.15a: Wildlife resource issue concerns within the Ash Creek watershed. 2015-2016

Wildlife Resources: Ash Creek Watershed-2

Advisory Committee	Resource Issues(s)	Location-HUC 6	Project and Assessment Goals	Time-line
Pine Valley Ranger District, UT, Utah Division of Wildlife Resources	<i>2a) Categorize areas for habitat restoration projects including:</i>	• West Sandy • Ash Creek Res • North Ash • Pinto Creek • Kanarra Creek • Ash Creek	a) Reduce the risk of encroaching unwanted noxious weeds that contribute to high severity fire events. b) Continue with re-seeding regimes and fuel treatments at designated sites. c) Monitor and evaluate long-term rangeland studies. d) Control of noxious weeds within New Harmony fire restoration/fuel break; Mill Flat BAER habitat enhancement.	Immediate through ten years.
	<i>2b) Monitor threaten & endangered species issues.</i>	• West Sandy • Ash Creek Reservoir • North Ash • Pinto Creek • Kanarra Creek • Ash Creek	a) Monitor identified MSO (Mexican Spotted Owl) Critical Habitat east side of I-15 and juvenile/winter dispersal habitat west of I-15. b) Monitor and evaluate the California condor foraging habitat.	Immediate through five years.

Table 5.15b: Wildlife resource issue concerns within the Ash Creek watershed. 2015-2016

USFS -Intermountain Adaptation Partner and Ash Creek Watershed

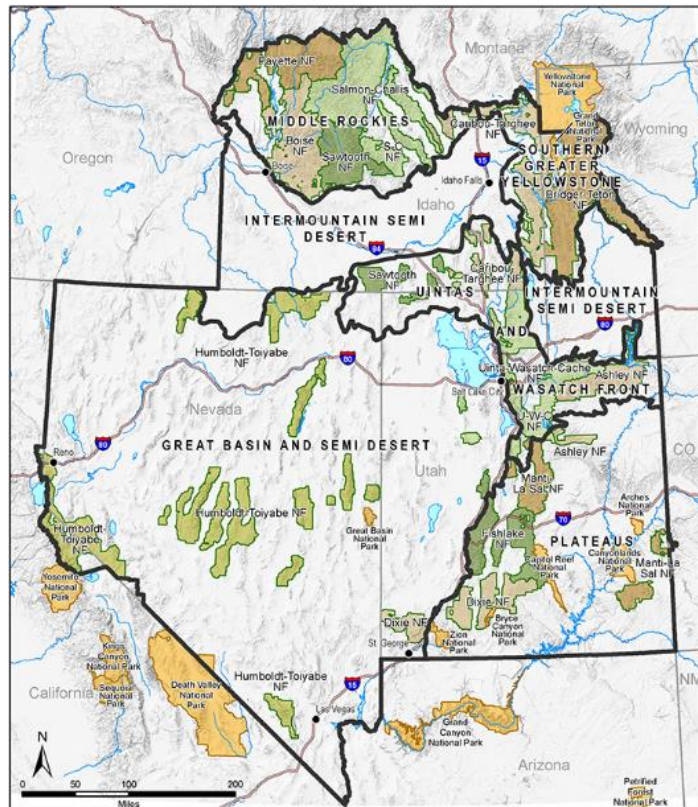


Figure 5.13: Vicinity map of USFS -Intermountain Adaptation Partner sites across the intermountain west.

Using several different climate prediction models, the USFS has organized a scientifically credible organization called the 'Intermountain Adaptation Partner-IAP.' Their goal is to identify future climate trends relating to global warming, and assist land managers and communities to prepare for future changes in watershed resources.

When predicting the resiliency of an ecosystem to changes in climate; many different factors are considered. While the Ash Creek watershed is not listed as having 303d-impaired waters, the natural resource issues monitored by the IAP group ranked it low-moderate. Particularly when soil condition, vegetation, water quantity, ground water recharge, and other factors are ranked collectively. This low score was again based upon the collective viability of the watershed.

The goals of IAP:

- 1) Increase climate change awareness;
- 2) Assess the vulnerability of natural resources and ecosystem services to climate change; and
- 3) Develop science-based adaptation strategies that can be used by national forests to understand and mitigate the effects of climate change.

The IAP conducted their evaluations of the watershed prior to the development of the Ash Creek CRMP. Future monitoring of water resource goals as outlined in the CRMP, after the suggested treatments has the potential to receive higher rankings.

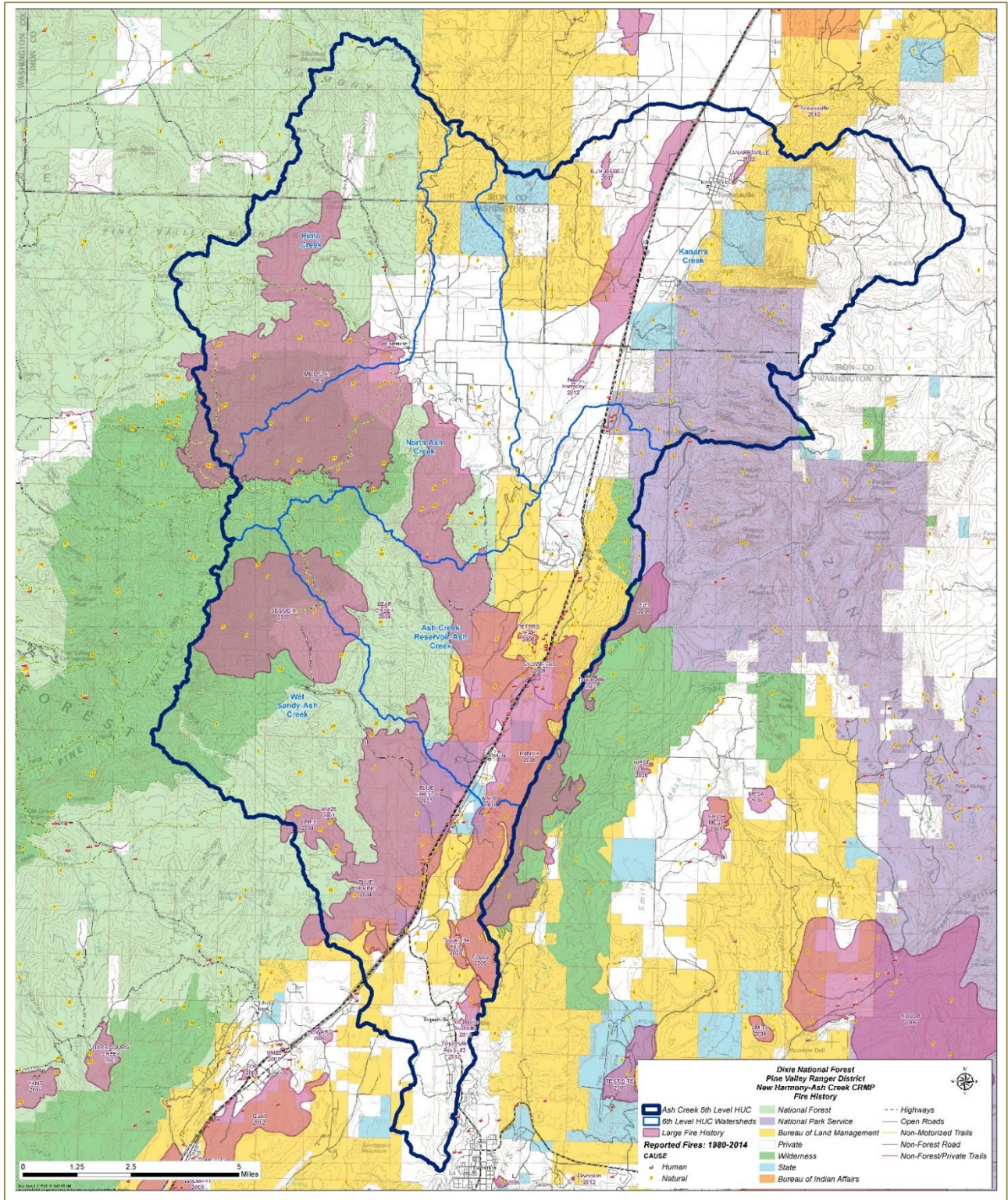


Figure 5.14: Acreage of the numerous Ash Creek Watershed fire. Map Credit. L. Parry. USFS. 2016.

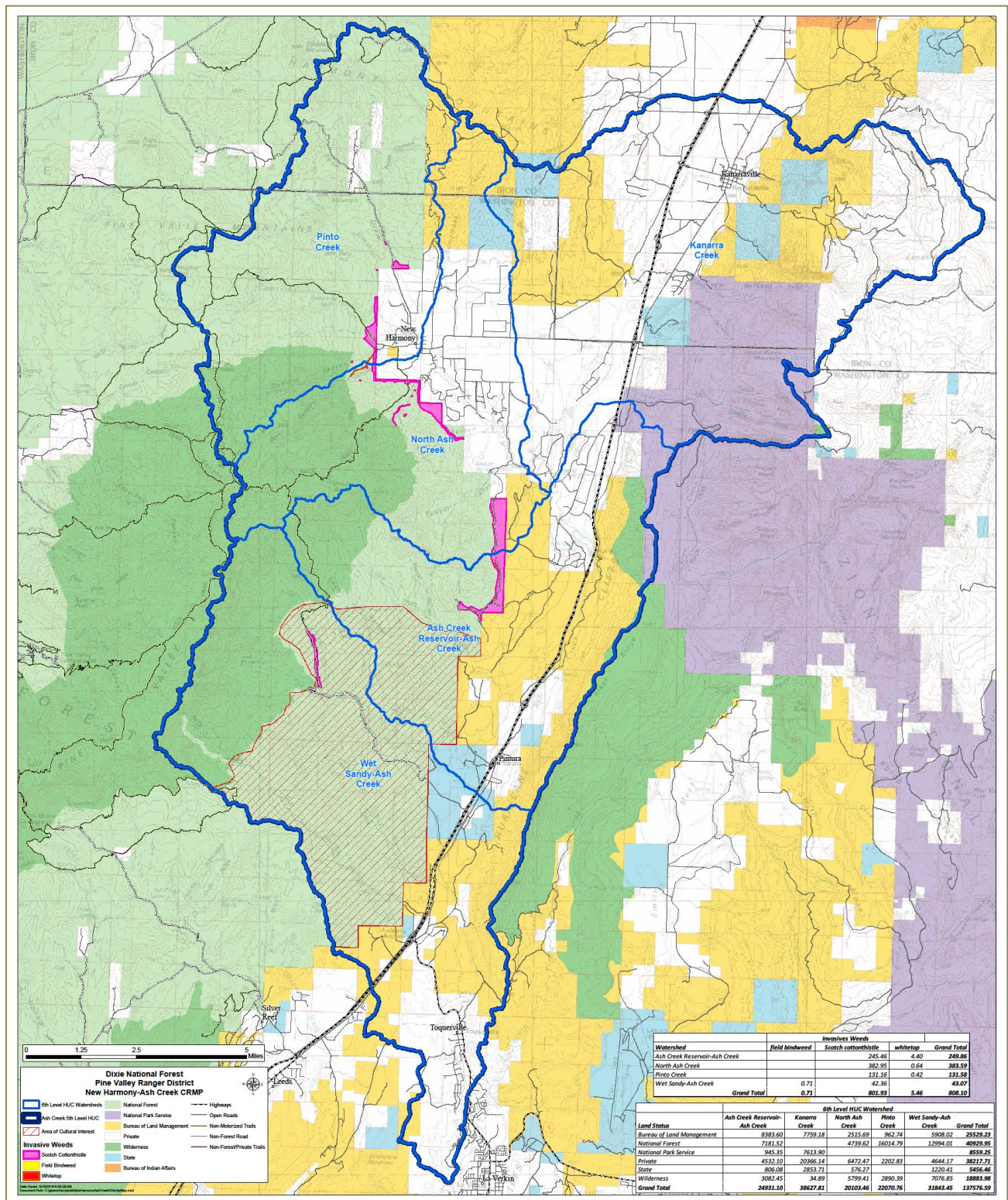


Figure 5.16: Invasive species within Ash Creek watershed. Map Credit: L. Parry. USFS. 2016

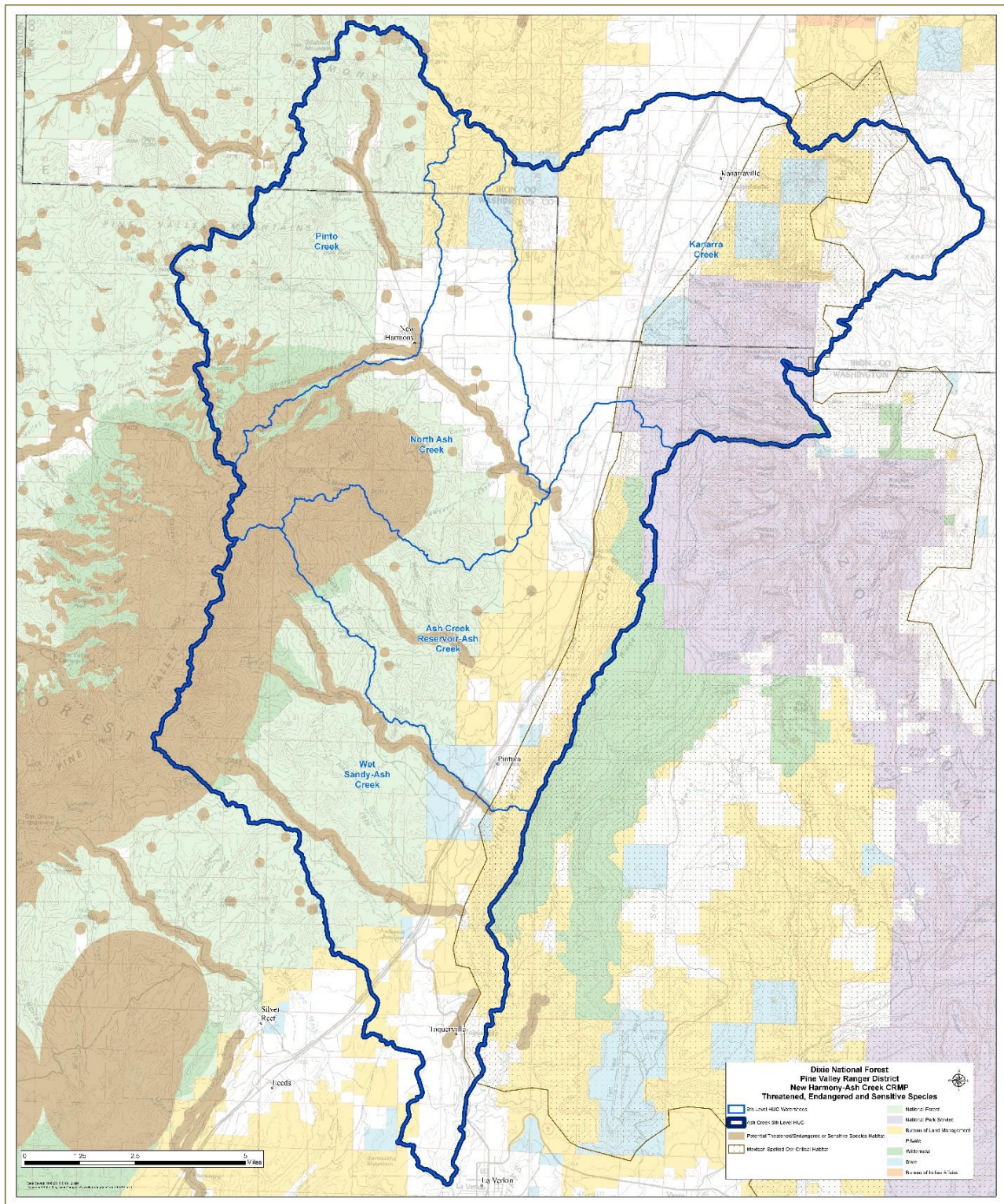


Figure 5.17: Habitat of threatened and endangered species in the Ash Creek watershed. Map Credit: L. Parry. USFS. 2016

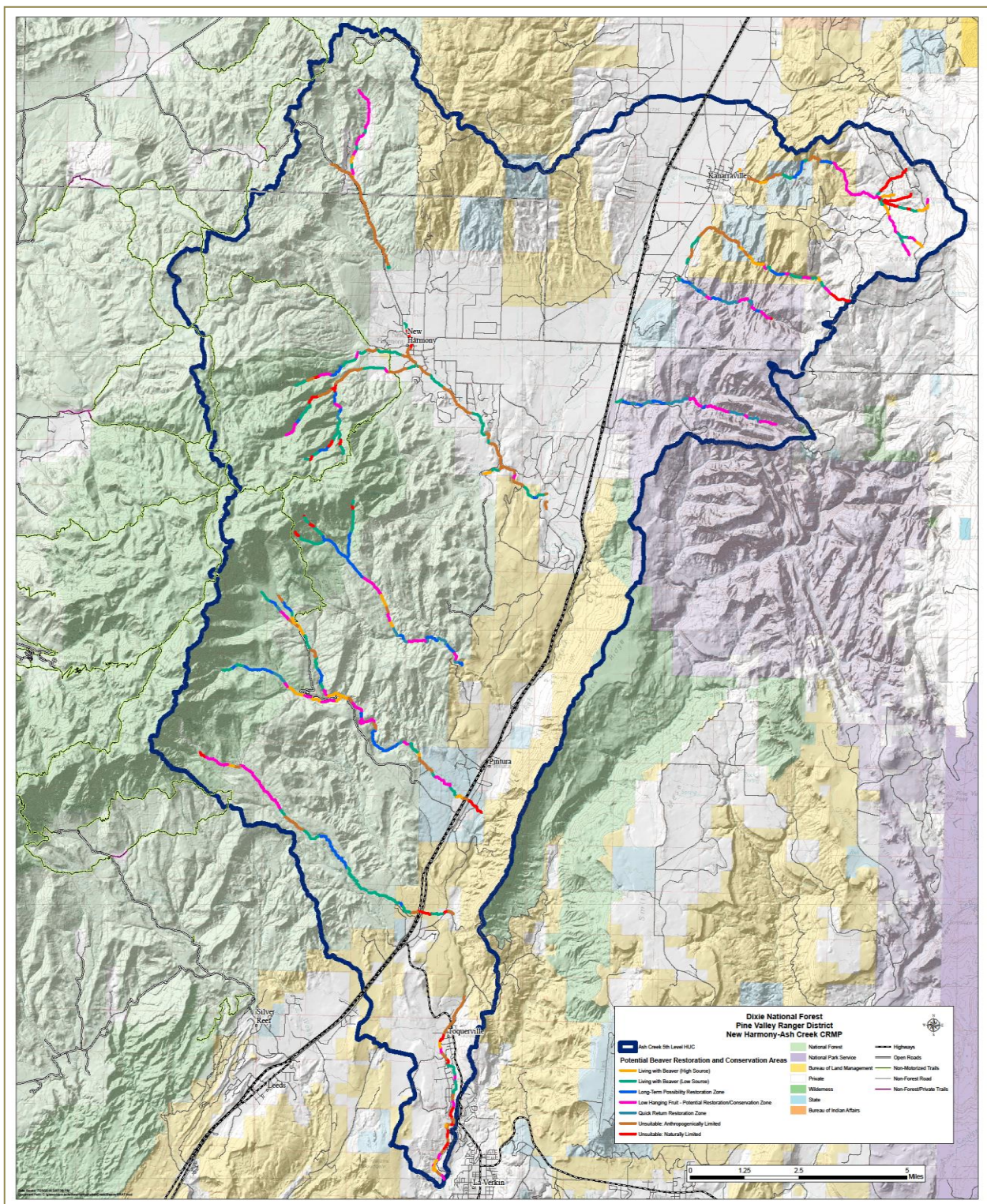


Figure 5.18: Potential beaver restoration sites within the vicinity of Ash Creek Watershed. BRAT. Map credit: L. Parry, USFS. 2016

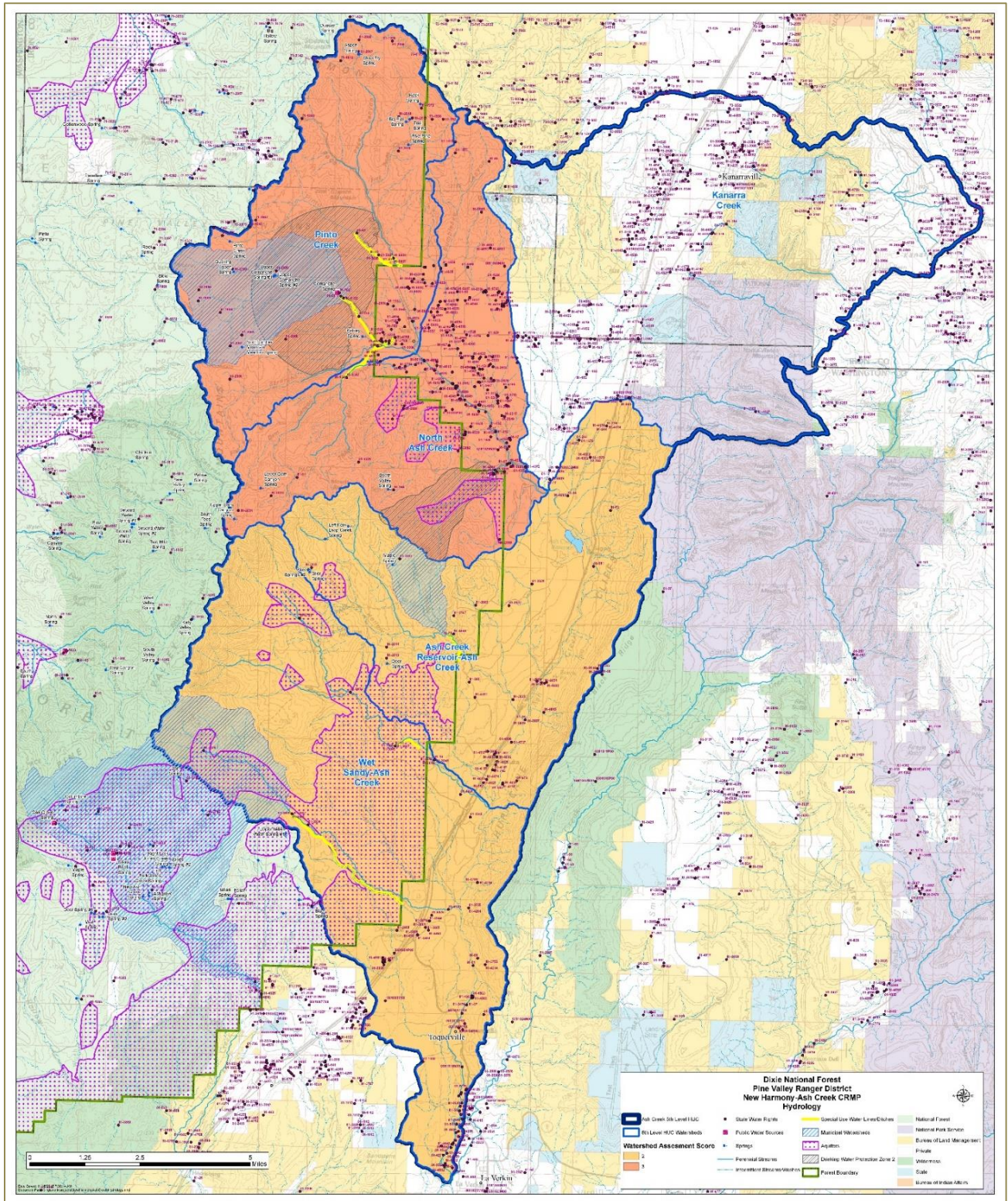


Figure 5.19: Hydrology categories in the Ash Creek watershed. Map credit: L. Parry, USFS. 2016.

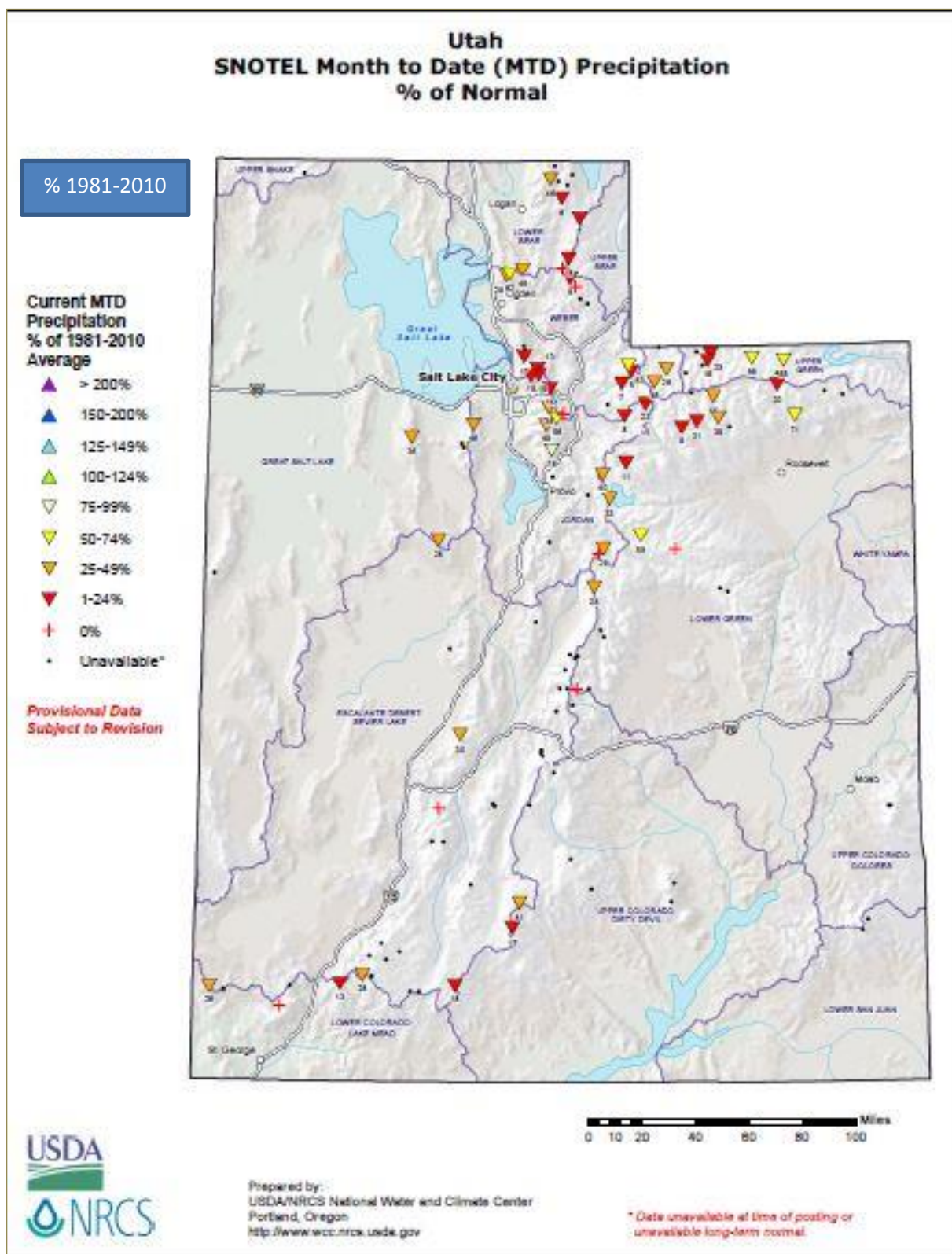


Figure 5.20: Natural Resource Conservation Service (NRCS), Snow Telemetry (SNOTEL) % of precipitation from 1981- 2010.

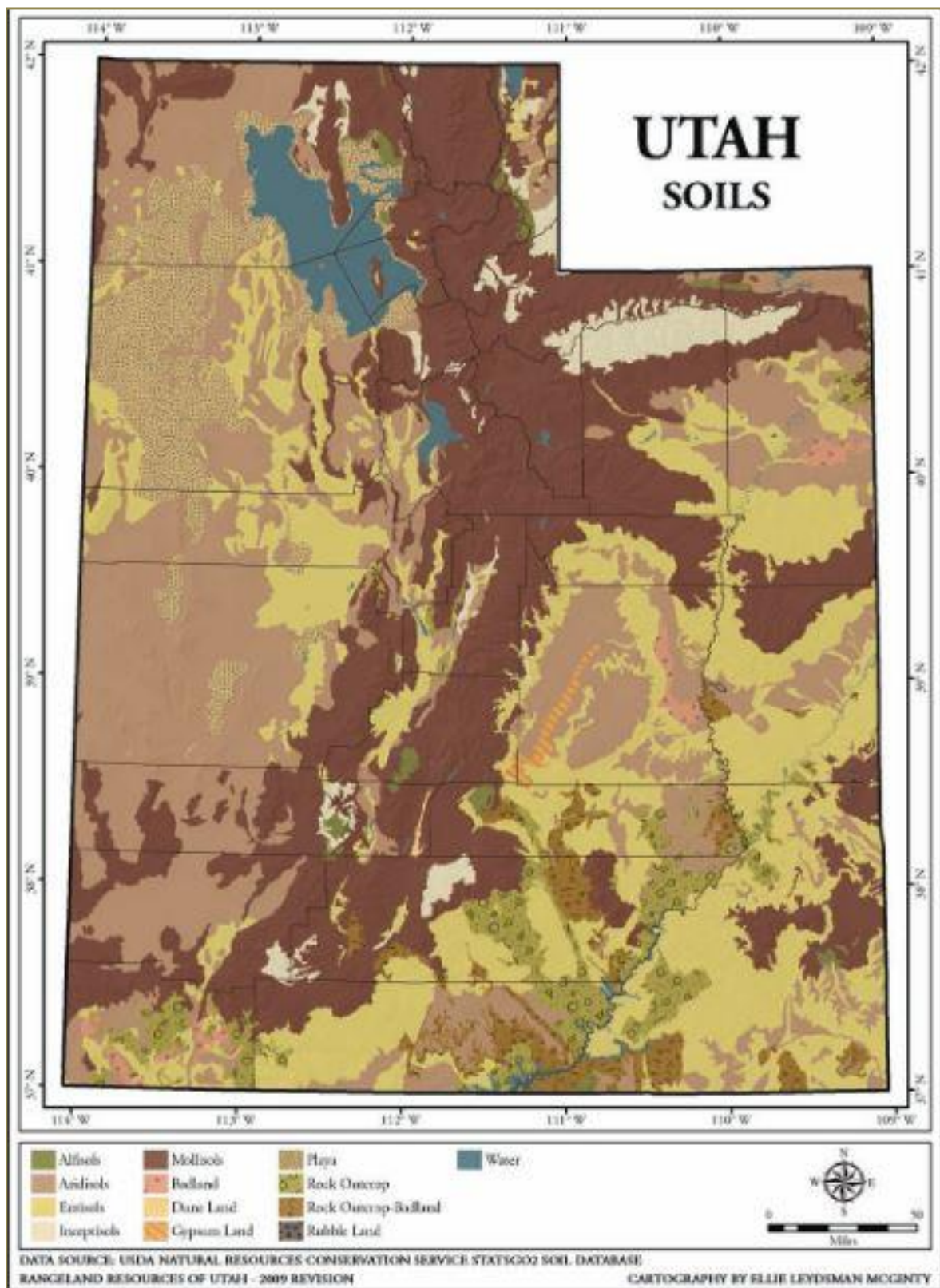


Figure 5.21: Soil types located throughout the state of Utah. Utah State Extension Service.

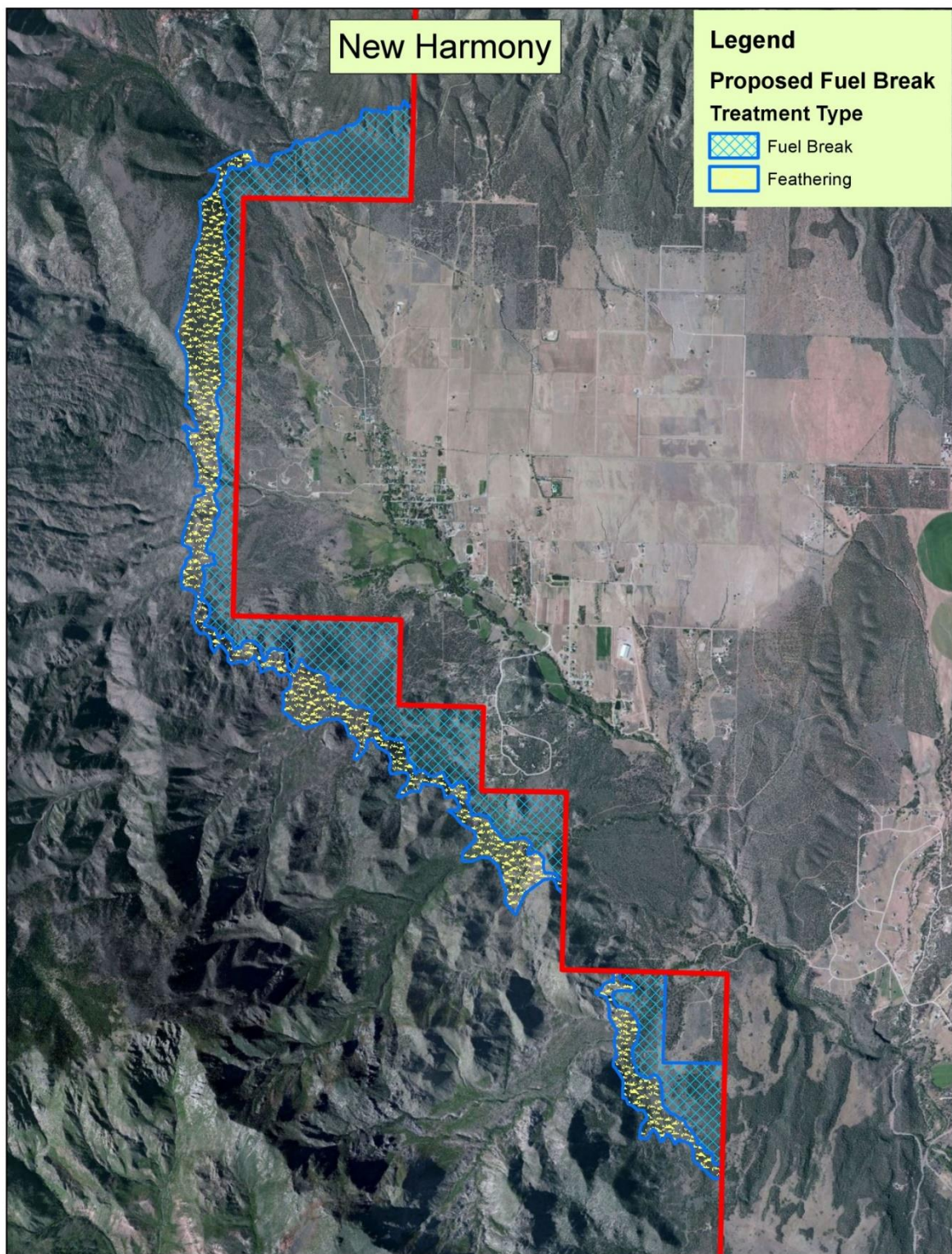


Figure 5.22: Proposed fuel break boundaries, and treatment types. Dixie National Forest. Map credit. L. Parry. 2016

Memorandum of Understanding
New Harmony-Ash Creek Watershed Partners
Coordinated Resource Management Plan
September 2015

This Cooperative Agreement (MOU) is entered into by:

Utah

Bureau of Land Management (St. George Field Office)
Bureau of Land Management (Cedar City Field Office)
Dixie Conservation District (representing private landowners)
State and Utah Institutional Trust Lands Administration (SITLA)
State of Utah Division of Wildlife Resources
United States Forest Service (Dixie Ranger District)
Washington County
New Harmony hamlet
E & I Conservation District (representing private landowners)
Iron County Commission
North Arizona-Southern Utah CWMA
Iron County CWMA

Purpose

The purpose of the Ash Creek-New Harmony Watershed Project is to foster collaborative relationships between users, through the development of a Coordinated Resource Management Plan (CRMP). This CRMP will assist local communities, watershed organizations, government, private and other non-governmental agencies operating within the watershed to develop and implement social, environmental and economically sustainable watershed management standards and objectives.

Need

The Ash Creek-New Harmony Watershed encompasses 132 sq. miles and is cooperatively managed by a variety of federal, state and local entities, including private landowners. Ash Creek and surrounding drainages is valued for its natural resources and recreational opportunities as well as its importance to local economies for commercial and non-commercial commodity production. The area is also a documented pre-history agricultural sites for local tribes.

Cooperators have identified extensive noxious weeds issues and potential water quality concerns. Coordinated technical, research and funding efforts between stakeholders, will guide future watershed uses and restoration opportunities.

Geography

Ash Creek drainage information: Latitude 37°24'45", Longitude 113°14'10" NAD27 Washington County, Utah, Hydrologic Unit 15010008; drainage area: 132.00 square miles; datum of gage:

4,450.00 feet above NGVD29. The Utah Geological Survey describes the drainage basin of Ash Creek drainage basin to consist of three aquifers. These comprise the ground-water system of the upper Ash Creek drainage basin: the uppermost Quaternary basin-fill aquifer, the Tertiary alluvial-fan aquifer, and the Tertiary Pine Valley monzonite aquifer. These aquifers are naturally bounded by the Hurricane Fault and by drainage divides.

On the basis of measurements, estimates, and numerical simulations of reasonable values for all inflow and outflow components, total water moving through the upper Ash Creek drainage basin ground-water system is estimated to be about 14,000 acre-feet per year. Recharge to the upper Ash Creek drainage basin ground-water system is mostly from infiltration of precipitation and seepage from ephemeral and perennial streams. The primary source of discharge is assumed to be evapotranspiration; however, subsurface discharge near Ash Creek Reservoir also may be important (USGS).

Goals

The 'Cooperators' seek to combine efforts, wherever possible, to develop working relationships that support long-term sustainability of natural resources within the Ash Creek Watershed. Stakeholders will work to:

1. Coordinate and integrate programs and projects across jurisdictional boundaries where feasible, in order to most effectively realize resource benefits.
2. Develop a CRMP for the watershed that includes watershed characterization, analysis of existing water quality issues, in coordination with the local stakeholders.
3. Establish consistent protocols for the collection, storage, and use of information and data gathered by the 'Cooperators.'
4. Foster a better understanding of watershed issues between the public and resource management agencies; by the development of educational programs.
5. Utilize and share expertise between the respective 'Cooperators,' public and private agencies, organizations and individuals for the purpose of natural resource restoration.
6. Work cooperatively to leverage funds and seek grant opportunities for the purpose of improving resource conditions within the watershed.

Funding

In addition, this plan may be used as a resource and funding tool when prioritizing watershed projects and programs that incorporate the Environmental Protection Agency

9-step requirements for watershed planning, or other grants aligned identified resource improvements.

Steering Committee

The steering committee is comprised of a representative from each of the entities listed as cooperators in this agreement. The steering committee will:

1. Be responsible for overall plan direction and for coordinating project implementation.
2. Responsible for fostering and developing partnerships at the local and national level.
3. Recommend technical advisory committee members and consider CRMP recommendations from them when developing programs of work.

Technical Advisory Committees

Technical advisory committees are comprised of stakeholders within the watershed who may have an interest, or provide an area of expertise. Technical advisory committee members may be recommended by the steering committee, or by other stakeholders that share a mutual interest concerning resources within the Kanab Watershed.

The Technical Advisory Committees will:

1. Be responsible for resource assessments and overall project development.
 2. Be comprised of resource specialists, private landowners, and interested stakeholders that are knowledgeable about resource issues. Interested stakeholders may be from but are not limited to the Cooperating agencies and other entities as follows:
 - Bureau of Land Management – St George Field Office
 - Bureau of Land Management (Cedar City Field Office)
 - Cedar City Band of Paiute Indians
 - Dixie Conservation District
 - E and I Conservation District
 - Iron County Cooperative Weed Management Area
 - Washington County Cooperative Weed Management Area
 - National Park Service – Zions National Park
 - Natural Resources Conservation Service, Utah State Office
 - State of Utah Division of Forestry, Fire and State Lands
 - State of Utah Division of Wildlife Resources
 - State of Utah School and Institutional Trust Lands Administration (SITLA)
 - State of Utah Division of Water Quality
 - United States Forest Service – Dixie National Forest-Pine Valley Ranger District
-

- University of Utah Extension
 - Utah Association of Conservation Districts
 - Utah Farm Bureau
 - Utah State University Extension
3. Recommend and seek funding to implement projects identified during the CRMP process.
4. The technical advisory committees would represent and make recommendations for the following resources:
- *Soil*: (erosion, salinity, etc.).
 - *Water*: (water quality/quantity, point/non-point source pollution, water conservation).
 - *Plant*: (noxious/invasive species, fuel loading, riparian health, etc.).
 - *Animal*: (wildlife, invasive species, fisheries, livestock).
 - *Energy*: (alternative energy development, education, initiatives).
 - *Human*: (watershed education, economic development, cultural resources, recreation, non-profit organizations).
 - *Oil/Gas/Mining*: (ground-water monitoring, TMDL, air quality, economic development).
 - *Agriculture and Rangeland*

The 'Cooperators' Mutually Agree and Understand that:

- Specific work projects or activities that involve the transfer of funds, services, or property among the 'Cooperators' will require the execution of separate agreements or contracts, contingent upon the availability of funds.
 - This agreement does not restrict the 'Cooperators' from participating in similar activities or arrangements with other public or private agencies, organizations, or individuals.
 - Records, data, and other information acquired, developed, collected, or documented under this agreement shall be the property of the originating agency.
 - Nothing in this MOU obligates the 'Cooperators' to either expend funds or enter into any contract or other obligations.
 - This instrument is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement, contribution of funds, or transfer of anything of value between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures.
-

**Memorandum of Understanding for
New Harmony-Ash Creek Watershed Partners
Coordinated Resource Management Plan
September 2015**

This Cooperative Agreement (MOU) is entered into by:

Organization	Signatories
Bureau of Land Management (St. George Field Office)	
Bureau of Land Management (Color Country Field Office)	
Dixie Conservation District (representing private landowners)	
State and Utah Institutional Trust Lands Administration (SITLA)	
State of Utah Division of Wildlife Resources	
United States Forest Service (Dixie Ranger District)	
Washington County Commission	
New Harmony hamlet	
E & I Conservation District (representing private landowners)	
Iron County Commission	
Cedar City Band of Paiute	
North Arizona-Southern Utah CWMA	
Iron County CWMA	
Zion National Park	

CRMP LINKS

Air Quality

www.deq.utah.gov/Divisions/daq/info/annualreports/docs/2015/02Feb/Final_Annual_Report_2015.pdf
http://www.ucair.org/hot_topics/
<http://www.airquality.utah.gov/>

Agriculture and Rangeland

<http://ag.utah.gov/>
<http://www.uacd.org/>
<http://ag.utah.gov/documents/annualreport2015web.pdf>
<http://www.washco.state.ut.us/files/assr/FAA%20Pamphlet%20Letter.pdf>
<http://plants.usda.gov/>
https://extension.usu.edu/files/publications/publication/AG_Econ_county-2005-30.pdf
<http://ag.utah.gov/documents/annualreport2015web.pdf>
<http://publiclands.utah.gov/wp-content/uploads/2013/08/LivestockGrazinginUtahHistoryStatus.pdf>

Bureau of Land Management

http://www.blm.gov/ut/st/en/fo/cedar_city.html
http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas/dataportal.html
<http://www.blm.gov/ut/st/en.html>
https://eplanning.blm.gov/epl-front-office/projects/lup/7100/42732/45531/CCFO_AMS_.pdf

Climate

<http://www.epa.gov/climatechange/impacts-adaptation/southwest-adaptation.html>
http://www.wcc.nrcs.usda.gov/snotel/SNOTEL_brochure.pdf

Cultural History

<http://wchsutah.org/towns/new-harmony1.pdf>
http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1048&context=usupress_pubs
http://historytogo.utah.gov/people/ethic_cultures/the_history_of_utahs_american_indians/chapter4html
<https://www.nps.gov/para/learn/education/upload/Total-Final-Curriculum.pdf>

Demographics

<http://www.utah.gov/about/demographics.html>
http://www.blm.gov/style/medialib/blm/ut/st_george_fo/planning/background_documents.Par.4155.File.dat/SGFO_Socioeconomic_Baseline_Report_2012_web.pdf

Extension Washington County-USU Extension

<http://extension.usu.edu/htm/publications/publication=5987>

Fire

http://www.fs.fed.us/psw/publications/documents/psw_gtr189/psw_gtr189_309-320_stratton.pdf
http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management.html
<http://www.utahfireinfo.gov/>
<http://www.firelab.org/project/coarse-scale-spatial-data/>

Forestry

<http://www.fs.usda.gov/dixie>
<http://adaptationpartners.org/iap/>
http://www.fs.usda.gov/detail/dixie/about-forest/?cid=fswdev3_00674
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5220831.pdf
<http://adaptationpartners.org/iap/>

Invasive Species

<http://www.invasivespeciesinfo.gov/unitedstates/ut.shtml> Lidar

Lidar

<http://gis.utah.gov/statewide-lidar-plan-for-utah/>

National Park Service

<https://www.nps.gov/articles/mexican-spotted-owl.htm>

<https://www.nps.gov/zion/learn/nature/condors.htm>

https://www.nps.gov/arch/learn/management/upload/SEUG-Exotic-Plant-Mgmt_the-Plan-2009.pdf

Noxious Weeds

http://www.utahweed.org/cwma_css.html

http://www.utahweed.org/PDF/strategic_plan.pdf

http://www.blm.gov/ut/st/en/fo/st_george/more/biological_resources/weed_management.html

<http://www.utahweed.org/laws.htm>

NRCS

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ut/technical/dma/nri/?cid=nrcs141p2_034132

www.nrcs.usda.gov/wps/portal/nrcs/detail/ut/contact/local/?cid=stelpdb1244086

Socioeconomic

[http://www.blm.gov/style/medialib/blm/ut/st_george_fo/planning/background_documents.Par.4155.](http://www.blm.gov/style/medialib/blm/ut/st_george_fo/planning/background_documents.Par.4155.File.dat/SGFO_Socioeconomic_Baseline_Report_2012_web.pdf)

[File.dat/SGFO_Socioeconomic_Baseline_Report_2012_web.pdf](http://www.blm.gov/style/medialib/blm/ut/st_george_fo/planning/background_documents.Par.4155.File.dat/SGFO_Socioeconomic_Baseline_Report_2012_web.pdf)

www.census.gov/quickfacts/table/PST045215/49053

Soil

http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/utah/UT634/0/UT634.pd

http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/utah/washingtonUT1977/Washington.pdf

<http://websoilsurvey.nrcs.usda.gov>

http://extension.usu.edu/utahrangelands/files/uploads/RRU_Section_Six.pdf

Threatened and Endangered Species

<http://dwr CDC.nr.utah.gov/ucdc/ViewReports/sslist.htm>

<http://wildlife.utah.gov/pdf/spotowl.pdf>

Washington County Historical Society

<http://wchsutah.org/index.php>

Washington County

<http://www.wcwcd.org/wp-content/themes/wcwcd/pdf/population-management-study-report.pdf>

<https://www.washco.utah.gov/wp-content/uploads/cdev/pdf/rm/resource-management-plan.pdf>

Water Resources and Water Rights

<http://waterdata.usgs.gov/ut/nwis/nwis>

<http://www.waterrights.utah.gov/wrinfo/>

Watershed Science

<http://wikiwatershed.org/>

http://nemo.snr.arizona.edu/nemo/characterizations/ColoradoGC/UpperVirgin_RWA.pdf

<https://wri.utah.gov/wri/>

<http://iwjv.org/news/watershed-restoration-initiative-launches-new-geo-database-website>

<http://192.168.1.1:8181/http://www.deq.utah.gov/ProgramsServices/programs/water/watersheds/docs/2015/08Aug/VirginRiver.pdf>

Wildlife-Utah Division

<http://dwr CDC.nr.utah.gov/ucdc/default.asp>

https://wildlife.utah.gov/hunting/biggame/pdf/mule_deer_plan.pdf

https://wildlife.utah.gov/uplandgame/turkey/turkey_management_plan.pdf

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*"Here is your country. Cherish these natural wonders, cherish the natural resources,
cherish the history and romance as a sacred heritage, for your children
and your children's children. Do not let selfish men or greedy interests skin your country
of its beauty, its riches or its romance."* Theodore Roosevelt