

## **The Benefits of Three Columbia Slough Restoration Projects on the Natural and Urban Environment.**

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### **Abstract:**

We sampled three different restoration projects; the Whitaker Ponds, the Vanport Wetlands and the Section 1135 Project, to determine what ecological and community benefits restoration is having on the slough and the local community. The Whitaker Ponds, once a junkyard, has been restored to a semi-pristine state and now acts as a community environmental learning center to create awareness of watershed importance. The Vanport wetlands is a young mitigation project that has already shown to aid in wildlife recovery and species diversity. The \$4.5 million section 1135 restoration project consists of several components to focus on system restoration. Each of these projects has shown to be successful early on, and a more concerted effort to collect quantitative data will help in steering future projects.

Key Words: Columbia River Slough, ecosystem, wetland restoration, urban ecosystems

## **Introduction**

The Columbia River Slough is a heavily industrialized and highly impacted area located in north Portland, Oregon. Within the past decade the value of its natural state has been realized, and efforts are being made to restore various areas. As land becomes available, the regional Metro government and other government agencies are acquiring lands to use as open space, recreation, and wildlife habitat (personal communication, Jay Mower, CRS watershed council). Currently, there are dozens of restoration projects by various government agencies, non-profit groups and volunteer workers. However, there is no concise relationship between these projects, nor any methodology to measure the projects' effectiveness.

This study investigates three separate restoration projects, the Whittaker Ponds, the Vanport wetlands, and the Columbia Slough Section 1135 Project, to determine the benefits that restoration has had on the urban community, wildlife habitat, and wetland revival, respectively. The goal of the study was to collect quantitative and qualitative data to support our hypothesis that these projects are benefiting both the urban and natural environments. Since most of these projects are fairly new, there is a lack of quantitative data available, however there is great enthusiasm in the community resulting in an abundance of qualitative data.

## **History and Background**

The Columbia Slough is part of a 61 square mile watershed that consists of wetlands, lakes and sloughs in the north part of Portland, Oregon. The slough is an eighteen-mile waterway that parallels the Columbia River and flows west from Fairview Lake near the town of Gresham, to its confluence with the Willamette River in Portland.

The vertical drop in river level over this distance is less than 1 inch (Personal Communication, Sue Barthow, Nov. 2002). The slough was a natural flood plain absorbing the flood waters from the Columbia River, but people have induced changes to the lands near the slough altering its function as a natural floodplain to a completely managed drainage canal (Center for Columbia River History [CCRH], 2002). Since the slough was a floodplain, periodic flooding produced rich soils over time giving life to many plants and animals, and eventually drew human settlement to the area. In the early 1920's, levees were constructed to prevent seasonal flooding and the waterway was transformed into the channelized and highly managed system now known as the Columbia Slough. With the elimination of yearly floods, farming, industrial and residential development flourished. As Collins et. al. point out, urban ecosystems, including the slough, are dynamic and changing (2000). The slough is considered a habitat patch but human changes have removed natural succession with flood control. People are now introducing a means to enhance biodiversity and succession with restoration.

Today, settlement among the Columbia Slough Watershed has led to over 158,000 residents, 4,200 companies, 24,000 homes, 3,000 businesses, 6 golf courses, 3 Interstate Freeways, a horse track, motor vehicle raceway and the Portland international airport. 3 drainage districts (for flood control) and 25 miles of levees protect over \$10 billion worth of property, 2 sewage treatment plants, and is home to 1/10 of all the jobs in Oregon. The Slough currently drains more than 34,000 acres of residential, commercial and industrial lands. More than 200 industrial, business, agricultural and recreational facilities border the Slough (CCRH). Many of the banks are steep and eroded.

Undeveloped areas along the Columbia Slough are classified as Flushed Slough and Scrub-shrub. This means that the banks are covered, for the most part, with blackberries, willows, and shrubs. These are non-native plant species that out-compete native species (Community Watershed Stewardship Program [CWSP], 2002). Even with these environmental impacts, the slough is still one of Portland's largest open spaces and wildlife habitat resources. River otters, beavers, coyotes, and bobcats live along the banks and cougars have been seen around the slough. Cover and feed is provided for over 120 bird species by the riparian areas and wetlands. Many tree species such as the black cottonwood, ash and willow offer a shady screen from nearby industrial areas (Portland BES, 2002).

Years of filling and diking have created two distinctly different sections of the slough. The lower slough extends from the Willamette River to the Peninsula Canal (about NE 13th Ave). One contiguous stretch, the lower slough offers high-quality canoe and kayak recreation to urban paddlers. Daily tidal influences may change water levels as much as three feet in this portion of the Columbia Slough. The upper slough continues eastward to Fairview Lake, but consists of long, narrow pond-like segments separated by road crossings and connected only by culverts that restrict small boat traffic. Storm runoff and springs provide much of the flow for the upper reach (Portland BES, 2002).

The climate around the slough consists of wet winters and dry summers. In the spring, the snow melts heavily in the Cascade Mountains located to the east and drains into the Columbia River sending some water to the slough.

Each year more than 13.7 million people and over 275,000 tons of freight come through the watershed. Impacts from 150 years of development have left a legacy of environmental problems in the Slough: contaminated fish and sediment, diminished wildlife habitat, and water pollution from both point and non-point sources (Columbia Slough Watershed Council [CSWC], 2002). Both sections of the slough face threats to water quality. Until recently, thirteen combined sewer outfalls (CSO's) empty diluted, untreated sewage into the lower slough whenever heavy rainfall overloads the City's sewer system. Along with the trouble of these CSO's is the landfill area, encircled by the Columbia Slough. It was once a wetland, home to an abundance of wildlife, plants, and fish. Through the years, industrial growth in the St. Johns area and growth of the landfill have altered this ecosystem. The high contamination levels in the Columbia Slough are partly due to waste disposal at the landfill. Storms also wash pollutants from nearby streets and industrial developments into the slough. The upper slough is further polluted by septic tank and cesspool effluent that enters the groundwater in mid-Multnomah County, emerging from the springs that feed the slough (Wells, 2002).

A great success happened for the slough in October 2000, the City of Portland Bureau of Environmental Services completed its "Big Pipe" project and sewage stopped flowing in to the Columbia Slough for the first time in a century. The elimination of CSOs from the Slough will greatly increase the health of the waterway (CSWC).

### **Study Sites**

Three sites were sampled for qualitative data to answer our question of restoration efforts and benefits to the urban environment. The Whittaker Ponds were an old

junkyard restored in a collaborative effort by city agencies, non-governmental organizations and volunteers. The Vanport Wetlands have had a large amount of revegetation and invasive species removal, and have subsequently seen an increase in wildlife populations. The section 1135 project is a large and multi-dimensional restoration project involving federal and state agencies. It focuses on wetlands as a system and encompasses various levels of restoration types, including the dredging, formation of wetland benches and revegetation. This paper will focus on the wetland benches and revegetation of the section 1135 project to indicate effectiveness to ecosystem health.

### **Whittaker Ponds**

In order to improve wetland quality through community restoration projects, public awareness and environmental education are essential. Environmental education, in particular, is a way to strengthen environmental



Source: Columbia Slough Watershed Council Website

stewardship within communities. By teaching students about the important ecological roles of wetland and riparian environments, the surrounding community will have a better appreciation for the restoration project, and the restoration project will have a greater chance of success (Lundmark, 2001). Whitaker Ponds is an example of how community participation and environmental education go hand in hand with restoration projects. Over the years, several educational projects have developed at Whitaker Ponds, bringing thousands of students to the site.

Whitaker Ponds is a 12-acre site with two ponds. Formerly part of a larger system of lakes and ponds on the Columbia Slough, the ponds have been separated due to industrialization of the surrounding area. The land was first purchased by the City of Portland and Metro. Since this purchase, Portland Public Schools has also purchased and incorporated land to the restoration site. Whitaker Ponds now serves as an environmental learning center for the local community and school district. The partnership between the city and school system has proven to be a valuable asset to the area.

Purchased by Metro in the early 1990's, the Whitaker Ponds site was a junkyard. Contamination included stormwater discharge, oil, and runoff from Columbia Boulevard. The restoration process included the removal of garbage, planting native vegetation, and building a small water treatment and testing center adjacent to the ponds (CCRH, 2002). This process has involved many people from the surrounding community and schools. Restoration at Whitaker Ponds has been about both repairing the surrounding ecosystem and increasing the community's knowledge base about the ponds. The largest step towards involving the community started with the completion of the Whitaker Ponds Environmental Learning Center. The learning center has become a significant point of activity on the Columbia Slough.

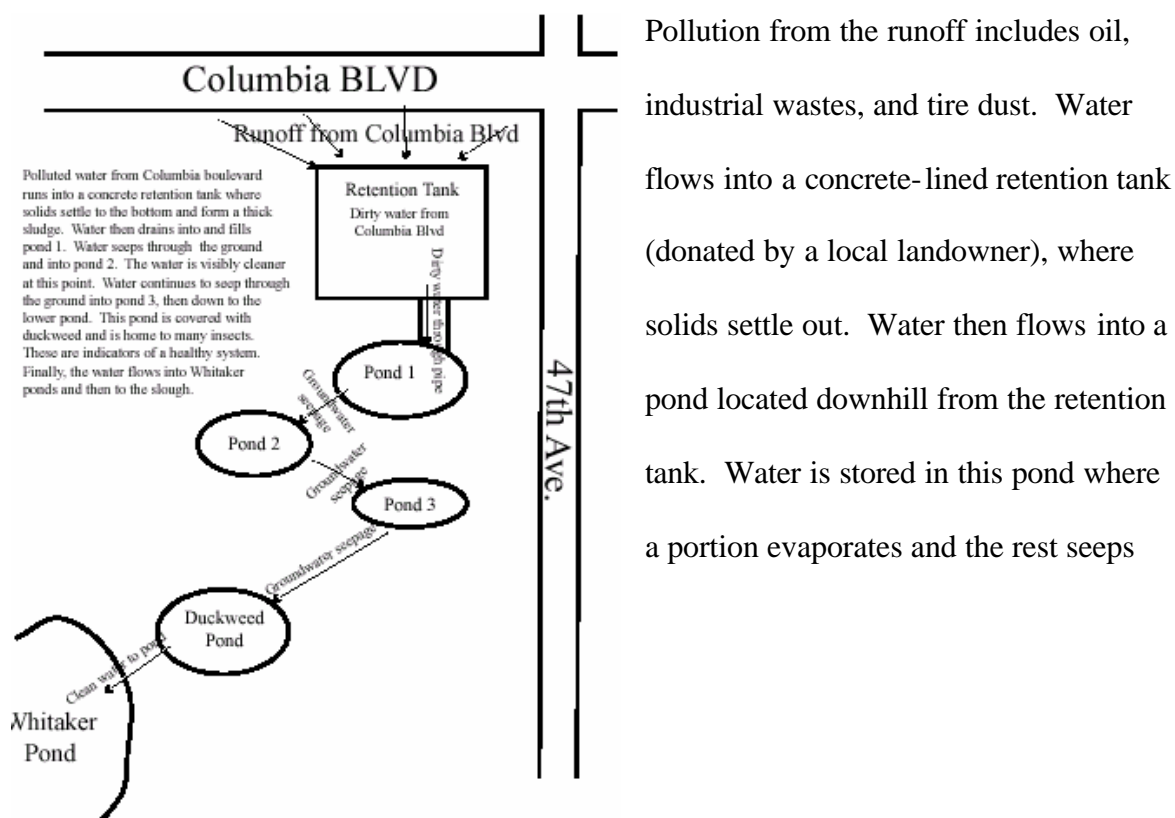
In 1999, the EPA gave the Multnomah School District "Turnaround School" a grant to help in the restoration project at Whitaker Ponds. Through this grant, at-risk and expelled students learned about the restoration process. The students "plant trees, monitor wildlife, implement salmon recovery, remove blackberry bushes, plant native willows, build nature paths, and implement water quality testing (EPA, 2002)."

In 2000, local high school students established 11 permanent monitoring plots to monitor native plant growth at sites that were planted from 1995 to 1997.

The Environmental Learning Center also has a variety of educational programs available to teachers who want to bring students to the site for a field trip. The field trips teach children about restoration through activities similar to those of the “Turnaround School” (Sustainable Portland, 2001).

In 2000, the City of Portland’s Bureau of Environmental Services (BES) Revegetation Program and community volunteers planted 3,000 plants and shrubs around Whitaker Ponds. Bi-annually, the BES and the Columbia Slough Watershed Council hosts an event called “Soup on the Slough” at the Whitaker Ponds. At this event, community members are invited to lunch or dinner to talk about the restoration projects taking place at the site and to share their concerns and perspectives about slough-related topics (CSWC Annual Report, 2000).

Another benefit of restoration on the ponds is an experiment to reduce pollution from runoff from Columbia Blvd., located 300 yards uphill of the ponds (see figure 1).



through the ground into a second pond. This process is repeated a total of 4 times. The lowest pond (not Whitaker) is covered with Duckweed, a fairly recent change, and though no quantitative data is available, water in the Duckweed pond is significantly cleaner with vibrant plant growth and a flourishing insect population (Personal Communication, Sue Barthow, Nov. 2002). A restoration project in the Everglades of Florida indicates that the presence of Duckweed and insects are indicators of a healthy ecosystem (Levin, 2002).

Though the ponds are relatively small, a study by Oertli et. al. concludes that species diversity is not a function of pond size, and that size showed only a minor relationship with species richness (2002). This study helps to justify the effort of purchasing and restoring small areas.

Without the organized participation of community and schools, Whitaker Ponds would not have the level of information and restoration completed that it has today. Through the aid of local scientists and environmentalists, wetland restoration has become an exciting and fun topic for school children. The Learning Center at Whitaker Ponds serves as a tool for the entire Columbia Slough.

### **Vanport Wetlands**

The 91-acre sites occupied by Vanport wetlands have had many faces over the years:

- Prior to the 1920's the site was actually Force Lake,



Aerial view of Vanport wetland site (Source: Port of Portland website)

named after a family that settled the area.

- In 1920 the Peninsula Drainage District drained Force Lake and the surrounding floodplain in order to develop more land for farming.
- The KGW radio towers were built on the land in the early 1920's, hence the name of "radio tower site" adopted after the great flood of 1948 that was the demise of the Vanport area.
- The land was farmed continually until 1965 at which point the land was abandoned to be taken over by invasive plant species primarily reed canarygrass, thistle, blackberry and nightshade
- In the 1990's the Port of Portland permitted for the filling of a wetlands near the airport. When the Port can't avoid the filling of wetlands they buy proportional land in the same watershed restoring it to natural wetlands.
- The Port contracted with natural resource agencies and interested watershed groups to finally decide on a site to purchase. In 1999 the Port purchased the radio tower site and the mitigation process began.

The Port of Portland has an environmental plan to create as much wetland as it destroys. In other words, if some wetlands are destroyed in the process of a project, then the Port will purchase a proportional or greater piece of land in the same watershed for restoration. A direct result of this plan was the purchase of the KGW Radio Tower site later known as the Vanport wetlands. The Port of Portland decided that it was necessary to enlarge part of the Portland airport, which resulted in the loss of about 18-acres of wetlands. In response to the impending loss the Port hired an environmental research agency to find a comparable wetland in the Columbia Slough watershed for purchase.

KGW radio station basically neglected the 91-acre site allowing invasive vegetation to begin taking over the land. The majority of the land was covered by reed canarygrass with other densely populated areas of thistle, blackberry, and nightshade. The invasive vegetation was so dense that it smothered nearly all other plant species in the wetland causing virtually no diversity. The result is a limited variety of wildlife that will use the wetland due to limited food sources.

The goal of the mitigation plan is to increase diversity of plant and wildlife habitat on the site by establishing a more diverse native-dominated wetland habitat with a surrounding vegetative buffer (Port of Portland, 2000). The objective for restoration of the Vanport wetlands is unlike most restoration projects in that the intentions are not to bring the area back to its original state. The intentions are to create new wetlands to enhance habitat for wildlife and native vegetation. After the Port of Portland acquired the land in 1999 a plan was developed to rid the new wetlands of invasive plant species through the following: mowing, disking, reseeding with native vegetation, and finally flooding the land to further inundate the invasive vegetation with stress. Prior to flooding the wetlands an earthen dike had to be built around the wetland to aid in flood control or more accurately to keep from flooding expo road. Another earthen project was to reconfigure the existing ditch system to a more natural meandering flow.

The site restoration is relatively new, which means solid data on how well fauna and flora are coming back is not readily available. However, according to the Port of Portland's website the ducks and geese are flocking to the new wetlands. The wildlife in general has been coming back steadily and the replanting of good wetland vegetation will only enhance the waterfowl conditions further. According to a Carrie Stevenson of the

Port of Portland the waterfowl have been thriving especially well now that the wetland is flooded nearly year around. She went on to say that it's not uncommon to see hundreds of Canadian honkers and ducks using the area. New sightings of Pintail, Green Wing Teal, Canvasback, and Northern Shovelers are becoming more common than not.



The result of a successful wetlands (Source: Port of Portland website).

Many different birds of prey, such as American kestrel, bald eagle, red-tailed hawk, osprey and great horned owl have been observed frequenting the wetlands. Several other species of birds have been observed in the area no doubt as a result of the increased waterfowl in the wetlands. The wader and shorebird types have increased rapidly in the wetland, probably due to the muddy wet edges of the swale that make for perfect foraging. Some of the more common waders and shorebirds to the wetlands are the common snipe, greater yellowlegs, long-billed dowitcher and sandpipers. The great blue herons as well as killdeer are frequently observed wading along the swale. With the increase in use by waterfowl and various bird species nesters have been observed to be using the wetland during the spring months. The nesters where observed to be mallards, killdeer, marsh wrens and cliff swallows (Port of Portland, 2002).

According to Stevenson, the battle with reed canarygrass and Himalayan blackberry has been very successful thus far. The port battled the invasive vegetation with the use of herbicides followed by disking the ground to further disrupt the plant.

The battle against the Himalayan blackberry has been especially successful by the means describe above. Unfortunately, the Port was unable to flood the entire wetland due



The building of the meandering swale and the earthen dikes where performed using heavy equipment (Port of Portland website).

to lack of rain, which has slightly stymied the battle against the reed canarygrass. However, Stevenson went on to say that the diversity of vegetation is already very noticeable with the emergence of bulrush,

spikerush, burreed and other intentionally planted or seeded vegetation.

The building of the earthen dikes had many purposes, one of which was to prevent the flooding of expo road the other was to allow for flooding of the wetland. The earthen dikes have obviously been built to maintain some control over the flooding process, which is further controlled through a single pump station from the Columbia slough. The natural meandering swale like system.



The Port's Carrie Stevens plants twinberry shrubs on the bank of the earthen dike in January 2002 (Port of Portland website).

## Section 1135 Project

The 1135 project, named after the U.S. Army Corps of Engineers (USACE) Section 1135 Restoration Program, is a multi-agency project consisting of several components along a 7.5 mile stretch (see map 2) of the slough. The nearly five million-dollar project is 75% funded by the USACE and 25% funded by the city of Portland BES (“Slough News,” 2002). It consists of several components, including:

1. Creating meandering channels and wetland benches.
2. Revegetating the new benches and controlling invasive non-native plants.
3. Replacing ineffective culverts in Buffalo and Whitaker slough.
4. Creating a 9-acre wetland to provide wildlife habitat and filter storm water (USACE Columbia Slough Section 1135 Restoration Project Report, 2001).

This collaborative effort is aimed at the ecological system instead of at a single location. While this is much more expensive, the long-term benefits should return a healthier ecosystem.

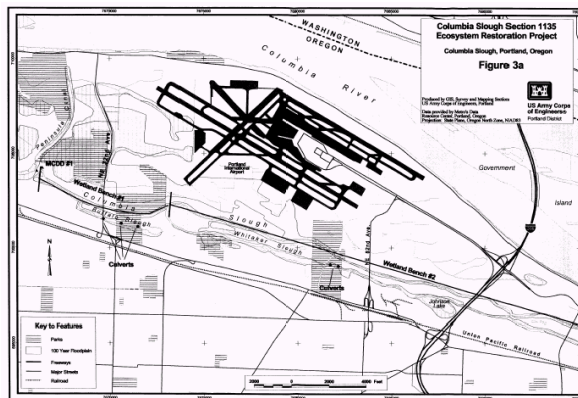
### Multnomah County Drainage

District #1 (MCDD #1) is responsible for dredging channels and building benches.

Due to the steep banks and narrow channel, there is little emergent marsh habitat

(USACE Section 1135 Restoration Report,

2001). This would involve dredging the slough to a designed depth and placing material along the banks to create wetland benches and meandering channels (Fig. 2). The Portland BES is planting emergent plants along these benches. This combined effort will reduce sedimentation from runoff, provide erosion control and reduce water temperatures (Lyn Barlow, Personal communication, Nov. 2002), all necessary components of



Map 2--Section 1135 project restoration sites (Source: USACE project report)

healthy salmon and steelhead habitat. The primary goals of the revegetation (BES

Watershed Revegetation Program Monitoring and Documentation Protocol) are:

1. Increase native tree canopy, shrub cover, and herbaceous cover
2. Increase shade over surface water.
3. Increase native plant diversity and structure for wildlife habitat.
4. Reduce erosion by stabilizing soils with native plantings and bioengineering.
5. Evaluate overall plant survival, mortality, and vigor by project site to indicate the need for planting treatments.
6. Reduce non-native weedy species.

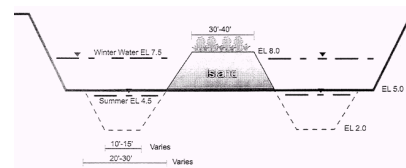


Figure 6. Middle Slough Island Design & Trench

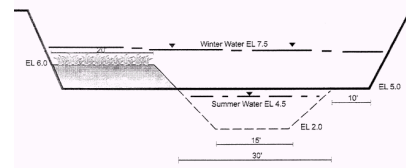


Figure 7. Middle Slough Bench & Trench Design

Since this project began in July 2002, no

quantitative data has been produced to measure how effective the wetland benches and revegetation has been. Subsequently, there is little baseline data to compare with

(Personal Communication, Lyn Barlow, Nov. 2002). However, the Portland BES has developed certain guidelines it will use to monitor the revegetation. One is a quantitative measurement and the other utilizes photo monitoring.

### Quantitative Data Analysis

Portland BES uses a simple equation to calculate means and extrapolation of plot means to generate per-unit area averages:

$$\text{Planted TPA} = T/nA$$

where: Planted TPA= planted trees per acre

T= total number of trees found on all plots

n= total number of plots

A= area of plot in acres

Survival percentages are calculated as the proportion of surviving *planted* trees or shrubs on plots divided by the total number of trees or shrubs originally planted on plots (BES

Monitoring and Documentation Protocol). This simple formula will give a general indication of how well revegetation is taking hold of the wetland benches.

### **Photomonitoring**

Photomonitoring is one of the most basic monitoring techniques, however photographs taken over a number of years are a valuable tool of evaluating plant progress. The two types of photographs used in this evaluation method are a general view (including features and landscapes) and close-ups.

- Feature photos: a general view photograph is taken along a transect in both directions. For example, plots are set up to monitor changes of a stream bank. A prominent landmark is chosen and two stakes about 40 feet apart are used to center the photos. A photo identification label is used to ensure photos of the same stream segment are taken and the dates kept in order.
- Landscape photos are an overview of the area showing the feature and its relationship to the surrounding area. These photos are used to show the area of the same section of stream of feature photos.
- Close-up photos show specific characteristics of an area, such as emergent wetland vegetation, soil surface or ground coverage. Close ups photos are taken from points permanently located to give as much information of change as possible.

Sites are monitored several times within a 5-year period, depending on the type of vegetation planted.

### **Discussion & Conclusions:**

Current data collection has proven that the water quality in the slough has gone up (CCRH, 2002), however it is insufficient to judge how well restoration as a whole has benefited the slough. However, the qualitative data collected through interviews, informal discussions and prior work has proven that the slough is a more productive ecosystem. The lack of baseline data collection prior to the beginning of many projects will inhibit the measurement of change over time, and current data collection should be increased assess what types of restoration are more effective than others.

The three projects discussed in this paper are fairly typical of many of the other projects occurring within the slough. They are a representative sample of how restoration projects are benefiting this urban ecosystem. The number of government agencies involved in restoring the slough is indicative of the importance of the area. While it will continue to be intensely managed for anthropogenic use, natural flora and fauna populations can recover and play a role in the ecosystem. The Whitaker Ponds brings the community together and educates the next generation to value the area as an integral part of the urban ecosystem. The Vanport Wetlands, though only recently restored, has seen a marked increase in bird populations. The natural removal of an invasive species by flooding is an alternative to labor-intensive non-native vegetation removal by hand. Replanting produces emergent wetland species that soon become self-supportive. The section 1135 Project is an example of how the financial sources of government agencies can make wide sweeping changes. This project will reduce the listed TMDL's of section 303(d) of the clean water act. These projects, with its many separate aspects, combine to restore the ecosystem back to a system, where all the parts work together. These sampled

projects support our hypothesis that restoration in the Columbia River Slough is benefiting the urban and natural environment.

**Recommendations:**

Dave Hendricks, MCDD #1 Operations Manager, says of restoration:

“(W)e can restore all the habitat we want to, but without the proper maintenance, without people overseeing and managing newly planted area, it’s going to deteriorate as fast as we restore it. And, this is especially true for wetland creation—something we do a lot of in the Columbia Slough Watershed (CCRH, 2002).”

Within the past ten years restoration projects have become very common.

Government agencies from the federal down to the local level are realizing the value of the slough, but there is currently little cooperation from one restoration site to the other. There is no one source documenting the various projects, therefore it is difficult to plan restoration as part of a system instead of as individual components. A provision should be in place to document what is occurring, where, at what time and its details. This will allow the people involved with restoration to concentrate efforts to include a range of components, much like the Section 1135 Project, only on a larger scale.

Volunteers have been an integral part of restoration, and the slough attracts many educators and businesses. People involved range from neighbors to academics to large business owners (personal communication, Soup on the Slough, Nov. 2002). Clearly the benefits of the slough as a healthy ecosystem are benefiting the local community, and vice versa, and while there is always room for more help, local organizations are doing a good job of keeping the community involved.

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