Wallsburg Coordinated Resource Management Plan

in support of the
Coordinated Resource Management and Planning Process

Wasatch Conservation District

February 7, 2012

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1.0 Executive Summary

The Wallsburg watershed, which covers about 45,000 acres, is tributary to Deer Creek Reservoir in Wasatch County, Utah. The major waterway in the watershed, Main Creek, conveys surface water from the upper mountainous watershed through rangeland and agricultural land. About one-third of the watershed (15,000 acres) is forest, about 3,000 acres are used for agriculture, and just under half of the watershed (21,600 acres) is privately owned. The watershed has about 600 residents; the only town in the watershed is the town of Wallsburg.

The Utah Division of Water Quality conducted a total maximum daily load (TMDL) study for Deer Creek Reservoir, and this study identified Main Creek as a major source of phosphorus in the reservoir. To address this and other water quality concerns, the Wasatch Conservation District initiated this Wallsburg Coordinated Resource Management Plan (CRMP).

1.1 Resources of Concern and Priority Rankings

In March 2007, local landowners and conservation agencies met to address local resource concerns and to form the Wallsburg Watershed Coordinating Council (WWCC) as the planning group for addressing these concerns. Using the CRMP process, stakeholders and the WWCC spoke about the local resources and the potential for actions to protect and restore these resources. Participants at the meeting listed the resources about which they had concerns and then ranked them by priority. Table 1-1 lists the top 20 concerns.

Table 1-1. Natural Resource Concerns for the Wallsburg Watershed

Resource Concern	Total Points	Number of Responses
Water conservation	40	11
Water quality	35	8
Noxious and invasive weeds	31	12
Water rights	28	8
Irrigation water management	25	7
Wildlife habitat	18	5
Forest health	10	5
Septic tank management	10	5
Air quality	10	4
Wetland protection	10	3
Riparian management	7	3
Animal waste	6	2
Soil erosion	6	2
Predator control	6	2
Threatened/endangered species	5	1
Recreation impacts	4	3
Pest management	4	2
Well head protection	4	1
Grazing management	4	1
Agricultural land converted to other uses	3	2

Because of this ranking, this CRMP to identifies recommendations and implementation activities for the following watershed resources: riparian corridors, rangeland, water quality, wildlife, forestland, and pastureland. In addition to these resources, this CRMP also assesses local economics, water rights, and septic tank functionality.

1.2 Results of the Resource Assessments

The resource assessments conducted for the CRMP identified specific concerns, degraded conditions, and land-use activities that could be better managed. The potential actions and recommendations focus on improving water quality and water management, conserving water, improving rangeland and pastureland, and restoring riparian and aquatic habitats while allowing a compatible level of agricultural use.

Some actions and projects were identified under several of the resource assessments. For instance, a supplemental water source for irrigation was identified in both the riparian corridor and grazinglands assessments as a benefit to sustaining natural creek flows, conserving water, and improving forage production. Likewise, stream restoration is valued as a water quality improvement through potentially reducing the transport of sediment and also as a way to improve aquatic habitat by providing shading and pool/riffle environments.

1.3 Recommended Strategies and Actions

This CRMP identifies guidance, strategies, and actions to improve water and water management in the Wallsburg watershed. Twenty-five specific projects, actions, and studies, with an estimated cost of about $2.8 million, are described along with potential funding and implementation partners (see Table 6-1, Recommendations, on page 104).

The specific recommendations are organized by resource concern. However, wherever possible, the actions should be integrated to achieve synergistic and positive impacts on water quality, water management, water conservation, riparian and aquatic habitats, and the local economy.

Table 1-2 summarizes the following general actions that are recommended.

Table 1-2. Recommended Actions

Recommendation	Estimated Cost
Conduct preliminary planning to identify a supplemental source of irrigation water to reduce the stream diversions, thereby allowing natural flows to remain in the creeks.	$100,000
Implement riparian corridor conservation practices for about 13,000 linear feet of stream banks to reduce the transport of sediment.	$575,300
Investigate the spring source of Spring Creek to identify and reduce the sources of phosphorus.	$50,000
Coordinate and implement grazingland-management plans and strategies to maximize grazing distribution and control noxious weeds on 10,000 acres.	$234,700
Enhance 5,600 acres of wildlife habitat and wet meadows.	$408,300
Restore Main Creek aquatic habitat, stream flow and manage fish communities	$1,333,670
Prepare community wastewater-treatment evaluations and management strategies to reduce the influence of wastewater-treatment systems on water resources.	$185,000

2.0 Coordinated Resource Management and Planning

Coordinated Resource Management and Planning (CRMP) is a voluntary, locally led planning process that has proven to be successful in managing natural resources. CRMP is a *people process* that allows local people to actively participate in developing and implementing proactive natural-resource-management decisions. CRMP brings all the affected interests, both private and public, together to establish common goals and to resolve issues as a team.

CRMP is a process open to everyone who is interested in resource issues and strives to balance environmental concerns while considering human and cultural needs.

Increasing demand for natural resources has led to intensified conflicts between interest groups, land users, and resource-management agencies. Coordinated Resource Management and Planning has evolved as a way to reduce these conflicts and reach mutually agreeable management strategies.

2.1 What Is CRMP?

Coordinated Resource Management and Planning is a consensus-based process by which natural-resource owners, managers, land users, and related interests work together as a team to formulate and implement plans for managing all major resources and ownerships within a specific area and/or resolving specific conflicts.

The purpose of CRMP is to resolve conflicts or issues that can hinder or preclude sound resource-management decisions. It can also proactively plan for improving natural resources and is based on the belief that people with common interests can work together to develop viable management strategies.

The goal of CRMP is to enhance the quality and productivity of natural resources by achieving compatibility among the multiple uses in a specific area. The objective is to improve and maintain natural resources in ways that are consistent with the priorities of the landowners, land users, interest groups, and land-management agencies.

CRMP is a voluntary, nonregulatory process that uses consensus as its strength. Landowners, users, managers, and other interested parties work together as a team from beginning to end. The exchange of values and viewpoints on objectives, problems, and alternatives is essential to achieving common goals and meeting resource needs. The most effective process is one that involves the local community from the outset and in which the regulating agency is comfortable with the local community being involved at the highest level of decision-making.

2.2 Rules of CRMP

CRMP has three rules:

1. **Management by consensus.** Participation in CRMP is voluntary, and consensus promotes involvement. Everyone must agree on conclusions before they can be accepted by the group.
2. **Commitment.** All participants must be committed to the success of the program.
3. **Broad involvement.** All interested and/or affected parties should participate.

2.3 Initiating the CRMP Effort

The Wallsburg CRMP was initiated because coordinated management was needed to resolve immediate resource problems and to prepare plans to keep problems from developing.

The CRMP program was initiated at the local level by landowners in the Wallsburg watershed. The Wasatch Conservation District is a legal special district and political subdivision of state government with responsibility for land and water conservation. For this reason, the District took the lead to organize the CRMP process.

The District coordinated assigning priorities and creating timetables and schedules with the other agencies, organizations, and interests involved. The CRMP process was reviewed with all parties to help them decide whether to proceed.

Once the decision was made to proceed with the CRMP process, a list of everyone who would be invited to participate was drafted and notices were sent. The chair of the CRMP planning group is a supervisor from the Wasatch Conservation District. The chair role is to oversee the organization of the planning group, assemble available inventory data, schedule meetings, and otherwise motivate the individuals involved in this planning process.

The general flow of a CRMP process is as follows:

- A private or public entity requests a CRMP program.
- Private and public landowners and managers, resource managers, and other interested parties in the general planning area are invited to an initial meeting.
- At the end of the initial meeting, consensus is reached about whether a plan should be developed.
- The specific planning area is defined; issues, problems and concerns are listed; and goals and objectives are developed.
- The information that is available and needed is determined.
- A checklist is developed to ensure that all resources have been considered.
- Each objective is addressed, and all actions needed to accomplish it are determined. For each action, the planning group determines who, what, when, and how long.
- A plan is developed using all information from the prior steps, and the plan is re-evaluated.
- A system is set up to maintain and implement the plan.
- The plan is implemented.

Once the plan is implemented, there is an annual review of the plan, plan progress, accomplishments, and problems and development of new objectives.

3.0 Introduction to the Wallsburg Watershed CRMP

3.1 Initiation of the Wallsburg CRMP

The Wallsburg CRMP was initiated because coordinated management was needed to resolve immediate resource problems and to prepare plans to keep problems from developing.

The Wallsburg CRMP was initiated by the Wasatch Conservation District on March 29, 2007. Local landowners and conservation agencies met in a public meeting to address local resource concerns. The meeting was conducted by the chair of the Wasatch Conservation District. The Uinta Headwaters Resource Conservation and Development (RC&D) coordinator facilitated the meeting to ensure that everyone had an opportunity to present their input.

Using the CRMP process, everyone was given the opportunity to speak about the local resources and the potential for protection and restoration. During the plan's initial phase, a public visioning session was held at which the participants identified their resource concerns for the watershed. Participants at the meeting listed the resources about which they had concerns. Once those were listed, everyone was given an opportunity to rank, by priority, those resources needing the highest level of attention. Watershed concerns were then tabulated, as shown in Table 3-1.

Table 3-1. Natural Resource Concerns for the Wallsburg Watershed

Resource Concern	Priority Ranking Points	Number of Responses
Water conservation	40	11
Water quality	35	8
Noxious and invasive weeds	31	12
Water rights	28	8
Irrigation water management	25	7
Wildlife habitat	18	5
Forest health	10	5
Septic tank management	10	5
Air quality	10	4
Wetland protection	10	3
Riparian management	7	3
Animal waste	6	2
Soil erosion	6	2
Predator control	6	2
Threatened/endangered species	5	1
Recreation impacts	4	3
Pest management	4	2
Well head protection	4	1
Grazing management	4	1
Agricultural land converted to other uses	3	2
Absentee landowners	1	1
Storm water management	1	1
Crop production	1	1

At the same public meeting, representatives were chosen to represent the landowners and various conservation agencies on the Wallsburg Watershed Coordinating Council. Members of the watershed council are identified below in Section 3.3, Wallsburg Watershed Coordinating Council.

3.2 Participating Agencies

The Wallsburg CRMP was prepared with input from the following agencies and participants:

Lead agency:	Wasatch Conservation District
Participating agencies:	U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Uinta-Wasatch-Cache National Forest Utah Division of Wildlife Resources Utah Division of Water Rights Utah Division of Water Quality Wasatch County Health Department
Consultants:	Desert Rose Environmental HDR Engineering
In cooperation with:	Wasatch County Wallsburg Town Central Utah Water Conservancy District Local landowners Irrigation companies

3.3 Wallsburg Watershed Coordinating Council

The Wallsburg Watershed Coordinating Council (WWCC) was formed as the planning group for the CRMP. The coordinating council consists of local citizens and property owners as well as representatives from local governments and agencies, state agencies, and federal agencies. The WWCC currently consists of the following members:

Name	**Representing**
Alan Brown (Chair)	Wasatch Conservation District
Ray Loveless	Wasatch Conservation District
Bob Gappmeyer	Wasatch Conservation District/Landowner
Bob Probst	Wasatch Conservation District
Norm Evenstad	NRCS
Reed Oberndorfer	Central Utah Water Conservancy District (CUWCD)
Lowell Gardner	NRCS
Keith Covington	Utah Association of Conservation Districts (UACD)
Jeff Dunne	Land Manager
Harvey Mecham	Landowner
Dee Mecham	Landowner
Lorin Smart	Landowner

Meetings were held on the following dates:

- 2009: January 21, February 18, March 18, April 15, May 20, June 17, July 1
- 2010: Any meetings in 2010?
- 2011: February XXX

The current WWCC would like to acknowledge the past participating council members who participated in meetings during the initial phases of this plan. Past council members include Val Warnick, Barbara Carey, Larry Hartley, …….

Watershed council meeting minutes are included in Appendix A, Watershed Council Minutes.

3.4 Wallsburg Watershed Outreach Plan

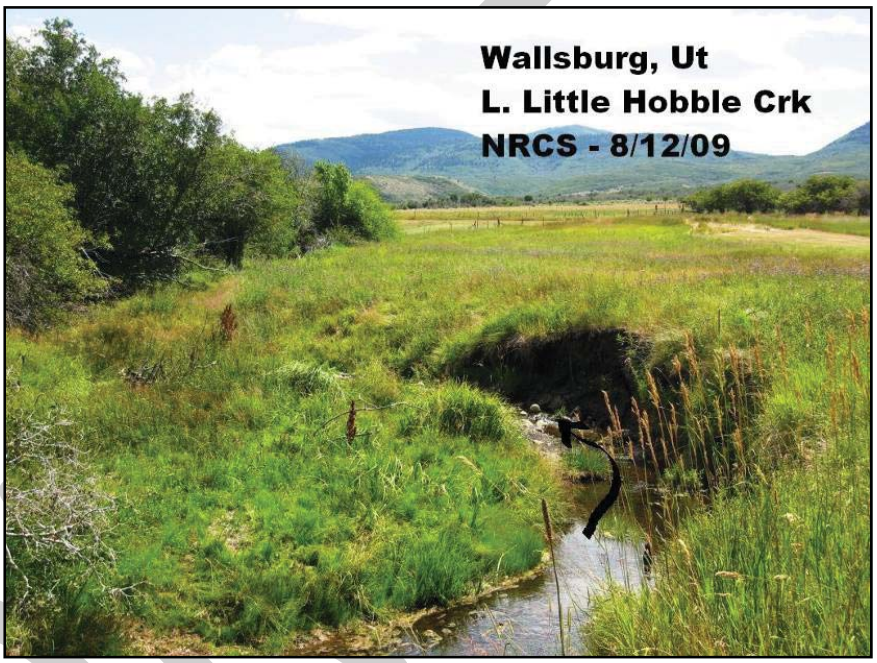
The Wallsburg Watershed Outreach Plan (UACD 2009) was prepared by the Uinta Headwaters RC&D and was adopted by the Wasatch Conservation District and the WWCC. The purpose of the outreach plan is to communicate a strategy for involving property owners, local citizens, agencies, and other interested parties in the planning process and developing the watershed plan.

Key components of the outreach plan includes the following:

- Schedule of WWCC meetings
- Wasatch Conservation District newsletter to keep people informed
- Public outreach workshops to report CRMP progress
- Public meeting to present the final CRMP

4.0 Watershed Characterization

This section provides a general description of the Wallsburg watershed with the intent of identifying opportunities for implementing projects that would improve the condition of the watershed. This review of the physical, biological, and chemical condition of the watershed, as well as the social components (such as population growth and recreational use), identify areas that might need some type of watershed project or might respond well to project implementation. This section specifically addresses the following aspects of the watershed: watershed area, authorities and jurisdictions, population and land use, social environment and recreation, climate, water resources, and wildlife and habitat.

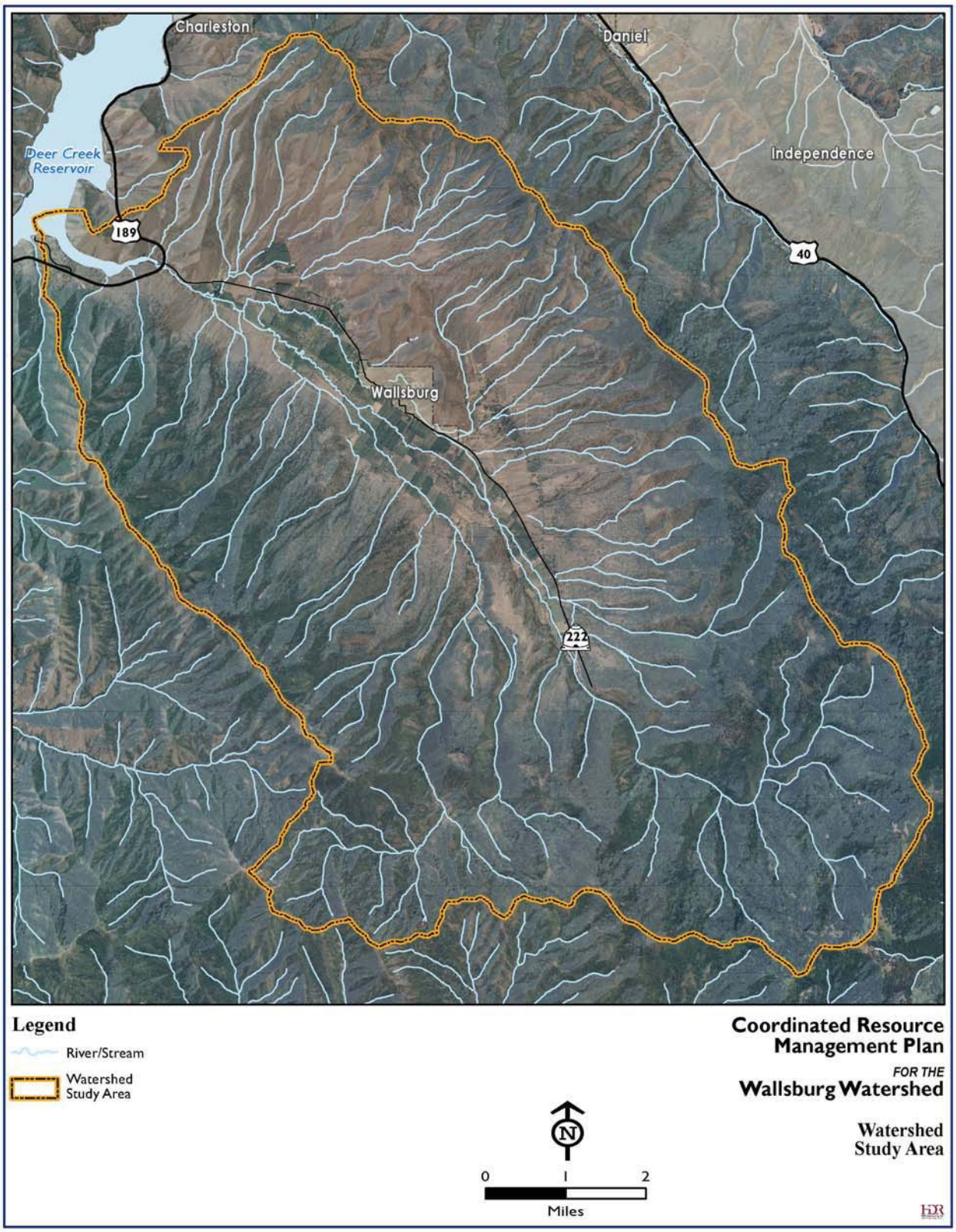


The best available information was used to develop this characterization. In several cases, further data collection and analyses were conducted to provide additional information that was used to assess the watershed and identify potential projects and management strategies.

4.1 Watershed Area

The Wallsburg watershed is located 10 miles southeast of Heber City, Utah, in the Wasatch Mountains. The watershed is about 11 miles long and 7 miles wide and encompasses about 45,000 acres (70 square miles) in Wasatch County (Figure 4-1). The following sections include general descriptions of the topography, town, roads, and climate in the watershed.

Figure 4-1. Watershed Study Area



4.1.1 Topography

The Wallsburg watershed is a narrow river valley bounded by mountains on the south and Deer Creek Reservoir on the north. Elevation ranges from about 9,500 feet in the surrounding peaks to about 5,500 feet at Main Creek's discharge into Deer Creek Reservoir near U.S. Highway 189 (US 189). The watershed slopes to the northwest following Main Creek; major tributaries are Spring Creek and Little Hobble Creek.

The watershed has a wide central area that is used primarily for agriculture and residential development. Irrigation ditches convey water from Main Creek across the eastern slope of the watershed, intersecting intermittent drainages. Figure 4-2 shows the topography of the watershed.

Additional information on geology, soils, and geologic hazards is provided in Appendix B, Wallsburg Watershed Geology and Environmental Hazards.

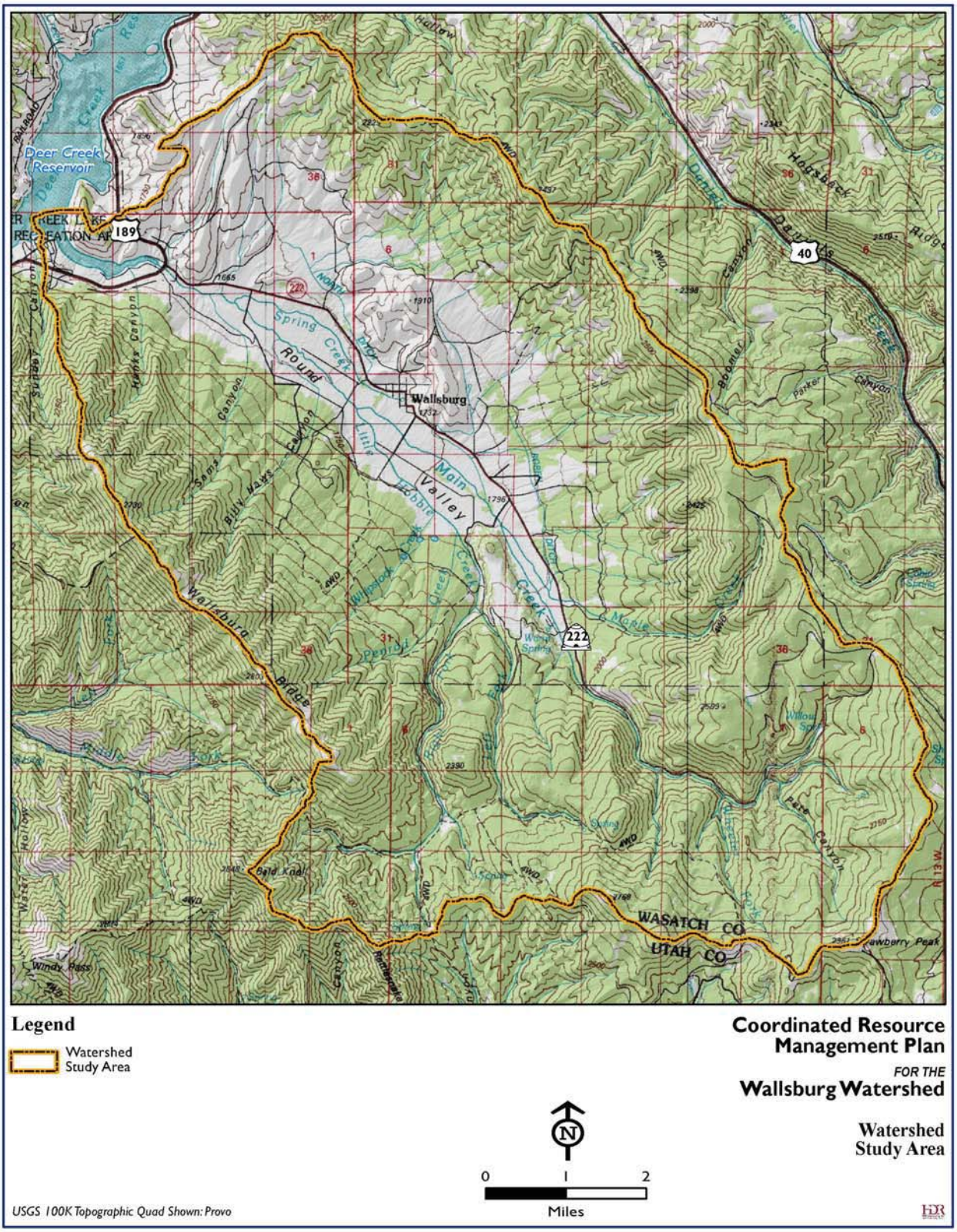
4.1.2 Wallsburg Town

Wallsburg is a small incorporated community in the center of Round Valley in Wasatch County. The town covers about 320 acres (0.5 square mile), or less than 1% of the watershed. The town has remained essentially the same for many years. Isolated among the Wasatch Mountains, the town and the surrounding valley are one of the few remaining pristine areas in the region.

The Little Warm Valley or Round Valley was the early Native American name for the area. It eventually was named for William Madison Wall, a native of North Carolina, who helped construct a road through Provo Canyon. Wall was an explorer, colonizer, military officer, and church leader. When Wallsburg was originally settled in the 1870s, it was mainly an agricultural community. Grazing and farming remain a significant part of the community today. Unlike most cities in Wasatch County, Wallsburg has experienced little growth within its boundaries. However, in all likelihood, the town and valley will grow as a result of both natural increase (births) and in-migration.

The town is characterized by its rural atmosphere with beautiful views of the surrounding mountains and an abundance of agriculture and open space. These natural features are valuable resources that have made Wallsburg unique, and great care should be taken to maintain and preserve the rural atmosphere while making it a wonderful place to live, work, and raise a family.

Figure 4-2. Topography of the Wallsburg Watershed



4.1.3 Roads

There is one main north-south road—Main Canyon Road (State Route 222)—through the watershed. This road connects US 189 near Deer Creek Reservoir to Wallsburg and continues to the upper watershed. Main Canyon Road is the primary access road for residents living south and east of the town. A series of local roads, including Roundy Lane, Round Valley Road, and Little Valley Road, connect Main Canyon Road to the western side of the valley. Wallsburg relies on Wasatch County for the maintenance of all current roads in the town. Wallsburg will continue to cooperate with the Wasatch County transportation goals and objectives in planning, building, and maintaining roads.

4.1.4 Climate

The nearest weather station is located on Deer Creek Dam (Station 422057, elevation 5,270 feet) about 6 miles downstream and northwest of the watershed. Annual average precipitation at the station site is 24.56 inches, with the majority received between October and April. January is reported as the coldest month of the year with a normal mean temperature of 19.5 degrees Fahrenheit, and July is the hottest month with a normal mean temperature of 66.8 degrees Fahrenheit.

4.2 Authorities and Jurisdictions

This section describes the authorities and jurisdictional controls of federal, state, and municipal governments and agencies.

4.2.1 Federal Agencies

NRCS Natural Resources Conservation Service

Since 1935, the Natural Resources Conservation Service (originally called the Soil Conservation Service) has provided leadership in a partnership effort to help the U.S.'s private landowners and managers conserve their soil, water, and other natural resources.

The conservation provisions in the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill) provide conservation opportunities for farmers and ranchers. The new provisions build on the conservation gains made by farmers and ranchers through the 1985, 1996, and 2002 Farm Bills. They simplify existing programs and create new programs to address high-priority environmental goals.

The Conservation Technical Assistance (CTA) program provides voluntary conservation technical assistance to land users, communities, units of state and local government, and other federal agencies in planning and implementing conservation systems.

U.S. Forest Service

The U.S. Forest Service is the largest land manager in the Wallsburg watershed. The Uinta-Wasatch- Cache National Forest encompasses nearly 15,700 acres within the Wallsburg watershed. Established in 1905, the Forest Service is an agency of the U.S. Department of Agriculture. The Forest Service Heber-Kamas District Ranger manages the National Forest lands in the watershed.

The Heber-Kamas District manages livestock grazing on one allotment within the watershed, known as the Wallsburg Allotment, and one allotment that straddles the Wallsburg watershed and Hobble Creek drainage, known as the Little Valley Allotment. Permitted use for seasonal grazing by ewes with lamb was supported with a 2008 Notice of Decision.

U.S. Army Corps of Engineers

Section 404 of the Clean Water Act grants primary authority for regulation of wetland development to the U.S. Army Corps of Engineers. Currently, wetlands are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions." There are many streams and creeks within the watershed that could fall under the jurisdiction of the Corps if they are altered.

Federal Emergency Management Agency

The mission of the Federal Emergency Management Agency (FEMA) is to reduce the loss of life and property and protect communities nationwide from all hazards, including natural disasters, acts of terrorism, and other human-made disasters. FEMA leads and supports the nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery, and mitigation.

The major regulatory authority exercised by FEMA that affects watershed function is delineating and managing floodplain zones. For this reason, FEMA works closely with state and local officials to identify flood hazard areas and flood risks. There are FEMA mapped floodplains along Main, Spring and Little Hobble Creeks within the Wallsburg watershed.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) leads the nation's environmental science, research, education, and assessment efforts. EPA is responsible for numerous activities that include developing and enforcing regulations and performing environmental research. The two most applicable statutes affecting watershed management are the Clean Water Act (U.S. Congress, 1972) and the Safe Drinking Water Act (U.S. Congress, 1974). States are typically given principal responsibility for implementing the provisions of these federal acts. Utah has been granted primacy for implementing the provisions of the Clean Water Act (CWA).

The CWA is the cornerstone of water quality protection in the U.S. EPA divides water pollution sources into two categories: point and non-point. Point sources of water pollution are stationary locations such as sewage-treatment plants. There are no point sources of pollution in the Wallsburg watershed. Non-point sources are more diffuse and include agricultural runoff, septic tanks, and paved roads and parking lots. EPA works with state and local authorities to monitor pollution levels in the nation's water and provide status and trend information on a representative variety of ecosystems.

The Safe Drinking Water Act (SDWA) focuses on all waters that are either actual or potential sources for drinking water. EPA regulates the quality of the nation's drinking water by issuing and enforcing safe-drinking-water standards. EPA also protects the nation's drinking water by safeguarding our watersheds and regulating the release of pollutants into the environment. In partnership with local authorities and community groups, EPA encourages water conservation. EPA also works with these partners to develop contingency plans for source contamination and other water emergencies.

The Utah agencies that are responsible to regulate the CWA and the SDWA are the Division of Water Quality, the Division of Water Rights, the Division of Drinking Water, and the Division of Water Resources.

4.2.2 State Regulatory and Management Agencies

Utah Department of Environmental Quality, Division of Water Quality

The Utah Division of Water Quality is responsible for regulating surface water discharges, wastewater treatment, stormwater, and groundwater in Utah. As a regulatory division, the Division of Water Quality oversees all permits for discharge, monitors water quality, establishes water-quality standards, sets beneficial-use designations, oversees total maximum daily load (TMDL) studies, and administers groundwater discharge permits.

Utah Department of Natural Resources, Division of Water Rights

The Utah Division of Water Rights is the state agency that regulates water right appropriations (that is, the designation of a legal right to take possession of specific water at a specific time) and the distribution of water in Utah. Water rights are granted based on quantity, source, priority date, nature of use, point of diversion, and physically putting the water to a beneficial use.

The doctrine of prior appropriation allows those who first made beneficial use of water to use and distribute the water from a certain source before those entities with later priority dates.

In addition to overseeing water right appropriations, the Division of Water Rights administers a Stream Alteration Permit Program that regulates activities affecting the bed and banks of natural streams.

Utah Department of Natural Resources, Division of Water Resources

The Utah Division of Water Resources is responsible for promoting the orderly and timely planning, conservation, development, use, and protection of Utah's water resources. The Division evaluate the state's water resources and supply demands on a river-basin basis. The State's 1997 Utah Lake Basin Plan summarizes existing conditions and forecasts water demands and includes the Wallsburg watershed within the larger basin setting.

Utah Department of Natural Resources, Division of Forestry, Fire and State Lands

The management objectives of the Utah Division of Forestry, Fire and State Lands are to protect and sustain the beneficial uses of state lands consistent with their long-term protection and conservation. Any beneficial use of public-trust resources is subsidiary to long-term conservation of the resources. The Division oversees permits uses, grants easements, and leases land for specific beneficial uses of the State lands and resources.

Utah Department of Natural Resources, Division of Parks and Recreation

The Utah Division of Parks and Recreation manages the Deer Creek Reservoir State Park. It also administers off-highway vehicle, boating, and trails programs and works to provide access to waterways and trails while protecting resources.

Utah Department of Natural Resources, Division of Wildlife Resources

The Utah Division of Wildlife Resources has authority for managing and conserving wildlife. The Division operates the Wallsburg Cooperative Wildlife Management Unit (CWMU) that lies within the watershed. It issues hunting permits and fishing licenses for the CWMU pursuant to Title 23 of the Utah Administrative Code.

4.2.3 Municipal Government

The town of Wallsburg is located in the Wallsburg watershed and has a population of about 275 people. Wallsburg Town provides culinary water to residents through a system of tanks, pumps, and pipelines (MAG 2007). Residents of Wallsburg and the unincorporated areas of the watershed use onsite wastewater treatment systems (septic tanks) for sewage disposal.

The Mountainland Association of Governments (MAG), along with the Town's planning commission and staff, produced the *Wallsburg General Plan, 2007–2012* (General Plan). The General Plan included the following vision for the community.

Community Visions and Goals

The community vision for Wallsburg is stated as "to be a beautiful, peaceful, organized community which enhances the historic, rural atmosphere of the valley, through preserving open space and our rural heritage" (MAG 2007).

The three goals, objectives, and policies of the plan are as follows:

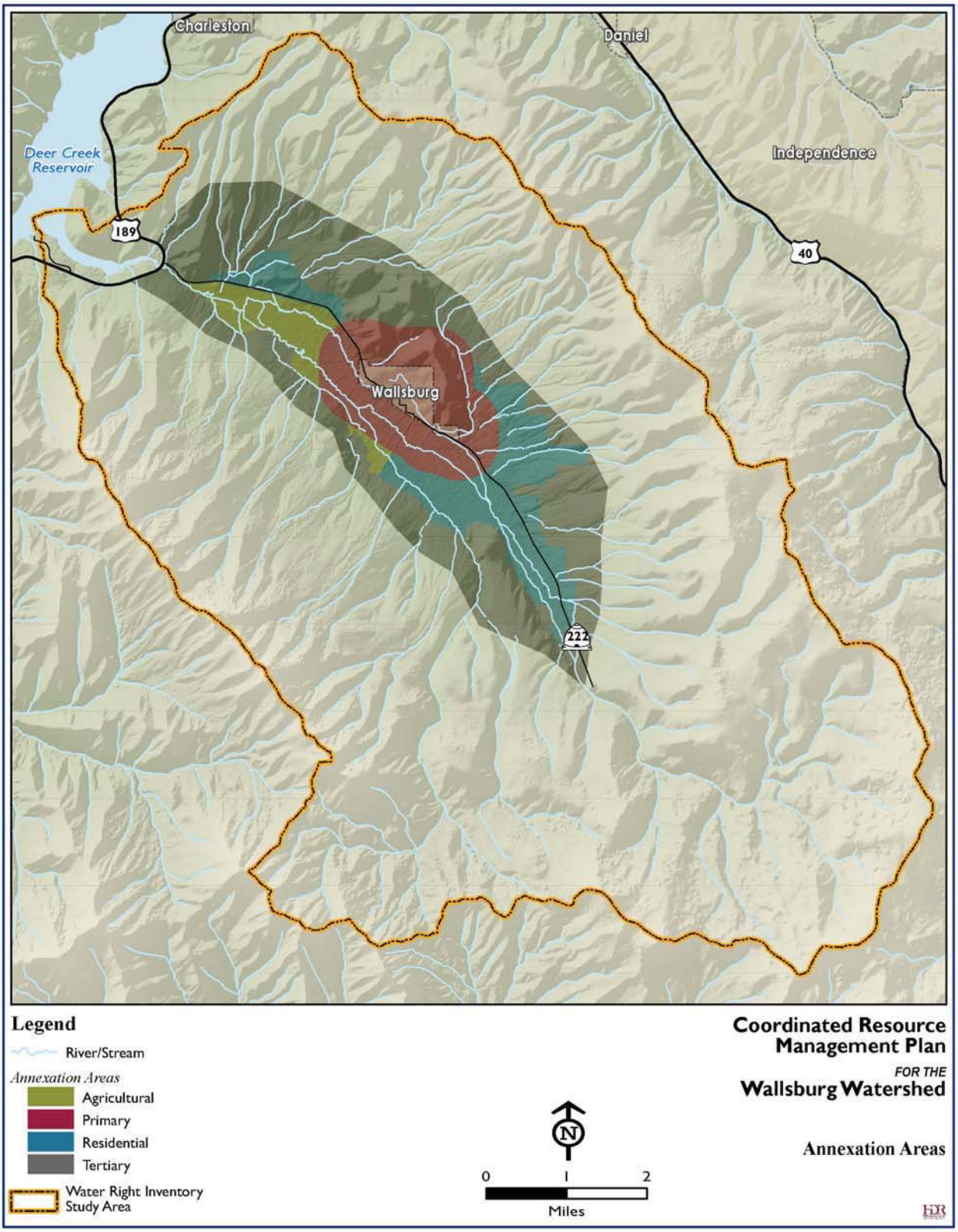
- **Goal 1: To be a beautiful, peaceful, organized, community.**
  - *Objective 1: To be a beautiful community.*
    - Policy 1: Ensure all town property is well maintained.
    - Policy 2: Enact and enforce a Town ordinance concerning property maintenance including old vehicle and equipment storage.
    - Policy 3: Hold an annual Community Cleanup Day focusing on community-wide upkeep as well as area-specific cleanups.
    - Policy 4: Establish a community beautification committee with awards for residential landscaping.
  - *Objective 2: To be an organized, peaceful community.*
    - Policy 1: Accept only well-managed growth and development in areas that benefit the community and maintain open space.
    - Policy 2: Development should be permitted only to the degree that the Town has capacity to provide the necessary public services or that capacity is provided by landowners in a manner that is economical to the Town.
    - Policy 3: Work together with Wasatch County to manage growth and control land uses and development in surrounding areas.
- **Goal 2: To enhance the historical and rural atmosphere of Wallsburg.**
  - *Objective 1: To enhance the historic, rural atmosphere of Wallsburg.*
    - Policy 1: Identify and encourage the preservation of prime agricultural land within Wallsburg.
    - Policy 2: Development should be encouraged into areas that have marginal agricultural value.

- Policy 3: Institute conservation and open-space development design standards to ensure that new development maintains a rural character while maintaining property rights.
- Policy 4: Priority should be given to existing animal rights and to maintaining zoning regulations that facilitate the ownership of animals for recreation and family food production.
- Policy 5: Encourage the preservation of historical structures and land uses such as agriculture.

- **Goal 3: To maintain open space.**
  - *Objective 1: To maintain open space.*
    - Policy 1: Enact a conservation subdivision ordinance that requires development to maximize open space.
    - Policy 2: Identify and prioritize desirable open-space areas that meet community objectives. Encourage mechanisms for acquisition including, but not limited to, bonding and outright purchase.
    - Policy 3: Work with county, state, and non-governmental open-space preservation funds and programs.
    - Policy 4: Do not extend roads and services to areas desired for open space.

Wallsburg Town has identified areas of projected annexations in the General Plan along with goals, policies, and criteria for future annexation petitions. Figure 4-3 below identifies the areas surrounding the town that have been identified as potential annexation areas.

Figure 4-3. Annexation Areas



Wasatch County

The Wallsburg watershed lies within Wasatch County, Utah. Wasatch County has five municipalities within its boundaries: Heber City, Midway, Charleston, Wallsburg, and part of Park City. Within the watershed are 10 special service districts that provide municipal services; two provide countywide services and the other eight service residents within specifically defined areas.

The *Wasatch County General Plan, 2001–2016* was approved December 10, 2001. The purpose of this general plan is to provide a comprehensive approach to coordinating development, natural resources, and open space in order to provide a harmonious relationship that meets the needs of present and future residents and also promotes the health, safety, and general welfare of the residents of the county.

The basic uses for the general plan are categorized as follows:

- It is a guide to the Planning Commission and County Commission as they evaluate proposals for improvements to or changes in the county's infrastructure.
- It is a guide to the Planning Commission and County Commission as they review requests for the approval of development projects.
- It is the framework that guides the establishment of policies regarding zoning, the development code, and capital-improvement programming.
- It is the source of information with regard to public policies useful in making decisions concerning plans for future development.
- It is a source of information with regard to public policies that could have any impact on a single parcel of property.

Mountainland Association of Governments

The Wasatch Rural Planning Organization (RPO) was organized by Wasatch County to coordinate, plan, and prioritize future transportation investments in Wasatch County. RPOs are generally rural organizations servicing populations of less than 50,000. In Utah, RPOs are managed and coordinated by regional organizations. For the Wasatch RPO, the Mountainland Association of Governments (MAG) is the lead coordinating agency. Members of the Wasatch RPO include the Utah Department of Transportation (UDOT), Wasatch County, the Cities of Heber and Midway, and the Towns of Charleston and Wallsburg.

4.3 Population and Land Use

4.3.1 Population

The Wallsburg watershed area is populated with one town and the surrounding area in unincorporated Wasatch County. MAG reports that, in 2000, the population of Wallsburg was 274, with 83 households and an average household size of 3.3 people. In the 2010 U.S. Census, the population of the town was reported at 250 in 2010, with 85 households and an average household size of 2.94 people.

In April 2008, MAG projected that the population of Wallsburg would grow to 557 in 2010, 864 in 2020, and 1,190 in 2030. While the population projections made in 2008 were high, growth of the area is expected to continue, and residents were active in working with MAG to develop the General Plan to identify priority elements and to plan for the future. Historic population numbers for Wallsburg are presented in Table 4-1 below.

Table 4-1. Population of Wallsburg, 1950–2000

Area	1950	1960	1970	1980	1990	2000
Wallsburg	207	180	211	239	252	274

4.3.2 Land Cover, Ownership, and Land Use

Land Cover

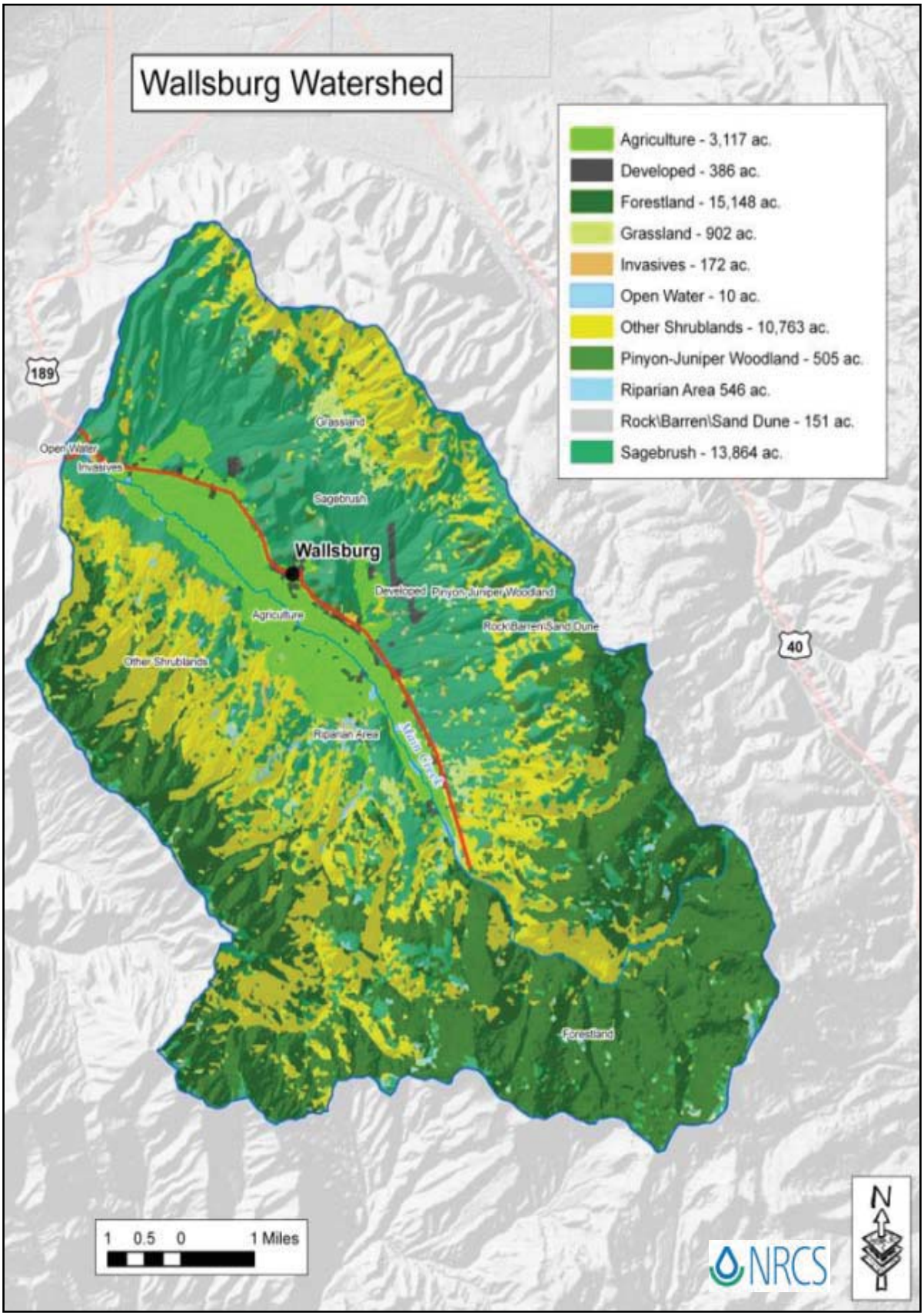
The land cover in the watershed can be generally described as dominated by three classifications: forestland in the upper reaches, sagebrush and shrublands in the mid-elevations of the watershed, and agriculture in the lowlands of the watershed. Table 4-2 shows the percentages of land cover type for the watershed; these are illustrated in Figure 4-4 (NRCS 2010a).

1

Table 4-2. Percentages of Land Cover in the Wallsburg Watershed

Land Cover	Acres	Percent of Watershed (%)
Agriculture	3,117	6.8
Developed (town)	386	0.8
Forestland	15,148	33.2
Grassland	902	2.0
Invasives	172	0.4
Open water	10	0.0
Other shrublands	10,763	23.6
Pinyon-juniper woodland	505	1.1
Riparian	546	1.2
Rock/barren	151	0.3
Sagebrush	13,864	30.4

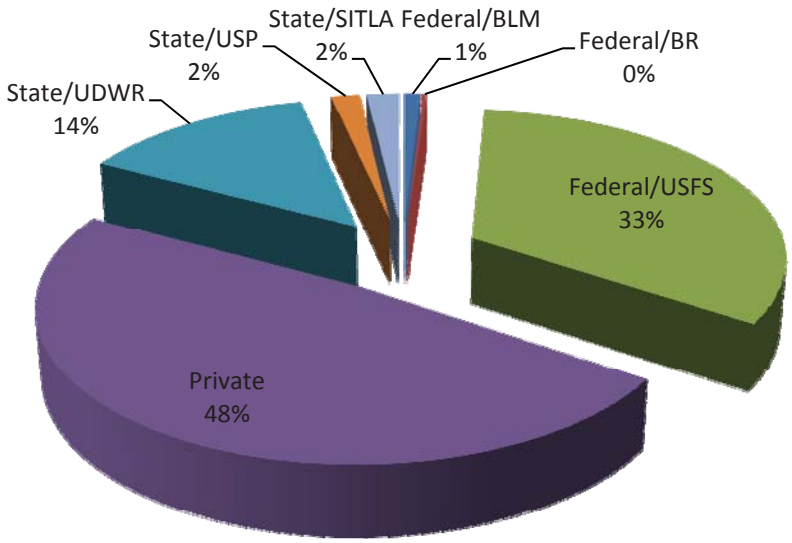
Figure 4-4. Land Cover in the Wallsburg Watershed



Land Ownership

Land in the Wallsburg watershed is owned by private, state, and federal entities (Figure 4-5). Just under half of the land is owned privately, with the other half managed by state and federal agencies.

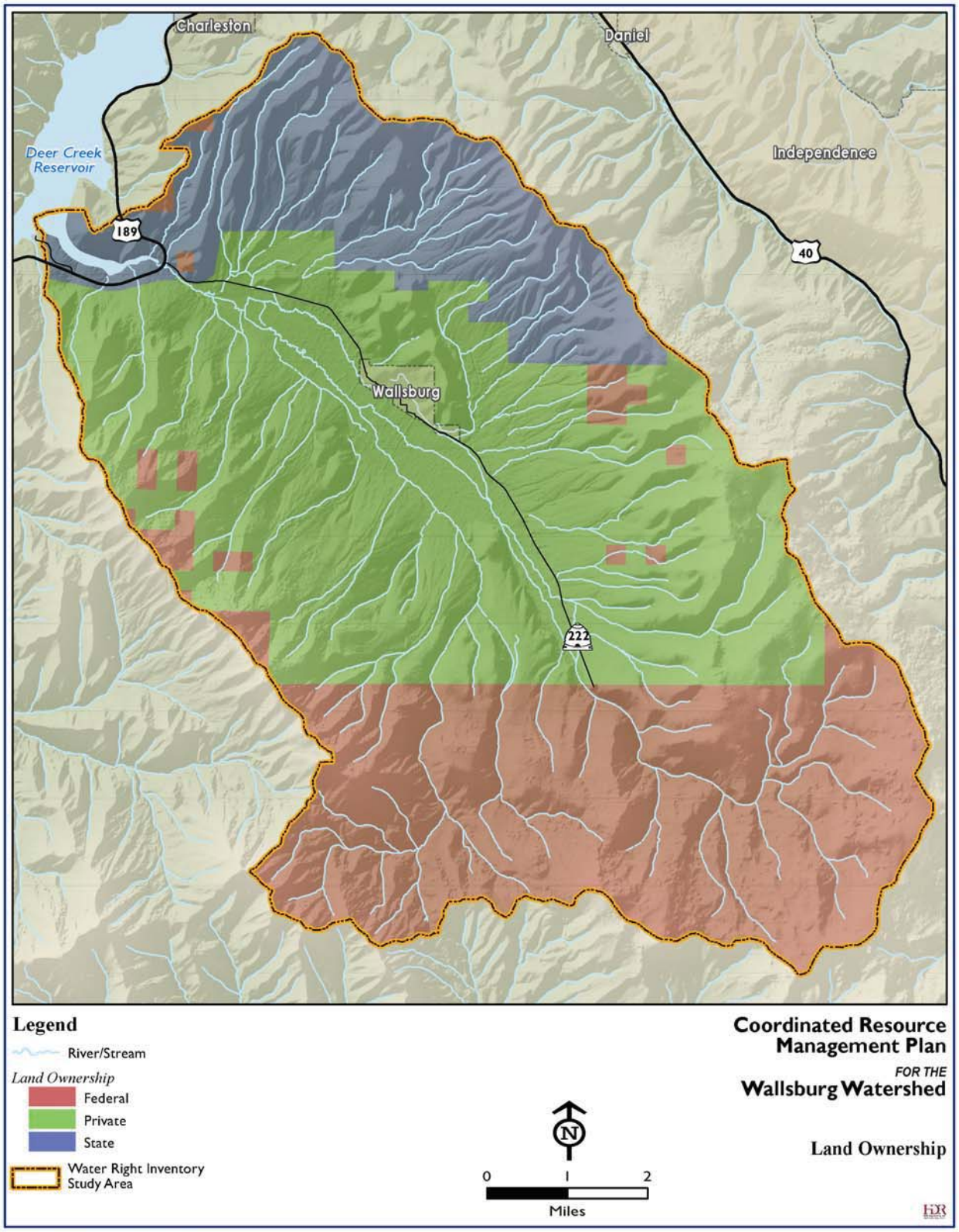
Figure 4-5. Percentages of Land Ownership/Management in the Wallsburg Watershed



UDWR = Utah Division of Water Resources; USP = Utah Division of State Parks and Recreation; SITLA = State of Utah School and Institutional Trust Lands Administration; BLM = Bureau of Land Management; BR = Bureau of Reclamation; USFS = U.S. Forest Service

Private lands tend to occupy the central and lower portions of the watershed, which are the most suitable acres for agriculture. The U.S. Forest Service (USFS) manages the federal lands that occupy the upper third of the watershed including the headwaters for Main, Maple, and Little Hobble Creeks. The Utah Division of State Parks and Recreation manages a parcel of land by Deer Creek Reservoir. The Utah Division of Forestry, Fire and State Lands and the federal Bureau of Land Management (BLM) also manage land holdings in the watershed. Figure 4-6 below shows land ownership in the watershed.

Figure 4-6. Land Ownership



Land Use

Land use is considered in the General Plan (MAG 2007) to be an important element of future development in the watershed. Historically, development of the central watershed has been dominated by agricultural and residential uses. The community values the open space of the watershed, and preservation is a key planning element of the General Plan. Table 4-3 identifies the land uses of the watershed according to the General Plan. A large portion of the upper watershed is not designated with a specific land use (Undesignated).

Table 4-3. Land Use in the Wallsburg Watershed

Land Use	Acres	Percent of Watershed (%)
Residential – 0.5-acre lots	333	<1
Residential – 5-acre lots	2,569	5
Agricultural	1,155	2
Preservation area	27,984	58
Public facilities	8	<1
Undesignated	16,076	33

4.4 Social Environment and Recreation

Through the process of developing the General Plan, the Wallsburg community concluded that it is important to preserve property rights while maintaining an open, rural feel to the watershed (MAG 2007). The community identified primary and secondary open-space areas and determined that these areas should be connected and form a network of open land wherever possible. Three areas are of particular concern:

- Land south and west of Main Canyon Road
- Land along two wildlife corridors
- The Main Canyon Road corridor

Open spaces within the watershed are valued for their ecological, agricultural, cultural, and recreational qualities.

Popular recreation activities within the watershed include hunting, fishing, driving four-wheel-drive vehicles (four-wheelers), and hiking.

The Utah Division of Wildlife Resources cooperatively manages the privately owned Wallsburg Cooperative Wildlife Management Unit (CWMU), which consists of about 8,170 acres southeast of Wallsburg. In 2012, public hunting permits will be issued for mule deer and elk on this CWMU.

The Division also manages a portion of the watershed as the Heber Wildlife Management Area (WMA) 69.

Dirt roads provide seasonal access for four-wheelers to the upper watershed and over the ridges into Daniels Canyon and Utah County.

There are no established public camping facilities in the watershed. A girls' camp for members of the Church of Jesus Christ of Latter-day Saints (LDS) is located about 5 miles southeast Wallsburg, along Main Creek, and offers camping facilities on private land with a capacity of 250 to 300 occupants.

4.5 Water Resources

This section describes the water resources in the Wallsburg watershed. These resources are surface waters, including natural streams; irrigation canals; wetlands; and water quality.

4.5.1 Surface Waters

Main Creek flows from its headwaters on National Forest land through the watershed and discharges to Deer Creek Reservoir near US 189. Main Creek and its major tributaries, Little Hobble Creek and Maple Creek, are fed by precipitation and springs. Another tributary known as Spring Creek begins at a large spring near the town center of Wallsburg and supplies irrigation water to farms downstream from Wallsburg.

All surface waters in the Wallsburg watershed eventually discharge to Deer Creek Reservoir. Main Creek, Little Hobble Creek, and Spring Creek are designated as perennial streams. However, several irrigation diversions on each stream lead to seasonal dewatering. Downstream from Wallsburg, Main Creek flows year-round because springs and seeps contribute water to the creek (UDNR 1991). Maple Creek is diverted completely into irrigation canals and does not flow into Main Creek.

The characteristics of surface waters in the watershed are summarized in Table 4-4.

Table 4-4. Major Creeks in the Wallsburg Watershed

Stream	Source	Stream Miles	Average Flow[a]
Little Hobble Creek	Upper watershed	3.1	• No gage • 2-year event flow is estimated at less than 1 cfs (cubic feet per second) • 10-year flow is estimated at 30 cfs
Main Creek	Upper watershed	14.6	• No current gage • 2-year event flow is estimated at 140 cfs • 10-year event flow is estimated at 229 cfs • Estimated average annual flow is 4–5 cfs
Maple Creek	Maple Canyon, upper watershed	5.1	• No gage
Spring Creek	Spring source within town limits	3.2	• No gage

[a] Source: NRCS 2010a

Within the watershed, over 30 minor tributaries seasonally flow from the upper watershed mountains to the valley and discharge into Main Creek or are intercepted by irrigation canals and stock ponds.

The above-mentioned creeks and tributaries might be considered jurisdictional waters of the U.S., and, if they are, any impacts to the creeks and tributaries would require permitting through Section 404 of the Clean Water Act under the jurisdiction of the U.S. Army Corps of Engineers and through the Stream Alteration Permit process administered by the Utah Division of Water Rights.

4.5.2 Irrigation Canals

Irrigation companies with water rights in the Wallsburg watershed are summarized in Table 4-5.

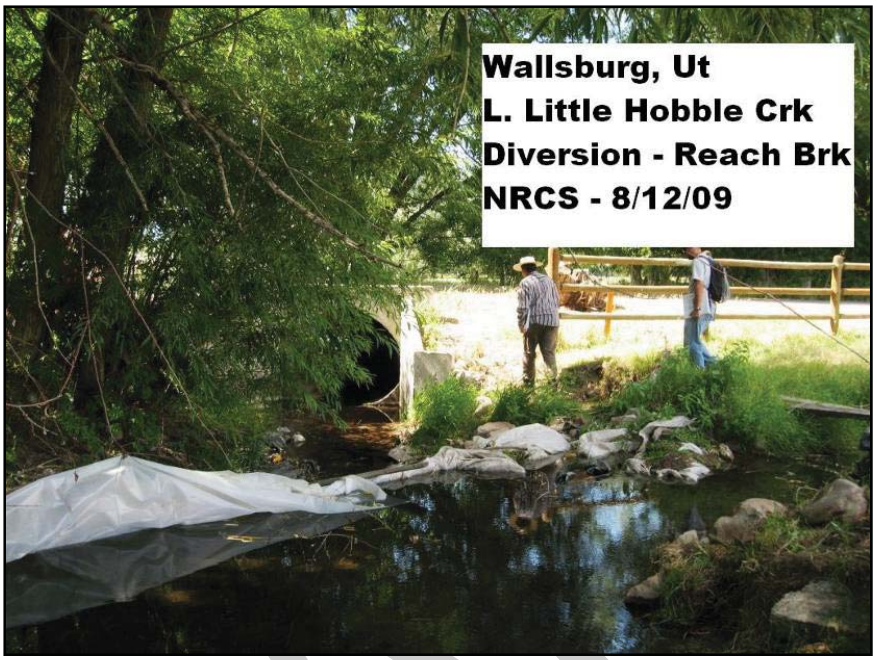


Table 4-5. Irrigation Companies

Company	Total Water Rights (cfs)	Total Water Rights (AF)	Uses	Source
Extension Irrigation Company	—	13.66	Irrigation, Stock, Domestic	Underground
Hobble Creek Irrigation Company	118	399	Irrigation, Stock, Domestic	surface, Underground
Main Creek Irrigation Company	46	16	Irrigation, Stock, Domestic	Surface, underground
North Ditch Irrigation Company	6	529	Irrigation, Stock, Domestic	Surface
Round Valley Water Corporation	20	—	Irrigation, Stock	Surface
Wallsburg Irrigation Company	3	3.8	Irrigation, Stock, Other	Surface

Source: Utah Division of Water Rights, 2011
AF = acre-feet

The 1997 Tri-Valley Watershed Plan Environmental Assessment identified irrigation-water-management methods and efficiencies for the watershed (NRCS 1997). In the upper watershed, most of the irrigated land upstream from Wallsburg is irrigated with sprinkler systems (65% on-farm efficiency). The irrigation water supply for this area is diverted from surface sources, Main Creek, Maple Creek, Little Hobble Creek, and smaller springs. The irrigation-conveyance system was improved by installing one main pond and pipeline to convey water to the fields, and these replaced numerous hillside canals and pond systems.

The Tri-Valley Report states that segments of Main Creek and Little Hobble Creek are dewatered by irrigation diversions after the spring high-water flows. Because there are no on-stream storage reservoirs, there is no opportunity to put water back into these segments for a continuous fishery habitat; the lack of continuous natural stream flows is a concern supported by several agency reports in Section 5.0, Watershed Planning Elements, of this plan.

The Tri-Valley Report also states that, downstream from Wallsburg in the lower watershed, most of the irrigated land is managed using the wild flood method (Table 4-6). The water supply for this area comes from Spring Creek and several smaller seeps and springs.

Table 4-6. Acres of Cropland in the Lower Wallsburg Watershed That Are Irrigated by Flood Systems

	Present Efficiency (%)	Irrigated Acres
North Ditch	20–30	403
Bull River Ditch	20–30	117
Lower valley pastures	20–30	613

Source: NRCS 1997

4.5.3 Wetlands

The National Spatial Data Infrastructure (NSDI) database identifies wetlands across the country based on information collected in 1986 (USFWS 1986). While there is a database map for the Wallsburg watershed, it identifies a large percentage of the central valley as wetlands and is meant to provide general information only. Projects that would disturb areas adjacent to and along the various streams in the watershed would require a site-specific wetland delineation study. If an area has wetland characteristics, the Corps would need to decide whether the specific wetland is jurisdictional under the Corps' regulatory program.

4.5.4 Water Quality

The Utah Water Quality Board, the Utah Division of Water Quality, the Utah Drinking Water Board, and the Utah Division of Drinking Water are responsible for regulating and managing water quality in Utah.

The Division of Water Quality determines beneficial-use classifications for streams, rivers, lakes, and reservoirs in Utah. Narrative and numeric water quality standards (Utah Code Annotated [UCA], R317-2-7) apply to all waters in the state.

Designated Beneficial Uses

All surface waters in the Provo River watershed that are tributary to Deer Creek Reservoir, including Main Creek, are classified for the following beneficial uses:

- **1C** – Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.
- **2B** – Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingesting water or a low degree of bodily contact with the water. Examples include wading, hunting, and fishing.
- **3A** – Protected for cold-water species of game fish and other cold-water aquatic life, including the necessary aquatic organisms in their food chain.
- **4** – Protected for agricultural uses including irrigating crops and stock watering.

Total Maximum Daily Load

Section 303 of the Clean Water Act directs each State to establish water quality standards to protect the beneficial uses of surface water and groundwater resources. The Act requires States to identify impaired water bodies and develop a total maximum daily load (TMDL) study for each pollutant that is causing impairments in the various water bodies.

The Division of Water Quality has identified Deer Creek Reservoir as not meeting its beneficial uses because of a lack of dissolved oxygen in the lower water column. Below is a brief description of the Deer Creek TMDL study (Psomas 2002) and some of the progress that has been made as remediation projects have been implemented.

During the 1980s, the reservoir had high nutrient loads and had become very eutrophic. However, current water quality analyses show that the reservoir has improved significantly and could now be considered a mesotrophic lake based on the average Carlson Trophic State index. The improvements can be attributed to the focus on the watershed and efforts to reduce pollution sources. Phosphorus sources in the watershed have been targeted for reduction to meet the recommended targets and endpoints of the TMDL study.

What are eutrophic and mesotrophic water bodies?

A eutrophic water body is characterized by excessive nutrients that support algae growth that leads to depletion of oxygen. A mesotrophic water body is characterized as having a moderate amount of nutrients.

Main Creek is one of the four major stream inputs to Deer Creek Reservoir that are monitored. The data suggest that the Provo River contributes 75% of the flow but only 69% of the phosphorus load. Main Creek, on the other hand, contributes 8% of the flow and 17% of the phosphorus load.

What is the Carlson Trophic State index?

The Carlson Trophic State index is a measurement standard to quantify clarity in lakes. Low clarity of water can be related to the high amounts of nutrients that support algal biomass.

The TMDL study found that Main Creek has high concentrations of nutrients and sediments in its flow to Deer Creek Reservoir. Additional discussion on the water quality of the watershed creeks is detailed in Section 4. XX.

Stormwater

Stormwater runoff from urban and rural landscapes often contains high concentrations of various pollutants and is a significant source of pollution. Common pollutants found in stormwater include pesticides, fertilizers, oils, salt, sediment, and other debris. An estimate of stormwater pollutant loading (the amount of a pollutant) is an important component in characterizing a watershed. Estimates serve to develop management strategies in an effort to target load reductions and help improve water quality.

To minimize the amount of pollutants that enter the water through stormwater runoff, the U.S. Environmental Protection Agency (EPA) initiated a two-phase process for implementing stormwater regulations. Phase I was first implemented in 1990 and affected certain types of industries, construction sites larger than 5 acres, and cities with a population larger than 100,000. No communities in Wasatch County, including Wallsburg, were affected by Phase I.

Phase II of EPA's stormwater regulations, which was first implemented in 2003, will affect smaller construction sites and any areas designated as Urbanized Areas by the U.S. Census Bureau. Phase II rules will apply to any community outside an urbanized area that has a population greater than 10,000 and a population density higher than 1,000 people per square mile. The town of Wallsburg does not meet these criteria.

While it may be a long time before Wallsburg will have to comply with federal and state municipal stormwater rules, it is encouraged that a proactive approach be made to protect the water from stormwater discharges.

However, construction sites greater than 1 acre in disturbance are required to obtain a stormwater discharge permit associated with construction activities. The State of Utah, Division of Water Quality issues permits for stormwater discharges associated with construction activities and requires implementation of best management practices to reduce the potential for erosion and to control sediment leaving the site.

Floodplains

Floodplains are defined as normally dry areas that are occasionally inundated by high stream flows. A stream has a *regulatory floodplain* if the floodplain is identified and mapped by FEMA. Development in floodplains can reduce their flood-carrying capacity and extend the flooding hazard beyond the developed area.

FEMA-mapped floodplains are managed at the local level to prevent flooding. FEMA-mapped floodplains have been identified along Main Creek, Little Hobble Creek, and Spring Creek in the Wallsburg watershed.

Groundwater

Utah Department of Natural Resources (UDNR) Technical Publication 101 assesses the surface water and groundwater hydrology and the effects of groundwater recharge in both the Heber Valley and the Wallsburg watershed (UDNR 1991). Technical Publication 101 estimates that up to 11 cfs of water from stream infiltration, precipitation, unconsumed irrigation water and inflow from consolidated rocks recharges the unconsolidated valley-fill deposits in the watershed. Of the 11-cfs recharge, 3 cfs is estimated to be recharge from precipitation, based on 16,000 acres of unconsolidated deposits with an annual average

precipitation of 18 inches and assuming that 10% recharges the valley fill. An estimated 5 cfs of stream infiltration contributes to the overall recharge estimate, based on a recharge estimate of 25% of the average stream flow of 19 cfs. The technical publication states that, since about 1978, as irrigation practices changed from flood to sprinkler irrigation, recharge from unconsumed irrigation might have changed from the 1969 estimate of about 2 cfs, although there are no recent data to support this possibility.

Groundwater discharges to the surface by springs, seeps and underground diversions. Technical Publication 101estimates that 0.2 cfs is pumped from about 115 small-diameter domestic and stock wells in the watershed.

Seasonal water-level fluctuations in wells within the watershed were assessed by UDNR in Technical Publication 101. According to the technical publication, in the central part of the watershed, the highest groundwater levels occur in the winter and spring due to stream infiltration. These groundwater levels can drop by 2 to 4 feet in the summer and fall as the streams are diverted for irrigation use. However, in the lower watershed, well (D-5-4)2cca-1, which is near the confluence of Main Creek and Deer Creek Reservoir, is reported to fluctuate 5 feet with the groundwater level being the highest in July. This might be when groundwater recharge from unused or return irrigation water is the highest (UDNR 1991).

4.6 Wildlife and Habitat

4.6.1 Aquatic Species

Two fish species, leatherside chub (*Lepidomeda copei*) and Bonneville cutthroat trout (*Oncorhynchus clarkii utah*), are considered state sensitive species and are found within the Wallsburg watershed. The other sensitive species found in the watershed is the Columbia spotted frog (*Rana luteiventris*).

4.6.2 Wildlife Species

The Wallsburg watershed supports a diverse wildlife community. There is year-round habitat throughout all or part of the watershed for elk, mule deer, and moose and possibly for black bear, cougar, and a variety of game birds. The northern and eastern hillside area has been identified as crucial elk winter range and southwestern hillside as crucial year-long elk habitat. Mule Deer crucial winter range is identified for the northeast and southwest lower hillsides of the watershed, with the upper hillsides as crucial winter/spring range. Wild turkeys also have been introduced into the area and are doing well.

4.6.3 Vegetation

Agriculture is the predominant land use in the lower-elevation river valley. In the adjacent foothills, sagebrush and juniper communities are common. Upper-elevation vegetation consists of oak brush and maple on the south-facing steeper slopes with mixed conifer and aspen dominating the moister, north- and west-facing sites. Vegetation characteristics of grazing lands and pasturelands are discussed in sections 4.3 and 4.10, respectively.

5.0 Watershed Planning Elements

In order to assess watershed resource concerns, resource evaluations and assessments are conducted to identify watershed-specific projects for implementation. This section explores several watershed planning elements in order to identify recommendations and implementation activities. The watershed planning elements are described in the following reports (the primary authors are shown in parentheses):

1. Economic Analysis (NRCS)
2. Riparian Assessment and Inventory (NRCS)
3. Range Assessment and Inventory (NRCS)
4. Water Quality Assessment (Desert Rose Environmental)
5. Wildlife Management (Utah Division of Wildlife Resources)
6. Forestry Assessment and Inventory (NRCS)
7. Water Rights Inventory (HDR Engineering)
8. Septic Tank Functionality (Wasatch County Health Department)
9. Hydrology (NRCS)
10. Pastureland Assessment (NRCS)

Summaries of these resource reports are presented below. The full reports are provided in the appendices to this plan.

5.1 Economic Overview

5.1.1 Background

The valley floor of the watershed in which the Town of Wallsburg is situated contains agricultural land, residential properties, and recreational homes as well as points of access for surrounding public recreation lands. While the economic history of Wallsburg is largely agricultural, the economic future of the valley might become more slanted toward commercial and residential development.

A majority of the current residents of the valley are opposed to increased development in their community (MAG 2007, p. 12.8). Because of anticipated economic pressures, there is likely to be an increase in the tension between the traditional lifestyle in the valley and some landowners' desire to profit from the subdivision and development of their land.

As population growth and an ongoing influx of new residents from both in and out of state continue to affect communities in Wasatch and Summit Counties, pressure to develop the Wallsburg watershed is likely to increase. Due to its close proximity to attractive, popular communities such as Midway, Heber City, and Park City, the Wallsburg watershed is at risk of becoming a more-attractive target for development. While this is not a problem in and of itself, mixed desires within the community could eventually create an unfavorable atmosphere of conflict and resentment related to economic disparity. Furthermore, new residents might tend to look negatively on traditional land uses in the valley. For example, local residents have carefully guarded their legal right to keep large animals on residential properties within Wallsburg and its surrounding community. The smells, sounds, and work activities that accompany this type of zoning might come under criticism as newcomers, who

might be unfamiliar or uncomfortable with standard agricultural activities, are affected by them.

This section assesses the economic setting and recent economic conditions in the Wallsburg community. In addition, it addresses some changes that could occur given different economic scenarios. It also offers recommendations for the local community to consider as it moves beyond the timeframe of the 2007 Wallsburg General Plan.

5.1.2 Observations

The community of Wallsburg has experienced an influx of growth, especially new non-agricultural residential housing, combined with its traditional, agriculturally oriented land uses. Many farmers and ranchers plan to sell farmland or ranchland for new development, and this can lead to conflicts between the new residents and the long-term residents.

There are few commercial businesses in the Wallsburg watershed and in Wallsburg itself. This is typical of small, rural communities where the population is not large enough to support many commercial businesses. The Wallsburg General Plan mentions the possibility of establishing new businesses in the community, including a convenience store.

The valley remains mostly agricultural and has many farms with well-developed infrastructure, such as sprinkler irrigation systems and extensive farm machinery. Some of the residences in town have corrals and other animal-related facilities next to them.

Some of the residences in Wallsburg show signs of economic stress. However, the town and valley in general have an overall appearance of economic health. Some residences in the valley do not fit the economic profile of the surrounding residences, an indication of the previously mentioned influx of new property owners. Some of the older properties in town have been well cared for.

5.1.3 Possible Future Economic Scenarios

This section presents four possible future economic scenarios for the Wallsburg watershed: (1) maintenance of the status quo, (2) moderate economic development, (3) moderate economic development with an emphasis on agriculture, and (4) aggressive economic development.

1. **Maintenance of the status quo.** If the community chooses, it could insist on maintaining the existing commercial and agricultural configuration of the valley. Only minimal changes to the business environment would occur. Agricultural operations would continue largely unchanged, and the population would evolve from generation to generation with few changes in overall composition.

2. **Moderate economic development.** In contrast, entrepreneurs could establish new businesses in or near Wallsburg. Businesses that depend on visitors from outside the valley would be vulnerable to fluctuations in traffic and visitation rates. Businesses designed to provide products and/or services to outside communities would have a higher probability of success because they would have a more stable customer base.

3. **Moderate economic development with an emphasis on agriculture.** In a separate scenario, the community could moderately expand business activities as described in scenario 2 but add agricultural capacity. In this scenario, the existing agricultural

community would optimize the use of natural resources to create a more economically and physically sustainable agricultural sector. There appear to be several opportunities in the Wallsburg area for improving agricultural output through more efficient use of resources. Although there are currently multiple sprinkler irrigation systems in operation in the valley, it also appears that there are additional opportunities to improve irrigation systems and agricultural systems in general.

4. **Aggressive economic development.** In this scenario, the current emphasis on rural community and agriculture would be dropped in favor of aggressive residential and commercial development. The Wallsburg watershed would become much more like a Snyderville Basin or Sun Valley–style community. Remnants of the existing town would make up the "historic" core of the new community, and many residential buildings would be either replaced or converted to commercial uses. Tourism and second-home residences would dominate, and zoning would be changed to support incoming development rather than protecting the current rural land uses.

   Expanding the commercial activities in the Wallsburg watershed would change the valley's character. Wallsburg's road system is designed to support only light traffic, and a new set of roads might need to be developed. However, it is unlikely that there are enough local customers to support a large increase in retail development. Therefore, businesses would need to attract customers from outside the valley. Further study would be required to determine whether businesses could attract customers outside the tourist season and what effect this would have on the existing rural community atmosphere.

5.1.4 Recommendations

The plan recommends the following actions in order to preserve the rural character of the Wallsburg watershed:

1. Commercial businesses in Wallsburg should cater to local customers. For example, a successful café or restaurant might be able to be established in town if it were to operate on a low-overhead basis and serve a menu that would attract repeat local customers on a regular basis. For long-term viability, commercial businesses are designed to provide products or services to customers outside the valley, they would need to be tied to stable markets. Being closely connected to outside markets tends to increase rather than decrease economic vulnerability and instability (Power 1998). This is even truer when an industry exploits natural resources for export outside the community at the expense of the community's beauty or natural amenities. We recommend that the community carefully consider the types of businesses it will allow in order to protect the existing natural environment and the general rural ambiance and maintain their economic and social benefits.

2. There are opportunities in the agricultural community to enhance output and make current farms and ranches more productive and profitable. If these operations can be made more profitable, this could delay or reverse the conversion of agricultural land to residential developments. As a result, the community would maintain the current rural lifestyle and atmosphere, as stated in the General Plan. An overview of existing and potential economic benefits from agriculture in the valley is shown in the table below. (TO BE ADDED)

3. New development in the Wallsburg watershed should follow the recommendations in the General Plan, especially with respect to cluster development and limitations on the sizes of individual lots. If large-scale changes in commercial or residential development patterns in the Wallsburg watershed are proposed, community leaders and residents should hire a facilitator or negotiator to make sure their voices are heard in the town's decision-making processes. Because the community is clearly vulnerable to an influx of new development and residents, it will be important for current residents, whether recent arrivals or long-term residents, to fully participate in civic dialogue and in decision-making processes such as zoning changes, transportation corridor developments, etc.

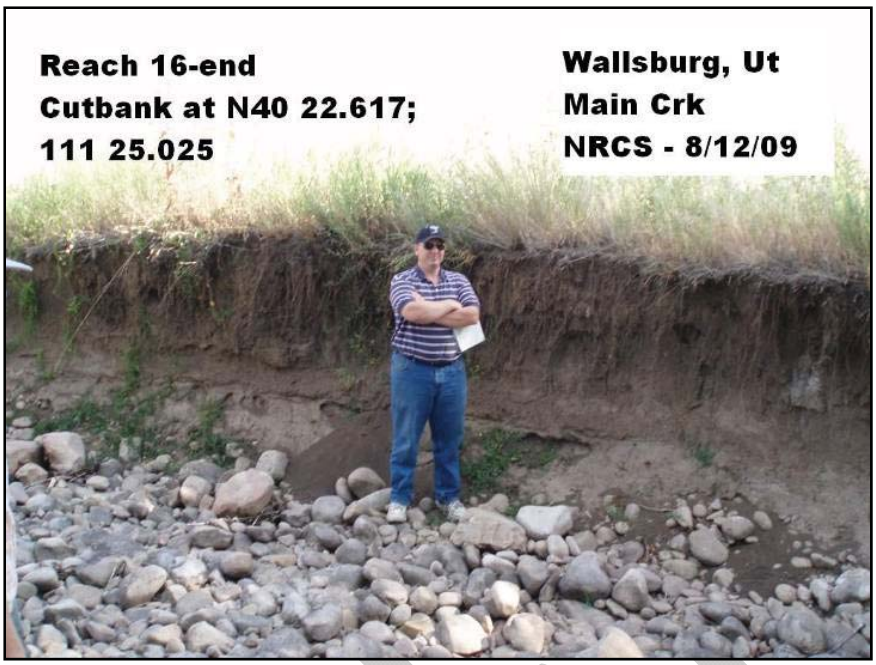
5.1.5 Conclusion

Wallsburg and the surrounding area are likely to undergo many changes in the coming years. In order for the economic component of these changes to serve the needs of the Wallsburg watershed as a whole rather than serving only the interests of specific individuals, the needs and preferences of the stakeholders—all valley residents—should be considered early in any decision-making process. Members of the community are encouraged to become actively engaged in guiding local decisions to ensure that changes in the local economy support local preferences as much as possible.

5.2 Riparian Assessment and Inventory

5.2.1 Background

The inventory described in the *Main Creek, Little Hobble Creek, and Upper Spring Creek Stream Visual Assessment Protocol ($SVAP_2$) Inventory* report (NRCS 2010a) was conducted by NRCS to identify areas of concern along and within the riparian corridors of Main Creek, Little Hobble Creek, and Spring Creek. The Stream Visual Assessment Protocol, Version 2 ($SVAP_2$) inventory was conducted on August 12–13, 2009, for Little Hobble Creek, Spring Creek, and most of Main Creek (Figure 5-1). An earlier $SVAP_2$ inventory was conducted in October 2006 for the lower 1.7 miles of Main Creek (reaches 25–29), the results of which are also included in NRCS's 2010 $SVAP_2$ report. The complete 2006 and 2010 $SVAP_2$ reports are attached as Appendix C, Stream Visualization and Assessment Protocol Report.



The $SVAP_2$ inventory team was composed of interdisciplinary members from the USDA, the Utah Association of Conservation Districts (UACD), and local landowners. The $SVAP_2$ inventory followed the standard protocols of NRCS's Stream Visual Assessment Protocol, Version 2. The protocol is described in detail in the *National Biology Handbook, Version 2*, Subpart B – Conservation Planning, Part 614 – Stream Visual Assessment Protocol (NRCS 2009). For most of Main Creek, the team could assess only eight of the 16 elements rated in the $SVAP_2$ protocol because the creek is mostly dewatered from April to October.

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Figure 5-1. SVAP$_2$ Stream Reaches (Upper Reaches)

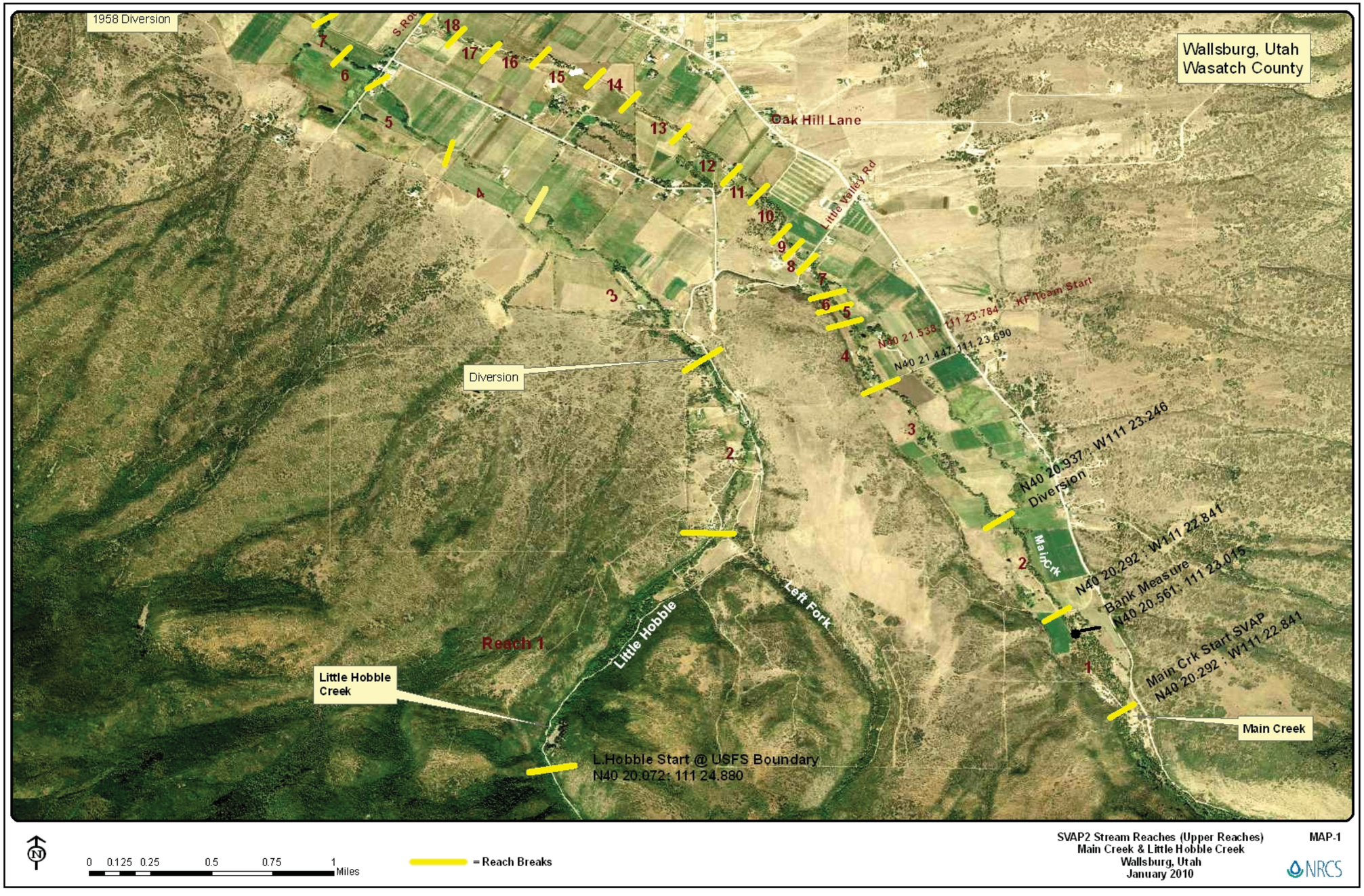
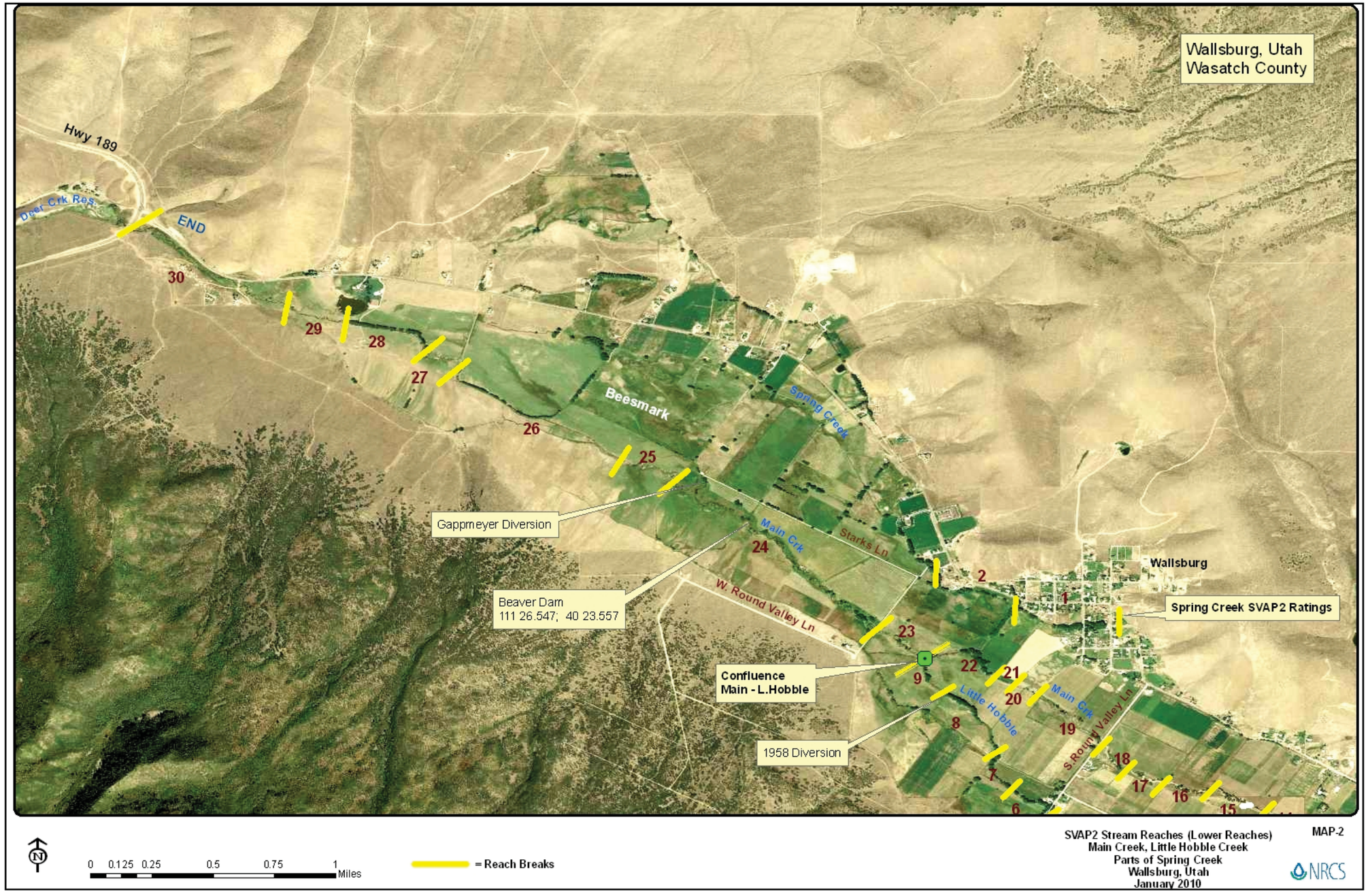


Figure 5-2. SVAP$_2$ Stream Reaches (Lower Reaches)



5.2.2 Results and Recommendations

The 2009 $SVAP_2$ inventory (NRCS 2010a) provided an assessment and restoration recommendations on a reach-by-reach basis as well as some overall recommendations, alternative recommendations, and proposed funding sources. The reach-by-reach $SVAP_2$ inventory is summarized for each reach as an overall score, as shown in Table 5-1.

Table 5-1. $SVAP_2$ Inventory Scores and Interpretation

$SVAP_2$ Score	General Condition	Main Creek (linear feet)	Little Hobble Creek (linear feet)	Spring Creek (linear feet)
1 to 2.9	Severely degraded	6,717 (17%)	0	0
3 to 4.9	Poor	17,372 (43%)	5,501 (24%)	0
5 to 6.9	Fair	14,609 (36%)	5,620 (24%)	3,515 (100%)
7 to 8.9	Good	1,480 (4%)	6,128 (26%)	0
9 to 10	Excellent	0	6,030 (26%)	0
	Total inventory	**40,178 (100%)**	**23,279 (100%)**	**3,515 (100%)**

Main Creek

An analysis of the 2007 and 2009 Main Creek $SVAP_2$ inventories revealed groups of reaches with similar $SVAP_2$ scores and similar needs and opportunities for restoration. For reaches 25–29 through the Beesmark Investment property, the following recommendations were made for restoration along about 1.7 miles of Main Creek. For the detailed recommendation, see Appendix C, Stream Visualization and Assessment Protocol Report.

General recommendations for Main Creek included:

- Restore flow.
- Increase riparian width.
- Control noxious/invasive plants.
- Control livestock access/fencing.
- Install bank protection/grade structures.
- Assess the need for old diversion structures and possibly remove them.
- Remove trash and debris from the channel.
- Plant native willows where recommended.

Little Hobble Creek

The Little Hobble Creek $SVAP_2$ scores were more variable than those for Main Creek, ranging from Excellent to Poor condition. Reaches 4, 6, 8, and 9 received Poor scores due to lack of woody riparian cover or non-native woody riparian cover, incised channel, unstable banks, and noxious weeds/invasive plants. Reaches 3 and 7 received Fair scores due to dewatered/turbid channel, noxious/invasive plants, and eroding banks.

General recommendations for Little Hobble Creek included:

- Install bank protection.
- Control livestock access.
- Assess the need for old diversion structures and possibly remove them.
- Remove trash and debris from the channel.
- Plant native willows where recommended.

Spring Creek

Two reaches on Spring Creek were assessed and used as training for the $SVAP_2$ protocol. Both reaches received Fair scores due to nutrient enrichment from livestock access. Reach 2 also suffered from low flows, inadequate riparian cover, and an impending head cut.

General recommendation for Spring Creek included:

- Control livestock access.
- Plant native willows in the lower reach.
- Mitigate the pending head cut.
- Consider velocity reduction.

Table 5-2 below provides a reach-by-reach summary of the $SVAP_2$ ratings, observations, and recommendations for Main Creek, Little Hobble Creek, and Spring Creek.

NRCS identified the potential for stream and habitat restoration work that could be planned, designed, and constructed through the Wetlands Restoration Program (WRP). There are three main options:

1. **Restoration Only.** Cost-share agreement with NRCS in which USDA would pay 75% of the costs and the landowner would pay 25% and agree to perform maintenance for 10 years.
2. **30-Year Easement.** Landowner agrees to a 30-year conservation easement along the creek, with permanent retirement of use for cropland for the easement area. USDA would pay 75% of the easement value, 75% of the restoration costs, and 100% of the legal costs to establish the easement.
3. **Permanent Easement.** Landowner agrees to a perpetuity conservation easement along the creek, with permanent retirement of use for cropland for the easement area. USDA would pay 100% of the easement value, 100% of the restoration costs, and 100% of the legal costs to establish the easement.

Table 5-2. SVAP$_2$ Summary – Main Creek to US 189

Rch No.	Stream - General Location	1 Chan Cond	2 Hyd Alt	3 Bnk Cnd	4 Rip Qnt	5 Rip Qual	6 Can Cover	7 Wat App	8 Nut Enrch	9 Man, Wste	10 Pools	11 Bar Mvmt	12 Fish Hab	13 Aq Hab.	14 Aq Com	15 Rif Embed	16 Saline	Total	Total / # rated	Reach Lngth (ft)	Erodg bank (ft)	Eros (ton)	Observations	Recommendations
1	Main Crk Diversion N40 20.292 ; W111 22.841; to Ables ~N40 20.292 ; W111 22.841	10	1	8	10	9	5	NR	NR	6	NR	0	NR	NR	NR	NR	NR	49	6.1	2436	0	0	Mostly dewatered during irrigation season, anything above 16 cfs continues downstream, channel dry in most of this reach, numerous bridges, livestock has access to the corridor, good age class of vegetation. Soil = Steed loam (St), Mountain loam bottom ecological site.	Not nuch opportunity for restoratin through this corridor - mainly needs water.
2	Able - N40 20.292 ; W111 22.841….to J.Young ~ N40 20.937 ; W111 23.246	10	0	8	3	9	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	33	5.5	2280	150	0.2	Diked alog entire reach; Riparian area reduced in width - limiited to active channel; Canopy~30%; 40 20.939 / 111 23.246; Warm Spring Div = 40 20.966/111 23.251. Soil = Steed loam (St), Mountain loam bottom ecological site.	Not much opportunity for restoration through this corridor, mainly needs water. 150 feet of bank protection.
3	J.Young to Taylors (Clarks old place) 40 21.447/111 23.690	10	1	7	4	8	3	NR	NR	6	NR	0	NR	NR	NR	NR	NR	39	4.9	3687	300	0.7	Numerous bridges; Dewatered; Livestock have access; Riparian density limited-but is wide; Invasives=Houndstongue, Thistle. Soil = Steed loam (St), Mountain loam bottom ecological site (upper 80% of reach; Kovich loam (Km) at lower 20% of reach.	Not much opportunity for restoration through this corridor; channel morphology is good, mainly needs water. 300 feet of bank protection.
4	KF-Team Start N40 21.538 / 111 23.784 - Clark--> Prop line	9	2	8	8	6	8	NR	NR	8	NR	8	NR	NR	NR	NR	NR	57	7.1	1480	300	0.9	Dewatered (May-Sept), some ponded areas, Woody veg good, herbaceous layer w/invasives, smooth brome; scotch/musk/Canadian thistle; Bulbous bluegrass, cheatgrass, field bindweed; [scuds, mayfly, dragonfly, snail]; Pool N40 21.664/ 111 23.814 (break reach). Soil = Kovich loam (Km) -	Control invasives - especially noxious weeds; Not much opportunity for restoration other than….adding water back to the corridor. 300 feet of bank protection.
5	Start: N40 21.664 111 23.814	9	3	8	8	6	8	6	7	8	3	8	4	5	7	8	NR	98	6.5	400	0	0	Dewatered (May-Sept), some shallow pools; water withdrawals is main driver in this corridor. Soil = Kovich loam (Km) -	Not much opportunity for restoration without water during growing season.
6	Start: N 40 21.686 111 23.843	8	2	7	7	4	8	NR	NR	1	NR	8	NR	NR	NR	NR	NR	45	5.6	330	0	0	Understory eliminated, width of riparian vegetation reduced; horse manue in stream & riparian areas. Soil = Kovich loam (Km) -	Grazing management - control access or reduce numbers.
7	Start: N40 21.757 111 23.880	7	2	6	6	5	8	NR	NR	3	NR	8	NR	NR	NR	NR	NR	45	5.6	835	0	0	Crack willow present, Moter wort, bedstraw, penny cressin herbaceous. Soil = Kovich loam (Km) -	Grazing management - control access to the stream or reduce numbers.
8	Start: L.Valley Rd to Div - 40 21.925 / 111 24.010	7	2	5	1	3	2	NR	NR	9	NR	1	NR	NR	NR	NR	NR	30	**3.8**	360	0	0	Riparian aree restricted by corrals/residence; riparian zone under modification, one age class-dominated by narrow-leaf cottonwood; Canopy cover reduced; Diversion=partial barrier to young fish (even when not dewatered). Reach previous = encroachment on both banks, weedy pasture & house at rt side / barrels/coops/sheds/corral at left side, trash in stream, goat corral on right bank ==> confines riparian zone. Soil = Kovich loam (Km) -	Remove diversion; Relocate corrals - set back from stream; Leave woody debris in creek; Comprehensive Nutrient Management Plan needed.
9	Diversion to Drain ditch discharge - 40 21.987;111 24.061	5	2	6	1	3	7	NR	NR	5	NR	1	NR	NR	NR	NR	NR	30	**3.8**	375	0	0	Channel incised- Stage IV; Riparian similar to previous reach/better canopy cover; Drainage ditch results in concentrated flow that can carry manure from corrals to stream. Soil = Kovich loam (Km) -	Remove diversion, expand riparian zone (buffer) to filter drainage flows; Look at WQ sample; AFO/CAFO - Comprehensive Nutrient Management Plan (from drainage ditch).
10	Drain Ditch to Pipe crossing - 40 22.113; 111 24.149	5	2	8	7	5	4	NR	NR	8	NR	8	NR	NR	NR	NR	NR	47	5.9	960	0	0	Increase in herbaceous cover through this reach; undisturbed width, W. wheatgrass, crested wheatgrass, smooth brome, orchard grass, mostly mature trees; Livestock have access; Manure on terrace adjacent, but limited use evident w/tall grasses.	CRP - right bank
11	Pipe Crossing to Oak Hill Ln: 40 22.191; 111 24.225	6	2	8	8	5	2	NR	NR	8	NR	8	NR	NR	NR	NR	NR	47	5.9	650	150	0.7	Stream has access to floodplain in spots; riparian vegetation recruitment on one side; cropland encroaching & limiting width on other side.	CRP or other protection program for left bank area (looking downstream). 150 feet of bank protection.

Rch No.	Stream - General Location	1 Chan Cond	2 Hyd Alt	3 Bnk Cnd	4 Rip Qnt	5 Rip Qual	6 Can Cover	7 Wat App	8 Nut Enrch	9 Man, Wste	10 Pools	11 Bar Mvmt	12 Fish Hab	13 Aq Hab.	14 Aq Com	15 Rif Embed	16 Saline	Total	Total / # rated	Reach Lngth (ft)	Erodg bank (ft)	Eros (ton)	Observations	Recommendations
12	Oak Hill Ln to Fence - 40 22.340; 111 24.405	1	2	2	1	3	3	NR	NR	1	NR	8	NR	NR	NR	NR	NR	21	2.6	1250	300	1	Cars in stream used for rip-rap; corral in stream; sheds falling in; lack of woody riparian vegetation; garden on the bank; reach is straightened and diked. Pictures: KF #26 = 40 22.225 / 111 24.270 (corral); #28 looking US from end of reach	Control livestock access to the stream; Grazing Management education will be useful here; IPM on alfalfa ; broadleaf herbicide has reduced age-class diversity. 300 feet of bank protection
13	Fence to Fence at 40 22.442; 111 24.593	3	2	6	1	3	1	NR	NR	8	NR	NR	NR	NR	NR	NR	NR	24	3.4	1100	0	0	Herbicide in alfalfa may kill some age classes of cottonwood; No manure, but potential commercial fertilizer runoff; Large veg. gaps; Reduced diversity; Some rip-rap areas and diked in sections. Photos: KF #29	Nutrient management; Integrated Pest Management; Planting of riparian vegetation.
14	Fence to Fence at 40 22.524; 111 24.723	2	2	5	0	1	0	NR	NR	8	NR	8	NR	NR	NR	NR	NR	26	3.3	800	0	0	Rip-rap in this section, dikes, concrete, stream crossing; No woody vegetation, large gaps, non-native herbaceous. Pictures: KF# 30- gabions SOIL: Km= Kovich loam-deep water table - depth to root restrictive layer >60", avail water to 60" is high, seasonal zone of saturation at 36" during April through June, OM in surface =~8%, Irrig Cap Class = 3w (includes upstream to 500 feet DS of Oak Hill Ln)	Tree planting
15	Fence to end of dikes/rip-rap: 40 22.551 ; 111 24.766 to 40 22.597; 111 24.894	1	2	2	1	3	2	NR	NR	8	NR	8	NR	NR	NR	NR	NR	27	3.4	1030	0	0	High dikes, thistle, debris dam in fence- N40 22.577; 111 24.836; rip-rap in this corridor, reach is channelized. Picture: KF#31 Top of reach	Thistle control, take debris out of stream if it can cause lateral cutting.
16	End of dike/riprap to N40 22.617; 111 25.025	6	2	6	6	5	2	NR	NR	9	NR	8	NR	NR	NR	NR	NR	44	5.5	862	250	9	Incision with recovery, some cut banks; moderately stable in most sections, some bank failures, no grazing impacts, low species diversity, introduced understory, some vegetal gaps, some functional groups. Pictures: KF #33-34 - end of rch cutbank	Water needed. 250 feet of bank protection
17	End of narrowleaf ctnwood begin crack willow : N40 22.670; 111 25.210	6	2	6	4	3	1	NR	NR	9	NR	8	NR	NR	NR	NR	NR	39	4.9	740	350	2	Fewer trees - mostly hawthorn; mostly introduced understory, Canada thistle, some rip-rap including cars (contributing to recovery); Fences creating debris jams. Pictures: KF # 35,36 = car riprap, typical reach SOIL: same Kovich soil (Km) as upstream	Tree planting; Noxious weed control. 350 feet of bank protection
18	Fence @ crack willow to Round Valley Rd (Check)	6	2	7	4	4	3	NR	NR	9	NR	8	NR	NR	NR	NR	NR	43	5.4	868	400	11	Banks mostly protected by grasses/crack willow, large gaps however, patches of crack willow, hawthorn; Some canopy cover from crack willow. Pictures: KF # 37-from Round Valley Rd looking upstream. Soil change to CgA around farmstead = Clegg loam = no zone of saturation within 72"; OM=4%; Non-irrig capability=4e / Irrig = 3e	Remove trash from channel; Fences cause debris jams; Tree planting. 400 feet of bank protection
19	Round Valley Rd to 40 22.885; 111 25.427 - fence-end of chnlized section 40 22.940; 111 25.527	1	2	7	1	5	9	NR	NR	9	NR	8	NR	NR	NR	NR	NR	42	5.3	1690	500	14	Transition to lowland riparian; car rip-rap present-stabilized w/trees; Coyote willow in channel directing water toward right bank; Channelized; Fence adjacent on left bank - cutbanks undercutting smooth brome ~3' deep; Very narrow reach - becoming clogged with willow. Pictures: KF # 39-41 riprap & trash in channel	Set back existing fence on the left bank; Remove trash. 500 feet of bank protection
20	End Chan sect to fence @ end of riprap - 40 22.980; 111 25.605	1	2	3	1	3	1	NR	NR	2	NR	8	NR	NR	NR	NR	NR	21	2.6	435	300	12	Cars as riprap, concrete, stumps, root wads present; Livestock access breaking down bank in sections; Pasture over-grazaed. Pictures: KF# 39-41 top reach, 42 bank condition. SOIL: change in this to CrA (Crooked Crk clay loam; seasonal zone saturation at 18" - year round; occasionally flooded; poorly drained; Wet Fresh Meadow (sedge) ecological site; Non-irrig/Irrig Capability = 4w; Hydric;	Grazing Management - control access; Pull out old riprap; Slope back banks / Revegetate. 300 feet of bank protection.
21	Start: 40 22.980; 111 25.605….to..40 22.998; 111 25.667	5	2	7	4	5	8	NR	NR	8	NR	8	NR	NR	NR	NR	NR	47	5.9	357	0	0	Overall stabilized/vegetated riprap; Incised - but not as deep; Missing tall trees; mostly coyote willow; Some invasives. Pictures: #43	Overall grazing management; weed control

Rch No.	Stream - General Location	1 Chan Cond	2 Hyd Alt	3 Bnk Cnd	4 Rip Qnt	5 Rip Qual	6 Can Cover	7 Wat App	8 Nut Enrch	9 Man, Wste	10 Pools	11 Bar Mvmt	12 Fish Hab	13 Aq Hab.	14 Aq Com	15 Rif Embed	16 Saline	Total	Total / # rated	Reach Lngth (ft)	Erodg bank (ft)	Eros (ton)	Observations	Recommendations
22	40 22.998/111 25.667 to Little.Hobble Crk Confluence	6	2	5	1	1	1	5	6	3	5	9	6	6	5	4	NR	65	**4.3**	1576	300	6	Crack willows w/no understory; Heavy impacts from cattle; Bare soil & manure on banks; Cattle breaking down banks; Diversion water returns in springs; Introduced pasture grasses downstream. Pictures: KF # 44-46=top of reach,cows in crk, div across fence line; #50,51 = 40 23.069; 111 25.869 = broken fld drain discharge to crk. SOIL: change to Kd (Kovich loam-channeled); poorly drained, avail water to 60" is low; seasonal zone of saturation at 18" during Jan-June & Nov-Dec; Non-irrig land capability = 7w; Irrig = 3w; meets Hydric criteria.	Grazing management; Cross fencing; Riparian pasture; Tree planting; Bank protection. 300 feet of bank protection
23	Conflu - Main/Hobble to Smart Rd Bridge	6	2	3	1	1	1	5	5	4	7	9	2	4	5	3	NR	58	**3.9**	1142	500	24	Stage IV - recovering, withdrawals, excessive bank erosion, water appearance visible to ~2 feet, algae present, mayfly & scuds present,	Grazing management (address livestock access), tree planting for improved woody diversity, thistle control, streambank protection (bio-engineering); 500 feet of bank protection
24	Smart Rd Bridge to property line downstream of the Gappmeyer diversion @ 40 23.686; 111 26.812 **<END>**	7	7	6	4	5	2	9	4	8	10	10	7	7	7	4	NR	97	6.5	5377	2000	95	Stage V - cutbanks, some water withdrawals, eroding at cutbanks, numerous riparian veg gaps - but decent diversity, young age class, Good numbers of young native woody species, decent floodplain access, midges, mayflies, caddis - good abundance, couple cars for rip-rap in bank, beaver dam @ 40 23.558; 111 26.568; (check valley slope)	Enhance woody vegetation, thistle control, bank protection, continue grazing management practices. Check hydrology/hydraulics- valley slope (Nathaniel modeling). 2000 feet of bank protection
25	Beesmark 2006 SVAP-Reach 1 - *continue reaches to Hwy189*	2	4	1	1	1	1	5	5	3	3	8	3	2	2	3	NR	44	**2.9**	1802	775	21	E3 Channel characteristics, some floodplain access, channel actively widening-but not deeply incised or entrenched, cutbanks actively eroding (3-6 ft high), no riparian vegetation, excessive sediment in stream, livestock has access, manure in stream.	Good potential for restoration. Restriction of livestock will allow woody/herbaceous vegetation to re-establish and help stabilize banks. Consider planting willows to expedite recovery. No instream structures required. 775 feet of bank protection
26	Beesmark 2006 SVAP-Reach 2	1	1	1	1	1	2	5	5	3	1	8	2	1	1	3	NR	36	**2.4**	3230	1600	32	F3 Channel, hydrology severely impaired, channel straightened, deeply incised, eroding banks-both sides (5,000+ feet); some Crack willows present below Spring Crk outlet, little to no habitat for fish or invertebrates, livestock access and manure impairing channel, rip-rap at 90 degree bend at end of reach	Low potential of restoring function to this reach due to past alterations, restricting livestock will allow woody/herbaceous vegetation to recover, willows may need to be planted to help expedite recovery. Consider designed cross vanes to reduce stream slope if lateral movement of banks accelerates. Rip-rap/Pole Planting may be needed at end of reach at 90 deg turn (8 ft bank); 1600' of bank protection
27	Beesmark 2006 SVAP-Reach 3	4	5	4	1	1	1	5	5	3	3	8	3	1	1	3	NR	48	**3.2**	721	218	2.2	Braided channel, Spring Crk contributing to flow, banks moderately unstable, flows have access to floodplain, riparian vegetation is absent, poor fish habitat	High potential for restoration, restrict livestock access, enhance woody/herbaceous cover; plant willows to help recovery and accelerated headcutting. Pending headcutting ==> instream structure may be needed. 218 feet of bank protection
28	Beesmark 2006 SVAP-Reach 4	5	6	7	3	3	6	5	5	3	5	8	6	3	3	2	NR	70	**4.7**	1554	276	2.8	B3c Channel, channel straightened, some rip-rap/crack willow on both sides, hydrol improved due to upstream tribs; livestock access/manure present	Moderate potential to restore function; restrict livestock access to the stream; no instream structures required. 276 feet of bank protection
29	Beesmark 2006 SVAP-Reach 5	7	5	4	1	1	1	5	5	3	3	8	4	1	1	3	NR	52	**3.5**	1077	822	8.3	C3 Channel, Heavy grazing removed woody veg, inadequate root masses in banks, high potential for restoration, channel has access to floodplain, 2-4 ft banks eroding, no riparian vegetation,	Grazing management (restrict-limit access); plant woody veg - wiillows; no instream structures required; 822 feet of bank protection
30	Below Beesmark - to Hwy 189 - KF team	6	3	6	2	3	2	4	5	5	7	9	4	5	5	0	NR	66	**4.4**	3210	500	5.4	Recovering-Stage IV - past incision in this section; Horses impacting bank stability & riparian quality; scattered willows, mostly herbaceous cover on banks; turbid water in pools; Algae in riffles; Horses have unlimited access part of the year; Pools present - not obscured by depth. Some mayflies, scuds (dom); crayfish	Control horse access; Consider bio-engineering practices; 500 feet of bank protection
																				42614	9991	247		

Table 5-3. SVAP$_2$ Summary – Little Hobble Creek to Main Creek Confluence

Rch No.	Stream - General Location	1 Chan Cond	2 Hyd Alt	3 Bnk Cnd	4 Rip Qnt	5 Rip Qual	6 Can Cover	7 Wat App	8 Nut Enrch	9 Man, Wste	10 Pools	11 Bar Mvmt	12 Fish Hab	13 Aq Hab.	14 Aq Com	15 Rif Embed	16 Saline	Total	Total / # rated	Reach Lgnth (ft)	Erode (ft)	Eros (ton)	Observations	Recommendations
1	Little Hobble-USFS to L.Fork Confluence	10	8	9	10	9	10	10	10	9	10	9	9	9	10	10	NR	142	9.5	6030	0	0	Flood d div has right to 50% water, but not taking that much, caddis, mayfly, stonefly present, no macrophyte beds	Maintain roads for erosion control, monitor runoff impacts to the stream
2	L.Fork to Sprinkling Diversion	7	8	8	6	7	5	10	9	6	10	8	10	10	8	8	NR	120	8.0	4100	0	0	Several bridges in this reach/some seem to narrow, culverts present, caddis mayfly, snails, some incision, thistle, houndstongue, knapweed	Some livestock access problems (patures) - can be solved; Increase woody vegetation where there are gaps.
3	L.Hobble Sprinkler Diversion to: N40 22.078; 111 24.930	5	5	6	4	5	4	10	6	8	10	8	7	8	8	6	NR	100	6.7	4676	320	15	Highway ditch runoff to culverts frequent, willow growth good through the reach, water is sediment laden after storm events (from upper areas); access of cattle to the stream (not much activity however - due to steep slopes); channel dewatered but establishes quickly ds, steel pipe crossing-low; smooth brome, thistle, knapweed, no large wood, few root matts	Channel dewatered, but establishes flow quickly downstream; 320 feet of bank protection practices
4	N40 22.078; 111 24.930 to the lane past big barn	4	5	4	0	1	0	10	4	4	3	1	1	2	8	6	NR	53	**3.5**	2022	500	4	No woody vegetation, entrenched channel, numerous cut banks (incised), water withdrawals, excessive erosion, smooth brome dominates, algae-covered rocks, some cobbles/boulders present.	Grazing management, woody riparian establishment. Look at bridges. 500 feet of bank protection
5	Lane past big barn - to next Lane	7	5	9	8	8	9	10	9	8	10	1	8	9	8	7	NR	116	7.7	2028	170	0.5	Incission, some bank erosion, withdrawals, narrow riparian community, invasives present, some algae, culvert/diversion - both ends, dominant mayfly, some stonefly, caddis, snails	Fix culvert for fish access, look at bridges (need?); grazing management, widen buffer area in some locations. 170 feet of bank protection
6	"Next Lane" to end of property (short reach)	3	2	2	1	2	6	10	6	0	7	0	4	4	6	2	NR	55	**3.7**	961	375	7	Stage II, many bank failures, dewatered, only few crack willows, thistle, canopy~50%, some algae, severe livestock access impact, 1 large/ 1small pool, scuds dominant, caddis & stonefly present	Address grazing management (livestock access), enhance woody vegetation; bank protection measures. 375 feet of bank protection
7	"Short reach" to old diversion @ Big guns	4	2	6	7	6	8	6	6	8	5	1	4	NR	6	1	NR	70	5.0	944	150	1	Incised, no floodplain, almost dewatered, some bank erosion, good riparian density/diversity…but invasives common, some turbidity, some algae, stubble grazing in hay fields, shallow pools only, old diversion present, junk cars/appliances present on banks; scuds, snails, mayfly, caddis present	Remove appliances/cars from streambanks; Assess need for old diverson structures with sprinklers; Evaluate incision at this reach ==> no straightening/dikes? 150 feet of bank protection
8	"Old diversion w/big guns to 1958 diversion 40 22.945; 111 25.846	5	1	5	5	4	9	7	7	5	7	0	4	5	5	0	NR	69	**4.6**	1642	800	14	Incised, no floodplain access, stagnant water, some bank erosion, riparian area is narrow/some gaps, old age crack willow, turbid water-clearing further downstream, some algae, manure in stream w/pasture access, low aquatic inverts, sediment high, stonefly & mayfly present.	Assess old diversions/remove - is there need with sprinkling systems already installed; manage livestock access. 800 feet of bank protection
9	"1958/68 Diversion" to confluence with Main Creek.	6	2	3	1	1	3	5	5	5	8	1	4	2	6	2	NR	54	**3.6**	876	300	5	Minor incision, hydro alteration w/withdrawals, excess bank erosion, scattered crack willows, invasive herbaceous community, all introduced woody veg, cattle access keep water turbid, algae & odor present, manure present, stonefly/caddis present (not abundant)	Grazing management (address livestock access), woody vegetation needed, bank protection alternatives. 300 feet of bank protection

Table 5-4. SVAP$_2$ Summary – Spring Creek (Upper Section)

Rch No.	Stream - General Location	1 Chan Cond	2 Hyd Alt	3 Bnk Cnd	4 Rip Qnt	5 Rip Qual	6 Can Cover	7 Wat App	8 Nut Enrch	9 Man, Wste	10 Pools	11 Bar Mvmt	12 Fish Hab	13 Aq Hab.	14 Aq Com	15 Rif Embed	16 Saline	Total	Total / # rated	Reach Lgnth (ft)	Erode (ft)	Eros (ton)	Observations	Recommendations
1	Spring Crk -source N40 23.196; -111 25.236 --to-- Crack Willow boundary - N40 23.249; -111 25.603	10	8	8	7	7.5	9	10	3	2	2	10	4	5	5	NR	NR	90.5	**6.5**	1800			B-channel (Rosgen), Photos 1-8, Spring fed flows (4-5 cfs), Livestock access==> nutrient enrichment from livestock & septic sources, mostly grp I invertebrates. Soils = Wallsburg-Rock Outcrop complex; colluvium/residuum parent material, depth to root restrictive layer = 12-20 inches, well drained, Mountain Shallow Loam ecological site, not hydric.	Water quality testing, Grazing Management/access, Shrub planting
2	Crack Willows-N40 23.249; -111 25.603 --to--ditch cleanout @ N40 23.376; -111 25.882.	5	5	5	1	4	2	9	9	4	2	5	6	7	8	3	NR	75	**5.0**	1715			Livestock impacts severe, no channel-forming flows, return ditch and diversion ditch in the reach, culvert, needs trees, non-native veg dominant, Risk of de-watering wet meadow if headcutting/gradient changes. Soil = Crooked Creek clay loam, parent material is alluvium from mixed sources, zone of water saturation is at 18 inches year round, meets hydric criteria, Wet Fresh Meadow ecological site.	Grazing Management, Plant trees, control access, consider potential for headcutting due to twiggs/woody debris concentration ==> consider grade control practice, Corral placement consideration, Nutrient Management. Consider wetland conditions of the soil.

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General Recommendations

The NRCS $SVAP_2$ report (NRCS 2010a) identifies improvements to the riparian corridors that have been inventoried and assessed. These improvements fall into two broad categories: conservation practices and restoration practices. Improvements are estimated to cost about $554,100.

Conservation buffers, which are strips of riparian vegetation placed to provide ecological protections and benefits, are recommended for all three streams in the valley. The recommended conservation practice and cost estimate for each stream is summarized in Table 5-5 below. In all, the work recommended to implement conservation practices in the watershed totals about $367,200.

Table 5-5. Recommended Conservation Practices and Estimated Costs for Stream and Habitat Restoration

Practice	Main Creek	Little Hobble Creek	Spring Creek
Channel bank vegetation	$80,000	$19,500	$2,600
Fence	$30,700	$15,400	$6,200
Riparian herbaceous cover	$1,600	$1,300	—
Stream habitat improvement and management	—	$65,000	—
Prescribed grazing	$2,400	$1,000	$500
Streambank protection	$80,000	$10,700	$1,800
Pest management	$33,100	$4,000	—
Watering facility	$6,100	$4,100	$1,200
Total	**$233,900**	**$121,000**	**$12,300**

In addition to the construction practices for the three creeks, specific restoration activities on the Beesmark section (reaches 25–29) of Main Creek were identified. Activities and cost estimates for about 8,384 linear feet of this section of Main Creek are identified in Table 5-6 below.

Table 5-6. Recommended Restoration Activities and Estimated Costs for Reaches 25–29 of Main Creek

Practice	Cost
Earthwork	$43,200
Establishing vegetation	$90,600
Reinforced concrete structure	$22,400
Fencing	$30,700
Total	**$186,900**

An alternative consideration proposed in the $SVAP_2$ report (NRCS 2010a) is to restore flow to Main Creek and Little Hobble Creek. These creeks are mostly dewatered from April to October by irrigation withdrawals. Restoring stream flows during the growing season would yield great benefits to the fishery, riparian condition, and overall functioning of the ecosystem. The Central Utah Project operates a pipeline near the headwaters of Main Creek and Little Hobble Creek. The report recommends evaluating the possibility of working with the Central Utah Water Conservancy District to provide an additional source of water for irrigation, thereby allowing continuous flows in Main Creek.

5.3 Range Assessment and Inventory

5.3.1 Background

NRCS has prepared a report titled *Wallsburg Watershed Grazinglands* (NRCS 2010c). The grazinglands report inventories and assesses all the rangelands, pasturelands, and haylands in the Wallsburg watershed. Rangeland classification in the report uses the NRCS Soil Survey Ecological Site Assessment framework. The complete grazinglands report, which includes information for the pastureland and agricultural assessments is summarized below and is attached as Appendix D, Grazingland, Forest, and Pastureland Reports.

5.3.2 Results and Recommendations

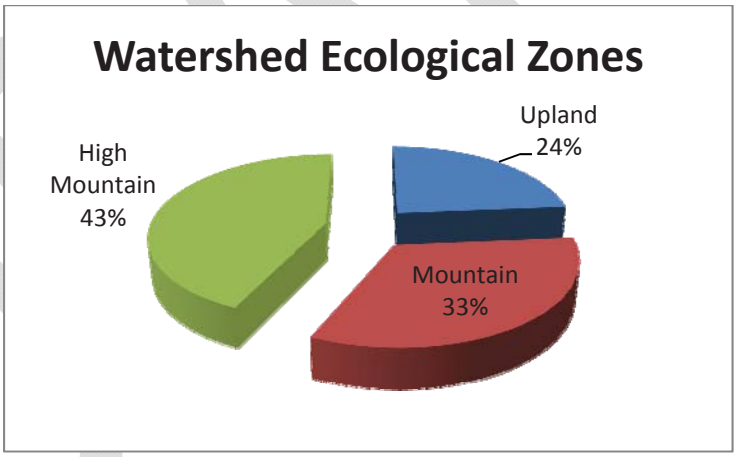
Rangelands in the Wallsburg watershed are present in three ecological zones—the upland, mountain, and high mountain zones—as well as in several ecological sites. Ecological zones were defined in the report by the characteristics in Table 5-7 below. In general, the Uplands are characterized by high sagebrush cover (>30%) and an understory dominated by bulbous bluegrass or Sandberg bluegrass. These plant communities indicate that improper grazing practices (heavy, continuous, season-long grazing, or HCSLG) have been used on the site in the past. Burned and reseeded areas with a greater perennial grass component are important mule deer winter ranges. There are about 9,764 acres of Upland zone within the watershed.

The Mountain sites are characterized by dominant Gambel oak cover and a poor understory plant composition. Native perennial grasses are largely absent, but forbs and shrubs are diverse, indicating that improper grazing practices have been used in the past. There are about 13,692 acres of Mountain zone within the watershed.

The High Mountain sites are characterized as complexes of aspen, oak, and conifers. Most of the High Mountain sites were in good condition but had similar symptoms in their understory plant community of improper grazing practices as the lower-elevation sites. There are about 17,837 acres of High Mountain zone within the watershed.

Figure 5-3 identifies the ecological zones and the percentage of each zone in the watershed.

Figure 5-3. Ecological Zones in the Wallsburg Watershed



Within each ecological site is a range of conditions and plant communities. The major ecological sites identified in the grazinglands report are summarized in Table 5-7 below. Several small (less than 100-acre) ecological sites were also identified in the report but are not described in Table 5-7.

Table 5-7. Inventory and Ecological Site Characterization of Rangelands in the Wallsburg Watershed

Ecological Zone	Characteristics	Ecological Site		Acres	Comments
		Soil	Plant Community		
Upland	Lowest elevations 16 inches/year precipitation Xeric/frigid big sagebrush and juniper	Loam	Bonneville big sagebrush	1,450	Sagebrush cover 20–35%, understory variable.
			(Bonneville big sagebrush) bulbous bluegrass stand	158	No shrubs or perennials, probably tilled. Bulbous bluegrass dominated.
		Loam	Wyoming big sagebrush	129	Understory dominated by Sandberg bluegrass and introduced perennials. Sagebrush cover 36%.
			Basin big sagebrush	688	Very good-condition, productive and diverse understory. Sagebrush cover >30%.
		Gravelly loam	Bonneville big sagebrush	3,586	Understory of Sandberg, Kentucky, bulbous bluegrasses; sagebrush cover up to 30–35%.
			(Bonneville big sagebrush) oak invaded	2,077	Understory of Sandberg, Kentucky, bulbous bluegrasses.
			(Bonneville big sagebrush) recent burn	23	Pubescent and crested wheatgrass dominant.
		Stony loam	Bonneville big sagebrush	580	Cheatgrass, bulbous bluegrass dominated.
		Upland shallow loam	Black sagebrush	522	
		Mountain clay loam	Slender wheatgrass	58	
		Bonneville big sagebrush site complex, burned, reseeded		493	Non-native grasses, sagebrush cover 4%.
Mountain	Most abundant 16–22 inches/year precipitation Xeric/frigid Gambel oak	Loam	Gambel oak	1,571	Lacking perennial bunchgrasses, past HCSLG.
		Gravelly loam	Gambel oak	10,822	Lacking perennial bunchgrasses, past HCSLG.
		Stony loam	Gambel oak	1,299	Lacking perennial bunchgrasses, past HCSLG.
High Mountain	Highest elevations >22 inches/year precipitation Udic/frigid-cryic Aspen/conifer	Loam	Aspen	7,022	Generally good condition, some evidence of HCSLG.
			Douglas fir	543	
		Stony loam	Aspen	6,770	Generally good condition, some evidence of HCSLG.
			Douglas fir	27	
			Mixed conifer	3,454	Generally healthy; some insect damage.
		Lithic	Aspen	21	

Source: NRCS 2010c

The major resource problems related to rangelands identified in the grazinglands report are summarized below.

- Invasive species:
  - Lower-elevation understory plant communities are dominated by bulbous bluegrass, which decreases the value for wildlife habitat and livestock forage.
  - Noxious weeds, including musk, Canadian and Scotch thistle, and knapweeds are present in the watershed and could rapidly expand if not controlled.
- Livestock forage:
  - Forage production is below potential. Replacing invasives with perennial grasses and improving grazing management might improve production.
  - Inadequate stock watering sources limit the grazing management flexibility needed to accomplish time-controlled grazing.

The *Wallsburg Watershed Grazinglands* report (NRCS 2010c) makes several recommendations that are summarized in Table 5-8 below. More details can be found in Appendix D, Grazingland, Forest, and Pastureland Reports.

Table 5-8. Recommended Practices to Improve Grazinglands in the Wallsburg Watershed

Practice	Activity	Description	Cost Estimate
Prescribed grazing	Grazing Land Conservation Plans	Considered first priority.	$80,000
	Prescribed grazing	Implement on 10,000 acres	$40,000
	Stock watering	Install 10 new sources	$50,000
	Fences	Install 10 miles of fence	$50,000
Brush management	Sagebrush-sites	Reduce sagebrush cover to 15% on 3,150 acres	$315,000
	Oak-invaded sites	Chemical treatment of oak	$50,000
Weed control	Spot treatment and public outreach	Spray noxious infestations; public relations campaign	$15,000
Wildlife habitat management	Conduct above treatments with wildlife habitat concerns in mind	Maintain sagebrush and maximize edges for wildlife	$0
		Total	**$600,000**

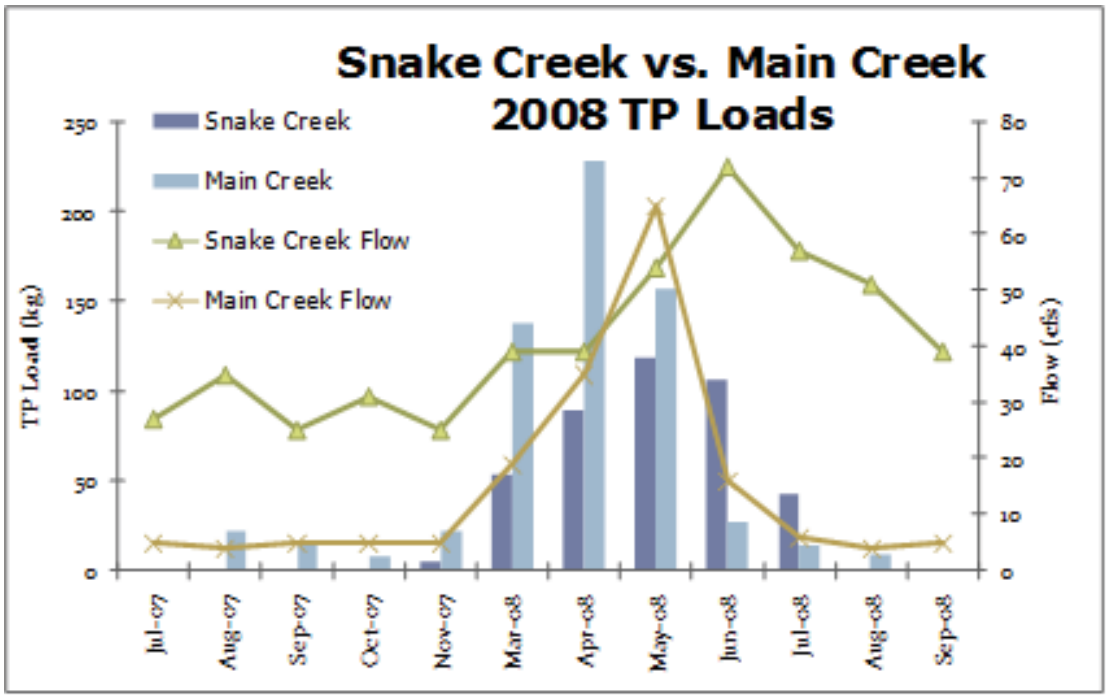
5.4 Water Quality Assessment

5.4.1 Background

A Water Quality Assessment Report was prepared by Desert Rose Environmental (2012). The report presents the results of monthly water quality sampling and analyses conducted from October 2009 through September 2010, compares this recent water quality with historic data, and relates the results of the SVAP analysis to water quality results. The complete Wallsburg Watershed Water Quality Assessment Report is attached as Appendix E, Water Quality Assessment Report.

Section 4.5, Water Resources, describes the watershed and the surface water resources in the valley. Section 4.5.4, Water Quality, provides a detailed description of the TMDL status for Deer Creek Reservoir. Main Creek is one of the four major stream inputs to Deer Creek Reservoir, and the creek contributes 8% of the reservoir's inflow and 17% of the phosphorus load. The reservoir's TMDL study establishes water quality targets and endpoints for the waters entering the reservoir, including Main Creek. The TMDL's phosphorus targets for streams tributary to Deer Creek are 0.030 mg/L for total phosphorous and 0.025 mg/L for dissolved total phosphorous (Figure 5-4).

Figure 5-4. Monthly Total Phosphorous Loads and Flows for Snake Creek and Main Creek Drainages to Deer Creek Reservoir

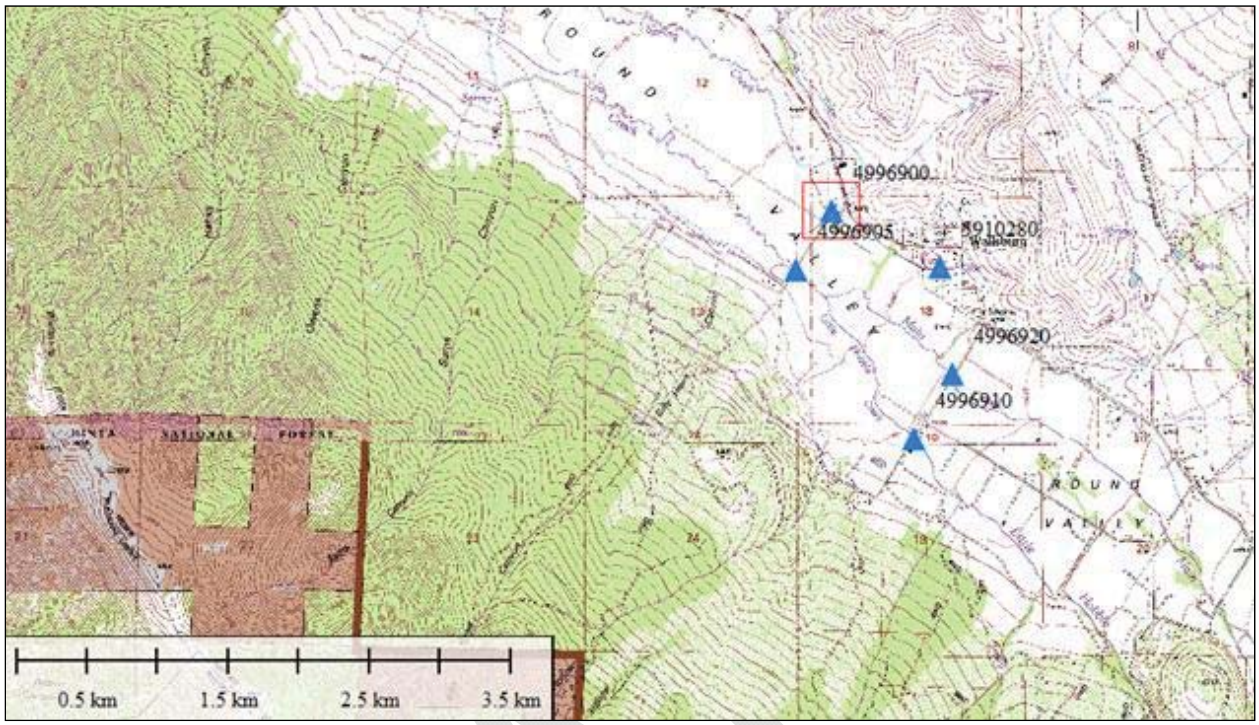


5.4.2 Results

2009-2010 Monthly Water Quality Sampling

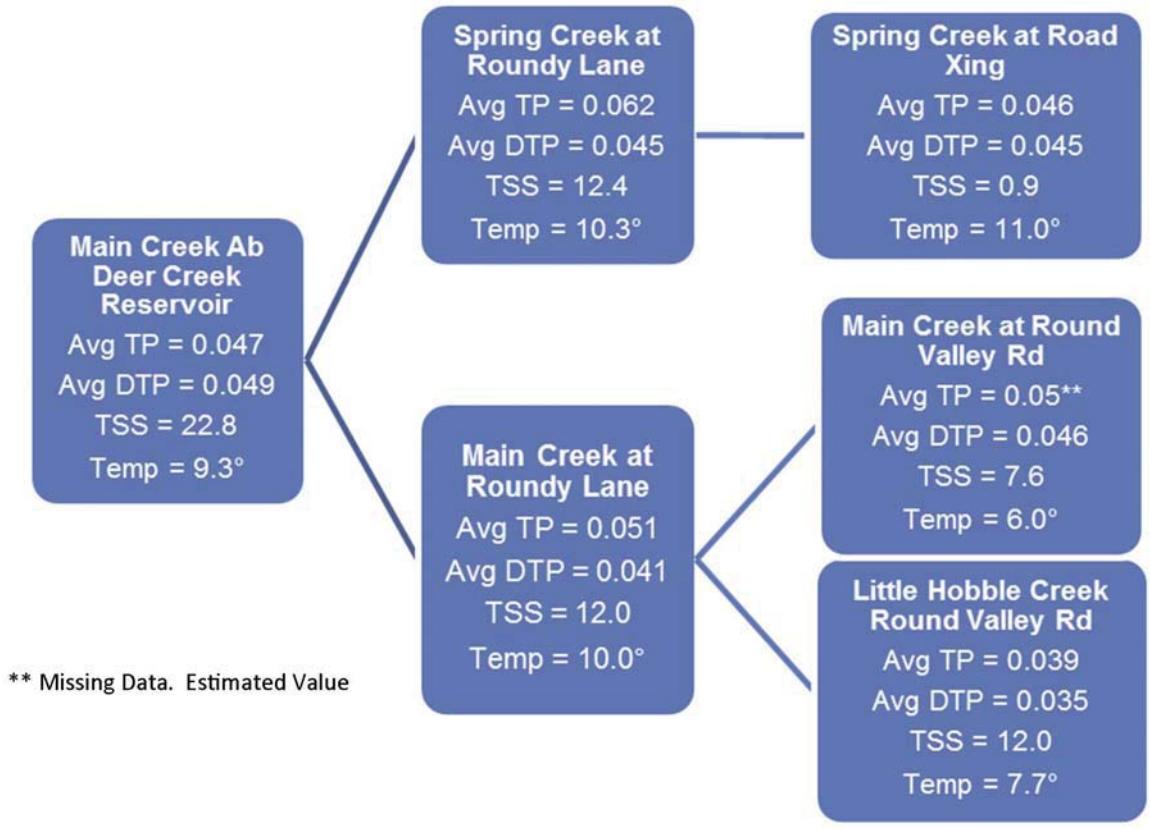
The Utah Division of Water Quality conducted monthly sampling at six locations in the Wallsburg watershed. Four locations were chosen because historic water quality data were available, and two new sites were chosen because of their land-use activities. Figure 5-5 shows the upper watershed sampling locations.

Figure 5-5. Water Quality Sampling Locations in the Upper Wallsburg Watershed



Monthly samples were collected and analyzed for total phosphorus (TP), total dissolved phosphorus (DTP), and total suspended solids (TSS). Field measurements for pH, conductivity, and temperature were also collected, and the creek flow was estimated. Figure 5-6 schematically illustrates the water quality sampling stations and the average results for analyses conducted during 2009 and 2010. Note that temperature is reported in degrees Celsius.

Figure 5-6. Average Water Quality Data at Sampling Sites, 2009–2010



Historic water quality data in the Wallsburg watershed were collected and analyzed in 1986, 1987, and 1988 consistently at three sites (Main Creek above Deer Creek Reservoir, Main Creek, and Little Hobble Creek at Round Valley Road). Data are available for the station Spring Creek at Roundy Lane for 1986 only.

The Main Creek location above Deer Creek Reservoir has the most complete data set, with monthly water quality data available for the period 1985 through 2010. This site has high spring flows due to snowmelt, with the lowest monthly flow in July. Table 5-9 compares average monthly data at the lowest Main Creek sampling location for flow, TSS, TP, and DTP. However, July has the lowest average flow of 6.5 cfs for the period 1985 to 2007. TSS are typically higher in the late winter and spring during higher runoff flows. On average, TSS levels are highest in May at 60 mg/L, which is similar to the timing of peak flow (Table 5-9). Whereas the average peak flow in May stands out from the rest of the months, the average TSS levels for March and April (55 mg/L and 59 mg/L, respectively) are very close to the average TSS levels in May. Peak phosphorus concentrations also generally occur in the late winter or early spring during high runoff.

Table 5-9. Average Monthly Data for Main Creek above Deer Creek Reservoir, 1985–2010

Month	Flow, Average (cfs)	Solids, Total Suspended (TSS) Average (mg/L)	Phosphorus, TP Average (mg/L)	Phosphorus, DTP Average (mg/L)
January	16.16	27.13	0.06	0.03
February	31.24	34.60	0.06	0.02
March	26.43	54.89	0.08	0.03
April	44.89	58.83	0.08	0.03
May	72.34	60.14	0.09	0.03
June	15.86	9.99	0.05	0.03
July	6.49	4.15	0.06	0.05
August	6.74	8.81	0.06	0.04
September	7.33	5.17	0.05	0.03
October	10.91	7.56	0.04	0.02
November	11.61	11.10	0.04	0.02
December	16.32	10.75	0.06	0.00

Figure 5-7 and Figure 5-8 illustrate the water quality data for the Main Creek sampling location above Deer Creek Reservoir for 1999 through 2010. Average annual DTP and TP are compared to Deer Creek TMDL target concentration goals of 0.025 mg/L and 0.030 mg/L, respectively. The data show that TP and DTP concentrations generally exceed target goals for the watershed.

Figure 5-7. Average Annual TP, DTP, and Flow at the Lowest Main Creek Water Quality Station

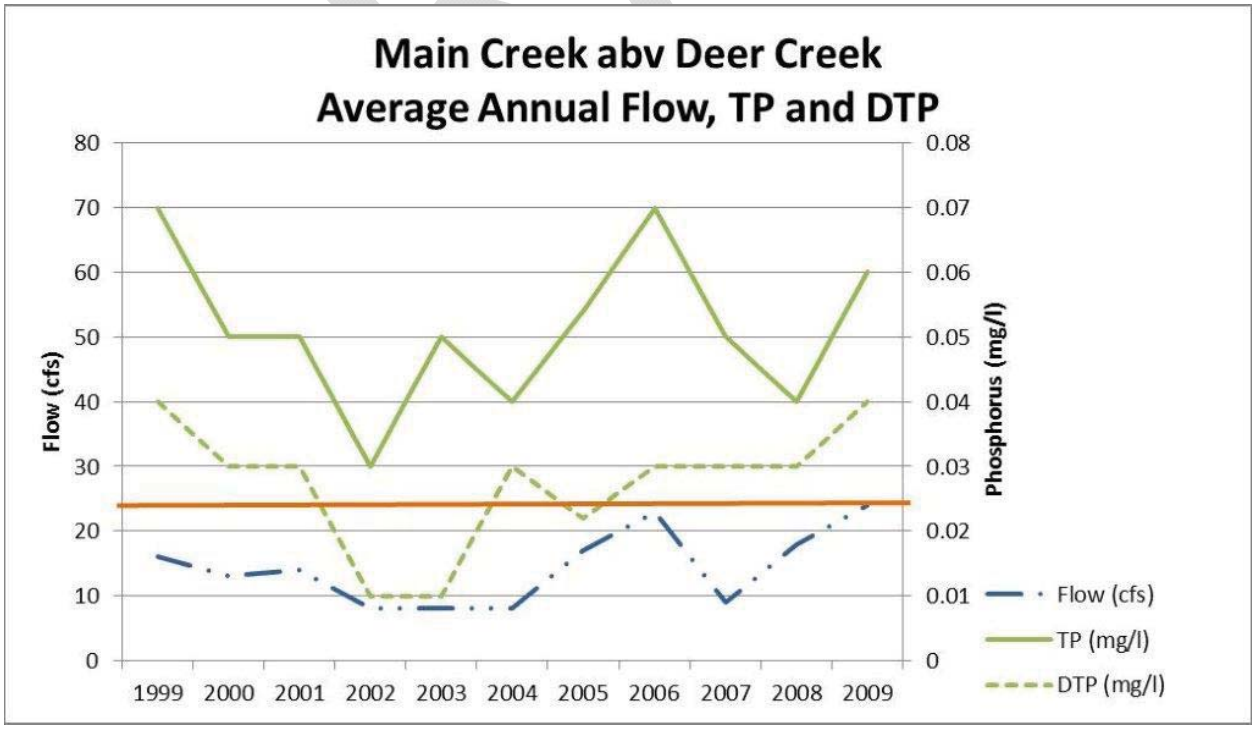
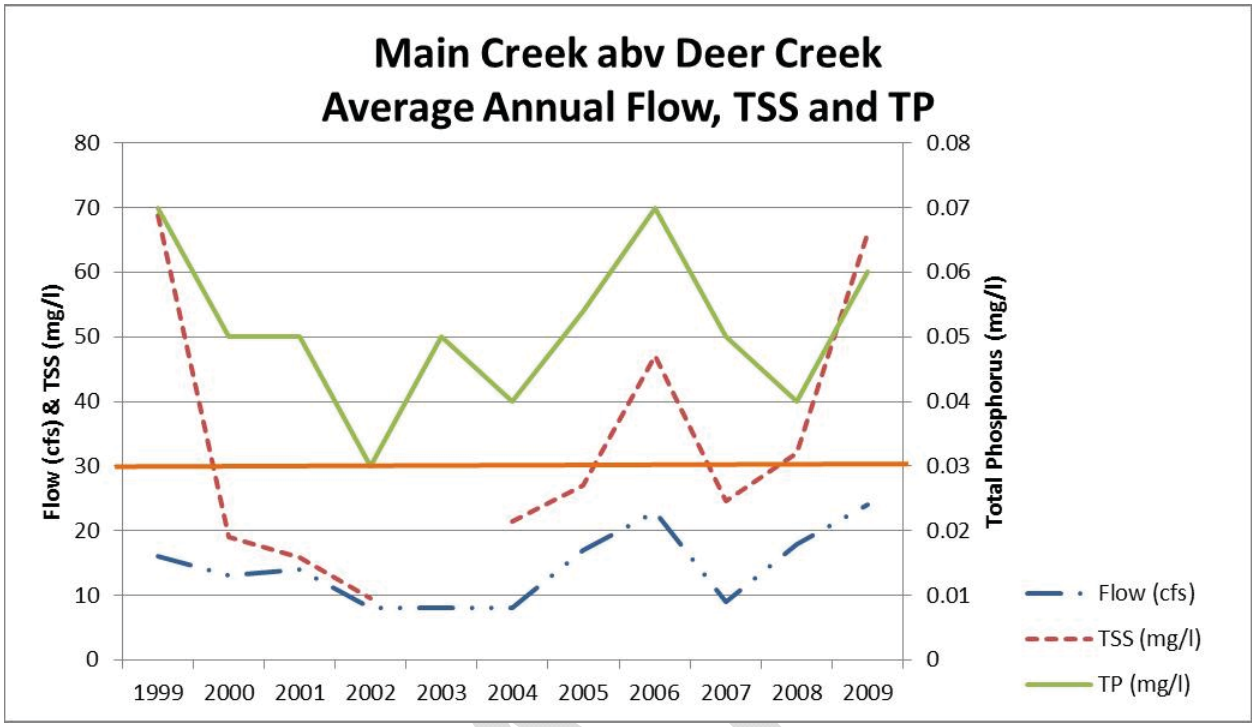


Figure 5-8. Average Annual TP, TSS, and Flow at the Lowest Main Creek Water Quality Station



5.4.3 Recommendations

The recommendations presented below are meant to help improve the water quality in the Wallsburg watershed. It is expected that, by implementing these recommendations, there will be cumulative improvements to the overall health of the watershed.

- **Goal 1 – Meet the TMDL endpoint of 0.03 mg/L of total phosphorus in Main Creek.** A reduction of about 0.02 mg/L of TP is needed to meet this goal.
  - *Recommendation 1a* – For identified animal feeding operations with impacts to water quality, work with landowners to prepare and implement voluntary nutrient-management plans.
  - *Recommendation 1b* – Work with livestock owners to develop and implement grazing-management plans to control livestock access to Main Creek.
  - *Recommendation 1c* – Stabilize stream banks to reduce erosion.
- **Goal 2 – Meet the TMDL endpoint of 0.025 mg/L of dissolved total phosphorus in Main Creek.** A reduction of between 0.015 mg/L and 0.02 mg/L of DTP is needed to meet this goal.
  - *Recommendation 2a* – Complete additional groundwater and surface water sampling, testing, and analysis to determine source of high DTP in Spring Creek. Once the causes are identified, develop an implementation strategy to reduce and/or eliminate the phosphorus sources.
  - *Recommendation 2b* – Encourage identified animal feeding operations that affect water quality to develop and implement nutrient-management plans.

- *Recommendation 2c* – Work with livestock owners to develop and implement grazing-management plans to control livestock access to Main Creek.

- **Goal 3 – Reduce the TSS concentrations to meet typical concentrations found in Snake Creek.** On average, a reduction of about 30 mg/L (a 75% reduction) of TSS is needed to meet this goal.
  - *Recommendation 3a* – Stabilize stream banks to prevent erosion.
  - *Recommendation 3b* – Work with livestock owners to develop and implement grazing-management plans to control livestock access to Main Creek.

The water quality data were compared to the results from the Stream Visual Assessment Protocol ($SVAP_2$) Inventory prepared by NRCS in January 2010. Specific recommendations were identified for each stream reach. Water quality results were also compared to the Septic Tank Density Study conducted as part of the Wallsburg CRMP. Specific recommendations were developed based on these comparisons.

Main Creek

With watershed drainage and tributary flows providing the source of flow in Main Creek, higher springtime flows due to snowmelt can be expected with lowest flows in the late summer. Monthly water quality data are available at the farthest downstream location from 1986 to 2011. Only 2009–2010 data are available at the mid-watershed location at Roundy Lane, and only 9 years data (since 1986) are available at the upper watershed location at Round Valley Road (1986–1988, 1994, 1995, 2000, 2005, 2009, and 2010).

At each of the three Main Creek monitoring locations, monthly concentrations of TSS, TP, and DTP do not correlate with flow. It is be expected that higher concentrations of TSS and TP would occur during high-flow times when flows erode the stream banks and carry sediment downstream. With TSS and TP concentrations fluctuating throughout the year (regardless of flow quantities), it appears that outside influences are occurring near or along the stream to stir up sediments. This could be due to animal grazing, channel alignment straightening, irrigation water management, or construction activities.

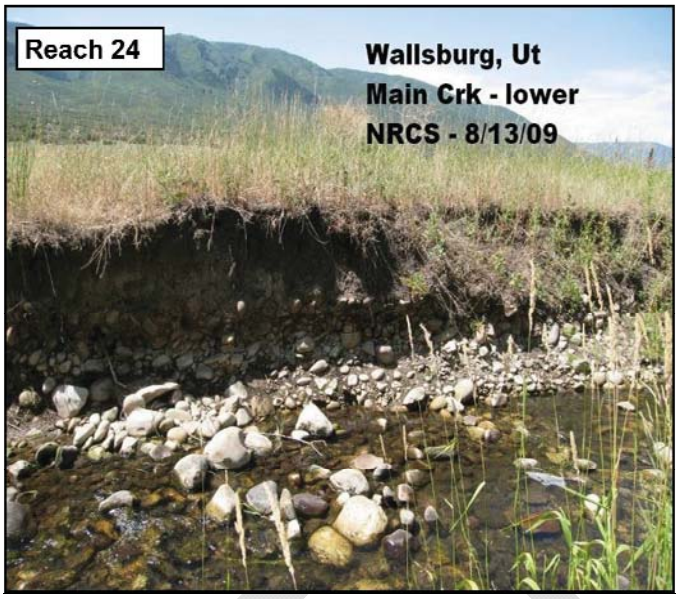


Table 5-10 summarizes the water quality constituents by segment and compares them to the sediment load reduction estimates from the SVAP.

Table 5-10. Main Creek, SVAP results compared to water quality

Main Creek Segment	Water Quality Concerns	SVAP Reaches	Length of Eroding Stream Bank (feet)	Eroding Stream Bank Length as Percentage of Total Stream Length	Potential Sediment Load Reduction (tons/year)
Above Round Valley Road (M5)	TSS, TP, TDP	1–18	2,200	11%	26
Round Valley Road to Roundy Lane (M4)	TSS	19–23	1,600	31%	56
Roundy Lane to Deer Creek Reservoir	TSS, TP[a]	24–30	6,200	36%	167

[a] Water quality reflects the contributions of Spring Creek and Main Creek.

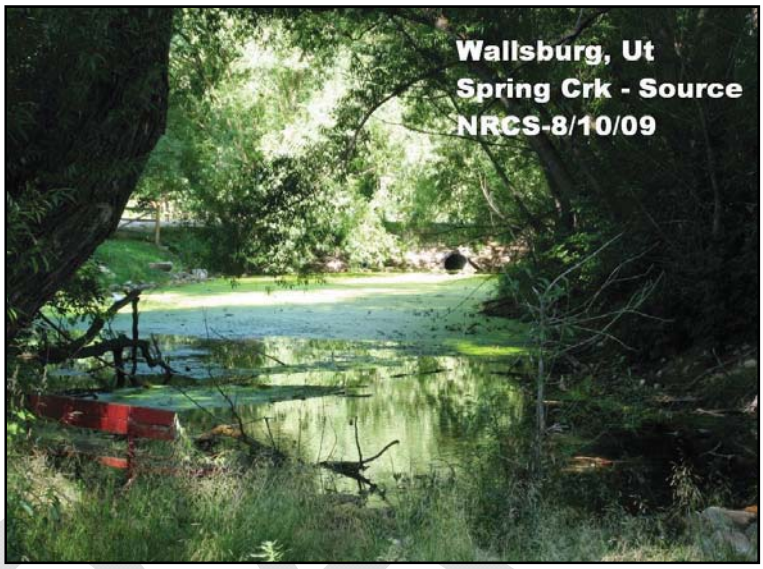
Spring Creek

The source of Spring Creek is a spring in the town of Wallsburg. The spring source supplies a more consistent flow rate, with some seasonal variability. There are two water-quality monitoring locations on Spring Creek: Spring Creek at road crossing (S2) has water quality data and flow data for 2009 and 2010, and Spring Creek at Roundy Lane (S1) has water quality data for 1986, 2009, and 2010, but no flow data.

TSS concentrations are low, with high TP and DTP values at the upstream monitoring point (S1). These data can be considered baseline water quality data, since they reflect the water quality at the headwaters of Spring Creek. An investigation to determine the cause of the high TP and DTP at the spring source is recommended. The Spring Creek source assessment should investigate and identify causes of the high TP and DTP. This could be done by sampling as close to the spring source as possible, dye-testing the septic systems of nearby

residences, or inventorying land-use and land-management practices such as fertilizer and pesticide use. Once the causes are identified, an implementation strategy should be developed to reduce the phosphorus load. It is estimated that the Spring Creek source assessment would cost about $50,000.

The SVAP observed evidence of livestock accessing the stream corridor. The consequences of these observed conditions are evident by the high TP and DTP values in the upper reaches. Recommendations to mitigate these problems could include improved grazing management and evaluating the function of nearby septic tanks.



Monitoring data from Spring Creek at Roundy Lane indicate an increase in TSS and TP above this location. The SVAP findings of severe livestock impacts, irrigation water management practices are reflected in the higher TSS and TP water quality values. Recommendations for this segment include gazing management, grade controls and runoff management from nearby corral structures.

Little Hobble Creek

With watershed drainage providing the source of flow in Little Hobble Creek, higher springtime flows due to snowmelt can be expected with lowest flows in the late summer. Little Hobble Creek (segment M3) has one water quality monitoring site at Round Valley Road, with data collected monthly for 1986–1988, 2009, and 2010. The monitoring site on Main Creek at Roundy Lane (segment M2) is downstream of the confluence of Little Hobble and Main Creek, and therefore the water quality is influenced by both streams.

Table 5-11 summarizes the water quality concerns by reach and compares the sediment-load-reduction estimate from the SVAP.

Table 5-11. Little Hobble Creek, SVAP results compared to water quality

Hobble Creek Segment	Water Quality Concerns	SVAP Reaches	Length of Eroding Stream Bank (feet)	Length of Eroding Stream Bank as Percentage of Total Stream Length	Potential Sediment Load Reduction (tons/year)
Above Round Valley Road (M3)	TSS	1–5	990	5%	20
Round Valley Road to Roundy Lane (M2)	TP, DTP[a]	6–9	1,600	37%	27

[a] Monitoring data reflect the influences of Main Creek and Little Hobble Creek.

5.5 Wildlife Management

5.5.1 Background

The following Wallsburg Watershed Wildlife Management Report was prepared by the Utah Division of Wildlife Resources.

The Wallsburg watershed contains significant aquatic resources in the form of perennial and ephemeral streams, springs, and riparian wetlands. The watershed is inhabited by a unique assemblage of native aquatic species including Bonneville cutthroat trout, southern leatherside chub, and Columbia spotted frog. Lotic (flowing) aquatic resources within the basin are fragmented by water-diversion structures, impassable culverts, and seasonally dewatered reaches.

Given its unique assemblage of aquatic resources, the Wallsburg watershed is a focus area for implementing conservation measures. Such measures include restoring rivers and riparian areas, increasing angler access, removing non-native species, purchasing and/or leasing in-stream flow, and modifying water-diversion structures (through voluntary efficiency projects) to facilitate fish migration and sustained in-stream flow.

Fisheries Resources

Several lotic (flowing) systems within the Wallsburg watershed support fish communities, but two systems, Main Creek and Little Hobble Creek, support the majority of fisheries biomass within the valley. The most recent thorough surveys of Main and Little Hobble Creeks were conducted in 2009 using dual-pass electroshocking methods (Figure 5-9). Little data exists on smaller systems, such as Spring Creek, within the basin, but those with permanent water are believed to have a species composition similar to Main and Little Hobble Creeks.

Figure 5-9. Fish-Monitoring Locations in the Wallsburg Watershed

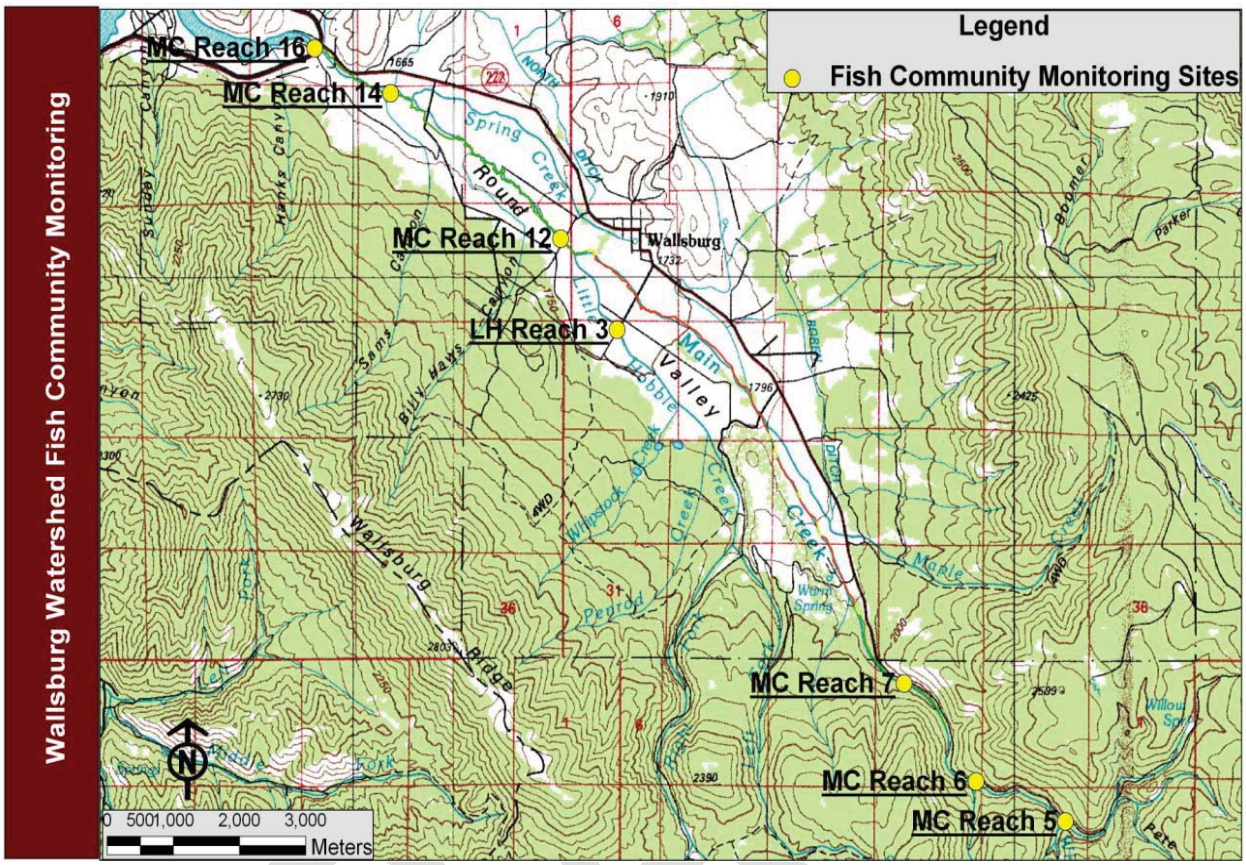


Table 5-12. Relative Proportions of Fishes Captured during Surveys of Main and Little Hobble Creeks*

Stream	Reach	Site	Date	*n*	Southern Leatherside Chub	Longnose Dace	Speckled Dace	Redside Shiner	Mountain Sucker	Utah Sucker	Mottled Sculpin	Bonneville Cutthroat Trout	Rainbow Trout	Brown Trout	Brook Trout	Yellow Perch	Green Sunfish
Main Creek	5	1	3-Aug-09	4	0	0	0	0	0	0	0	1.00	0	0	0	0	0
Main Creek	6	1	3-Aug-09	24	0	0	0	0	0	0	0	1.00	0	0	0	0	0
Main Creek	7	1	27-Jul-05	15	0	0	0	0	0	0	0.43	0.57	0	0	0	0	0
		2	3-Aug-09	37	0	0	0	0	0	0	0.62	0.38	0	0	0	0	0
			18-Aug-10	57	0	0	0	0	0	0	0.47	0.53	0	0	0	0	0
Main Creek	12	2	9-Aug-05	161	0	0.01	0.89	0.07	0.02	0	0	0	0	<0.01	0	0	0
		1	11-Jul-07	363	0.02	0.02	0.47	0.12	0.10	0	0.26	0	0	<0.01	0	0	0
			12-Aug-08	100	0.03	0	0.48	0.07	0.03	0	0.38	0	0	0.010	0	0	0
			12-Aug-09	237	0.01	0	0.22	0.01	0.03	0	0.70	0	0.01	0.02	0	0	0
Main Creek	14	1	3-Sep-09	509	0.04	0.12	0.27	0.28	0.22	0.01	0	0	0.01	0.05	0	<0.01	<0.01
			30-Jun-10	340	0.06	0.14	0.24	0.15	0.31	0.01	0.06	0	<0.01	0.02	0		<0.01
Main Creek	16	1	4-Aug-05	105	0	0.05	0.14	0	0.02	0	0.19	0	0.02	0.39	0	0.19	0
		2	11-Jul-07	332	0.02	0	0	0.01	0.00	0	0.64	0	0.01	0.31	0	0	0
			12-Aug-08	191	0	0	0	0	0.03	0	0.81	0	0.05	0.12	0	0	0
			10-Sep-09	417	0	0	0	0	0.01	0	0.79	0	0	0.20	0	0	<0.01
Little Hobble	3	1	28-Jul-05	15	0	0	0	0	0	0	0	0	0.33	0	0.67	0	0
		1	12-Aug-09	91	0	0	0.02	0	0	0	0	0	0.20	0	0.78	0	0

* The table is a synopsis of data previously presented by Grover and Crockett (2009) and Nielson (2009).

The basin is inhabited by at least four species of trout: Bonneville cutthroat trout (*Oncorhynchus clarkii utah*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*). Bonneville cutthroat trout are the only trout native to the drainage.

Several native nongame fish species, including southern leatherside chub (*Lepidomeda aliciae*), longnose dace (*Rhinichthys cataractae*), speckled dace (*Rhinichthys osculus*), redside shiner (*Richardsonius balteatus*), mountain sucker (*Catostomus platyrhynchus*), Utah sucker (*Catostomus ardens*), and mottled sculpin (*Cottus bairdii*), inhabit aquatic systems within the basin. Two additional non-native game fish, yellow perch (*Perca flavescens*) and green sunfish (*Lepomis cyanellus*), are also present in the lower portions of Main Creek.

Two of the native fish species within the drainage, Bonneville cutthroat trout and southern leatherside chub, are classified as Utah sensitive species and are managed through comprehensive multiagency management plans, known as conservation agreements and strategies, to guide conservation efforts (Lentsch et al. 1997; Utah Division of Wildlife Resources 2010).

The Main Creek population of Bonneville cutthroat is managed as a conservation population in an effort "to preserve the historical genome and/or unique genetic, ecological, and/or behavioral characteristics within specific populations" (Lentsch et al. 2000, p. 17).

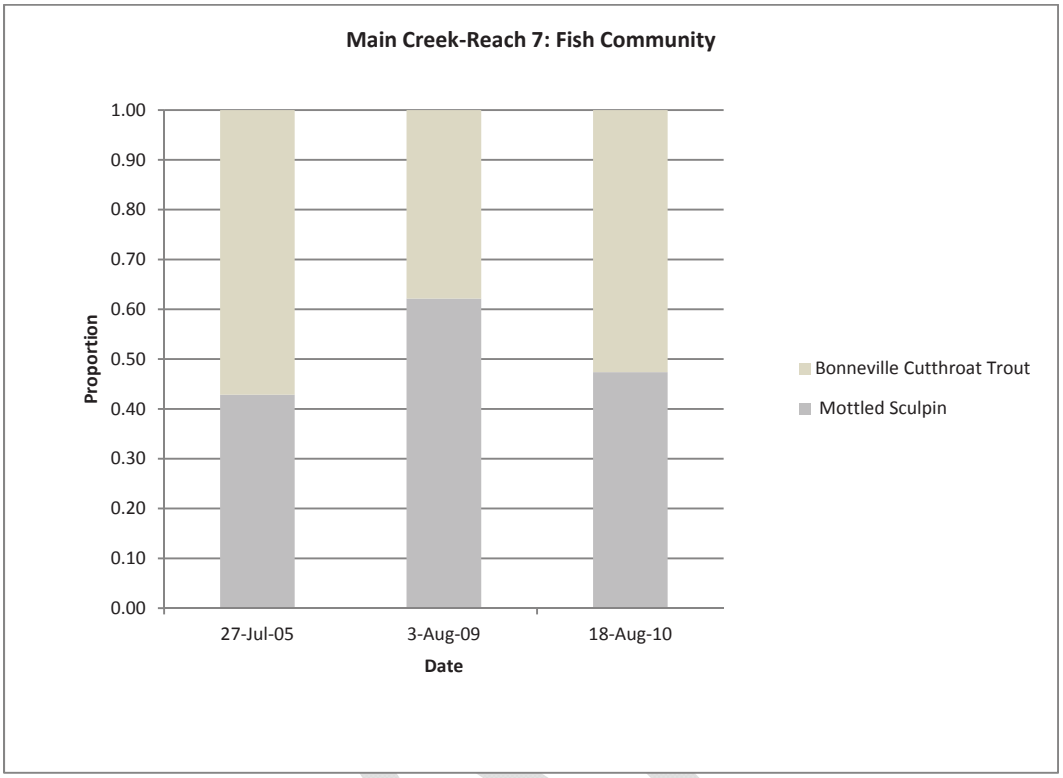
The Main Creek population of southern leatherside is the most genetically divergent population within the species complex and might be experiencing the harmful effects of a population bottleneck caused by genetic isolation (that is, little connectivity with other populations) (Belk et al. 2010).

Table 5-13. Fish Population Estimates for Southern Leatherside Chub and Combined Trout Species in Main Creek in 2009

Reach	Date	Southern Leatherside Chub			Trout (All Species Combined)			
		#/100m^2	Avg. Length (mm)	Avg. Weight (g)	#/km	#>150mm/km	Avg. Length (mm)	Avg. Weight (g)
Reach 5	3-Aug-09	0	NA	NA	131	0	113	22
Reach 6	3-Aug-09	0	NA	NA	525	88	110	21
Reach 7	3-Aug-09	0	NA	NA	230	180	161	54
Reach 12	12-Aug-09	0.97	86	8.3	63	63	366	563
Reach 14	3-Sep-09*	3.81	77	5.2	123*	58*	251	297
Reach 16	10-Sep-09	0	NA	NA	871	467	191	130

* Sampling error prevented the calculation of a trout population estimate for 2009. The site was resurveyed in 2010 and the corresponding estimate is included.

Figure 5-10. Fish Community Composition in Reach 7 of Main Creek



Amphibian Resources

At least five amphibian species, Columbia spotted frog (*Rana luteiventris*), Western chorus frog (*Pseudacris triseriata*), tiger salamander (*Ambystoma tigrinum*), Woodhouse toad (*Bufo woodhousii*), and Great Basin spadefoot toad (*Spea intermontana*), inhabit the watershed. Most of these species rely on breeding habitat associated with seasonally flooded meadows and beaver ponds within riparian corridors. Columbia spotted frog are classified as a Utah sensitive species and are managed through a multiagency management plan (Bailey et al. 2006). The population of Columbia spotted frogs in the watershed was not discovered until 2008 and has been documented in only a small geographic area (Crockett et al. 2009).

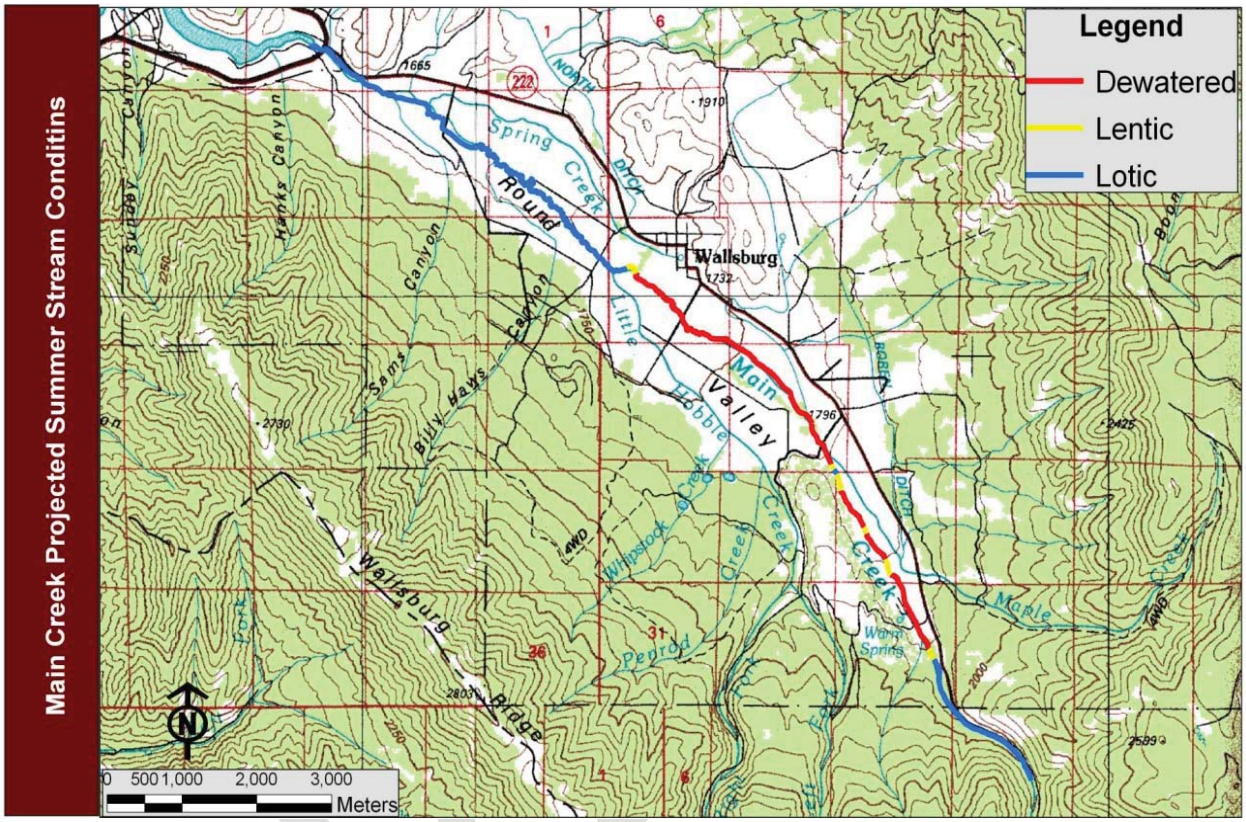
5.5.2 Results and Recommendations

Main Creek Upper Reaches

Fish-monitoring surveys conducted from 2005 to 2010 in Main Creek suggest several trends. The uppermost reaches of the system (reaches 5 and 6) are inhabited solely by native Bonneville cutthroat trout with densities ranging from 131 to 524 fish per kilometer of stream (Table 5-12). The average weight and total length of fish sampled in the two reaches are relatively consistent and range from 21 to 22 grams and 110 to 113 millimeters, respectively (Table 5-13). Surveys conducted in 2005, 2009, and 2010 in Reach 7 found a native fish community composed of Bonneville cutthroat trout and mottled sculpin (Figure 5-10). Population estimates conducted in Reach 7 in 2009 estimate a Bonneville cutthroat trout

population of 230 individuals per kilometer of stream with an average length of 161 millimeters and an average weight of 54 grams (Table 5-13).

Figure 5-11. Summer Water Conditions in Main Creek



Key: Dewatered = dry; lentic = small pools but no flow; lotic = flowing water

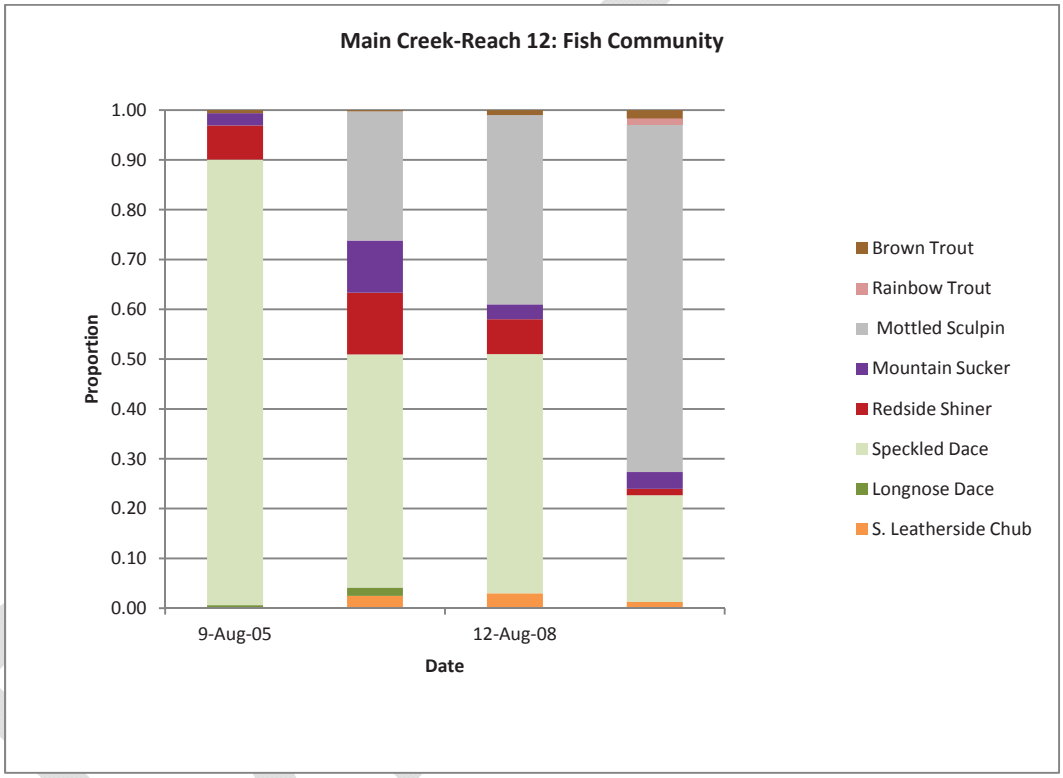
Main Creek Middle Reaches

Limited fish survey data exist for the reaches of Main Creek located between the USFS boundary and Roundy Lane due to the lack of year-round flow within these reaches. Data collected independently by both the Utah Division of Wildlife Resources and NRCS (NRCS 2010a) in 2009 were used to create a map of seasonally dewatered reaches of Main Creek (Figure 5-11). The represented spatial extent of dewatered reaches is a snapshot of conditions during early August 2009. Future annual conditions will vary depending on seasonality, precipitation, and timing of diversion operations. Nonetheless, the 2009 conditions can approximate the typical late summer water conditions in Main Creek.

Based on 2009 projections, about 5.7 kilometers of Main Creek are seasonally dewatered (Figure 5-11). Dewatering limits fish migration between the upper and lower reaches, traps fish if they are unable to escape to watered reaches, limits available fisheries habitat and productivity, and harms riparian vegetation and corresponding stream bank stability (Cross et al. 1985; Rood et al. 2003; Perkins et al. 2010). Main Creek from about Roundy Lane Bridge downstream to its confluence with Deer Creek is expected to have perennial flow during a typical year.

Fish surveys in reach 12 (near the Roundy Lane Bridge) found a fish community composed of native cyprinids and non-native trout (Figure 5-12). The relative proportions of fish species captured during surveys in reach 12 have changed over time. The proportion of mottled sculpin has increased, whereas speckled dace have decreased proportionally since 2005. A statistical analysis indicates that the relative abundances of the five most common species in reach 12 in 2009 differed significantly from previous years (Grover and Crockett 2010). The reach contains low densities of southern leatherside chub (0.97 individuals per 100 square meters) with average lengths of 86 millimeters and average weights of 8.3 grams (Table 5-13). The reach also contains low densities (63 individuals/kilometer) of non-native brown and rainbow trout (Table 5-13).

Figure 5-12. Fish Community Composition in Reach 12 of Main Creek



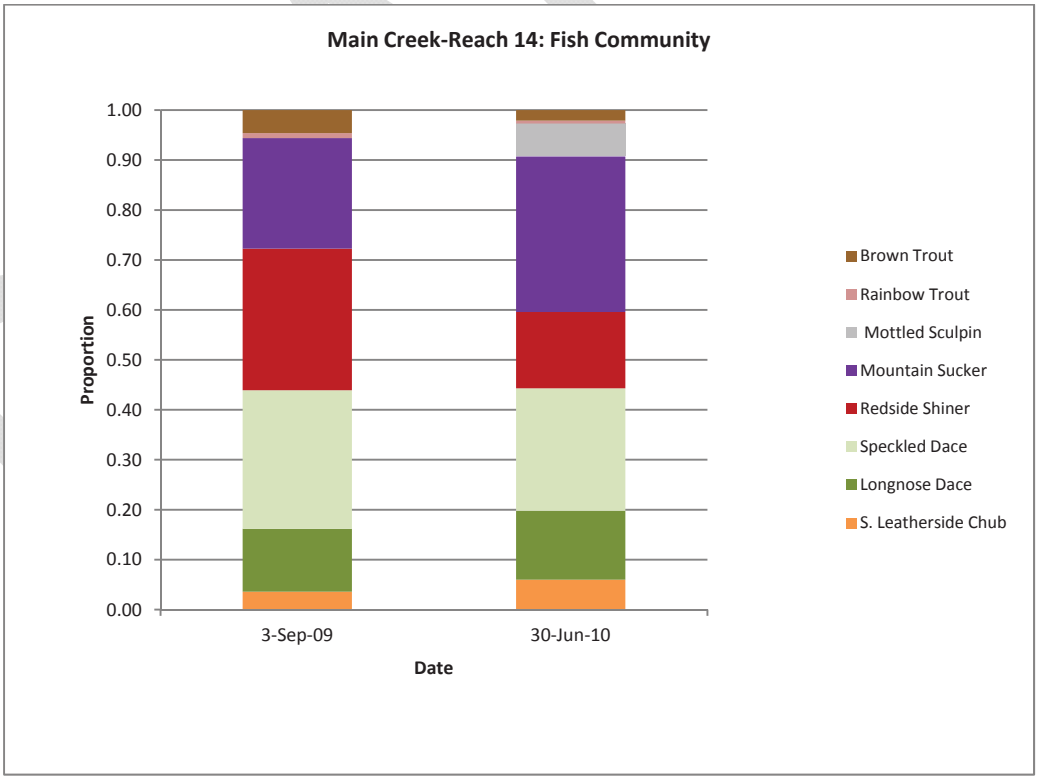
Main Creek Lower Reaches

There are two monitored fish survey sites (reaches 14 and 16) within the lower 1.4 kilometers of Main Creek. Reach 14 has a diverse assemblage of species proportionally dominated by native cyprinids and suckers (mountain sucker, speckled dace, and redside shiner) (Figure 5-13). Southern leatherside chub densities (3.81/100 square meters) within reach 14 are significantly higher than in any other site in Main Creek (Table 5-13). A sampling error in 2009 prevented the determination of an accurate trout population estimate, but the site was resurveyed in 2010. Relatively low densities of trout (123/kilometer) were encountered in 2010. Of those 123/kilometer, only 58/kilometer were of a total length over 150 millimeters. The sampling location for reach 16 is located upstream of US 189 near Main Creek's confluence with Deer Creek Reservoir.

Surveys in 2009 found a fish community dominated by mottled sculpin and brown trout (Figure 5-14; Table 5-12). Multiple surveys have detected the presence of fish species associated with Deer Creek Reservoir, including green sunfish and yellow perch. The reservoir also serves as a source of rainbow trout migration into Main Creek. Such migration will be harmful to the upstream Bonneville cutthroat trout if hybridization between the two species occurs (Lentsch et al. 1997). The reach contains relatively high densities of trout (predominantly brown trout) with an estimated 871 individuals per kilometer, of which 467 are over 150 millimeters in total length (Table 5-13).

No southern leatherside chub have been detected in reach 16 since 2007. The distribution and abundance of southern leatherside chub within Main Creek likely reflect a complex interplay between habitat parameters and the influence of other species. Brown trout, a piscivorous (fish) predator, harm the habitat associations, foraging success, and survival of southern leatherside chub (Walser et al. 1999; Wilson and Belk 2001; Nannini and Belk 2006). Recent population estimates for southern leatherside chub and brown trout at sites in streams in which both species are present indicate that population densities of southern leatherside chub are negatively correlated with the population densities of brown trout in the Provo River (including Main Creek), the Spanish Fork River, and San Pitch River sub-basins (Grover and Crockett 2010).

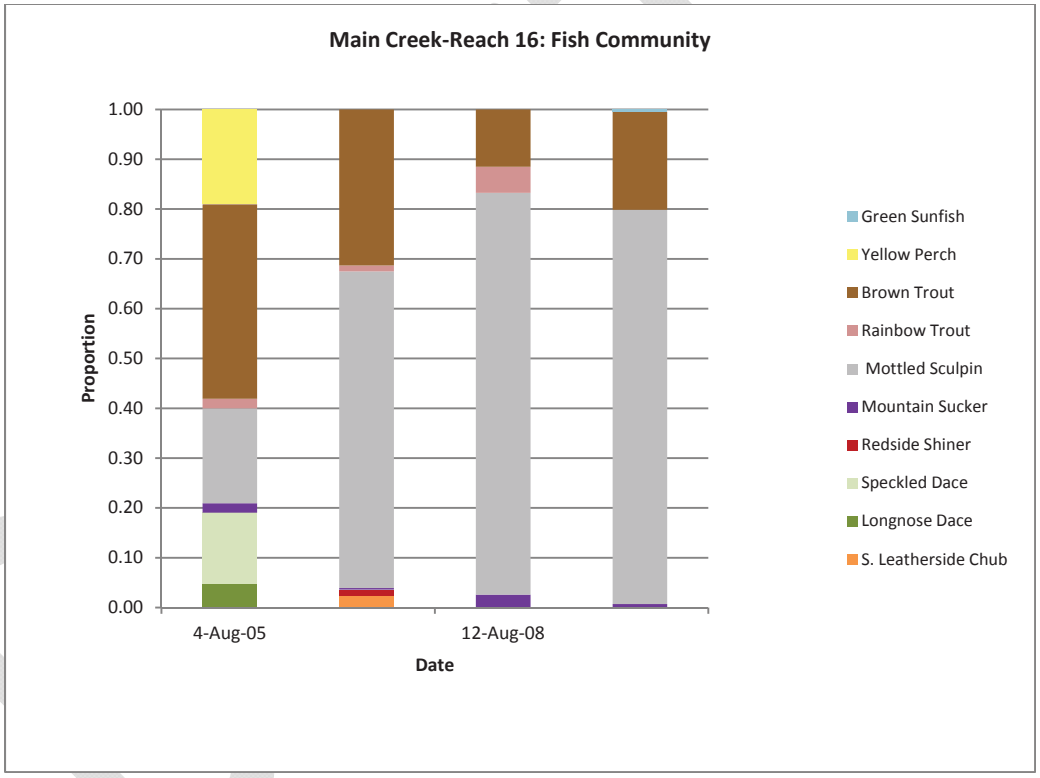
Figure 5-13. Fish Community Composition in Reach 14 of Main Creek



Little Hobble Creek

There are limited recent survey data for Little Hobble Creek with the exception of surveys conducted in 2005 and 2009 near its confluence with Main Creek (Figure 5-9). Species composition in 2009 was proportionally composed predominantly of non-native trout (brook trout, 78%; rainbow trout, 20%) with only a small proportion of speckled dace (2%) inhabiting the system (Table 5-12). In 2005, a similar trout community was present, but no speckled dace were found (Figure 5-15). Historic surveys conducted in the early 1970s indicate a fish community composed predominantly of native Bonneville cutthroat trout Utah Division of Wildlife Resources 1973). It appears that Bonneville cutthroat trout have been eliminated from the lower reaches, but additional surveys are needed to determine if Bonneville cutthroat trout still persist within the headwaters.

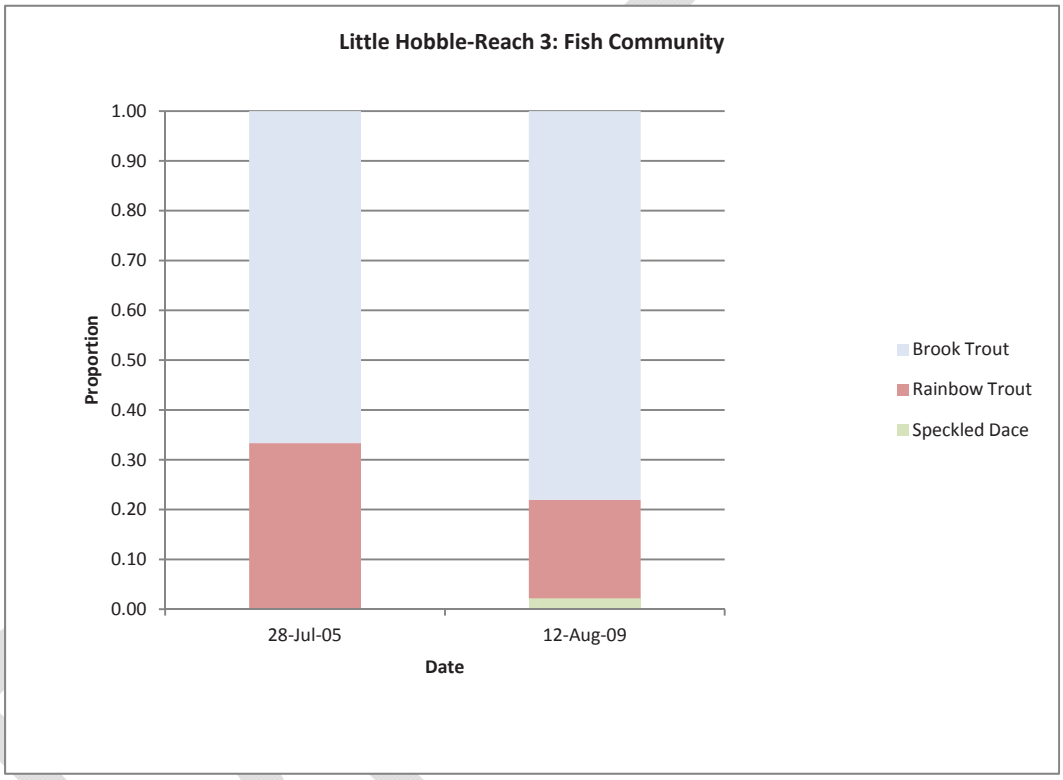
Figure 5-14. Fish Community Composition in Reach 16 of Main Creek



Amphibian Surveys

Amphibian monitoring surveys were conducted from 2008 to 2011 in an effort to locate Columbia spotted frogs in the Wallsburg watershed. Current data (Grover and Crockett 2010) suggest that the Columbia spotted frog population in the watershed is relatively small (less than 20 individuals). Additional exploratory surveys of suitable habitat are needed in order to better evaluate the extent and viability of this population. We are optimistic that future surveys will reveal a substantially larger population in the riparian corridors of Main and Little Hobble Creeks.

Figure 5-15. Fish Community Composition in Reach 3 of Little Hobble Creek



Recommendations

Several conservation strategies should be implemented in the watershed to enhance fisheries and aquatic resources. Implementation of all objectives is needed to protect aquatic resources in the watershed. A brief overview of each is included below.

Objective 1: Restore the natural stream hydrology and topography of lower Main Creek. Several entities (Utah Division of Wildlife Resources, NRCS) have identified impaired reaches in the watershed with dewatered sections, incised banks, inadequate riparian vegetation, excessive erosion, and other detriments to fisheries and aquatic resources.

- **Strategy 1:** Identify priority reaches for restoration based on current condition, landowner support, and restoration feasibility. Create and implement a comprehensive stream-restoration plan.
- **Strategy 2:** Conduct an in-stream flow study to determine the minimum flow needed to maintain aquatic resources and proper stream function within Main and Little Hobble Creeks.
- **Strategy 3:** Acquire minimum sustained in-stream flows in the watershed through purchasing and/or leasing water and implementing collaborative water conservation/efficiency projects.
- **Strategy 4:** Establish conservation easements with private landowners to ensure the long-term protection of riparian and wetland habitats.

Objective 2: Restore the native fish community and increase densities of Bonneville cutthroat trout and southern leatherside chub (two Utah sensitive species, both endemic to the Great Basin).

- **Strategy 1:** Repatriate Bonneville cutthroat trout to the middle and lower reaches of Main Creek. Mechanical and/or chemical removal of non-native trout species is preferred to reduce predation, competition, and hybridization threats.
- **Strategy 2:** Install a fish barrier in the lower downstream reaches of Main Creek to prevent the migration of non-native species from Deer Creek Reservoir. Non-native fish species pose predation, competition, and hybridization threats to Bonneville cutthroat trout and a predation threat to southern leatherside chub.

Objective 3: Increase angler access within the watershed.

- **Strategy 1:** Develop walk-in-access lease agreements and other partnerships with private landowners to allow angling access to Main and Little Hobble Creeks. The Utah Division of Wildlife Resources' Walk-In-Access Program monetarily compensates private landowners for public access to their property. Additional access improvements such as fence stiles, parking, etc., can be funded through Habitat Council grants.

5.6 Forestry Assessment and Inventory

5.6.1 Background

Two reports provide information on forest resources in the Wallsburg watershed: the NRCS *Wallsburg Watershed Grazinglands* report (NRCS 2010c) and the USDA Forest Service 2008 Notice of Decisions document for the two sheep grazing allotments on USFS-managed land in the watershed. The USDA Forest Service sheep grazing allotment assessment and decision document are included in Appendix D, Grazingland, Forest, and Pastureland Reports, and are summarized below.

5.6.2 Results and Recommendations

NRCS's grazinglands report (NRCS 2010c) stated that forest resources in the watershed are in generally good health. Aspen ecological sites showed good regeneration and at least two age-classes and low conifer encroachment. Douglas-fir and mixed-conifer stands showed low insect mortality and good age-class distribution with adequate regeneration. The grazinglands report identified an unknown quantity of merchantable timber in the watershed, but identified steep slopes as a limiting factor.

The Heber-Kamas Ranger District of the Uinta-Wasatch-Cache National Forest assessed forest resource health for the purpose of reauthorizing current grazing management on the Wallsburg and Little Valley sheep allotments (USFS 2008). The allotments are summarized in Table 5-14 below. The USDA Forest Service evaluated the current grazing-management practices against the goals and sub-goals of the Forest Plan and concluded that grazing as currently managed meets or is moving toward each of the three applicable forest goals. For more information, see the USDA Forest Service report in Appendix D, Grazingland, Forest, and Pastureland Reports.

Table 5-14. Sheep Grazing Allotments on USFS-Managed Land in the Wallsburg Watershed

Allotment	Drainage	Acres	Animal Units
Wallsburg	Main Creek	5,446	1,200 (June 6 – Oct 5)

5.7 Water Rights Inventory

5.7.1 Background

HDR Engineering prepared the water rights inventory, which consists of a data review and GIS (geographic information systems) representation of existing points of diversion in the Wallsburg watershed as identified and administered by the Utah Division of Water Rights (cite the website). Points of diversion (PODs) are locations where water is removed for use and include underground, surface, return, rediversion, and point-to-point diversions.

During the CRMP process, water conservation and water quality protection emerged as top priorities of the stakeholders in the Wallsburg watershed. The water rights inventory is intended to help stakeholders understand water use and water management in the watershed.

A recommendation made by several resource agencies was to evaluate the potential to develop an irrigation water source to replace the surface diversions from Main Creek and Little Hobble Creek. If water rights were satisfied from a different source, the natural flows in the creeks could be restored. This recommendation is discussed below and is recommended in order to improve surface water conservation, provide a more reliable source of irrigation water, and provide the water necessary for restoring the riparian and aquatic resources in the watershed.

5.7.2 Results

The Utah Division of Water Rights maintains a database of water right points-of-diversion, based on information submitted with water right applications. The location data are of varied quality and include both map-scaled and field-surveyed information.

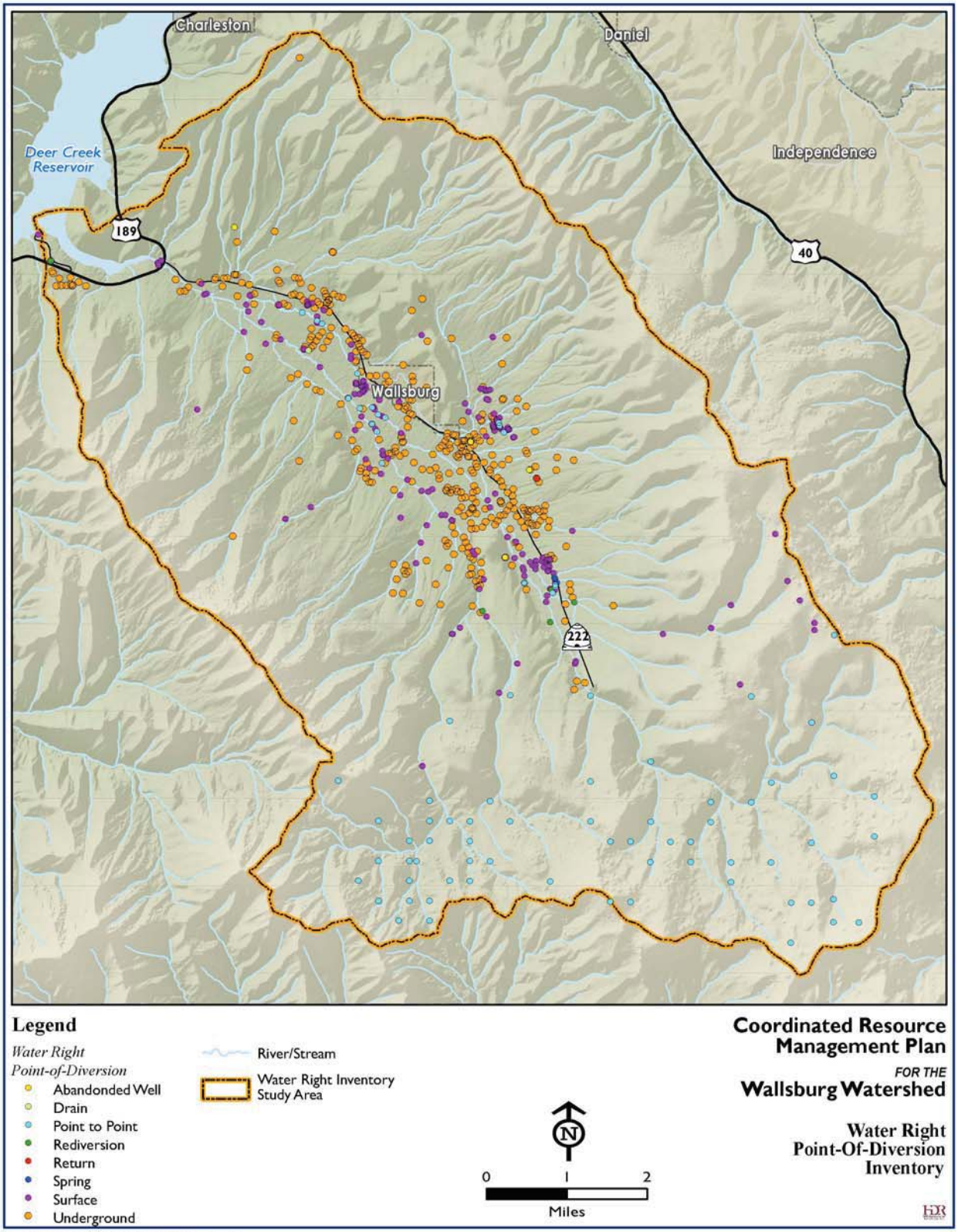
The Division's data indicate that there are 1,127 PODs in the Wallsburg watershed. These PODs and the number and status of the water rights are summarized in Table 5-15 below and shown in Figure 5-16 below. Detailed maps of the watershed showing the locations and types of PODs are attached as Appendix F, Water Right Point of Diversion Maps.

The water right database was analyzed to show recent trends in POD activity in the Wallsburg watershed. For the analysis, the terminated and unapproved water rights were removed from the analysis, leaving 896 PODs that have approved and perfected rights in the watershed. Figure 5-17 below shows the number of approved and perfected water right PODs in the watershed for surface and underground diversions only.

Table 5-15. Number and Status of Water Rights for Points of Diversions in the Wallsburg Watershed

Type of POD	Approved	Shares	Perfected	Terminated	Unapproved	POD Totals
Abandoned well	1		3			4
Drain			1			1
Point to point			108		41	149
Rediversion	3		20		1	24
Return	2					2
Spring	9		1			10
Surface	31	47	396	37	12	523
Underground	78		196	137	3	414
Total	**124**	**47**	**725**	**174**	**57**	**1,127**

Figure 5-16. Water Right Point-of-Diversion Inventory



Beneficial Use

Many PODs have multiple uses; for instance, a surface diversion can be used for both irrigation and stock watering, while some wells have domestic, irrigation, and stock uses. The beneficial uses for the PODs with perfected or approved water rights are shown in Table 5-16 below. Each physical POD could have multiple uses, so the total number of PODs in the table is more than the number of physical PODs.

Table 5-16. Number of Points of Diversion Associated with Each Use

Use	Number of PODs[a]
Domestic	424
Irrigation	825
Stock	753
Municipal	8
Other	61
Not Listed	89

[a] Some PODs have multiple uses and are tabulated under each use.

Water can be withdrawn from the natural source by many different types of diversions. The number of PODs by each type of diversion for each beneficial use is shown in Table 5-17 below for identified PODs in the watershed.

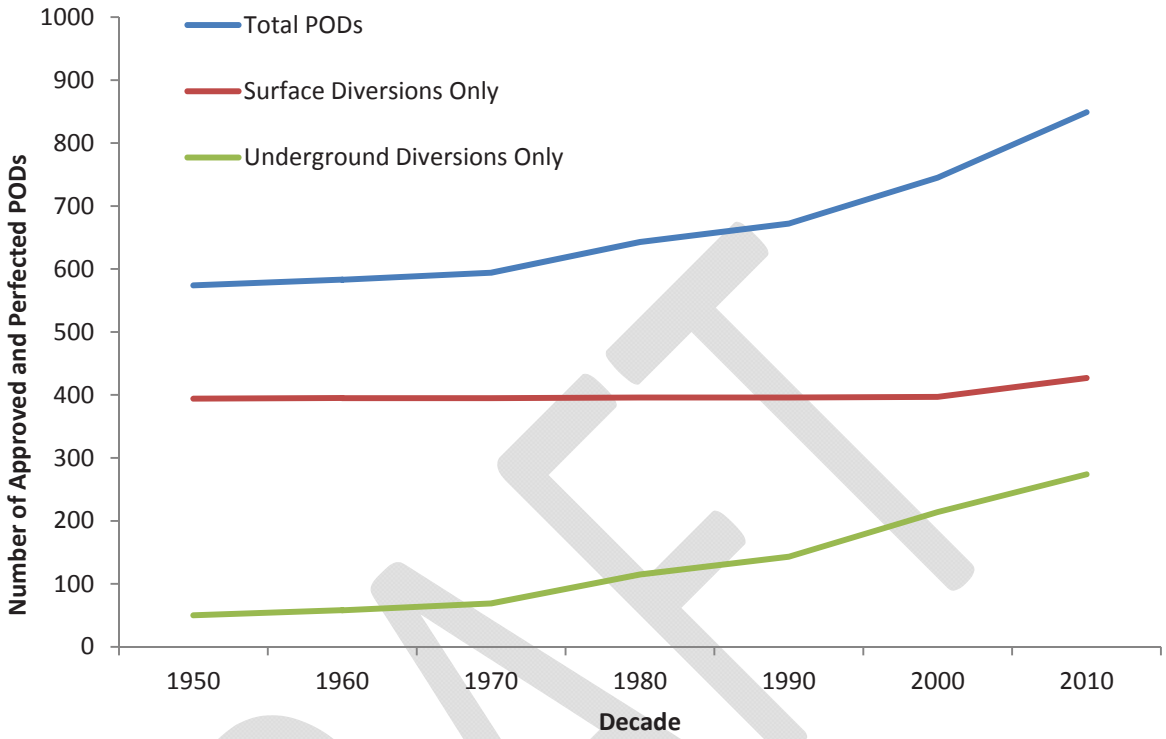
Table 5-17. Number of PODs by Use for Each Type of Diversion

	Use						
Type of POD	Domestic	Irrigation	Stock	Municipal	Other	Not Listed	Total[a]
Abandoned well	4	4	2	0	0	0	4
Drain	0	1	1	0	0	0	1
Point to point	40	1	148	0	36	1	149
Rediversion	3	22	13	0	0	0	24
Return	2	2	2	0	0	0	2
Spring	9	10	1	0	0	0	10
Surface	67	462	296	2	15	27	536
Underground	299	323	290	6	9	61	426
Total[a]	**424**	**825**	**753**	**8**	**61**	**89**	**1,152**

[a] Some PODs have multiple uses and are tabulated under each use.

An analysis of the data to identify PODs that have approved or perfected rights by decade shows a trend of increasing underground PODs in the last 20 years. These data are shown in Figure 5-17.

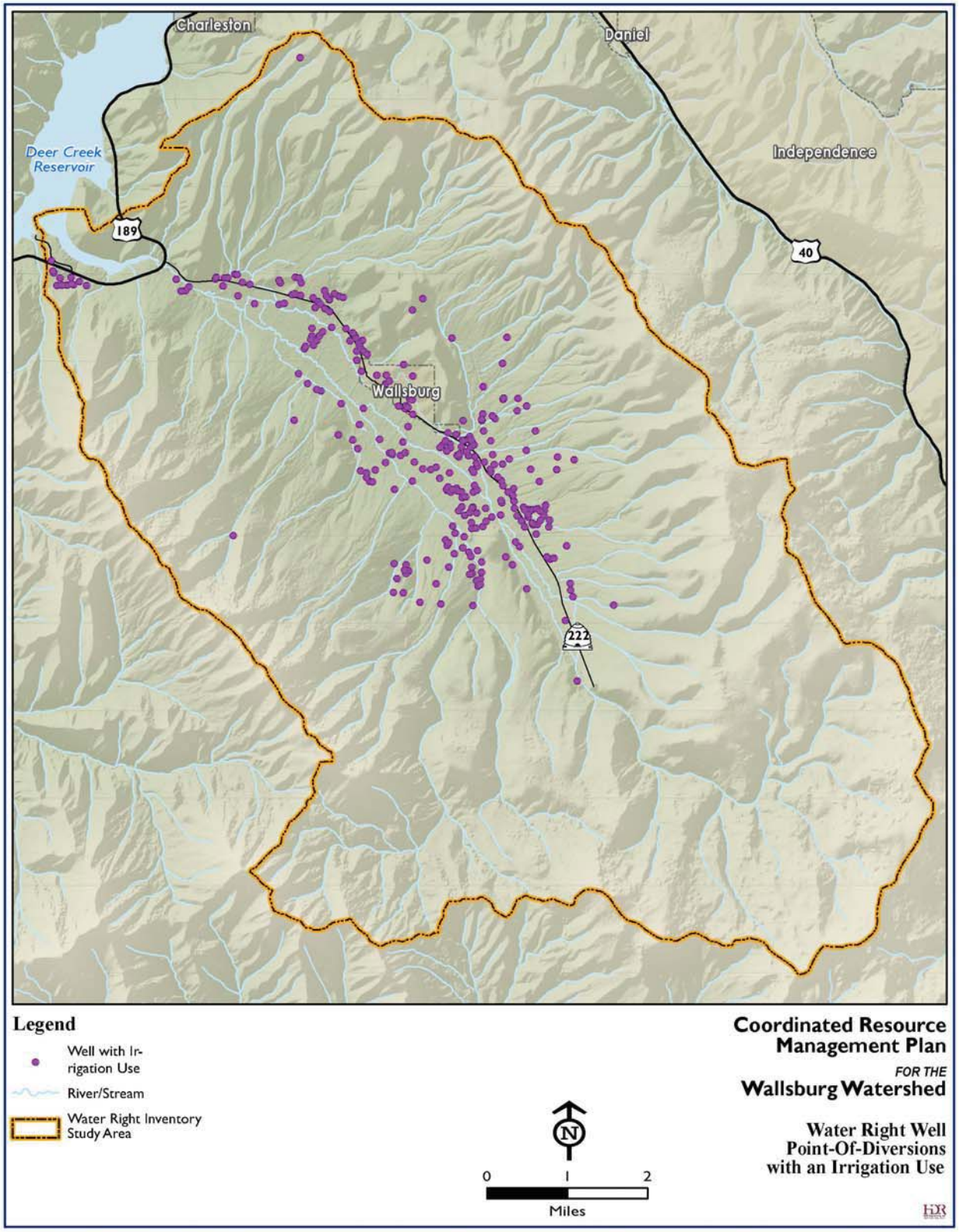
Figure 5-17. Approved and Perfected Surface and Underground Water Right PODs since 1950



The water rights inventory analysis identifies a trend in water appropriation that could support the concern of some water users that the watershed no longer yields enough water to satisfy all rights. Utah follows the doctrine of prior appropriation; that is, the first person to use the water ("senior appropriator") acquires the right ("priority") to use the water against all later users ("junior appropriators"). The community recognizes the value of water conservation, and this analysis supports the need for water-conservation programs so that all water rights can be exercised.

Figure 5-18 below shows the underground PODs that have a beneficial use of irrigation.

Figure 5-18. Water Right Well Points-of-Diversion with an Irrigation Use



5.7.3 Recommendations

Water conservation, water rights, and irrigation-water management were three of the top five resource priorities identified during this CRMP process. Any watershed-improvement projects should not harm the ability of water right holders to exercise their rights.

The recommendation to conduct preliminary planning for a Wallsburg watershed improvement plan is supported by each of the resource evaluations made within the watershed and is specifically recommended by the riparian assessment (see Section 5.2, Riparian Assessment and Inventory) and the grazinglands resource assessment (see Section 5.3, Range Assessment and Inventory). Because the majority of water right PODs provide water for irrigation and stock use, the preliminary planning should first focus on evaluating an alternate or supplemental water supply for irrigation and stock-watering uses.

In discussions with Central Utah Water Conservancy District and Wasatch Conservation Board members, it was determined that the preliminary planning effort should meet the following goals: (1) identify supplemental or alternate irrigation and stock water sources; (2) identify opportunities to improve irrigation efficiency; (3) identify the water development, conservation, and efficiency improvements necessary to restore natural flows to Main Creek and Little Hobble Creek; and (4) identify additional means of improving the quality of water in Main Creek that flows into Deer Creek Reservoir by reducing the amounts of sediment and phosphorus.

The preliminary planning study efforts should include, at a minimum, the following tasks:

- **Inventory existing irrigation systems.**
  - Identify irrigation and ditch companies, conveyance systems and diversions, water rights, and places of use.
  - Determine the acreage irrigated and stock water rights from (1) surface diversions of each of the major creeks (Spring Creek, Little Hobble Creek, and Main Creek) and (2) underground PODs.
- **Determine the needed water supply.**
  - Identify the amount of irrigation and stock water required to satisfy water rights and ways it could be delivered so that existing irrigation companies can use the current infrastructure.
  - Identify water rights (transactions) or the beneficial-use conversions required to meet water needs and project goals.
- **Identify potential sources of water.**
  - Potential sources of water could include:
    - Strawberry Reservoir water supplied to the Wallsburg watershed through Soldier Creek or the Diamond Fork system
    - Daniels Pond (via the Central Utah pump station)
    - A new groundwater supply well
    - Deer Creek Reservoir water that would be pumped up to the watershed

    - A new storage facility on Little Hobble Creek
    - Wasatch County agricultural water (pipeline from Charleston)

- **Assess the benefits of each proposed watershed-improvement project.**
    - Evaluate and quantify the benefits of the project to the irrigation-water-management companies, irrigation efficiencies, aquatic and riparian resources, agricultural production, water quality, and Deer Creek Reservoir water quality.
- **Determine costs and funding.**
    - Determine the lifecycle costs for each project alternative, operating entity, and funding partner.

The preliminary planning effort should include coordination with the Wasatch Conservation Board, the Central Utah Water Conservancy District, the WWCC, the Provo River Watershed Council, irrigation companies in the Wallsburg watershed, and state and federal agencies as required. It is estimated that this planning effort will cost between $50,000 and $100,000, depending on the number of alternatives evaluated and the coordination necessary.

5.8 Septic Tank Functionality

5.8.1 Background

The Wasatch County Health Department provided a summary and assessment of onsite wastewater treatment systems (septic tanks) in the Wallsburg watershed. The Department's report, *Onsite Wastewater Treatment Systems in the Wallsburg Watershed* (WCHD 2011), is included in Appendix G, Septic Tank Functionality Report. Figure 5-19 below was taken from this report and shows the locations of septic tanks in the watershed.

The Wasatch County Health Department is unaware of any ongoing studies or sampling of groundwater in the Wallsburg watershed area (WCHD 2011). Historically, there has been limited documentation of groundwater sampling data from wells and springs in the area as well. A 1991 study titled *Hydrology of Heber and Round Valleys, Wasatch County, Utah, with Emphasis on Simulation of Ground-water Flow in Heber Valley* was published by the Utah Department of Natural Resources (UDNR 1991). This report contained chemical analysis data from 14 wells and springs in Round Valley. One data point was from a sample collected in 1941, and the remaining data points were from samples collected in 1989. The samples were analyzed for 25 inorganic properties, not all of which had reported analytical data. The health department's 2011 report did not report the analytical data from the report by UDNR (1991).

In 1993, Wasatch County contracted Hansen, Allen & Luce, Inc,. to prepare a hydrogeologic/water quality study to address some of the county's most pressing water quality issues (WCHD 2011). Wasatch County has sensitive watersheds that provide a significant portion of the culinary water supply to large population areas downstream. Throughout the years, Wasatch County has made significant efforts to protect the quality of the vulnerable water resources. The stated purpose of the study was to "assess the adequacy of current county water quality protection measures and to prepare or strengthen guidelines in the following three areas as needed: drinking water source protection, septic system usage, and surface water quality protection." The study is significant to this plan since it reviewed,

collated, and summarized significant data specific to Wasatch County, including Round Valley. Figure 5-20 and Figure 5-21 below show general groundwater elevation levels in Round Valley and groundwater velocities and flow directions in the valley, respectively.

Most significantly, the Hansen, Allen & Luce report provided recommendations that Wasatch County has acted on, in part within the Wallsburg watershed, to reduce impacts on water quality. Specifically, Wasatch County increased the minimum size of new parcels to the recommended 5 acres as an attempt to reduce water quality issues caused by the densities of onsite wastewater treatment systems (OWTS). Additionally, the report recommended improving site evaluation and monitoring depths to groundwater. The report also reaffirmed Wasatch County's rule requiring a 4-foot minimum separation to groundwater from the soil absorption system, replacing the 2-foot minimum separation requirement in Utah Code R317-4. Figure 5-22 below shows the Utah Geologic Survey's feasibility determination for OWTS as it relates to the depth of groundwater.

Figure 5-19. Septic Tanks in the Wallsburg Watershed

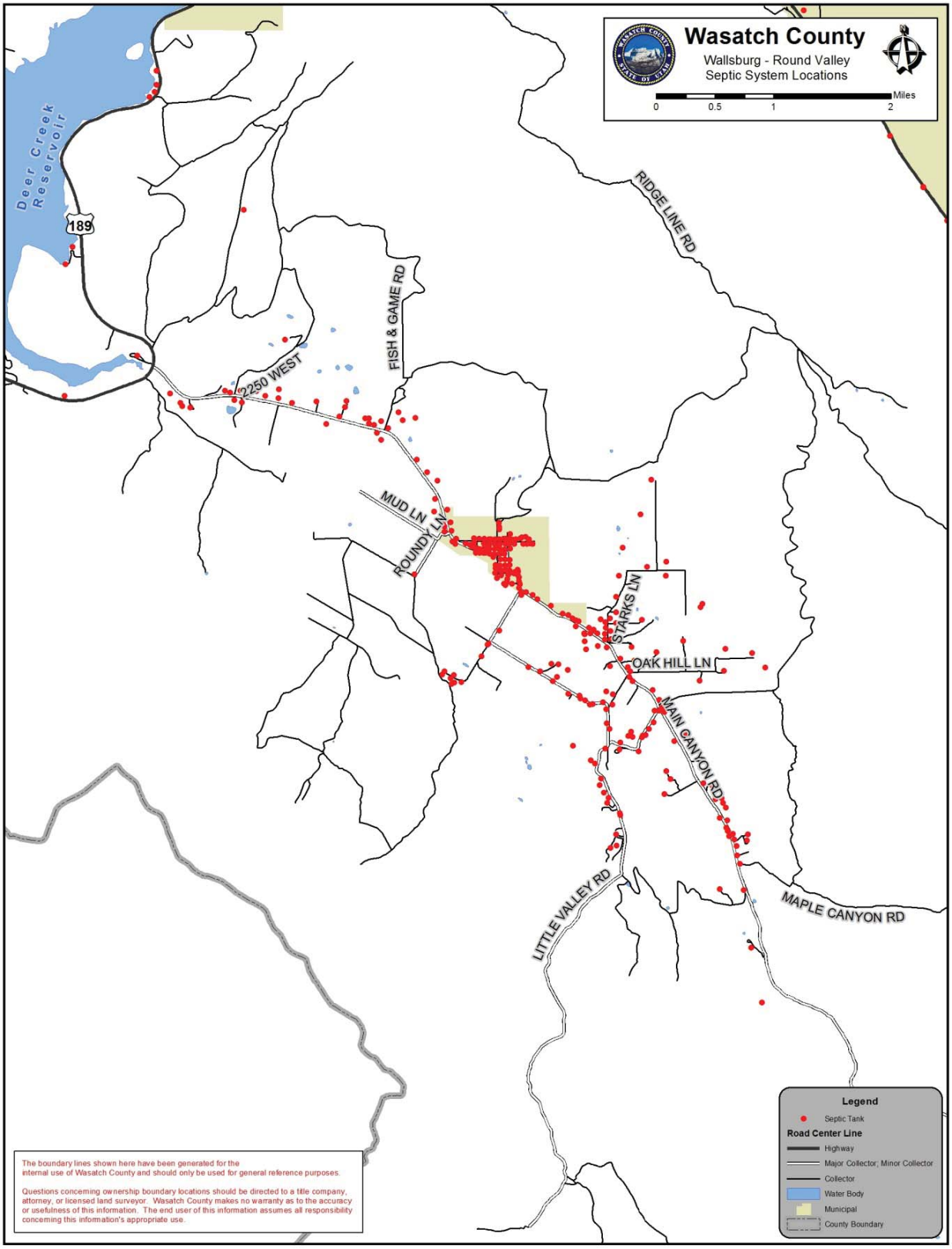
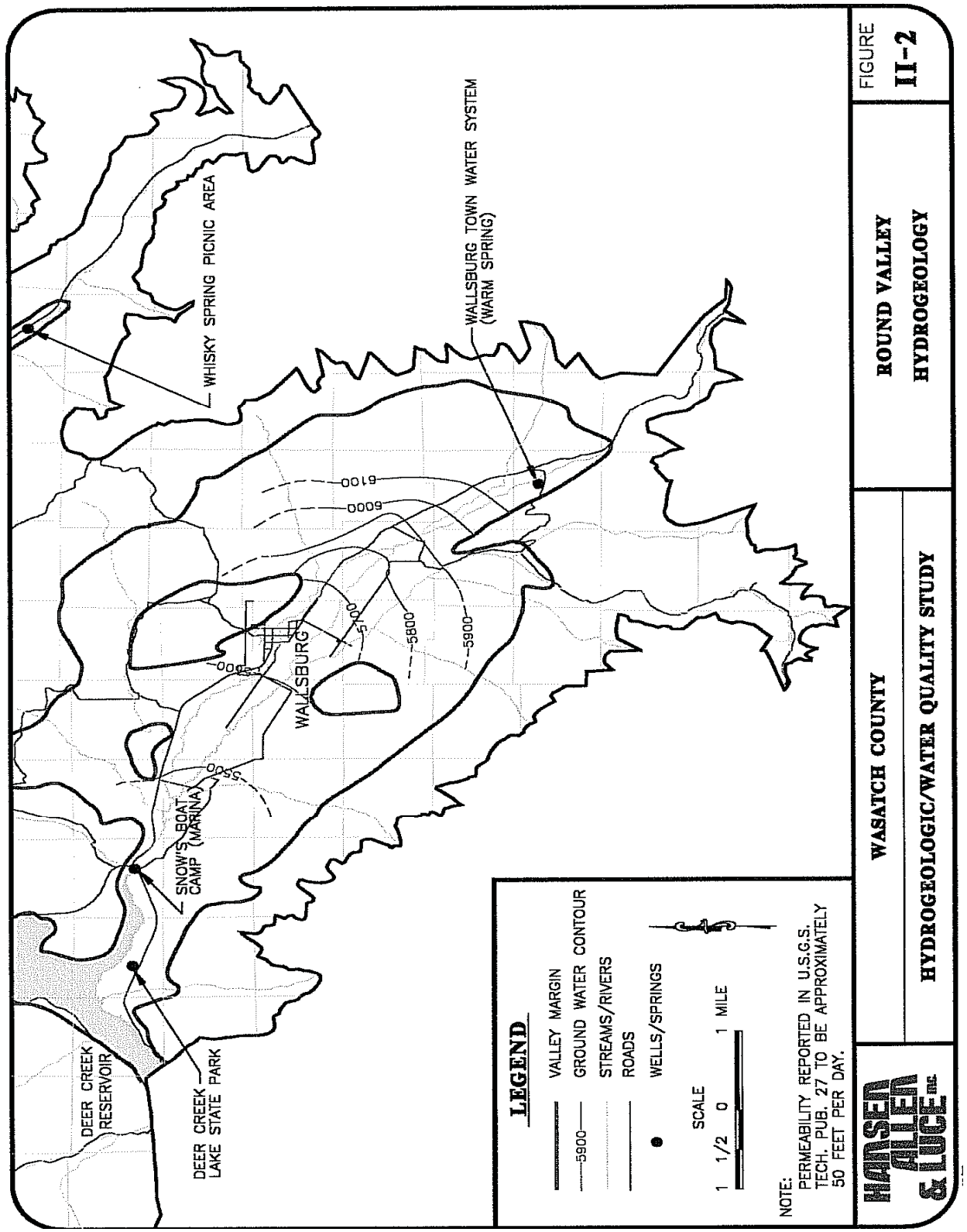
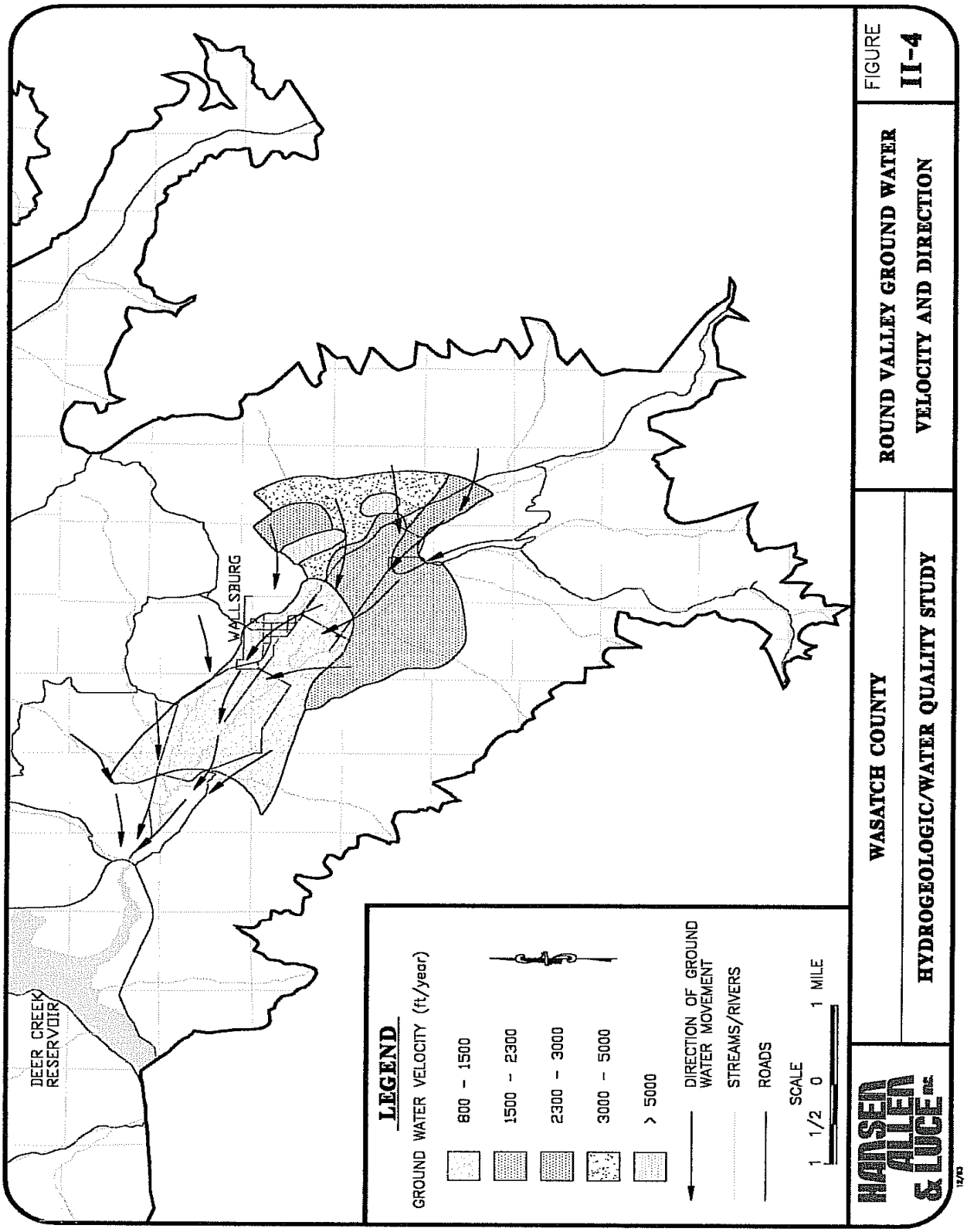


Figure 5-20. Hydrogeology in the Wallsburg Watershed



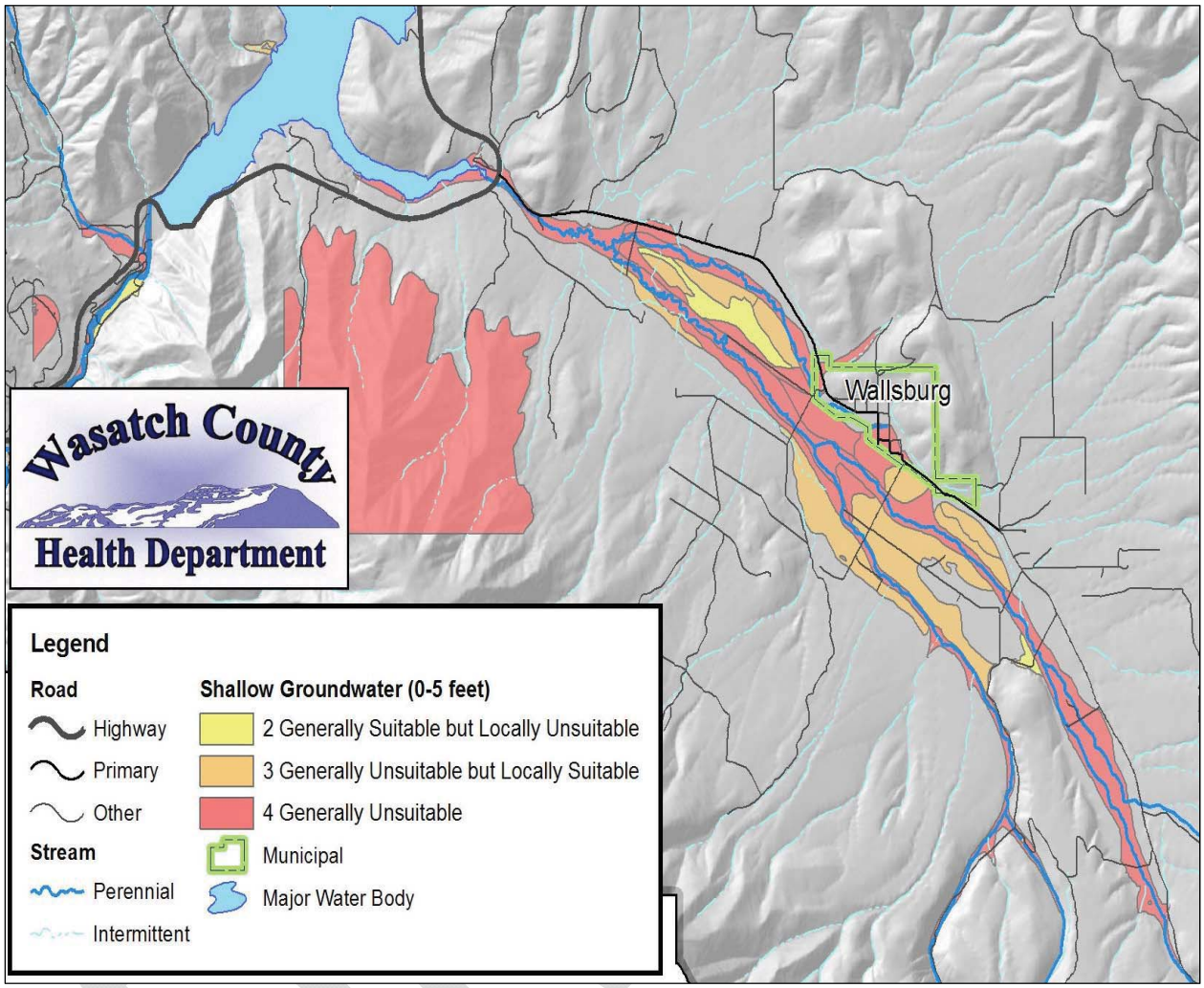
Source: Luce, Hansen & Poole 1994

Figure 5-21. Groundwater Velocity and Direction in the Wallsburg Watershed



Source: Luce, Hansen & Poole 1994

Figure 5-22. Suitable Areas for Onsite Wastewater Treatment Systems Given the Depth to Groundwater



Source: Utah Geologic Survey year

5.8.2 Results and Recommendations

The Wasatch County Health Department maintains files for properties where OWTS have been installed and operated. However, records extend only back to the 1980s and sometimes to the 1970s. A survey was conducted in 2005 in an attempt to identify parcels with OWTS and to locate the components of the systems. According to the data collected from the Department's files and the results of the survey, there were 289 OWTS in operation in the Wallsburg watershed. To take into account systems that might have been missed and the permits issued since that time, this plan estimates that there are 320 OWTS in the Wallsburg watershed.

The Department conducted a hydrogeologic study on groundwater in the Heber Valley. This study consisted of collecting groundwater samples and performing chemical analyses for pollutants of concern; collecting data related to the elevation of groundwater and flow directions; correlating the data collected with the existing U.S. Geological Survey three-dimensional, finite-difference groundwater flow model; and predicting the future septic tank influence on groundwater conditions based on future land-use build-out conditions. The Department was able to better understand the influence and effect of septic tanks on groundwater through this study and recommends that a similar study is conducted for the Wallsburg watershed. The Wallsburg study might be more effort if a groundwater model is to be developed to assist with the existing and future data analyses, since there is no existing groundwater model for the area.

On average, about one to two failing OWTS a year in the area are reported to the Department. A wastewater permit is required for all failures, repairs, and replacements of OWTS. Unfortunately, not everybody reports a failure, repair, or replacement of their OWTS as required by the Department's wastewater rules.

Technologies are available for constructing new OWTS and repairing or replacing existing OWTS. Design techniques could be required that allow better treatment of wastewater and sustainability of the OWTS. Such techniques include oversizing the tank and drainfield, providing convenient access to the tank and drainfield for inspection purposes, using alternating drainfields, dosing the effluent throughout the drainfield through a pressurized system, and using alternative technologies that treat the effluent prior to disposal for water quality's sake.

However, these new technologies come with a price to the property owner. The Department estimates that a conventional OWTS for a single-family residence costs between $8,000 and $10,000 depending on site conditions. The new alternative technologies could cost as much as $20,000 per single-family residence. The Department recommends that a study is done with community outreach and involvement to evaluate the costs and benefits of requiring alternative treatment systems for new home construction and repairing or replacing existing systems in the Wallsburg watershed and to evaluate whether funds are available to offset the increased treatment costs.

Forming a sewer district should also be considered. A sewer district could be used to convert existing systems in the Wallsburg watershed to a modified centralized sewer system or even a traditional centralized sewer system. The centralized sewer treatment system would need to meet current no-discharge requirements pertaining to the Provo River watershed.

Regarding the use of OWTS in the Wallsburg watershed, the Department presents the following recommendations from least expensive and most achievable to most expensive and least achievable:

- Because private citizens own and operate these systems, there is limited ability to ensure the systems' proper operation and maintenance. For this reason, steps should be taken to initiate an educational campaign for property owners to help them understand how to operate and maintain their systems in a manner that minimizes impacts.

  Estimated cost: $7,500

- Develop and institute a maintenance program for all OWTS in the area. This program could be voluntary or could be overseen by an onsite wastewater management district. The program could require all OWTS owners to obtain an operating permit that would require the submission of proof of annual inspections of the entire system for renewal; or those participating could just be required to pump the septic tank and inspect all components of the system every 3 to 5 years of operation.

  Estimated cost for voluntary program: $7,500
  Estimated cost for formal district program: $25,500

- To understand the water quality issues in the Wallsburg watershed, the Department recommends that an expanded hydrogeologic/groundwater quality study, similar to the 1994 study for the Heber Valley area, be considered specifically for this area. This study could better evaluate the actual and future impacts to groundwater and surface water resources in the area from not only OWTS but also from agricultural and residential practices, change of irrigation patterns, and use of pesticides and fertilizers.

  Estimated cost: $85,000

- Conduct a community-based study to identify the feasibility of requiring improved treatment systems for all new, repaired, or replaced OWTS. The study would look at the impact to current ordinances, future development, acceptable alternative technologies, potential funding to offset the increased treatment requirement, and community acceptance.

  Estimated cost: $25,000

- Conduct a feasibility study to evaluate the impacts and costs of alternative sewer collection and treatment systems. Potentially evaluate the impacts of using a STEP system (septic tank effluent pumping system that moves wastewater to a centralized disposal area) and the traditional centralized sewer system (central collection of sewage with treatment and disposal) as well as other options.

  Estimated cost: $60,000

5.9 Hydrology

5.9.1 Background

The Utah NRCS office conducted a hydrology study of the Wallsburg watershed to estimate potential discharges from the ungaged watershed (NRCS 2010b). Three hydrology models were used to derive the various parameters necessary to estimate the return interval discharges that could be expected from the Wallsburg watershed: NRCS GeoHydro, HEC GeoHMS, and WinTR20. A verification and sensitivity analysis was conducted on model results to verify the accuracy of the predictions. The verification study included a comparison of model predictions to USGS Regression Equations and USGS stream gages in the vicinity. A bankfull analysis was also conducted to determine the bankfull discharges. Details of the modeling techniques and verification analysis used, as well as model inputs and outputs, are included in the Wallsburg (Round Valley) Hydrology report in Appendix H, Hydrology Report.

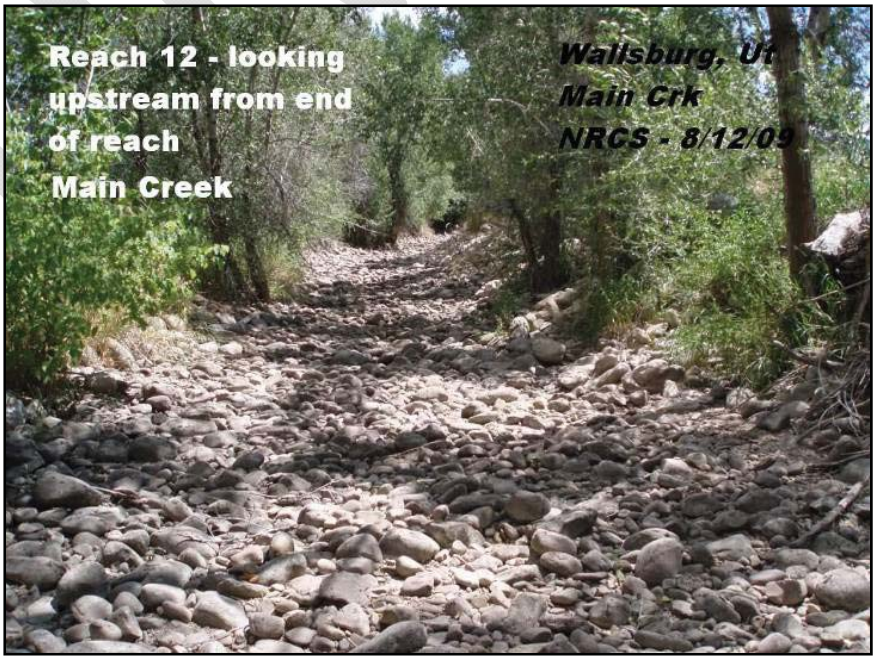
5.9.2 Results and Recommendations

The Main Creek drainage system was delineated into 12 sub-basins. Average return interval discharges at the outlet of Round Valley predicted by the NRCS report (NRCS (2010b) are summarized in Table 5-18 below.

Table 5-18. Return Interval Discharges for Main Creek

Watershed Area (sq. mi.)	2-Year Event (cfs)	5-Year Event (cfs)	10-Year Event (cfs)	25-Year Event (cfs)	50-Year Event (cfs)	100-Year Event (cfs)
70.09	142.6	163.3	229.0	386.5	556.5	860.9

Source: NRCS 2010b



The NRCS (2010b) hydrology report did not make specific recommendations. The information in the report, however, should be considered in any engineered restoration project.

5.10 Pastureland Assessment

5.10.1 Background

An inventory of irrigated pasture and hayland in the Wallsburg watershed was included in the *Wallsburg Watershed Grazinglands* report prepared by NRCS [NRCS 2010c]. Pasturelands in the Wallsburg watershed were divided into nine categories based on their use, management, and soils (NRCS 2010c). The report is included in Appendix D, Grazingland, Forest, and Pastureland Reports, and is summarized below.

5.10.2 Results and Recommendations

NRCS estimates that about 3,186 acres of the watershed are irrigated pasture and hayland. The land categories and a summary of observations from the *Wallsburg Watershed Grazinglands* report are provided in Table 5-19 below.

Table 5-19. Irrigated Pasture and Haylands in the Wallsburg Watershed

Irrigated Lands Category	Acres	Observations
Wet meadows	933	Flood and sub-irrigated pastures with high plant diversity; some poisonous and undesirable weeds present. Typically one hay cut and continuous season-long grazing.
Grass/alfalfa hay	835	Dominant use for irrigated, low-water-table lands. Flood and sprinkler irrigation used. Few weeds. Typically two hay cuts and stubble grazing in fall.
Horse pasture	436	Season-long grazing, severely used. Mostly flood-irrigated, non-native grasses with many weeds. Low forage production from poor management.
Irrigated pasture grass	265	
Buildings and farmsteads	557	All yards, buildings, parking lots, etc., in the watershed were included in this category.
Alfalfa/grain rotation	52	Well managed.
Abandoned	20	
Alfalfa pasture	88	Alfalfa apparently used for pasture.
Total	**3,186**	

Source: NRCS 2010c

The major resource problems related to rangelands that were identified in the grazinglands report are summarized below.

- Invasive species:
  - Lower-elevation understory plant communities are dominated by bulbous bluegrass, which decreases the value for wildlife habitat and livestock forage.
  - Noxious weeds, including musk, Canadian and Scotch thistle, and knapweeds are present in the watershed and could rapidly expand if not controlled.
- Livestock forage:
  - Forage production is below potential. Replacing invasives with perennial grasses and improving grazing management could improve production.
  - Inadequate stock-watering sources limit the grazing management flexibility needed to accomplish time-controlled grazing.

The recommendations made in the grazinglands report are summarized in Table 5-20. More details can be found in Appendix D, Grazingland, Forest, and Pastureland Reports.

Table 5-20. Recommended Practices to Improve Pasturelands in the Wallsburg Watershed

Practice	Activity	Description	Cost Estimate
Small-pasture management	Public outreach campaign	Educate landowners on principles of irrigation management and grazing management to maximize forage production.	$20,000
Planting improved forage species	Establish Garrison creeping meadow foxtail	Plant Garrison creeping meadow foxtail on half of the 933 acres of wet meadow.	$23,325
		TOTAL	**$43,325**

Source: NRCS 2010c

The grazinglands report (NRCS 2010c) also suggested that the option to convert the entire valley to pressurized sprinkler irrigation by exchanging Central Utah Project water would yield great benefits for water quality and conservation and should be explored.

6.0 Recommendations

The overall goal of this watershed CRMP plan is to identify watershed priorities based on stakeholder input, assess existing resources in the Wallsburg watershed, and develop a framework of recommendations and actions that can be implemented to address priorities.

The top three priorities for the watershed were identified as:

- Water quality/quantity management and conservation
- Rangeland and pastureland improvement
- Riparian corridor management

To improve water quality in Main Creek, Spring Creek, and Little Hobble Creek, the plan identifies recommendations for restoring the riparian corridors and grazing management. Developing a supplemental irrigation water source would allow better water management and increase water conservation.

To address the resource needs and priorities, resource agencies and consultants developed the following recommendations for specific projects. Implementing these recommendations is strictly voluntary on the part of the landowners and watershed council partners. Designation as a partner does not imply responsibility or commitment of resources.

In all, implementing the recommendations would cost an estimated $2.9 million and would involve multiple landowners. This plan identifies funding programs through NRCS (Environmental Quality Incentives Program [EQIP], Conservation Resource Program [CRP], Wildlife Habitat Incentives Program [WHIP]), the Utah Division of Water Quality (319 non-point source funds), and the Utah Division of Wildlife Resources as potential funding sources.

Table 6-1. Recommendations

Resource	Objective	Strategy	Estimated Cost	Partners[a]
Water Conservation	Increase irrigation efficiencies of pasture and haylands	Evaluate conversion of all irrigation systems to gravity-feed pressurized sprinkler irrigation.		
	Increase stream flow in Main Creek and Little Hobble Creek	Conduct preliminary planning study to evaluate the Wallsburg Watershed Improvement Plan.	$100,000	CUWCD, WCD
Water Quality	Improve water quality in Spring Creek	Conduct an assessment of the Spring Creek water source to identify the cause(s) of the high phosphorus. Develop a plan to reduce the phosphorus sources to Spring Creek.	$50,000	NRCS, PRWC
	Riparian corridor conservation practices to minimize sediment transport	Main Creek riparian practices: 4-miles of fence, 44 acres of seeding, 1,000 linear feet of willow planting, 66 acres of weed treatment, grazing management, and 15 watering troughs.	$233,900	WRP, 319, PRWC, property owners
		Little Hobble Creek riparian practices: 2-miles of fence,44 acres of seeding, 3,000 linear feet of willow planting, 66 acres of weed treatment, grazing management, and 10 watering troughs.	$121,000	WRP, NRCS WHIP, 319, NRCS EQIP, PRWC
		Upper Spring Creek riparian practices: 1.2 miles of fence, 44 acres of seeding, 1,000 linear feet of willow planting, 66 acres of weed treatment, grazing management, and 5 watering troughs.	$33,500	WRP, NRCS EQIP, NRCS WHIP, PRWC
	Stream corridor restoration for the Beesmark Property	Fencing and restoration practices on 8,390 linear feet of Main Creek: 12,000 cubic yards of earthwork, 60 cubic yards of concrete structure, 5 miles of fence, and 11,400 acres of new vegetation.	$186,900	WRP, property owners, NRCS, PRWC
		Total Water Quality	**$625,300**	
Groundwater Quality	Assess hydrogeologic/ groundwater quality	Evaluate current and future impacts to groundwater and surface water resources from OWTS, agricultural and residential land-management practices, change in irrigation patterns, and use of pesticides and herbicides.	$75,000	Wasatch County, Utah Division of Water Resources
	OWTS education	Educate and inform residents about OWTS and operating and maintenance (O&M) procedures.	$15,000	Wasatch County
	OWTS management	Develop and enforce O&M program.	$25,000	Wasatch County

Table 6-1. Recommendations

Resource	Objective	Strategy	Estimated Cost	Partners[a]
		Conduct feasibility study to create an onsite wastewater management district or sewer district. Could require operating permit and annual inspections. Fund through permits or convert onsite systems to a centralized sewer system.	$ 60,000	Utah Division of Water Quality, Wasatch County
		Create guidance document for best practices for new septic systems.	$10,000	Wasatch County
		Total Groundwater	**$185,000**	
Grazing lands	Improve grazingland production	Develop whole-ranch grazing-management plans with the 5 to 7 largest landowners/permittees.	$80,000	UDAF, USU, UACD, NRCS
	Implement prescribed grazing practices	Target 10,000 acres with conservation plans to implement practices.	$40,000	USDA Farm Bill Program
	Increase grazing distribution	Develop 10 new/improved stock-watering facilities to facilitate grazing distribution on public and private land.	$50,000	USFS, Utah Division of Water Rights, NRCS GIP, UDA
	Implement grazing management	Construct 10 miles of fences to implement grazing management on private land.	$50,000	NRCS, UDA
	Implement weed-control practices and education	Conduct public outreach and spot treatment on public and private land.	$15,000	NRCS EQIP
Pastureland	Education and outreach campaign	Conduct workshops and field days, prepare grazing guide, and conduct personal interviews with landowners.	$20,000	USU Extension Services, UACD, NRCS
	Plant wet meadow sites	Target 933 acres of wet meadow for seeding with Garrison creeping meadow foxtail.	$23,300	
		Total Grazing/Pasture	**$278,000**	
Wildlife Habitat	Increase sage grouse habitat	Target 3,150 acres for sagebrush and rabbitbrush treatment, thin shrub canopy, and improve understory plant community.	$315,000	Utah Division of Wildlife Resources, NRCS EQIP
		Target 2,500 acres for chemical treatment on individual oak clones.	$50,000	Utah Division of Wildlife Resources, NRCS EQIP
		Total Wildlife Habitat	**$365,000**	

Table 6-1. Recommendations

Resource	Objective	Strategy	Estimated Cost	Partners[a]
Aquatic Resources	Restore native fish community	Construct separation structure to restrict the upstream migration of non-native fish from Deer Creek Reservoir into Lower Main Creek.	$25,000	Utah Division of Wildlife Resources, URMCC
	Restore natural stream conditions throughout the lower 6 miles of Main Creek	Conduct in-stream flow study to determine minimum flow requirements for fisheries habitat.	$45,000	Utah Division of Wildlife Resources, UWRL
		Restore proper meander ratios, bank slope, and vegetative cover to stream through comprehensive stream restoration project. Basis of cost is $100,000–$150,000 per mile (depending on condition) for 6 miles.	$900,000	Utah Division of Wildlife Resources, NRCS, UDWQ, HC
	Restore native fish community to Main Creek	Mechanically and/or chemically remove brown trout and stock Bonneville cutthroat trout below Roundy Lane and above the barrier after restoration.	$8,000	Utah Division of Wildlife Resources
	Increase angling opportunities	Develop walk-in-access leases and other voluntary partnerships with private landowners to allow angling access to Main and Little Hobble Creeks.	$5,670	WIA, HC
	Ensure Main Creek in-stream flows	Purchase and/or lease in-stream flow and implement water-conservation projects.	TBD	Utah Division of Wildlife Resources, UWRL, NRCS, TU, HC
	Ensure long-term protection of aquatic habitat	Establish conservation easements with private landowners to protect riparian and wetland habitat.	$350,00	Utah Division of Wildlife Resources, NRCS
		Total Aquatic	**$1,333,670**	
		GRAND TOTAL	**$2,836,970**	

Table 6-1. Recommendations

Resource	Objective	Strategy	Estimated Cost	Partners[a]

[a] Abbreviations:

319 = 319 Non-point Source Grant Program (State of Utah)
CUWCD = Central Utah Water Conservancy District
EQIP = Environmental Quality Incentives Program (NRCS)
GIP = Grazing Improvement Program (NRCS)
HC = Habitat Council
NRCS = Natural Resources Conservation Service
PRWC = Provo River Watershed Council
TU = Trout Unlimited
UACD = Utah Association of Conservation Districts
UDA = Utah Department of Agriculture
UDAF = ???
URMCC = Utah Reclamation Mitigation and Conservation Commission
USDA = U.S. Department of Agriculture
USFS = U.S. Forest Service
USU = Utah State University
UWRL = Utah Water Research Laboratory (USU)
WCD = Wasatch Conservation District
WHIP = Wildlife Habitat Incentives Program (NRCS)
WIA = Walk-in-Access
WRP = Watershed Restoration Program

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