Section 319 Nonpoint Source Pollution Control Program Watershed Project Final Report

Wallsburg Watershed Improvement Project

FY 2014

By

The Wasatch Conservation District
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Figure 1: Project Work on Main Creek in the Wallsburg Watershed

This Project was conducted in cooperation with the State of Utah and the United States Environmental Protection Agency, Region 8

HUC: 160202030404, 160202030403, 160202030402

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Executive Summary

PROJECT TITLE: Wallsburg Watershed Improvement Project

GRANT SOURCE: Utah Division of Water Quality, EPA Clean Water Act section 319.

INITIATION DATE: 7/01/2014	EXPIRATION DATE: 6/30/2017
EPA FUNDING: $150,000.00	TOTAL BUDGET: $975,822.60
Total EPA 319 FY 2014:	$150,000.00
Total EPA 319 Expenditures FY 2014:	$150,000.00
Total Eligible Match Accrued:	$459,400.80
Total Ineligible Match Accrued:	$366,421.80

Summary Accomplishments

Resource concerns were identified by local landowners in the 2012 Wallsburg Coordinated Resource Management Plan. Water Quality was ranked as the second priority. The Wasatch Conservation District became the lead agency for the watershed improvement. Project work for phase 1 began on Main Creek on September 5th 2013 and included funding sources from the Natural Resource Conservation Service (NRCS) Environmental Quality Initiative (EQIP), Utah Department of Agriculture and Food (UDAF), Utah Division of Water Quality (UDWQ), Provo River Watershed Council, the Utah Grazing Improvement Program (UGIP) and Watershed Restoration Initiative (WRI) funding sources. Phase 1 of the Main Creek Restoration Project included the first five landowners upstream from Deer Creek Reservoir, of those five, four landowners completed stream restoration projects on their property. Phase 2 began in October 2014, with the fifth landowner from phase 1 and included two additional upstream landowners.

To date, 3.22 miles of stream have been restored. In some sections meanders were reinstalled, banks were pulled back to a 3:1 slope. The disturbed areas were seeded and a wide assortment of riparian vegetation was planted. Other sections used soil lifts wrapped with coconut fiber mesh. A seed mixture was spread below the fabric and native vegetation was planted. Over 10,000 willow cuttings were inserted through the coconut fiber. 5 miles of fencing has been installed. Unrestricted access to the stream by livestock has been reduced. Water gaps and crossings were installed to allow cattle selective water access and movement between pastures.

Depending on the availability of project funds, the Wasatch Conservation plans to assist additional landowners for phase 3 beginning in the fall of 2015.

Introduction

Project Water Quality Priority

The TMDL for Deer Creek Reservoir has various target loads of phosphorus into the reservoir. Not only has Main Creek exceeded the TMDL for total phosphorus, but has also been very high when compared to other source waters. The TMDL target load for total phosphorus in Main Creek is 1,210 kg/year. In 2009 the total phosphorus load from Main Creek was 3,175 kg/year, which is 2.5 times greater than the TMDL target load. The TMDL study found that Main Creek contributes 8% of the flow into Deer Creek Reservoir and 17% of the phosphorus load. The average annual total phosphorus load contribution from Main Creek is 2,629 kg. Due to these exceedances in total phosphorus in Main Creek, the Wallsburg Watershed Plan was initiated. (Psomas, 2002)

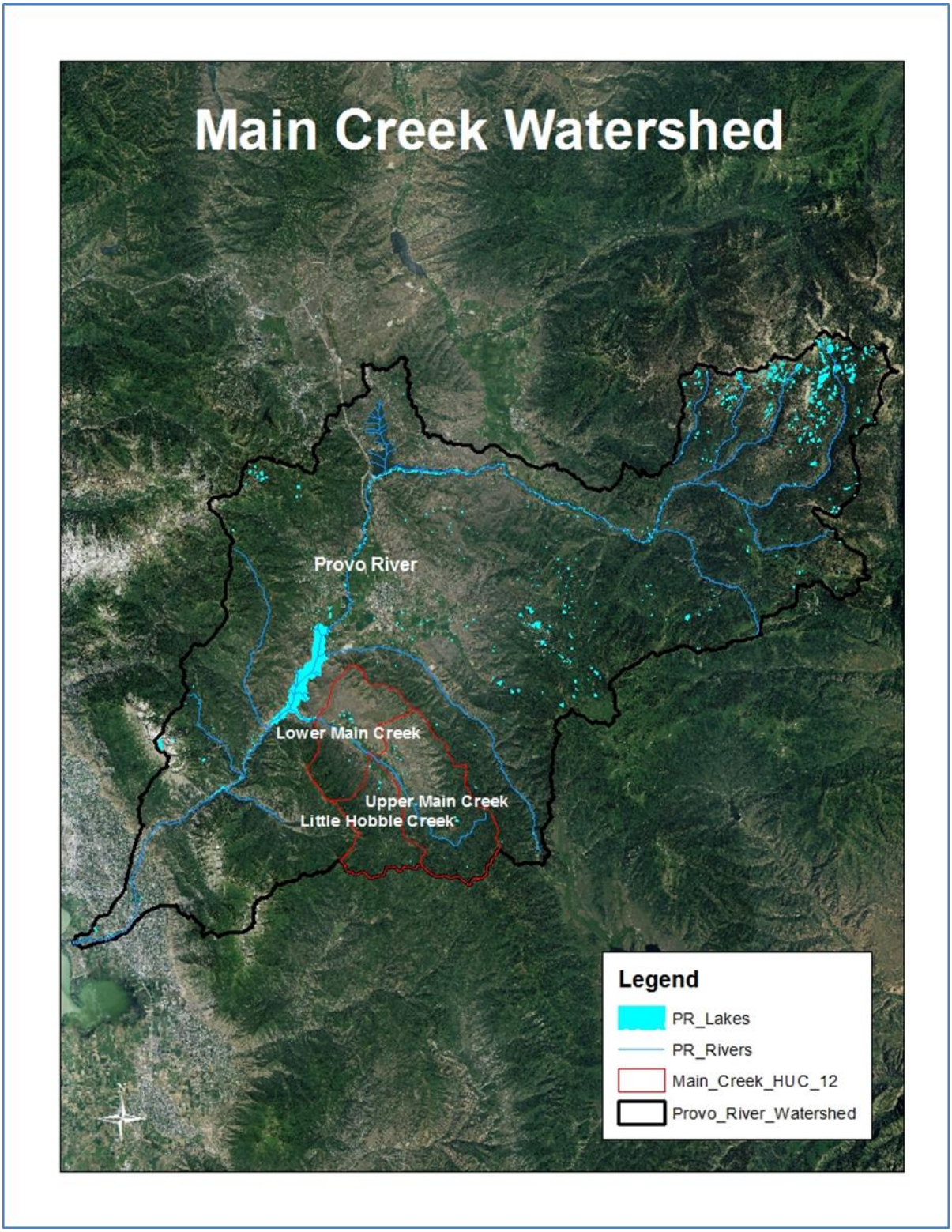
In March 2007, the Wasatch Conservation District, local landowners and conservation agencies met to address local resource concerns and to form the Wallsburg Coordinating Council (WWCC). Using the Coordinated Resource Management (CRM) process, stakeholders, landowners, and agency personnel discussed the local resources and the potential for actions to protect and restore the watershed. Participants listed water conservation and water quality as the top two resource concerns.

Each resource concern was established using the consensus based approach idealized with the CRM process. After all of the resource concerns were addressed, the Wasatch Conservation District completed a Coordinated Resource Management Plan for the Wallsburg Watershed in 2012. Within the document, stream restoration was listed as an important factor in phosphorous reduction for the watershed. For a copy of the Wallsburg Coordinated Resource Management Plan go to wasatchconservationdistirct.org

Waterbody Information

Currently, Deer Creek Reservoir (HUC: 160202030405) is listed as an impaired water body (i.e., this water does not meet water quality standards) by the Utah Department of Environmental Quality due to high levels of total phosphorus and low levels of dissolved oxygen. Based on the 2002 Deer Creek Reservoir Drainage TMDL (Total Maximum Daily Load) Study, the average annual total phosphorus load contribution from Main Creek was estimated as 2,629 kg. As a major drinking water source for the residents living along the Wasatch Front, Deer Creek Reservoir's water quality problems are of great concern. High phosphorus levels result in increased aquatic plant growth within the reservoir. As these plants grow and die, the result is reduced oxygen levels and subsequent fish kills. In 2010, Main Creek (HUC: 160202030404, 160202030403) was listed for Escherichia coli and temperature not conducive for a cold water fishery.

Map



Map 1: Map of the Wallsburg Watershed and associated creeks.

General Watershed Information

As a tributary to Deer Creek Reservoir in Wasatch County Utah, the Wallsburg watershed covers approximately 45,000 acres. About one-third of the watershed is forest (15,000 acres), roughly 3,000 acres are used for agriculture, and just under half of the watershed (21,600 acres) is privately owned. With only one town, Wallsburg, the watershed has about 600 residents.

The Wallsburg watershed is a narrow river valley bound 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 Highway 189. 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.

At approximately 14.6 miles, Main Creek is the major stream in the watershed. Tributaries to Main Creek include Little Hobble Creek (3.1 miles) and Spring Creek (3.2 miles). The hydrology of Main Creek and Little Hobble Creek is primarily controlled by snowmelt, with high flows occurring from April through July. Spring Creek begins at a large spring on the eastern side of Wallsburg. It flows along the southwest portion of Wallsburg and eventually enters Main Creek. Since it is spring fed, Spring Creek does not see the high snowmelt flows in spring and early summer, but has a more even flow which tapers down in late fall. All three creeks 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. (Wasatch Conservation District, 2012)

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

The Wallsburg watershed supports a diverse wildlife community. There is year-round habitat throughout all or part of the watershed for elk, mule deer, moose, as well as black bear, cougar, and a variety of game birds. The northern and eastern hillsides of the watershed are crucial elk winter range, and the southwestern hillside is crucial year-long elk habitat. The northeast and southwest lower hillsides are crucial mule deer winter range, and the upper hillsides are crucial mule deer spring/winter range. Wild turkeys also have been introduced into the area and are doing well. (Utah Division of Wildlife Resources, 2010)

Water Quality Problems

Streams within the Wallsburg Watershed are characterized by steep raw banks and an unconnected flood plain. During spring runoff, large sections of the banks have been known to slough off. Main Creek is prone to down-cutting. A lack of riparian vegetation along some reaches increases the risk of bank side erosion. The soil in the Wallsburg watershed is high in phosphorus, which contributes to the eutrophication problems in Deer Creek Reservoir. Agricultural runoff and the direct contact with animals to Main

Creek increase the transmission potential of E. coli to the stream. Due to a lack in fencing, there is a shortage of native woody vegetation along stretches of the river. This decreases the shading of the stream and allows for an increase in temperature. Main Creek is listed for exceedances in phosphorous, temperature and E. coli.

Fencing, soil lifts, cattle crossings, j-hooks, off-site watering, water gaps, cross vanes, native vegetation plantings, rock riprap, and riparian seedings are the associated practices for erosion control and reduction in the Wallsburg Watershed. Fencing will reduce unrestricted, direct animal contact with the stream, decreasing the transmission potential for E. coli and reducing hoof sheer. Increasing the amount and variety of riparian vegetation will promote additional stream shading which will decrease in-stream temperature. (Wasatch Conservation District, 2012)

Project Goals, Objectives, Tasks

Progress Narrative Project Goals, Objectives, Tasks

Goal 1: Reduce phosphorus pollution loading to Deer Creek Reservoir, increase the stability of the stream-banks, eliminate unrestricted access of cattle with fencing to reduce E. coli, and improve riparian habitat to decrease stream temperature.

Objective 1: Plan, design and implement riparian restoration projects in priority areas along Main Creek, Little Hobble Creek and/or Spring Creek within the Wallsburg Watershed. The specific tasks listed below will reduce sediment and nutrient loading, reduce E. coli concentrations, increase stream shading, reduce stream temperatures, and improve the cold water fishery habitat.

Task 1: Improve the conditions of the creek including; improving the functional stream channel width/depth ratio, meander pattern and floodplains, stabilize undercut banks with woody riparian vegetation, in-stream rock and woody structure and cover for fish habitat. Stream restoration practices to be implemented will utilize heavy machinery to slope back and stabilize vertical eroding banks, soil lifts with coconut erosion control fabric, riparian distributed beneath the first soil lift, upland seed mixtures on higher soil lifts and disturbed sites, willow pole plantings, cross vanes, j-hooks, and barbs.

Product: 3.22 miles of stream have been restored. In one section, the NRCS engineer decided that pulling the banks back to a 3:1 slope was the best option. (Phase 2) This section of stream was arrow straight and prone to down-cutting. Meanders and were reinstalled along with the sloping. (Refer to figures 4 through 6 in the appendix.) 1,693 feet of stream was increased to 3,250. Rock clusters were installed throughout the section to help reduce water energy, slow water flow and reduce erosion. To further increase bank stabilization, 8,690 riparian plants were installed from a local nursery.

In other sections, (Phase 1) soil lifts and coconut fiber laybacks were used. (Refer to figures 8 through 10 in the appendix.) Soil lifts indirectly enhance stream habitat through the creation of a stable stream bank toe and reduced sedimentation from erosion (Schueler, 2004). Many areas only required one soil lift, while another stretch of stream channel was deep enough to require three. Using soil lifts allows the inclusion of small flood plains on near the thalweg. River energy is more easily dissipated with the lifts. Each lift was wrapped in coconut fiber. Coconut fiber is used to immediately reduce bank erosion. A riparian seed mixture was spread below the fiber and more than 10,000 willow cuttings were inserted through the fiber matrix. An additional 3,990 riparian potted plants were installed. The added vegetation will increase bank stabilization and improve stream shading. Stream temperature will decrease as the amount of vegetation increases.

J-hooks were used help control the flow of the water. Cross vanes (refer to Figure 13 in the appendix) were installed to help control down cutting, reduce stream velocity and retain sediments. These in stream structures will help reduce erosion and allow vegetation to become established in areas with bare riparian zones.

Cost: $873,863.58	EPA 319: $139,500	EQIP:	$365,331.76 (not match)
		State NPS:	$221,600.00
		UDAF:	$100,000.00
		WRI:	$85,000.00
		PRWC:	$50,000.00
		In-kind:	$12,431.82

Task 2: Improve livestock management adjacent to the creeks where appropriate. BMP's for livestock management will include fencing, watering sites, rest/rotational grazing, timing and season of use, off-stream watering, etc.

Product: 26,900 linear feet of fences along the riparian section have been installed (5 miles). One landowner added cross fences and was able to separate his grazing into three allotments. Improved grazing management will increase the amount of cover vegetation and reduce nutrient rich overland runoff. Animals are watered with rocked animal crossing access points. Controlling cattle will reduce hoof sheer along the stream bank and allow the riparian plantings to flourish. Once the riparian vegetation is established, a two week flash grazing management program will be used in the fences zone to control weeds and improve willow vitality.

Cost: $74,059.02	EPA 319: $0	EQIP:	$1,090.04 (not match)
		UGIP:	$25,873.50
		Wasatch County:	$3,000.00
		In-kind:	$44,095.48

Goal 2: Increase public awareness through education, outreach and information.

Objective 2: Using a combination of information mailers, project site tours and public outreach meetings; inform Wallsburg landowners about the Main Creek Restoration Project, and encourage other landowners to implement similar BMPs on their property.

Task 3: Create and distribute a mailer that will inform and educate the general population of Wallsburg, including targeted landowners, to increase project visibility and public awareness.

Product: 150 Mailers. 2 Meetings with the Wallsburg Town Council. 60 Hats. 2 Volunteer Planting Project Days. The mailer (see figure 2 below) was produced to target landowners in Wallsburg owning property along Main Creek, Spring Creek and Little Hobble Creek. The four fold mailer was created for the residents of Wallsburg, detailing the strategies and actions, project timeline, resource assessment, and partnering opportunities of the Wallsburg Watershed Improvement Project. The mailer also contained information for the public outreach meeting sponsored by the District. To keep public relations high, the Wasatch Conservation District met with the Wallsburg town council twice in 2014 to discuss the project and give status updates. 60 Hats (see figure 3) were produced, embroidered with Wasatch Conservation District. These hats were given out to Wallsburg landowners during the outreach meetings, tours and presentations. In order to educate the youth on conservation projects and stream restoration, the District used volunteer students from the Wasatch High School Future Farmers Association and students from the Soldier Hollow Charter School. Over 100 student labor hours were used to plant willow pole cuttings into the soil lifts. Over 8,000 willow pole cuttings have been planted. Cuttings were taken from local landowners and the DNR property located on Deer Creek Reservoir at the Main Creek confluence.

Figure 2: District Mailer

Figure 3: Conservation District Hats

Since project work began in September of 2013, the Wallsburg Watershed has seen 5 tours. The Utah Conservation Commission had a meeting in Wallsburg and toured project sites. After the Resource Coordinator gave a presentation at one of the meetings, the American Water Resources Association, Utah Chapter decided to hold their fall tour in Wallsburg. Other groups that toured the Wallsburg Watershed Improvement Project include; The Utah Watershed Coordinating Council, Wasatch County Council, and the Utah Association of Conservation

Districts Zone 3. Numerous landowner tours have been held allowing neighbors to see the stream improvements being made in their area.

Cost: $376.25 EPA 319: $0 District Funds: $376.25

Task 4: Hold a public meeting in Wallsburg to showcase the project successes and increase awareness.

Product: 2 Public Outreach Meetings. The Wasatch Conservation District held the first public outreach meeting on February 18th 2014 at the Wallsburg Town hall; over 100 landowners were in attendance. Project work on the first 4 landowners was highlighted with before and after pictures and a catered dinner was provided for area residents. Three more landowners signed up for project work to be completed on their properties. On January 19th the District held the second public outreach meeting as a Conservationist of the Year dinner which spotlighted the Wallsburg Watershed Project. Invitees included; Wallsburg residents, members from the Wallsburg Town Council, members from the Wasatch County Council, local State Representatives and Senate members. (Refer to Figure 12 in the appendix.)

Cost: $1,400.00 EPA 319: $0 State NPS: $1,400.00

Product: 1 Teachers in industry and Business Externship (Mountainland Region). The District Resource Coordinator, was able to secure an externship for a biology/chemistry teacher from Salem High School. The teacher was able to donate 40 hours during the summer for chemical monitoring and photo documentation at photo-points. The teacher was paid by the school district and was able to receive industry experience in project monitoring.

Cost: $1,000.00 EPA 319: $0 In-kind: $1,000.00

Product: 1 Phosphorous Runoff Risk Index Study. The Wallsburg CRMP included the recommendation to further identify the sources of phosphorous inputs from the Wallsburg Watershed. The District obtained funding from the Utah Division of Water Quality Non-Point Source Funding and subcontracted with Brigham Young University's (BYU) Department of Plant and Wildlife Sciences. BYU took soil samples from around the watershed, from the upper reaches of the forest service to the valley floor near the river bottoms. (Refer to map 4 in the appendix.) Landowners benefited from the study. When BYU took a soil sample in a farmer's field, the soil sample analysis and results were shared with the landowner. This enabled them to understand nitrogen and phosphorous level in their soil. This knowledge will enable landowners to make educated, proactive decisions on fertilizer applications. After all the soil samples have been created, BYU will overlay the samples with soils data from the web soil survey. BYU will then create a tool to rank the relative risk of phosphorous loss from land to water based on site and management factors. This will act as a method to

identify site specific management options to reduce risks if they are high. The index tool will be a more flexible approach than soil test thresholds. Though the phosphorus runoff risk index tool is not yet created, work continues and the tool should be available in the summer of 2015. Initial findings suggest that the majority of phosphate inputs into Main Creek are the result of naturally high phosphate rich soils. Stream bank erosion throughout the Wallsburg Watershed contributes to the high phosphorus loads. Stream restoration therefore become the most effective tool at keeping the soil in place and reducing phosphorous.

Cost: $15,000.00 EPA 319: $0 State NPS: $15,000.00

Goal 3: Project Administration.

Objective 3: The Wasatch Conservation District will charge 7% as an administration fee. Administration includes tracking funds, expenditures and match.

Task 5: Track funds and compile match record.

Product: The Wasatch Conservation District kept records of expenditures, fund balances and matching documentation.

Cost: $10,500 EPA 319: $10,500 Other:

Planned/Actual Milestones

Milestone Table

Goals/Tasks	Output	Planned/Actual Fund Usage													
		FY 2014												2015	
		J	F	M	A	M	J	J	A	S	O	N	D	J	F
Goal 1: On the Ground															
Task 1: Improve the conditions of the creek.	Reduce sediment and nutrient loading, increase stream shading, reduce stream temperatures, & improve the cold water fishery habitat.									XX	XX	XX	X		
Task 2: Improve livestock management adjacent to the creeks where appropriate.	Reduce sediment and nutrient loading, increase stream shading, reduce stream temperatures, & improve the cold water fishery habitat.									XX	XX	XX			
Goal 2: I&E															
Task 3: Create & distribute a mailer.	Increase public awareness in Wallsburg.	X	X						X	X					
Task 4: Hold a public meeting in Wallsburg.	Showcase the Main Creek Restoration Projects & increase public awareness in Wallsburg.		X							X				X	
Goal 3: Administration															
Task 5: Track funds and compile match record.	Grant Administration			XX			XX			XX		X	XX	X	X

Table 1: Milestone Table

Evaluation of Goal Achievement

Project work began on time and was completed in the beginning of December. In order to obtain an increase in public interest, the District decided to have a public meeting on February 18th, rather than the month of September. Because of this decision, the mailers were sent out early as well and were made to include information about the upcoming public meeting. A catered dinner was held to further incentivize landowner attendance. Another reason the District decided on a new date was to correlate with NRCS EQIP sign

up timeframes and deadlines. Landowners desiring to complete stream restoration on their property were able to sign up with NRCS. Also, landowners were able to use additional funding from the District. To enhance landowner participation, the District decided to fund participating landowners up to 90% of the total project cost. Landowners were able to donate their time and equipment to use as in-kind match. Other landowners donated money for their matching contribution. A second public outreach meeting was held by the district in January of 2015. As project work continues, more landowners are signing up as public interest increases.

Supplemental Information

The various Best Management Practices (BMP's) used are listed below with their NRCS project number and name:

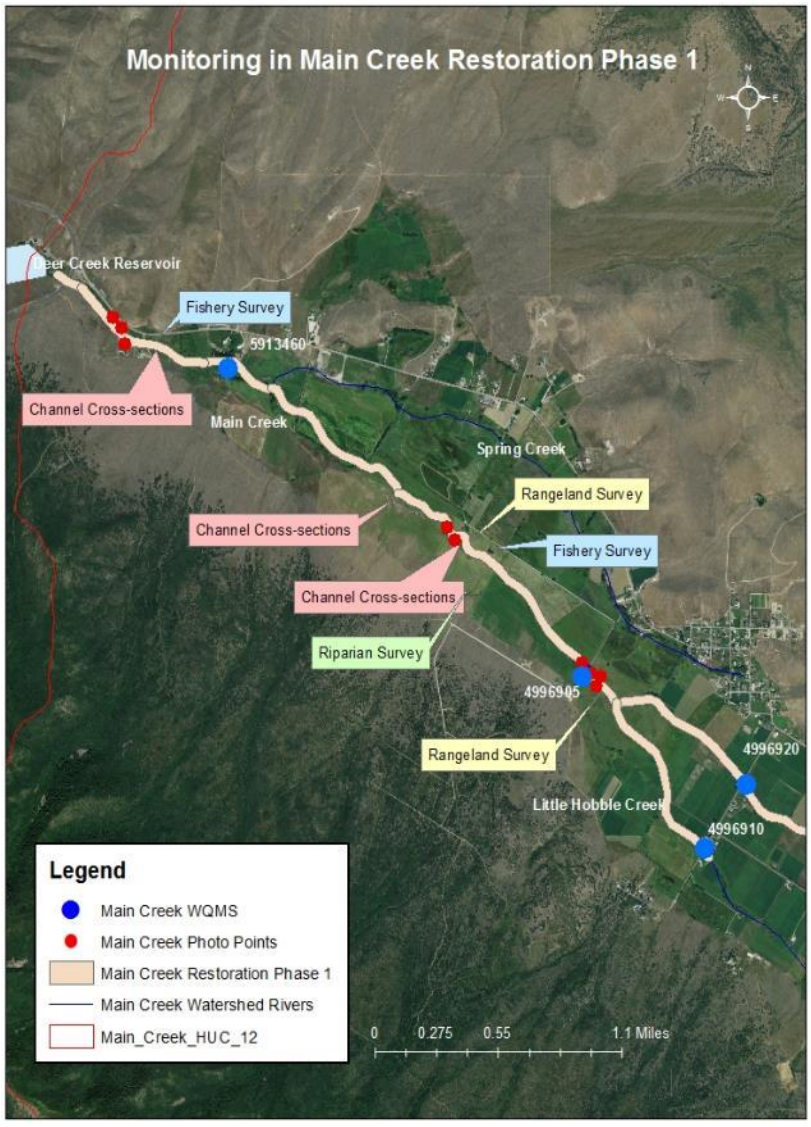
382 – Fencing: 26,900 linear feet of fence installed. Cattle management practices improved. Direct, unrestricted livestock stream access abated. Erosion (phosphorous) associated with hoof shear and insufficient vegetation decreased. Cattle fecal matter (E. coli) inputs reduced.
391 – Riparian Herbaceous Buffer: 24.4 acres treated. 10,000 pole plantings from willow cuttings were installed and 12,680 potted riparian plants were installed from a local nursery.
516 – Livestock Pipeline: 650 linear feet. Pipeline created to move water away from stream into two 600 gallon watering troughs.
578 – Stream Crossing: 1,920 square feet. Hardened animal crossings reduce instream erosion (phosphorous) of channel and bank.
582 – Open Channel: 22,000 cubic yards of material moved. 1,693 linear feet of stream was increased to 3,250. Stream meanders will reduce water velocity and reduce erosion (phosphorous).
580 – Stream and Shoreline Protection: 11,400 linear feet. Practices include hardened structures; j-hooks, cross vanes, rock barbs. Practices also include vegetative and bioengineering; coconut fiber laybacks, coconut fiber bioblocks, willow cuttings for 10,000 willow pole plantings. Erosion (phosphorous) decreased, vegetation increased which will reduce instream temperatures.
584 – Channel bed Stabilization: 410 linear feet. Instream rock structures to stabilize banks and channel. Reduce erosion (phosphorous) by decreasing stream velocity and protecting banks.
587 – Structure for Water Control: 3 installed. Water structure acts as input source to move water to watering facility.
614 – Watering Facility: Two 600 gallon watering troughs installed. Removing cattle watering from stream reduced fecal inputs (E. coli), and hoof shear along banks and through the channel.

Monitoring Results

Before project work began, the district held a series of Wallsburg monitoring meetings. All of the agencies were brought together and a comprehensive, interagency monitoring strategy was created. Each agency was able to bring specific monitoring strategies to detail the alterations to the watershed with the influence of watershed improvement best management practices.

Monitoring

Monitoring is used to check if the selected strategies are reducing pollutant loading. Long term monitoring stations have been set up within the Wallsburg Watershed by the Utah Division of Water Quality. Refer to Map 2 for monitoring strategies. Effectiveness monitoring may be quantitative (e.g., laboratory analysis of total phosphorous (TP), and E. coli concentrations in water from specific sub-basins, or in water exiting private property) or qualitative (e.g., visual observation of sediment reduction in the water passing through a fenced riparian area), depending on the BMP implemented and the scope and overall size of the project. Although quantitative monitoring methods can document actual concentrations of TP and E. coli, the size of the stream restoration projects and the small timeframe allotted for accumulating monitoring results, forces the chemical grab samples to be inefficient and incapable of reflecting the appropriate load reductions from the Wallburg Watershed Restoration projects.



Map 2: Monitoring Strategies within the Wallsburg Watershed.

Qualitative methods can be an effective means for providing an effective measurement of implementation success. Other examples of qualitative monitoring include photo-points,

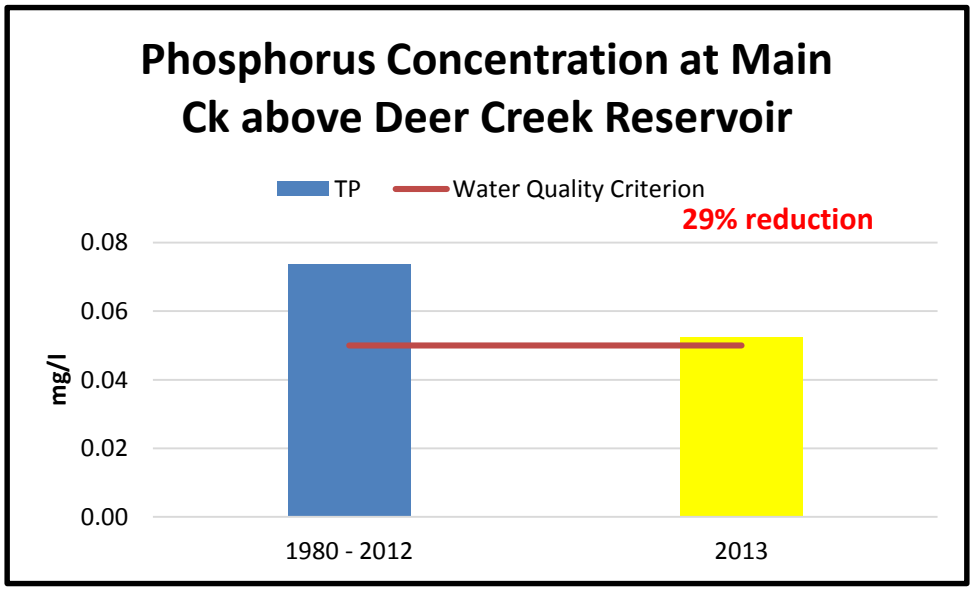
temperature probes, grazing surveys, multiple indicator monitoring (MIM), BMP monitoring, fish surveys. Although these methods do not provide quantitative information on the effectiveness of the projects, they do illustrate progress and can show the success of implementation activities.

Another tool has been used to estimate potential load reductions along Main Creek. The Spreadsheet Tool for the Estimation of Pollutant Load (STEPL) model has been used as a tool to estimate potential load reductions from the various stream restoration projects. Soils data for the model were obtained from the Web Soil Survey, including; K factors and hydrologic soil group ratings. Slopes were measured onsite and averaged.

Surface Water Chemistry

There are 8 DWQ water quality monitoring stations in the Main Creek watershed (refer to Map 3 in the appendix). Restoration monitoring sites will include 5 existing sites plus 2 additional sites created on the Forest above any anthropogenic sources. Chemical grab samples will be collected by UDWQ every 6 week from August 2013 to 2 years after project completion. Monitoring sites may change as additional Restoration Phases commence. Samples will be analyzed for phosphorus, total dissolved solids, and nitrogen. Samples will be processed by Unified State Laboratories.

Though work on the Wallsburg Restoration project has only been for the past two years, initial water quality testing suggests a 29% decrease in total phosphorous into Deer Creek Reservoir (Refer to graph 1 below).



Graph 1: Chemical Grab Sample Analysis from the Division of Water Quality.

As willow pole plantings and riparian vegetation grow and develop, stream erosion will continue to reduce. As the project matures, more riparian root mass will become established and the amount of phosphorous loading into Deer Creek Reservoir from Main Creek will continue to decrease. In order to track water quality trends, the DWQ will continue to monitor total phosphorous using chemical grab samples throughout the duration of the Wallburg Watershed Restoration Project.

Stream Physical/Biological/Habitat Monitoring

In order to identify watershed improvements specific to the Wallsburg Watershed Restoration Project, there were a variety of physical, biological and habitat monitoring practices used to identify changes and track trends. The types of strategies include; the Utah Comprehensive Assessment of Stream Ecosystems (UCASE) monitoring, *Escherichia coli* Colilert® testing solutions, and estimated fish community population densities.

UCASE Monitoring

UCASE is a monitoring program with both probabilistic and targeted components designed to meet the following objectives:

- Assess the biological, physical, and chemical conditions of Utah's wadeable and partially wadeable streams.
- Target pollution/contamination sources to Utah's streams and identify water quality impairments.
- Establish a baseline to compare future stream surveys for trend assessments.
- Assess the effectiveness and changes in stream habitats after restoration projects (i.e. Non-point Source (NPS) projects) in order to determine project effectiveness.

UCASE monitoring parameters include; Water Chemistry, chlorophyll-a, periphyton assemblage, benthic macroinvertebrate assemblage, fish assemblage, fish tissue contaminates indicator, and physical habitat assessments. (Utah Department of Environmental Quality, 2014)

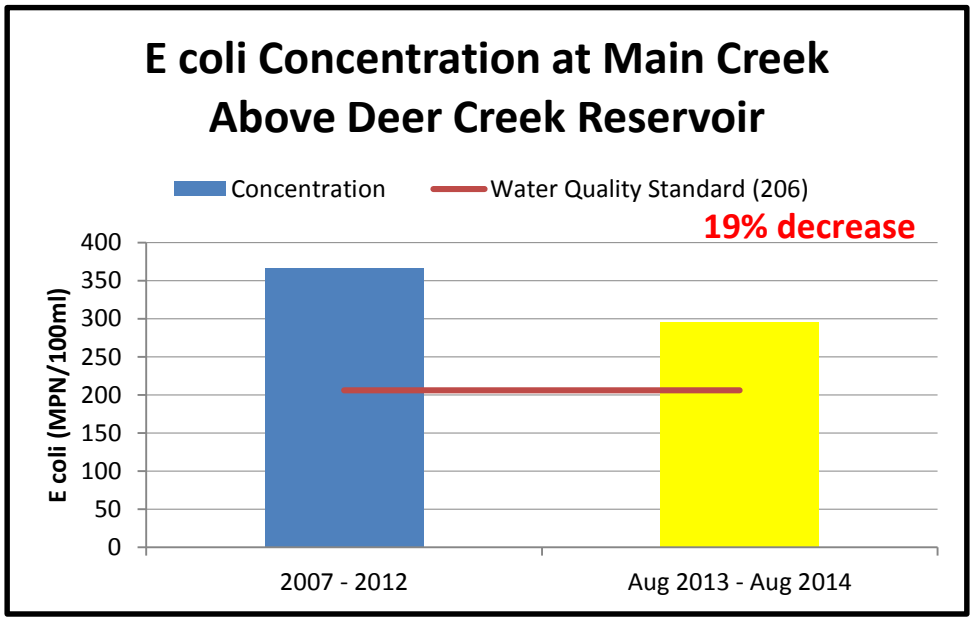
A UCASE monitoring site was established on Main Creek before project work began in September 2013. Unfortunately, comparative analysis was not available for this report. A comparative sample will be taken 5 years post project work. This will enable the overall health and trends of Main Creek to be quantified.

Escherichia coli sampling

Because fencing was used in conjunction with stream restoration, the unrestricted presence of cattle was removed from the stream. In order to identify improvements to Main Creek, *Escherichia coli* sampling was selected as a monitoring tool. *Escherichia coli* monitoring is used as an indicator for the presence of intestinal pathogens from warm-blooded animals. E. coli water sampling can be used to define the localized inputs for point and nonpoint sources of fecal coliform contamination. Multiple monitoring sites for E. coli were established throughout the Wallsburg Watershed.

The Division of Water Quality used *Escherichia coli* Colilert® monitoring practices from IDEXX laboratories. Colilert® uses the patented Defined Substrate Technology® (DST®) to simultaneously detect total coliforms and E. coli. Two nutrient-indicators, ONPG and MUG, are the major sources of carbon in Colilert® and can be metabolized by the coliform enzyme β-galactosidase and the E. coli enzyme β-glucuronidase, respectively. Using the 24 hour, EPA approved Colilert® method, allowed onsite monitoring to gauge the effects of stream alteration. (IDEXX Water Testing Solutions, 2015)

Since the project work began in 2013, there has been a 19% reduction in E coli concentrations within the Wallsburg Watershed. (See Graph 2 below.)



Graph 2: E. coli Grab Sample Analysis from the Division of Water Quality.

Though E. coli concentrations are still above the State Water Quality Standard for E. coli concentrations, initial findings suggesting the Wallsburg Watershed Project is generating a decreasing trend.

Fish Community Population Densities

Fish communities were monitored by Utah Division of Wildlife Resources (UDWR). Initial monitoring took place in 2013. Monitoring protocols included dual pass backpack electroshocking population estimate surveys. The estimated population density, biomass, and age structure of Southern Leatherside Chub captured in 2013 were compared to data from past years and were combined with the 2012 monitoring data to evaluate recent population trends. The 2012 and 2013 data suggest that Southern Leatherside have experienced a recent increase in population density at reach 12 (Main Creek). On average, estimated population densities of Southern Leatherside Chub in reach 12 (Main Creek) were roughly seven times higher than 2007-2010. Based on the leatherside population estimates, the post restoration biomass is higher the pre-restoration data.

Though numerous variables can impact populations, it is encouraging to see an increase in leatherside densities. Due to lack of habitat and high water temperatures Trout numbers are not significant enough to report. The UDWR anticipates the restoration practices implemented will create deeper pools and eventually cooler water due to willow shading. In stream conditions will improve for cutthroat trout, but the smaller fish (like leathersides) will most likely be the first to respond and take advantage of improved habitat conditions. Additional fish monitoring will continue by the UDWR. Depending on the type and quantity of fish, the UDWR will be able to extrapolate the health of the stream. (State of Utah Department of Natural Resources, Division of Wildlife Resources - Native Aquatic Species, 2013)

Other Monitoring

In order to track the trends of the Wallsburg Watershed, the Wasatch Conservation District used additional monitoring methods. These include an aerial drone for project flyovers, grazing improvement transects, photo-points and STEPL.

Aerial Drone

The NRCS has been using aerial drones to document changes to the stream profile. The drone is equipped with a camera to obtain high-resolution aerial film and photography. Riparian areas are flown and individual photos at a resolution of approximately 1.5 cm are taken. These products will aid in detecting changes in riparian vegetation, as well as changes in streambed characteristics. Flights over phase 1 and 2 of the project have been completed. Post project flyovers will be scheduled for each phase after two years of vegetative growth.

Grazing Improvement

The UDAF Grazing Improvement Program is monitoring two sections of the Wallsburg watershed for grazing land improvement where GIP funding was used to install fencing and increase grazing management. Grazing improvement monitoring uses a camera mounted on a monopod to take ground cover photos along 100-m transects on upland areas. Landscape photos are taken down the same transects. This method has been used on two of the landowners who qualified for grazing improvement funding. For comparative analysis, the sections are scheduled for additional monitoring 5 years after phase one was completed. After which, ground cover photos will be analyzed using SamplePoint software to determine percent cover of vegetation, bare ground, litter, rock, pavement, and cryptogams. This method will aid in detecting changes in vegetation cover, species composition, and ground cover.

Photo-Points

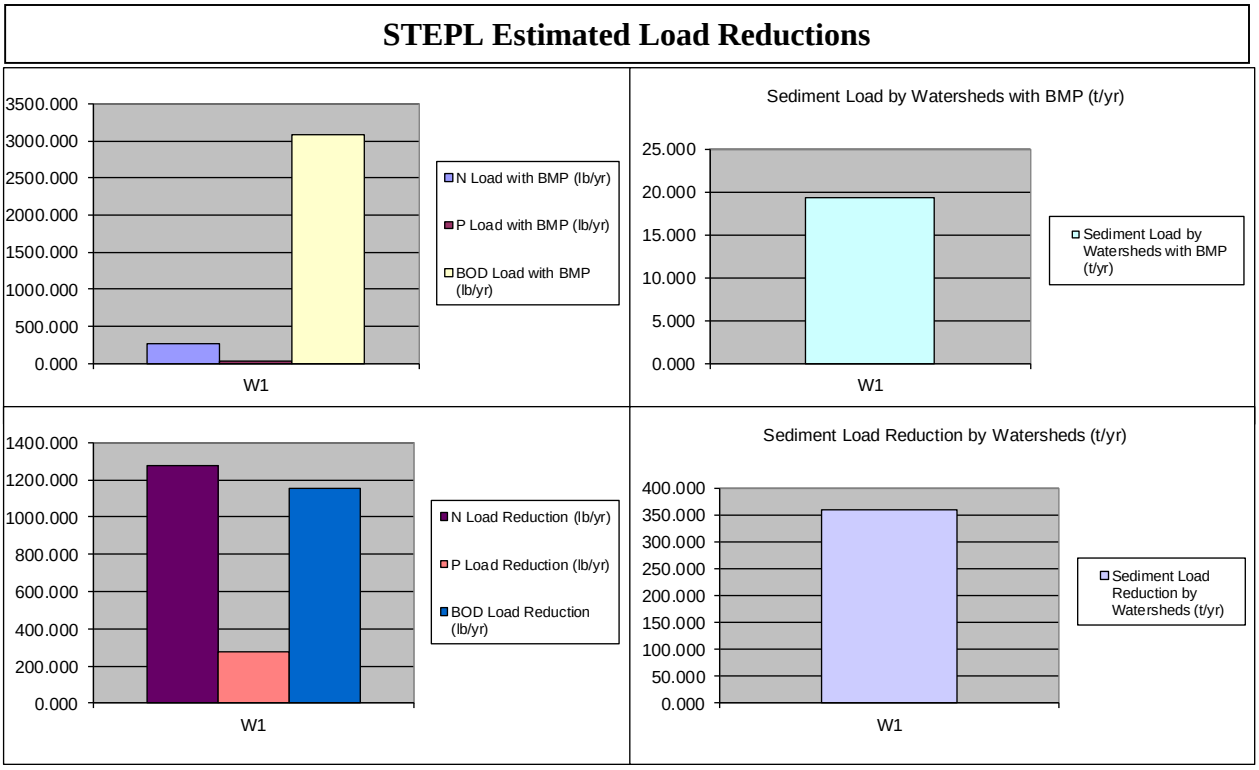
Photo-points were established by the Wasatch Conservation District to demonstrate the physical changes to the stream. Photo-points were established with GPS coordinates and the times and dates of the photos were recorded. Though the photos can only currently document the physical changes for the past two years, the District plans to take additional photos to further document the changes to Main Creek, Little Hobble Creek and Spring

Creek. Additional photo-points will be created as necessary throughout the Wallsburg Watershed. Refer to figures 4-7 and 8-10 in the appendix.

Spreadsheet Tool for Estimating Pollutant Load

The Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used on the segments of Main Creek and Little Hobble Creek that have had project work completed (Phase 1 and 2). Soil data from the web soil survey was obtained and incorporated into the spreadsheet. Slopes were measured onsite and averaged. STEPL is able to calculate estimates on load reductions based on the best management practices (BMPs) included. All BMPs associated with the Wallsburg Watershed Project were inserted including; fencing, riparian plantings, sloping, flood plain enhancement, etc.

Shown below, Graph 3 demonstrates the load reductions of nitrogen, phosphorus,



Graph 3: STEPL Estimated Load Reductions.

The upper left graph demonstrates the drainage load of N, P, and BOD with the BMP in place. Lower left are the load reductions. Upper right us the sediment load with the BMP in place, while the lower right is the sediment load reduction.

biological oxygen demand and sediment with the BMPs in place. Overall load reductions are also shown. Area was based on a project scale level, incorporating the areas where stream restoration project work ensued. 3.22 river miles were inserted into the model. The land acres adjacent to the stream were also used.

Table 2 shows the total calculated inputs into the project. Load reductions are calculated by separating out the effect of the installed BMPs. Incorporating fencing, stream bank

1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction	N Load (with BMP)	P Load (with BMP)	BOD (with BMP)	Sediment Load (with BMP)
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	1539.8	304.3	4243.1	378.2	1275.1	274.5	1153.9	358.8	264.7	29.8	3089.2	19.4
Total	1539.8	304.3	4243.1	378.2	1275.1	274.5	1153.9	358.8	264.7	29.8	3089.2	19.4

Table 2: Total load by watershed and associated reductions for the Wallsburg Watershed.

sloping, water velocity decreases, reseeding, and the various planting projects. There is an estimated sediment reduction of **358.8 tons/year** over the 3.22 restoration miles. In addition to the reduced sediment load, there is an estimated reduction of **1,275 lbs/year** for nitrogen, a **275 lbs/year** reduction in phosphorus and a **1,153.9 lbs/year** reduction in BOD. As the restoration practices have a life expectancy of 10 to 15 years, the total reduction of sediment, nitrogen, phosphorus and BOD would be significantly greater.

Coordination

The success of the Main Creek Restoration Project is due to the cooperation of the various groups involved. The Wasatch Conservation District is a local board appointed with the conservation of soil, water, air, plants and animals. It is through the District's coordination efforts that additional public and governmental entities have partnered and become cooperators. The District has been vital in securing volunteer efforts during implementation and completion. Sharing information between federal, state and local government agencies generated increased project scope and outputs.

Coordination Efforts

The Wasatch Conservation District is composed of local landowners living within Wasatch County. Several board members have ties to the Community of Wallsburg and one board member lives in the watershed. Project work succeeded because of the district's ability to relate to the landowners, ranchers and farmers. Without the Wasatch Conservation District, the full scope of the Wallsburg watershed project would not have been realized.

The Wallsburg Watershed Restoration Project is an example of a "grass roots" approach. The Wallsburg CRMP was created with local landowner involvement rather than agency "top down" pressure. When improvements come from the local level, landowners feel empowered to improve the soil and water and create a conservation plan with their input.

The District successfully brought landowners and agency personnel together. Funding sources were matched to resource concerns and the improvement to the watershed has been drastic.

Coordination from Local Entities

Provo River Watershed Council: Provo River Restoration Funding.
Salem High School: Teachers in industry and business externship for Wallsburg project monitoring and photo point documentation.

Soldier Hollow Charter School: Student volunteers for willow pole plantings on Main Creek.
Wallsburg Town Council: Project Support and Coordination.
Wallsburg Watershed Council: Project Support and Coordination.
Wasatch Conservation District: Project Lead, Coordination, permit completion, photo-point monitoring and volunteer coordination.
Wasatch County: Project Support and Coordination.
Wasatch High School Future Farmers of America Organization: Student volunteers for willow pole plantings on Main Creek.

Coordination from State Entities

Brigham Young University: Watershed Monitoring, and the creation of the Wallsburg Watershed Phosphorous Risk Runoff Index.
Reclamation and Mitigation Commission: Matching funds for Wallsburg CRMP.
Utah Association of Conservation Districts: Conservation district Assistance Funding.
Utah Conservation Commission: Conservation district support.
Utah Department of Agriculture and Food: Funding assistance, conservation district support.
Utah Department of Agriculture and Food, Grazing Improvement: Grazing improvement plans, monitoring, and funding for fencing.
Utah Division of Water Resources: Clean Water Act section 404 permitting.
Utah Division of Water Quality: NPS funding, chemical monitoring, MIM's monitoring, and UCASE monitoring.
Utah Division of Wildlife Resources: Threatened and endangered species information, fish monitoring, temperature monitoring, in-stream work crews, watershed restoration initiative funding.
Utah State University: Graduate Student Monitoring of installed best management practices.

Coordination from Federal Entities

Natural Resource Conservation Service: Engineering of stream restoration project, wetland delineations, Cultural Resources, Threatened and Endangered Species and EQIP funding.
U.S. Army Corps of Engineers: Nationwide 27 permitting.
U.S. Environmental Protection Agency: Funding from the Clean Water Act section 319.
U.S. Fish and Wildlife Service: Project funding, threatened and endangered species.

Accomplishment of Agency Coordination Meetings

Agency Coordination meetings were held regularly by the Wasatch Conservation District. Representatives from partnering agencies would give status updates on potential funding sources, funding source stipulations, engineering updates, project monitoring, potential stream restoration practices, and project updates. When situations warranted the inclusion of additional partners, the Wasatch Conservation District extended invitations.

Without the leadership of the Wasatch Conservation District the amount of partnering agencies would have decreased and the full potential of the Wallsburg Watershed Improvement Project would not have been realized.

Other Sources of Funds

Other sources of funding that have been used in the Wallsburg Watershed Improvement Project in concert with EPA section 319 funds include; Environmental Quality Incentives Program (EQIP) from the NRCS, Watershed Restoration Initiative (WRI) from the Utah Partnership Conservation Development, Provo River Watershed funding from the Provo River Watershed Council, State Nonpoint Source Funding from the Division of Water Quality, Grazing Improvement Funding from Utah Grazing Improvement Program, Conservation Assistance funding from the Utah Department of Agriculture and Food, and Wasatch County for fencing on county roads boarding Main Creek.

Summary of Public Participation

Public participation has been an important aspect of the Wallsburg Watershed Project since its inception. When the Wasatch Conservation District formed and managed the Wallsburg Watershed Coordinating Council, local landowners were the initial participants. Local resource concerns were brought up and ranked.

When Phase 1 of the project was identified, the District invited the first five landowners to a meeting to discuss the issues on Main Creek. Though a few were skeptical in the beginning, as the meeting went on the landowners agreed that something must be done to improve Main Creek. Not being able to visualize how the stream restoration would appear on their land, the Wasatch Conservation District scheduled a field trip to the nearby Strawberry River Improvement Project. The Division of Wildlife Resources was able to answer question about stream restoration practices. The landowners were able to visualize how their own property would look after restoration efforts ensued. All five landowners have since completed stream restoration projects on their property.

In order to bring light to the restoration work being performed in the Wallsburg Watershed, the District created a public outreach mailer detailing the restoration efforts. A landowner appreciation dinner was held to further advance additional phases of stream restoration and increase public awareness and interest. The Wallsburg Town Council was updated biannually on project work. For additional phases, field trips out of the watershed are no longer required, interested landowners are brought to the sections on Main Creek completed with phase 1 and 2.

In order to educate the youth, the District used volunteer students from the Wasatch High School Future Farmers Association and students from the Soldier Hollow Charter School. Over 100 student labor hours were used to plant willow pole cuttings into the soil lifts. Over 10,000 willow pole cuttings have been planted. Cuttings were taken from local landowners and the DNR property located on Deer Creek Reservoir at the Main Creek confluence. Initial findings suggest that the current pole cuttings have a 90% success rate. (Refer to Figure 11 in the appendix)

The Wallsburg Watershed has been spotlighted with a multitude of presentations and tours. The District Resource Coordinator gave a presentation at the American Water Resources Association,

Utah Chapter, a tour for the group was later held and project sites throughout Wallsburg were observed. The Wasatch Conservation District Chairman gave a presentation at the Utah Water Users Association spotlighting Coordinated Resource Management and the Wallsburg Watershed Project.

A YouTube video of the Wallsburg Watershed Stream Restoration for Main Creek was created to help inform the public about the project. The video has been used in multiple presentation given by the district. To watch the video, click on the link or copy the URL into your browser. https://www.youtube.com/watch?v=U5Xvvn1cY9w

Aspects of the Project That Did Not Work Well

Using a wide variety of funding sources posed a problem. Each source contained specific stipulations on usage and match requirements. In order to solve the issue, the District held an agency funding meeting. All of the partnering groups and agencies met with the conservation district board and identified how, where and when their specific funding sources could be used.

Using numerous volunteers posed issues with crowd control and training. After the first batch of volunteers, the District began training students before any tools were used. After the training was implemented, the confusion using volunteers to planting willow cuttings was reduced dramatically.

Due to using volunteers, the district decided to incorporate additional liability insurance to act as a protection against possible lawsuits for potential injuries incurred during restoration work. Though volunteers were kept away from areas using heavy machinery, utilizing volunteers required the district to take a proactive approach. This forced the district to use more operations funding than normal.

Future Activity Recommendations

There are additional river miles along Spring Creek, Main Creek and Little Hobble Creek that need restoration to reduce bank erosion and head cutting. Upland areas surrounding the watershed on both private and public lands could see a reduction in nutrient transport loads with improved grazing management and reseeding. Though the initial findings from the Phosphorous Runoff Risk Index from BYU suggests that stream restoration would have the highest yield in phosphorous reduction, the district recommends further studies to identify potential sources of phosphorous within the watershed.

Though no work has been completed to date, the District received funding for water quality monitoring samples which will identify pharmaceuticals and caffeine. Using this approach, the district will be able to detect the presence of septic system inputs into the various creeks throughout the watershed.

For 2015, the District is planning on continuing stream restoration efforts on Main Creek. In addition, the District has identified areas along Spring Creek that need improvements. Spring

Creek is the priority area for 2015. Landowner have already been contacted and the District will work to get all of the necessary permits in place to continue improving the Wallsburg Watershed.

Wallsburg town has identified a culvert on Roundy Lane that is a potential problem. The culvert is not large enough to allow Spring Creek to flow below the road. During late fall and winter, the water backs up and ponds. Nearby corrals are flooded and water has the potential to undermine the road. The District is planning on meeting with the county road department and seek funding sources next year that will assist with increasing the size of the culvert and prohibiting water from pooling into nutrient rich fecal material. Eliminating this problem will reduce E. coli, nitrogen and phosphorus inputs into Spring Creek and ultimately, Deer Creek Reservoir.

Literature Cited

IDEXX Water Testing Solutions. (2015). *IDEXX Water Testing Solutions*. Retrieved from IDEXX Products and Services: https://www.idexx.com/water/products/colilert.html

Psomas. (2002). *Deer Creek Reservoir Drainage Total Maximum Daily Load Study.* Salt Lake City: Psomas.

Schueler, T. B. (2004). Urban Subwatershed Restoration Manual Series Manual 4: Urban Stream Repair Practices. Ellicott City, MD: Center for Watershed Protection.

State of Utah Department of Natural Resources, Division of Wildlife Resources - Native Aquatic Species. (2013). *Southern Leatherside Chub (Lepidomeda aliciae) Statewide Monitoring Summary* . Salt Lake City: Utah Division of Wildlife Resources.

Utah Department of Environmental Quality, D. o. (2014). *Utah Comprehensive Assessment of Ecosystems (UCASE) Field Opperations Manual* . Salt Lake City: Division of Water Quality.

Utah Division of Wildlife Resources. (2010). Conservation Agreement and Strategy for Southern Leatherside Chub (Lepidomeda aliciae) in the State of Utah. *Publication 10-19*. Salt Lake City, Utah.

Wasatch Conservation District. (2012). *Wallsburg Coordinated Resource Management Plan.*

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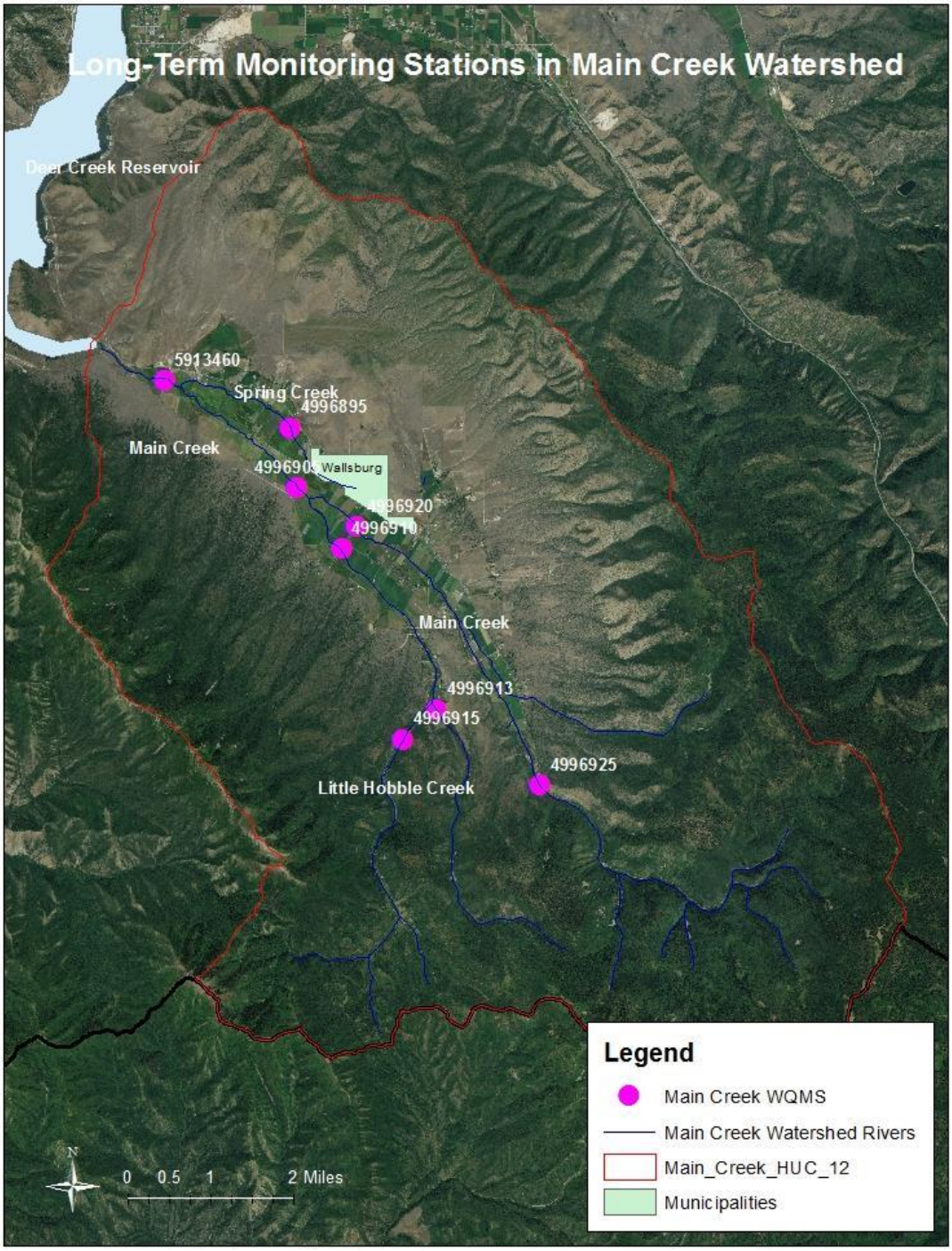
Appendix

Figure 4: Main Creek Before: Flags show where meanders will be reinserted.

Figure 5: Main Creek During: Banks are being sloped and stream meanders added.

Figure 6: Main Creek During 2: Riparian vegetation planting.

Figure 7: Main Creek After. Seeding installed, vegetation planted.



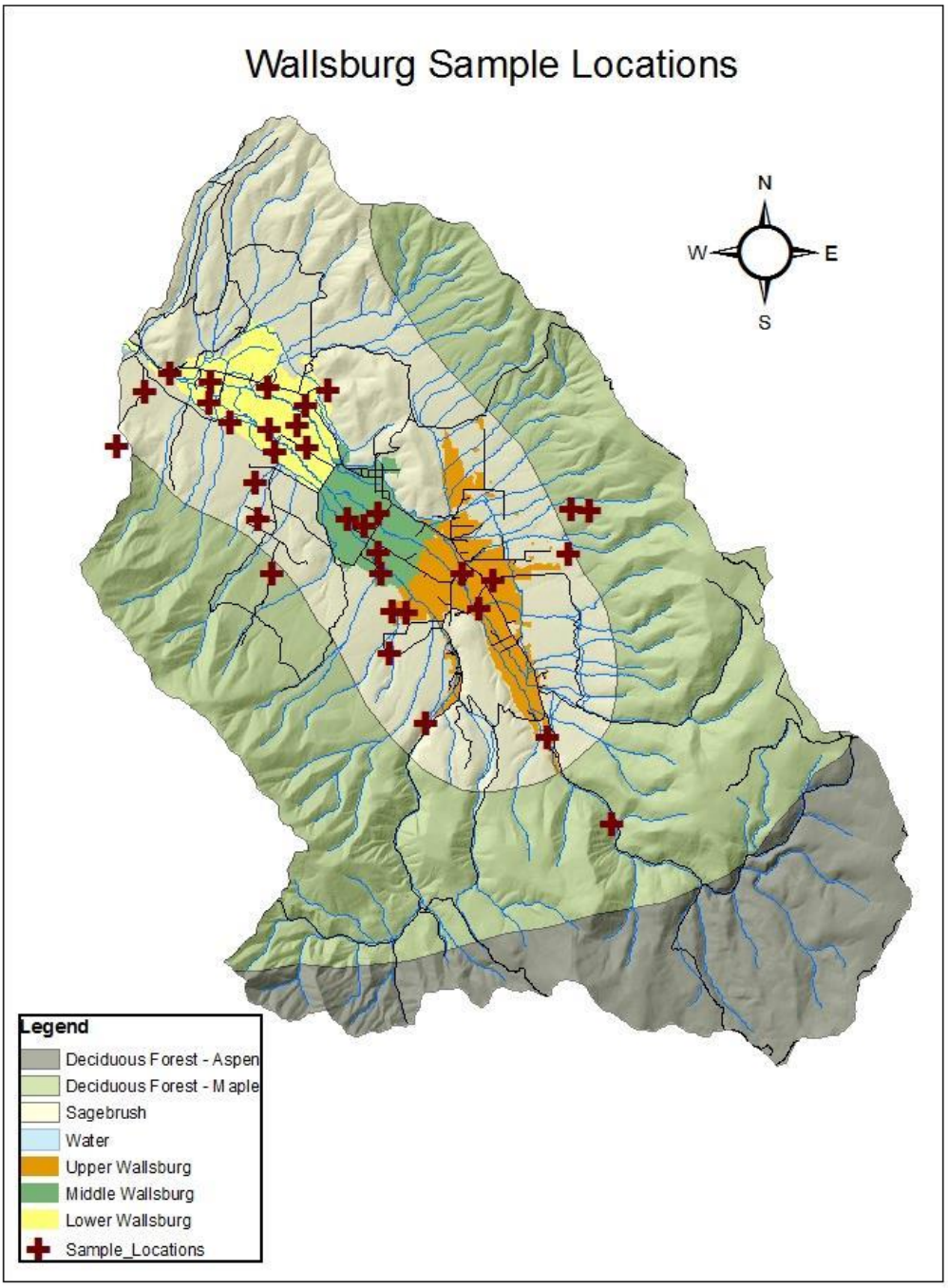
Map 3: Division of Water Quality monitoring stations throughout Wallsburg

Figure 8: Main Creek Before: Cross vane diversion site.

Figure 9: Main Creek During: Cross vane installation and rock placement.

Figure 10: Main Creek After: Cross vane installed, cars removed.

Figure 11: Volunteers planting willow pole cuttings on Main Creek.



Map 4: Soil Sample Locations for the Phosphorous Risk Runoff Index Tool. Courtesy, BYU.

Figure 12: Wallsburg, Landowner Appreciation Dinner.

Figure 13: Main Creek, Wallsburg Watershed. Cross vane.