

SECTION 319 NONPOINT SOURCE POLLUTION CONTROL PROGRAM

ASSESSMENT/PLANNING PROJECT FINAL REPORT

**Upper Jordan River Ecosystem Restoration  
8600 South to 9000 South  
Section 319 Funding  
Fiscal Grant Year 2009**

By

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Sponsored by Salt Lake County Flood Control and Engineering

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

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State (DEQ) Contract #101585  
Salt Lake County Contract #NN09154C

*Upper Jordan River Ecosystem Restoration (FY-09)-Final Report*

## **1.0 EXECUTIVE SUMMARY**

**PROJECT TITLE: UPPER JORDAN RIVER ECOSYSTEM RESTORATION (FY-09)**

**PROJECT START DATE 10/1/2010 PROJECT COMPLETION DATE 9/30/2012**

**FUNDING:** This project was a combination of Section 319 fund, South Valley Water Reclamation Facility grant, and match from Salt Lake County.

<b>TOTAL BUDGET</b>	<b><u>\$339,295.87</u></b>
<b>TOTAL EPA GRANT</b>	<b><u>\$96,000.00</u></b>
<b>TOTAL EXPENDITURES OF EPA FUNDS</b>	<b><u>\$24,560.05</u></b>
<b>TOTAL MATCH ACCRUED</b>	<b><u>\$41,848.87</u></b>
<b>TOTAL OTHER GRANTS</b>	<b><u>\$54,311.81</u></b>
<b>BUDGET REVISIONS</b>	<b><u>None</u></b>
<b>TOTAL EXPENDITURES</b>	<b><u>\$120,720.73</u></b>

### **SUMMARY ACCOMPLISHMENTS:**

The primary goal of the restoration project along the Jordan River was to enhance the water quality and restore stream bank stability of the Jordan River at 8600 South and 9000 South, respectively. See Appendix A for project area map.

Salt Lake County removed concrete rubble from approximately 1,150 linear feet of bank along with invasive vegetation. The bank was graded to a desirable slope and a rock toe was installed to protect the stream bank from further erosion. A small emergent bank was also established at the upstream section. The emergent bench was created to expand a zone of seasonal saturation, increase access to the water table, as well as expand the flood plain. Weed management also took place before and after the project construction to mitigate weed establishment.

Using STEPL, it was found that this project provides load reductions of 577.85 lb/yr of Nitrogen, 222.47 lb/yr of Phosphorus, 1155.70 lb/yr of BOD and 180.58 lb/yr of sediment.

## **2.0 BACKGROUND**

Degraded areas along the Jordan River were first documented in 1985 as a result of channel stability and wetland assessments. This project segment of the Jordan River has been given the following beneficial use designations: 2B (Protected for secondary contact recreation such as boating, wading, or similar uses), 3A (Protected for cold-water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain), and 4 (Protected for agricultural uses including irrigation of crops and stock watering) waters. Additionally, the status of the segment of the Jordan River from 7800 South to Bluffdale is listed as impaired for Temperature and Total Dissolved Solids (TDS) and has an Integrated Report Category of 5A, which means the water quality standard is not attained and is caused by a pollutant. Also the assessment unit (AU) is found not supporting one or more of its designated beneficial uses and a TMDL is underway or scheduled (Utah DWQ 2006 Integrated Report, 2006).

Plans were then developed for the selected degraded areas by the Army Corp of Engineers in partnership with Salt Lake County under the Army Corp's 206 program. Due to the loss of funding, the Army Corp turned the plans over to Salt Lake County, who then began to complete the project, site by site. This project included one site along the Jordan River. The site length is approximately 1,150 feet long.

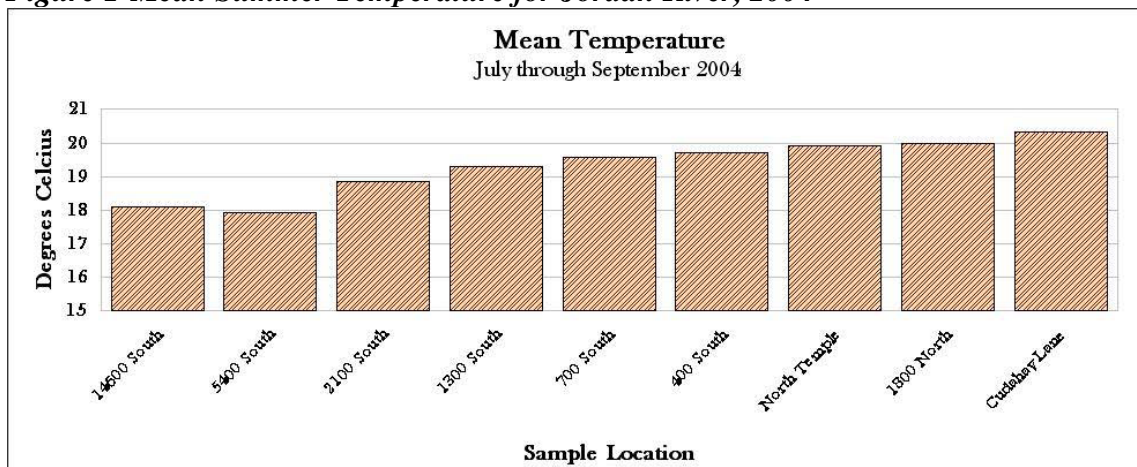
This site had major bank erosion, in one area specifically; a power pole was dangerously undercut. This location was listed as a priority by Salt Lake County, due to these factors. Rocky Mountain Power, who is the land owner, also, felt this would be a worthwhile project for their property and granted an easement for work at no cost.

### **2.1 Water Quality Priority**

The project segment of the Jordan River is listed as impaired for temperature, which can influence: 1) dissolved oxygen (DO) levels; 2) the rate at which algae and aquatic plants photosynthesize; 3) the metabolic rates of aquatic organisms; and 4) how aquatic organisms are affected by different pollutants, parasites and pathogens. The increase in temperature may be due to decreased vegetation coverage, increased sediment load, and/or confluence with contributing streams (Salt Lake County Jordan River Water Quality TMDL Assessment, 2004).

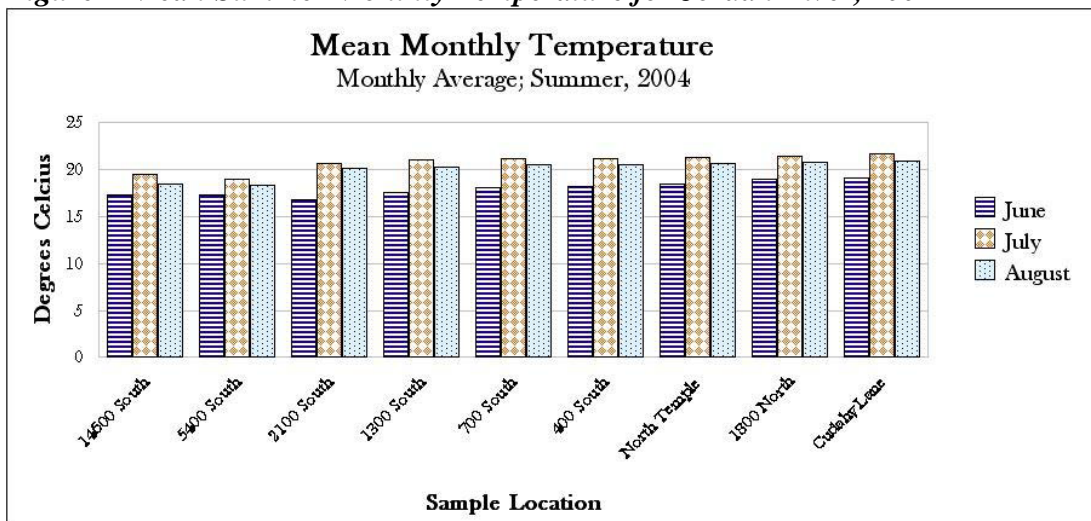
During the 2004 Jordan River Water Quality Total Maximum Daily Load (TMDL) Assessment done by Salt Lake County, it was found mean temperature in the Jordan River varied between 17.94 °C and 20.34 °C for the ten sample locations utilized in this study. Ambient temperature for Salt Lake City varied between 11 °C and 37 °C for this same time period (NOAA, website). The data suggests that the River's temperature increases as it progresses downstream. Notably, the highest mean temperature was observed at the Cudahy Lane sample location (20.34 °C) and the lowest mean temperature was observed at the 6400 South sample location (17.94 °C) (Salt Lake County Jordan River Water Quality TMDL Assessment, 2004).

**Figure 1-Mean Summer Temperature for Jordan River, 2004**



As with mean summer temperature, 30 day average water temperatures increased as the River progresses downstream. Overall, temperatures were highest in the month of July (varying between 19.57 °C and 21.7 °C) and lowest in the month of June (varying between 17.31 °C and 19.15 °C). August temperatures were slightly lower than July temperatures but remained above the values observed for June, varying between 18.48 °C and 21.0 °C (Salt Lake County Jordan River Water Quality TMDL Assessment, 2004).

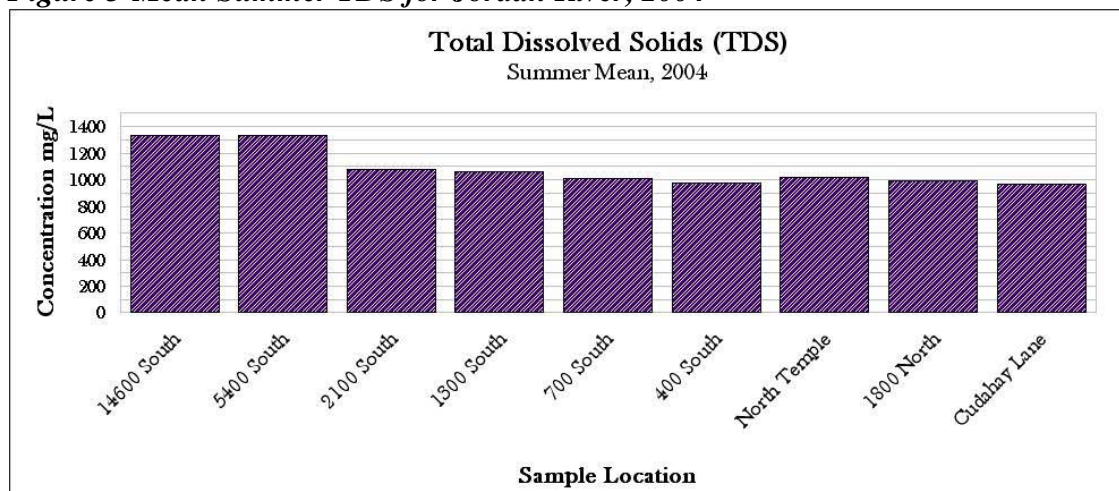
**Figure 2-Mean Summer Monthly Temperature for Jordan River, 2004**



Total dissolved solids (TDS) refers to minerals, salts, metals, cations and/or anions that are dissolved within the water column. TDS includes all material that is neither H<sub>2</sub>O nor particles that are suspended in the water column.

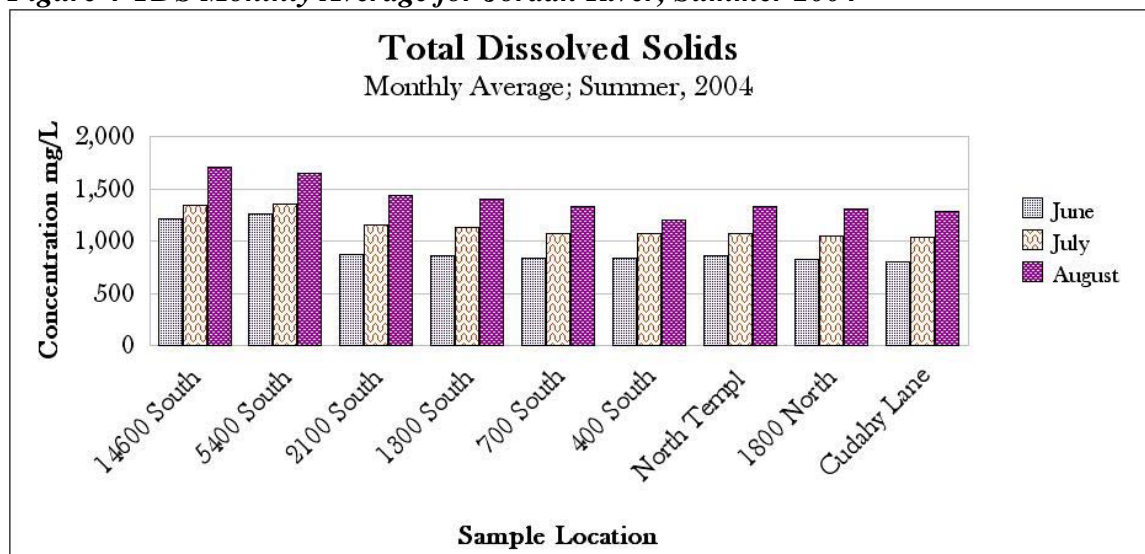
The irrigation standard for TDS along the Jordan River is 1200 mg/L. As can be seen in the figure below, this standard was violated at the Bluffdale sample location (1330.56 mg/L) and the 5400 South sampling location (1332.44 mg/L). In general, TDS levels appeared to decrease as the river progressed downstream with a low of 970.56 mg/L observed at the Cudahy Lane sample location (Salt Lake County Jordan River Water Quality TMDL Assessment, 2004).

**Figure 3-Mean Summer TDS for Jordan River, 2004**



As with mean summer TDS, 30-day average TDS concentrations were highest at the Jordan Narrows, and gradually decreased as the River progressed downstream. In contrast to patterns observed with temperature, total phosphorus, and TSS data, TDS concentrations were highest in the month of August (varying between 1,208.8 mg/L and 1,708.0 mg/L) and lowest in the month of June (varying between 803.67 mg/L and 1,267.67 mg/L). July TDS concentrations were between August and June concentrations (varying between 1,038.0 mg/L and 1,348.0 mg/L). Notably, 30 day average TDS values exceeded the 1,200 mg/L standard for the Bluffdale and 6400 South sample sites for all three months of this study (Salt Lake County Jordan River Water Quality TMDL Assessment, 2004).

**Figure 4-TDS Monthly Average for Jordan River, Summer 2004**



## 2.2 Waterbody

The Jordan River, hydrologic unit code (HUC) 16020204, is a 4<sup>th</sup> order stream originating from Utah Lake, a shallow playa formed during the early Cenozoic era from seismic downward block faulting. The Jordan River meanders approximately 58 miles from Utah Lake through the Utah Lake valley, Jordan

Narrows and Salt Lake valley, before draining into the Great Salt Lake. The Jordan River is approximately 44 miles in length through Salt Lake County. The release of water from Utah Lake to the Jordan River is managed for water supply (irrigation water rights) and flood control purposes. In addition to Utah Lake inflow, the Jordan River receives water from Wasatch and Oquirrh mountain tributary streams, two major water treatment plants, and irrigation diversions.

This sub-watershed crosses multiple jurisdictions and receives the majority of stormwater in Salt Lake County. The river contains 2B (Protected for secondary contact recreation such as boating, wading, or similar uses), 3A (Protected for cold-water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain), 3B (Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain), and 4 (Protected for agricultural uses including irrigation of crops and stock watering) waters. Historically, the Jordan River had a substantial meander corridor with marshes, oxbows, sloughs and ponds; however, it is currently a highly channelized, highly developed, and polluted river. The Jordan River is listed as water quality impaired on the State Division of Water Quality 303(d) List for low dissolved oxygen, high sediment, high temperature, and high bacteria levels.

### **2.3 Watershed Information**

The Salt Lake Countywide Watershed (Watershed) drains 805.6 square miles (515,600 acres). The Watershed is bounded on the east by the Wasatch Mountains, on the west by the Oquirrh Mountains, and on the south by the Traverse Range. Approximately 370 square miles (46% of the land) in the Watershed are in rugged mountain ranges and are largely undevelopable. Approximately 134.3 square miles (16.7%) of the Wasatch Mountains are protected to ensure drinking water quality for Salt Lake City and Sandy City. The Great Salt Lake is the eventual recipient of water in the north-flowing Jordan River. The Jordan River meanders for approximately 58 river miles flowing from the outlet of Utah Lake north to the Great Salt Lake. Seven major tributary streams (Little Cottonwood Creek, Big Cottonwood Creek, Mill Creek, Parley's Creek, Emigration Creek, Red Butte Creek and City Creek) feed into the River as it flows north to the Great Salt Lake.

The lowest elevation in the Watershed is found at the Great Salt Lake, which typically has an elevation of approximately 4,200 feet, depending on climate conditions. The highest elevation in the Watershed is Twin Peaks (between Big and Little Cottonwood Canyons) at 11,330 feet. The Wasatch Range to the east of the Jordan River has the highest elevations in the Watershed reaching levels over 11,000 feet. The Oquirrh Mountains to the west of the Jordan River, reach elevations of over 9,000 feet. The land surface between these ranges consists of a series of benches, each of which slope gradually away from the mountains and drop sharply to the next bench.

### **Land Use**

Commercial land uses are expected to expand along the I-15 corridor, and along all major transportation corridors throughout the Salt Lake County. Residential development is expected to expand along the Oquirrh Mountain replacing agricultural, industrial, and open space land uses. Dominant land uses anticipated in 2030 include: Forest (39.3%), Residential (32.2%), and Parks/Agriculture/Open Space (6.7%). Land uses anticipated to comprise less total acreage in 2030 include: Industrial (6.6%), Public/Institutional (4.2%), Transportation (1.8%), Commercial (0.9%), and Other (0.2%). Land use analysis, predicts an overall increase of 5,429 acres (3.7%) of impervious surfaces in the Salt Lake Countywide Watershed by 2030. Additionally, by 2030,

the Jordan River Corridor is anticipated to have an increase in impervious surface area of 17.5 percent and a decrease in open space of 33.3 percent

### **Population**

Salt Lake County's population was estimated at 970,612 in 2005. This number is expected to grow to 1,381,519 by 2030, an increase of 410,907 people or a yearly increase of 16,436 people. Although Salt Lake City and the unincorporated area of Salt Lake County are anticipated to continue as the most populous areas of the County, cities in the southwestern region of the County are anticipated to experience the highest percent changes in population by 2030. In 2005, the Jordan River Corridor had a population of 200,236 people. By 2030, it is anticipated the Jordan River Corridor will have a population of 257,465 people, a change in population of 22.3 percent.

### **Climate**

The Salt Lake Countywide Watershed has a semi-arid continental climate with four distinct seasons (NWS, 2007). The climate in Salt Lake County is generally determined by: 1) latitude, 2) elevation, 3) regional storm paths, 4) the distance from moisture sources such as the Pacific Ocean and the Gulf of Mexico, 5) local mountain ranges, and 6) the Great Salt Lake. Additionally, winds traveling inland from the Pacific Ocean must cross the Sierra Nevada and Cascade mountain ranges before reaching Salt Lake County. As moist air travels over high mountain ranges, it is forced to rise to higher altitudes causing condensation and precipitation. Therefore, westerly air currents that reach Utah and the Watershed are relatively dry.

In Salt Lake County, summer months are typically hot and dry with low relative humidity (mean humidity is typically less than 60%). Winter months are cold, but usually not severe, due again to the low relative humidity. The average maximum daytime temperatures in Salt Lake City range from 37° in January to 93° in July; however, mountain temperatures can be substantially different due to altitudinal effects or temperature inversions typical in winter months. Average temperatures at the Salt Lake City International Airport range between 51.9° and 54.2° F between 1995 and 2005. Mean daily fluctuations in temperature can vary between 18° F in the winter months and 30° F in the summer months.

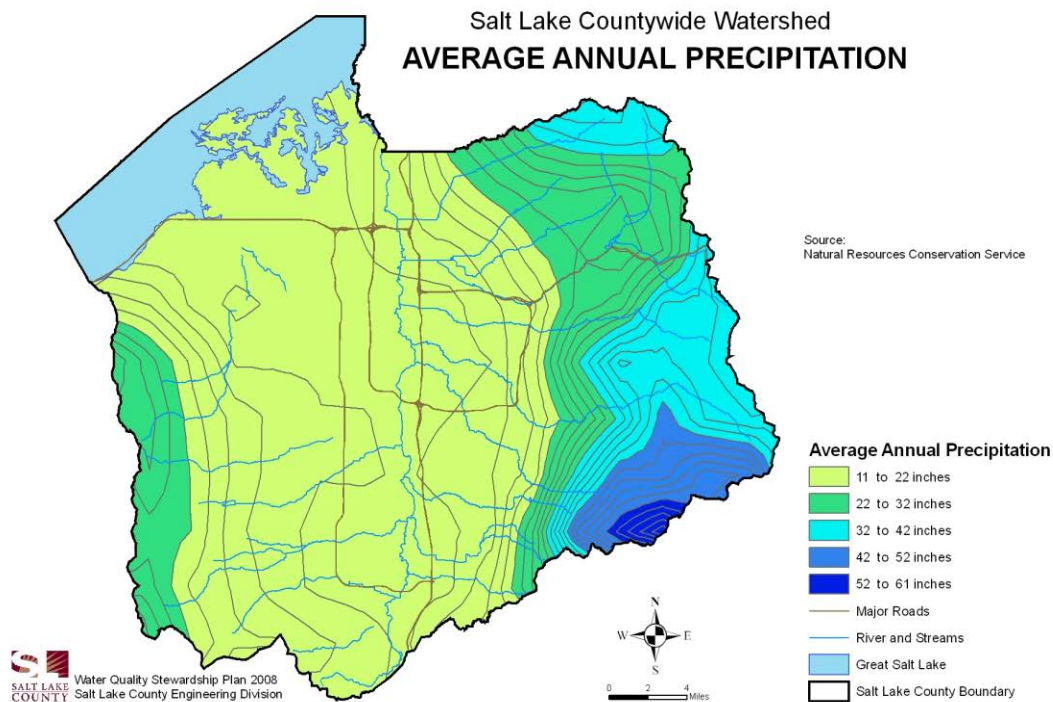
### **Precipitation**

The average annual precipitation at the Salt Lake City International Airport has varied between 14 and 23 inches per year between 1995 and 2005. On average, the Salt Lake Valley receives less than 23 inches of rainfall per year (Figure 5). Precipitation tends to be light and isolated in the summer and fall months and heavy in the spring when frontal storms move inland from the Pacific Ocean. Higher precipitation levels are apparent in the Wasatch and Traverse Mountains where mean annual precipitation levels reach up to 60 inches per year. Interestingly, Upper Emigration, Upper Parley's, and Upper Mill Creek Sub-Watersheds receive lower levels of precipitation than the southern upper watersheds of Big Cottonwood, Little Cottonwood, and Corner Canyon. The highest average monthly precipitation levels are typically in April with a mean of 2.21 inches per month. The driest month of the year is July with an average precipitation of 0.72 inches, as measured at the airport.



Annual snowfall has varied between 22 and 86 inches in the valley between 1995 and 2005. The higher elevation bench areas receive significantly more snowfall. Snow accumulation in the mountain areas can reach depths of 10 feet or more. At some locations, the average annual snowfall is 40 to 50 feet. Due to the state's inland location, Utah's snow is unusually dry, with less than 10% moisture content (NWS, 2007).

**Figure 5-Average Annual Precipitation**



### 3.0 PROJECT GOALS

The overarching goal of this project is to improve water quality in the Jordan River by removing sediment by stabilizing eroding banks. Using STEPL, it was found that this project provides load reductions of 577.85 lb/yr of Nitrogen, 222.47 lb/yr of Phosphorus, 1155.70 lb/yr of BOD and 180.58 lb/yr of sediment. While the model shows a reduction, empirically, it can be seen that the bank is now stable and is no longer shifting to the west, which means the soil wasting into the river has been reduced.

### 4.0 PROJECT ACTIVITIES

The following are the project activities/objectives that were identified in the initial proposal. Each objective is followed by the respective outcome.

#### **Objective 1: Ecosystem Restoration Easement**

**Task 1:** Obtain right of way acquisition from Rocky Mountain Power (RMP)

**Outcome:** Salt Lake County was able to bring RMP in as a partner on the project. The project benefit was realized, and therefore, RMP was willing to grant a no cost easement for the project. The limitations



that came with that no-cost easement were: 1) the access road was not to be moved; 2) the power lines were to be protected.

**Objective 2: Construct a typical side slope, remove and dispose excess material**

Task 2: Perform clearing and grubbing of site

Task 3: Remove rubble from site

**Outcome:** This objective encompassed the length of the project. In addition to the excess native material, concrete rubble was also removed from the length of the project.

**Objective 3: Perform excavation of the bench and slope and stockpile topsoil**

Task 4: Excavation of the bench and slope

Task 5: Excavation and stockpile topsoil

**Outcome:** The material that would typically be used for topsoil was found to be overwhelmed with concrete rubble. It was also worried that the phragmites seeds would withstand weed treatments. So while the excavation of the bench and slope occurred, the material excavated was disposed of offsite.

**Objective 4: Construct stone and end protection per plan and details**

Task 6: Excavation of the top/toe protection

**Outcome:** This objective occurred concurrently with Objectives 2 and 3.

**Objective 5: Place COIR fabric per plan, profile, and detail on sheet C-45.**

Task 7: Place COIR fabric control on site

Task 8: Place filter fabric under the stonework

**Outcome:** A filter fabric was not used under the stonework. It was determined that a granular filter layer would be more appropriate for this site. Fabrics tend to be very unforgiving in situations that it is expected for some shifting in the riprap to occur. A granular filter layer allows for “self-healing” of the riprap, which means the riprap is allowed to settle and compress naturally through the years.

**Objective 6: Finish grade to contain 0.3M of amended topsoil, placed in two 0.15M layer.**

Task 9: Backfill the bench and slope

Task 10: Backfill the top/end protection

**Objective 7: Construction stone protection and top protection, place stone pad, and construct stone revetment per plan and details on sheets C-45 and C-45**

Task 11: Construct stonework toe, end protection, pad and trenching

**Outcome:** As the excavation was occurring, stone/riprap was being placed.

**Objective 8: Relocate and match existing path per plan.**

Task 12: Relocate and reconstruct path at site

**Outcome:** RMP stipulated the path was not to move. This was taken into account and the slopes were adjusted to end at the side of the path.

**Objective 9: Extend fine grade and seed/plant application to blend the limits of construction disturbance.**

Task 13: Broadcast seeding of site

Task 14: Plantings of site

**Outcome:** The hard armoring associated with this project was completed late fall/early winter in 2010. Weed mitigation then occurred. The intent was to go bank early spring to broadcast seed and plant the site. Unfortunately, the river level rose in early February and did not recede until late summer of 2011. This prevented any planting on this site.

**Objective 10: Install beaver fence to the site.**

Task 15: Beaver fencing

**Outcome:** Due to no trees planting, no beaver fencing was necessary.

**Objective 11: Maintain restoration site in perpetuity.**

Task 16: Site maintenance

Task 17: Develop final report at end of project

**Outcome:** SLCO continues to monitor this site. No problems with the hard armoring have occurred to date. It is possible those in the next couple of year, as our willow supplies increase, this site may receive some willow stakings.

#### **4.1 PLANNED AND ACTUAL MILESTONES, PRODUCTS, AND COMPLETION DATES**

When the grant was written, it was planned that all would be completed in 2009. However, due to project management changes and constructions schedules, work actually commenced in 2010.

<b>Task</b>	<b>Accomplishment</b>
1. Ecosystem Restoration Easement	2010
2. Construct a typical side slope, remove and dispose excess material	2010
3. Perform excavation of the bench and slope and stockpile topsoil	2010
4. Construct stone and end protection per plan and details	2010
5. Place COIR fabric per plan, profile, and details on C-45	
6. Finish grade to contain 0.3 M of amended topsoil, placed in two 0.15 M layers	
7. Construct stone protection and top protection, place stone pan, and construct stone revetment per plan and details on sheets C-45	2010
8. Relocate and match existing path per plan	2010
9. Extend fine grade and seed/plant application to blend the limits of construction disturbance.	
10. Install beaver fence to the site	
11. Maintain restoration site in perpetuity	Annually

#### **4.2 EVALUATION OF GOAL ACHIEVEMENT AND RELATIONSHIP TO THE STATE NPS MANAGEMENT PLAN**

This project supports the State NPS Management Plan by: 1) mitigation erosion on the Jordan River, and 2) creating habitat.

## **5.0 PARTNERS**

**Rocky Mountain Power (Pacific Corp)** - Granted the permanent easement at no cost. This was a large savings to the project budget.

**South Valley Water Reclamation Facility**- provided a grant for additional funds on this project.

**Utah Division of Water Quality**- Provided funding for project implementation.

**Salt Lake County**- Provided project design and oversight of the project, and completed project reporting.

**U.S. Environmental Protection Agency**- Provided Section 319 funding for project implementation, and feedback on Project Implementation Plans.

## **6.0 COMPLICATIONS**

This project was a success from the standpoint of stopping erosion. However, with the fluctuation of the river level and extreme heat of the years that followed, planting was not feasible, due to the lack of irrigation. Salt Lake County did perform weed mitigation on multiple occasions, but without the cooperation of the river levels and weather, planting did not occur.

## **7.0 RECOMMENDATIONS**

### **LESSONS LEARNED:**

The major lesson learned on this project was timing. If a project goes to construction too late in the season, it makes planting right after completion hard to accomplish. This happened on this project and with the high water in the following years planting became unfeasible.

Another lesson was making sure the person operating the machinery understood the purpose of the project. It makes the construction go more smoothly when the operator understands why the project is being constructed.

The final major lesson is about monitoring. There was not background monitoring before the project and no funding for post-construction monitoring. Establishing a monitoring plan while the project is in design phase would be very beneficial to ensure a successful project.

## **8.0 ENVIRONMENTAL RESULTS**

Using STEPL, it was found that this project provides load reductions of 577.85 lb/yr of Nitrogen, 222.47 lb/yr of Phosphorus, 1155.70 lb/yr of BOD and 180.58 lb/yr of sediment.

The banks are no longer mass wasting in to the river, due to the toe being installed. The two power lines have also been protected by a riprap revetment.

Before, during and after photos follow.



**Before Construction (November 2001)**





**Before Construction (November 2008)**



**Before Construction (November 2008)**





**During Construction (August 2010)**



**During Construction (August 2010)**



**After Construction (April 2012) – Note: Water level is above the riprap in this picture.**



**After Construction (April 2012) – Note: Water level is above the riprap in this picture.**



## 9.0 DELIVERABLES AND FINANCES

The deliverables outlined in the contract were the reports with each invoice, as well as annual reports and a final report. Additional copies of these reports are available on request.

This following table shows the cost sharing between the 319/NPS Funds, South Valley Water Reclamation Facility grant and the match provided by Salt Lake County.

<b>Task</b>	<b>Deliverables</b>	<b>319/NPS Funding</b>	<b>Addition Funding - SVWRF</b>	<b>Addition Funding - SLCO Match</b>	<b>Total</b>
1. Ecosystem Restoration Easement	Signed Easement				
2. Construct a typical side slope, remove and dispose excess material	Bank stabilization	\$24,560.05	\$54,311.81	\$41,848.87	\$120,720.73
3. Perform excavation of the bench and slope and stockpile topsoil					
4. Construct stone and end protection per plan and details					
5. Place COIR fabric per plan, profile, and details on C-45					
6. Finish grade to contain 0.3 M of amended topsoil, placed in two 0.15 M layers					
7. Construct stone protection and top protection, place stone pan, and construct stone revetment per plan					
8. Relocate and match existing path per plan					
9. Extend fine grade and seed/plant application to blend the limits of construction disturbance.					
10. Install beaver fence to the site					
11. Maintain restoration site in perpetuity					

## 11.0 CONCLUSIONS

This project was a good example of private and public partnerships. It was also successful in mitigating bank erosion. It provided many learning opportunities, such as monitoring and project scheduling.

## Appendix A: Project Area Map



# Jordan River - 9000 South to 8600 South



Project area is outlined in red.  
Approximately 1150 feet of bank had rubble  
and invasive plants removed.  
It was then sloped to a minimum of 2:1  
and a riprap toe was placed.



0 100 200 400 Feet