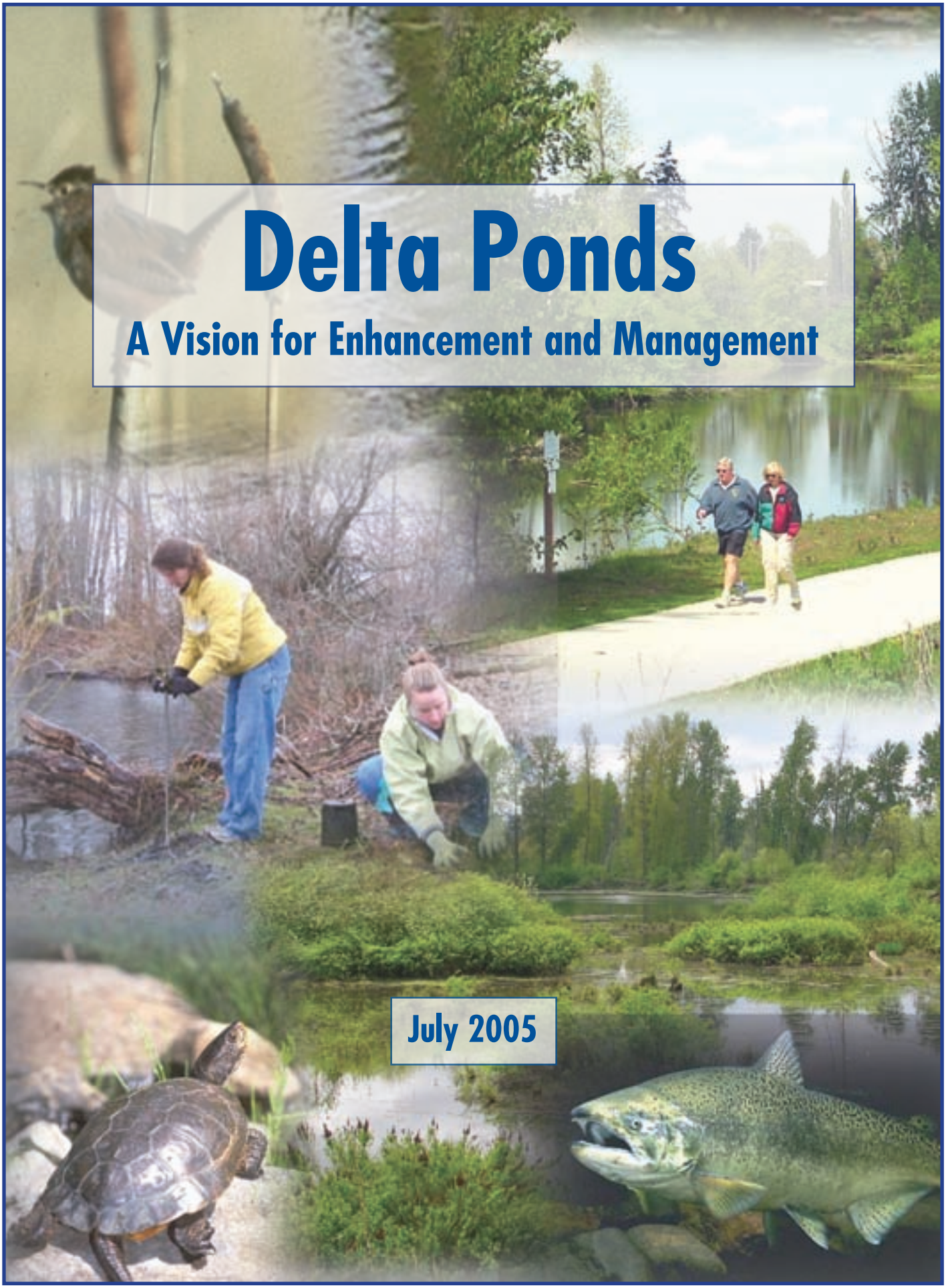
Delta Ponds

A Vision for Enhancement and Management



July 2005

Delta Ponds

A Vision for Enhancement and Management

Prepared for

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Background and Purpose

Over the past four decades, Delta Ponds has transitioned from an abandoned quarry into a valuable community asset, providing wildlife habitat and recreational opportunities within an otherwise urbanized setting.

Delta Ponds is a unique and valuable open space resource situated adjacent to the Willamette River in a heavily urbanized portion of Eugene. A remnant of an aggregate mining operation, this 150-acre ecosystem of ponds, channels, uplands, and wetlands owned by the City of Eugene and Lane County has evolved into a favorite spot for bird watching, fishing, and hiking and provides valuable habitat for a variety of wildlife. The area also poses a number of difficult management issues such as invasive plant and animal species colonization, rare wildlife species, access management challenges, and water quality issues.

Over the past several years, significant effort and resources have been directed toward the enhancement of the Delta Ponds system including its habitat, access, aesthetics, and hydrologic function. Partners in this effort include the City of Eugene (City), the U.S. Army Corps of Engineers (Corps), Lane County, the U.S. Bureau of Land Management (BLM), Oregon Parks and Recreation Department, Oregon Department of Fish and Wildlife (ODFW), and the University of Oregon (UO), not to mention numerous dedicated Rotary Club and Stream Team volunteers. In addition, a group of regional partners was formed through the efforts of former Mayor Jim Torrey and Oregon Solutions in an effort to bring together those who can help the Delta Ponds reach its potential. This group includes representatives from community service organizations, property owners, regulatory agencies, neighborhood associations, and other interested parties. In 2003, members of the partners group signed a declaration of cooperation, demonstrating their support and commitment to the project.

Great horned owl

The purposes of this management plan are threefold: 1) to develop a long-term vision for the Delta Ponds system including how it fits into the broader regional park, recreation, and open space system; 2) to incorporate the long list of planned and proposed enhancements for the area into a single coordinated plan; and 3) to chart out management objectives and actions that will be needed to maintain the enhanced facility over the long-term.

Delta Ponds viewed from the south (2004 aerial photo and tax lot lines).

Numerous planning efforts such as the Corps Section 206 Restoration Project, the Cooperative Conservation Initiative funded vegetation management effort, and several City-initiated recreation and habitat enhancement efforts are well underway and are likely to be implemented within the coming years. This management plan is assuming that these enhancements will proceed as planned and recommended management actions will reflect this assumption.

This report has been organized into the following sections:

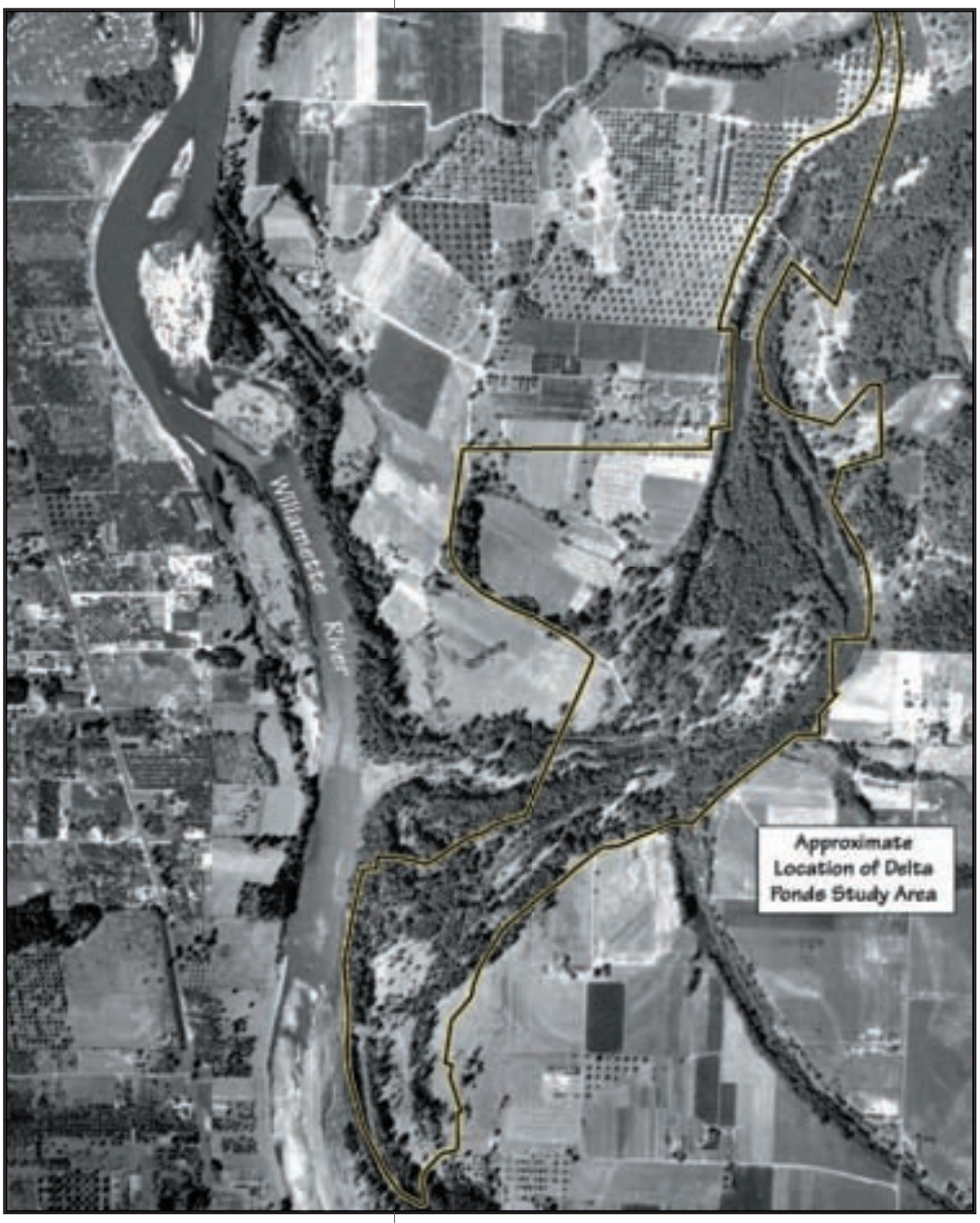
- Context
- Site History
- Existing Conditions
- Planned and Proposed Site Improvements
- Delta Ponds Vision
- Proposed Management Goals and Recommended Actions
- Implementation Priorities

Planning Areas

Five planning areas have been identified by the Corps as part of the Section 206 Restoration Project and are referred to throughout this report. Area-1 includes the southern ponds to the west of Goodpasture Island Road; Area-2 includes the ponds between Delta Highway and Goodpasture Island Road as well as the portion of Dedrick Slough north of the ponds; Area-3 includes the ponds to the east of Delta Highway; and Area-4 includes the grassy area north of Goodpasture Island Road and east of Dedrick Slough. Area-5 (not shown on map) includes the remnant channel on the west side of the Willamette River, but is not a component of this management plan since it will be managed as part of the West Bank Park.

Site History

Historically, the Willamette River and its floodplain consisted of a broad network of side channels, oxbow lakes, wetlands and riparian forest. This was particularly true in the upper reaches of the river near Eugene and Springfield where 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 species 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 (Christy et al. 1999 based on the General Land Office surveys of the 1850s) the current Delta Ponds area was part of a broad riparian forest over a mile in width associated with the meandering Willamette River. 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 the time the area was settled until the 1950s, the land on Goodpasture Island was used primarily for farming, with a few scattered homes present.



1936 Aerial Photo

The completion of the major flood control dams on the upper Willamette River in the 1950s and 1960s significantly altered the character of the river system including the Goodpasture Island area. From that time, the Willamette River has essentially been confined to its present day channel as it passes through Eugene, and is much less prone to flooding. The resultant loss of the side channels and backwater areas has contributed to the decline of the wildlife species dependant on this habitat.

As the Eugene area began to rapidly urbanize following World War II, the rich aggregate deposits left over from millenniums of deposition were mined, in part for use in the construction of the adjacent Delta Highway and Beltline Road. It is estimated that 2 million cubic yards of sand and gravel were extracted from the site in a 20-year period ending in 1962 (Gallagher, 1980). Following the completion of the mining operation, the ponds were essentially abandoned and natural succession was allowed to occur. No effort was made to reclaim or enhance the area following the mining operation, and much of the area is now heavily colonized by invasive non-native vegetation and hydrologic flow in and out of the ponds is limited.

This 1963 aerial photo shows the ponds just after the aggregate mining operation ended and just prior to the urbanization of the Goodpasture Island area.

In 1979 and 1980, the City purchased approximately 88 acres of the ponds for open space preservation, for a total cost of $801,000 using a combination of federal, state, and local funds. In 1988, Lane County purchased an additional 8 acres for $31,000. From the time of these purchases, the ponds have remained largely unchanged, with the exception of minimal maintenance, some recent habitat restoration efforts, and the addition of recreational facilities including an overlook and access point in 1998. In 2002 the final segment of the East Bank multi-use path, which passes through the southern ponds, was constructed, and a gravel surfaced trail at the north end of the ponds was added in 2004. However, significant enhancement efforts are being planned by the City and Corps and are described later in this report. In 2003, the City Parks and Open Space Division hired a full time Delta Ponds Vegetation Enhancement Coordinator to assist with coordination of the capital improvement enhancement projects planned for the area.

Urban development in many cases is situated in close proximity to Delta Ponds as is the case along the northern edge of the Area-2 ponds.

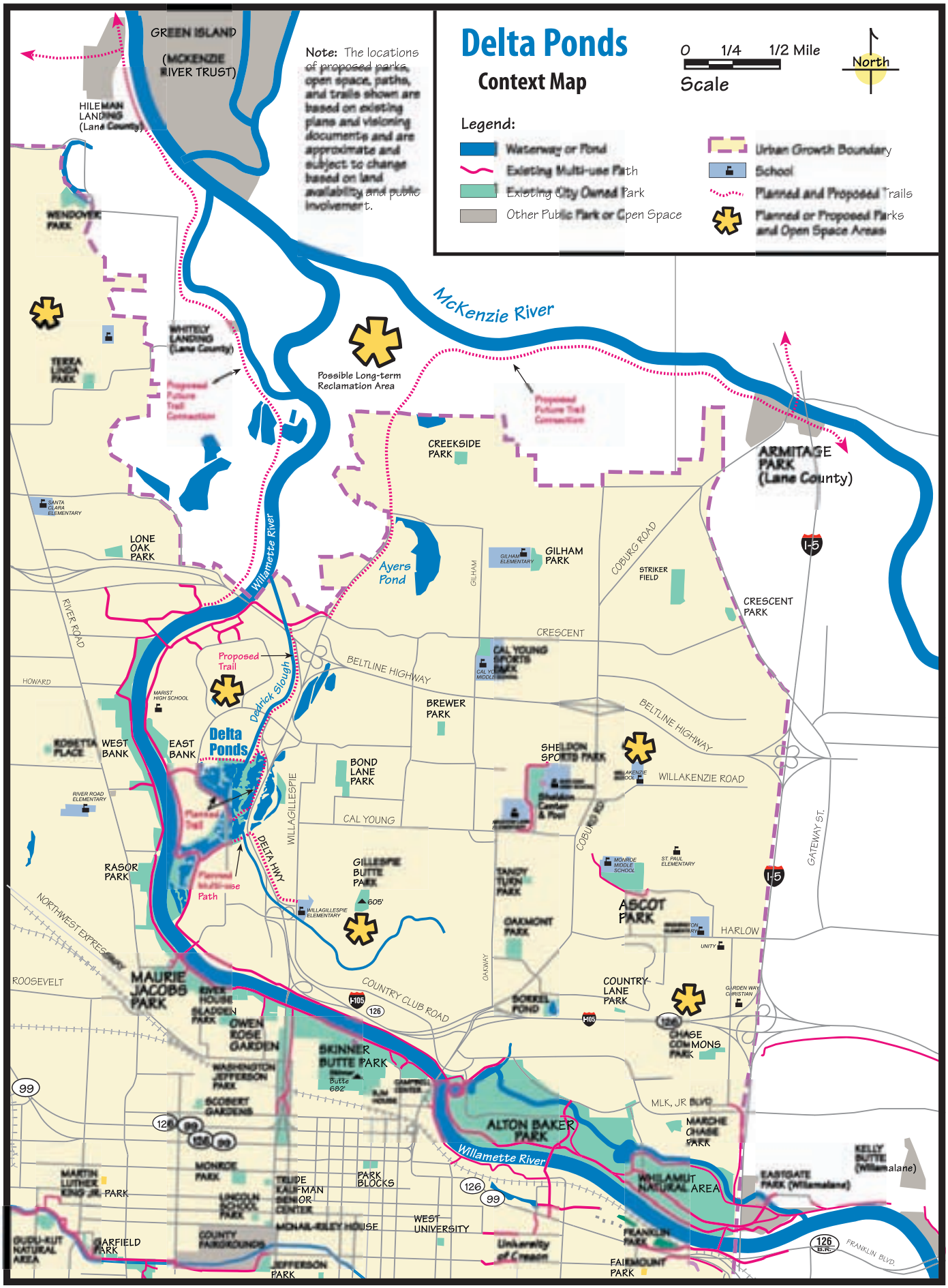
Context

The Delta Ponds and Dedrick Slough system is situated in one of the most highly urbanized areas of Eugene. Adjacent uses consist of extensive commercial development to the south including the Valley River Center and numerous office buildings and auto dealerships, a low density residential neighborhood to the east; and extensive multi-family complexes to the north and west. Goodpasture Island Road and Delta Highway, two significant area transportation corridors, physically bisect the Delta Ponds complex.

Although situated in an urban setting, the Delta Ponds system lies within close proximity of several very significant park and open space resources and recreational facilities. The closest of these is the series of interconnected City owned linear parks lining both sides of the river. These parks connect to the Delta Ponds complex at both its southern and northern ends. The newly constructed East Bank multi-use path, which runs along the river, passes directly through the southern ponds in Area-1 and over Dedrick Slough on the northern end of the site. Upstream of Delta Ponds, this chain of riverside parks connects with two other major metropolitan parks, Alton Baker and Skinner Butte. These two parks have direct recreational connections to Delta Ponds via the existing riverside multi-use path system.

The newly constructed East Bank Multi-use Path passes through the Area-1 ponds.

Down river from Delta Ponds lie two significant open space areas. The first is the 1,200 acre Green Island property which lies just to the north of the McKenzie River confluence and was recently acquired by the McKenzie River Trust for habitat conservation and floodplain restoration. Second is the complex of quarries that lie immediately to the south and east of the McKenzie River confluence. Although currently in private ownership, these quarries have been noted in both the *Rivers to Ridges* regional park and open space

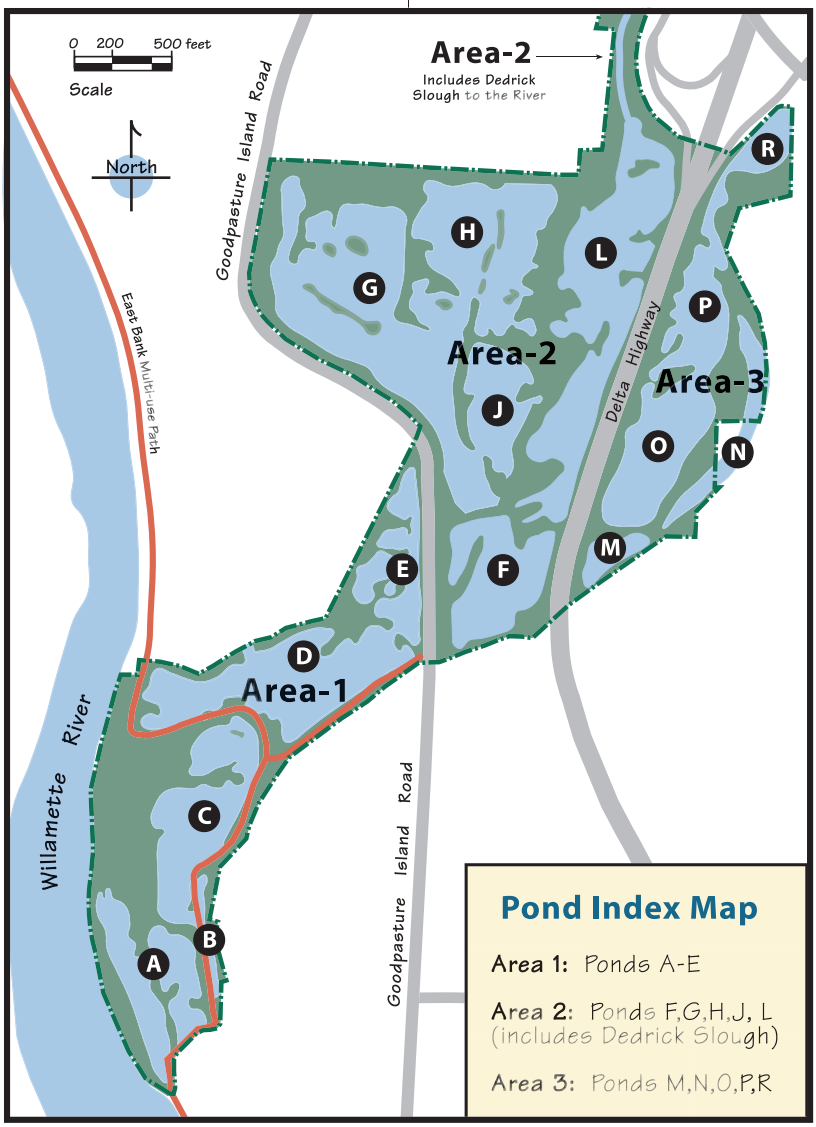

Delta Ponds
Context Map
0 1/4 1/2 Mile
Scale
North
Legend:
Waterway or Pond
Existing Multi-use Path
Existing City Owned Park
Other Public Park or Open Space
Urban Growth Boundary
School
Planned and Proposed Trails
Planned or Proposed Parks and Open Space Areas
Note: The locations of proposed parks, open space, paths, and trails shown are based on existing plans and visioning documents and are approximate and subject to change based on land availability and public involvement.
GREEN ISLAND (MCKENZIE RIVER TRUST)
HILEMAN LANDING (Lane County)
WENDOVER PARK
TEKKA LINDA PARK
WHITELY LANDING (Lane County)
Proposed Future Trail Connection
McKenzie River
Possible Long-term Reclamation Area
CREEKSIDE PARK
ARMITAGE PARK (Lane County)
SANTA CLARA ELEMENTARY
LONE OAK PARK
Willamette River
Ayers Pond
GILHAM
GILHAM ELEMENTARY
GILHAM PARK
COBURG ROAD
STRIKER FIELD
CRESCENT PARK
I-5
RIVER ROAD
CRESCENT
CAL YOUNG SPORTS PARK
BELTLINE HIGHWAY
HOWARD
Proposed Trail
Dedrick Slough
MARIST HIGH SCHOOL
BREWER PARK
ROSETTA PLACE
WEST BANK
EAST BANK
Delta Ponds
SHELDON SPORTS PARK
WILLAKENZIE ROAD
BOND LANE PARK
RIVER ROAD ELEMENTARY
WILLAGILLESPIE
CAL YOUNG
Planned Trail
DELTA HWY
COBURG RD
GATEWAY ST.
RASOR PARK
GILLESPIE BUTTE PARK
605'
TANDY TURN PARK
MONROE MIDDLE SCHOOL
ST. PAUL ELEMENTARY
Planned Multi-use Path
WILLAGILLESPIE ELEMENTARY
ASCOT PARK
HARLOW
NORTHWEST EXPRESSWAY
OAKMONT PARK
UNITY
OAKWAY
ROOSEVELT
MAURIE JACOBS PARK
COUNTRY CLUB ROAD
COUNTRY LANE PARK
GARDEN WAY CHRISTIAN
RIVER HOUSE
SLADDEN PARK
SORREL POND
I-105
126
OWEN ROSE GARDEN
CHASE COMMONS PARK
SKINNER BUTTE PARK
Butte 682'
WASHINGTON JEFFERSON PARK
99
SCOBERT GARDENS
MLK, JR BLVD
ALTON BAKER PARK
MARCHE CHASE PARK
Willamette River
KELLY BUTTE (Willamalane)
MONROE PARK
MARTIN LUTHER KING JR. PARK
TEUDE KAUFMAN SENIOR CENTER
PARK BLOCKS
WHILAMUT NATURAL AREA
EASTGATE PARK (Willamalane)
LINCOLN SCHOOL PARK
MCNAIR-RILEY HOUSE
WEST UNIVERSITY
FRANKLIN PARK
GUDU-KUT NATURAL AREA
GARFIELD PARK
COUNTY FAIRGROUNDS
University of Oregon
FAIRMOUNT PARK
JEFFERSON PARK
FRANKLIN BLVD.

Dedrick Slough near the confluence with the Willamette River

vision (2003) and the draft *City of Eugene Park, Recreation, and Open Space Comprehensive Plan* (2004). The quarries have great potential for future reclamation and could be included in the region's open space system once aggregate operations have ended. The *Rivers to Ridges* vision and the *Regional Transportation Plan* (2004) both identify a potential future recreational corridor running between Delta Ponds and the confluence area with further trail connections east along the McKenzie River all the way to Armitage Park.

Hydrology

The Delta Ponds currently have no regular surface inflow from the Willamette River. The water in the ponds originates from a number of sources including ground water flow, urban runoff, and in some cases occasional flooding from the Willamette River into the southern most ponds (Area-1) during high flows. Sediment deposition is evident in these ponds due to this periodic flooding. Many of the ponds in the system are hydrologically isolated and differences in surface elevation of ponds immediately adjacent to one another can vary by several feet. Some of the northern-most ponds (Area-2) do have a direct connection into Dedrick Slough which drains toward the Willamette River approximately 4,500 feet to the north. Due to the limited inflow and outflow during the summer months, most of the ponds tend to become very warm, with water temperatures as high as 85 degrees (F) having been recorded. For reference, the adjacent Willamette River reaches a maximum of 64 degrees (F) during the summer months.



The ponds average 5.3 feet in depth with a maximum recorded depth of 10.4 feet. In most cases, the steep-sided banks of the ponds transition almost directly from upland to open water, which has created a situation where very little riparian or wetland hydrology exists. Listed on the following page is a description of the general hydrologic conditions that exists in each of the four planning areas based on field observations and as described in the Corps Section 206 Restoration Project Report and Environmental Assessment (September 2002). Conditions described here are those which existed prior to the implementation of the proposed restoration project:

Area-1 (southern ponds to the west of Goodpasture Island Road)
A total of five distinctive ponds are located in this area. Of these, ponds A, B, and C are periodically connected to the Willamette River during high flows and have received some sediment deposition during those periods. A small outflow channel periodically drains water from the ponds back into the river. The surface elevation of the ponds drops significantly during the summer and fall. With the exception of periodic flooding, the primary water source for these ponds is a combination of ground water percolation, urban runoff, and air conditioner water discharge from a nearby building. There is currently no surface connection between the ponds on the south and north sides of this planning area. The only connection between the Area-2 ponds to the east of Goodpasture Island Loop is through a culvert under the road, which only functions during very high flows. With flow limited in these ponds, summer water temperatures as high as 79 degrees (F) have been recorded.

Area-1 Pond A

Area-2 (ponds between Goodpasture Loop and Delta Highway and Dedrick Slough)
A total of three distinct ponds (not connected by surface flow) exist in this planning area. The water level between ponds often varies by one to two feet, with the ponds separated by levees remaining from the mining operation. These ponds reach a maximum depth of 10 feet and contain an extensive network of islands. With flow limited in these ponds, water temperatures have been recorded as high as 85 degrees (F) during the summer months. Pond L in this area currently has a direct connection to the Willamette River via Dedrick Slough, which drains to the north. Dedrick Slough is a remnant side channel of the Willamette River, and flows approximately 4,500 feet between Delta Ponds and the river. On occasions when the river is high, water backs up into the slough.

Pond H in Area-2

Area-3 (ponds east of Delta Highway)
A series of five distinct ponds are located in this area east of Delta Highway. These ponds are hydrologically connected to the ponds in Area-2 by groundwater and by two perched culverts which function only during very high water. The water in these ponds comes from subsurface flow and stormwater discharge from the adjacent residential area and the highway. Summer water temperatures as high as 84 degrees (F) have been recorded in these ponds.

Area 4

This area is located on the west side of Delta Highway adjacent to Dedrick Slough and Pond L. This area includes a portion of mowed highway right-of-way as well as a seasonal wetland vegetated mainly of exotic pasture grasses and is in Lane County ownership. A portion of this area may potentially be used for Delta Highway interchange improvements in the future.

Water Quality

The current lack of consistent inflow or outflow on most of the ponds has resulted in a number of water quality issues. As mentioned above, water temperatures in the ponds can reach as high as 84 degrees (F) during the summer months due to lack of shade and minimal flow. Runoff entering the ponds from adjacent residential and commercial development is the source of many common urban pollutants such as nutrients (fertilizers) and fecal coliform. The combination of high water temperatures and elevated nutrients has caused extensive algae growth in the ponds and as a result, seasonally low dissolved oxygen levels in the system.

In support of the Corps Section 206 Restoration Project, water samples for chemical analysis were taken in Dedrick Slough and ponds in areas 1-3 for a number of parameters. Most samples taken were found to have elevated levels of fecals and the nutrients total phosphorus and total kjeldahl nitrogen (TKN). Of the thirteen metals measured, only chromium exceeded the criterion. No polycyclic aromatic hydrocarbons (PAHs), herbicides, or pesticides were detected. The results of analysis indicated the source of enrichment of nutrients and fecals were likely urban runoff and the elevated chromium is likely from street runoff.

Soils and Pond Sediments

The Lane County Soil Survey (1987) maps the soils in the Delta Ponds project area as *Fluvents, Nearly Level* [48] and *Pits* [110], which represent newly deposited sediment derived from mixed sources and 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 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 benzo fluroanthene. These contaminants were above screening levels listed under the Dredge Material Evaluation Framework Guideline, which would prohibit dredging as a maintenance option in Delta Ponds without more detailed testing. An industrial point source is the suspected source of these pollutants and is currently being addressed.

Existing Vegetation Communities

Although non-native vegetation has become well established across much of the site, pockets of native species including mature trees, shrubs, and understory species are present. A significant invasive species control effort is now underway on the site with major native planting efforts planned for the coming year. There are four general vegetation communities or zones currently found on the site.

Upland

Upland areas are located throughout the site, generally on the high points between and adjacent to the ponds and on some of the islands. Non-native species such as Armenian blackberry (*Rubus armeniacus*), Scot's broom (*Cytisus scoparius*), and English ivy (*Hedera helix*) currently dominate most of these areas. However, much of this exotic vegetation is currently being removed as part of the Cooperative Conservation Initiative (CCI) funded vegetation management project (described on page 24) and other smaller scale City initiated efforts. Some native species such as mature bigleaf maple (*Acer macrophyllum*), snowberry (*Symphoricarpos albus*), and sword fern (*Polystichum munitum*) can be found in these areas.

Riparian

Due to the steepness of most of the banks that transition from upland to open water, the riparian zones on site are typically relatively narrow. Non-native vegetation is abundant in these areas, but some mature 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 stolonifera*), and Douglas spiraea (*Spiraea douglasii*) are present. Area-1 currently contains some of the larger and higher quality riparian habitats as pictured to the right.

Riparian forest and emergent wetland in Area 1

Wetland

Emergent wetland areas can be found adjacent to some of the ponds and are dominated by reed-canarygrass (*Phalaris arundinacea*), yellow flag iris (*Iris pseudacorus*), beggarstick (*Bidens tripartite*), slough sedge (*Carex obnupta*), and rice cut-grass (*Leersia oryzoides*). Also present in the area bordering Dedrick Slough (Area-4) is a degraded wet prairie area, mainly dominated by non-native pasture grasses.

Open water

Open Water

Open water communities within the ponds are largely dominated by highly invasive non-native Brazilian watermilfoil (*Myriophyllum aquaticum*) and Eurasian watermilfoil (*Myriophyllum spicatum*) along with large algae mats in some ponds. Limited native emergent species are present in some areas including mosquitto fern (*Azolla filiculoides*), which has become more common in recent years.

Rare plant populations

Based on an assessment done in support of the Corps Section 206 Restoration Project, no federally *threatened* or *endangered* plant populations are thought to currently exist on the site.

Wildlife

With the variety of habitat zones found within the Delta Ponds system, abundant wildlife, both native and non-native can be found. Mammals such as beaver and nutria are common in and around the ponds, and river otters have been observed on several occasions. A total of 106 species of birds have been recorded including great blue heron, great egret, great horned owl, osprey, wood duck, downy woodpecker, American widgeon, and bald eagle (Gordon, 2004). Amphibians including tree frog and bull frog (non-native); and reptiles including western pond turtle and red-eared slider (non-native) are also present on the site.

Western pond turtle

The Delta Ponds are utilized by the native western pond turtles (Federal endangered species status: *species of concern* and State endangered species status: *critical*), with an estimated population of approximately sixty individuals currently present in the ponds (Services Learning Program, 2005). However, the turtle population is not thriving in the system for a number of speculated reasons including limited habitat, predation, and competition by the red-eared slider, an introduced turtle species. The western pond turtle has specialized habitat needs during its life cycle including areas for nesting, overwintering, and rearing. Although Delta Ponds does provide aspects of good habitat for the pond turtle, improvements in all habitat categories, as well as reduction of predation, are needed for the population to thrive. More detail about the existing western pond turtle habitat at Delta Ponds can be found in the *Draft Delta Ponds Turtle Management Plan* (2004).

A wide variety of fish species can be found in the ponds and Dedrick Slough. 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 are still present. In addition, shiners, cutthroat trout, rainbow trout, and Chinook have also been found in the ponds (Russ Fetrow Engineer, Inc. 1989). Currently, the habitat for salmon is poor do to lack of connectivity with the river and high summer water temperatures.

Wood ducks

In an effort to find out more about the current fish populations and migration to and from the Willamette River via Dedrick Slough, a two-way fish trap was installed on the slough immediately north of Beltline Road and may be re-installed in future years. The City has contracted with the UO Environmental Studies Service Learning Program (SLP) to develop protocols for and implement a fish and wildlife monitoring program at Delta Ponds the winter and spring of 2004-2005. This work is being done in close coordination with ODFW and City staff. In addition to the fish trap, a public fishing derby was held in May 2005 to census fish.

Site Access and Recreation

Formalized access and recreational facilities are currently limited at Delta Ponds. However, in recent years access has been greatly improved with the construction of the final segment of the East Bank Multi-use Path, which runs through and adjacent to the southern ponds, and with the construction of a gravel surfaced trail along the northern edge of the Delta Ponds system. Informal parking is currently available in two locations along Goodpasture Island Road for a limited number of cars. The northern parking lot of the adjacent Valley River Center also provides unofficial, but convenient parking for accessing the ponds. A viewing platform is located near the southern parking area near Goodpasture Island Loop. A number of unofficial trails have developed over time, mainly along the edges of some of the ponds and the river.

The East Bank Multi-use Path provides public access to the southern ponds.

Even with the limited facilities present today, the area is heavily used by people commuting to work or to stores along the multi-use path and for a variety of recreational activities, including walking, running, biking, rollerblading, geo-caching, bird watching, fishing, and non-motorized boating. The City of Eugene recognizes that recreation in and around Delta Ponds will continue to increase as the surrounding population and associated developments continue to grow and as more facilities are provided. Delta Ponds offers a unique and valuable opportunity to provide a wilderness-like experience in a centrally located urban setting.

In addition to bird watching and nature study boating and fishing are currently common recreational activities at Delta Ponds.

The City has developed a plan for recreation improvements in the Delta Ponds area which will be implemented in the coming years with the goal of increasing public access and recreation and providing educational opportunities and wildlife viewing for visitors to the ponds. A description of these improvements is included in the *Planned and Proposed Site Access* section.

Education and Community Involvement

Delta Ponds is currently being used as an educational resource by the City of Eugene Stream Team and other local educators. Also, a significant number of individuals and groups volunteer on various enhancement and monitoring activities.

Volunteers planting at Delta Ponds

The City of Eugene's Stream Team has been working out at Delta Ponds for many years and is participating in the following activities:

- monitoring water levels in the ponds and along the river adjacent to the ponds;
- collecting native seeds for use in re-vegetation efforts at the ponds;
- fish and wildlife monitoring;
- tree and shrub planting, maintenance and monitoring at a test planting site;
- invasive species mapping and removal (purple loosestrife and other species)
- regular volunteer parties to plug willows, protect trees from beavers, and improve habitat; and
- trail and overlook maintenance on Goodpasture Island Road (Downtown Lions Club).

The Volunteer in Parks program has been working with multiple Eugene area Rotary Clubs and other community volunteers to build a gravel trail and boardwalk along the northern end of the ponds.

The City will be developing interpretive materials and educational support amenities that will be integrated into the recreation features at Delta Ponds. The proposed improvements will facilitate the use of Delta Ponds as an outdoor classroom for area youth and as an informal education tool for the general public. Additionally, volunteer opportunities will continue to connect the community to this valuable resource.

Fish trap on Dedrick Slough

Ongoing Monitoring Program

A large number of monitoring efforts for plants, wildlife, and water quality are currently underway and will make an important contribution for shaping planned enhancement efforts and adaptive management strategy of the Delta Ponds system. A brief description of current monitoring efforts is listed on the following page:

Fish and Wildlife Monitoring:

- Fish monitoring
  - installation and daily checking of a two-way fish trap in Dedrick Slough
  - seining (netting) survey of fish in the ponds
  - fishing derby open to public (May 2005)
- Amphibian monitoring
  - salamander survey
  - red-legged frog egg survey
  - tree frog and bull frog vocalization surveys
- Turtle monitoring
  - adult turtle trapping, tagging and visual surveys
  - turtle hatchling surveys
  - removal of non-native turtles
  - nest site monitoring and nest protection
- Bird monitoring
  - neotropical migratory bird surveys
- Vegetation monitoring
  - 2004 aerial photo analysis of vegetation cover at Delta Ponds.
  - The SLP students are developing the monitoring protocols and are working closely with Stream Team volunteers to carry out this first year's survey efforts.

Other Monitoring Efforts

- Hydrology monitoring – a dedicated Stream Team volunteer has been reading water levels on four staff gauges installed in the ponds for the past five years. Three new staff gauges were installed in the river adjacent to the ponds at the end of 2004. The data being gathered from these gauges is being used to design the placement of weirs and culverts for the Corps of Engineers project.
- Water quality monitoring - City of Eugene Stormwater Monitoring staff have installed continuously reading probes at four sites in Delta Ponds to monitor temperature and dissolved oxygen before and after the reconnection of the ponds to the river. This will provide the City and the Corps of Engineers with valuable information on the impact of the restoration efforts on the water quality of the ponds.
- Photo-point monitoring - Fifteen photo-point monitoring stations have been set up around the ponds to monitor visual changes in vegetation, habitat, recreation and hydrology as the result of many of the projects now taking place at Delta Ponds. Photos will be taken twice a year for a period of five years or more.

Current Maintenance Activities

Currently, very few regularly scheduled maintenance activities occur at Delta Ponds, although that will change dramatically with the implementation of planned enhancement efforts in the coming years. The following maintenance activities now occur on a regular basis in the Delta

Ponds area:

- Mowing along Goodpasture Island Road right-of-way
- Mowing of grassy areas at radio tower
- Multi-use path maintenance (mowing and leaf debris removal)
- Maintenance of the Delta Ponds overlook area off of Goodpasture Island Road by *Downtown Lions,* a *Stream Team* adoption group, twice annually
- Invasive species removal and abandoned camp site clean-up by municipal offenders crew as needed

Several significant efforts aimed at improving the habitat, hydrology, and recreational facilities of Delta Ponds are now well underway and will likely be implemented over the next several years. These efforts are in support of the City's long-term goal of improving the overall function and accessibility of this urban natural area and are being closely coordinated to avoid conflicts. The complex nature of enhancing the Delta Ponds system requires that partnerships be formed and that multiple funding sources be utilized. The major enhancement efforts now underway at Delta Ponds are listed below:

Delta Ponds Section 206 Restoration Project

The City of Eugene has entered into partnership with the U.S. Army Corps of Engineers to improve critical habitat at Delta Ponds for a variety of fish and wildlife species. This restoration effort has a special emphasis on declining native species such as salmon, western pond turtles, and neotropical migratory birds and focuses on creating habitat more suitable for these species. The restoration effort, estimated at $6.2 million, is being funded through Section 206 of the Water Resource Development Act which provides 65 percent funding for aquatic habitat restoration projects. The City will be contributing more than $2 million in land and matching funds from local stormwater user fees and the 1998 voter-approved parks and open space bond measure.

The major objectives of this effort are to:

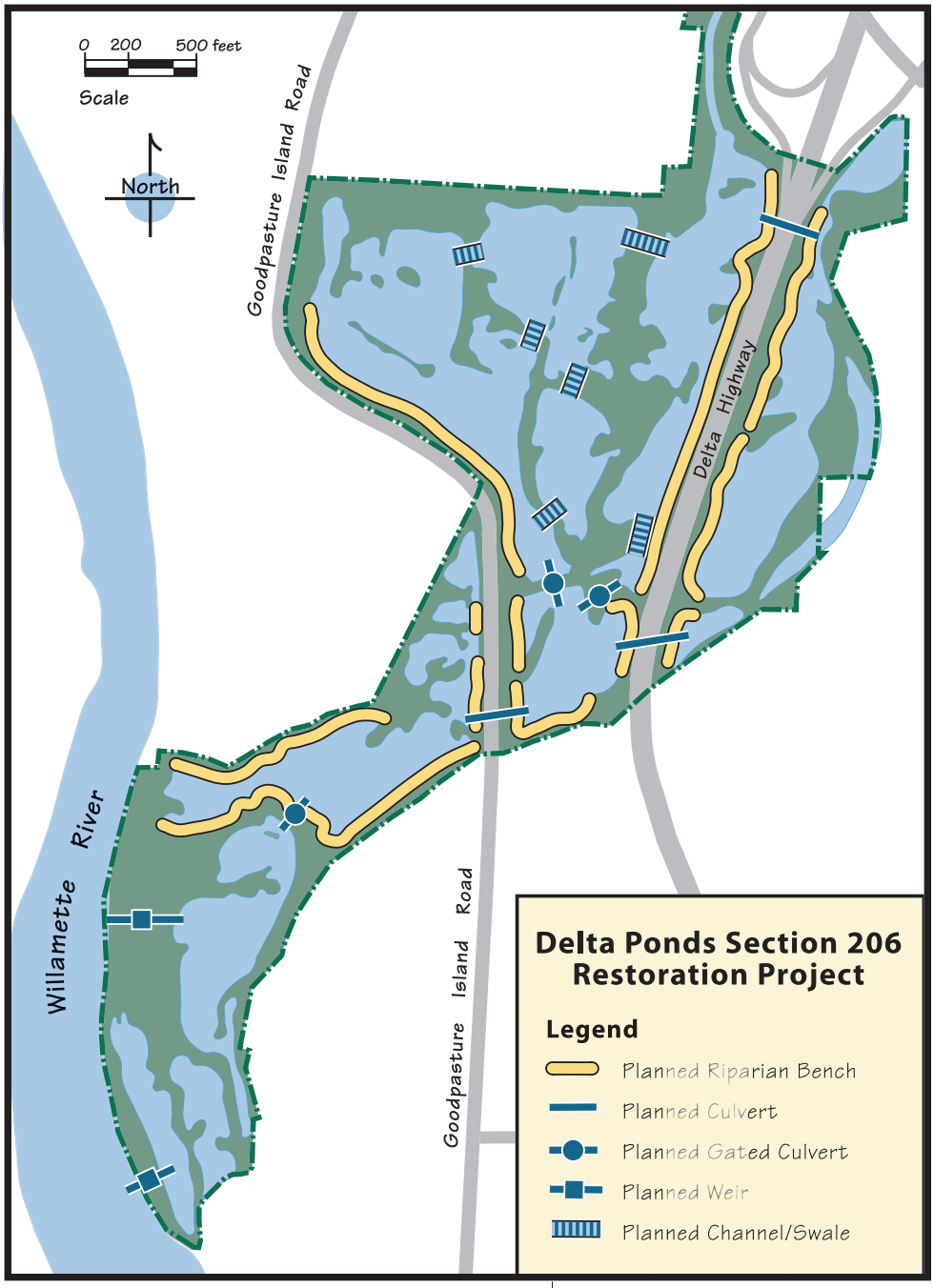
- reestablish the hydrologic connection between the Willamette River and Delta Ponds during winter high water;
- create more gradually sloped riparian benches along the banks of the ponds;
- replace invasive, non-native vegetation with native vegetation;
- enhance habitat for juvenile Chinook salmon, western pond turtles, and neotropical migratory birds; and
- provide recreational and educational opportunities for the community, while limiting habitat impacts.

In developing the preferred project alternative, the Corps has gone through an extensive plan formulation process, which developed and assessed a total of eleven restoration alternatives. Each alternative was assessed for cost effectiveness based on a comparison of the *without project* (existing) condition. The benefits of the alternatives were measured as the net gain in environmental outputs over the existing conditions. The cost of implementing each of the alternatives were then compared with the benefits of each alternative, using both a cost-effectiveness analysis and an incremental cost analysis. The habitat benefits were evaluated using a modified Habitat Evaluation Procedure (HEP) for the target species of salmon, amphibians, western pond turtle, and neotropical migratory birds. Based on this analysis, a single preferred alternative, which is both cost effective and provides a high level of environmental outputs was selected and is described below. A complete description of this assessment can be found in the *Eugene Delta Ponds Section 206 Restoration Project Ecosystem Restoration*

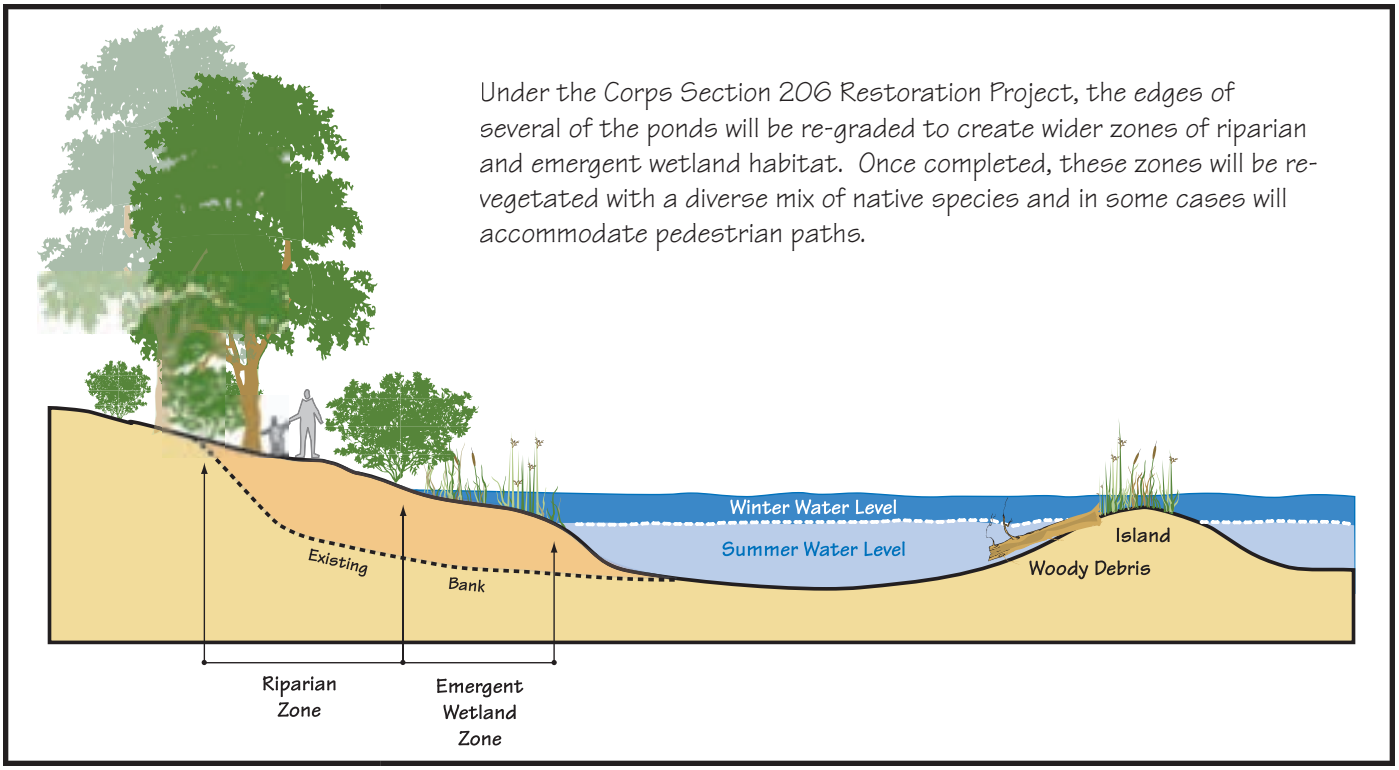
Report and Environmental Analysis (September 2002).

Recommended Plan

The recommended plan selected under the Corps analysis is an alternative which focuses the enhancement effort on the ponds in Areas-1, -2, and -3 as well as enhancements to Area-5 (the side channel on the west side of the Willamette River not covered in this management plan). The primary focus of the project will be to reconnect hydrologically much of the Delta Ponds area to the Willamette River during winter and spring flows and enhance the associated riparian and wetland communities. This will be achieved through the addition of numerous new culverts and swales which will connect hydrologically the ponds, Dedrick Slough, and the river. The flow from the Willamette River into the ponds will be metered and controlled by two weirs between the river and the Area-1 ponds and by a large gated culvert between ponds C and D. This resultant improved flow will provide area for salmon rearing and refuge during Willamette River flood events and improve overall water quality in the ponds.



To improve riparian and wetland habitat, the plan proposes re-grading the edges of several of the ponds to create wider zones of riparian and emergent wetland habitat. These zones will be re-vegetated with a diverse mix of native trees, shrubs, forbs, and grasses. Habitat improvements for target species under this plan include the placement of large woody debris into the ponds and channels and the removal of non-native vegetation throughout the project area. The end result will be a system that more closely mimics a natural riverine environment with an increased and more complex distribution of flow, improved water quality (temperature and pollutants), diverse native vegetation, and much improved habitat conditions for Chinook salmon, western pond



Cross section of typical riparian bench enhancement

turtle, neotropical migratory birds, and other native species. Specific enhancements for Areas-1 through -3 are listed below (insert diagram map showing Ponds A-R):

Area-1 (lower ponds)

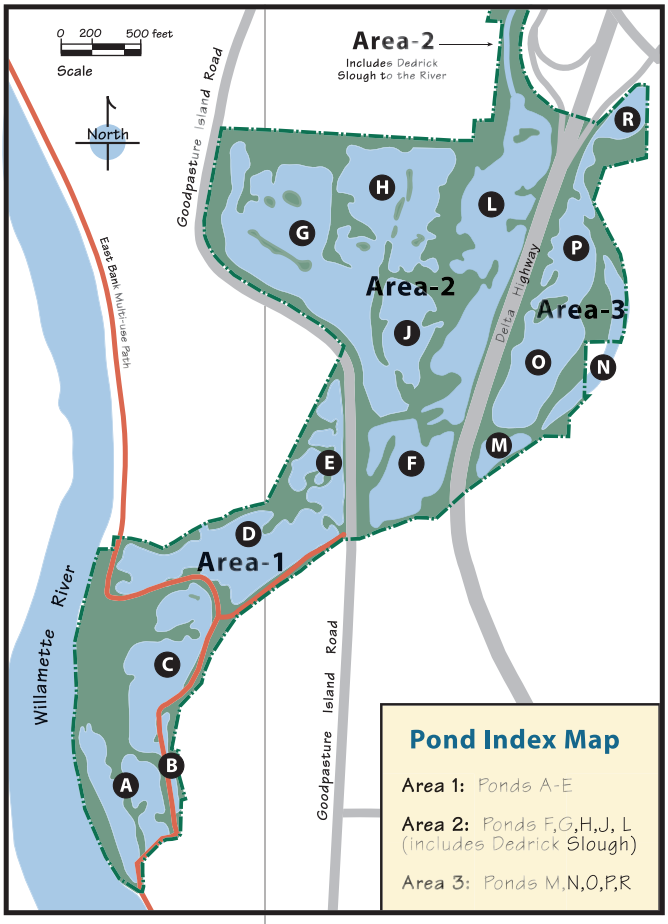
- Two weirs would be constructed to allow flow to enter the ponds when the Willamette River flow is in excess of 3,500 cfs.
- A 12-foot diameter gated culvert will be installed under the existing levee separating Pond C and D. This will allow the flow into the ponds to be reduced or cut-off if desired.
- The steep banks of most of Pond D and a portion of Pond E will be re-contoured to produce more gradual slopes (3:1 or shallower). This will result in broader riparian and emergent zones. Approximately 20,000 CY (cubic yards) of fill material will be imported to construct the new banks. These areas will be planted with native riparian and emergent species immediately following grading.
- Non-native invasive plant species will be removed on approximately 5 acres of Area-1 and replanted with native trees and shrubs.
- Large woody debris will be placed in Ponds A, C, and D to provide habitat.

Area-2 (ponds between Goodpasture Island Loop and Delta Highway)

- A 12-foot wide box culvert with a “v” bottom will be placed under Goodpasture Island Road to allow flow through and fish passage between Areas-1 and -2, making a direct connection between ponds E and F.
- A 12-foot wide box culvert will be placed at the inlet of Dedrick Slough (south end of Area-2) to accommodate the planned multi-

use path extension. The City will finance this element.

- A number of swales or channels will be cut through high spots currently separating the ponds in Area-2 to allow flow from these ponds to move toward Dedrick Slough, to allow fish passage, and limit access.
- Portions of the steep banks in ponds F, G, and L will be re-contoured to produce more gradual slopes (3:1 or shallower). This will result in broader riparian and emergent zones. Approximately 62,000 CY of fill material will be imported to construct the new banks. These areas will be planted with native riparian and emergent species immediately following grading.
- Non-native invasive plant species will be removed on approximately 4 acres of Area-2 (in addition to the CCI funded invasive project removal now underway) and replanted with native trees and shrubs.
- Large woody debris will be placed in Ponds F and L to provide habitat.
- High points in Dedrick Slough will be removed to the bottom elevation of 380 feet to improve outflow and fish passage.



Area-3:

- Two 6-foot wide culverts will be installed under Delta Highway hydrologically connecting Areas-2 and -3. Flapper gates will be installed on these culverts to prevent flooding of properties adjacent to the Area-3 ponds.
- The steep pond banks adjacent to the highway embankment will be re-contoured to produce more gradual slopes (3:1 or shallower). This will result in broader riparian and emergent zones. Approximately 34,100 CY of fill material will be imported to construct the new banks. These areas will be planted with native riparian and emergent species immediately following grading.
- Non-native invasive plant species will be removed on approximately 1 acre and replanted with native trees and shrubs.
- Large woody debris will be placed into ponds M and O to provide habitat.

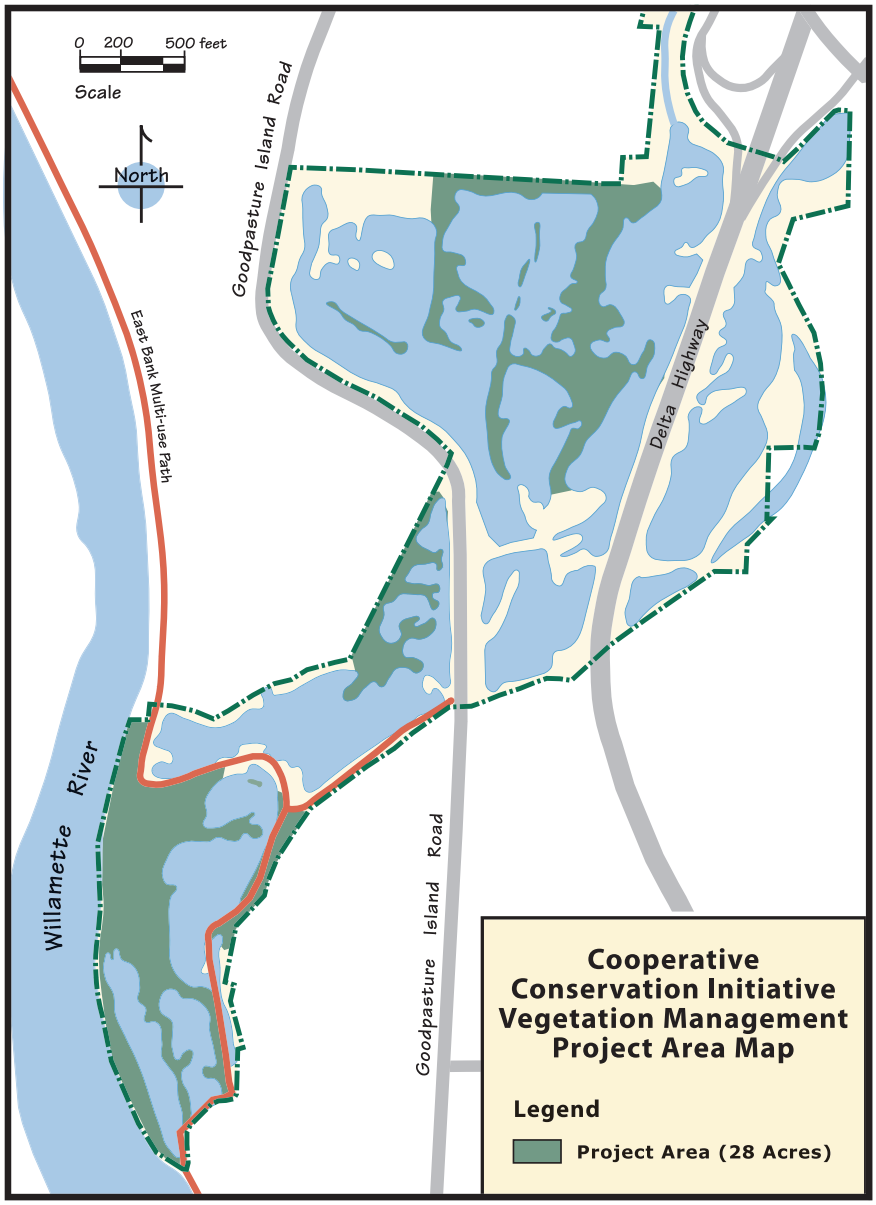
Other Plan Elements:

- 5 years of aggressive exotic vegetation removal will be performed throughout the site. Native species will be introduced into these areas as needed.
- An accessible pedestrian loop trail will run around the outside perimeter of the ponds to provide recreational access and viewpoints. The trail will make connections to the East Bank Path. Interpretive signage and seating would be included along the trials along with two pedestrian bridges.

- Two small parking areas will be constructed along Goodpasture Island Road.
- A multi-use path connection is planned along the southern edge of Area-2. The City will take the lead on designing and implementing these facilities, which may include an underpass beneath Delta Highway.

Project Status

City staff are currently working on wetland fill, land use, and water permits for the project and are coordinating with Corps staff on the design and construction of the recreation improvements. Corps staff have completed their survey work on the site and have reviewed the hydrology and hydraulics study for the project. Work on the *60 percent plans and specifications* for the project have been completed. While the start of construction for this project has been postponed, the City of Eugene is continuing to work with the Corps of Engineers to utilize the funds that have been made available to move the project forward as effectively as possible. All in-water construction will occur during the fish window from June 1 through October 31.



Cooperative Conservation Initiative Vegetation Management Grant

In 2004, the City was the recipient of a $389,000 Cooperative Conservation Initiative (CCI) through the U.S. Department of the Interior for vegetation management at Delta Ponds. This federal funding is being matched by an in-kind contribution of approximately $289,000 and $100,000 in City Stormwater funds. The focus of this work effort is invasive vegetation removal and the establishment of native vegetation on 28 acres. This effort is being closely coordinated with the $6.2 million Corps Section 206 Restoration Project and vegetation management is only occurring in areas not impacted by planned Corps of Engineers construction.

Species targeted for removal include Armenian blackberry (*Rubus armeniacus*), Scot's broom (*Cytisus scoparius*), purple loosestrife (*Lythrum salicaria*), English ivy (*Hedera helix*), English holly (*Ilex aquifolium*), and English hawthorn

(*Crataegus monogyna*). Following the removal of the exotics, the 28 acres will then be planted with a diversity of native species. This will likely include red-osier dogwood (Cornus sericea), bigleaf maple (*Acer macrophyllum*), Oregon ash (*Fraxinus latifolia*), willow (*Salix* spp.), alder (Alnus spp.), snowberry (*symphoricarpos albus*), Willamette Valley ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), and Oregon white oak (*Quercus garryana*). Additional native understory species will also be added to this area in the coming years to maximize diversity.

This effort is being implemented in four phases:

<u>Phase I</u>: Initial invasive vegetation removal. This work was successfully completed in fall 2004 with the removal of massive quantities of invasive non-native vegetation over 28 acres including several islands. Although several species were targeted, Armenian blackberry by far covered the most area, forming large monocultures in places. Because access by vehicles is limited over much of this area, crews performed the work using hand tools and motorized brush cutters. The blackberry canes were then chopped into small pieces and then spread on site. This was in an effort to avoid the cost of having to haul large quantities of debris off site and the canes will also perform an erosion control function. Following this, the blackberry crowns (roots) were grubbed out and piled onto filter fabric. Once the crowns have dried out and are no longer viable, they will also be spread evenly onto the site. A total of 18 piles of blackberry crowns have been created, with an estimated volume of 270 cubic yards (about 27 dump truck loads of material). Following vegetation removal, a total of ten species of native grasses and forbs were seeded onto this area for erosion control.

Crews removing exotic vegetation, fall 2004

Large area of blackberry removal, winter 2004

Phase II: Repeat removal of invasive vegetation
This work is scheduled for late spring 2005 and will remove any re-growth of the targeted species. It will also target several purple loosestrife populations that could not be targeted in phase I.

Phase III: Repeat removal of invasive vegetation
In fall 2005, immediately prior to the planting native shrubs and trees, any re-growth of the targeted invasive species will be removed.

Phase IV: Native tree and shrub planting
Native trees and shrubs will be planted on 9 of the 28 acres, in those areas that had the greatest cover of invasive species at the start of the project. A combination of bare root and container plants, cuttings, and seed will likely be used to re-vegetate the area over several years. Invasive vegetation will continue to be targeted to ensure success of the plantings.

Planned and Proposed Access and Recreation Improvements

The City is taking the lead on overseeing numerous efforts to increase recreational opportunities and access at Delta Ponds and the vicinity. Some of these efforts will be implemented in conjunction with the Corps Section 206 Restoration Project while others will proceed independently. While the close proximity of Delta Ponds to urban development represents certain management challenges, it also presents a great opportunity for providing recreational benefits to the many people who live and work in the area.

The City and Corps are currently proposing an approach for providing public access and utilization of the ponds, which by design and siting, will help limit potential negative habitat impacts. A $250,000 Oregon Parks and Recreation Department grant, a significant donation of property from a local business, and ongoing volunteer work are among the latest developments in a major project to enhance the Delta Ponds recreation experience.

In August 2003, The Oregon Parks and Recreation Department awarded a $250,000 grant in support of a number of the proposed facility improvements at Delta Ponds including the construction of the planned northern parking lot (June 2005) and the first leg of the planned loop trail. The City will match the state grant with $250,000 in local funds, including $200,000 from the city's park bond measure approved by local voters in 1998.

The following recreation, interpretation, and access facilities are now planned or proposed at Delta Ponds:

Parking and Amenities
Two small parking lots are planned along Goodpasture Island Road, each with the capacity of approximately ten cars. The parking lot on the north end of the ponds is currently under construction with completion scheduled for June 30, 2005. A second similar parking lot will be constructed further to the south on Goodpasture Island Road at a later date and will also accommodate one bus. Both parking lots

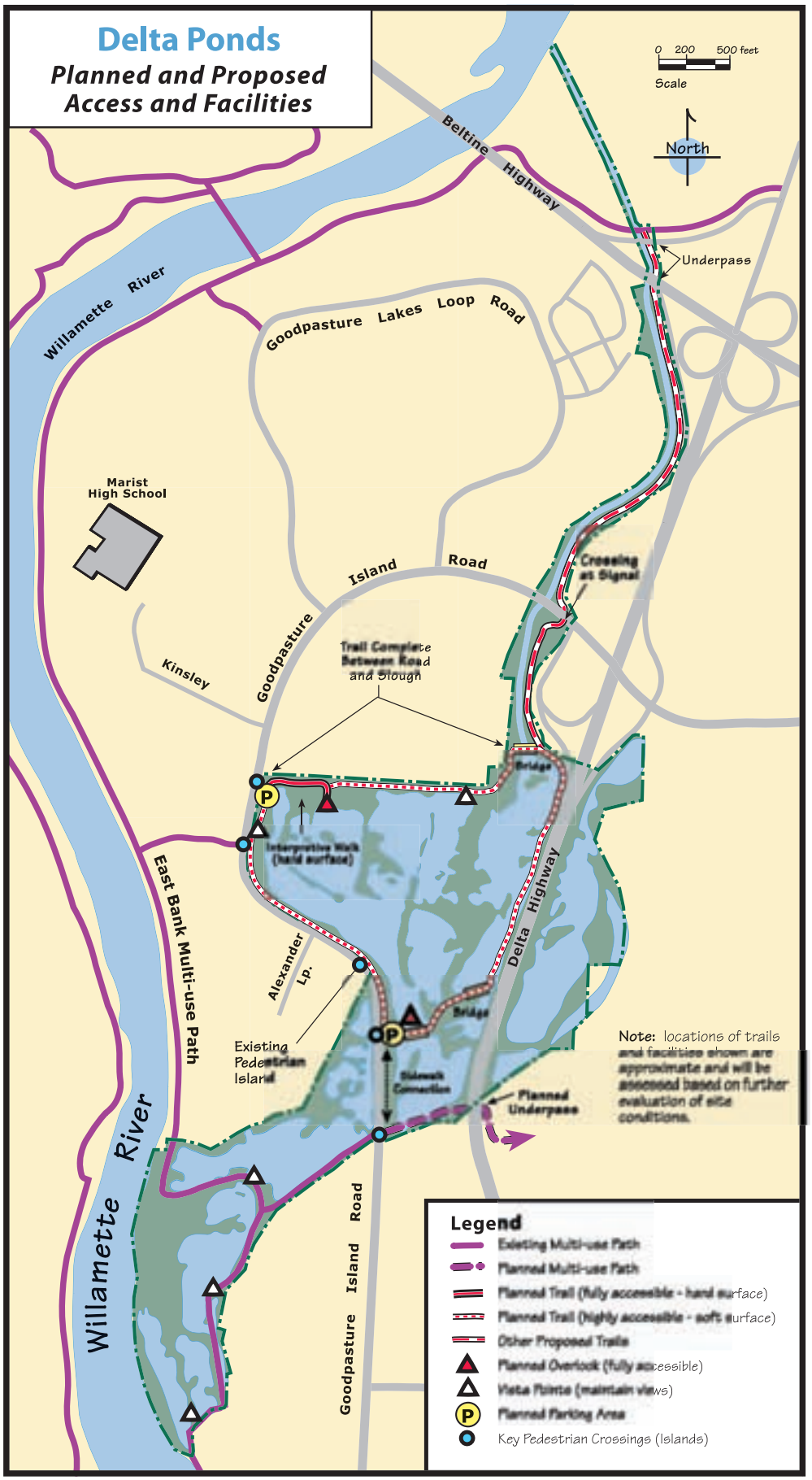
will provide direct access to the planned Delta Ponds loop trail and will include portable restrooms, drinking fountains, bike racks, benches and signage.

Trails

An accessible gravel surfaced loop trail, approximately 1.3 miles in length, is proposed along the outer perimeter of the ponds in Area-2. Scenic overlooks, interpretive signage, three bridges, and places to rest will be constructed as part of this loop trail. The first leg of this gravel trail which runs approximately 1,800 feet from Goodpasture Island Road to Dedrick Slough along the northern edge of the ponds is nearing completion. This trail segment will also include a fully accessible concrete portion leading from the parking lot to a lower boardwalk and viewing platform at the edge of the ponds.

Donation of land and access easements by John and Renate Tilson of the McKenzie River Broadcasting Company and volunteer work done by local Rotary Clubs were key to making construction of the first trail segment possible.

The City has also proposed another pedestrian trail connection along Dedrick Slough between the north end of the ponds and the existing multi-use path to the north of Beltline Road, which would be



Volunteers constructing the trail from the planned parking area to Dedrick Slough along the north edge of Delta Ponds

approximately 3,500 feet in length. This trail concept needs further study to determine if passing under Beltline Road is feasible.

Neighborhood Connections

The City is also planning a Multi-use path extension in this area, which would run from the existing East Bank Path spur starting at Goodpasture Island Road eastward along the southern edge of Delta Ponds and under Delta Highway. A construction date for this segment has not yet been set although federal funds for construction have been secured. This path will have significant benefits to those living in the Cal Young and Willakenzie neighborhoods as it will create an off-street pedestrian connection to the riverfront multi-use path system.

Regional Connections

The *Rivers to Ridges* regional parks and open space vision (2003) and the *Regional Transportation Plan* (2004) both identify a potential future recreational corridor running between Delta Ponds and the McKenzie River and Willamette River confluence area to the north with additional trail connections east along the McKenzie River all the way to the Lane County owned Armitage Park. Further study and land acquisition will be required to make these proposed connections a reality, but if constructed, would create significant recreational connections between the Delta Ponds and the larger regional park and open space system. These concepts are shown on the Context Map on page 7 of this report.

Homeschoolers and their parents tour Delta Ponds with the Stream Team

Education

Opportunities for public education are ripe in this urban natural area. In addition to providing parking for school buses, the creation of gathering spaces and overlooks can facilitate outdoor classroom activities that cater to school children. The need for two formalized outdoor classrooms has been discussed. The first could be located in an area containing a healthy mature riparian forest, and a second could be sited in the vicinity of the south parking lot to interpret wetland and open water habitats and the ongoing enhancement process. Design and siting of these facilities will likely occur once the Corps Section 206 restoration project has been implemented. The development of an interpretive program which explains the natural processes that take place within the pond environment can include signage, art, and interactive experiences, which are formatted for community members with sight and mobility disabilities.

Planned and Proposed Wildlife Enhancements

The proposed improvements to the site's hydrology, removal of non-native vegetation, and creation of extensive riparian and wetland areas will greatly improve overall wildlife habitat values of the Delta Ponds system. In addition, a number of species specific wildlife habitat enhancements are being proposed and area listed below:

Western Pond Turtle Habitat Protection and Enhancement
In 2004, the City's Delta Ponds Habitat Enhancement Coordinator Lauri Mullen and ODFW's Bill Castillo collaborated to develop a draft Western Pond Turtle Habitat Management Plan for Delta Ponds. The intent of this draft plan was to help direct the planned enhancements at Delta Ponds to maximize benefit for pond turtle habitat. The recommendations from this draft plan are summarized below by category:

Western pond turtle

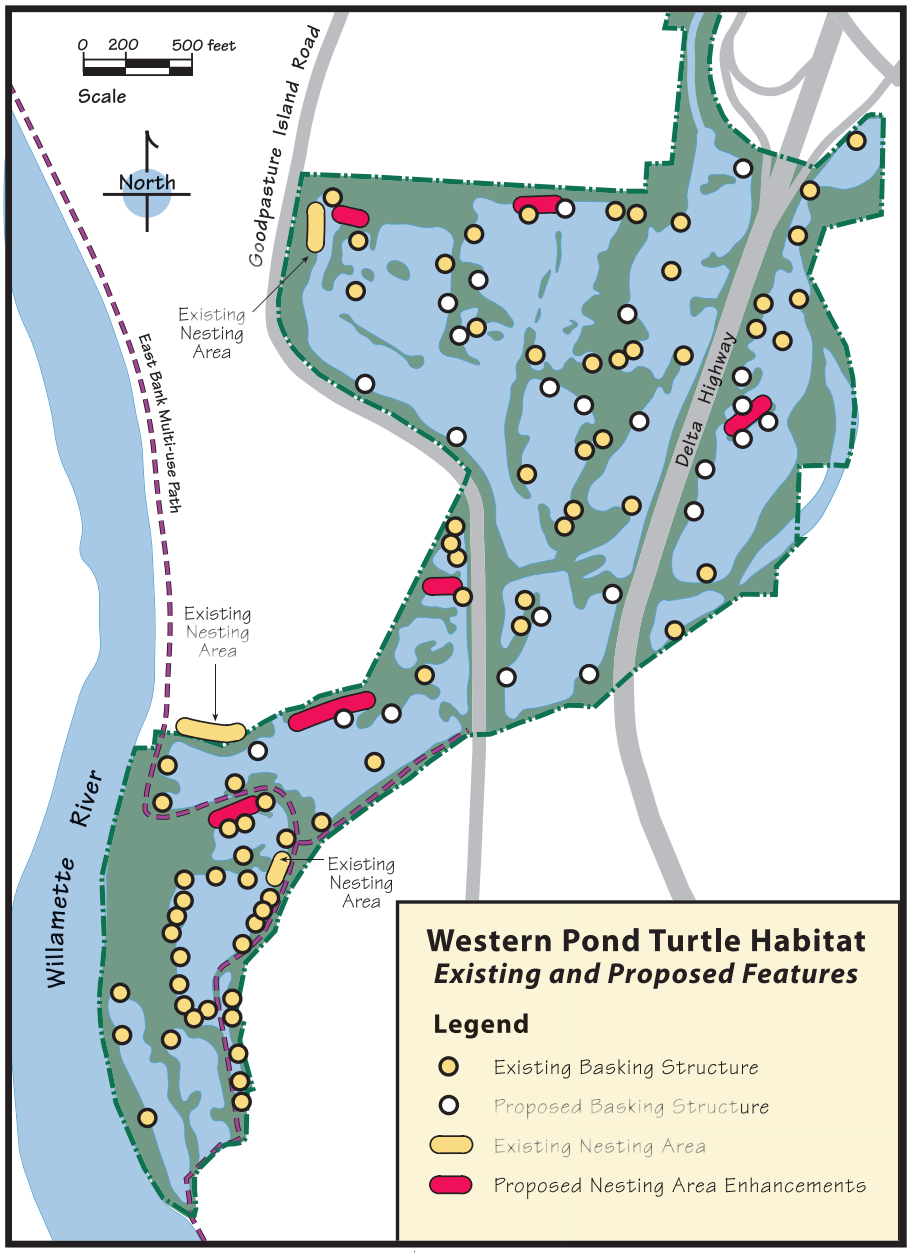
Basking
All existing logs and other basking structures at Delta Ponds will be left undisturbed, unless they are located in areas where construction will occur. Those basking structures that need to be moved will be relocated nearby or to a location that provides the most habitat potential for western pond turtles.

In order to enhance basking habitat for western pond turtles, particularly in Areas-2 and -3, the Corps and City will be obtaining logs and root wads from various sources to place at Delta Ponds. If logistically feasible, new basking structures will be placed near nesting areas, adjacent to deep water habitat and in areas lacking any similar basking structures.

Existing basking structures such as these logs will be retained, while additional structures are added.

Nesting
In order to maintain low growing, sparse vegetation on nesting sites, all of the existing and proposed turtle nesting areas will be mowed or weeded annually in May. This will either be done by City of Eugene Natural Resource Maintenance staff or by volunteer adoption groups.

Additionally, two of the three existing nesting sites at Delta Ponds are currently unprotected and are at high risk of being disturbed by humans and/or predators. This project hopes to further protect these areas where possible and to provide additional nesting areas nearby that will be more secure. The following site specific protection measures and enhancements are recommended:



Area-1

The nesting area along the east bank of Area-1 is already protected by a fence with a locked gate. This area will continue to be maintained as a turtle nesting area, however there will be a more concerted effort to remove the blackberries and other shrubs that are starting to take over the site. To provide additional nesting habitat in the southern part of Area-1, a second turtle nesting area will be installed northwest of the current nesting area, just south of the bike path. This new nesting area could be created by pushing fill over the edge and shaping it in such a way to create a gentle south facing slope. This area could be fenced and educational signs mounted nearby.

The upland area in and around the Willamette Oaks greenhouse and the adjacent vacant property currently provide the best available upland nesting for western pond turtles at Delta Ponds. Unfortunately, both are on private property and it is likely that the vacant property will be developed. The thick growth of blackberry vines on the banks of the pond also make these areas difficult for turtles to access. However, there are plans to create additional nesting habitat nearby. During construction of the Corps Section 206 Restoration Project, a riparian bench will be built along the bank to the south of the current nesting area and extending east to the peninsula. This bench will be gradually sloped towards the south and will be vegetated with a mixture of low growing native grasses and annuals. At its western end, the bench will be widened and a larger south facing mound will be created to provide a more secluded nesting area. The bench will be created in such a way as to discourage recreational access, yet still allow access for maintenance or monitoring personnel. This will either be done with fencing or physical deterrents such as swales. The bench and the banks leading up to the existing nesting habitat will be kept clear of blackberries and other vegetation. In this way the access to the current nesting sites will also be improved.

Area-2

The nesting area at the northwest corner of Area-2 is situated very close to the proposed location for the north parking lot. The Project hopes to preserve most of the existing nesting habitat by relocating the parking lot slightly further south and by directing pedestrian traffic up along the current sidewalk. In addition, the nesting area would be screened from view by planting native shrubs and other vegetation between the sidewalk and the swale.

The area adjacent to the radio tower at the north end of Area-2 has been identified as a potential turtle nesting area due to its south facing slope and proximity to turtle basking areas. Currently this area is becoming overgrown with Armenian blackberry and thick grasses. The soils are also very gravelly and are highly compacted. Furthermore this area is used by nearby residents to access the ponds for fishing, picnicking, running dogs and other activities. While the Delta Ponds Restoration Project has partnered with seven local Rotary groups to install a recreational trail in this area, the Project hopes to construct it in such a way as to protect and enhance the turtle nesting habitat, while educating the community. To limit access to the nesting area by people and dogs, a fence will be placed along the edge of the trail. Since turtles are sensitive to movement and activity nearby, native shrubs and other vegetation may also be planted between the fence and trail to screen the nesting area from view. If feasible, fill material will be brought in and placed along the south facing bank (below the fence) to provide better nesting substrate. The south facing slope and the access to and from the water will be mowed or weeded annually in May to eliminate blackberries and maintain a cover of low growing vegetation. Finally, educational signs will be placed along the trail that will describe the life cycle and habitat needs of western pond turtles.

The non-native red-eared slider is thought to compete for nesting and basking habitat with the Western pond turtle.

Since Area-2 appears to support a relatively large number of turtles, the creation of a third turtle nesting area is being considered at the north end of Area-2. This new habitat would be created below the steep bank in an area where up to 18 turtles have been observed basking on logs. Fill will be brought in and a gradually sloped mound will be created at the bottom of the bank. The new site will be seeded with low growing native grasses and forbs and fenced off from human access.

Area-3

While there have been no sighting of turtles in Area-3, the Corps Section 206 Restoration Project will be connecting the ponds in Areas-2 and -3. Depending on the ultimate design of the culverts, this area may be opened to turtle movement between ponds. Area-3 has many of the habitats needed by turtles, with the exception of nesting habitat. Since this area is already difficult to access, no measures would need to be taken to fence it off.

Rearing
The construction of gradually sloped riparian benches throughout Delta Ponds will greatly increase the rearing habitat for western pond turtles. The edges of these riparian benches will be planted with native emergent plant species. Once emergent and aquatic vegetation has had a few years to become established, shallow water rearing should be plentiful.

The Corps Section 206 Restoration Project is also considering including shallow, vernal pools in those areas where new nesting habitat is being created. These would be excavated between the ponds and nesting mounds or slopes so as to provide easy access for young turtles.

Predation and Competition
Aside from fencing nesting areas off from human and canine access, there are currently no plans to control populations of any of the western pond turtle's predators. The City of Eugene does hope to work with ODFW staff and other local experts to set up a turtle monitoring program to monitor turtle nesting activities and to install cages over nests to protect them from predators. The creation of additional rearing habitat with emergent and aquatic vegetation will provide additional cover for young turtles from predators. In addition, educational signs and materials will explain to local residents and recreational users the importance of not disturbing or taking turtles that they find on the trail or on land nearby.

The non-native turtle, the red-eared slider, is common in the ponds and is thought to compete with the western pond turtle for basking and nesting habitat. A trapping program will be considered to control their population.

Overwintering
The existing areas of deep water at Delta Ponds will be enhanced with the placement of logs and root wads nearby, as described in the Basking section. These will provide turtles with cover from predators and places to bask in the sun. Although it would likely benefit the turtles, there are currently no plans for dredging the ponds to create additional deep water areas for turtles, due to concerns about sediment contamination. If it is feasible and equipment becomes available, the creation of new deep areas will be considered in the future.

Due to the development surrounding Delta Ponds, the creation of new terrestrial overwintering habitat for turtles is not feasible. However, the vegetation enhancement activities that will occur as part of this project will improve the overwintering habitat that already exists. The removal of blackberries and other invasive species along the adjacent banks will allow the turtles to more easily access the upland areas. Planting of native trees and shrubs within and adjacent to the existing upland areas will also help to maintain the long-term health of these upland areas.

Bird Habitat Enhancement

Habitat for wading birds such as the great blue heron will be greatly improved with the proposed riparian and wetland enhancements.

Riparian areas like that found along the Willamette River, Delta Ponds, and Dedrick Slough provide important habitat for many different bird species. While this habitat is currently present at Delta Ponds, it has potential for significant enhancement. Since one of the goals of the Delta Ponds restoration project is to improve habitat for neotropical migratory birds, the habitat needs of these birds will be taken into consideration in the restoration planning process. In addition, there are other bird species that will benefit from the protection or creation of specific habitat components on the project site. The information on bird habitat contained in this section is a summary of suggestions provided by local bird experts Steve Gordon, Charlie Quinn, Dan Gleason, and Bruce Newhouse and should be used as a guideline for future enhancement and management.

Habitat Types

The following is a list of important bird habitat types currently present or planned at Delta Ponds, including some examples of bird species that may benefit from them:

Riparian shrubs and trees (cover, nesting)

- Neotropical migratory birds (willow flycatcher, yellow warbler, warbling vireo)
- Resident birds (black-capped chickadees, bushtit, spotted towhee, song sparrow)
- Wintering birds (red-breasted nuthatch, white-crowned and golden-crowned sparrows, and dark-eyed junco)
- Others (belted kingfisher, green heron, American kestrel)

Trees and shrubs that produce flowers, nectar and/or berries (feeding, source of insects)

- Neotropical migratory birds (rufous hummingbird, willow flycatcher, warbling vireo, western wood-pewee, warblers)
- Resident birds (black-capped chickadees, cedar waxwings, Anna's hummingbird, ruby-crowned kinglet)

Emergent vegetation (feeding, nesting, nest material)

- Resident & breeding waterfowl (Canada goose, mallard, pied-billed grebe)
- Songbirds (wrens, sparrows, red-winged blackbirds)
- Others (American bittern, Virginia rail, sora, American coot)

Mature trees & snags (perching, roosting, nesting)

- Raptors (bald eagle, osprey, red-tailed hawk, sharp-shinned hawk, Cooper's hawk, American kestrel)
- Herons/cormorants (great blue heron, double-crested cormorant, black-crowned night-heron)
- large cavity nesters (wood duck, common merganser, hooded merganser, western screech owl, great horned owl, American kestrel, pileated woodpecker)
- Small cavity nesters (black-capped chickadee, red-breasted nuthatch, tree swallow, downy woodpecker, northern flicker, red-breasted sapsucker, house wren, Bewick's wren)

Islands with low growing vegetation (resting and nesting)

- Overwintering waterfowl (northern shoveler, green-winged teal, gadwall, bufflehead, ring-necked duck, lesser scaup)
- Resident waterfowl (Canada goose, mallards, common merganser)

Vegetation Enhancement for Bird Habitat

Vegetation enhancement involves two components: invasive species removal & control and establishment of more diverse and dense native vegetation.

When conducting invasive species removal and control there are some key things to keep in mind to minimize the impact on the existing bird populations:

- Invasive species removal, especially where there are dense stands of vegetation, should occur in the fall when the breeding/ nesting season is over and before the winter months when birds become dependent on vegetation for cover. If feasible, invasive vegetation removal should occur over several years so that the existing habitat is not completely eliminated in one season.
- Although aquatic invasive species control is not currently part of the restoration project, management of such species may need to occur in the future to retain areas of open water where waterfowl can continue to feed.

Habitat snag

In developing a plan for the establishment and/or enhancement of native vegetation, here are some things that will benefit bird populations:

- Provide a diversity of habitat types and ages. It is just as important to have mature trees and snags as it is to have emergent vegetation and riparian shrubs. In other words, the goal is not to have a mature riparian forest over the entire site, but a mix of habitat types, including early successional stages.
- Seek to connect the ponds to the Willamette River and to each other. This will aid in the ability of the site to support a diversity of habitat types and thus a diversity of bird and wildlife species.
- Seek to re-establish a dense understory shrub and herbaceous layer. Many bird species depend on thick understory vegetation for food, cover and nesting and this type of habitat is being severely reduced in most areas.
- Seek to create patches of habitat, rather than continuous stretches of trees and shrubs. Intersperse patches of trees and understory

vegetation with patches of shrubs or emergent vegetation. This will create edges and diverse habitats that will support a broader variety of bird species.

- Where possible, especially in the more urbanized areas, create corridors of vegetation that allow some of the more reclusive species to move from one area to another without having to move out in the open.
- Plant native vegetation which provide nectar, seeds or berries that are attractive to insects and birds. While many birds will eat the seeds and berries produced by plants, the insects that are attracted to the vegetation are just as critical to bird diversity.
- The construction of benches with more gradual slopes along the edges of the ponds will benefit emergent vegetation, insects, birds, and other wildlife.

Habitat Enhancements for Juvenile Salmon

One of the primary reasons for undertaking the Delta Ponds restoration project is to provide side channel habitat for juvenile salmon during the winter months. Much of the hydrological work that is planned for the site will greatly benefit juvenile salmonids by allowing these fish to move into and through the site. There are a number of habitat features that will also increase the survival of the juvenile salmon while in the Delta Ponds. These include some of the following:

Woody Debris

Both large woody debris (logs and root wads) and small woody debris (branches, tree tops) provide juvenile salmon with a place to hide from predators, such as bass and other warm water fish. Such structures will be interspersed throughout the site to allow juvenile salmon to find refuge in all parts of the ponds.

Adult Chinook salmon

Aquatic and Emergent Vegetation

Aquatic and emergent vegetation, like woody debris, provide areas for juvenile salmon to hide from larger predatory fish. In addition, since aquatic insects are abundant in and around aquatic and emergent vegetation, these habitats provide a source of food for juvenile salmon.

Education

Perhaps one of the best ways to educate the general public about the importance of the Delta Ponds as a side channel refuge for juvenile salmon would be to have an interpretive sign along one of the trails or at one of the overlooks. This sign could include information about the salmon life cycle, the needs of juvenile salmon and how side channel habitats are no longer very common.

Management Goals and Recommended Actions

The statement below is intended to create a vision of how the Delta Ponds system will look and function in the future and is meant to be an overall guide under which all aspects of this plan are organized. The goals and recommended actions contained in this report are the tools with which this vision will be realized. The vision statement will continue to be refined over time based on input from the public and Delta Ponds project partners.

A Vision for Delta Ponds

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.

Vegetation Management and Enhancement Goals

Goal 1

Protect, repair, and enhance native riparian, scrub-shrub, upland, and emergent wetland vegetation communities across the site.

Recommended Actions

1. Install the riparian benches as specified under the Corps Section 206 Restoration Project and re-vegetate those areas with a diverse mix of native emergent, riparian, and upland species.
2. Continue implementing the CCI-funded vegetation management project over 28 acres of the site in order to re-establish healthy and diverse native upland, riparian, and emergent vegetation communities in these areas. The strategy for establishing native vegetation includes the following:
   a. The short-term (5 years) effort in these areas will be to establish a dense native cover that will help minimize the re-colonization

of this area by exotic species and will help prevent erosion. This will be achieved through a planting effort that will include a combination of bare-root and container plants, cuttings, plugs, and seed. A relatively limited pallet of more aggressive native species will be selected initially in an effort to achieve rapid cover. In addition to native forbs and grasses, the seed mixes to be used will also include a component of native tree and shrub species. Plant selection and placement will be based on an assessment of historic vegetation community and consideration of current, and expected post-project, site conditions. Continued control of exotic vegetation will be key to the success of this re-vegetation effort and will likely continue at an intensive level for several years after planting.

Portions of the CCI project area currently contain a relatively healthy native plant community composed of large trees, shrubs and herbaceous plants. These areas will require minimal invasive species removal, and the short-term focus will be on improving species diversity using plants from sources, including the City's native plant nursery. This diversity planting would be an excellent activity for volunteers.

b. Over the medium-term (5-15 years), the effort in the CCI project area will focus on improving overall diversity and abundance of native species. Using an adaptive management model (see page 45), the area will be monitored and evaluated to identify issues related to invasive species and diversity. Additional species will be introduced throughout the area in an effort to increase diversity. In particular, those species more dependent on shade will be introduced as canopy cover and appropriate soils develop. If stands dominated by a single species such as fir or alder emerge, thinning may be considered in an effort to achieve more diversity.

c. The long-term (15 years and beyond) goal for this area is the creation of largely self-sustaining vegetation communities, which will require very minimal maintenance. Routine maintenance activities over the long-term will likely be focused primarily on controlling exotic vegetation.

Goal 2

Control and eradicate invasive exotic vegetation across the site.

Recommended Actions

1. Target invasive species known to be problematic at Delta Ponds currently such as Armenian blackberry (*Rubus armeniacus*), Scot's broom (*Cytisus scoparius*), purple loostrife (*Lythrum salicaria*), and English Ivy (*Hedera helix*). City maintenance staff, volunteers, and other resources, will be used for a regular removal program. The goal of this effort will be to control and limit the spread of these species. Only limited vegetation management will be done in the areas designated for enhancement under the Section 206 Restoration Project until after the project is completed.

2. Monitor invasive species, using an adaptive management approach and noting the abundance of existing exotics and the arrival of exotic species new to the Delta Ponds system. Exotic species which are increasing in range and abundance at the ponds will be given priority for control. Exotic species which are becoming problematic elsewhere in the region, but not currently at Delta Ponds, such as Japanese knotweed (*Polygonum cuspidatum*), falsebrome (*Brachypodium sylvaticum*), and butterfly bush (*Buddleja davidii*), will be monitored and eradicated immediately to prevent rapid colonization.
3. Conduct further study to determine what, if any, negative impacts non-native water milfoils (*Myriophyllum* spp.) are having on native wildlife in the ponds, especially on Western pond turtle and Chinook salmon. Control methods can be considered over the long-term if it is found that milfoil is significantly impacting wildlife habitat.

Goal 3:
Over the long-term, enhance habitat along Dedrick Slough between the Area-2 ponds and the Willamette River.

Recommended Actions:
1. Plant native tree and shrub species along the banks of Dedrick Slough to increase shading and improve wildlife habitat.
2. Consider enhancing the open area located between Delta highway and Dedrick Slough (Area-4) if the land is ultimately not used for highway interchange improvements. This area could be forested to expand the width of the Dedrick Slough riparian zone and could also potentially accommodate a side channel or other habitat features.

Recreation and Access Goals

Goal 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.

Recommended Actions
1. Provide a hierarchy of pedestrian trails to access Delta ponds. This will include three levels of accessibility:
   a. Fully Accessible: A hard-surfaced ADA accessible interpretive trail 600 feet in length is currently under construction and will lead from the northern parking lot to an overlook at the water's edge.
   b. Highly Accessible: A 1.3-mile pedestrian loop trail is planned to run along the outside perimeter of the Area-2 ponds, passing through both of the planned parking areas. The trail will be surfaced with compacted gravel and designed with inclines of less than 5 percent, giving it a high level of accessibility. Portions of this loop trail will be sited on the riparian benches that will be constructed as part of the Corps Section 206 Project and will eventually include a total of three bridge crossings. The first leg of this trail (approximately 1,800 feet) was completed in 2005 with

the help of volunteers, and runs between the northern parking lot and the bank above Dedrick Slough.

c. Other Trails: Over the long-term, a pedestrian trail could be constructed along the length of Dedrick Slough between the Area-2 ponds and the existing multi-use path to the north of Beltline Road. This trail will create a larger loop option of approximately 3.7 miles for walkers and provide access to the slough for wildlife viewing and maintenance activities. Over time, this trail can be upgraded to a higher level of accessibility if desired. The feasibility of the trail passing under Beltline Road and the associated highway ramp requires additional study.

2. Minimize negative impacts to the site's vegetation and wildlife by controlling public access into areas of the Delta Ponds system not currently designated for trail access. This can be achieved through a combination of signage and by blocking unwanted trails with woody debris, vegetation, fencing, and in some cases swales or channels (now planned under the Corps Section 206 Restoration Project).
3. Provide a series of designated viewpoints along the Delta Ponds trail network to provide trail users visual access to the ponds. Amenities such as seating and interpretive signage will be concentrated in these areas. Three distinct types of viewpoints will be provided at Delta Ponds:
    a. Overlooks: Two overlooks are currently planned at Delta Ponds. The first will be a platform located at the terminus of the fully accessible interpretive trail, on the northern edge of the Area-2 ponds. A second overlook is planned for the area near the southern parking lot and will be constructed once the Corps Section 206 Restoration Project has been completed. This overlook could potentially be incorporated into the bridge structure planned for this area. Both overlooks will be fully accessible and include interpretive signage.
    b. Vista Points: A total of five key vista points have been designated at Delta Ponds. View-obstructing vegetation will be removed or pruned in these areas to maintain the views over time and seating and interpretive signage may be added. As planned trails are constructed, additional viewpoints may be identified.
    c. Wildlife Viewing Blind: To provide views of waterfowl, basking turtles, and other wildlife, a viewing blind will be sited at Delta Ponds, most likely along the trail in Area-2. The blind will be constructed to provide a location for photographers, bird watchers, and other visitors to observe the ponds without disturbing or flushing wildlife. The blind will be sited to provide westward facing views to provide optimal lighting for morning photography. To create a feature that will blend into the landscape, the blind will be constructed of natural materials such as rock or root wads, and screened from the ponds by vegetation. At the same time, care will be taken to ensure that the viewing blind is clearly visible from the main trail, or other trafficked routes, to prevent illegal camping or other safety issues.
4. Construct the two parking lots planned for Delta Ponds access along Goodpasture Island Road. The first will be located near the northern edge of the ponds in Area-2 and is designed to accommodate

approximately ten cars. Construction of this lot is scheduled for spring 2005. A second parking lot is planned for an area further south along Goodpasture Island Road. The southern parking area will accommodate about ten cars and will also provide parking for one bus. Both parking lots will include a trail head and will provide direct access to the planned trail system around the Area-2 ponds. Additional amenities located at each of the parking lots will include benches, way-finding signage, a drinking fountain, and portable restroom facilities. In addition to these two lots, the northern end of the existing Valley River Center parking lot currently provides unofficial parking for recreational users accessing the multi-use path and Delta Ponds from the south. In the long-term, the City may consider developing a formalized public parking arrangement with the owners of this or other adjacent parking lots. A formalized parking agreement could allow the City to add signage and make access improvements in this area.

5. Provide adequate bicycle parking at the Delta Ponds parking lots and in locations where the Delta Ponds trail system ties into existing East Bank Multi-use Path in order to accommodate bicyclists who want to leave their bikes and use the pedestrian trail system.
6. Assess the need for formal access for fishing and boating in the ponds. Such access is not currently planned at Delta Ponds, but as long as ODFW condones it, this use will continue to be allowed and the City will assess the need for facilities to accommodate these uses.
7. Post and strictly enforce the City's leash law to minimize negative impacts on the site's habitats and wildlife.
8. Consider adding noise reduction structures such as *jersey* barriers or sound walls along the west side of Delta Highway to enhance the recreational user's experience and provide a barrier for wildlife.
9. Provide experiential access to the ponds system to visitors of all abilities, including those who experience the ponds from a motor vehicle. Protect and enhance the visual and auditory experience of the ponds and develop and maintain parking and adjacent facilities to maximize the auto-centered experience of the ponds.

Goal 2

Provide a safe, comfortable, and secure environment for all users and discourage illegal activities.

Recommended Actions:

1. Provide amenities such as benches and signage to encourage individuals to visit Delta Ponds on a regular basis and that promotes care and stewardship of the resource.
2. Discourage camping and other illegal activities at Delta Ponds by using a combined approach of access control (limiting access to areas not readily visible), managing vegetation along trails to eliminate possible hiding places, and signage.
3. Consider developing a neighborhood watch program for the ponds area. A number of businesses and residents are located immediately adjacent to Delta Ponds and could be enlisted to help monitor for, and report, illegal activities. The program would provide residents and employees with instruction and contact information to report problems.
4. Recruit docents or other volunteers to patrol Delta Ponds on a

periodic basis and report illegal activities, maintenance needs, and other problems.

5. Install pedestrian medians (islands) at key pedestrian crossing points along Goodpasture Island Road to provide safer access to the Delta Ponds trail heads. A total of five key pedestrian crossing points have been identified (see map on page 27).
6. Maintain at least a minimum of visual access to the ponds from Goodpasture Island Road, the parking areas and Delta Highway. Visual access can be maintained through planting and facility design, and vegetation management.
7. Promote the recreation value of the ponds and continue to ensure that facilities are in good shape to encourage positive and legitimate uses of the area.

Education and Stewardship Goals

Goal 1

Promote stewardship and awareness of Delta Ponds by neighbors and the general public.

Recommended Actions

1. Continue to involve *Stream Team* and other volunteers in the active management and monitoring of the Delta Ponds system to promote understanding and a sense of ownership.
2. Install signage at key locations along major roadways such as Goodpasture Island Road and Delta Highway identifying Delta Ponds as a geographic feature.
3. Develop a Delta Ponds education and publicity plan that includes major educational goals, and resources and timelines for achieving the goals.
4. Work with School District 4J, the Willamette Resources Education Network (WREN), and other existing education local entities to develop curriculum specific to Delta Ponds.
5. Identify a process for the naming of individual ponds that involves participation by the public.

Goal 2

Provide facilities to accommodate educational activities at Delta Ponds

Recommended Actions

1. Develop a comprehensive interpretive plan which directs the installation of interpretive signage, artwork, and interventions at key points along the Delta Ponds trail network. Topics may include plants, wildlife, human history, and the Delta Ponds habitat enhancement process.
2. Identify designated gathering spots or outdoor classrooms at Delta Ponds for use by large groups visiting for educational purposes. The need for two formalized gathering spots has been tentatively identified. The first would be located near a mature and diverse riparian forest, to serve as a model for demonstrating the long-term

vision for Delta Ponds. A location near the river or the ponds in Area-1 is suited for this. The second would likely be located in the vicinity of the planned southern parking lot on Goodpasture Island Road. This area is generally well suited for the interpretation of a number of habitats as well as the overall enhancement effort. Both gathering spots will require additional study for siting once the Corps Section 206 Restoration project has been implemented.

Wildlife Habitat Goals

Goal 1
Protect and enhance habitat for the Western pond turtle, Chinook salmon, and neotropical migratory birds.

Recommended Actions

1. Implement the *Corps Section 206 Restoration* and CCI-funded vegetation management projects as designed. Both projects will significantly improve habitat for the target wildlife species.
2. Protect and enhance Western pond turtle habitat by implementing the recommendations from the draft *Delta Ponds Turtle Management Plan* as summarized starting on page 29 of this report. This plan recommends preserving and protecting existing turtle habitat, while adding additional habitat features such as basking structures, nesting areas, and rearing habitat (see map on page 30). To further protect turtles, barriers should be constructed in key areas to prevent migration across busy roadways.
3. Consider acquisition or purchase of conservation easements on key undeveloped parcels immediately adjacent to the site to provide additional habitat. In particular, areas containing potential for turtle nesting habitat should be considered. Areas to consider include the undeveloped tax lots on the east side of the Area-3 ponds, the pond-side edges of the Peacehealth and Willamette Oaks properties to the north of the Area-1 ponds, the Lane County owned property near the Delta Highway/Goodpasture Island Road ramp (assuming it is not needed for highway improvements), and Dedrick Slough to the north of Beltline Road.
4. Enhance habitat for neotropical bird species by restoring native vegetation communities, retaining habitat features such as snags, and limiting human access to certain areas to encourage nesting. In addition, major vegetation management and construction activities will be scheduled to avoid the bird nesting season (April through July) if possible. A list of general enhancement strategies for bird habitat is listed starting on page 33 of this report.
5. Provide habitat for juvenile Chinook salmon by reintroducing flow from the Willamette River into the ponds and Dedrick Slough and by adding woody debris (logs and root wads) and aquatic vegetation for cover.
6. Develop a long-term strategy for reducing populations of non-native animal species such as bull frog, nutria, red-eared slider, and large

mouth bass in the Delta Ponds. These species are thought to compete for or damage habitat and in some cases feed on juvenile pond turtles and salmon.
7. Make future management decisions for the target wildlife species based on conclusions drawn from the planned and on-going monitoring, and using an adaptive management approach.

Goal 2
Enhance general habitat conditions for native species associated with the diverse ecosystem provided by Delta Ponds.

Recommended Actions
1. Retain habitat snags throughout the site in all vegetation zones. Snags provide habitat for invertebrates, which in turn provide food for other wildlife and also provide habitat for bird nesting and perching. Habitat snags and other improvements, such as platforms for osprey and other raptor nesting, may also be added where they are currently lacking.
2. Leave large fallen trees or tree limbs on the ground, where possible, for reptile and amphibian habitat. In most cases, limbs that have fallen onto trails can be moved off the trail and left on site.
3. Add additional habitat features such as bat boxes and bird nest boxes throughout the site. This would be an excellent volunteer activity.
4. Assess the need to install barriers between the ponds and adjacent roadways to reduce incidences of wildlife being hit by automobiles.

Hydrology Goals

Goal 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.

Recommended Actions:
1. Implement the hydrologic reconnection of the Willamette River and Delta Ponds as specified in the Corps Section 206 Restoration Project. This will likely include the installation of two weirs between the river and the Area-1 ponds, which will allow river flows in excess of 3,500 cubic feet per second (cfs) to begin flowing into the ponds. In addition, a series of swales, channels, weirs, and culverts will be installed to allow flow to move from the Area-1 ponds into the rest of the system and down Dedrick Slough.

Goal 2
Protect adjacent properties and public facilities from flood damage.

Recommended Actions:
1. Implement flood control measures as specified in the Corps Section 206 Restoration Project. To limit the extent of potential flooding, a 12-

foot diameter gated culvert will be installed between ponds C and D in Area-1. The gate will be automated and will close when river flows exceed 9,000 cfs. The design, function, and specifications of this gate are still is still being refined.

Water Quality Goals

Goal 1
Improve overall water quality within the Delta Ponds system.

Recommended Actions:
1. Re-introduce seasonal flow between the Willamette River and the Delta Ponds system as specified under the Corps Section 206 Project. This will reduce average water temperatures, improve dissolved oxygen levels, and flush nutrients and other pollutants from the ponds.
2. Identify and eliminate point-sources of pollutants entering the Delta Ponds system.
3. Employ erosion control methods when disturbing soil around the ponds during implementation of site enhancements.
4. Continue to monitor water quality to document success and determine where additional problems remain.
5. Limit the disruption to pond sediments, which are know to contain pollutants including the metals and semi volatile organic compounds.

Goal 2
Reduce pollutant loads entering the Delta Ponds system from tributaries such as Dedrick Slough and Valley River Village drainageways.

Recommended Actions:
1. Provide technical assistance to private property owners whose runoff flows into the Delta Ponds system in an effort to modify management practices and reduce pollutant loads. Major property owners such Eugene Country Club, Valley River Village, and Valley River Mall should be given highest priority for assistance.
2. Consider acquisition of easements or property along upper Dedrick Slough (above Area-2) and Valley River Village to better manage for stormwater quality.

Maintenance Goals

Goal 1
Maintain the Delta Ponds facilities and trail system, preserving the public's access to the site.

Recommended Actions
1. Perform regular maintenance on the pedestrian trail network including maintaining accessible surfacing, keeping drains clear, and repairing erosion or other damage.

2. Remove fallen limbs, branches and other obstructions from the trails and trim low hanging branches and vegetation encroaching on the pedestrian trails. This debris can generally be left on site for habitat. Special attention should be paid to clearing the *fully accessible* hard surfaced trail near the north parking lot and the *highly accessible* loop trail. This task is well suited for volunteers, with larger limbs and fallen trees to be removed by City crews.
3. Leave all fallen limbs and dead and dying trees to serve as habitat with the exception of trees in imminent danger of falling onto trails, viewing areas, parking lots, or adjacent roadways.
4. Provide maintenance access to culverts, swales, and channels and inspect on a regular basis to ensure they are properly functioning. Remove debris, beaver dams, and sediment as needed to maintain desired flows. The gated culvert should be inspected most frequently.
5. Develop a strategy for gaining maintenance access, when needed, to the peninsulas that will become islands with the creation of the planned swales and channels. Access could be provided by portable bridges or boats and should be considered when the swales are being designed. Designate several areas to launch boats for maintenance access to the islands and inaccessible shoreline.
6. Continue to mow the grass along the edges of the multi-use paths adjacent to Delta Ponds to minimize fire danger and to keep woody vegetation from establishing and blocking lines of sight.
7. Maintain turtle nesting areas (annual mowing).

Goal 2
Provide adequate access onto the site for maintenance activities and fire protection.

Recommended Actions
1. Design bridges and trails on the pedestrian trail network to be a minimum of 4 feet wide and with a minimum load capacity of 2,500 pounds. The existing multi-use paths and pedestrian trail network will provide the primary access for maintenance onto the site and designing to these minimum standards will allow maintenance crews to use motorized wheelbarrows and small ATVs with trailers as needed.

Goal 3
Control the spread of invasive non-native vegetation.

Recommended Actions
1. In the short-term, implement the Corps Section 206 Restoration Project and the CCI funded vegetation management grant to remove large quantities of exotic species.
2. Establish a long-term maintenance plan that includes limiting the spread of invasive exotic vegetation. This can be accomplished in part by volunteers, but will likely require the assistance of City crews or hired contractors. Additional grant funds and partnerships should be sought to supplement this maintenance activity.

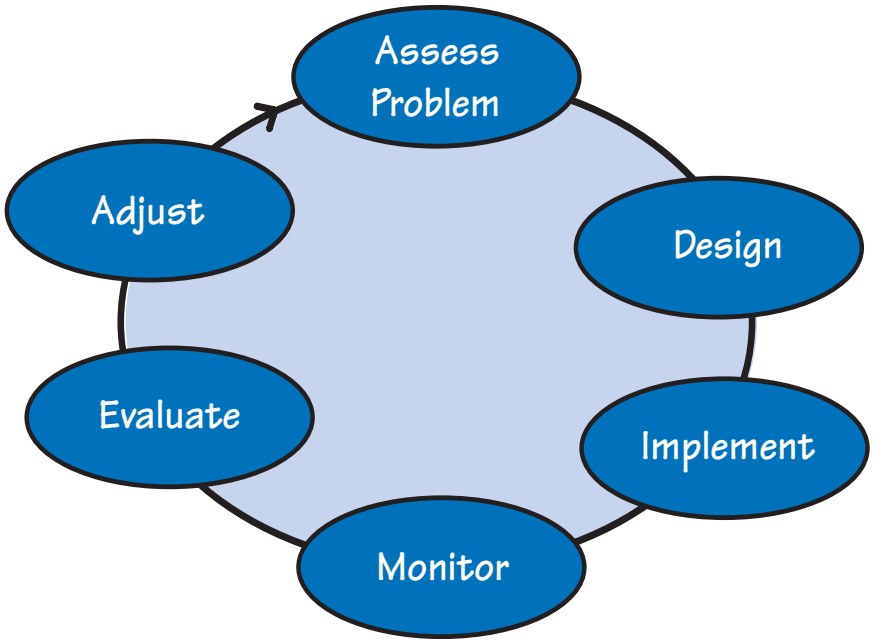
Adaptive Management Goal

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

Recommended Actions
1. Document thoroughly all major enhancement and management efforts and activities as they occur.
2. Design monitoring strategies that will help demonstrate the relative success of various management efforts over time.
3. Use the monitoring data to inform future management decisions.

Adaptive management
Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. In an adaptive management approach, management actions are documented as they occur and then monitored over a period of time. The interpretation of monitoring results is then used to modify and improve management practices and techniques, and to identify unforeseen problems that need to be addressed.

The diagram below shows a six-step cycle that is typical of an adaptive management approach.



Characteristics of adaptive management:

1. acknowledgement of uncertainty about what policy or practice is "best" for the particular management issue;
2. thoughtful selection of the policies or practices to be applied (the assessment and design stages of the cycle);
3. careful implementation and documentation of a plan of action;
4. monitoring of key response indicators;
5. analysis of the management outcomes in consideration of the original objectives; and
6. Incorporation of the results into future decisions.