

Scientific studies form the backbone of the Provo River Restoration Project

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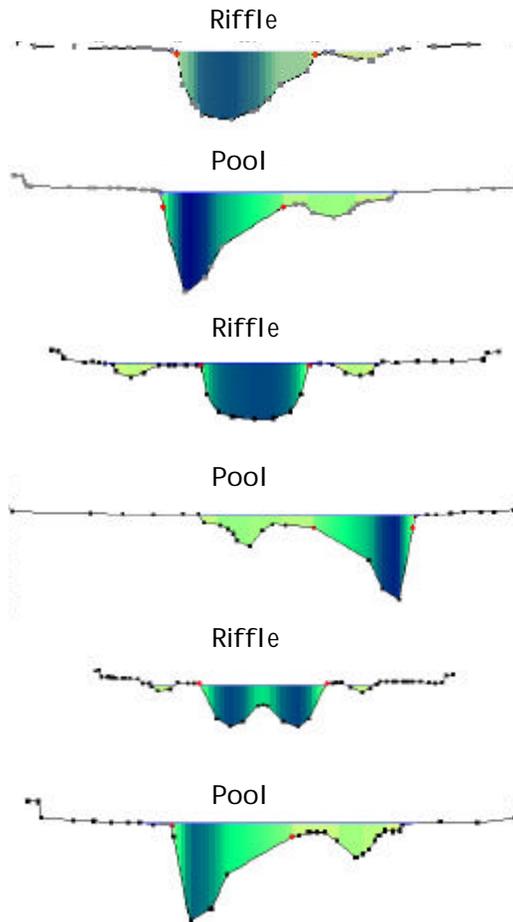
The Provo River Restoration Project design is based on the latest scientific information. An interdisciplinary team of scientists are contributing their expertise to PRRP by designing and implementing several studies. These physical and biological studies provide three essential components for restoration: 1) they thoroughly describe the existing physical condition and biological communities (i.e., baseline condition); 2) they provide a basis for restoration design; and 3) they initiate monitoring that enables planners to detect measurable change due to the restoration activities and to make informed management decisions.

PHYSICAL STUDIES

This group of studies investigates the Provo River physical environment. Scientists involved in these studies are hydrologists, geologists, and geomorphologists from the US Geological Survey, Arizona State University, and Commission staff. The types of physical studies and their importance are listed below:

Geological Setting: To understand the character of the middle Provo River, scientists reviewed the geologic history and geological setting of the Heber Valley. This provided insight into the natural Provo River condition prior to human disturbance. Understanding the undisturbed, natural condition is important because restoration planners assume that most native organisms are adapted to this natural condition and that creation of similar conditions will benefit most native organisms.

Hydrology Studies: Hydrologists have evaluated old hydrologic records, used computer simulations of natural conditions and stream gage records to reconstruct the natural Provo River hydrological conditions. Flow variation within a year and across years is important. For example, the establishment of cottonwood and willow seedlings requires soil disturbance created by large flood flows, but also depends on an extended period of lesser flows. Many plants and wildlife species are adapted to and depend on natural flows. Unfortu-



Shown above is a series of cross sections in a recently drafted Provo River Restoration design. The cross-sections show the shape of the channel, flow elevation and velocity simulated at 1775 cfs (considered bankfull) as the river flows down through riffles, pools and critically important new side channels. The black line in each diagram is the ground surface. Flow velocity is indicated by color with the darkest blue being the fastest moving water and the lightest green being the slowest. The simulation was done with the U.S. Army Corps of Engineers' HEC-RAS model.

nately the same species are greatly impacted by flow modification. Using information from hydrologists' studies, the Commission will work with the Central Utah Water Conservancy District, Provo River Water Users Association, U.S. Bureau of Reclamation and others to implement flows that mimic natural flow patterns while continuing to meet water users needs.

River Mechanics studies: The forces of flowing water carve the river channel. Channel size, shape, and pattern are related to flow magnitude, duration, and frequency as well as valley soils and slope. River mechanics experts determined the middle Provo River's forces and sediment transport capability. With this data, designers are identifying expected channel characteristics and are designing channels that will be sustained by natural processes. The channels also should provide flow depths and velocities consistent with native species habitat needs.

BIOLOGICAL STUDIES

Another group of studies investigates biological communities along and within the Provo River. Utah Division of Wildlife Resources, U.S. Fish and Wildlife Service, Arizona State University, Idaho State University, Utah State University, Brigham Young University and Commission staff contribute to these studies that help designers 1) determine the condition of the biological community; 2) understand the habitat needs of native plants and animals; and 3) plan for desirable habitat conditions for plants and animals.

Game fish: A primary PRRP goal is to increase game fish populations and suitable habitat. Restoring a meandering river channel will have its most immediate effects on game fish populations by quickly increasing availability of cover, suitable spawning areas, and rearing areas. Game fish have been monitored along the Provo River by the Utah Division of Wildlife Resources for many years and this will continue throughout the restoration and recovery

phase of PRRP. Benefits of channel restoration to game fish will be reflected through continued population monitoring.

Native fish: Habitats favoring native fish will be constructed during PRRP. Ongoing studies show that native fish, particularly leatherside chub, are very sensitive to predation by game fish, and typically occur in refuge habitats in channels other than the main stem of the Provo River. Particularly backwater areas and side channels are suitable habitats where small native fish can escape the threat of predation. An increase in aquatic habitat diversity, such as side channels, undercut banks and increased cover by bank vegetation, will benefit survival of both game and non-game fish. Ongoing studies will determine what types of channel features should be considered to favor habitat for native fish.

Bird studies: Birds were one of the main groups of wildlife used to develop habitat restoration guidelines. Birds can be easily watched and studied. They are sensitive indicators of which riparian and wetland habitats are missing or in poor condition. By searching for areas where sensitive species thrive, scientists can learn what plant types and environmental factors need to be restored in order to rehabilitate the full complement of bird species once found along the Provo River.

Some birds once found along the Provo River have undergone recent wide-spread population decreases due to habitat destruction. An example is the rare yellow-billed cuckoo, which declined so dramatically in recent years that it is now petitioned to be listed on the Endangered Species list. This species breeds in large expanses of riparian forest; only one individual was found during bird surveys. It is anticipated that PRRP will result in regularly finding riparian-dependent birds once again along the Provo River.

Vegetation studies: A botanical study has been conducted to learn the physical requirements for establishing native riparian and wetland plants. Plant species were combined into groups according to their requirements for soils, ground water, elevation, flow regimes, and location in relation to river and wetlands. The various requirements will be used for revegetating reconstructed streambanks and wetlands.

Ute ladies' tress: Small colonies of native orchid plants known as Ute ladies' tress,



This speckled dace was sampled during surveys of a relic side channel reconnected in the spring portion of the Provo River Restoration Pilot Project. The side channel was attached to the main river this summer and is now supporting several native fish species.



These sandhill cranes were photographed in wetlands northeast of the Cottonwood Canyon bridge. These wetlands have long been a favorite for bird watchers. As such habitat is restored and enhanced, the number and variety of birds will increase.



Spotted frogs are a conservation species in Utah that live along the middle Provo River. Habitat restoration will greatly benefit these native amphibians. This frog was found in one of the eleven wetland ponds created during the spring portion of the Provo River Restoration Pilot Project. Frogs were observed in the ponds as soon as one day after they were created.

which are federally listed as threatened, have been delineated and monitored for several years in the Provo River corridor. The sites of these colonies will be protected from construction. Ongoing monitoring of the colonies, recording number of plants, pollinator species, and timing of flowering, will continue throughout the restoration and recovery phase.

Bat studies: Bat studies provide different information than other biological studies because bats do not usually defend territories like some other animals. If restoration is successful, bat numbers and bat guilds could significantly change in response. These changes may track improving conditions more closely than changes observed in other animals because the number of bats in an area is only limited by habitat and resource availability, and not by territorial behavior.

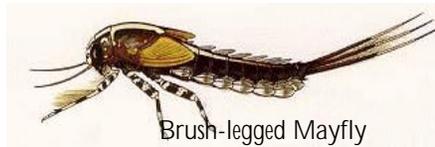
General bat activity can be gauged for different habitat types by tracking echolocation calls bats use for navigation. Different types of bats can be distinguished based on their calls. Bat activity will be monitored in degraded, newly constructed, and recovering habitats of PRRP. Similar to birds, bats utilize a variety of habitat types for foraging; as vegetation diversity is restored along the Provo River, a greater variety of bats is expected, as well as a general increase in bat activity.

Small terrestrial mammals: Small mammals, including mice, shrews, and voles, are good indicators of habitat recovery at a small scale. Areas previously used for agricultural activities can experience a quick and significant increase in certain small mammal species as native habitats are recovered. In contrast to birds and bats, terrestrial mammals are more attached to one area and respond strongly to changes and local improvements in vegetation. Other species, such as the house mouse, are not typically found in undisturbed native habitats, and are expected to decrease in response to riparian and wetland restoration during PRRP. Currently, small mammals are monitored along vegetation transects established for botanical studies, so that recovery of native plant species can be directly related to changes in the number of small mammals.

Spotted frogs: Spotted frogs, important amphibians greatly on the decline in Utah, should benefit significantly from this project as several wetlands will be created according to construction guidelines specifically targeting spotted frog suitability. A full inventory of spotted frog use in the Provo River corridor will be done annually throughout the restoration and five years of habitat recovery. All existing wetlands in the corridor will be mapped and standardized surveys for spotted frog use in each wetland site will be conducted.

Bald Eagles: With increasing game fish populations and eventual recovery of old mature cottonwood trees, wintering Bald Eagles will consequently receive additional habitat along the Provo River. Currently, wintering bald eagles are monitored in an annual sweep survey along the river, in which exact locations of eagles are recorded on a digitized map. Over time, changes in numbers or habitat shift by eagles within the corridor will be detected through Geographic Information System analysis.

Macroinvertebrates (i.e. stoneflies, mayflies, midges, etc): Macroinvertebrate diversity and abundances are expected to benefit from the diversification of aquatic habitats, similar to the responses expected in fish communities. A healthy community of invertebrates provides an improved food base for fish. In itself, an aquatic invertebrate community can be an indicator of stream health. In the current channelized river, most of the channel consists of high-velocity, large-substrate riffle habitat. By introducing a more natural riffle-pool sequence and creating backwater and side channel habitats, a greater variety of aquatic features and microhabitats will be available to invertebrates allowing a greater variety of species to survive. Invertebrate monitoring will be continued for several years throughout the restoration and recovery of PRRP.



Brush-legged Mayfly

PRRP Pilot Project Q & A:

The Mitigation Commission has received several questions about our Pilot Project to restore the middle Provo River. The following are some commonly asked questions and our response:

Q: Where is the pilot project taking place?

A: The pilot project covers approximately 1.45 miles. It starts about 1.6 miles downstream of Jordanelle Dam and ends about .9 miles south and west of highway 40.

Q: What is the schedule?

A: The pilot project is scheduled for the Spring and Fall, 1999. The spring portion of the project started April 1, 1999 and work was finished in May. The fall portion of the project began mid-August, with the primary bulk of excavation taking place mid-September. The pilot project will be completed November, 1999.

Q: What will be done during the fall pilot project?

A: New meanders and side channels will be constructed along the main Provo River channel between the Cottonwood Canyon bridge and Highway 40. The Valeo Diversion and associated dikes will be removed and incorporated into the new meandering river channel. Access trails in the area north of the Cottonwood Canyon bridge will be relocated and improved. Public access at the bridge will also be further improved to provide a restroom and better parking. There will be no vehicle access beyond the parking lot. Approximately 25,000 native trees and shrubs will be planted to revegetate areas disturbed by construction and to improve the health of the forest around the river, creating a better environment for the animals that live there now and for those that thrived there fifty years ago.

Q: What is the purpose of a "pilot project"?

A: The pilot project's purposes are to 1) test the channel design 2) demonstrate our methods and product 3) create additional essential habitat for spotted frogs prior to construction disturbances 4) train construction workers in ecosystem restoration methods, and 5) troubleshoot construction difficulties. Lessons learned from the pilot project will be incorporated into subsequent phases of the restoration to ensure its ultimate success.

Q: How will the fishery be affected?

A: The fishery will not deteriorate outside the construction area. Within a newly constructed river reach we expect it to take about six months to a year for the fishery to recover (it takes this long for the food base to rebuild). After this period, the fishery will be greatly improved. Anglers can fish the Provo River outside the construction zone. We've planned measures to maintain water quality. Any increase in turbidity (cloudy water) will be short term – a few hours at most.

Q: Will private landowners be affected?

A: The pilot project is on publicly-owned property, so private landowners should not be significantly affected. We are working around the irrigation season, so irrigation flows will not be interrupted. There will be increased truck traffic during construction, but very little on paved highways. Most truck traffic will be seen on dirt roads.

Q: Why aren't you starting work at the top of the river?

A: Starting work lower in the river allows the reach above to be a source of aquatic insects that float down the river and colonize the reconstructed reach. After a couple of years, this reconstructed reach could in turn serve as a source area for other reaches. The pilot project is entirely on public property and it coincides with the Wasatch County Water Efficiency Project.

Q: Who will do the work?

A: The U.S. Bureau of Reclamation and Utah Division of Wildlife Resources construction crews will do the work under the oversight of the Mitigation Commission.

Q: How much will it cost?

A: The Pilot Project's cost is estimated at \$1.1million.

Q: What will happen next?

A: What happens where next depends in part on the progress of private property acquisition, but we hope to be able to move construction downstream from the pilot project area. Currently, the Commission has acquired about 280 acres of the approximate 600 needed to complete the restoration.

For further information, contact Diane Simmons at the Mitigation Commission office: 801-524-3146