Lower Spanish Fork River Watershed

Coordinated Resource Management Plan

Prepared By
Mark M. Petersen
Petersen Environmental Consulting, LLC
and
The Lower Spanish Fork River CRMP Technical Advisory Committee

For
The Timp-Nebo Conservation District

November 2015

Preface

Appreciation is expressed to the many individuals representing local units of government, federal agencies, state agencies, private organizations and landowners who have cooperated and worked to bring this Coordinated Resource Management Plan (CRMP) to completion. Members of the Lower Spanish Fork River CRMP Technical Advisory Committee (TAC) have completed inventories and assessments, analyzed data, prepared charts and graphs, and coordinated planning efforts to develop objectives and actions that will help achieve the project vision developed by the Project Steering Committee and local landowners.

Local interest in developing a CRMP for the Lower Spanish Fork River was largely based on a desire to be pro-active in reducing damage from future large flood events by planning and preparing in advance. In the past, flood control has been reacting to a crisis during and after a large flood event.

The intent of this Coordinated Resource Management Plan is to provide direction and guidance for the development of individual and group conservation plans. The CRMP will also be used to develop applications for funding to help implement the planned actions. Implementation of action items in this CRMP will be by individual landowners or groups of landowners through voluntary participation in developing and implementing conservation plans. Technical assistance will be provided by members of the Technical Advisory Committee and others. These plans will be specific to each particular land unit based on landowner decisions. Best Management Practices (BMPs) will be listed that achieve the goals and objectives of local landowners.

It is expected that when landowners have implemented their conservation plans – which have been developed with direction and guidance from this CRMP – the project goal or “Vision” will have been achieved.

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Executive Summary

Purpose of the Plan

This plan presents feasible solutions to identified resource concerns that, when implemented, will achieve the vision of the local landowners and Timp-Nebo Conservation District for the area. It will also be a guidance document for developing individual and group conservations plans. When applying for funding to implement the planned actions, the CRMP can be used to apply for a variety of federal, state, and local conservation programs.

Project Sponsor

The Timp-Nebo Conservation District is the sponsoring organization of the Lower Spanish Fork CRMP.

Location of Planning Area

The priority focus of this plan is on the Lower Spanish Fork River and the land that is adjacent to the river. The planning area includes the river from Interstate15 to Utah Lake. The Lower Spanish Fork River is 6.8 miles in length and flows in a north-westerly direction from the crossing of Interstate 15 to Utah Lake. The watershed area of the Lower Spanish Fork River is also included in the plan.

Land Ownership

The Lower Spanish Fork River CRMP planning area is privately owned except for the area bordering Utah Lake which is owned by the State of Utah. State owned land near Utah Lake is used mainly for recreational activities and wildlife habitat.

Major Resource Uses

The Spanish Fork River is a tributary to Utah Lake, which is a major recreational water body that also serves as habitat for many species of song birds, fish, waterfowl and shore birds. Utah Lake also provides agricultural water to several thousand water users.

Water is diverted from the Spanish Fork River to irrigate crop and pasture land and is used to water livestock. There are two irrigation diversions within the planning area, the Lake Shore Irrigation Company Dam and Lakeside Irrigation Company Dam.

Farming is the major land use in the planning area. Irrigated crops include alfalfa hay, grass hay, small grains, corn for grain and silage, improved pasture and native salt meadow pasture. Animal agriculture includes small beef feedlots (less than 100 animals) and pasture grazing of cow-calf pairs, beef and horses.

Water quality in the Lower Spanish Fork River is not classified as impaired for any of the beneficial uses by the Division of Water Quality; however, several parameters are near the threshold of impairment.

The Lower Spanish Fork River has been classified by the Utah Division of Wildlife Resources as a warm water fishery. It is potential spawning habitat for the June Sucker, which is a federally listed endangered species. Along the Lower Spanish Fork River, there have been sightings of the Western Yellow-billed Cuckoo, which is a federally listed threatened species.

Identified Resource Concerns and Conservation Opportunities

Resource concerns and conservation opportunities were identified by landowners and other interested parties through a public scoping process. A Technical Advisory Committee (TAC) was then created to address each identified resource concern and opportunity. Resource concerns and conservation opportunities addressed in this plan are the following:

1. Streambank Erosion, Flood Control and Trees and Debris in River
2. Noxious and Invasive Weeds
3. Agricultural Production Improvements
4. Water Quality
5. Fencing
6. Trespassing Issues/Access Points
7. Endangered Species

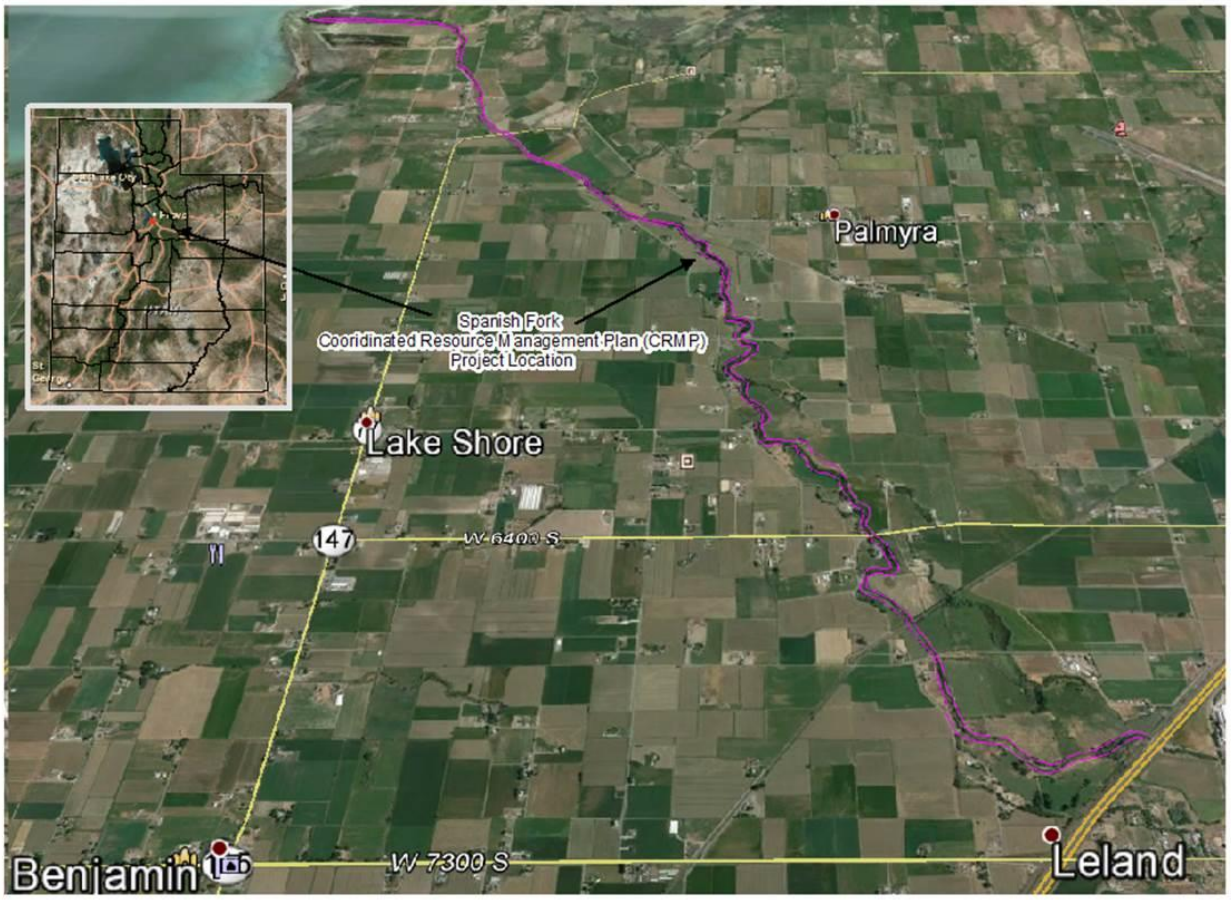
Expected Benefits

When landowners implement their conservation plans that have been developed with direction and guidance from this CRMP, the project goals will be achieved. One of the project goals is to reduce erosion. It is estimated that sediment loading from streambank erosion will be reduced by over 300 tons/year. Damage from flooding and large runoff events will be decreased or eliminated. Noxious and invasive weeds in the planning area will be greatly reduced. Improved irrigation water management and improved pasture management will result in increases in production of agricultural products. The Lower Spanish Fork River will not be listed as impaired. Habitat for fish and wildlife species will be improved, which could potentially benefit the June Sucker and the Western Yellow-billed Cuckoo, two federally listed species.

Costs:

In order to implement the planned actions in this CRMP and to achieve the expected results, an estimated $4,714,000 is needed from a variety of funding sources. An additional $37,000 will be needed to carry out the planned monitoring activities.

Project Map



Lower Spanish Fork River Watershed
Coordinated Resource Management Plan

Purpose of the Plan

The purpose of this coordinated resource management plan (CRMP) is to identify resource concerns and conservation opportunities in the Lower Spanish Fork River Watershed and to develop planning objectives and feasible conservation action. The plan presents solutions that, when implemented, will achieve the vision and goals of the CRMP Steering Committee, the Timp-Nebo Conservation District and the local landowners. The CRMP will be a guidance document for developing conservation plans. The CRMP can be used to apply for funding through a variety of federal, state, and local programs to implement the planned conservation actions.

Project Sponsor

The Timp-Nebo Conservation District is the sponsoring organization of the Lower Spanish Fork CRMP.

Authority

The Timp-Nebo Conservation District is a legal subdivision of the State of Utah and is responsible for local soil and water conservation programs. On March 6, 2014, the Timp-Nebo Conservation District board members voted to support and sponsor a CRMP for the Lower Spanish Fork River. They then submitted an application to the Utah Department of Agriculture for funding to develop the CRMP. Funding for the CRMP was approved in July 2014. Petersen Environmental Consulting LLC was contracted to coordinate planning activities and to write the CRMP.

Project Vision

The project sponsor and Steering Committee adopted a project vision to guide all activities of the CRMP planning process. The overall vision of this project is to achieve:

"An area with a properly functioning stream channel and riparian area that provides quality fish and wildlife habitat and water quality that meets the standards for its beneficial uses while supporting viable, sustainable and productive family farms and ranches."

Voluntary Implementation

Implementation of resource conservation actions by landowners will be through voluntary participation. Conservation plans will be developed and implemented. These plans will be tailored to address the specific resource concerns and conservation opportunities that pertain to each particular land unit and the desires of each landowner.

Public Participation

Steering Committee

The Lower Spanish Fork River planning area was divided into four sections. A Steering Committee was organized with representation from each section to provide local planning guidance and direction for the CRMP. The Steering Committee is comprised of the following:

Representing	Name
Timp-Nebo Conservation District	Rex Larsen
Section 1	Jon Beck Blake Beck Brad Beck Bill Beck
Section 2	Sterling & Marylyn Argyle Gilbert Archuleta Richard Edwards
Section 3	Ed Holt Farms Cody Holt
Section 4	Byron Betts

Technical Advisor Committee (TAC)

A Technical Advisory Committee was formed to provide needed technical assistance to the Steering Committee. The TAC responsibilities included conducting the needed resource inventories, assessing resource data, and formulating viable conservation alternatives for the Steering Committee and private landowners.

Members of the Technical Advisory Committee (TAC) are:

Name	Expertise	Organization
Mark Petersen, Coordinator	Watershed Planning, Riparian	Petersen Environmental

Dustin Rowley	Planner	Timp-Nebo CD
Daniel Gunnell	Resource Coordinator	UDAF
Dean Miner	Education/Outreach	Utah County Extension
Aaron Eagar	Weed Specialist	Utah County Public Works
Glen Tanner	Engineer	Utah County Public Works
Nathaniel Todea	Hydraulic Engineer	NRCS
Chris Crockett	Aquatic Biologist	UDWR
Terri Pope	Sensitive Species Biologist	UDWR
Carl Adams	Water Quality Specialist	UDWQ
Niels Hansen	Agronomist	NRCS
Karl Fleming	Wildlife Biologist	USFWS

Scoping

Six scoping meetings were held with local landowners, agency personnel, irrigation companies and other interested groups. During the scoping process, ten resource concerns and conservation opportunities were identified. These concerns were divided into two priority groups as follows:

Priority 1 Resource Concerns and Conservation Opportunities
- Streambank Erosion – Sandbars and Sediment
- Flood Control, Including the Railroad Bridge
- Trees and Debris in River, Including Beaver Issues
- Noxious and Invasive Weeds
- Agricultural Production Improvements
- Water Quality

Priority 2 Resource Concerns and Conservation Opportunities
- Fencing
- Trespassing Issues/Access Points
- Endangered Species
- High Water Table

Description of Planning Area

Location of Planning Area

The CRMP planning area includes the Lower Spanish Fork River from Interstate 15 to its termination point at Utah Lake and the watershed that drains into the Lower Spanish Fork River. The total length of the Lower Spanish Fork River in the planning area is 6.8 miles. The river flows in a north westerly direction from its crossing at Interstate 15 to the confluence with Utah Lake.

The priority focus of this plan is on the river and land adjacent to the river.

Land Ownership

The Lower Spanish Fork River CRMP planning area is privately owned except for the area bordering Utah Lake, which is owned by the State of Utah.

State owned land near Utah Lake is used mainly for recreational activities and wildlife habitat.

Major Resource Uses

The Spanish Fork River is a tributary of Utah Lake which is a major recreational water body. The Lake provides habitat for many species of fish, waterfowl and shore birds. Utah Lake also provides agricultural water to several thousand water users.

Agriculture

Water is diverted from the Spanish Fork River to irrigate the crop and pasture land in the planning area and to water livestock. There are two irrigation diversions within the planning area, the Lake Shore Irrigation Company Dam and Lakeside Irrigation Company Dam (also sometimes referred to as the "Last Chance" or "Huff" Dam.) These dams can divert all of the water in the river during low flow conditions.

Farming is the major land use in the planning area. Irrigated crops include alfalfa hay, grass hay, small grains, corn for grain and silage, improved pasture, and native salt meadow pasture. Animal agriculture includes small beef feedlots (less than 100 animals) and pasture grazing of cow-calf pairs, beef and horses.

Water Quality

According to the State of Utah, the quality of water in the Lower Spanish Fork River is protected for the following uses:

Use Class 2B = Infrequent primary contact recreation (e.g. wading, fishing);
Use Class 3B = Warm water fishery/aquatic life;
Use Class 3D = Waterfowl, shore birds and associated aquatic life;
Use Class 4 = Agricultural uses (crop irrigation and stock watering)

The Lower Spanish Fork River is not classified as an impaired waterbody for any of the beneficial uses defined by the Division of Water Quality; however, there are several parameters which are near the threshold of impairment.

Utah Lake is protected for the same Use Classes as the Lower Spanish Fork River and is listed as impaired for its warm water fisheries use due to polychlorinated biphenyl (PCBs) in fish tissue and for total phosphorus. The lake is also impaired for its agricultural use designation due to high concentrations of total dissolved solids (salts).

An evaluation of the current data obtained by the Division of Water Quality indicates that the water quality of Utah Lake is fairly good. It is considered to be very hard, with a hardness concentration value of approximately 399 ml/L (CaCO3). Parameters that have exceeded state water quality standards for defined beneficial uses continue to be total dissolved solids, total phosphorous and on occasion, dissolved oxygen in the water column. (Utah Division of Water Quality (DWQ), Watersheds: Lakes and Reservoirs. Retrieved for Utah Lake. http://waterquality.utah.gov/watersheds/lake.htm)

Fish and Wildlife

The Lower Spanish Fork River has been classified by the Utah Division of Wildlife Resources as a warm water fishery and is potential spawning habitat for the June Sucker, a federally listed endangered species. The upper reaches of the Lower Spanish Fork River support low densities of Brown trout and some warm water species. Lower reaches towards the lake that are not seasonally dewatered support a mix of species including Common carp, Black bullhead, Channel catfish, White bass, Green sunfish, Bluegill, Walleye, and Brown trout.

There have been sightings of the Western Yellow-billed Cuckoo, a federally listed threatened species, along the Lower Spanish Fork River. There is potential for other bird species that are on the Utah List of Species of Greatest Conservation Need (SCGN) to nest and forage in the riparian vegetation and fields adjacent to the river.

Climate and Soils

The climate in the project area is temperate. The mean annual air temperature is 46 to 48 degrees F. Mean annual precipitation ranges from 14 to 16 inches and the frost-free period ranges from 130 to 150 days.

The soils in the planning area are approximately 55 percent silty clay loam with loam and fine sandy loam making up about 35 percent. Some soils in the lower part of the area are saline and alkali. Some soils have a high water table. A soils map and soil descriptions are in Appendix A.

Resource Concerns and Conservation Opportunities

Ten resource concerns and conservation opportunities were identified through a public scoping process. It was decided by the Steering Committee and Technical Advisory Committee that the high water table concerns associated with groundwater, irrigation, and lake levels are outside the scope of this CRMP. Because the hydrologic and geomorphic processes of flooding, streambank erosion, and sediment bars are interrelated – and because these processes are directly affected by trees and debris in the river channel – the Technical Advisory Committee combined these resource concerns. Resource concerns and conservation opportunities were prioritized by the Steering Committee. A Technical Advisory Committee Interdisciplinary (ID) Team was assigned to address each concern and opportunity.

Priority 1

Resource Concerns and Conservation Opportunities: Streambank Erosion, Flood Control and Trees and Debris in River

- Loss of land from bank erosion
- Sediment damage to crop and pasture land after a flood
- In-channel sediment bars causing increased stress on stream banks
- Union Pacific Railroad bridge causing debris dams and flooding
- Past flood work done with ineffective and improper equipment.
- Diversion structures lack proper spillway to regulate flood flows
- Trees and debris in the river channel during a flood event cause debris dams and increased bank erosion and flooding
- Culverts and bridges not designed to pass debris and flood flows
- Beaver felling trees into the river
- Beaver cutting desirable trees

ID Team to address this Resource Concern: Nathaniel Todea, NRCS; Glen Tanner, Utah County Public Works; Chris Crockett, UDWR; Terri Pope, UDWR; Karl Fleming, USFWS; Daniel Gunnell, UDAF; and Mark Petersen, Consultant. (Union Pacific was contacted, but no one agreed to serve on the ID Team)

Resource Concern and Conservation Opportunity: Noxious and Invasive Weeds

- In Riparian Area: Russian olive, Phragmites, Tamarisk, Scotch thistle, Perennial peppergrass (giant whitetop), Poison hemlock
- Pastures and Cropland: Whitetop, Bindweed, Teasel
- Right-of-ways: Abandoned railroad right-of-way (UTA)
- Access to control weeds

ID Team to address this Resource Concern: Aaron Eager, Utah County Weed Supervisor; Niels Hansen, NRCS; Terri Pope, UDWR; and Mark Petersen, Consultant.

Resource Concern and Conservation Opportunity: Agricultural Production Improvements

- Cropland and pasture land damaged by sediment deposition during flooding can no longer be irrigated
- Irrigation return flows add nutrients to the river
- There may be opportunities to increase crop and pasture production through improved nutrient management, improved irrigation water management and intensive grazing practices.
- There may be opportunities to increase crop and pasture production through restoring and maintaining old open and tile field drains.
- Animal Agriculture – improve nutrient management

ID Team to address this Resource Concern: Niels Hansen, NRCS; Dean Miner, USU Extension; and Mark Petersen, Consultant.

Resource Concern and Conservation Opportunity: Water Quality

- Address water quality opportunities to prevent (make it unnecessary) listing on 303d list.
- Pollutants of Concern:
    - Nutrients
    - Sediment
    - E.coli
    - Oxygen depletion

ID Team to address this Resource Concern: Daniel Gunnell, UDAF; Carl Adams, and Niels Hansen, NRCS.

Priority 2

Resource Concern and Conservation Opportunity: Fencing

- Improperly designed fences across the river causing debris dams during a flood
- Fences across the river need to be replaced after each flood
- Livestock damage to streambanks

ID Team to address this Resource Concern: Mark Petersen, Consultant and Nathaniel Todea, NRCS.

Trespassing Issues/Access Points

- Trespassing to access the river for fishing (trout, carp)
- Trespassing to hunt pheasants
- Trespassing for water recreation activities at diversion ponds

ID Team to address this Resource Concern: Chris Crockett, UDWR, and Glen Tanner, Utah County Public Works.

Resource Opportunity: Endangered Species

- June Sucker, *Chasmistes liorus,* is a federally listed endangered species that occurs in Utah Lake and there may be potential for June sucker to use the Lower Spanish River. *However, the June Sucker Recovery Plan only mentions the Provo River as a concern for June spawning.*
- The riparian area may be potential Western Yellow-billed Cuckoo, *Coccyzus americanus*, habitat. The Western Yellow-billed Cuckoo is a federally listed threatened species.

ID Team to address this Resource Concern: Chris Crockett, UDWR; Terri Pope, UDWR; and Karl Fleming, USFWS.

Planning Objectives and Planned Conservation Actions

1. Streambank Erosion, Flood Control and Trees and Debris in River

Extent of Resource Concern:

1. There are approximately 70 hazardous trees. Ten (10) are above the railroad bridge.
2. There are two irrigation diversions
3. Approximately 3,600 feet of eroding stream banks
4. Approximately 7,830 feet of 1964 Flood Channel
5. Approximately 4,300 feet of weak or low berms
6. Approximately 500 feet of in-channel bars
7. One railroad bridge causing flow restriction and debris dam hazard
8. Beaver sometimes add to the debris problems by felling trees into the river.

Planning Considerations:

1. Avoid removing trees or other disturbance work during the bird breeding season.
2. Consider leaving root system of hazard trees in place to protect stream banks while existing and planted trees are establishing.
3. Disturbed areas should be planted and/or seeded to desirable species unless there are adequate native willows and desirable herbaceous plants to re-colonize the disturbed area.
4. Anchored wood should be left in place to provide aquatic habitat.
5. Consider using vegetation, soil lifts, and other bioengineering techniques to stabilize eroding banks.
6. Manage beaver, as needed, according to the guidelines in Appendix B.

Planning Objective 1: Reduce erosion from eroding streambanks with a Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS) rating of High-High to a rating of Low-Low.

Planned Conservation Actions:

1. Streambank protection spot treatment on approximately 1700 feet of eroding stream banks in the upper reach.

   Estimated Cost: $145,000

   Estimated Time Frame to Implement: Within 5 years after the project is funded.

2. Streambank protection to stabilize 1900 feet of saturated, unstable banks upstream from the Lakeside Irrigation Company (Last Chance) Dam to 4400 South.

   Estimated Cost: $1,750,000

   Estimated Time Frame to Implement: Within 5 years after the project is funded.

Planning Objective 2: Minimize flood and sediment damage to property while considering bank stability and riparian resiliency.

Planned Conservation Actions:

1. Restore the 7830 feet 1964 Flood Channel

   Estimated Cost: $193,000

   Estimated Time Frame to Implement: Within 5 years after the project is funded.

2. Remove sediment bars and reconstruct 500 feet of channel to increase conveyance capacity.

   Estimated Cost: $37,000

   Estimated Time Frame to Implement: Within 5 years after the project is funded

3. Reconstruct and fortify 4300 feet of river levees.

   Estimated Cost: $721,000

   Estimated Time Frame to Implement:

3. Construct a flood water bypass for the Lakeside Irrigation Company (Last Chance) Dam diversion.

   Estimated Cost: $200,000

   Estimated Time Frame to Implement: Within 5 years after the project is funded

4. Construct a flood water bypass for the Lake Shore Irrigation Company Dam diversion.

   Estimated Cost: $200,000

   Estimated Time Frame to Implement: Within 5 years after the project is funded

5. Mitigate potential impacts to the water table resulting from higher dikes by installing approximately 1900 feet of interceptor drain on the west side of the Lake Side Irrigation Company (Last Chance) Dam impoundment with an outlet into the river below the Dam. Implementation of this action would have the additional benefit of adding instream flow to the river below the dam with potential benefits for the endangered June Sucker.

   Estimated Cost: $ 24,000

   Estimated Time Frame to Implement: Within 5 years after funding for the project.

Planning Objective 3: Identify and remove approximately 70 hazard trees, mostly non-native Crack Willow (*Salix fragilis)*, and debris that can cause debris dams and flooding. The ten (10) hazard trees above the railroad bridge will be high priority for removal.

Planned Conservation Actions:

1. Remove or prune hazard trees and remove unanchored, in-channel and near-channel debris.

   Estimated Cost: $12,000

   Estimated Time Frame to Implement: Within the 1st year after project funding. Highest priority will be hazard trees and unanchored debris above the railroad bridge.

Monitoring

1. Hazard trees
2. Pre and Post-treatment BEHI/NBS to monitor effectiveness of erosion control measures. Provide both annual and 5-10 total loss/sediment yield estimates.
3. Use photo plots to monitor changes in width/depth ratios and riparian vegetation.
4. Use modelling to show flooding impacts before and after practice implementation.
5. Track reduction in County flood emergency responses.

   Estimated Monitoring Cost: $5,000 per year for 5 years = $15,000

2. Noxious and Invasive Weeds



Extent of Resource Concern:

1. There are approximately 100 acres of noxious and invasive weeds in the project area.
2. There are approximately 350 Russian Olive trees. 246 Russian Olive trees occur in 9 potential treatment areas with Russian Olive canopy cover greater than 20 percent. The remaining 100 plus Russian Olive trees occur in scattered stands or individual trees with less than 10 percent Russian Olive canopy cover.
3. Salt Cedar (*Tamarisk*) occurs in small communities or as individual plants along the riparian area. The densest communities of Salt Cedar occur within the same 9 Russian Olive potential treatment areas.

Planning Considerations:

1. Herbicides must be aquatic labeled.
2. Avoid controlling or removing trees during the bird breeding season.
3. Russian Olive is not listed in as a noxious weed Utah County. Salt Cedar is listed as a "containment species" in Utah County.
4. The extent of control or tree removal will be an individual landowner decision.
5. When planning the extent of control, consider the wildlife values of Russian Olive such as food (fruit) and nesting.
6. In some of the densest stands, trees may be removed in stages to maintain a desired vegetative community structure.
7. Disturbed areas should be planted and/or seeded to desirable species unless there are adequate native willows and desirable herbaceous plants to re-colonize the area after removing or controlling Russian Olive and/or Salt Cedar.
8. Follow up treatment will be needed in most cases.

Planning Objective 1: Control noxious and invasive weeds, including Russian Olive and Salt Cedar (Tamarisk) within the project area with priority upon the riparian area and fields adjacent to or near the river.

Planned Conservation Actions:

1. Control noxious and invasive weeds on approximately 100 acres on stream banks, fields adjacent to or near the river, and right-of-ways. Follow recommendations of the Utah County Weed Supervisor.

   Estimated Cost: $10,000 for initial treatment. $5,000 for follow up treatments.

   Estimated Time Frame to Implement: Within 5 years after the project is funded.

2. Remove invasive Russian Olive trees (See Appendix E for potential treatment areas)
   a. Where Russian Olive is controlled, the area should be managed to allow Peachleaf Willow (*Salix amygdaloides*) recruitment to maintain functionality and habitat. If there is not enough Peachleaf Willow present in the treatment area for natural recruitment, willow poles will be planted to accelerate restoration. (See Appendix D for pole planting guidelines)
   b. Three methods of removal and control may be used:
      i. Trees can be cut with chainsaws or bullhog and stumps treated with an appropriate herbicide as recommended by the County Weed Supervisor or USU Extension. This method leaves the root system in place to maintain function. Tops are removed or chipped in place.
      ii. Trees can be girdled, leaving both the roots and dead tops in place to maintain function and provide habitat, and the girdle treated with an appropriate herbicide as recommended by the County Weed Supervisor or USU Extension. *This method should not be used if the dead trees can become hazard trees*.
      iii. A combination of treatment methods with some trees removed and some trees girdled.

   Estimated Cost: $30,000 for initial treatment. $8,000 for follow up treatments

   Estimated Time Frame to Implement: Within 5 years after the project is funded. Some dense stands may be treated in phases over a 10 year period after the project is funded. Follow up treatments over 5 years following the initial treatment.

3. Remove invasive Salt Cedar (Tamarisk) (See Appendix E for potential treatment areas)
   a. Where Salt Cedar is controlled, the area should be managed to allow Coyote Willow (*Salex Exigua*) recruitment and establishment. If there is not enough Coyote willow present in the treatment area for natural recruitment, willow poles will be planted to accelerate restoration. (See Appendix D for pole planting guidelines)
   b. Individual plants or communities of plants can be controlled using one of the following methods:
      i. Treatment with an appropriate herbicide as recommended by the County Weed Supervisor or USU Extension.
      ii. Removal of entire plants roots and tops, with a backhoe or other appropriate equipment.

iii. Removal of the tops and treating the stumps with an appropriate herbicide as recommended by the County Weed Supervisor or USU Extension.

Estimated Cost: $15,000 initial treatment; $5,000 follow up treatments.

Estimated Time Frame to Implement: Within 5 years after project is funded.

4. Plant willow poles (Peachleaf Willow and Coyote Willow) and seed herbaceous mix on disturbed areas. (See Appendix D for pole planting guidelines)

   Estimated Cost: $15,000 initial treatment; $5,000 follow up treatments.

   Estimated Time Frame to Implement: Within 5 year after project is funded with follow up treatment over 5 years following initial treatment.

Monitoring:

1. Base-line before treatment
2. Effectiveness of Treatment: 1st, 2nd, 3rd, 5th, 10th, and 15th year after treatment
   a. Desirable Species Recruitment
   b. Undesirable species re-infestation
   c. Wildlife habitat condition
   d. Beaver damage to desirable trees

   Estimated Monitoring Cost: $10,000

3. Agricultural Production Improvements

Extent of Resource Concern:

There is potential to improve agricultural production on approximately 1100 acres of crop and pasture land in the Lower Spanish Fork River watershed area. This figure includes farmland adjacent to the river and farmland that drains into the river.

Planning Considerations:

1. Fields that are not adjacent to the river should be included in this project because most are connected to the river by drainage ditches.
2. When fields are close to a stream there is a potential for Biochemical oxygen demand (BOD), nutrients, and pathogens to move into the stream through field runoff. If Basin irrigation systems were installed in this watershed (not just fields adjacent to the stream) the risk of moving BOD, pathogens, and nutrients off the fields would be significantly reduced. Not all fields in the watershed need an improved irrigation system, but there are roughly 1100 acres where crop production could be improved.
3. If Basin irrigation systems were installed water quality will be improved in the river and in Utah Lake by reducing the nutrients and pathogens entering the stream. However, farmers will also benefit from being able to make their irrigation water go farther and to use fertilizer more efficiently because none of the fertilizer washes off the end of the field.
4. Much of the farmland in the Lower Spanish Fork River area is in small fields and owned by part time farmers. Intensive crop farming such as small grain and silage and grain corn is not a viable option due to the cost of machinery. An alternative would be grazed pastures where production in maximized with a minimum of inputs. Additionally Management Intensive Grazing systems (MiG) can produce finished cattle on pasture rather than feedlots. Some of the land in the area could be used for these systems.
5. NRCS provides technical assistance in Irrigation Water Management, Watering Structures, Fencing, Forage and Biomass Planting, and Prescribed Grazing (developing grazing management plans).

Planning Objective 1. Reclaim and/or improve productivity on approximately 200 acres of crop or pasture land damaged by flooding and sediment deposition

Planned Conservation Action:

1. Mitigate flood and sediment damaged land by install precision land leveling and level basin, graded border, or sprinkler irrigation systems on approximately 200 acres.

   Estimated Cost: $216,000 ($1,078/acre)

   Estimated Time Frame to Implement: Within 5 years after project is funded

Planned Objective 2. Improve agriculture production on approximately 900 acres of cropland and pasture land

Planned Conservation Actions

1. Install precision land leveling and level basin or graded border irrigation systems (or sprinkler irrigation systems) on approximately 900 acres.

   Estimated Cost: $970,000 ($1,078/acre)

Estimated Time Frame to Implement: Within 10 years after project is funded

2. Implement Prescribed Grazing (Management Intensive Grazing Systems) on approximately 500 acres of pasture land in the Lower Spanish Fork River watershed area.

   Estimated Cost: $14,000 ($28.26/acre)

   Estimated Time Frame to Implement: Within 5 years after project is funded

Planned Objective 3. Restore old open and tile field drains to a properly functioning condition.

Planned Conservation Actions

1. Restore approximately 8,600 feet of open field drains.

   Estimated Cost: $ 76,000

   Estimated Time Frame to Implement: Within 5 years after project is funded

2. Implement a study to map existing old tile field drains and assess needed repairs and replacements to restore the tile field drains to a proper function condition.

   Estimated Cost: $30,000

   Estimated Time Frame to Implement: Within 5 years after project is funded

Monitoring:

Implementation monitoring to track the amount of precision land leveling, level basin, graded boarder, or sprinker irrigation systems and prescribed grazing installed annually for 10 years after funding and implementation begins.

Estimated Monitoring Cost: $5,000

4. Water Quality

Extent of Resource Concern: The Lower Spanish Fork River is not classified as water quality impaired for any of the beneficial uses by the Division of Water Quality. Several parameters are near the threshold of impairment, including nutrients, dissolved oxygen, and E. coli bacteria. For current water quality data, including dissolved oxygen and E. coli from the Lower Spanish Fork River, refer to appendix C.

Planning Objective: Address opportunities to reduce pollutants and prevent listing the Lower Spanish Fork River on the State 303d list of impaired waters.

Planned Conservation Actions:

1. Implement streambank erosion and agriculture production resource concern actions.

   Estimated Cost: (See streambank erosion and agricultural production resource concerns)

   Estimated Time Frame to Implement: (See streambank erosion and agricultural production resource concerns)

Monitoring:

Monitor Nutrients, Dissolved Oxygen, and E. coli Bacteria according to Division of Water Quality monitoring schedule

Estimated Monitoring Cost: Included in UDWQ monitoring budget

5. Fencing

Extent of Resource Concern:

1. There are 4 fences that cross the river.
2. Approximately 6,000 feet of fence to protect streambank erosion control projects

Planning Considerations:

1. It is preferable to have as few fences crossing the waterway as possible. Fencing off the stream and leaving a properly designed water-gap for livestock water access can eliminate the need for fencing across the river.
2. Fences that run parallel to the direction of flood flow are less likely to be damaged than those that span the channel.
3. Fences that are set well back from the stream channel are less prone to damage. This is because both flow velocity and depth decrease with distance from the channel.
4. The section of fence that crosses the channel should be isolated from the rest of the fence.
5. Fences that cross over the river should be placed in a straight section of the stream where flow energy is naturally directed to the center of the channel. A cross fence should never be

placed on a meander bend where flow energy is directed against the outside bank and can cause bank scouring.

Planned Objective 1: Construct properly designed river-crossing fences that are designed to withstand and pass flood flows and debris. (An alternative could be to fence off the river leaving a water-gap for livestock water access.)

Planned Conservation Action:

1. Construct 4 river-crossing fences that are designed to withstand and pass flood flows and debris.
   Option 1. Suspended Cable with 3" PVC droppers
   Option 2. Suspended Cable with galvanized chain droppers
   Option 2. Suspended Cable with 2x6 wood droppers

   Estimated Cost: $9,000

   Estimated Time Frame to Implement: Within one year after project funding.

Planned Objective 2: Protect streambanks erosion control projects from livestock damage.

Planned Conservation Action:

1. Construct approximately 6,000 feet of standard 4-strand barbed wire fence to protect streambanks erosion control projects from livestock damage.

   Estimated Cost: $20,000

   Estimated Time Frame to Implement: As streambank erosion control practices are implemented.

Monitoring:

1. Check river-crossing fences after high flows and determine effectiveness of the new fence designs.
2. Check protection of erosion control projects annually until restoration is well established

   Estimated Monitoring Cost: $2,000

6. Trespassing Issues/Access Points

Extent of Resource Concern:

Trespassing is a concern on private property along the river and in areas where water is impounded by both diversions.

Planning Objective: Control illegal trespassing onto private property.

Planned Conservation Actions:

1. Walk-In-Access (WIA). If the landowner meets the program qualification, the property can be enrolled in the Utah Division of Wildlife Resources Walk-in Access (WIA) Program. (http://wildlife.utah.gov/walkinaccess)

   A Walk-In-Access (WIA) area is a tract of private land on which the Division of Wildlife Resources has leased hunting, trapping or fishing privileges for public recreation.

   Landowners enrolled in the WIA program receive monetary compensation based upon suitable habitat and wildlife, the amount of land, and the length of time the land or water is enrolled in the program. In addition to monetary payments some landowners may also qualify for habitat restoration projects designed to attract and benefit wildlife species.

   In most cases access to WIA properties is limited to foot traffic only unless the landowner specifically designates roads for vehicle travel.

   The Division will provide discretionary conservation officer patrols and liability coverage under Utah State law.

   Estimated Cost: Could be monetary compensation from UDWR

   Estimated Time Frame to Implement: As landowners enroll in the program

2. Post property as access by permission only and provide a sportsman access gate or sty with signage “Private property. Please respect the privilege to access by permission only.”

   Estimated Cost: $500. Cost of signage. Landowners could assume some liability. There could be monetary compensation from charging an “access fee.”

   Estimated Time Frame to Implement: As landowners decide to post their property

3. Prohibit access by posting property as “No Trespassing” and solicit enforcement assistance from the County Sheriff and/or UDWR Law Enforcement Officer.

   Estimated Cost: $500. Cost of signage and patrolling costs

   Estimated Time Frame to Implement: As individual or groups of landowners decide to post their property.

7. Endangered Species

Extent of Resource Concern/Opportunity: Two species, the June Sucker and the Western Yellow-billed Cuckoo, are federally listed under the Endangered Species Act (ESA). Several entities have identified impaired reaches in the Lower Spanish Fork River Watershed with seasonally dewatered sections, incised banks, inadequate riparian vegetation, streambank erosion, and other detriments to fisheries and aquatic resources.

A. June Sucker (Endangered)

Background: June sucker are endemic to Utah Lake and its tributaries. They were once historically abundant in Utah Lake but several factors including loss of habitat, water development, water quality, harvest, and the introduction of nonnative fish species led to a decline from millions in the early 1800s to a natural population of less than 300 individuals in the late 1990's. The current spawning population is estimated at one to two thousand individuals. Historically June sucker spawned in all major tributaries but prominent spawning congregations are now only found in the Provo River, Hobble Creek, and the Spanish Fork River.

Planning Objective 1: Improve water quality within the drainage to support healthy fish communities and adhere to Utah Division of Water Quality goals and standards.

Planned Conservation Action:

1. Implement water quality recommendations as identified under water quality and stream bank erosion resource concerns.

   Estimated Cost: (See water quality and stream bank erosion resource concerns)

   Estimated Time Frame to Implement: (See water quality and stream bank erosion resource concerns)

Planning Objective 2: Where feasible, enhance flow and fish passage throughout the Lower Spanish Fork with priority emphasis upon the lower 15,000 feet of the stream (from approximately 5000 South/River Drive and the interface with Utah Lake).

Proposed Conservation Actions:

1. Identify priority reaches for restoration based on current condition, landowner support, and cost/feasibility.
2. Meet with irrigation companies to determine availability and willingness of companies to lease/sell water rights to support instream/improved flows.

3. Meet with irrigation companies to determine options to replace or retrofit diversion structures with structures compatible with fish passage and entrainment reduction.
4. Work with willing water users to lease water for instream/improved flows.
5. If feasible and acceptable to water users and Irrigation Company, replace/retrofit one priority diversion with fish passage compatible structure.
6. If feasible and acceptable to landowners, restore the Lower Spanish Fork River to a more natural stream hydrology and topography.

Estimated Cost: To be determined by feasibility study.

Estimated Time Frame to Implement: To be determined by feasibility study.

B. Western Yellow-billed Cuckoo (Threatened)

Background: Western Yellow-billed Cuckoos are a federally listed migratory songbird protected under the Endangered Species Act. Western Yellow-billed Cuckoos were once considered common and widespread in Utah, but populations have been declining due to loss of its preferred habitat, which is wide stretches of multi-storied riparian vegetation with a dense overstory of mature trees. Western Yellow-billed Cuckoos have been detected along the lower Spanish Fork River as recently as 2007 and just upstream of I-15 in 2014, but there are no records of breeding pairs in recent memory.

Planning Objectives:

1. Ensure minimal negative impact to native riparian woodlands.
2. Enhance and increase extent of multi-story riparian vegetation with a dense canopy of mature trees.

Proposed Conservation Actions:

1. Assess the need for planting native cottonwoods and willows to maintain bank stability and water temperature in tree removal project areas.
2. Allow for natural regeneration of native cottonwoods and willows following removal of hazard and non-native trees.
3. Plant native cottonwoods and willows in tree removal project areas and other locations that may help increase the extent of existing native riparian woodlands.
4. Where feasible, allow natural disturbance to occur to encourage natural regeneration of riparian vegetation outside of tree removal project areas.
5. Where there are willing landowners with fields adjacent to patches of riparian vegetation, reduce use of pesticides to help maintain a prey base of large arthropods (e.g. cicadas, katydids, grasshoppers, and caterpillars) for foraging cuckoos.

Estimated Cost: $3,000, in addition to planting and seeding cost in the Noxious and Invasive Weeds resource concern.

Estimated Time Frame to Implement: Within 5 years after project is funded.

Monitoring

Annually monitor breeding pairs and other sightings of Western Yellow-billed Cuckoo in the Lower Spanish Fork River for 15 years

Cost of Monitoring: $5,000

Information and Education Program

Outreach to the landowners along the Lower Spanish Fork River will be direct contact. They are all on an email list and many have already had personal visits either at meetings or on their farms.

Project accomplishments will go to the general public through newspaper feature articles in the Daily Herald and the monthly Spanish Fork Press. We believe it is best to focus on positive impacts rather than the planning process.

Reports will also be made to the Utah County Commission during their commission meetings as an informational item. These reports and the newspaper features will be delivered as goals are put into place or achieved. We also plan to have displays of accomplishments at the Utah County Fair each year.

USU extension, in cooperation with the Timp-Nebo Conservation District will hold a winter crop school. Although landowners along the river will be the primary focus, the event will be open to all producers in the county. This event will be held annually starting in 2016.

Compliance with NEPA and Other Regulations

Whenever federal funds are used to implement conservation actions, the federal agency providing the funding will prepare the necessary environmental evaluations, assessments, environmental impact reports and decision documents. The information gathered by the respective agency will meet the requirements of the National Environmental Policy Act (NEPA) and other regulations as required.

Lower Spanish Fork River CRMP Budget

Resource Concern/Planned Actions	Estimated Cost
1. Streambank Erosion, Flood Control and Trees and Debris in River	
Streambank Protection spot treatment on approximately 1700 feet of eroding stream banks.	$ 145,000
Streambank Protection to stabilize 1900 feet of saturated, unstable banks upstream from the Lakeside Irrigation Company (Last Chance) Dam to 4400 South.	$ 1,750,000
Restore the 7830 feet 1964 Flood Channel	$ 193,000
Reconstruct 500 feet of channel to increase conveyance capacity	$ 37,000
Reconstruct and fortify 4300 feet of river levees.	$ 721,000
Construct a Flood Water Bypass for the Lakeside Irrigation Company (Last Chance) Dam diversion.	$ 200,000
Construct a Flood Water Bypass for the Lake Shore Irrigation Company Dam diversion.	$ 200,000
Remove or prune hazard trees and remove unanchored, in-channel and near-channel debris.	$ 12,000
Install 1900 feet of Interceptor Drain	$ 24,000
Resource Concern Estimated Cost	**$ 3,282,000**
2. Resource Concern or Opportunity: Noxious and Invasive Weeds	
Control noxious and invasive weeds	$ 15,000
Remove invasive Russian Olive trees	$ 38,000
Remove invasive Salt Cedar (Tamarisk)	$ 20,000
Plant willow poles (Peachleaf Willow and Coyote Willow) and seed herbaceous mix on disturbed areas.	$ 20,000
Resource Concern Estimated Cost	**$ 93,000**
3. Resource Concern or Opportunity: Agricultural Production Improvements	
Mitigate flood and sediment damaged land by install precision land leveling and "basin" irrigation systems on approximately 200 acres.	$ 216,000
Install precision land leveling and "basin" irrigation systems on approximately 900 acres.	$ 970,000
Implement Prescribed Grazing (Intensive Grazing Management) on approximately 500 acres of pasture land.	$ 14,000
Restore approximately 8,600 feet of open field drains	$ 76,000

Resource Concern/Planned Actions	Estimated Cost
Implement a study to map existing old tile field drains and assess needed repairs and replacements to restore the tile field drains to a proper function condition	$ 30,000
Resource Concern Estimated Cost	**$ 1,306,000**
4. Resource Concern or Opportunity: Water quality	
Implement Streambank Erosion and Agriculture Production resource concern actions.	$ -
Resource Concern Estimated Cost	**$ -**
5. Resource Concern or Opportunity: Fencing	
Construct 4 river-crossing fences that are designed to withstand and pass flood flows and debris.	$ 9,000
Construct approximately 6,000 feet of standard 4-strand barbed wire fence to protect streambanks erosion control projects from livestock damage.	$ 20,000
Resource Concern Estimated Cost	**$ 29,000**
6. Resource Concern or Opportunity: Trespassing Issues/Access Points	
Walk-In-Access (WIA).	$ -
Post property as access by permission only and provide a sportsman access gate or sty with signage	$ 500
Prohibit access by posting property	$ 500
Resource Concern Estimated Cost	**$ 1,000**
7. Resource Concern or Opportunity: Endangered Species	
Implement water quality recommendations as identified under "Water Quality" and "Stream bank Erosion" resource concern.	$ -
June Sucker planned actions	TBD based on feasibility study
Western Yellow-billed Cuckoo planned actions	$ 3,000
Resource Concern Estimated Cost	**$ 3,000**
TOTAL ESTIMATED IMPLEMENTATION COST	**$ 4,714,000**
TOTAL ESTIMATED MONITORING COST	**$ 37,000**
TOTAL ESTIMATED PROJECT COST	**$ 4,751,000**

Appendixes

Appendix A - Soils Map

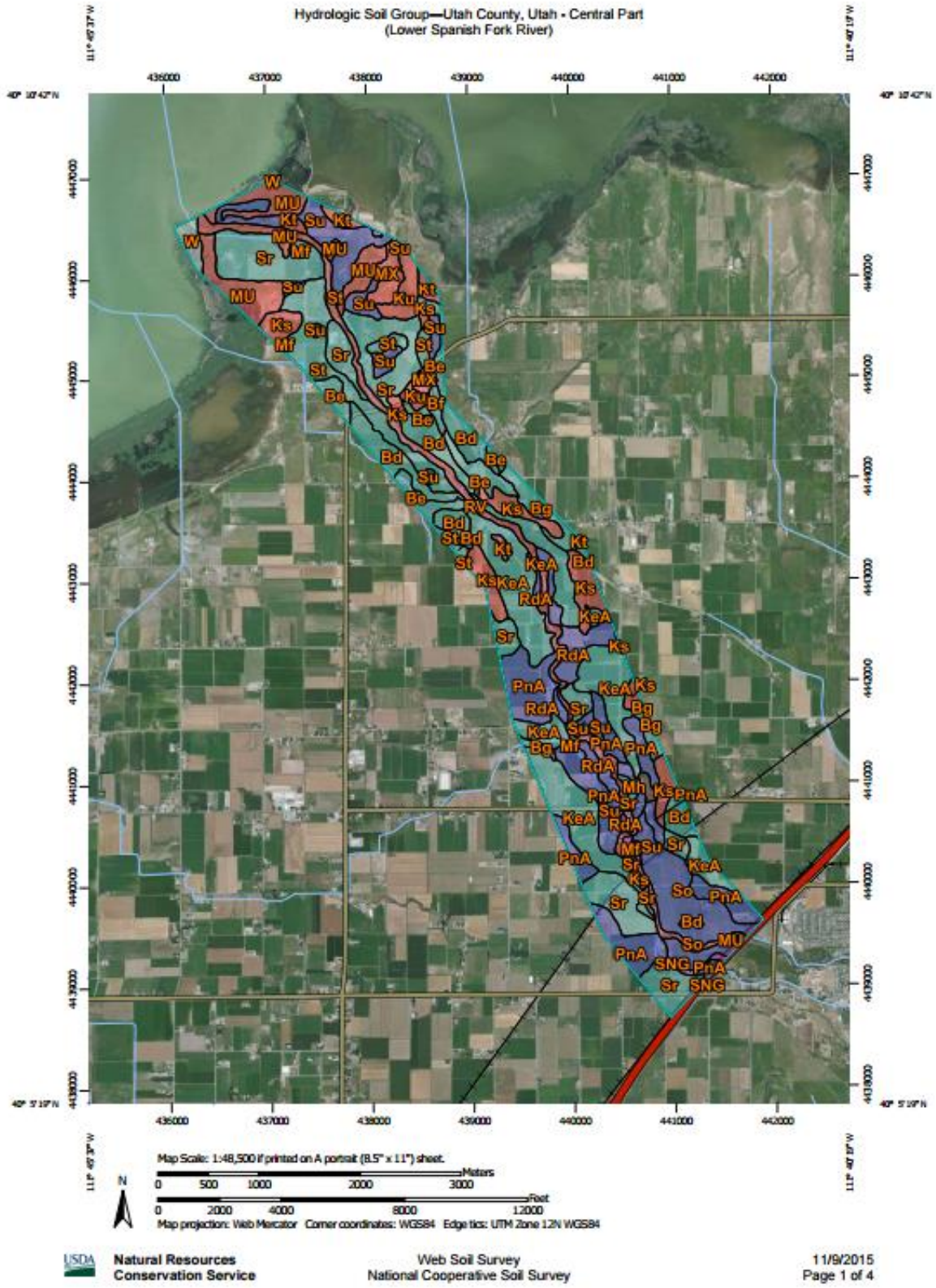
Appendix B - Beaver Management

Appendix C – Water Quality Data

Appendix D – Guidelines for Successful Willow Pole Plantings

Appendix E – Potential Russian Olive and Salt Cedar Treatment Areas

Appendix A - Soils Map



Hydrologic Soil Group—Utah County, Utah - Central Part
(Lower Spanish Fork River)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Utah County, Utah - Central Part
Survey Area Data: Version 8, Sep 23, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 2, 2011—Aug 12, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Utah County, Utah - Central Part (UT621)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Bd	Benjamin silty clay	C	182.7	6.6%
Be	Benjamin silty clay, moderately alkali	C	105.8	3.8%
Bf	Benjamin silty clay, strongly alkali	C	11.2	0.4%
Bg	Benjamin silty clay, sandy substratum	C	44.4	1.6%
KeA	Keigley silty clay loam, 0 to 1 percent slopes	C	448.9	16.3%
Ks	Kirkham silty clay loam	D	166.7	6.0%
Kt	Kirkham silty clay loam, moderately saline-alkali	D	35.4	1.3%
Ku	Kirkham silty clay loam, strongly saline-alkali	D	47.0	1.7%
Mf	Martini fine sandy loam	A	11.9	0.4%
Mh	McBeth silt loam	B/D	7.4	0.3%
MU	Mixed alluvial land	D	151.6	5.5%
MX	Mixed alluvial land, saline	D	45.1	1.6%
PnA	Pleasant Vale loam, 0 to 2 percent slopes	B	300.4	10.9%
RdA	Redola loam, 0 to 3 percent slopes	B	95.7	3.5%
RV	Riverwash	D	170.1	6.2%
SNG	Sterling-Terrace escarpments complex, 30 to 70 percent slopes	A	8.5	0.3%
So	Sunset loamy fine sand	B	160.8	5.8%
Sr	Sunset loam	C	403.2	14.6%
St	Sunset loam, clay substratum	C	160.6	5.8%
Su	Sunset loam, moderately saline	B	177.0	6.4%
W	Water		21.0	0.8%
Totals for Area of Interest			**2,755.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Appendix B - Beaver Management

Background: Historically beaver were common throughout the Spanish Fork River drainage but changes in land use management, available habitat, and extensive trapping has significantly reduced their densities. Beavers can assist in the creation of complex and dynamic stream habitats but their activities can often conflict with infrastructure needs and protection.

Beaver Assisted Ecosystem Services

- Water storage in ponds extends summertime flows
- Create wildlife habitat
- Raise water table and sub-irrigate surrounding area
- Moderate flood flows
- Capture sediment

Potential Threats To Infrastructure

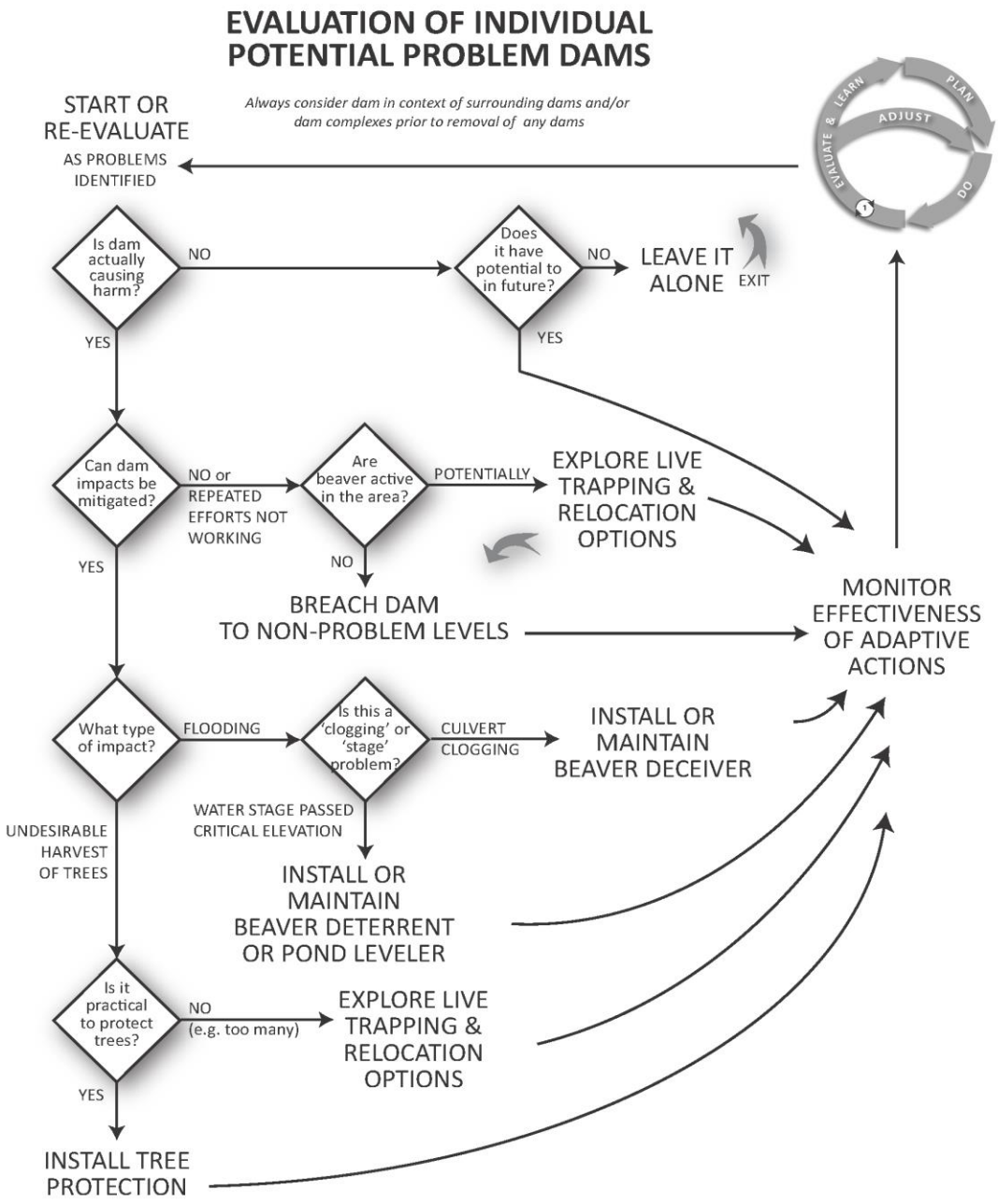
- Culvert blockage
- Blockage of irrigation diversions
- Flooding of infrastructure
- Loss of legacy/ornamental trees

Beaver Contacts

Central Region UDWR
Josee Seamons
(385) 985-7483
jseamons@utah.gov

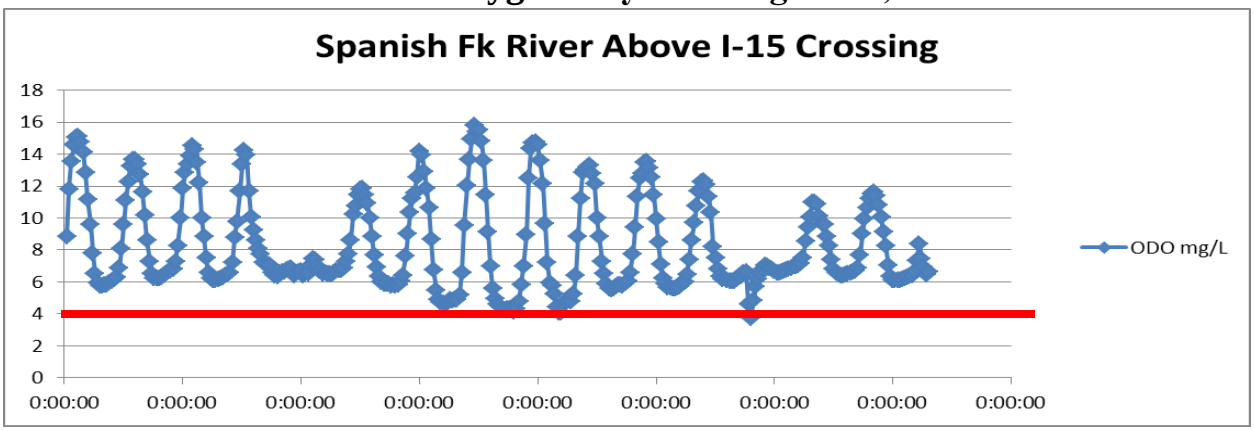
Other Resources

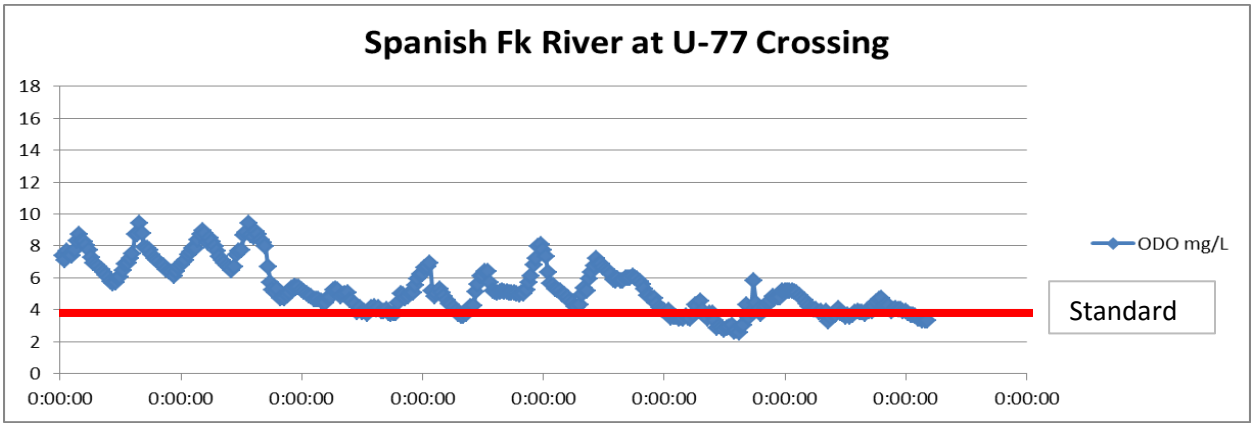
Utah Beaver Management Plan
https://wildlife.utah.gov/furbearer/pdf/beaver_plan_2010-2020.pdf
Beaver Solutions
http://www.beaversolutions.com/
Partnering with Beaver
Utah State University
http://beaver.joewheaton.org/

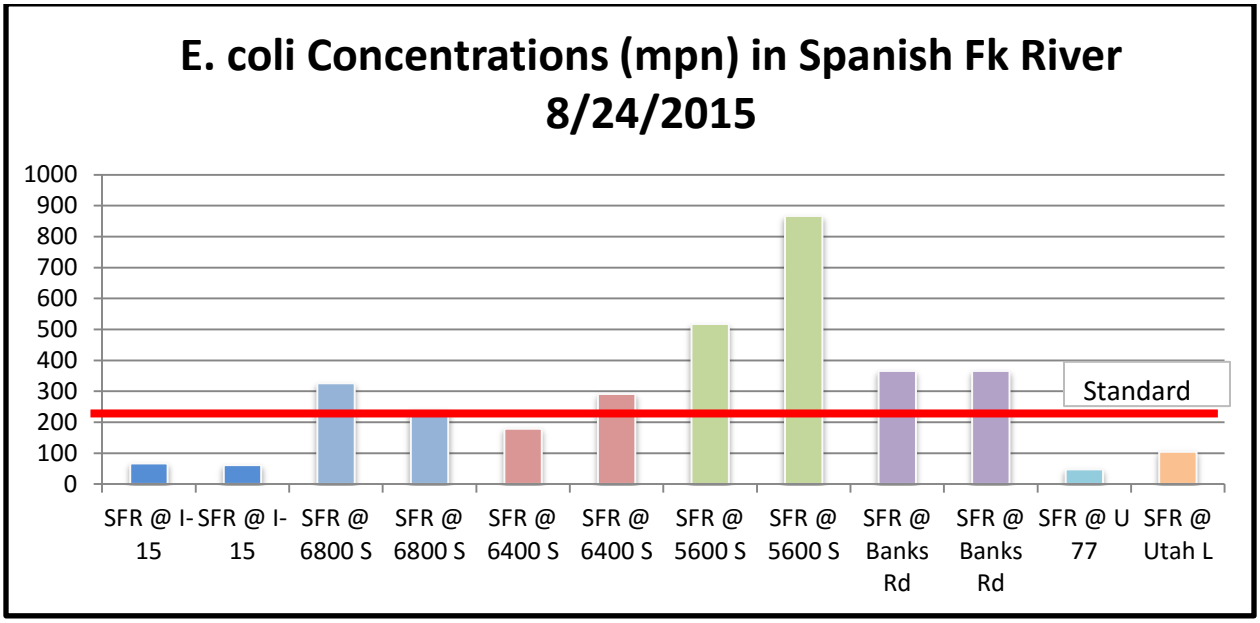

EVALUATION OF INDIVIDUAL POTENTIAL PROBLEM DAMS
Always consider dam in context of surrounding dams and/or dam complexes prior to removal of any dams
START OR RE-EVALUATE AS PROBLEMS IDENTIFIED
PLAN
DO
ADJUST
LEARN
EVALUATE
Is dam actually causing harm?
NO
Does it have potential to in future?
NO
LEAVE IT ALONE
EXIT
YES
YES
Can dam impacts be mitigated?
NO or REPEATED EFFORTS NOT WORKING
Are beaver active in the area?
POTENTIALLY
EXPLORE LIVE TRAPPING & RELOCATION OPTIONS
YES
NO
BREACH DAM TO NON-PROBLEM LEVELS
MONITOR EFFECTIVENESS OF ADAPTIVE ACTIONS
What type of impact?
FLOODING
Is this a 'clogging' or 'stage' problem?
CULVERT CLOGGING
INSTALL OR MAINTAIN BEAVER DECEIVER
WATER STAGE PASSED CRITICAL ELEVATION
UNDESIRABLE HARVEST OF TREES
INSTALL OR MAINTAIN BEAVER DETERRENT OR POND LEVELER
Is it practical to protect trees?
NO (e.g. too many)
EXPLORE LIVE TRAPPING & RELOCATION OPTIONS
YES
INSTALL TREE PROTECTION

Appendix C – Water Quality Data

Dissolved Oxygen July 29 – August 14, 2015







Readings above 206 mpn are unhealthy, especially for the very young and those with compromised immune systems.

Appendix D

Guidelines for Successful Willow and Cottonwood Pole Plantings

Mark M. Petersen, Petersen Environmental Consulting, LLC

The following guidelines are recommended for successful pole planting projects. These guidelines are the result of a study of over 30 successful and unsuccessful willow pole planting projects.

1. Select collection sites as close to the area as possible to conserve genetic diversity. Try to match donor site and revegetation site in terms of soils, elevation, hydrology, and salinity.

2. Select willow cuttings from a local, native stand in healthy condition. Prune no more than 2/3 of plants in the donor area. Willow cuttings for pole plantings should generally be at least 1/2 inch in diameter or larger. Select the longest, straightest poles available. Use only two to four- year old wood. The total length of the poles needed depends upon the water table depth.

3. Measure water table fluctuations in the planting area for at least 1 year, preferably longer, to determine the lowest seasonal water table depth. Take a reading at least once a month during the season of lowest water table depth.

4. Cut poles while dormant. Remove all side branches. Prepare cuttings by trimming off the top to remove the terminal bud, allowing a majority of the energy in the stem to be sent to the lateral buds for root and shot development.

5. Soak poles in water for at least 5 to 7 days before planting.

6. Dig holes to the depth of the lowest anticipated water table. Sites where the water table will be within one foot of the ground surface during the growing season are better suited for willows than cottonwoods.

7. Electric hammer drills (Dewalt model DW530) fitted with one-inch diameter, 3-foot bits can be used to make the holes for the willow poles. A power auger or a punch bar can also be used. In cobble soil, a “stinger” mounted on a front-end loader can be used.

8. The cuttings should extend several inches into the low seasonal permanent water table to ensure adequate moisture for sprouting. At least 2/3's of the cutting should be below ground to prevent the cutting from being ripped out during high flows. Usually, at least 2 to 3 feet should be below ground. No more than one foot should remain above the ground surface.

9. Place the cuttings in the holes the same day they were removed from the soak treatment.

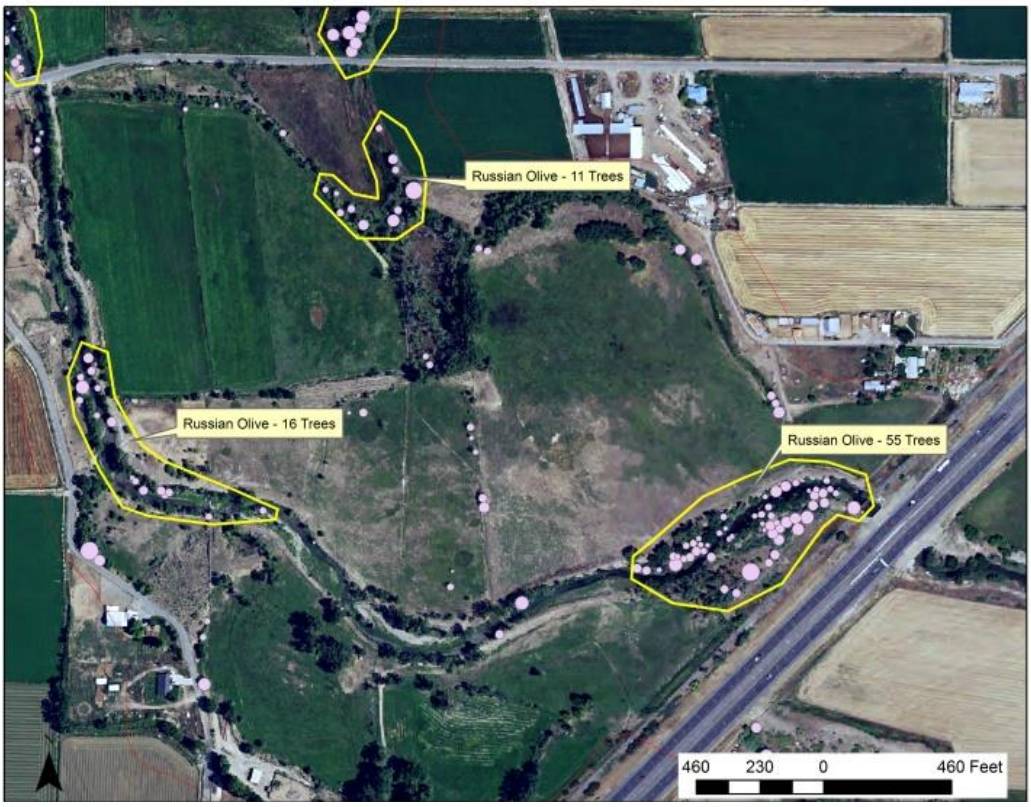
10. Make certain that the poles are placed with the holes with the buds pointing up.

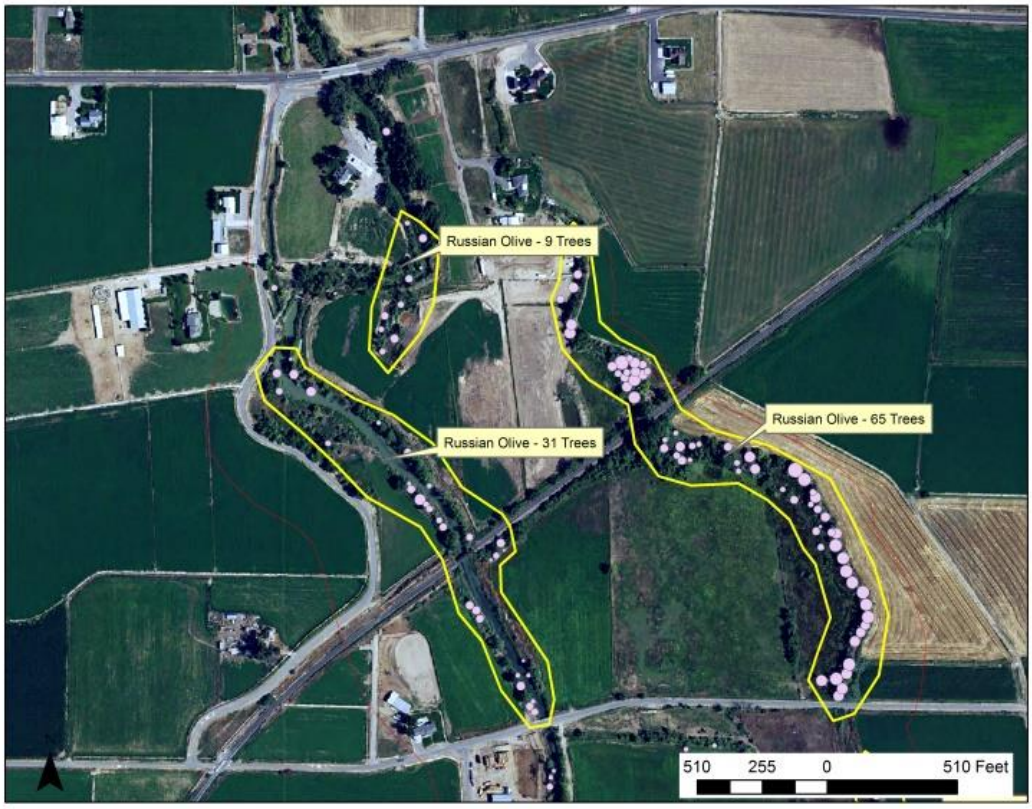
11. It is critical to ensure that the soil is packed around the cutting to prevent air pockets. "Mudding" (a slurry of soil and water poured into the hole) can remove air pockets.

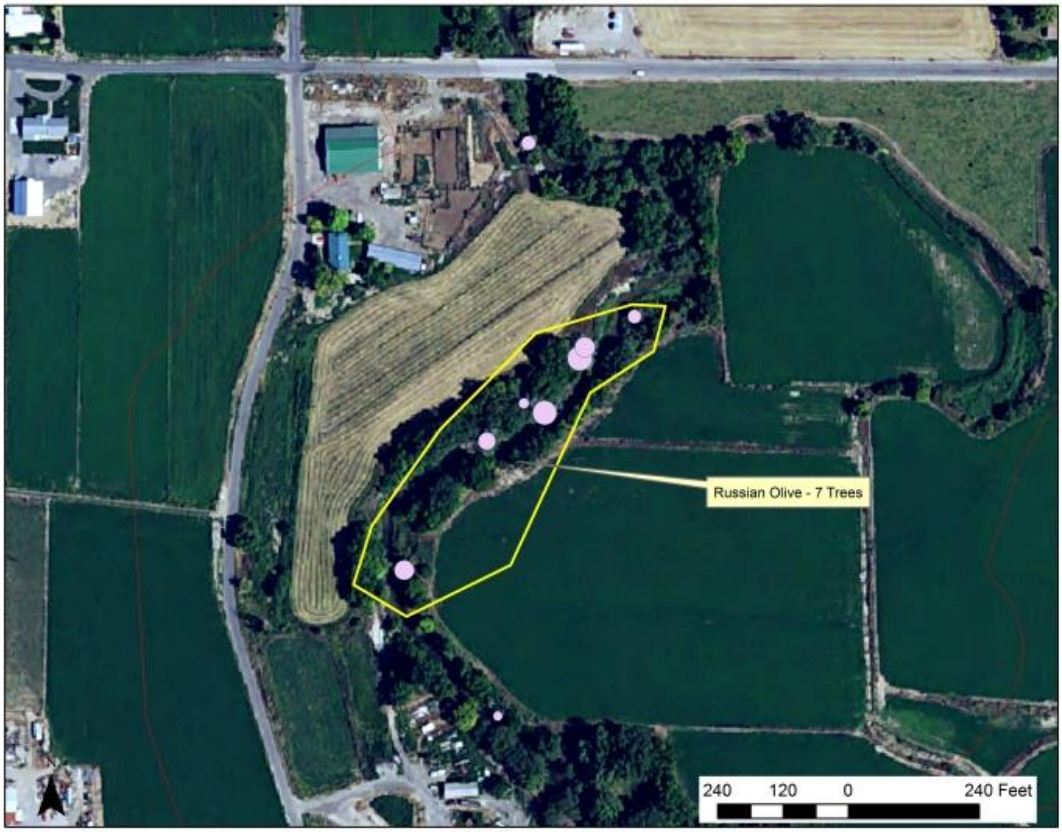
12. When necessary, install tree guards around the poles to protect from beavers, other rodents, or rabbits. Most willows are fairly resistant to pruning from beavers, so tree guards may not be necessary.

13. Exclude the planting area from livestock grazing for at least two to three growing seasons.

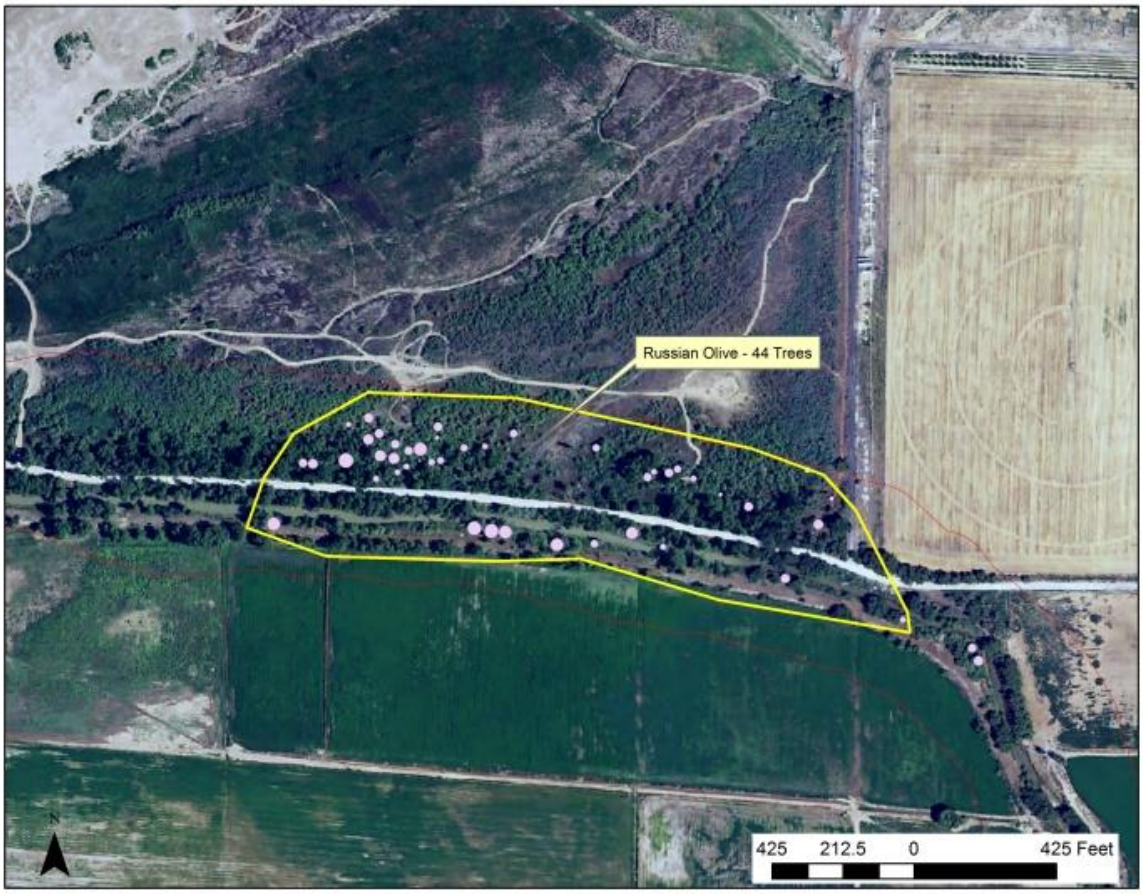
Appendix E – Potential Russian Olive and Salt Cedar Treatment Areas






Russian Olive - 7 Trees
240 120 0 240 Feet


Russian Olive - 8 Trees
240 120 0 240 Feet


Russian Olive - 44 Trees
N
425 212.5 0 425 Feet