Delta Ponds Restoration Project

From Opportunity to Completion

An Overview of the Vision, Accomplishments, Management, and Lessons Learned

February 2014

Project Partners

The City of Eugene worked collaboratively with an extensive group of partners including federal, state, and local organizations and community groups. In fact, this project would not have been possible without federal appropriations to the U.S. Army Corps of Engineers and numerous grants, including those awarded by U.S. Bureau of Land Management, Oregon Department of Fish and Wildlife, Oregon Watershed Enhancement Board, Oregon Parks and Recreation Department, and National Oceanic and Atmospheric Administration. Additionally, thousands of volunteer hours have been donated to the project by community members over the past decade and formal adoption groups as well as individuals are still active at Delta Ponds on a regular basis. Project partners include the following:

Funding Partners

- City of Eugene
- National Oceanic and Atmospheric Administration
- Oregon Parks and Recreation Department
- Oregon Department of Fish and Wildlife
- Oregon Watershed Enhancement Board
- U.S. Army Corps of Engineers
- U.S. Bureau of Land Management

Volunteer Contributions

- Cascade Family Flyfishers
- Cal Young Neighborhood Association
- Churchill High School, Rachel Carson Program
- City of Eugene Park Steward (formerly Stream Team) volunteers
- Downtown Lions Club
- Eugene Rotary Clubs
- Friends of Trees (formerly Eugene Tree Foundation)
- Goodpasture Island Neighborhood Association
- Lane Community College
- Lane County Audubon Society
- Lane Independent Living Alliance
- Marist High School Ecology Class
- McKenzie River Broadcasting
- Oregon Solutions
- University of Oregon Environmental Leadership Program

Report Produced By

The City of Eugene, with assistance from Jeff Krueger Environments LLC

Eugene

Cover Photo by RaptorViews

Table of Contents

Continued next page

Maps

Appendices

Key Delta Ponds Related Plans and Reports

The following plans and reports are available upon request:

- *Operations and Maintenance Manual, Section 206 Eugene Delta Ponds*. Draft, December 2013. U.S. Army Corps of Engineers.
- *Delta Ponds Riparian Restoration Assessment*. Spring 2013. University of Oregon Environmental Leadership Program, Wetlands Wildlife Team.
- *City of Eugene Delta Ponds Trail Extension Pedestrian Bridge Alternatives Analysis*. January 2013. Produced by KPFF Consulting Engineers.
- *Fish Monitoring at the Delta Ponds Floodplain Restoration Project*. December 2012. Cramer Fish Sciences.
- *Technical Memorandum: Goodpasture Island Road Weirs and Susbstrate Final Design*. November 2, 2012. Tetra Tech.
- *Eugene Delta Ponds Section 206 Aquatic Ecosystem Restoration Design/Build Project As-Construct Plans.* May 2012. U.S. Army Corps of Engineers.
- *Invasive Ludwigia hexapetala Management Plan for the Delta Ponds Natural Area (Eugene, Oregon) 2013-2018. 2012.* City of Eugene, Parks and Open Space Division.
- *Willamette River Open Space Vision and Action Plan*. October 2010. Lane Council of Governments.
- *Delta Ponds – A Vision for Enhancement and Management.* July 2005. Lane Council of Governments and the City of Eugene.
- *Delta Ponds.* 2005. University of Oregon Service Learning Program in partnership with the City of Eugene.
- *Eugene Delta Ponds Section 206 Restoration Project, Ecosystem Restoration Report and Environmental Assessment*. September 2002. U.S. Army Corps of Engineers.
- *Final Biological Assessment, Eugene Delta Ponds Restoration Project, Lane County, Oregon*. March 2002. Tetra Tech Inc.
- *Natural Resource Assessment, Delta Ponds, Eugene, Oregon.* 1989. Russ Fetrow Engineering, Inc. and Scientific Resources Inc.

1 Project Overview and Vision

Overview

Delta Ponds is a 150-acre City of Eugene owned natural area situated in the heart of Eugene, Oregon. For millennia, the Willamette River moved across the flat valley floor, routinely generating large floods that inundated and shaped the valley bottom including the area that is today Delta Ponds. However, during the past century and a half, the Willamette River system has changed dramatically. The combined impacts of urban and agricultural development, sand and gravel mining, flood control projects, and an influx of invasive species have significantly tamed and degraded the Willamette River system.

Interpretive trail and signage at Delta Ponds

The Delta Ponds Restoration Project is part of growing movement within the Willamette Valley focused on revitalizing the river through incremental restoration of habitat for native wildlife, improvement of water quality, and promotion of public appreciation and stewardship through better access and facilities. Now largely completed, the Delta Ponds Restoration Project serves as a model for other similar projects within the valley and elsewhere in the nation. To accomplish this ambitious project, it took the leadership of the City of Eugene and the collaboration of numerous federal and state agencies, plus many local organizations, thousands of volunteer hours, and an investment of over $9 million.

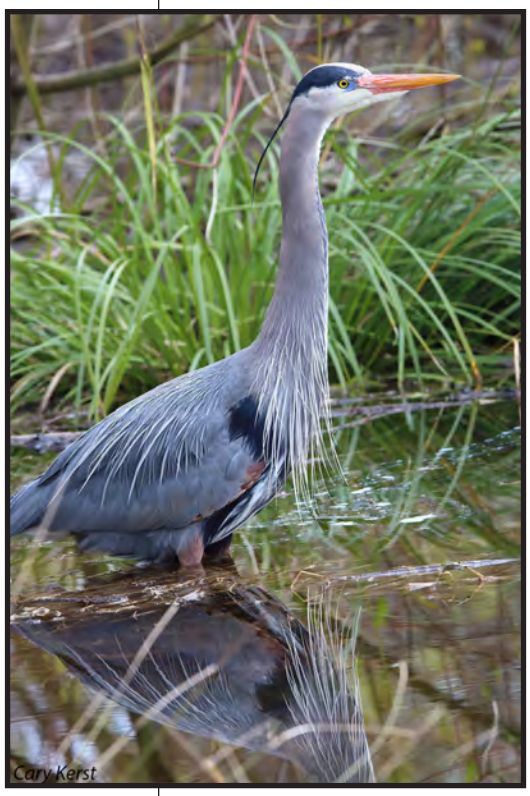


Photo: Cary Kerst

Blue Heron

The Vision for Delta Ponds

Following the completion of nearly two decades of periodic gravel mining operations that formed the Delta Ponds, the area was essentially abandoned in the early 1960s, with no significant efforts to reclaim or enhance the area. In subsequent years, much of the land became heavily colonized by invasive vegetation and the ponds remained isolated from the nearby river and largely forgotten. Some of the ponds and floodplain were gradually filled to accommodate urban development. However, beginning in the 1970s, community leaders began realizing and discussing the potential of this area as an open space amenity and in 1979, the City of Eugene purchased 88 acres of land around the ponds for future park use. Since then additional lands were added by the City and Lane County. The potential restoration of Delta Ponds was first formally identified in the 1989 Eugene Parks and Recreation Plan, which designated the project as High Priority and called for major recreational and habitat improvements. Although the project area was in public ownership and considered a high priority, it wasn't until the late 1990s that more intensive site planning and on-the-ground

The Delta Ponds Vision

Delta Ponds is a unique and treasured natural area in the midst of Eugene's urban core. It is an oasis for citizens and wildlife alike. A broad array of wildlife species are present at the ponds, due to a diversity of native plants and habitats acting as host. Valued, visited, and stewarded by the community, Delta Ponds provides passive recreation opportunities for citizens seeking nature viewing and education, or simply refuge and relaxation.

improvements began in earnest. Energized by the ambitious vision for Delta Ponds, an extensive group of partners came together, pooling their funding and expertise. Major on-the-ground implementation of the vision was kicked off in 2004 and largely complete by 2012.

Willow planting on riparian bench

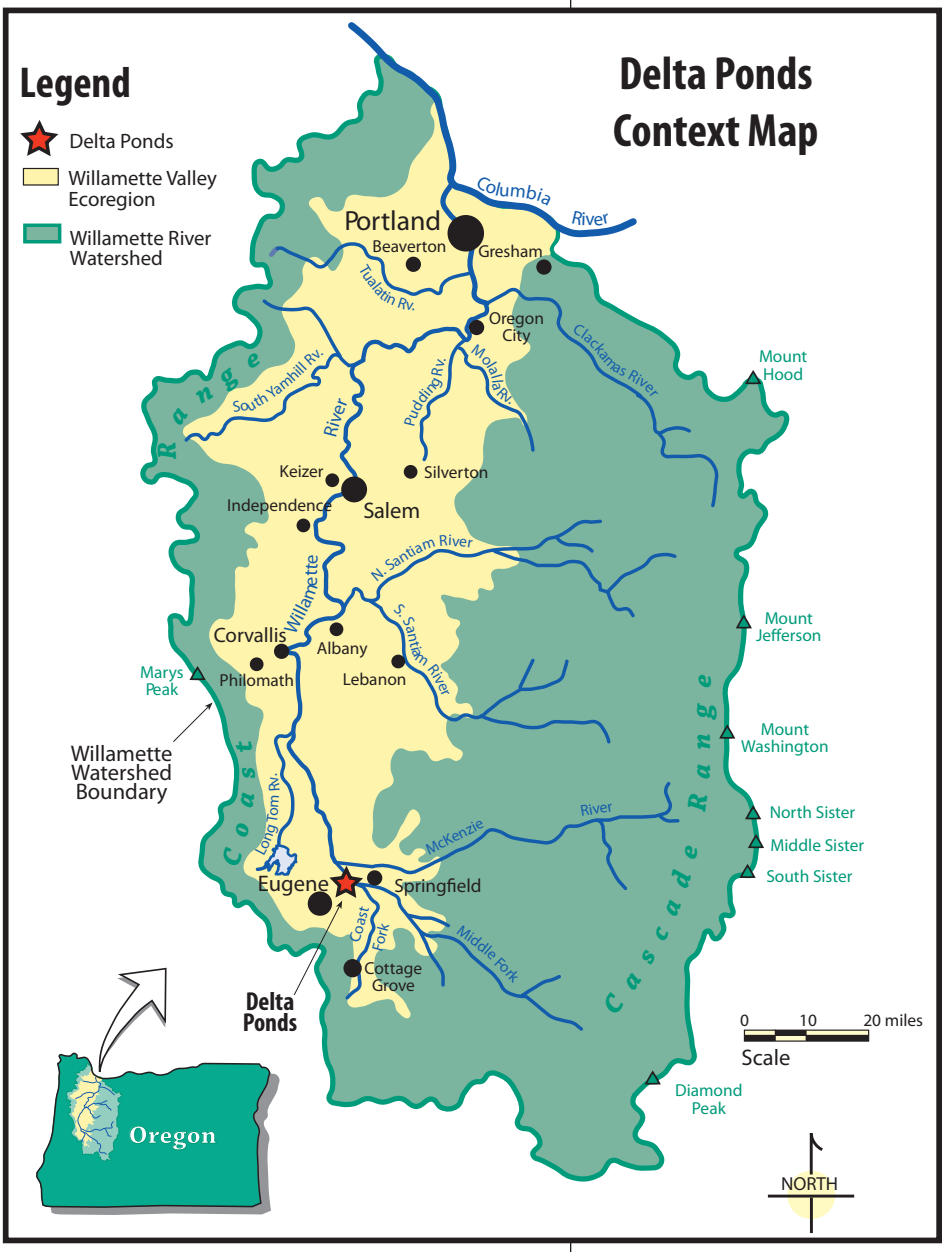
Major Accomplishments

After many years of planning and nine years of on-the-ground implementation, the project was considered largely complete in the fall of 2012 and achieved the following:

- Hydrologic connection of 2.2 miles of side-channel habitat to the Willamette River, providing critical rearing habitat for juvenile Chinook salmon.
- Creation of 7 acres of shallow, low gradient riparian habitat and emergent wetlands through the conversion of steep rocky banks created by former gravel mining operations.
- Removal of invasive species, such as Himalayan blackberry, Scotch broom, and English ivy on nearly 60 acres of land.
- Planting of over 98,000 native trees, shrubs, sedges and rushes along with extensive seeding of native grasses and forbs.
- Construction of recreational and interpretive facilities including several miles of trails, boardwalks, pedestrian bridges, overlooks, and interpretive signs.

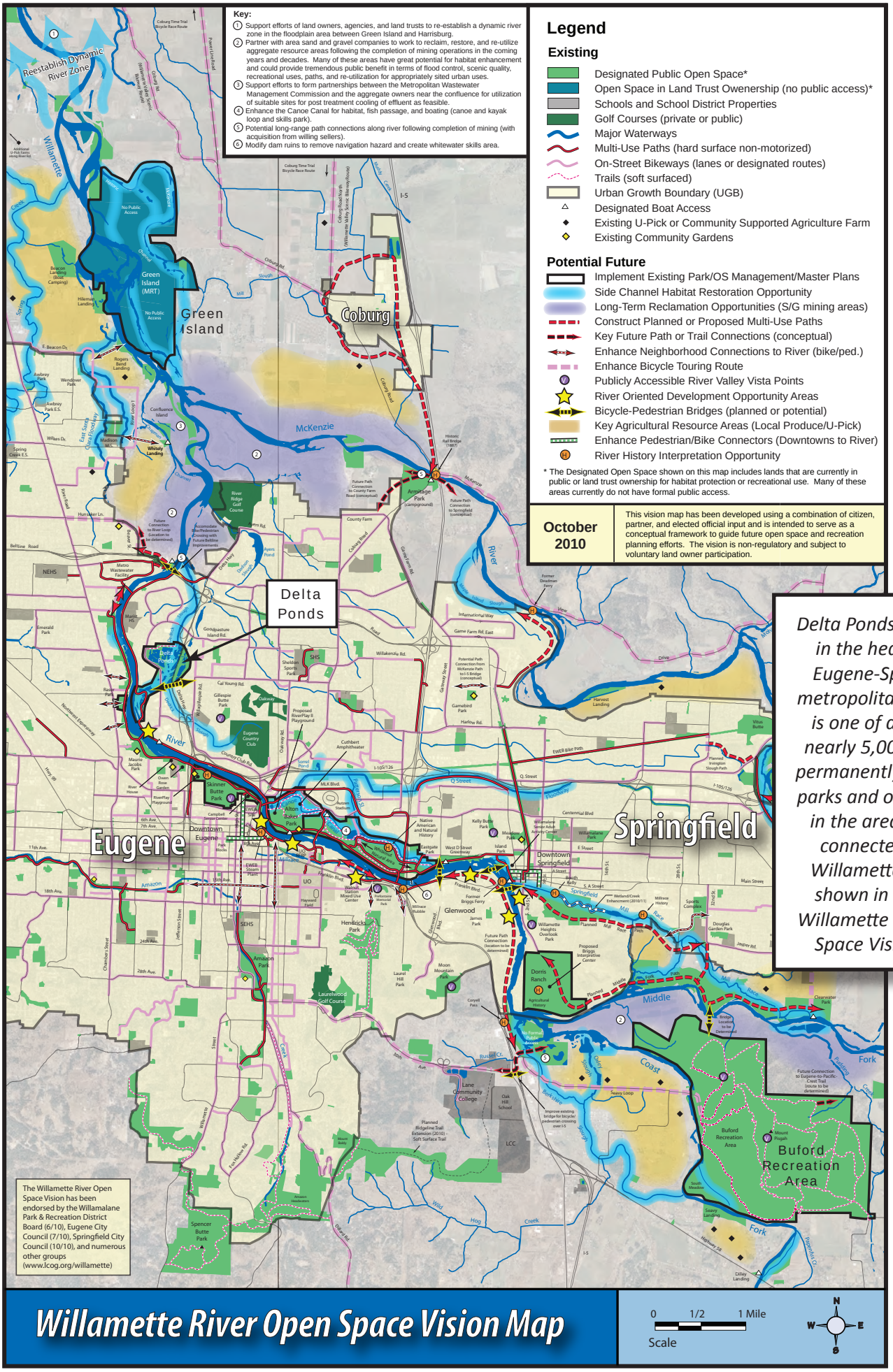
2 Regional Context

Like most rivers, the Willamette is fed not by a single source, but by numerous tributaries within its 12,000 square mile watershed that lies between the crests of the Coast Range and Cascade Range. The four major tributaries found in the southern Willamette Valley area are the Coast Fork Willamette River, which drains the southern end of the valley; the Middle Fork Willamette River, which flows from the Cascades originating at Waldo Lake; the McKenzie River, which also flows from the Cascades originating at Clear Lake; and the Long Tom River, which originates in the Coast Range. Delta Ponds is centrally located within this complex of river confluences. The Coast and Middle Forks converge to form the Main Stem Willamette River approximately seven miles upstream of Delta Ponds. The McKenzie River converges with the Willamette approximately four miles downstream of Delta Ponds and the Long Tom River converges approximately thirty miles downstream.



Delta Ponds is situated in the heart of the Eugene-Springfield metropolitan area, one of the state's largest metropolitan areas with a combined population of over 300,000 residents, immediately surrounded by intensive commercial and residential land uses. It is also one of a string of nearly 5,000 acres of permanently protected parks and open spaces in proximity to the metropolitan area that are connected by the Willamette River. These include Howard Buford Recreation Area (Lane County), the Coast Fork-Middle Fork Confluence Property (The Nature Conservancy), Dorris Ranch (Willamalane Park and Recreation District), Alton Baker Park (City of Eugene and Willamalane Park and Recreation District), Skinner Butte Park (City of Eugene), and Green Island (McKenzie River Trust).

Delta Ponds, as a former aggregate mine within the Willamette River floodplain, is not unique in the valley. There are estimated to be several hundred active or former sand and gravel mines in the Willamette Valley. With the Delta Ponds Project now complete, it can serve as a valuable template for other similar restoration projects elsewhere in the Willamette Valley.



Delta Ponds is situated in the heart of the Eugene-Springfield metropolitan area and is one of a string of nearly 5,000 acres of permanently protected parks and open spaces in the area that are connected by the Willamette River as shown in the 2010 Willamette River Open Space Vision Map.

3 Historical Context

Historic Condition of the Willamette River System

For thousands of years, the Willamette River has meandered through the flat valley bottom, changing course on a frequent basis. Regular floods inundated large areas of the river floodplain including much of what is now Eugene and Springfield. These floods shaped the landscape and deposited thick layers of rich agricultural soils and gravels. This dynamic river system also created abundant aquatic habitat by continuously carving new side channels, building sheltered alcoves, creating pools, toppling trees, and pushing sediment downstream.

Sketch by local artist and historian Susan Applegate

This sketch depicts a party of Kalapuya men in their cedar canoe along the Willamette River.

The Willamette River has played an important role in the lives of countless generations of people dating back perhaps as long as 10,000 years, when the first Native Americans are thought to have migrated into the valley. Sadly, by the mid-1800s, the population had been so decimated by disease that their once thriving culture had collapsed and little is known about how they interacted with the river. Oregon Trail immigrants were drawn to the Willamette Valley by the high quality soils, access to abundant water, and initially by the transportation that the river provided. The fact that navigation became increasingly difficult above the confluence of the Coast and Middle Fork was one of the primary reasons that Eugene and Springfield were sited in their current locations.

Photo: Courtesy of Lane County Historical Museum

The Willamette River with the Ferry Street Bridge in the background (ca. 1905). Note the large gravel bars.

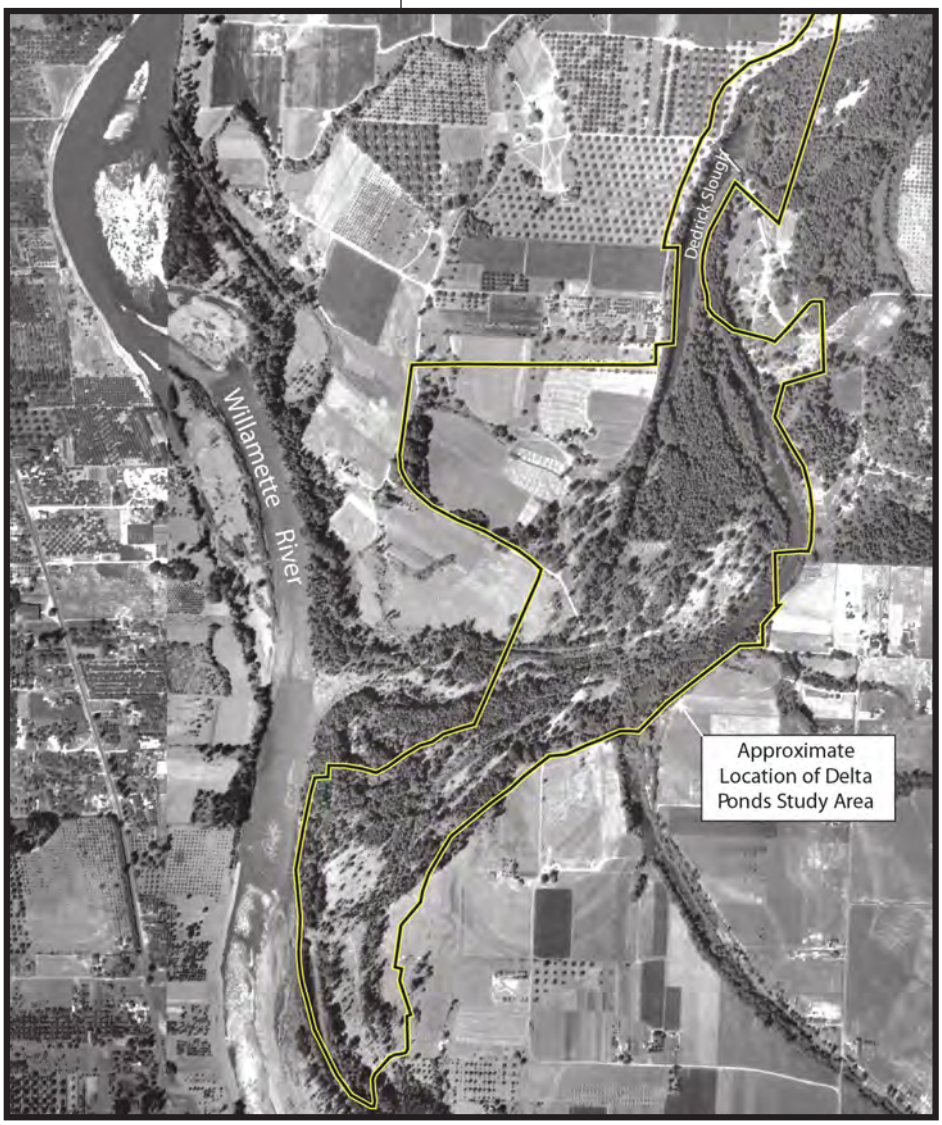
The Willamette River encountered by the first immigrants in the southern end of the valley was much different than it is today. Broad expanses of riparian forest lined much of the river, in some places up to several miles wide. Many side channels, oxbows, sloughs, and islands existed and the river was filled with large quantities of fallen trees and wide gravel bars. At the time, some segments of river channel flowed in much different locations, including through the areas that are today Delta Ponds, Alton Baker Park, and Autzen Stadium. The McKenzie River joined the Willamette nearly four miles further north than its present location before shifting to its current location in 1964.

The cumulative impacts of modifications to the river since the 1850s have been substantial. For example, in the segment between Eugene and Albany, it is estimated that approximately 41% of the area of side channels, 80% of the area of riparian forest, and 74% of the area of river alcoves and sloughs has been lost (Hulse et al. 2002).

Flooding was frequent and often massive, washing out bridges, inundating farms and homes, and frequently changing the course of the river.

Significant modification of the river system first began in the mid-1800s as the population in the southern Willamette Valley began to boom. Agricultural uses replaced riparian forests as trees were removed and wetlands drained, and towns sprang up adjacent to the river, including Eugene and Springfield. At the same time, the Willamette River was becoming a major transportation route with river boats traveling as far upstream as Eugene. In an effort to improve safety for navigation, massive efforts were undertaken to remove fallen trees, straighten the river, block side channels, and construct wing dams to create a deeper central channel. It is estimated that over 69,000 snags were removed from the Willamette River between 1880 and 1950 (Sinclair, 2005). The construction of levees and bank hardening to protect towns and farms further restricted the river to a single channel. Flooding was still a regular occurrence however, until the 1960s when the U.S. Army Corps of Engineers (Corps) completed the last of 13 major flood control dams along Willamette River tributaries, including six in the watershed above Delta Ponds. While the dams have been very effective at limiting major flood events, they've also had a negative impact on aquatic habitat. In addition to blocking fish migration, they have also significantly reduced large flood events, which historically created habitat features such as side channels and pools, and also limited transport of woody debris and sediment, which are essential contributors to fish native habitat.

1936 Aerial Photo



The History of Delta Ponds through 2005

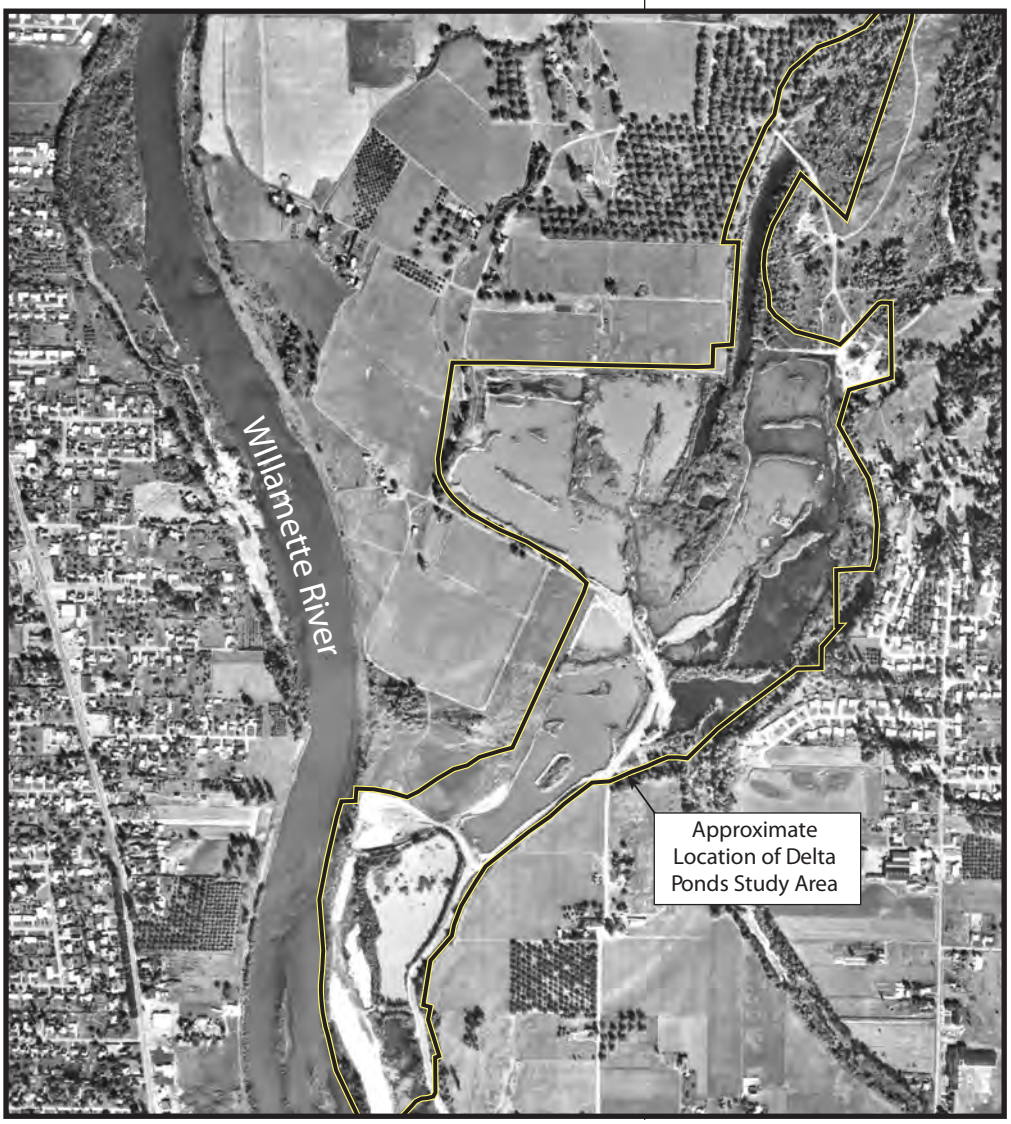
Historically, the upper reaches of the Willamette River, including what is today Delta Ponds, consisted of a broad network of side channels, oxbow lakes, wetlands and riparian forest. The river frequently changed course as a result of seasonal flooding and the accumulation of woody debris. This river system supported a diverse community of fish and wildlife including many species which are uncommon in the area today such as Oregon chub, steelhead, Chinook salmon, Western pond turtle, and river otter. Based on historic vegetation mapping collected by the Government Land Office in the 1850s (compiled by Christy et al. 1999) the area where Delta Ponds sits today was part of the active river channel situated in a broad riparian forest over a mile in width. As recently as 150 years ago, the main channel of the Willamette River flowed through the area now occupied by the ponds (Russ Fetrow Engineering, Inc., 1989). The area was referred to as Goodpasture Island after Alexander Goodpasture, who filed a donation claim to the area in 1853. From this time until the 1950s,

the land on Goodpasture Island was used primarily for farming, with a few scattered homes present. With the completion of the major flood control projects on the upper Willamette River in the 1950s and 1960s, the Goodpasture Island area became much less prone to flooding and urban development began to expand steadily into the area.

As the Eugene area began to rapidly urbanize following World War II, the rich aggregate deposits left by millennia of deposition in the Delta Ponds area were mined, in part for use in the construction of the adjacent Delta Highway and Beltline Road. It is estimated that in a 20-year period ending in 1962, two million cubic yards of sand and gravel were extracted from the site (Gallagher, 1980). Following the completion of the mining operation, the ponds were essentially abandoned and no effort was made to reclaim or enhance the area. Much of the area became overgrown by invasive non-native vegetation and hydrologic flow in and out of the ponds was limited because the levees that protected the area during the mining operation were left in place.

With an eye toward natural area preservation and future park use, the City of Eugene purchased approximately 88 acres of the ponds in 1979 for a total cost of $801,000. In 1988, Lane County followed suit with the purchase of an additional 8 acres for $31,000. From the time of public acquisition until the mid-1990s, the ponds remained largely unchanged. In 2002, access through the ponds and public awareness of this area were significantly improved with the construction of the final segment of the East Bank multiuse path along the Willamette River, which passes through the area of the southern ponds. In 2003, the City of Eugene's Parks and Open Space Division hired a full time Delta Ponds Vegetation Enhancement Coordinator to assist with capital improvement projects planned for the area. Although planning for the Delta Ponds Project was initiated through a partnership between the U.S. Army Corps of Engineers and the City of Eugene in 1999, major on-the-ground restoration work did not begin in earnest until 2004.

1963 Aerial Photo



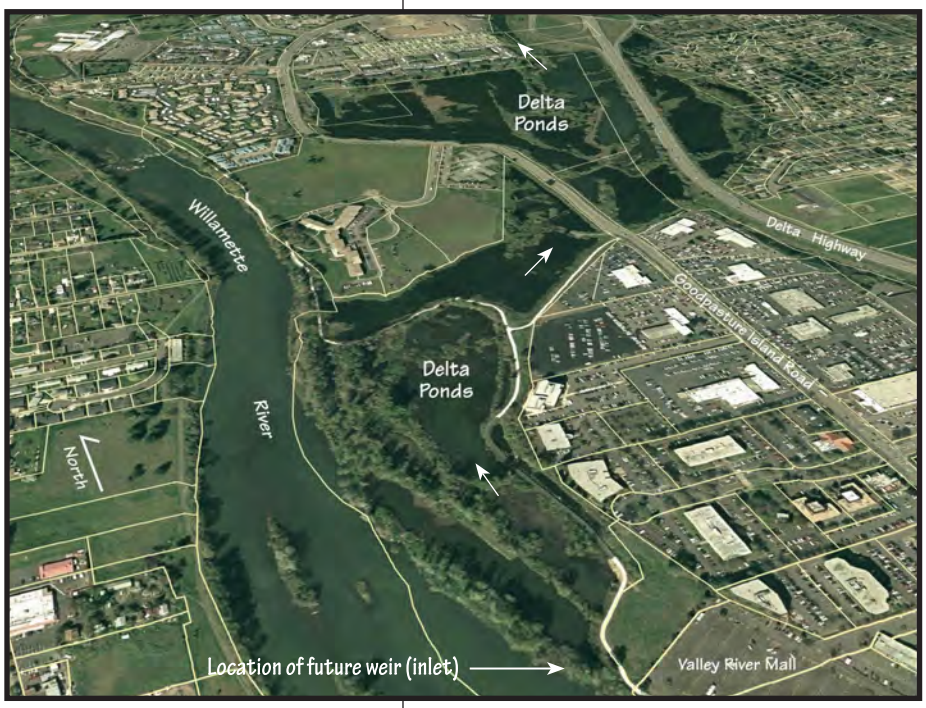
The 1963 aerial photo (rigth) shows the extent of the aggregate mining operation, which had just been completed.

4 Pre-Project Conditions at Delta Ponds

Prior to the implementation of the Delta Ponds Restoration Project in 2004, significant site analysis and monitoring occurred to aid the planning process and provide baseline data. The following section describes conditions at Delta Ponds at that time.

Hydrology

Prior to the implementation of the restoration efforts, Delta Ponds had no regular surface inflow from the adjacent Willamette River except during very high flood flows, which would occasionally move into the westernmost ponds. The water in the ponds originated from a combination of sources including direct rainfall, ground water percolation, and urban runoff. Many of the ponds were hydrologically isolated from the others and differences in surface elevation of adjacent ponds could vary from pond to pond. The northern-most ponds had an outflow connection to Dedrick Slough, which drains toward the Willamette River, with an outfall approximately 4,500 feet to the north. Based on readings from staff gauges that had been installed in the river and in various ponds, it was observed that the water elevations in the ponds would gradually rise and fall with the river levels, suggesting a hyporeic (sub surface) connection. In general, the hyporeic connection with the river was more pronounced in the ponds closest to the river. Due to the limited inflow during the summer months, most of the ponds would become very warm, with water temperatures recorded as high as 84 degrees (F). For reference, the adjacent Willamette River reaches a maximum of 64 degrees (F) during the summer months.



Source: Lane Council of Governments

2004 aerial perspective of Delta Ponds with property lines shown

The ponds were surveyed for depth and averaged 5.3 feet, with a maximum recorded depth of 10.4 feet. In most cases, the steep-sided banks of the ponds transitioned almost directly from upland to open water, which resulted in a very narrow band of hydrology that was suited to support riparian or wetland vegetation.

Water Quality

The lack of consistent surface inflow or outflow from the Delta Ponds system prior to the restoration project had contributed to a number of water quality issues. As mentioned above, water temperatures in some ponds became extremely warm during the summer months, exacerbated by shallow depths, lack of shade, and minimal surface flows. Runoff entering the ponds from adjacent residential and commercial development was a source of many common urban pollutants such as nutrients (fertilizers) and fecal coliform bacteria, which would build up in the ponds

due to lack of flow. The combination of high water temperatures and elevated nutrients caused extensive algae growth and as a result, low dissolved oxygen levels were a seasonal occurrence in the system. The U.S. Army Corps of Engineers (Corps) collected pre-project water samples from several of the ponds and Dedrick Slough and conducted a chemical analysis for a number of parameters. Most samples taken were found to have elevated levels of fecals and nutrients. Of the thirteen metals measured, only chromium registered at a significantly elevated level. No significant levels of polycyclic aromatic hydrocarbons (PAHs), herbicides, or pesticides were detected. Analysis of the results indicated that the source of enrichment of nutrients and fecals were likely urban runoff and elevated chromium was likely from street runoff and illegal discharge from a nearby metal plating company, which was later fined.

Soils and Pond Sediments

The soils in the Delta Ponds project area are mapped as Fluvents, which are river deposits, and Pits, which represent open excavation. In general, the soils around the ponds tend to be highly disturbed and/or compacted, the result of former aggregate mining.

In support of the Corps Section 206 Floodplain Restoration Project, sediments from several of the ponds were collected and evaluated for pollutants in 2000. Chemical analysis revealed the presence of the metals cadmium, zinc, and silver and the semi volatile organic compounds of benzoic acid, benzyl alcohol, phenol, and benzofluroanthene. These contaminants were above screening levels listed under the Dredge Material Evaluation Framework Guideline, which ultimately limited dredging as a maintenance or restoration practice for the restoration project.

Prior to the restoration project, many of the ponds were steep sided and lined with large blackberry thickets.

Vegetation

Prior to the implementation of the restoration project, non-native vegetation had become well established across much of the site, with some pockets of native trees, shrubs, and understory species present. Based on an assessment done in conjunction with the Corps Section 206 Floodplain Restoration Project, no federally threatened or endangered plant populations were found to be present. The general habitat zones found at Delta Ponds included upland, riparian, wetland, and the open water of the ponds.

Most of the upland and riparian zones were heavily colonized by non-native species including Himalayan blackberry (*Rubus bifrons)*, Scotch broom (*Cytisus scoparius*), and English ivy (*Hedera helix*). Due to the steepness of the banks transitioning into the ponds, the zones suitable to support riparian vegetation were typically very narrow. However, some pockets of mature native trees and shrubs were present including black cottonwood (*Populus balsamifer* var. *trichocarpa*), willow (*Salix* spp.), red alder (*Alnus rubra*), white alder (*Alnus rhombifolia*), Oregon ash (*Fraxinus latifolia*), red-osier dogwood (*Cornus sericea*), and Douglas spiraea (*Spiraea douglasii*) were present, particularly near the river. Areas of emergent wetland were present, but also limited in extent due to the steep transition from upland to open waterway. These wetlands were primarily dominated by non-native species such as reed canarygrass (*Phalaris*

arundinacea) and yellow flag iris (*Iris pseudacorus*), but native species such as beggarstick (*Bidens tripartite*), slough sedge (*Carex obnupta*), and rice cut-grass (*Leersia oryzoides*) were also present. Open water communities within the ponds system were largely dominated by non-native Brazilian watermilfoil (*Myriophyllum aquaticum*) and Eurasian watermilfoil (*Myriophyllum spicatum*) along with large algae mats in some ponds. Limited native emergent species were present in some areas including mosquito fern (*Azolla filiculoides*). Uruguayan primrose (*Ludwigia hexapetala*), a highly invasive non-native aquatic plant, was not present at Delta Ponds during this initial survey, but was first observed in 2007, expanded rapidly, and became the target of focused control efforts .

Wildlife

With the variety of habitats present at the Delta Ponds, abundant wildlife, both native and non-native, were present prior to implementation of the restoration project. Mammals such as American beaver and nutria (non-native) were common in and around the ponds, and river otters were periodically observed. A total of 106 species of birds were recorded including great blue heron, great egret, osprey, wood duck, downy woodpecker, great horned owl, American widgeon, and bald eagle (Gordon, 2004). Amphibians including Pacific tree frog and bull frog (non-native); and reptiles including western pond turtle and red-eared slider (non-native) were also present on the site. The western pond turtle (Federal endangered species status: species of concern and State endangered species status: critical) population was estimated at approximately sixty individuals in 2005 (University of Oregon Services Learning Program).

Photo: Cary Kerst

Belted Kingfisher

A wide variety of fish species were documented in the ponds and Dedrick Slough (See Appendix D: Delta Ponds Fish Species Key). In the 1960s, following the completion of the aggregate operation, the State Game Commission eradicated the existing fish in a number of ponds with rotenone and then re-stocked warm water fish species including bass, crappies, catfish, and blue-gill, all of which were still present at the time of pre-project surveys. In addition, shiners, cutthroat trout, rainbow trout, and Chinook salmon were also found in the ponds (Russ Fetrow Engineer, Inc. 1989). Prior to the restoration project, the habitat for salmon was very poor due to lack of connectivity with the river and high summer water temperatures.

Recreation, Public Access, and Public Safety

Formalized access and recreational facilities at Delta Ponds were very limited prior to the restoration project with the exception of the East Bank Multi-use Path, which had just been completed. This extension of the Willamette River path system was routed over and adjacent to the southern ponds. Informal parking for Delta Ponds was available in two locations along Goodpasture Island Road for approximately a dozen vehicles, plus the north end of the Valley River Center parking lot served as parking for Delta Ponds access. An extensive network of unofficial trails ran around the perimeter of many of the ponds and the river, formed by people seeking access for fishing, bird watching, and in some cases, illegal camping. These trails were not maintained or improved and were often overgrown by blackberry thickets. Even with the limited facilities, the area received relatively heavy use by people biking and walking along the newly installed multi-use path and for a variety of recreational activities. Illegal camping had been common in and around Delta Ponds and the river for many years, negatively impacting habitat, creating litter and sanitation problems, and deterring legitimate public use.

5 Project Goals

The following goals were developed to guide the overall restoration and management of Delta Ponds and were implemented through various project components:

Vegetation Management and Enhancement Goals

1. Protect, repair, and enhance native riparian, scrub-shrub, upland, and emergent wetland vegetation communities across the site.
2. Control and eradicate invasive exotic vegetation across the site.
3. Over the long-term, enhance habitat along Dedrick Slough between the ponds and the Willamette River.

Recreation and Access Goals

1. Provide public access and facilities at Delta Ponds that support passive recreational activities such as walking, wildlife viewing, picnicking, and nature study. Public access will be controlled in a way that balances human access with protection of the site's vegetation and wildlife.
2. Provide a safe, comfortable, and secure environment for all users and discourage illegal activities.

Education and Stewardship Goals

1. Promote stewardship and awareness of Delta Ponds by neighbors and the general public.
2. Provide facilities to accommodate educational activities at Delta Ponds.

Wildlife Habitat Goals

1. Protect and enhance habitat for the Western pond turtle, Chinook salmon, and neotropical migratory birds.
2. Enhance general habitat conditions for native species associated with the diverse ecosystem provided by Delta Ponds.

Hydrology Goals

1. Re-introduce seasonal (winter) flows from the Willamette River into the Delta Ponds system to create a hydrologic regime that more closely mimics a natural Willamette River floodplain.
2. Protect adjacent properties and public facilities from flood damage.

Water Quality Goals

1. Improve overall water quality within the Delta Ponds system.
2. Reduce pollutant loads entering the Delta Ponds system from stormwater runoff and tributaries such as Dedrick Slough.

Maintenance Goals

1. Maintain the Delta Ponds facilities and trail system, preserving the public's access to the site.
2. Provide adequate access onto the site for maintenance activities and fire protection.
3. Control the spread of invasive non-native vegetation.

Adaptive Management Goal

1. Use an adaptive management model at Delta Ponds to guage success and adjust future management actions.

6 Project Partners and Funding

The City of Eugene worked collaboratively with an extensive group of partners including federal, state, and local organizations and community groups to implement this project. When combined, the overall funding for the project totaled over $9 million. The funding partners and focus areas are listed below:

Source	Amount	Focus of Funding
US Army Corps of Engineers	$5,000,000	Hydrologic connections and earthwork through the Corps Section 206 Floodplain Restoration Project, including: • 2005 excavation of the inlet weir and four channels between interior ponds • 2007 construction of the gated culvert under the bike path levee • 2008 earthwork to construct 3 acres of riparian "benches" • 2010 construction of a box culvert under Goodpasture Island Road • 2010 earthwork to construct 4.6 acres of riparian "benches" • 2010 excavation of lower portion of Heron Slough • 2011 construction of an overview at the north trail head • 2011 installation of a pedestrian bridge over one of the key channels that allows flow to move through the system
National Oceanic and Atmospheric Administration	$1,642,000	• Soil amendment, seeding and planting of 4.6 acres of wetland habitat constructed along formerly steep banks in 2010 • Excavation of four additional channels to improve hydrological connectivity • Completion of side channel at Heron Slough • Invasive species control at Delta Ponds (16.4 ac.) and Heron Slough (10 ac.) • Over 57,000 native plantings at both Delta Ponds and Heron Slough • Fencing of mature trees to protect them from herbivory by beaver and nutria • Fish monitoring in 2011-12 by Cramer Fish Sciences to determine species composition and presence of juvenile Chinook salmon • Interpretive path system and educational signage • Removal of debris from decades of miscellaneous dumping, including old tires, shopping carts, homeless camp remnants, etc. • Assessment of options to improve flow regulation
City of Eugene	$1,550,000	• Invasive species control • Planting of native vegetation • Recreation enhancement • Staff oversight of contracts • Grant and project management • Cash match for grants
US Bureau of Land Management	$ 389,000	Initial invasive species efforts on 28 acres using manual control methods.
Oregon Parks and Recreation	$ 250,000	Recreational facilities, including the north parking lot, ADA accessible path, boardwalk and overlook off of Goodpasture Island Road.
Oregon Watershed Enhancement Board	$ 204,000	• Invasive species removal on over 40 acres including blackberry, Scotch broom, English ivy, yellow flag iris and purple loosestrife • Amending the soil and spreading native seed on three acres of newly constructed riparian benches, and planting • Watering and maintaining 22,609 native plants on nine acres
Oregon Department of Fish and Wildlife	$ 87,000	This grant was paired with the OWEB grant and helped to cover the costs of the soil amendment, seeding, and planting of three acres of newly constructed riparian benches.
Lane County	-	Land transfer and access
Total	**$9,122,000**	

7 Implementation of the Delta Ponds Restoration Project

The Delta Ponds Restoration Project was implemented over a period of approximately nine years at a total cost of just over nine million dollars, with substantial volunteer contributions by the community. Due to the scale and complexity of the project and the fact that multiple funding sources were utilized, the project was implemented in a series of sometimes overlapping phases. For simplicity's sake, the narrative below describes the detail of what on-the-ground actions were taken and are organized by topic area as opposed to funding source.

Enhancement of Hydrology and Topography

Significant hydrologic and topographic modifications were conducted in order to achieve the water quality and habitat goals of the Delta Ponds Restoration Project. As described earlier, the Delta Ponds and Dedrick Slough were largely cut off from surface flows from the adjacent Willamette River and associated floodplain, which resulted in significant water quality issues and poor habitat conditions for native wildlife, particularly aquatic species.

The overall restoration strategy called for the establishment of a stable hydrologic connection between the river, the ponds, and Dedrick Slough during winter high flows. In addition, to further improve riparian and wetland conditions, the strategy called for reshaping the steep banks of many of the ponds to create a broader riparian and wetland transition that was better suited for native plant and animal species. These hydrologic and topographic enhancements were implemented in phases beginning in 2004 and completed in 2011. The following major on-the-ground and permitting actions were taken to achieve the overall project goals:

The weir, or inlet, from the Willamette River was cut in 2005, allowing flow to enter the southernmost pond.

- Water Control Weir Installed: In 2005, a segment of levee that separated the southernmost pond and the Willamette River was removed and a permanent stone weir was installed. A weir is a water control structure that is constructed at a set elevation to meter flow. In order to accommodate winter flows, the weir elevation was set at an elevation that would allow flows to enter the ponds when the river flow was at approximately 3,500 cfs at a nearby NOAA gauge station. This was based on extensive hydrologic and hydraulic modeling showing that at 3,500 cfs, the river would flow into the ponds over 90% of the time by November and would flow to varying degrees until sometime during March through June (Tetra Tech, 2002).
- Excavation of Channels: In conjunction with the installation of the weir in 2005, the berms that separated many of the ponds were breached and channels excavated in multiple locations to allow flows to move freely from the river and through the ponds toward the Dedrick Slough. However, two major barriers to flow were still present. The first

barrier was at the levee that carried supported the newly installed multi-use path and the second barrier was Goodpasture Island Road. At this time, river flows that entered the southern ponds were diverted back to the river less than a quarter mile downstream.

- Water Right Exemption Granted: In June 2006, ODFW granted the City of Eugene a Water Right Exemption under the Salmon Trout Enhancement Program (STEP), allowing for the diversion of flows from the Willamette River into the ponds and Dedrick Slough. This state program is aimed at providing water right exemptions to benefit fish production and propagation projects.
- FEMA Map Revision Conditionally Approved: In July 2006, FEMA issued a "Conditional Letter of Map Revision" for the Delta Ponds Restoration Project based on the preliminary designs and hydrologic modeling, allowing the project to proceed within the constraints of the hydrologic model presented in the application.
- Removal-Fill Permit Granted: In August 2006, the City of Eugene received a permit from the Oregon Department of State Lands for fill-removal work for Delta Ponds project that included construction of the gated culvert and the Goodpasture Island Road culvert.

Photo: RaptorViews

Gated culvert under the levee and mulit-use path

Excavation of the northernmost channel near the Dedrick Slough outlet

- Gated Culvert Installed: In 2007, a gated culvert was installed under the major levee that accommodated the newly constructed multi-use path. This dual culvert system was designed to regulate the volume of water moving through the downstream ponds during high flows and could be adjusted as needed to manage habitat and protect downstream features from heavy flooding.
- Riparian Benches Contoured: Between 2008 and 2011, the steep rocky banks along 1.2 miles of pond edge were re-contoured, creating 7.5 acres of shallow, low gradient riparian habitat and emergent wetlands. This effort necessitated the importation of tens of thousands of cubic yards of soil which was deposited along the edges of the ponds and spread to create gradually sloping banks, transforming steep sided banks from a 1:1 or 2:1 slope to a much shallower 20:1 slope. Much of this soil was brought in from the nearby Golden Gardens pond restoration project, which required soil removal to achieve similar riparian restoration goals. The newly graded benches were amended with a layer of approximately 3 inches of blended soil and compost prior to planting.
- Additional Channels Excavated: Additional channels were excavated at various times during the implementation of the project to further improve hydrologic connectivity between ponds prior to the installation of the last remaining culvert. This work was done in conjunction with the excavation of another side channel on the opposite side of the river in an area called Heron Slough (considered a component of the Corps Delta Ponds Section 206 Project).
- Culvert Constructed Under Goodpasture Island Road: In 2010, the final barrier to flow was removed with the installation of a 12-foot wide fish friendly box cul-

North

January 2014

0 500 1000 ft

Scale

Aerial Photo Base: Summer 2009

Beltline Road

Eugene Sand and Gravel

Eugene Sand and Gravel

ODOT Ownership

Willamette River

Side Channel Constructed (2010)

Shared-Use Path (2003)

Bicycle-Pedestrian Bridge (2010)

Heron Slough

Marist High School

Side Channel Constructed (2011)

Bicycle-Pedestrian Bridge (2012)

Goodpasture Island Road

Dedrick Slough

Lane County Ownership

Delta Hwy

Invasive Species Control and Riparian Planting (2009-2011)

Parking Lot (2005)

Boardwalk (2008)

Trail (2005)

Planned Bridge

Boardwalk

Radio Tower

Invasive Species Control and Riparian Planting (2010-2012)

Trail (2011)

Bridge (2011)

Bridge (2011)

Trail (2011)

Invasive Species Control and Riparian Planting (2004-2012)

Shared-Use Path (2003)

Parking Lot (2011)

Bridge (2011)

Bridge (2011)

Willagillespie Rd.

Culvert to Allow Flow Under Road (2010)

Invasive Species Control and Riparian Planting (2004-2012)

Willamette Oaks Ownership

Sherwood

Robin Hood

Dedrick Slough

Shared-Use Bridge and Path (2010)

Gated Culvert to Regulate Flow (August 2007)

Shared-Use Path (2003)

Weir Installed to Allow High Water Flow into Ponds (2005)

River Rd.

Valley River

Valley River Center

Delta Ponds

Completed or Planned Enhancements

Key:

- Delta Ponds Project Boundary
- Weir (inlet to ponds from river)
- Gated Culvert
- Culvert
- Excavated Channel (to improve flow within ponds)
- Riparian Bench (contoured and planted 2008-2011)
- Parking Lot
- Pedestrian Trail
- Planned Pedestrian Trail
- Bridges (existing or planned)
- Interpretive Signage (2011)
- Direction of Water Flow
- Restroom

Grading riparian bench

Box culvert under Goodpasture Island Road

vert under the road. This final link effectively connected 2.2 miles of side-channel habitat to the Willamette River. The first flows began moving through the entire Delta Ponds system in fall of 2010.

Invasive Plant Species Control

Invasive species control was a major component of the Delta Ponds Restoration Project, with multiple phases of control occurring throughout the project utilizing a variety of funding sources. The primary targeted species included Himalayan blackberry (R*ubus bifrons*), Scotch broom (*Cytisus scoparius*), English hawthorn (*Crataegus monogyna*), and English ivy (*Hedera helix*). Additional invasive species targeted during the project included yellow flag iris (*Iris pseudacorus*), purple loosestrife (*Lythrum salicaria*), English holly (*Ilex aquifolium*), tansy ragwort (*Senecio jacobaea*), common teasel (*Dipsacus fullonum*), meadow knapweed (*Centaurea pratensis*), bull thistle (*Cirsium vulgare*), false brome (*Brachipodium sylvaticum*), and most recently Uruguayan primrose (*Ludwigia hexapetala*). Invasive species control was ongoing throughout the project, highlighted by the following large scale efforts:

Early manual control efforts for blackberry

- Early Manual Control Efforts: Beginning in the fall of 2004, the City utilized BLM Cooperative Conservation Initiative (CCI) funds to launch a major invasive vegetation control effort in upland and riparian areas on a total of 28 acres throughout Delta Ponds. Areas targeted in this effort were selected to ensure that they occurred only in areas that would not later be re-contoured during the planned Corps project or other effort. Blackberry was by far the most dominant invasive species targeted under this effort, although Scotch broom, English ivy, English holly, and English hawthorn were also controlled. The initial phase of this effort relied on cutting blackberry thickets with hand tools and mechanical brush cutters followed by the grubbing and removal of blackberry crows. In order to reduce costs and make the project more sustainable, crowns were piled onsite on top of weed fabric to decompose, rather than being hauled off site. A total of 18 piles of blackberry crowns were created with an estimated volume of 270 cubic yards. Repeat phases of manual removal occurred

throughout 2005 and then the areas were seeded with native grasses followed by native tree and shrub plantings.

- Dedrick Slough and Area East of Delta Highway: From 2010 to 2011, invasive species control efforts, utilizing OWEB and NOAA funding, targeted an additional 26 acres that had not been included in the 2004/2005 Cooperative Conservation Initiative (CCI) project. The initial phase of control targeted blackberry, Scotch broom, English hawthorn, English ivy, and false brome on 16 acres. This was accomplished using several different techniques including manual removal of all species, followed by spot spraying re-sprouting blackberry. The second phase of control included a follow-up spraying on the initial 16 acres to treat re-sprouting blackberry, as well as newly emerging weeds such as tansy ragwort, teasel, meadow knapweed, and bull thistle. This second phase also included control on the 10 acres of land surrounding Heron Slough.
- Ludwigia Control Efforts: First noted in Delta Ponds in 2007 near the old boat ramp on Goodpasture Island Road, the highly invasive Uruguayan primrose willow (*Ludwigia hexapetala*) rapidly colonized the shallow water areas of Delta Ponds, most notably in the southernmost pond just east of Goodpasture Island Road. This aquatic plant is native to South America and widely used in fresh-water aquariums, which was the likely source. The City began mapping the extent of this weed in 2008 and by 2010 it was so extensive that the City started researching and experimenting with different control methods. In 2011 and 2012, contractors were hired to manually pull Ludwigia growing in the water and to spot spray Ludwigia found along the shore and in mud flats. While this was successful in the areas of low to moderate infestation, it did nothing to control the dense mats that had become established in the shallow pond just downstream of the Goodpasture Island Road culvert. With the realization that this aggressive weed would continue to spread downstream and had the potential to be transported into the Willamette River, the City developed an Invasive Ludwigia Management Plan for the Delta Ponds Natural Area in 2012. The goal of this plan was to significantly reduce the population of this aquatic invasive to diminish its ecological impacts within the Delta Ponds system and decrease its ability to spread downstream into the Willamette River system over a five year period (2013-2018). In 2013, the City received funding from the Oregon State Weed Board and successfully implemented the first phase of Ludwigia control. This included a combination of manual pulling and herbicide control and was extremely successful, but follow-up treatments will likely be necessary.

Early Ludwigia control efforts at Delta Ponds

Uruguayan primrose willow (Ludwigia hexapetala)

Native Plantings

More than 98,346 native plants have been planted at Delta Ponds since the start of this project. As with most other aspects of this project, planting of native species took place in several phases:

- Initial Planting Efforts: The first large scale planting project took place beginning in 2006 on the 28 acres of upland habitat where the initial invasive species removal had taken place in 2004 and 2005. This planting included 24,583 native trees and

shrubs and was funded using the BLM Cooperative Conservation Initiative (CCI) funds, Army Corps of Engineers funding, and local stormwater fees.

- Planting of 2008 Riparian Benches: The second large scale planting took place following the construction of three acres of riparian benches in 2008. In the fall, after the soil amendment work, the benches were seeded with 73 pounds of an aggressive mix of native seed that included the following species: *Agrostis exarata, Bromus carinatus, Bromus sitchensis, Danthonia californica, Deschampsia cespitosa, Elymus glaucus, Epilobium densiflora,* and *Lupinus rivularis*. In addition, the benches were seeded with just over five pounds of tree seeds of the following species: bigleaf maple (*Acer macrophyllus*), white alder (*Alnus rhombifolia*), and Oregon ash (*Fraxinus latifolia*). In the spring of 2009, 16,000 native trees, shrubs, sedges and rushes were planted in four zones: emergent, wetland transition, riparian and upland.
- Planting of 2010 Riparian Benches: In the fall of 2010, the new riparian benches were seeded with approximately 100 pounds of seed. Most of the seed consisted of the same aggressive mix of native species that were planted in 2008. In addition, a narrow strip along the water's edge was seeded with a mix of emergent wetland species that included: slough sedge (*Carex obnupta*), awlfruit sedge (*Carex stipata*), lateral sedge (*Carex unilateralis*), common spikerush (*Eleocharis palustris*), common rush (*Juncus effuses*), panicled bulrush (*Scirpus microcarpus*), and softstem bulrush (*Scirpus validus*). Finally, ten pounds of tree and shrub seeds of the following species: big leaf maple (*Acer macrophyllum*), white alder (*Alnus rhombifolia*), red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia*), serviceberry (*Amelanchier alnifolia*), osoberry (*Oemleria cerasiformis*), and choke cherry (*Prunus virginiana*) were spread along the new riparian benches. In the spring of 2011, approximately 9,320 native trees, shrubs, sedges and rushes were planted along the newly created riparian benches.
- Heron Slough Plantings: Plantings of the side channel restoration project located on the west side of the river (originally identified as Area 5 in the Corps Section 206 Restoration Project), but now called Heron Slough took place in three distinct phases:
  - Planting of the lower portion of the slough and surrounding upland habitat in 2011: This included the planting of 166 trees, 2,180 willow/dogwood cuttings, 3,740 shrubs, 2,200 sedges and rushes, and 590 understory forbs.
  - Planting of the upper portion of the slough in 2012: This second round of planting at Heron Slough took place following the completion of

Riparian bench near gated culvert

Protective tubes and fencing to limit herbivory

Heron Slough

Riparian planting along Dedrick Slough

the upper portion of the slough and included 94 trees, 2,820 willow/dogwood cuttings, 760 shrubs, and 3,000 sedges and rushes.

- o Supplemental willow cutting and understory forb planting: As the result of cost savings achieved under the NOAA grant, the City was able to add final round of planting at Heron Slough in late 2012/early 2013. This included the planting of 1,000 willow cuttings and 570 understory forbs.

- Additional Plantings at Delta Ponds: between 2010 and 2013, an additional 31,323 native plants were planted at Delta Ponds. This included planting of approximately 22,400 in "non-bench" areas that had previously been covered with invasive species. The final planting, which took place in late 2012/early 2013 included planting of a 7,000 willow cuttings and 1,917 understory forbs.

Planting Techniques

For all plantings, the City required all material to be purchased from nurseries in the southern Willamette Valley (Salem and southward) in order to ensure locally adapted genetic material. Most plants were bare root, except for willow cuttings and several species that were only available as potted stock. Trees and shrubs planted in 2006 were not protected in any way from herbivores. The City had thought that trees and shrubs planted densely enough the loss from herbivory would not be significant. Unfortunately, the damage by beaver and nutria was extremely high. After that experience the City required all willows and dogwoods to be protected with 24-30" tall rigid seedling protection tubes that were staked in place with 30-36" bamboo stakes. These were removed after two years, once the plants had established healthy root systems and could better withstand herbivory. All trees were protected with metal fencing secured with metal t-posts. These fence rings were large enough to allow for a decade or more of growth and have been left on site indefinitely.

Temporary irrigation was used to water trees and shrubs for the first two years following planting.

To ensure maximum survival, trees and shrubs in the upland and riparian zones were watered every two weeks for the first two years following planting. Contract specifications required that all trees receive five gallons of water at each watering event, while all shrubs receive three gallons at each watering event. While the contract specified watering, the contractors were allowed to develop their own watering methods. The most cost effective way to water turned out to be the installation of temporary sprinkler systems that were run off of portable pumps drawing water from the ponds. A full species list of native trees, shrubs, ferns, forbs, sedges, and rushes that were planted at Delta Ponds between 2006 and 2013 is included in Appendix B.

Wildlife Habitat Enhancements

While the Delta Ponds Restoration Project provides habitat for a range of native wildlife species, the restoration effort had a special emphasis on declining native species such as spring Chinook salmon, Western pond turtle, and neotropical migratory birds. Therefore, the restoration project was focused on creating riparian and aquatic habitat conditions that were most suitable for these species.

Salmon Habitat Enhancements

The major decline in native runs of spring Chinook salmon in the upper Willamette Rivers system, which ultimately led to the federal listing under the Endangered Species Act, is thought to be in part due to the decline of protected side-channel and alcove habitats as described previously. These quiet backwater areas are especially critical for juvenile salmon that seek slower moving water, particularly during the winter months when flows in the main stem of the river are high. The Delta Ponds Restoration Project now provides 2.2 miles of this essential slow moving backwater habitat. Furthermore, the conversion of steep banks to gradually sloping riparian benches and the planting of tens of thousands of native emergent, wetland, and riparian plants are now providing cover and food for overwintering juvenile salmon.

Western pond turtle on basking log

Western Pond Turtle Habitat Enhancements

Western pond turtles are considered a "Sensitive-Critical" species in Oregon and a "Species of Concern" by the U.S. Fish and Wildlife Service throughout its range. Threats to its survival include the loss or alteration of habitat, disease, predation, pollution, introduction of non-native turtles, and population isolation (Bury et al. 2012). Second only to Chinook salmon, Western pond turtles have been one of the primary focuses of wildlife habitat enhancement work under the Delta Ponds Restoration Project. Improvements to Western pond turtle habitat focused primarily on basking, nesting, and rearing habitat. Dozens of large logs were placed and anchored throughout the pond system to provide adequate basking habitat. A historic nesting site, identified by the ODFW prior to the project implementation, was protected and enhanced through the addition of top soil and seeding with native forbs. During the construction of the 2008 riparian benches, a seven thousand square foot nesting area was created in the pond west of Goodpasture Island Road, adjacent to a large empty field slated for development. Turtle nests had been observed in the field and in the garden of the adjacent Willamette Oaks facility for years, making this a natural location to create new nesting habitat. Since the base of the constructed turtle nesting area was a mix of compacted aggregate, the area was topped with approximately 8 inches of a sandy loam to provide turtles with a suitable soil layer to nest in. This was then seeded with a mix of native upland prairie species including clarkia (*Clarkia purpurea*), small lupine (*Lupinus polycarpus*), seablush (*Plectritis congesta*), cinquefoil (*Potentilla gracilis*), selfheal, (*Prunella vulgaris*) and Oregon sunshine (*Erioplyllum lanatum*).

Protected turtle nesting area with low fencing to keep turtles off the path

The conversion of steep sided banks to gradually sloping benches that could support a diversity of emergent wetland habitat was a huge benefit for turtles. The shallow water provides a refuge for tiny juvenile turtles to hide from large predatory fish such as largemouth bass, and the emergent vegetation provides cover to hide from predators such as herons and raccoons. In addition to habitat enhancements to benefit Western pond turtles, this project has included surveying for and protecting Western pond turtle nests. Annually from mid-May through early July, City staff and volunteers scout the turtle nesting areas every evening, looking for turtle nests. When a nest is identified, a wire cage is immediately installed over the nest to keep predators such as raccoons from digging up and eating the eggs. The openings in the wire cage are designed to be large enough to allow the quarter-size turtles to escape, yet keep the predators at bay.

Photo: Cary Kerst

Double-crested Cormorant

Bird Habitat Enhancements

The overall habitat restoration efforts, including the planting of thousands of native trees and shrubs, controlling human access into sensitive areas, and the creation of gradual transitions between habitats have all contributed to improved conditions for a wide range of bird species at Delta Ponds. As of 2013, 146 species of birds have been recorded at Delta Ponds, an increase of 40 species since this list was started in 2004 (see Appendix C: Bird Checklist).

Recreational Amenities and Access

With the central location of this large-scale restoration project within one of Oregon's largest metropolitan areas, Delta Ponds provides close-to-home recreational opportunities, unique nature viewing in the heart of the city, and an outstanding educational amenity. The extension of the East Bank multi-use path through Delta Ponds in 2002 and the construction of the bicycle-pedestrian bridge over Delta Highway in 2009 have significantly improved public access to the area. Several important recreational and educational enhancements have been implemented as part of the Delta Ponds Restoration Project:

Volunteers constructing the north trail

- North Parking Lot: In 2005, utilizing Oregon Parks and Recreation District (OPRD) funds, a paved parking lot and a short section of concrete path were constructed along Goodpasture Island Road to provide future access to an accessible boardwalk and overlook, as well as the Delta Ponds gravel walking trails.
- North Trail: In 2005, the Delta Rotary club in partnership with several other Eugene-area rotary clubs, volunteered their time and resources to construct a gravel path along the northern edge of Delta Ponds, running 1,300 linear feet from the North Parking Lot to Dedrick Slough.
- Boardwalk and Viewing Area: Following the completion of the North Parking Lot and a short section of concrete path, an accessible boardwalk and viewing area were constructed in 2006.
- Delta Pond Interpretive Trail and South Parking Lot: In the summer of 2011, utilizing funding from the NOAA grant, a

Interpretive trail

Bridge over Heron Slough

0.9 mile long interpretive trail and three associated pedestrian bridges were constructed in the central portion of the ponds. The six foot-wide gravel surface path and the bridges were designed for pedestrian-only traffic to facilitate passive recreational activities such as walking, bird watching, and wildlife viewing. Eventually, it is hoped that this new trail will form a complete 1.4 mile loop around the perimeter of the ponds. To form a complete loop, one additional bridge (over Dedrick Slough) will need to be constructed.

Photo: Vern Rogers

The bike-pedestrain bridge over Delta Highway provides access from North Eugene to Delta Ponds and the river.

- Delta Highway Bridge: Although not officially considered part of the Delta Ponds Restoration Project, this major bicycle and pedestrian bridge, which spans Delta Highway, was completed in 2009 and significantly improved recreational access to Delta Ponds and the Willamette River from the Willakenzie neighborhood.
- Interpretive Signage: In 2011, a total of ten interpretive signs were installed throughout the Delta Ponds site (including one at Heron Slough) to educate the public about the history of the area, the restoration that has taken place, and the value of those restoration efforts to native species such as juvenile Chinook and American beaver. This project was funded using a portion of the NOAA grant.

One of ten interpretive signs installed in 2011

Photomonitoring showing pre- and post-construction conditions of riparian bench

Monitoring

Photopoint Monitoring

In 2004, the City set up 15 photopoint stations throughout the project site with the goal of capturing changes in vegetation, hydrology, and recreation over time. Annual photos have been taken from all 15 stations through 2013 and have captured landscape scale changes. In order to capture changes created by specific phases of the project, additional photopoint stations were established during the implementation of the OWEB and ODFW grants (2008), the NOAA grant (2009), construction at Heron Slough (2011), and the recent Ludwigia control project (2013). The before and after photos that resulted from these monitoring efforts proved to be invaluable, especially for grant funders who could clearly see what changes had taken place as the result the projects that they had funded.

Vegetation Monitoring

The primary vegetation monitoring that occurred as part of this project was associated with the contracted plantings, which were required to achieve an 80% survival rate over a two year period. In order to determine survival rates for each of these plantings, monitoring plots were set up in each new planting area. Baseline monitoring was conducted in the spring after an area was planted to determine the initial species quantities for each plot. This was followed by the first year of monitoring which was conducted in early fall by returning to the plots and repeating the species counts. Fall data was compared to spring data and the site was assessed for possible causes of damage. Survival rates were determined for each species within a plot and for all plots combined. Those data were used to determine overall survival for the entire planting. If survival rate was less than 80% the contractor was required to replant to meet this minimum threshold. The contractor was not expected to replace plants damaged by vandals, herbivores, or other unexpected events out of the contractor's control. The process for the second year of monitoring was the same as the first year.

In 2005, the University of Oregon's Environmental Leadership Program (UO ELP) used aerial photos and ground surveys to categorize Delta Ponds into five vegetation zones. They concluded that the Delta Ponds habitat consisted of 9% upland, 30% riparian, 19 % wetland transition, 9 % emergent, and 30 % blackberry thickets. In 2013, UO ELP students repeated vegetation monitoring with the goal of examining the change in vegetation since 2005. The results from their efforts showed a clear increase in all habitat types except for blackberry thickets, which declined from 30% cover down to 2% cover.

Amphibian Monitoring

In 2005 and again in 2013, the UO ELP conducted amphibian monitoring at Delta Ponds. In 2005, the UO ELP developed protocols for baseline amphibian monitoring. This included the placement of artificial habitat that was monitored for rough skinned newts and Northwest salamanders for a 4 month period, visual surveys for red-legged frog egg masses, and auditory surveys at ten locations throughout the ponds to assess Pacific chorus populations. In 2013, ELP conducted very similar surveys, with some slight modifications to protocols. Very few amphibians were detected in either the 2005 and 2013 surveys using the monitoring techniques employed. The exception to that were the auditory surveys which detected several areas with strong Pacific chorus frog populations. The most likely explanation for the lack of discovery of amphibians at Delta Ponds during the UO ELP surveys is that the sampling methods used were not sufficient to detect the presence of amphibians. It is also possible that the habitat, which was severely degraded during the gravel mining operations, has not recovered sufficiently in the short time since the implementation of the Delta Ponds Restoration Project to support amphibian populations, aside from Pacific chorus frog.

Rotary screw trap located just downstream of the weir

Fish Monitoring

From 2004 through 2007, the City of Eugene partnered with ODFW and various educational programs to conduct fish monitoring at Delta Ponds. In 2005 the UO ELP assisted with the installation and monitoring of a two-way trap in Dedrick Slough. They also conducted seining in the pond just west of Goodpasture Island Road, which at that time had no surface connection to the river or adjacent ponds. In 2005-2006, following the construction of the weir to connect the upper most ponds to the river, a group of Lane Community College students helped the City and ODFW to install and monitor hoop and minnow traps at four locations in the pond complex. In January 2006, ODFW was able to borrow a rotary screw trap, which was placed at the downstream end of the weir, at the location where the river first flowed into that upper most pond. Finally, in 2007, ODFW used electrofishing and trap nets specifically to monitor the interior ponds. During these studies, dozens of juvenile Chinook salmon were captured in the rotary screw trap and several made their way into the hoop traps. Combined, these monitoring efforts detected a total of thirteen native species (including three salmonids) and eight non-native species. A notable finding was that native fish were far more abundant than non-native fish within the ponds that had an open connection with the river, while the isolated interior ponds were dominated by non-native species.

Electrofishng

In 2011, with the hydrological connections fully completed, the City hired Cramer Fish Sciences to conduct fish monitoring at Delta Ponds and Heron Slough with the goal of determining species composition, relative abundance, and the timing of juvenile salmonid use of Delta Ponds and Heron Slough. Methods used included the placement and monitoring of a rotary screw trap

Source: Cramer Fish Sciences

Species Type	Common Name	Total
Salmonid (native)	Chinook	78
	Rainbow Trout	48
	Cutthroat	3
Native	Peamouth	384
	Shiner	304
	Dace	274
	Sculpin	228
	Sucker	154
	Lamprey	140
	Pikeminnow	41
	Whitefish	9
	Chiselmouth Chub	6
	Threespine Stickleback	5
	Sand roller	2
Non-native	Bluegill	355
	Bass	268
	Yellow Perch	236
	Mosquitofish	67
	Bullhead	66
	Carp	65
	Pumpkinseed	15
	Warmouth	12
	Crappie	5
Total		**2,765**

Fish Caught Using All Sampling Technique
(Nov 2011 - Nov 2012)

Juvenile Western Pond Turtle at Delta Ponds

Fish monitoring crew

near the inlet to Delta Ponds, seining along the shore, and the use of a backpack electrofishing unit. The seining sampling method yielded very few fish and was discontinued after the first couple of monitoring sessions. During the one year of sampling, a total of 2,759 fish and 23 species were detected using all methods (table left). Juvenile Chinook salmon were found in three of the five study reaches from January through May, typically following periods of high Willamette River discharge events. Salmon presence in formerly isolated ponds, confirmed that project goals related to connectivity and access were met. A key of Delta Ponds fsh species is included in Appendix D.

Turtle Monitoring

As with the amphibian monitoring, the 2005 and 2013 UO ELP classes conducted turtle monitoring at Delta Ponds. In 2005, guided by ODFW staff, the ELP students conducted a capture/mark/release survey to assess Western pond turtle and red-eared slider populations in the ponds. Using these methods the team estimated that the Western pond turtle population was between fifty and sixty individuals, while red-eared sliders numbers were closer to two hundred.

In 2013, rather than conduct capture/mark/release surveys, the UO ELP students established observation points at each of the ponds and conducted visual surveys on four dates during the peak of the spring basking season. In addition, the team assessed pond health at each of these locations, ranking the ponds based on the number of basking structures, presence of submerged vegetation, and the slope of the pond edges. The primary conclusion presented by the 2013 ELP team was that there was not a direct correlation between habitat rankings and turtle numbers. Given that there are many variables that likely determine the quality of turtle habitat and that these may not have been captured in the habitat ranking, these results may not be significant. The UO ELP students did not make any attempt to estimate either Western pond turtle or red-eared slider population numbers.

Bird Monitoring

Bird monitoring took place at Delta Ponds for seven years starting in 2005. Two routes each with seven point count stations were set up and volunteer birders were recruited to conduct the actual monitoring. Each year from mid-April through the end of May, two-person teams conducted five minute counts of all birds identified by sight or sound within fifty to one hundred meters of each station. Monitoring took place two to three times a week, depending on the availability of volunteers. Cursory data analysis did not show significant change from year to year, so it was decided to suspend the annual monitoring effort for a period of time until the newly planted vegetation is more mature and provides more beneficial habitat conditions. Monitoring will likely restart in five to ten years, using the previously collected data as baseline for comparison. The most frequently observed bird species from these surveys are listed below by category and in order of frequency.

Bird monitoring at one of seven point count stations

Top Ten Most Frequently Counted Bird Species between 2006 and 2010

Neotropical Migratory Birds	Resident Birds	Winter Birds
• Violet-green Swallow	• Canada Goose	Green-winged Teal
• Vaux's Swift	• Cedar Waxwing	American Wigeon
• Cliff Swallow	• Yellow-rumped Warbler	Golden-crowned Sparrow
• Tree Swallow	• Mallard	Townsend's Warbler
• Barn Swallow	• Red-winged Blackbird	Gadwall
• Orange-crowned Warbler	• Double-crested Cormorant	White-crowned Sparrow
• Wilson's Warbler	• Wood Duck	Ring-necked Duck
• Bullock's Oriole	• European Starling	Northern Shoveler
• Warbling Vireo	• Rock Pigeon	Hooded Merganser
• Black-headed Grosbeak	• Brewer's Blackbird	Bufflehead

Common Merganser

Photo: Cary Kerst

8 Lessons Learned

There have been many lessons learned during the implementation of this multi-year restoration project. The list below includes some of the more significant lessons that were identified by various project staff:

Project Planning

- Project Phasing: Implementing this project over several years allowed for adaptive management and for modifying restoration techniques over time (such as planting). Multi-year phasing also allowed completed work to be used to demonstrate partial successes and commitment to the project, which helped leverage additional funding.
- Multiple Uses: Integrating recreation and interpretation into this large-scale habitat restoration project within an urban area dramatically improved community support for the project. Additionally, the visual quality and the overall aesthetic of the project proved to be very important to recreational users, adjacent property owners, and elected officials. This topic is often given low priority in habitat restoration focused projects.
- Partnering: Partnering with a diversity of agencies, organizations, and individuals was key to leveraging political, financial, and technical support and a central aspect of the project's success.

2005 planning meeting at Delta Ponds

- Relationships: Maintaining relationships with key staff from partner agencies was vital to accomplishing the work. Over the life of this project, the players from all of the agencies changed and so did the dynamic of the group. On a project of this duration, it is essential to continuously review the goals and priorities and to touch base with all of the participants.
- Balance of Interests: At various points in the implementation, one interest or another dominated the discussion. While this tension is essential to a project of this nature, it is important to ensure that the overall multi-objective goals are met. Many projects are accomplished in two parts. First the vision is developed and then handed off to the implementers. During implementation, the concerns were (broadly) construction, habitat, and recreation. From a construction standpoint, the Delta Ponds project was not very complex, but the goals were. Since the project was constructed in phases, it was a challenge to keep the overall vision at the forefront of people's minds. Having a group to keep the vision and provide oversight to implementation is very important.
- Endurance: The Delta Ponds project was accomplished because the City continued to push for its completion. Leadership of the project changed many times. While the changing players created challenges, it also provided fresh perspective and enthusiasm. This must be recognized at a high level and on a project of this duration, managing enthusiasm is at least as important as continuity.
- Patience: If you build it, they will come. As is typically found with restoration projects of this nature, it often takes time for the desired plant communities to establish and for target wildlife species to move in. Sometimes this takes decades, which appears to be the case for bird habitat, while other times the response is immediate as was demonstrated with juvenile Chinook immediately moving into the newly restored side channels.
- Shared Online Database: Setting up and maintaining a project-based intra-agency online database, particularly with the advent of cloud computing, would be helpful for accessing documents, agreements, data, minutes, and photos. With any project of this scope and duration, key staff people are likely to change and having access to information in one central location would be beneficial.

Monitoring and Data

Heron Slough

- Pre- and Post-Project Data: Gathering pre-project data regarding project targets to compare with post project accomplishments is critical in order to verify project success. In this case, photopoint, hydrology, and fish monitoring was valuable and will continue to be important for assessing impacts on these target species/conditions. For this project, the vegetation and wildlife monitoring did not result in data that was as useable for the purposes of verifying project success. The data collected is still valuable and shows some possible trends, but the methodology and quality of the data make it difficult to draw any conclusions.
- Hydrologic Modeling: Hydrologic modeling is valuable but limited in its ability to accurately predict exact post-project conditions. It would be wise for hydrology altering projects to set aside contingency funds in order to make minor adjustments after the project is implemented to ensure that hydrology goals can be met. While the U.S. Army Corps of Engineers relied heavily on the modeling done by Tetra Tech and others and engineered the project accordingly, the implementation team was still guessing at the elevations for the benches quite late in the project and it seemed like the process was delayed because the scientific foundation of the modeling was not as solid as the implementation team would have liked. The project could have benefited from a more design-build-test-modify approach and less rigid reliance on early hydrologic modeling data. Advances in surveying and mapping techniques since this project was implemented, including subsurface data, might allow for more accurate and robust models to start with on future projects.

Implementation

- Vegetation Establishment Specifications: Including two years of vegetation establishment specifications such as detailed watering criteria and minimum percent survival requirements greatly increased the effectiveness of establishing vegetation.
- Beaver: Impacts caused by beaver activity need to be well considered and planned for in this type of wetland restoration project, as they are major ecosystem builders and shapers. On the Delta Ponds Project, beavers have largely had a positive influence on the hydrology. In the spring, after the highest winter flows have subsided, beavers build dams across most of the channels between ponds, backing up water, allowing ponds to maintain some depth and potentially not become as warm and stagnant throughout the summer. This also creates better habitat for a number of species, most importantly, Western pond turtle. Likewise, finding a balance between protecting newly planted vegetation and providing habitat and food for beaver over the long-term is important to a project's overall success. The installation of seedling tubes to protect vulnerable shrub species, followed by the removal of these tubes after two years proved to be a good way to achieve that balance. By the time the tubes are removed, plants have a well-established root system and can withstand herbivore damage.

Slough sedge planting on riparian bench

Lessons Learned (continued)

Culvert installation under the East Bank Path

- Predation of Sedge and Rush Plugs: Many of the sedges and rushes planted during the restoration project were pulled up by geese soon after planting, although some survived to establish. Project managers still recommend planting plugs, but also advocate for supplementing with sedge and rush seeding on project sites where herbivores are likely to take a toll on newly planted plugs. Alternatively, survival rates could also be increased by staking or somehow securing plugs in the soil at the time of planting.
- Flagging of Plants in Monitoring Plots: All plants in the monitoring plots should be flagged at the time of baseline monitoring. Even though plants were readily visible shortly after planting, the dense cover that resulted from the native seed made finding some of the smaller plants nearly impossible at the end of the season. Either pin flags or flagging tape may be used to flag plants, although tall pin flags may be the best choice when plants are small and may become obscured by taller plants such as lupine.
- Seeding Trees and Shrubs: In 2008 and 2010, seeds of tree and shrub species were dispersed onto the bare soil created by the construction of the riparian benches. These benches were topped with three inches of a top soil compost blend, seeded with native grasses and forbs, and planted with bare root trees and shrubs. Since those areas were starting with bare soil, project staff decided to utilize tree and shrub seed on an experimental basis to see which, if any, species developed into viable plants. While no formal monitoring was done, it appears that the alder seeding was highly effective. Ash and maple seeds also appeared to take in some places, while no shrubs were observed as a result of the seeding. In the case of the alder, within a couple of years some of the trees that germinated from seed surpassed the growth of the bare root alder that were planted concurrently. This technique holds a lot of promise, especially for restoration sites where banks are reshaped and there is bare soil exposed. The cost of seeding a site is far less than the cost of planting and the associated maintenance. It is not expected that this method would be very successful on sites with existing vegetation in the form of grasses, invasive species or other dense vegetation.

A Lane County Audubon led bird watching trip

- Maintenance Funding: It is critical with projects of this scale to plan upfront for a sustainable funding source for the maintenance of the site. It can be difficult to find outside funding for maintenance so ensuring that internal funding is available is one approach. In the case of Delta Ponds, the City approved $75,000 annually for maintenance. This will partially fund a staff position, as well as provide some funding for contract work.
- People Like Loops: As of today, the bridge over Dedrick Slough has not been constructed due to engineering challenges and cost. Although the interpretive trail is very popular, many users express disappointment that they are not able to complete the trail as a loop. The City will continue to seek funding for this last leg of the interpretive trail.
- Celebrate and Acknowledge: On a project of this scale, that has been implemented over a relatively long timeframe and in phases, it is important to celebrate and acknowledge at multiple times throughout the project. In addition to thanking the funding agencies, it is important to also acknowledge the many volunteer organizations, identify key staff who worked behind the scenes on technical aspects of the project, and identify and recognize the early visionaries who saw the potential and promoted the project idea for many years before funding was secured.

Delta Ponds Restoration Project

From Opportunity to Action

Appendices

Appendix A
Trails and Paths at Delta Ponds and Vicinity

Appendix B
Native Plant Species Planted at Delta Ponds by Zone

Appendix C
Delta Ponds Bird Checklist

Appendix D
Delta Ponds Fish Species Key

Trails and Paths at Delta Ponds and Vicinity

Native Plant Species Planted at Delta Ponds by Zone

The following native species of trees, shrubs, ferns, forbs, sedges and rushes were planted at Delta Ponds between 2006 and 2013. Note that those with an asterisk (*) were planted in 2006 but removed from future planting lists either because they didn't thrive or they had not been historically present in any significant numbers.

WETLAND TRANSITION

Carex obnupta	Slough sedge
Carex stipata	Sawbeak sedge
Carex unilateralis	one-sided sedge
Cornus sericea	Red osier dogwood
Eleocharis palustris	Creeping spikerush
Juncus effusus	Common rush
Juncus ensifolius	dagger-leaf rush
Juncus oxymeris	Pointed rush
Salix hookeriana	Hooker's willow
Salix lasiandra	Pacific willow
Salix sessifolia	Soft-leaved willow
Salix scouleriana	Scouler willow
Salix sitchensis	Sitka willow
Spirea douglasii	Douglas spirea

RIPARIAN

Alnus rhombifolia	White alder
Alnus rubra	Red alder
Carex deweyana	Dewey's sedge
Carex tumulicula	Berkeley Sedge
Claytonia perfoliata	Miner's lettuce
Cornus sericea	Red osier dogwood
Delphinium trollifolium	Trollius-leaved larkspur
Dicentra formosa	Bleeding heart
Fraxinus latifolia	Oregon ash
Hydrophyllum tenuipes	Waterleaf
Maianthemum racemosum	False Solomon's seal
Maianthemum stellatum	False Solomon's Seal
Physocarpus capitatus	Nine-bark
Populus balsamifera	Black cottonwood
Salix lasiandra	Pacific willow
Salix sitchensis	Sitka willow
Sambucus cerulea ssp. trichocarpa	Blue elderberry*
Tellima grandiflora	Fringecup
Thalictrum occidentalis	Western meadowrue
Thalictrum polycarpum	Tall meadowrue
Tolmiea menziesii	Piggy-back plant
Vancouveria hexandra	Inside-out flower

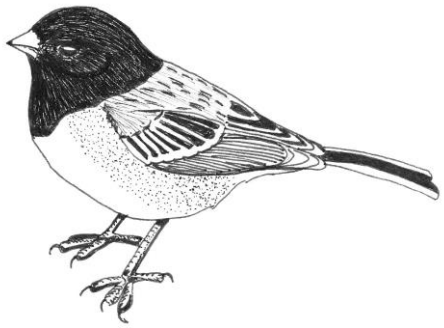
UPLAND

Acer macrophyllum	Big-leaf maple
Amelanchier alnifolia	Serviceberry*
Arbutus menziesii	Madrone*
Baccharis pilularis	Coyote bush*
Calocedrus decurrens	Incense cedar*
Crataegus suksdorfii	Douglas hawthorn
Holodiscus discolor	Oceanspray*
Lupinus polyphyllus	Big leaf lupine
Mahonia aquifolium	Oregon grape
Oemlaria cerasiformis	Osoberry
Pinus ponderosa	Ponderosa pine*
Polypodium glycyrrhiza	Licorice fern
Polystichum munitum	Sword fern
Potentilla gracilis	Cinquefoil
Prunella vulgaris	Selfheal
Prunus emarginata	Bitter cherry
Prunus virginiana	Common chokecherry
Pseudotsuga menziesii	Douglas fir*
Quercus garryana	Oregon white oak*
Rhamnus purshiana	Cascara
Ribes sanguineum	Red flowering currant
Rosa nutkana	Nootka rose
Rosa pisocarpa	Clustered wild rose*
Symphoricarpos albus	Common snowberry
Symphyotrichum subspicatum	Douglas' aster
Viola glabella	Woodland violet

Delta Ponds Bird Checklist

Since 1979, 147 species have been recorded at Delta Ponds and the adjacent stretches of the Willamette River. As habitat improvements are made, this list is certain to grow. If you find additions to this list, please contact Steve Gordon, 541-344-9591. Feb. 2014

__ Greater White-fronted Goose
__ Canada Goose
__ Cackling Goose
__ Wood Duck
__ Gadwall
__ American Wigeon
__ Mallard
__ Blue-winged Teal
__ Cinnamon Teal
__ Northern Shoveler
__ Green-winged Teal
__ Canvasback
__ Redhead
__ Ring-necked Duck
__ Greater Scaup
__ Lesser Scaup
__ Bufflehead
__ Hooded Merganser
__ Common Merganser
__ Ruddy Duck
__ Ring-necked Pheasant
__ California Quail
__ Pied-Billed Grebe
__ Western Grebe
__ Double-crested Cormorant
__ American Bittern
__ Great Blue Heron
__ Great Egret
__ Green Heron
__ Turkey Vulture
__ Osprey
__ Bald Eagle
__ Sharp-shinned Hawk
__ Cooper's Hawk
__ Red-shouldered Hawk
__ Red-tailed Hawk
__ American Kestrel
__ Merlin
__ Peregrine Falcon
__ Virginia Rail
__ Sora
__ American Coot
__ Killdeer
__ Greater Yellowlegs
__ Lesser Yellowlegs
__ Spotted Sandpiper
__ Western Sandpiper
__ Least Sandpiper
__ Long-billed Dowitcher
__ Wilson's Snipe
__ Mew Gull
__ Ring-billed Gull
__ California Gull
__ Herring Gull
__ Glaucous-winged Gull
__ Common Tern
__ Rock Pigeon
__ Mourning Dove
__ Eurasian Collared-Dove
__ Western Screech-Owl
__ Great Horned Owl
__ Vaux's Swift
__ Anna's Hummingbird
__ Rufous Hummingbird
__ Belted Kingfisher
__ Lewis' sWoodpecker
__ Acorn Woodpecker
__ Red-breasted Sapsucker
__ Downy Woodpecker
__ Hairy Woodpecker
__ Northern Flicker
__ Pileated Woodpecker
__ Olive-sided Flycatcher
__ Western Wood-Pewee
__ Willow Flycatcher
__ Hammond's Flycatcher
__ Dusky Flycatcher
__ Pacific-slope Flycatcher
__ Black Phoebe
__ Western Kingbird
__ Cassin's Vireo
__ Hutton's Vireo
__ Warbling Vireo
__ Red-eyed Vireo
__ Steller's Jay
__ Western Scrub-Jay
__ American Crow
__ Tree Swallow
__ Violet-green Swallow
__ Northern Rough-winged Swallow
__ Cliff Swallow
__ Barn Swallow
__ Black-capped Chickadee
__ Chestnut-backed Chickadee
__ Bushtit
__ Red-breasted Nuthatch
__ White-breasted Nuthatch
__ Brown Creeper
__ Bewick's Wren
__ House Wren
__ Pacific Wren
__ Marsh Wren
__ Golden-crowned Kinglet
__ Ruby-crowned Kinglet
__ Western Bluebird
__ Swainson's Thrush
__ Hermit Thrush
__ American Robin
__ Varied Thrush
__ Wrentit
__ European Starling



Dark-eyed Junco

__ Cedar Waxwing
__ Orange-crowned Warbler
__ Nashville Warbler
__ Yellow Warbler
__ Yellow-rumped Warbler
__ Black-throated Gray Warbler
__ Townsend's Warbler
__ MacGillivray's Warbler
__ Common Yellowthroat
__ Wilson's Warbler
__ Yellow-breasted Chat
__ Western Tanager
__ Spotted Towhee
__ Chipping Sparrow
__ Savannah Sparrow
__ Fox Sparrow
__ Song Sparrow
__ Lincoln's Sparrow
__ White-throated Sparrow
__ White-crowned Sparrow
__ Golden-crowned Sparrow
__ Dark-eyed Junco
__ Black-headed Grosbeak
__ Lazuli Bunting
__ Red-winged Blackbird
__ Western Meadowlark
__ Brewer's Blackbird
__ Brown-headed Cowbird
__ Bullock's Oriole
__ Purple Finch
__ House Finch
__ Pine Siskin
__ Lesser Goldfinch
__ American Goldfinch
__ Evening Grosbeak
__ House Sparrow

Notes: _____

Delta Ponds Native Fish Species


Juvenile Chinook Salmon


Sandroller


Threespine stickleback


Speckled Dace


Torrent sculpin


Northern pikeminnow


Redside shiner


Rainbow trout

Western brook lamprey


Largescale sucker


Pacific lamprey

Delta Ponds Non-Native Fish Species


Bluegill


Pumpkinseed


Largemouth bass (juvenile)


Largemouth bass (adult)


White crappie


Western mosquito fish

Yellow perch


Brown bullhead


Common carp