Tualatin River
Watershed Council

Lower Gales Creek Habitat Enhancement Plan

March 2003

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Abbreviations and Acronyms

BMP	Best Management Practices
BOR	US Bureau of Reclamation
COE	US Army Corps of Engineers
Council	Tualatin River Watershed Council
CREP	Conservation Reserve Enhancement Program
CWS	Clean Water Services
D	Domestic Water Use
DO	Dissolved Oxygen
DSL	Division of State Lands
DEQ	Oregon Department of Environmental Quality
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FI	Fish
FONSI	Finding of No Significant Impact
FSA	USDA Farm Services Agency
GCWA	Gales Creek Watershed Assessment Project
GIS	Geographic Information System
HROC	Tualatin Habitat Restoration Oversight Committee
IR	Irrigation Water Use
LC	Low Gradient, Confined
LM	Low Gradient, Moderately Confined
LWD	Large Woody Debris

MH	Moderate Gradient, Headwater Channel
MU	Municipal Water Use
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service (Now known as NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
NRCS	USDA Natural Resources Conservation Service
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODOT	Oregon Department of Transportation
OWEB	Oregon Watershed Enhancement Board
OWRD	Oregon Water Resources Department
RM	River Mile
SPOTAC	Stream Protection Opportunities Technical Advisory Committee
SWCD	Soil and Water Conservation District
SWRP	Student Watershed Research Project
TMDL	Total Maximum Daily Load
TRK	Tualatin Riverkeepers
TRWC	Tualatin River Watershed Council
TU	Trout Unlimited
UGB	Urban Growth Boundary
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WRD	Oregon Water Resources Department

Introduction

Section 1

1-1 Purpose

The purpose of this report is to outline a 5-year anadromous fish habitat enhancement plan for a four mile reach of lower Gales Creek, a tributary of the Tualatin River (see Figure 1-1). The Lower Gales Creek Habitat Enhancement Plan (Lower Gales Plan) builds upon a base of work conducted through a watershed assessment process, habitat studies, and work performed by the Tualatin River Watershed Council (Council) stream and riparian restoration committee. The Lower Gales Plan was developed in response to a U.S. Bureau of Reclamation (BOR) request for proposal to evaluate and prioritize factors limiting salmonid production, particularly winter steelhead trout (*Oncorhynchus mykiss*), and develop a 5-year habitat restoration plan for one priority area within the Tualatin River Watershed. The BOR is providing funds to mitigate for loss of salmonid habitat caused by the construction of Scoggins Dam and the creation of Henry Hagg Lake.

The Lower Gales Plan describes the process used to identify the priority area. After the reach was identified, a functional assessment and limiting factors analysis was completed. This led to the division of the priority area into 13 functional sub-reaches (project reaches). The current condition of the stream and riparian corridor, opportunities for enhancement projects, and recommendations for action for each of these 13 project reaches is described in the Lower Gales Plan. Enhancement projects for each of the project reaches were evaluated based on biological significance, accessibility, and willingness of landowners to participate. The recommendations provide a guideline for future enhancement efforts. The recommendations in the Lower Gales Plan provide conceptual level design information. Additional design work will be required to implement projects.

The analyses conducted for this plan consider all life history stages of winter steelhead trout. However, it should be recognized that there are other important species in Gales Creek. Although aspects of this plan have been written specifically with winter steelhead trout in mind, it is the hope of the Council and partners that the projects developed from this plan will benefit multiple species.

The Council is committed to supporting the recommendations in the Lower Gales Plan. One of the main goals of the Council, identified in the Tualatin River Watershed Action Plan (Action Item 2), is to conserve and improve fish and wildlife habitat (focusing on anadromous fish). The main elements of this Action Item are:

- Promote and implement streambank and riparian restoration;
- Improve fish passage at identified priority artificial obstructions;
- Promote development of management plans for non-indigenous terrestrial and animal species; and
- Identify priority habitat areas and suggest strategies for protection and management of wildlife purposes.

In addition, there are a number of partners in the watershed that share the common goal of protecting and enhancing anadromous fish habitat, and will assist with the implementation of this plan. This plan has been

developed in partnership with the Tualatin Soil & Water Conservation District (SWCD). Guidance for the plan was provided by the Tualatin Habitat Restoration Oversight Committee (HROC). HROC members include: U.S. Bureau of Reclamation (BOR), Clean Water Services (CWS), Oregon Department of Fish and Wildlife (ODFW), NOAA Fisheries (formerly known as National Marine Fisheries Service –NMFS), Tualatin Riverkeepers (TRK), Trout Unlimited (TU), and the U.S. Fish and Wildlife Service (USFWS).

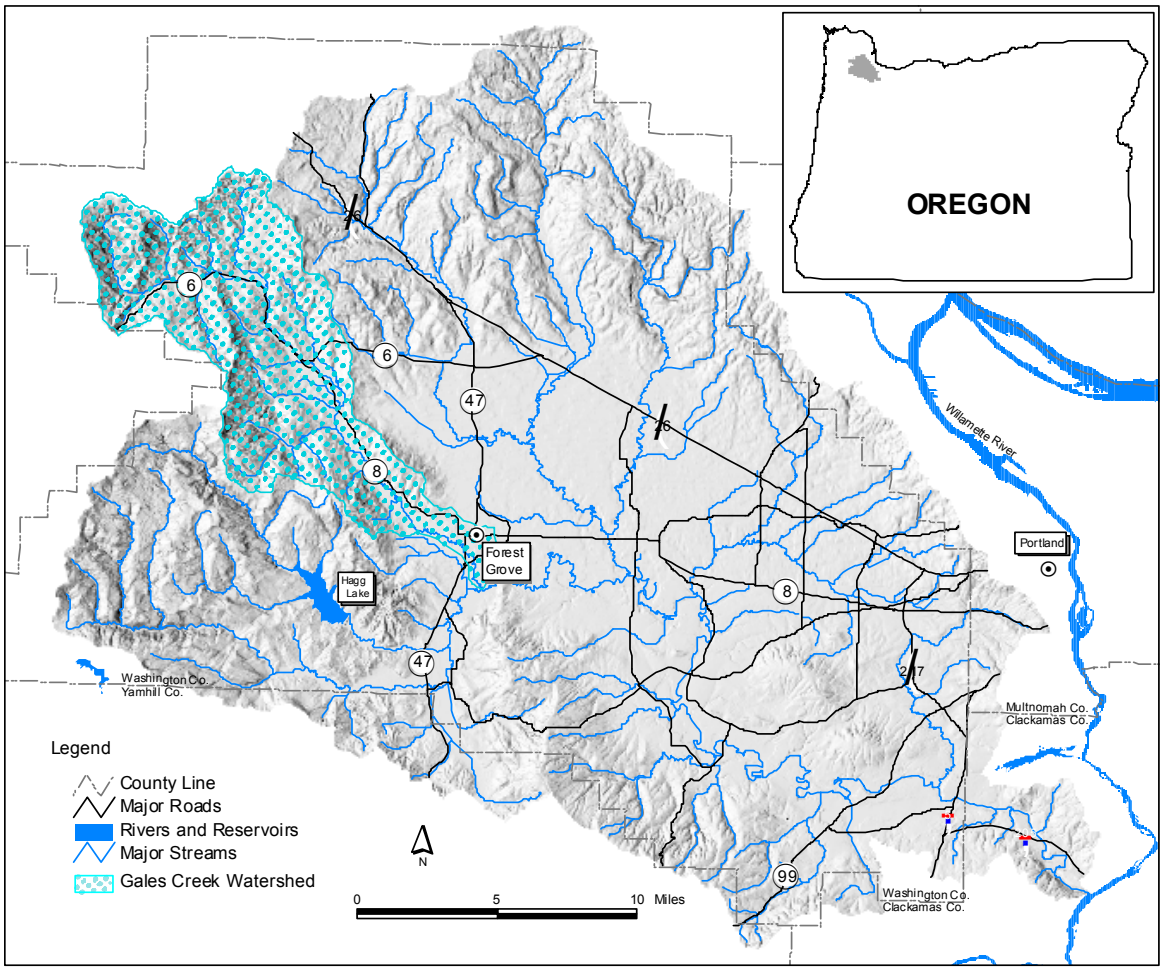


Fig. 1-1: Location of Gales Creek Watershed Within the Tualatin River Basin

1-2 History of Fish Mitigation in the Tualatin Basin

The construction of the BOR's Tualatin Project, consisting of Scoggins Dam/ Henry Hagg Lake and related elements, eliminated 15 miles of anadromous fish spawning habitat upstream of Hagg Lake (see Figure 1-1). BOR has an ongoing Federal requirement to mitigate for impacts on anadromous fish populations in the Tualatin River basin due to construction of the Scoggins Dam (Tualatin Project); established by a 1972 Final Environmental Impact Statement[1] and 1973 supplement.

To meet the mitigation requirement, historically BOR provided funding on an annual basis to ODFW to trap, hold, rear, and stock hatchery anadromous fish in the Tualatin River basin. In 1998, ODFW reached an agreement with NOAA Fisheries to stop releasing hatchery-reared anadromous fish into the Tualatin River basin. The change in policy is an effort to comply with ODFW's Wild Fish Gene Resource Conservation Policy, specifically relating to potential genetic risks associated with interactions between wild and hatchery steelhead trout stocks. To respond, BOR determined that using the annual mitigation funds for its original purpose of stocking hatchery fish is no longer reasonable and appropriate.

In order to determine the appropriate use of the annual mitigation funds, BOR conducted a National Environmental Policy Act (NEPA) review and subsequently completed an Environmental Assessment (EA) and Findings of No Significant Impact (FONSI) in May 2001. BOR's preferred alternative and final NEPA decision determined that the annual funding would continue to meet BOR's required fish mitigation obligations by funding habitat enhancement and restoration projects instead of supporting hatcheries. In future years, BOR's mitigation funds may be used to help implement on-the-ground habitat restoration projects based upon the 5-year enhancement plan for Lower Gales Creek. (BOR, 2001)

1-3 Gales Creek: An Overview

Physical Characteristics

The Gales Creek watershed is one of the many large rural sub-basins of the Tualatin River watershed. The 49,481-acre (77.9 sq. mi.) sub-basin is situated on the eastern side of the Coast Range Mountains and is primarily contained within the northwestern edge of Washington County, except for two small portions extending into Tillamook County (see Figure 1-2). The mainstem of Gales Creek is 23.5 miles long and flows in a southeasterly direction, entering the Tualatin River about 1.5 miles south of the City of Forest Grove.

Elevations in the Gales Creek Watershed range from a minimum of 159 ft., at the confluence with the Tualatin River, to a maximum of 3,154 ft. The mainstem of Gales Creek has a low gradient and is slow moving for about 10 miles upstream from the confluence. Above the community of Gales Creek, the gradient increases and the slope rises steeply (in the middle reach). In the upper reaches of the watershed the slope becomes much steeper, with gradients over 15%. Table 1-1 provides a list of the tributary streams, the location of their confluence with Gales Creek and their contributing drainage area.

[1] Required by Section 102(2) (c) of the National Environmental Policy Act (NEPA)

Table 1-1: Main Tributaries of Gales Creek[2]

Stream Name	Gales Creek river mile (RM) at confluence with tributary	Drainage Area (Acres)
Prickett Creek	6.53	841
Roderick Creek	7.70	664
Godfrey Creek	8.94	343
Clear Creek	10.68	6109
Iller Creek	11.44	3089
Fir Creek	11.47	932
Little Beaver Creek	12.40	4393
White Creek	14.44	566
Bateman Creek	16.26	892
Beaver Creek	18.00	6560
Coffee Creek	19.88	1238
Finger Creek	20.07	588
South Fork Gales Creek	20.70	2631
North Fork Gales Creek	21.60	8969
Low Divide Creek	22.76	*Included in North Fork

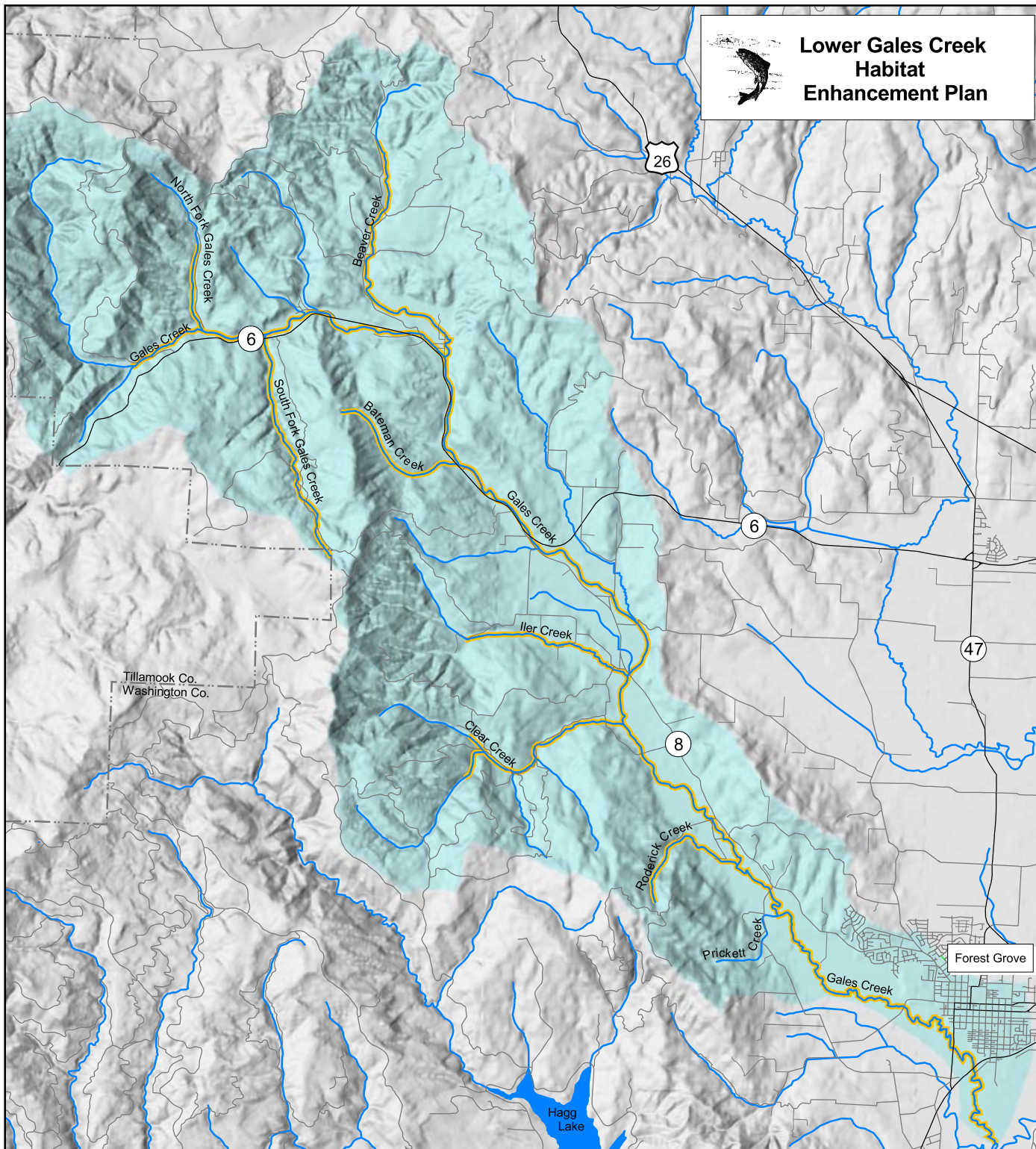
Vegetation

The Gales Creek watershed contains a mosaic of native and introduced plant species. The original forest uplands, most of which were logged 40 to 80 years ago or burned in two stand-replacing fires (1933 and 1945) have been replaced with Douglas fir forests that are intensely managed. Douglas-fir, western red cedar, red alder, big leaf maple, vine maple, and elderberry are the dominant plant species in the riparian zone of the upper reaches of Gales Creek. The lower elevation foothills were originally Oregon white oak and Douglas fir but are now dominated by woodland, pastureland, vineyards, Christmas tree farms, and orchards. The flat, flood plain lands of the watershed are almost exclusively used for agricultural crops, including container nurseries and small livestock operations. Riparian vegetation in the lower reaches includes a mix of native and introduced species: Douglas-fir, western red cedar, willows, red alder, big leaf maple, Oregon ash and black cottonwood. Typical, native understory species are red-osier dogwood, snowberry, hawthorn, ninebark, oceanspray, cascara and sedges. Invasive plant species such as Himalayan blackberry, reed canarygrass, English ivy, Japanese knotweed, and Scot's broom are found in patches in the lower reaches of the watershed.

Land Use

Almost two/thirds of the watershed is privately owned, either as industrial forestland (26%) or private agriculture and rural residential lands (38%). The Oregon Department of Forestry (ODF) owns and manages 28% of the watershed as part of the Tillamook State Forest. The City of Forest Grove owns another 8%. There are no federal lands in the watershed.

[2] Excerpted from the Gales Creek Watershed Assessment Project



Legend

- County Line
- Rivers and Lakes
- Major Streams
- Winter Steelhead Habitat
- Gales Creek Watershed

Gales Creek Watershed Map

1 0 1 2 Miles

N

Data Sources: Washington County (2002)
Metro (RLIS Lite 2002)
ODFW (2002)
Tualatin CD (1998)

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Figure 1-2

A small part of Forest Grove, the only incorporated city within the watershed, is located at the southeastern edge of the Gales Creek basin. Small rural communities include Gales Creek, Balm Grove, and Glenwood. Rural residences are scattered throughout the watershed, with most homes located near the banks of the mainstem of Gales Creek. Because the majority of the watershed is outside of the urban growth boundary, and the dominant land uses are forestry and farming, population growth in the watershed is limited. (Breuner, 1998)

1-4 Salmonid Distribution

According to the Gales Creek Watershed Assessment Project: cutthroat trout, steelhead trout, and coho salmon are important fish species found in the Gales Creek watershed. They depend on clear, cool water, vegetated riparian zones, and unobstructed passageways to rearing, spawning, and overwintering habitat. The tributaries and mainstem of Gales Creek provide the only non-fragmented natural connection between the upland forests of the Coast Range and the wetlands and floodplain of the Tualatin River. Anadromous fish migrate to and from the watershed via the Tualatin, Willamette, and the Columbia rivers on their way to and from the Pacific Ocean. (TRWC, 1998)

Evidence suggests that winter steelhead trout (*Oncorhynchus mykiss*), an anadromous species listed as threatened under the Federal Endangered Species Act (ESA) in 1999, has historically used Gales Creek for spawning and rearing and are considered indigenous to the watershed (NOAA, 1999). Cutthroat trout *(O. clarki)* are also considered indigenous to the Tualatin basin. Populations of cutthroat are found in most of the larger tributaries and headwater areas of Gales Creek where cool water temperatures and good water quality persists. Cutthroat trout in the Gales Creek system are either resident or seasonally migratory (potamodromous). Migratory cutthroat trout inhabit the mainstem of the Tualatin and Willamette rivers from May to October/November and, in late fall/ early winter, migrate into the smaller streams in the upper watersheds to spawn (BOR, 2001).

Coho salmon (*O. kisutch)* are not native to the Tualatin basin and did not utilize the watershed until construction of a fish ladder at Willamette Falls in the late 1800's[3]. Coho fingerlings were stocked in Gales Creek from 1936 until 1987 (TRWC, 1998). With improved fish passage at Willamette Falls, strays from other basins, and the introduction of hatchery stock, some natural production of coho salmon is now occurring in the Tualatin basin. Juvenile coho salmon have been observed in the upper Tualatin River, Gales Creek, and lower Roaring Creek, a tributary to the Tualatin River (Leader, 2001).

Salmonid populations statewide are decreasing. Appropriate enhancement or restoration activity in watersheds like Gales Creek will help to strengthen native fish populations by providing viable spawning and rearing habitats. Indigenous to the watershed and listed as a threatened species under the ESA, winter steelhead trout are the focus species for the habitat enhancement efforts identified in the Lower Gales Plan.

[3] Given adequate conditions, winter steelhead trout were able to migrate past the falls before the fish ladder was constructed.

Selection of Priority Area

Section 2

2-1 Selection Process

Stream Prioritization Matrix

In order to select a priority area, a systematic approach is required to identify stream reaches where enhancement efforts will bring the greatest benefit to salmonid habitat in the Tualatin Basin. The Tualatin River Watershed Council has developed a decision matrix that can be used as a tool to prioritize stream reaches in terms of highest potential benefit of restoration on stream system health. Eight habitat condition criteria form the basis of the decision matrix. When using the matrix, each stream reach is assigned a score for each of the eight criteria. The criteria are summarized in Table 2-1 (See Appendix A & B for the full criteria).

Table 2-1: Criteria Utilized in Decision Matrix

Habitat Condition Criteria	Range of Scores	Weight
Anadromous Spawning/Rearing	0 = not present, passage only 5 = 100% of reach is accessible, degradation is severe	5
Resident Salmonid Spawning/Rearing	0 = not present, passage only 5 = 100% of reach is accessible, degradation is severe	5
On DEQ's 303(d) list	One point per listed parameter, excluding temperature (maximum of 5 points)	3
On DEQ's 303(d) Temperature List	0 = Not listed and max. temp < 64°F 3 = 303d listed and max. temp < 70°F 5 = 303d listed and max. temp > 70°F	4
Accelerated Erosion	0 = < 15% of banks have accelerated erosion 3 = 15-60% of banks have accelerated erosion 5 = > 60% of banks have accelerated erosion	4
Riparian Quality (Vegetation Width and Diversity)	0 = Average width is > 50 feet 3 = Average width is 25 - 50 feet 5 = Average width is < 25 feet	5
Potential for Anadromous Fish Use	0 = No manmade barrier is present 3 = 2nd order stream with manmade barrier 5 = 3rd order stream with manmade barrier	5
Riparian Area Connected to a Wildlife Corridor	0 = No potential to serve as a wildlife corridor 3 = Already serves as a wildlife corridor 5 = Has potential to serve as wildlife corridor	3

The criteria were assigned weighting factors that relate to the potential effect that each habitat category could have on the ability for viable winter steelhead population to exist. The weighting factors are multiplied by the sum of the scores from the eight categories to produce a total score.

The habitat condition criteria were applied to nearly 160 stream reaches within the Tualatin River Basin. A full list of the stream reaches and their related scores is included in Appendix C. From this application of the decision matrix, a short list of high priority stream reaches was developed. Table 2-2 summarizes the results for the top priority reaches:

Table 2-2: Example of Stream Prioritization Matrix Results

Stream	Reach	Priority Rating
McKay Creek	Jackson Creek to Brunswick Canyon	3.32
Gales Creek	Roderick Creek to Godfrey Creek	3.18
West Fork Dairy Creek	Garrigus Creek to Mendenhall	3.12
West Fork Dairy Creek	Williams Creek to Burgholzer Creek	3.12
McKay Creek	Waible Gulch to Jackson Creek	3.00
Gales Creek	Prickett Creek to Roderick Creek	2.97
Gales Creek	Godfrey Creek to Clear Creek	2.97
East Fork Dairy Creek	Murtaugh Creek to Plentywater Creek	2.65
East Fork Dairy Creek	Big Canyon Creek to Murtaugh Creek	2.59

After the initial evaluation, an additional criterion was added to account for the potential success of stream projects for salmon habitat enhancement. It was assumed that success would be greatest where there was a nearby large population of salmonids within the stream or its tributaries. For this purpose, a 'run strength' criterion was added to the stream prioritization matrix. This criterion was assigned scores based on recent fish population surveys sponsored by CWS and the Council, and conducted by ODFW (2000 & 2001). The number of fish found in a stream reach, over a year period, were tallied and assigned a score based on this breakdown:

Table 2-3: Run Strength Scoring

Total Number of Fish	Score
> 40	5
20- 40	4
~ 5	2
1-2	1
0	0[1]

Scores were assigned to each of the reaches in the stream prioritization matrix based on proximity to survey sites and known fish habitat, or lack of habitat. This method of assigning scores for run strength has some bias. It is possible that the same fish were counted more than once during a period of a year. However, the same process was applied to all the reaches so the bias is consistent throughout. A final priority score was calculated using the run strength score and the rest of the data from the original categories of the matrix.

[1] A score of zero indicates that the area is not accessible, was surveyed and no steelhead were found, or is not considered by ODFW to be a stream with anadromous fish habitat.

Following inclusion of the 'run strength' criterion the top stream prioritization scores were as follows:

Table 2-4: Adjusted Matrix with Run Strength Scoring

Stream	Reach	Priority Score
Gales Creek	Roderick Creek to Godfrey Creek	3.28
Gales Creek	Prickett Creek to Roderick Creek	3.10
Gales Creek	Godfrey Creek to Clear Creek	3.10
McKay Creek	Jackson Creek to Brunswick Canyon	3.03
East Fork Dairy Creek	Murtaugh Creek to Plentywater Creek	2.95
East Fork Dairy Creek	Big Canyon Creek to Murtaugh Creek	2.90
East Fork Dairy Creek	Bledsoe Creek to Gum Creek	2.90
West Fork Dairy Creek	Garrigus Creek to Kuder Creek	2.85
West Fork Dairy Creek	Kuder Creek to Whitcher Creek	2.85

Based on these scores, it was determined that an approximately 4-mile stretch of Gales Creek, and connecting tributaries (Prickett Creek to Clear Creek) was the highest priority area. Sections of McKay and East Fork Dairy Creek were kept in consideration pending the review of other factors. Figure 2-1 shows the location of the high priority streams within the Tualatin River Basin.

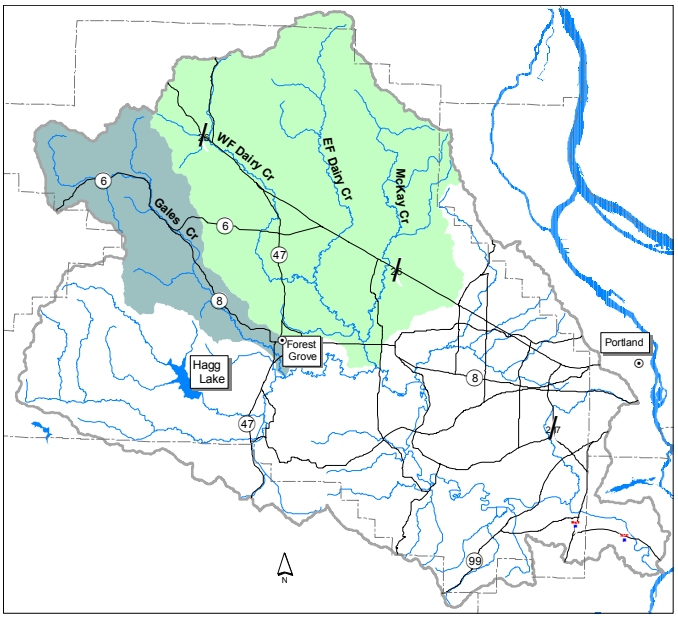


Fig 2-1: High Priority Stream Options

Consultation with Local Experts

Conservation planners from the Natural Resources Conservation Service and the Tualatin Soil and Water Conservation District were consulted regarding the potential of finding landowners likely to participate in restoration projects. Staff from these agencies have built up relationships with agricultural landowners in the area. These sources did not indicate a stream reach under consideration that held a particular advantage over the other reaches. Individuals associated with the Tualatin River Watershed Council were also

consulted, and indicated that some efforts were made in the past to organize a community group in Gales Creek. During this process a group of rural residential landowners demonstrated an interest in protecting their local resources.

Landowner Survey

An additional source of information for Gales Creek provides some insight on landowner perspectives relating to problems facing people and salmonids. In the fall of 2001, the Tualatin SWCD surveyed agricultural landowners along Gales Creek[2]. Twenty-four out of sixty surveys were returned. The survey results show that agricultural landowners have some understanding of problems facing fish; and over half of the landowners that responded felt that it was a medium to high priority to solve problems affecting fish (See Appendix D). Landowners also seemed to be aware of challenges in trying to plant trees along the creek. Over half of the landowners indicated that they might be interested in getting some technical assistance from the SWCD. While this is just a sampling of landowners' perspectives, the survey provides some insights into possible responses to future projects along Gales Creek. This type of information is not available for either East Fork Dairy Creek or McKay Creek.

Examination of Data Sources

Existing data sources were examined to determine those stream sections that had the most available data. There was available data for Gales, McKay, and East Fork Dairy Creeks, but the type of data varied between stream reaches. The Gales Creek data was collected according to ODFW protocols, while East Fork Dairy Creek and McKay Creek had data collected according to BLM protocols. Although both of these protocols offered useful insights into habitat conditions, the Gales Creek data provided the most information applicable toward benchmarks for determining stream condition. While the Gales Creek habitat surveys were taken in forested reaches outside the focus reach, they did offer insights on upstream conditions that could potentially affect the priority area. Table 2-5 summarizes the data that is available for the three creeks. The data sources include the Oregon Department of Environmental Quality (DEQ), the Oregon Department of Agriculture (ODA), the Student Watershed Research Project (SWRP), the Farm Service Agency (FSA), and CWS.

Table 2-5. Coverage of selected data types for candidate priority streams

Stream	***Gales Creek***	***East Fork Dairy Creek***	***McKay Creek***
Temperature	DEQ 1999	DEQ 1999	DEQ 1999
TRWC/CWS fish surveys	Yes	Yes	Yes
Habitat surveys	Upper Gales	Above Big Canyon	Above EF McKay
WQ sites: Agency	1 (CWS)	1 (ODA)	2 (CWS, ODA)
WQ sites: SWRP	4	4	1
Macroinvertebrate surveys	Upper watershed (Cole, pers. Data)	2 sites (CWS)	None
Riparian inventory	FSA slides	FSA slides	FSA slides

[2] Surveys were mailed to select agricultural landowners along Gales Creek from approximately Southwest B Street (also known as Old Hwy 47) in Forest Grove to the confluence of Clear Creek and Gales Creek.

Although this study is designed to use existing data, the feasibility of access for future data collection was also considered. Most property along the candidate reaches is privately owned, thus limiting access opportunities. However, the Gales Creek area had the largest number of public stream crossings. Few public stream crossings were present along McKay Creek and East Fork Dairy Creek.

Results

Gales, East Fork Dairy, and McKay Creek have similar salmonid enhancement values. However, Gales Creek ranked the highest and more information is available about landowner perspectives and potential willingness to participate in enhancement projects. Gales Creek also has an advantage in available information and the opportunity to acquire additional information at public access points.

Based on the above analysis, Gales Creek (Prickett to Clear Creek) was chosen for the priority area. The boundaries may be adjusted if warranted by further analysis. Since upstream factors influence conditions in the priority area, contributing stream reaches are also considered for potential projects.

The analysis performed during the site selection process determined that the identified priority area has the greatest potential for enhancement projects to benefit winter steelhead trout. As shown in Figure 2-2, the priority area encompasses more than just the creek and adjacent riparian area. In order to do meaningful enhancement it is important to consider the upland areas of Gales Creek and the condition of tributary creeks that feed into the priority area. Problems in the uplands like erosion and high water temperatures in small stream and ditches can significantly impact the health of winter steelhead trout.

2-2 Existing Conditions in the Priority Area

Development of the Gales Creek watershed has followed a pattern of population growth commonly seen in the Northwest. The removal of vegetation for homes and farms, straightening of the stream channel, bank hardening, water withdrawals and the introduction of non-native species have decreased the complexity and channel stability of the creek. Over time, the changes in the creek and adjacent riparian areas have impacted the complex ecological functions necessary to support a healthy population of winter steelhead trout. Efforts are being made on the local, state, and federal level to restore the natural functions of waterways such as Gales Creek.

The Oregon Department of Environmental Quality (DEQ) is responsible for carrying out the requirements of the 1972 Federal Clean Water Act (CWA) in Oregon. The Clean Water Act requires the protection of lakes, rivers and other waters for fish and wildlife, human consumption, industry, agriculture, recreation, navigation, and other uses. DEQ has established standards to protect waters for these uses.

If a stream or river does not meet clean water standards, it is identified as water quality limited and placed on the Oregon 303 (d) list. Once a stream or portion of a stream has been listed DEQ is required to identify the sources of pollution causing the standards to be violated and to calculate how much reduction from those sources is necessary to meet water quality standards. This is commonly referred to as a Total Maximum Daily Load (TMDL). (Burkhart, 2000)

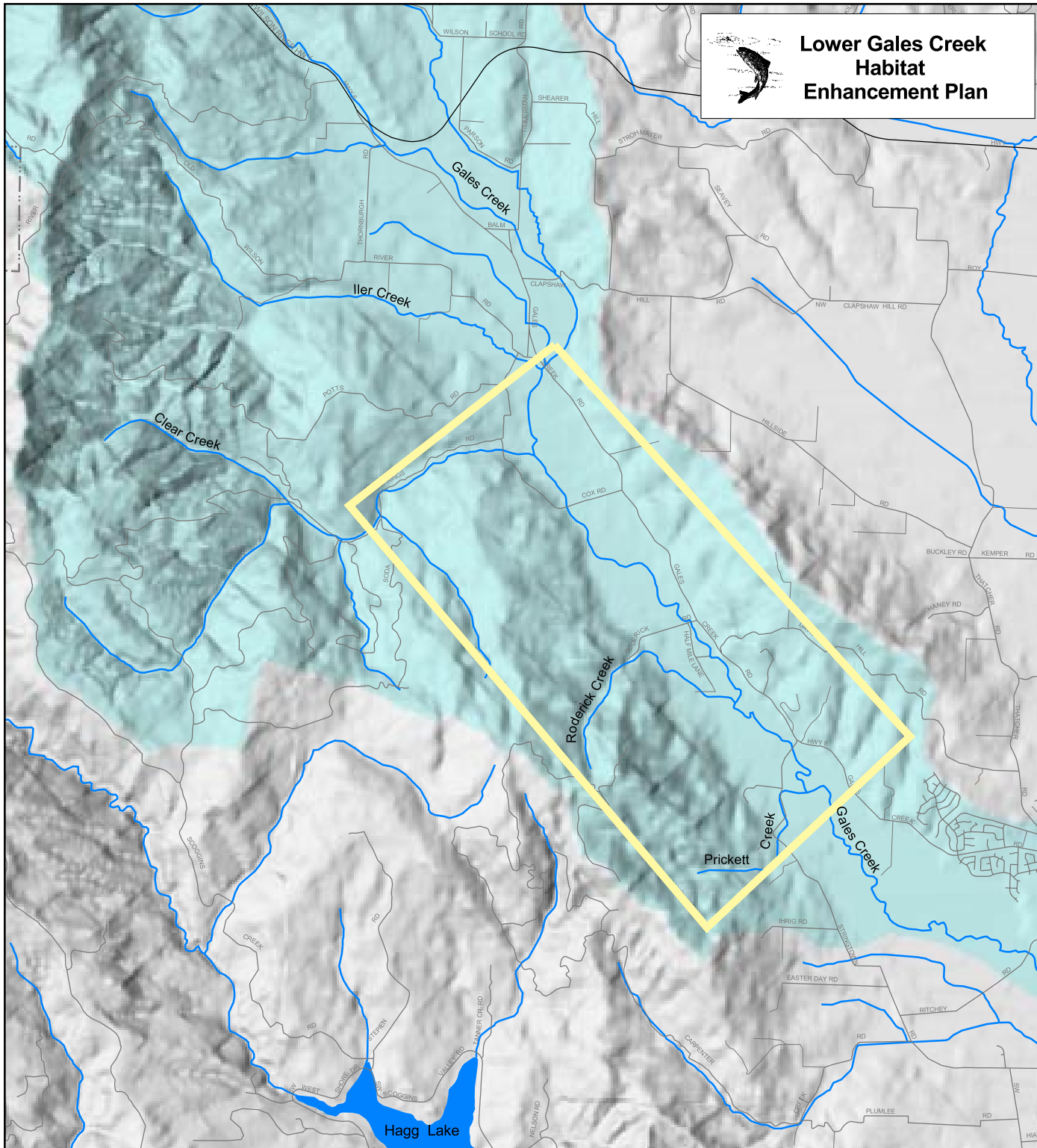
In 2001, four TMDLs were developed for the Tualatin Basin to address dissolved oxygen, temperature, bacteria, and algae/phosphorus. The TMDLs established standards that are designed to protect water quality and improve the conditions in listed streams. Lower Gales Creek has three water quality concerns: high temperatures (particularly in the summer months), low levels of dissolved oxygen (DO), and bacteria (during the summer).

Gales Creek is home to winter steelhead trout and resident cutthroat trout. Elevated temperatures (above 64°F) can cause increased incidence of disease, an inability to spawn, reduced rates of growth and survival of eggs and juveniles, and increased competition for limited habitat and food. Temperatures in the mid 70's can become lethal to salmonids. Some of the causes of elevated stream temperatures in the Gales Creek area may include: lack of riparian vegetation, wide stream channels with little shading, and low water levels due to withdrawals from the stream. A standard of 64°F has been established for the many of the streams in the Tualatin Basin to protect temperature sensitive species like salmonids.

Most cold-water species like winter steelhead trout require high levels of dissolved oxygen in streams. Dissolved oxygen enters water by diffusion from the surrounding air, aeration (when water churns it picks up oxygen more easily), and as a waste product of photosynthesis. Low DO levels have an adverse affect on aquatic life and sustained low levels can lead to fish kills. According to the DEQ, the two factors that have the most significant effect on the low DO concentrations in streams, such as Gales Creek, are temperature and sediment oxygen demand (the decomposition of bottom sediments which consumes dissolved oxygen).

Recreational uses of Gales Creek include swimming, wading, fishing and boating. Bacterial contamination of this stream can affect the health of people recreating in the water. Bacteria can enter the waterway though several different routes. Failing septic systems, runoff contaminated with animal wastes (such as livestock or domestic pets), can elevate bacteria levels in surface water. The highest levels of bacteria in Gales Creek occur during the warm summer months and during periods of storm water runoff due to rain events.

Despite impairments, Gales Creek continues to have strong ecological value and real potential to benefit from enhancement and conservation efforts. Winter steelhead trout continue to utilize the upper reaches of Gales Creek for spawning. Enhancement efforts in the lower reaches will support healthier fish populations by improving rearing potential.



Legend

- County Line
- Rivers and Lakes
- Major Streams
- Selected Area
- Gales Creek Watershed

Priority Area

3000 0 3000 6000 Feet

N

Data Sources: Washington County (2002)
Metro (RLIS Lite 2002)
Tualatin CD (1998)

March 2003

Figure 2 - 2

Functional Reach Identification

Section 3

3-1 Process

A defined process for the evaluation of stream enhancement opportunities is essential in the development of a successful habitat enhancement plan. This enhancement plan establishes a process for the evaluation and prioritization of factors that are limiting salmonid production within the priority area and associated tributaries. The process provides a framework for the evaluation of the habitat condition and functionality of the priority area. The evaluation focuses on the mitigation for the loss of habitat for winter steelhead trout. However, it is recognized that there are other important species within the priority area and associated tributaries.

The process for the evaluation of stream enhancement opportunities in the priority area and associated tributaries includes the following steps:

Step 1: Assess and characterize the habitat condition and functionality of the priority area and associated tributaries through the review of previous studies, surveys and field investigations.

Step 2: Divide the priority area and associated tributaries into functional reaches.

Step 3: Develop criteria to score each of the functional reaches according to their degree of impairment.

Step 4: Identify factors that are limiting anadromous fish production.

Step 5: Contact landowners along the priority area and associated tributaries to determine the feasibility of enhancement projects on their land.

Step 1: Characterization

Since early settlement, the waters of Gales Creek have been used for agriculture, log transportation, sawmills and drinking water. The development in the watershed has followed a typical pattern of population growth seen throughout the Northwest, with the removal of vegetation, channel straightening, bank hardening, water withdrawals and the introduction of non-native species. These changes have decreased the complexity and channel stability of the creek in developed areas, and affected the complex ecological functions necessary to support a healthy population of winter steelhead trout. However, through the analysis performed during the site selection process, it was determined that the identified priority area has the greatest potential for enhancement projects to benefit winter steelhead trout.

Developing an understanding of the biological, chemical and physical conditions within the priority area laid the foundation for the approach used to characterize the priority area. Data from existing studies and surveys that were conducted within the Gales Creek watershed were utilized. The following sources of data were used during the characterization:

1. Breuner, Nancy, 1998, *Gales Creek Watershed Assessment.*
2. ODFW (Oregon Department of Fish and Wildlife), 2001, *Distribution and Abundance of Fish, and Measurement of Available Habitat in the Tualatin River Basin Outside of the Urban Growth Boundary.*
3. ODFW (Oregon Department of Fish and Wildlife), 1995, *Distribution of Fish and Crayfish and Measurement of Available Habitat in the Tualatin River Basin, Final Report of Research*.
4. DEQ (Oregon Department of Environmental Quality), 2001 *Tualatin Subbasin, Total Maximum Daily Load (TMDL).*
5. SWRP (Student Watershed Research Project), Data collected at Isaac Walton Park between 1992 and 2002
6. OWRD (Oregon Water Resources Department), Water Availability Report (WARS) database

Informal field surveys were completed in 3 days during Fall 2002. The purpose of the surveys was to obtain a general knowledge of the condition of the channel in the priority area. The two individuals that completed the survey spent portions of 3 days walking the channel, taking photos, making visual observations, evaluating the bed composition and performing a cursory examination of the biological characteristics of the priority area. Elements of the Oregon Stream Habitat Data Sheet were used to help with the visual characterization of the channel conditions.

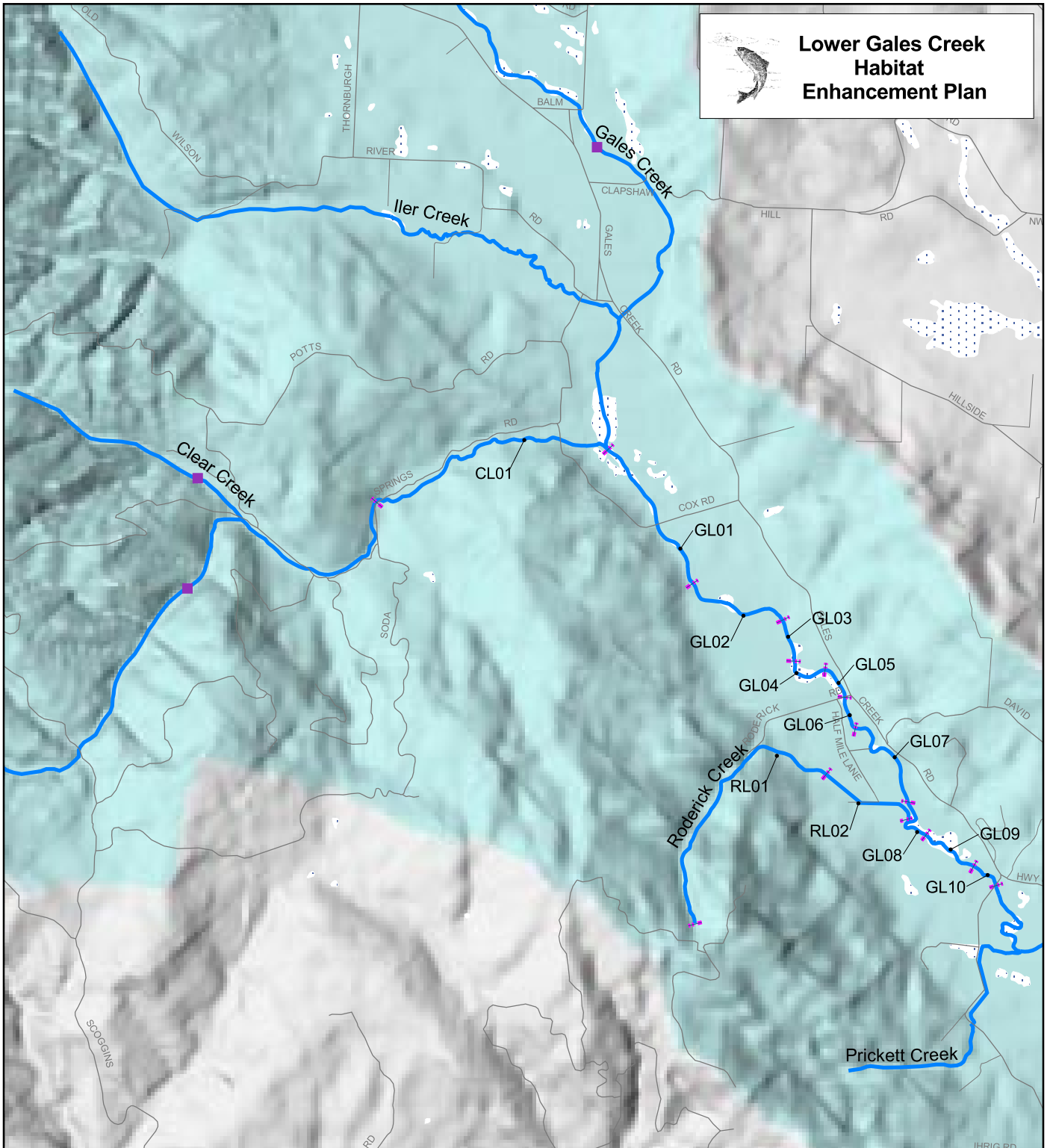
Step 2: Identify Functional Reaches

After the review of data from existing studies and completing the field surveys, the priority area was divided into functional reaches. Gales Creek was divided into 10 reaches, Roderick Creek into 2 reaches and Clear Creek was treated as one reach. The reach delineation was based on specific changes in channel type (e.g. stream reached confined by bank hardening, bed material, vegetation changes, bridges), and channel geomorphic characteristics such as bank condition, number and size of wood pieces, and primary flow characteristics. The habitat type characteristics were generally categorized as riffle, pool or glide. Figure 3-1 presents the relationship of the reaches within the priority area.

Step 3: Development of Criteria

The initial evaluation of the project reaches was performed to assess the habitat condition and functionality of each of the reaches. Six major areas of habitat condition were evaluated as to whether the reach was in Properly Functioning Condition, At Risk of not properly functioning, or Not Properly Functioning. The criteria used to determine the level at which a reach was functioning was based on criteria developed by NOAA Fisheries (National Oceanic and Atmospheric Administration Fisheries), the EPA Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers, and the Oregon Watershed Assessment Manual. Table 3-1 presents an outline of the criteria used in the condition assessment for each of the reaches. A table that describes the criteria in more detail is included in Appendix E.

The NOAA Fisheries criteria for Habitat Elements that were used in the evaluation set a rather high standard. They were developed for mountain streams and some would argue that they are not applicable to lower elevation streams that flow through more developed areas. However, it is believed that even if some of the specific measures within the criteria (e.g. # of pools = 35/mile) may not be directly applicable to lower Gales Creek, they still provide a tool to evaluate the functionality of the reaches. The criteria used to estimate the degree of impairment is relative for all project reaches. The NOAA Fisheries criteria did not go into



Legend

GL00 - Project Reach
Barriers
Reach Divider
Stream Centerline 2002
County Line
NWI Wetlands

Priority Area Overview Map

2000 0 2000 4000 Feet

N

Data Sources: Washington County (2002)
Metro (RLIS Lite 2002)
National Wetlands Inventory (1992)
ODFW (2002)
SWCD (2003)
March 2003

Figure 3 - 1

significant detail concerning riparian conditions. Since much of the riparian area along Lower Gales Creek is impaired, it was important to include a habitat category that covers riparian conditions. Therefore, riparian condition criteria from the EPA and Oregon Watershed Assessment Manual were added to the condition assessment.

Table 3-1: Summary of Channel Condition Assessment Criteria

Habitat Category	*Channel Conditions*	*Riparian Conditions*	*Water Quality*	*Water Quantity*	*Habitat Access*	*Habitat Elements*
Habitat Factors	1) Streambank Condition 2) Floodplain Connectivity 3) Channel Modifications	1) Width of Riparian Area 2) Vegetation Characteristics 3) Stream Shading 4) Riparian Recruitment Potential 5) Bank Stability	1) Temperature 2) Sediment 3) Chemical Contamination and Nutrients	1) Peak/Base Flows 2) Diversions 3) Drainage Network	1) Physical Barriers	1) Substrate 2) Large Woody Debris 3) Pool Frequency 4) Pool Quality 5) Off Channel Habitat 6) Refugia

After the reaches had been characterized, they were scored according to their degree of impairment relative to each of the habitat factors. Based on the evaluation criteria in Table 3-1, each reach was ranked on a scale from 1 (most impaired) to 5 (least impaired). Those reaches that were least impaired were considered to be in a properly functioning condition. A reach is considered to be properly functioning when it is dynamic, but also resilient against land use actions that would cause significant changes in its biological or physical characteristics. A reach is considered to not be properly functioning when land use actions have led to a significant change in its biological or physical characteristics. The following scoring was used:

- Properly Functioning = 5
- At Risk of not properly functioning = 3
- Not Properly Functioning = 1

After each of the project reaches were given scores in the 6 habitat categories, weighting factors, from 1 – 3, were applied to each of those areas. The weighting factors are summarized in Table 3-2. The purpose for weighting each of the habitat categories was to emphasize the importance of each of the categories in providing habitat for winter steelhead trout. The main stem of lower Gales Creek is known to be used for migration and has potential to be used for rearing and spawning. It is assumed that the greatest potential use would be for rearing. Therefore, the weighting system was designed to give more weight to the conditions that are critical for rearing of juvenile winter steelhead trout.

Table 3-2: Weighting Factors Used to Assess Degree of Impairment

Habitat Category	Weighting	Purpose for Weighting
Channel Conditions	2	Moderate factor
Riparian Conditions	3	Significant factor due to large diurnal temperate variability from lack of shading.
Water Quality	2	Moderate factor
Water Quantity	2	Moderate factor
Habitat Access	1	Small factor due to no presence of barriers in the mainstem of Gales Creek, within the priority reach.
Habitat Elements	3	Significant factor due to lack of pools, LWD in the channel, and off-channel habitat. Limits opportunities to find refugia during high summer water temperatures and during high winter flows.

Table 3-3 summarizes the results of the degree of impairment scoring. The complete spreadsheet tables that form the basis for Table 3-3 are included in Appendix F.

Table 3-3: Summary of Degree of Impairment Scoring

	Channel Conditions	Riparian Conditions	Water Quality	Water Quantity	Habitat Access	Habitat Elements	Score x Weighting Factor	Overall Rating
Weighting Factor	2	3	2	2	1	3		
Project Reach								
GL01	1.7	1.0	2.3	2.3	5.0	1.3	24.7	1.9
GL02	1.7	3.4	2.3	2.3	5.0	1.7	32.9	2.5
GL03	3.7	3.0	2.3	3.7	5.0	2.0	39.3	3.0
GL04	3.0	2.2	2.3	3.7	5.0	2.3	36.6	2.8
GL05	2.3	3.8	2.3	3.7	5.0	1.0	36.1	2.8
GL06	1.7	3.8	2.3	2.3	5.0	1.3	33.1	2.5
GL07	1.7	2.2	2.3	3.0	5.0	2.0	31.6	2.4
GL08	1.7	2.6	2.3	3.7	5.0	1.7	33.1	2.5
GL09	2.3	2.2	1.7	3.7	5.0	1.0	29.9	2.3
GL10	2.3	1.8	1.7	2.3	5.0	1.0	26.1	2.0
RL01	3.0	3.4	2.3	3.0	1.0	3.0	36.9	2.8
RL02	1.0	1.0	1.7	3.0	1.0	1.0	18.3	1.4
CL01	4.3	5.0	3.7	3.0	1.0	5.0	53.0	4.1

The results of this evaluation were used as a tool for comparing the degree of impairment of each of the project reaches and determining the types of projects that would benefit habitat within the respective reach. For example, if a reach scored low for riparian conditions, it is recognized that this reach would benefit from riparian enhancement. The overall rating provides a picture of the overall condition of the reach. The least impaired reaches are closer to a properly functioning condition. It is assumed that they will maintain themselves if they are protected from further impairment. Moderately impaired reaches are likely to provide the best potential for improvement of aquatic habitat. Improvement of habitat in the most severely impaired

reaches may be difficult due to the potential for substantial labor and equipment costs relative to ecological benefit.

Proposed projects cannot be based solely upon the technical benefit criteria. For a type of project to be successful, the construction of the project must be feasible and not overly costly. Therefore, feasibility criteria and cost criteria were developed.

The feasibility criteria measured the risks associated with project implementation, monitoring and maintenance. These criteria were evaluated on the basis of public involvement feedback, the project team's experience, discussions with resource agency representatives, and review of applicable documents from the Oregon Department of Fish and Wildlife, Natural Resources Conservation Service, Oregon Division of State Lands, U.S. Army Corps of Engineers, and county land use planning departments. The criteria are:

- Public acceptance (landowner concerns and community support)
- Regulatory support (feasibility and ease of permitting)
- Implementability (considering such issues as construction access and ability to water new plantings)

A cost criterion was used to compare the capital costs of each project type. The assumptions used in the cost estimates for the project evaluation and recommended costs for project types are detailed in Table 3-4.

Table 3-4: Basis for Order of Magnitude Cost Estimates

Type of Enhancement Activity	Estimated Costs	Source/Notes
Acquire conservation easements	$3,700 per acre	(1) Highest value from Metro appraisal reports – irrigated crop lands.
Removal of non-native species in riparian areas	$300 per acre	(2) Assumes 50% removed by hand and 50% by machine.
Riparian area site preparation and planting	$7,000 per acre	(2) Assumes beaver protection, weed mats, etc.
Riparian area maintenance	$300 per acre	(2) Assumed to be same as removal costs, but all work by hand.
Grading, planting and LWD placement on floodplain (not in channel)	$17,000 per acre	(3) This covers work on floodplain, not in-channel work.
Increase in-stream complexity	$1,250 mobilization fee plus $125 per linear foot	(2) Assumes placing LWD, bank reinforcement & planting.
Modify channel alignment	$65,000 per acre	(3) Creation of new meanders in channel.

Sources:
(1) SPOTAC Memorandum #11
(2) NRCS – Cost Estimate Spreadsheet 2002g-LWB
(3) Clean Water Services – Phone message from Kendra Smith 2/20/2003

Step 4: Identify Limiting Factors

In Step 3, six habitat categories were examined to develop an understanding of habitat condition and functionality in the project reaches. This was completed in order to determine which of the habitat factors are

likely to be limiting winter steelhead trout production within the project area. The process revealed that the Habitat Elements category had the greatest number of factors limiting production of winter steelhead trout. This category includes factors related to substrate embeddedness; number of pieces of large woody debris (LWD); pool frequency; pool quality; off-channel habitat; and refugia. However, there are numerous factors that limit fish production in some of the reaches. The limiting factors for each of the reaches are presented in Section 4.

Step 5: Landowner Contact

Landowner participation is critical to the success of implementation of projects identified in the Lower Gales Plan. With the majority of the land in the project area privately owned, it is necessary to both work with landowners to obtain access to the stream and to incorporate their knowledge and interests in the land into future project designs. In order for the Lower Gales Plan to lead to meaningful enhancement of Gales Creek in the long run, it is vital that a good relationship is developed and maintained between the landowners and the organizations working on enhancement projects, monitoring and maintenance.

Landowners in the project area were contacted several times during the development of the Lower Gales Plan. In order to gain access to the stream in the project area, selected landowners were contacted for verbal permission to access the portion of creek on their property. As the project progressed we felt that it was necessary to inform landowners about our interest in the project area. A letter was sent out inviting the landowners with property along the creek to attend a community meeting. In addition, landowners were called to make sure that they had received the letter and to encourage them to attend the meeting. Several landowners attended the meeting and filled out a form indicating their thoughts about the project and any additional information they would like to receive about the project. A follow-up letter was sent to all of the landowners who did not attend the meeting. The letter provided a synopsis of the public meeting and included a survey form for landowners to fill out and return if they had interest or concern about the project.

Several landowners responded favorably to the idea of working with the Council and partners to develop enhancement projects on their land. Other landowners expressed an interest in receiving updates about progress with the Lower Gales Plan. Landowner responses from phone calls, meetings, and completed surveys formed the public acceptance feasibility criteria, and helped to direct the selection of priority projects listed in Section 4.

3-2 Enhancement Components

Moving from the planning stage to the development of implementation strategies is often difficult. It is challenging to know where to begin the process. A description of enhancement components is provided as a means to move from the planning and evaluation stage to the implementation stage of the project. The enhancement components are described and related target functions are assigned to each of these components. The target functions identify recommended actions that will be implemented to address factors that are limiting the production of winter steelhead trout in the project area. The recommended actions are described in more detail in Section 4.

Fish Habitat Enhancement

Lower Gales Creek is impacted by activities that occur throughout the entire watershed. The cumulative effects of land use practices within the contributing watershed and modifications to the stream channel affect the condition and functionality of fish habitat within the priority area. Channelization, bank hardening, encroachment into riparian areas and floodplains, and filling of wetlands have all occurred within the watershed. Lower Gales Creek exhibits many of the symptoms of a creek where modifications such as these have occurred within the contributing watershed. These symptoms include channel entrenchment, extensive bank erosion, and loss of in-channel habitat complexity, such as the number of stable, deep pools and large woody debris structures.

There is a wide range of fish habitat enhancement opportunities. Undercut banks and meander backwaters provide some excellent fish habitat. Some of the most important habitat is provided by the formation of large wood jams. Stable and persistent wood structures create important hydraulic controls that provide a variety of functions beneficial to winter steelhead trout. Some of the benefits include pool formation, channel bed stability and control of bank erosion. One of the primary goals of the Plan is to evaluate opportunities to increase in-stream complexity by supplying large wood to Lower Gales Creek in both the short term and long term. This consists of the anchoring of large wood pieces in the stream channel. It also includes planting of trees adjacent to the channel so that there is increased LWD recruitment potential.

The target functions that relate to enhancement of fish habitat are: increasing in-stream complexity; enhancement of the riparian zone; floodplain connection and removal of fish barriers. Target functions are assigned to each of the project reaches in Section 4, as a way to provide a basis for the recommended actions.

Riparian Enhancement

Riparian areas are essential for water temperature moderation and fish and wildlife habitat. Critical functions of riparian areas are stream shading, bank stabilization, sediment control, water runoff filter, large wood and organic litter recruitment, and augmentation of basal flows. These areas are important links in providing a food source for macroinvertebrates in the form of decomposing leaf litter. Many of these riparian areas lie within the floodplain. Inundation of the riparian areas during high flow conditions allows access for winter steelhead trout to off-channel refuge areas during winter peak flows.

Floodplain Connection

Enhancement of natural functions within Lower Gales Creek will require recognition that the adjacent floodplain provides essential functions for flood storage, augmentation of basal flows and supply of essential off-channel habitat for winter steelhead trout. Allowing floodwaters access to the floodplains through connection with backwater channels (old channels, oxbows, and depressions of the main channel) will allow for the creation of off-channel habitat for juvenile steelhead trout. During winter months, juveniles may use these off-channel habitats as refuge from adverse main channel conditions such as high velocities and large volumes of suspended sediment.

The floodplain within Lower Gales Creek area falls into three categories:

- Floodplains that are well connected to the stream and have an intact riparian area with backwater areas that provide refuge during high flow conditions.
- Floodplains that are connected to the stream, but are farmed and provide little, if any refuge during high flow conditions.
- Floodplains that have become disconnected from the stream channel and don't flood during high flow conditions.

3-3 Limits of Plan

The Lower Gales Creek Habitat Enhancement Plan is not intended to be a stand-alone document nor an end in itself. Rather, it is intended to be a planning document that provides a basis for the design and installation of fish habitat enhancement projects over a 5-year time horizon (FY 2003 – 2007). This document provides guidance concerning the types of projects that are needed to enhance the functions within the project area. However, it does not provide design details at any specific location.

Project Considerations

Section 5

5-1 Five-Year Plan

Section 4 of the Lower Gales Plan presented a number of projects for consideration. Completion of these projects or projects of a similar nature is considered a priority in the effort to enhance winter steelhead trout habitat in lower Gales Creek. Table 5-1 introduces these projects in a 5-year schedule. The schedule begins in fiscal year 2003 and extends through fiscal year 2007. The idea is to work on small projects with willing landowners in the beginning, in order to build trust and confidence with other landowners within the project area. After a couple of years, the more significant projects are proposed for design and construction.

5-2 Conceptual Monitoring Plan

The primary reasons for implementing a monitoring plan is to assess the progress of an enhancement project in order to determine the level of success and/or the need to modify actions to improve the project. Monitoring plans should be developed during the planning phase of a project so that they support the goals and performance criteria of the enhancement effort. It is important to start the development of monitoring plans early so that necessary resources can be allocated to collection of baseline data, pre- and post- enhancement monitoring, as well as monitoring during actual implementation. The elements of a complete monitoring plan include:

- Clear, meaningful monitoring goals that provide the basis for scientific evaluation;
- Appropriate allocation of resources for data collection, management, organization, interpretation, and analysis;
- Quality assurance procedures and peer review;
- Flexible plans that allow for changes when needed due to new conditions or information; and
- Accessible and useful monitoring information is available to all interested parties. (FISRWG, 1998)

Developing a full monitoring plan is one of the next steps in the process of implementing the Lower Gales Plan. The Lower Gales Plan identifies existing conditions in the project area, actions required to enhance the system, and a basic timeline for action. Before specific projects are designed, a monitoring plan needs to be developed that will address the overall goals of the Lower Gales Plan and identify specific monitoring needs and protocols for the different project types. The types of monitoring that will serve to measure the progress of enhancement projects include photo-monitoring to track nonnative species control and riparian plantings; vegetation monitoring for individual restoration sites; water quality monitoring for stream conditions and temperature, and macroinvertebrate monitoring to track changes in the health of the stream system.

Table 5-1: Lower Gales Creek Habitat Enhancement – 5 Year Plan

Project Action	Fiscal Year 2003	Fiscal Year 2004	Fiscal Year 2005	Fiscal Year 2006 and Fiscal Year 2007
Planning and Monitoring	- Create a typical planting palette for project area. - Create a standard monitoring plan. - Consult with a Geomorphologist about stability of watershed functions and proposed projects.		Monitor project success by following defined monitoring protocol set up for each project.	
Conservation of Large Riparian Areas	Acquire conservation easements (Project 2). This will be a multi-year project that will involve presenting landowners with attractive options for putting their land into conservation easements. It will also involve working with other non-profit conservation groups to find funding for easement purchase.			
Permitting and Barrier Assessment and Remediation	Consult with the COE/ DSL and ODFW in FY 2002 about permit requirements, and recommendations.	Work with the City of Forest Grove to remove water pipe across Clear Creek (Project 9).	Work with landowners to plant native veg. along Roderick Creek & remove passage barrier (Project 8).	
Increase In-stream Complexity	Permit and design Project 5, located in Reach GL08. This project involves realigning the channel to increase sinuosity.		Construct Project 5 during the in-stream work period.	Permit, design and construct Project 1 (Reach GL02), to increase in-stream complexity
Riparian Area Enhancement	Clear non-native vegetation and plant native shrubs and trees on County property (Reach GL06) in Fall 2003.	Clear non-native vegetation and plant native shrubs and trees along right bank of Reach GL10 (Project 7).	Clear non-native vegetation and plant native shrubs and trees along left bank of Reach GL02 in Fall 2005.	Clear non-native vegetation and plant native shrubs and trees along left & right bank of Reach GL07 and GL09
Increase In-stream Complexity	Permit and design Project 3, located in Reach GL05. The purpose is to increase in-stream complexity	Construct Project 3 during the in-stream work period.		
Eliminate Illegal Access and Floodplain Enhancement	Work with landowner to stop illegal access to creek in Reach GL09 (Project 6).	Permit and design Project 4, located in Reach GL06. This project involves enhancing the floodplain to create a backwater channel and to increase in-stream complexity.		Construct Project 4 during the in-stream work period.
Maintenance	Water and Weed all riparian enhancement projects. ◄——————————————————————►			

5-3 Opportunities for Long-term Stewardship

In order to maximize the benefits of enhancement and conservation efforts, it is important to develop long term stewardship plans for project areas. Long-term stewardship can take the form of commitments from landowners, often with the assistance of agencies and conservation groups, to maintain a property or it can involve legal permanence tools like conservation easements. The following section describes some options for long-term or permanent land conservation and some incentive programs that can help landowners to plan for installation and maintenance of enhancement projects on their land.

Conservation Easements

Conservation easements are an effective management tool for streamside areas where there is a need to protect investments in enhancement projects or a need to conserve areas with good ecological integrity. A conservation easement is a legal agreement between a government agency or a qualified conservation organization that permanently limits a property's uses in order to protect it conservation value. Through the easement process, landowners receive compensation for modifying or giving up portions of their development rights while the easement holder acquires the right to maintain designated restrictions on the use of the property. Conservation easements provide a number of benefits:

- They are flexible, and can be written to meet the individual needs of the landowner while protecting the property's conservation value.

- They leave ownership in the hands of the landowner, who may choose to sell the land, pass it on to heirs, or continue to live on the land.

- They are permanent, remaining in place when the land changes hands. A land trust or government agency ensures that restrictions on land use are followed.

- They can significantly lower estate taxes. Easements can provide landowners with other benefits for income and property taxes. (Land Trust Alliance)

Conservation easements may be established with federal agencies like the Natural Resources Conservation Service, state agencies, counties, or through nonprofit organizations like Three Rivers Land Conservancy and The Nature Conservancy. It is often beneficial for federal, state, and local governments to work with nonprofit organizations to establish conservation easements in partnership. Nonprofit organization can work with public agencies to act more efficiently to take advantage of tax incentives, mobilize local knowledge and support, and set up long-term stewardship of a property. (FISRWG, 1998)

Federal and State Conservation Programs

There are federal and state programs that provide resources for landowners to conserve and enhance their land on both a short-term and long-term basis. Incentive programs provide technical assistance and funding for the installation of conservation measures and best management practices. Longer-term programs such as

the Conservation Reserve Enhancement Program (CREP) also provide technical assistance and funding for conservation measure, and they have a mechanism for protecting the enhanced areas by paying the landowners to set the land aside from agricultural production. The programs described below are a sample of programs available from local agencies: USDS Farm Services Agency (FSA), USDA Natural Resources Conservation Service (NRCS), local Soil and Water Conservation Service (SWCD), US Fish and Wildlife Service (USFWS), Oregon Department of Fish and Wildlife (ODFW), and Oregon Department of Forestry (ODF).

Incentive programs

Environmental Quality Incentive Programs (EQIP)

Under this program, landowners develop a whole farm plan to install water quality and wildlife measures such as manure compost storage, fencing, nose pumps, pasture management, cover crops, erosion control structures, tree planting, wildlife habitat, and other practices. In return, landowners receive up to 75% of the cost to install these conservation measures. Landowners are eligible for EQIP if they have farm plans that rank high in water quality and wildlife values. Lead agencies: NRCS, SWCD.

Partners for Fish and Wildlife

Landowners improve near stream, instream, wetland and native plant areas to benefit fish and wildlife. In return, the landowner can receive biological advice and up to 50% cost-sharing (a one-to-one match of federal to nonfederal dollars) to install habitat measures. Private, non-federal landowners with land suitable for improving fish and wildlife habitat are eligible for this program. Lead agency: USFWS.

Riparian Tax Incentive Program

Landowners enhance streamside areas by fencing off livestock, practicing pasture management, protecting "leave strips" that are not logged or tilled, and minimizing irrigation, check dams, or stream crossings. In return, up to 100 feet next to streams is exempt from property taxes. In order to be eligible, landowners must improve or maintain their streamside property for water quality and wildlife, and property must be zoned agriculture or forestland and be located outside the urban growth boundary. Lead agency: ODFW.

Reforestation Tax Credit

Landowners plant or improve forests on unproductive land. In return, landowners may apply for a tax credit that covers 30% of eligible expenses such as site preparation, trees, planting, animal damage control, hired labor and equipment operating costs. Landowners are eligible if they have at least 5 acres of commercial forestland (this may include pasture or brushland acreage that landowners want to plant). The tax credit does not apply to Christmas trees or requirements to plant under the Forest Practices Act. Lead agency: ODF.

Long-term Conservation Programs

Conservation Reserve Enhancement Program (CREP)

Under this program, landowners develop a whole farm plan to plant trees and fence animals away from streams or to restore wetlands. In return, landowners receive 75-100% of the cost to install conservation measures and annual rental payments for 10-15 years. Landowners are eligible for this program if they have cropland or pasture that borders salmon-bearing streams or were wetlands in the past. Lead agencies: FSA, NRCS, and SWCD.

Wetland Restoration Program (WRP)

Under this program, landowners restore wetlands, streamside areas and flooded areas and adjacent uplands areas for fish and wildlife. In return, landowners receive up to 100% of the cost to install conservation measures. They may also sell a 30-year or permanent conservation easement to the government and receive from 75 to 100% of the agricultural value of the land. To be eligible for WRP, landowners must prove ownership and land must be suitable for restoring wetlands that are valuable for wildlife. Lead agencies: NRCS and local SWCD.

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SWRP (Student Watershed Research Project), Data collected at Isaac Walton Park between 1992 and 2002.

Appendices

Appendix A:

Watershed Council Riparian Committee Definitions and Assumptions for Criteria

Appendix B:

Criteria For Rating Tualatin Basin Stream Reaches

Appendix C:

Matrix of Priority Stream Reaches with Additional Run Strength Scoring

Appendix D:

Gales Creek Watershed Landowner Survey Results

Appendix E:

Channel Condition Assessment Criteria

Appendix F:

Summary of Degree of Impairment Scoring and Supporting Tables

Appendix G:

Student Watershed Research Project Data for Gales Creek at Isaac Walton/County Property Site

Appendix A:

Watershed Council Riparian Committee Definitions and Assumptions for Criteria

FINAL DRAFT
January 5th, 2000

WATERSHED COUNCIL RIPARIAN COMMITTEE
Prioritization of Steam Restoration Projects, Tualatin Watershed

Goal: To create a scientifically supportable and defendable stream reach ranking system to prioritize stream restoration projects in the Tualatin River watershed. The criteria used for a ranking system must be obtainable, measurable, and meaningful.

Purpose: This document is a tool to be used during the ranking procedure. Definitions, assumptions, and directions for the stream reach prioritization matrix need to be fully understood to produce repeatable and objective data.

DEFINITIONS

GENERAL DEFINITIONS

Stream Restoration – Recovery of streams and associated riparian areas to a more naturally functioning self-sustaining system, hydrologically, morphologically, and biologically. Various techniques used to replicate the hydrological, morphological, and ecological features that have been lost in a stream due to urbanization, farming, or other disturbances.

Stream Reach – A section of a stream with similar characteristics including geomorphology, gradient, valley form, valley width, and flow.

Riparian Zone – The natural and potential area on each side of a stream as determined by plant species and hydrology.

In-stream Zone – The stream area incorporating the stream banks to ordinary high water, substrate, debris, and other objects in a stream

Stream Corridor – The longitudinal pathway that includes the stream channel, riparian zone, and floodplain of a stream. This narrow and long ecological landscape serves many functions for wildlife movement.

Habitat – The area or environment in which a plant or animal lives or grows, described by physical, chemical, and biotic characteristics. Typically, habitat describes the local area of an environment.

Diversity – The abundance of different animal or plant species or habitat types in a given location.

Morphology – The physical structure and pattern of a stream created by natural processes: hydrological, physical, and geological. Dynamic equilibrium between these forces determines the stability of a stream system. Erosion and sediment deposition are two of the major contributors to stream morphology.

Reference Site – A healthy self-sustaining stream system that can be used as a model for other stream restoration projects. A reference site can help set a goal, provide a blueprint for stream restoration techniques, and help managers to evaluate the success of a project.

Salmonid Migration – Travel patterns to and from the ocean for anadromous salmonids. Anadromous salmonids require certain stream conditions for moving to the ocean for their adult stage as well as traveling back to natal headwaters for spawning: no fish barriers, sufficient flow and water depth, and water quality.

CRITERIA DEFINITIONS

Anadromous Fish – Fish that are spawned and reared in freshwater, migrate to the ocean for the adult stage, and then later return to freshwater for spawning (Chinook, Coho, and Steelhead).

Salmonid Spawning – The release and fertilization of eggs, which begins the new life cycle of the fish. Salmonid spawning requires properly sized substrates and cool, well oxygenated water

Salmonid Rearing – The early developmental stages of anadromous salmonids. Rearing salmonids require specific habitat types during their early life stages. These habitat requirements vary seasonally and among species. In general, habitat requirements include pools with cover, riffle areas, and good spatial heterogeneity.

Resident Fish – Fish that are spawned, reared, and developed in freshwater and do not migrate to the ocean for the adult stage. All stages of the life cycle for these fish are in freshwater (Cutthroat trout).

303(d) List – Section 303(d) of the 1972 Federal Clean Water Act requires that the Department of Environmental Quality must develop a list of all waters in the state Oregon that do not meet water quality standards, exceed narrative standards, evidence of beneficial use impairment, or indicate a declining trend in water quality such that it would exceed a standard prior to the next listing. The parameters listed in the 303(d) list are: aquatic weeds and algae, bacteria, biological criteria, chlorophyll-a, dissolved oxygen, habitat modification, flow modification, nutrients, pH, temperature, sedimentation, total dissolved gas, toxins, and turbidity.

Temperature – Water temperature is an important parameter for salmonids. Spawning, rearing, and migration are all affected by high water temperatures. The preferred water temperature of 50-55 ^{o}F is ideal for salmonid habitat. Even though spawning is most susceptible to high water temperatures, the rearing habitat will be the focus due to the warmer time of year when rearing is occurring. Spawning typically occurs during the cooler winter months when water temperature is not a major factor. Water temperatures during the summer months (rearing season) and 303(d) listings will determine the criteria value.

Accelerated Erosion – Severe detachment of soil particles that result in an excessive quantity of suspended load and sediment deposition. Accelerated erosion is caused by direct human impacts such as channelization, in-stream removal of bed material, deforestation and vegetation removal in riparian zone, and soil exposure from overgrazing and agricultural practices. Symptoms of accelerated erosion may include turbid waters, extreme total suspended solids concentrations, deep exposed stream banks, extreme bank scouring, entrenchment, and sediment deposition.

Riparian Quality – The quality of the riparian zone is dependent on width, canopy cover over the body of water, naturally functioning plant community, density, spatial heterogeneity, connectivity to other ecosystems, and overall productivity.

Potential Anadromous Fish – A stream reach that has potential anadromous fish use if a human-made barrier is removed or altered to allow fish passage.

Wildlife Corridor – Wildlife Corridor – A linear habitat whose primary function is to connect two or more significant habitat areas. Corridors provide the following benefits: a) allow animals to travel, migrate and meet mates; b) facilitate dispersal of native plants; c) decrease the risk of wildlife in-breeding; c) allow wildlife to escape pollution and other environmental stresses; d) allow wildlife to re-colonize areas from which they have been eliminated. For the purposes of the Riparian Restoration Matrix, a "significant habitat" is:

- Any upland area devoid of significant human activity with contiguous predominantly native woody vegetation with mean length greater than 1320 feet and mean width greater than 1320 feet , or
- Any contiguous wetland area devoid of significant human activity with mean length greater than 660 feet and mean width greater than 660 feet.

A "corridor" is defined here as any strip of predominantly native woody vegetation or native wetland vegetation that:

- Connects two or more significant habitats that are less than 2 miles apart, and
- Is at least 35 feet wide, and
- Is devoid of significant human activity, busy roads, railroads or other human structures that would significantly reduce animal migration.

Corridors must *connect* two or more significant habitats. A reach of a stream that is *part* of one large habitat is not a corridor and would receive 0 points for this criterion.

ADDITIONAL CRITERIA INFORMATION

Predominant Land-use – Document the dominant land-use around the stream site: agricultural (Ag), urban (Ur), or forested (Fo).

High Visibility – Document whether or not the stream reach is an important political site where there is a high public attention for the restoration, either yes or no.

Fish Barriers – Document if there are impassible fish barriers downstream from restoration site, either yes or no.

Stream Classification – Use Dave Rosgen's or other stream classification systems to identify stream type. The stream classifications Systems look at stream channel, entrenchment, width/depth ratio, sinuosity, slope, channel material, etc…

Metadata – Document all of the sources of data for each criteria for each stream reach. Include name of source, date of the document, location or department of data source, and any other helpful information.

IMPORTANT ASSUMPTIONS

1. Anadromous Fish Locations– for the purpose of this stream reach prioritization matrix, it is assumed that most tributaries and stream reaches in the Tualatin River watershed downstream of natural barriers historically supported populations of anadromous fish. Historical, potential, current, and confirmed fish existence are factors in the matrix.

2. Fish Habitat Rating – the three primary habitat functions that a stream provides for anadromous fish are spawning, rearing, and migration (see definitions). For the purpose of this stream reach prioritization matrix, it is assumed that spawning habitat is the most important habitat function to be restored followed by rearing and migratory habitat respectively.

3. Restoration Target Species – all fish species in a stream reach will benefit from stream restoration projects. However, the stream reach prioritization matrix places more of an emphasis on anadromous species utilization (primarily steelhead trout and Chinook salmon) than resident species. However, cutthroat trout utilization is included in the stream reach prioritization matrix, restoration process, and goals.

4. Criteria for Matrix – Measurable physical parameters and social statistics will be separate in the ranking process. Physical criteria are rated individually then summed and normalized to generate a quantitative ranking system while social/political parameters document verbal qualitative comments for future references and general information purposes.

5. 303 (d) Listings – Just because a stream reach is not on the list, it will not be assumed that the stream is fully functional. It is important not to assume positive stream conditions due to lack of documentation.

6. Overall Rating of Streams – the higher the overall rating, the higher priority for stream restoration.

Appendix B:

Criteria For Rating Tualatin Basin Stream Reaches

Tualatin River Watershed Council

Criteria For Rating Tualatin Basin Stream Reaches

Determine stream reach for restoration.
Collect all the necessary data and information for this site

- USGS maps
- Aerial photographs
- 303 (d) and TMDL lists
- Appropriate stream studies

1. **Anadromous Spawning/Rearing Criteria -**
   - 5 = 100% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe.
   - 4 = 75% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe OR > 75% of spawning/rearing habitat is available and is moderately to severely degraded.
   - 3 = 50% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe OR > 50% of spawning/rearing habitat is available and is moderately degraded.
   - 2 = 25% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe OR > 25% of spawning/rearing habitat is available and is minimal to moderately degraded.
   - 1 = 1% to 24% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe OR > 10% of spawning/rearing habitat is available and is minimally degraded.
   - 0 = Not present, passage only.
2. **Resident Salmonid Spawning/Rearing Criteria** -
   - 5 = 100% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe.
   - 4 = 75% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe OR > 75% of spawning/rearing habitat is available and is moderately to severely degraded.
   - 3 = 50% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe OR > 50% of spawning/rearing habitat is available and is moderately degraded.
   - 2 = 25% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe OR > 25% of spawning/rearing habitat is available and is minimal to moderately degraded.
   - 1 = 1% to 24% of reach is accessible for spawning/rearing and degradation of spawning/rearing habitat is severe OR > 10% of spawning/rearing habitat is available and is minimally degraded.
   - 0 = Not present, passage only.

3. **303 (d) List Criteria -** How many parameters the stream reach has listed on the current Oregon 303(d) list.

One point per criteria listed excluding temperature, up to 5 points. 303(d) list parameters, excluding temperature, are identified as:

- aquatic weeds or algae
- bacteria
- biological criteria
- chlorophyll-a
- dissolved oxygen
- habitat modification
- flow modification
- nutrients
- pH
- sedimentation
- total dissolved gas
- toxics
- turbidity

Note: Add 1 point each (but not to exceed a total of 5 points) for each parameter with a developed TMDL, excluding temperature. Parameters with a developed TMDL are removed from the 303(d) list but are still critical parameters.

4. Temperature List Criteria -

- 5 = Stream segment listed in the current Oregon 303(d) list and maximum temperature exceeds 70^0F, or data shows temperature equal to or exceeds 70^0F.
- 3 = Stream segment listed in the current Oregon 303(d) list and maximum temperature does not exceed 70^0F, or data shows temperature ranges between 64^0F and 69^0F.
- 0 = Stream segment not listed in the current Oregon 303(d) list or data indicates temperatures do not exceed 64^0F.

5. **Accelerated Erosion Criteria –**

- 5 = > 60% of banks have accelerated erosion. (ORIS indicator: Bank Erosion = Severe in Non-Point Source Details Window).
- 3 = 15% - 60% of banks have accelerated erosion. (ORIS indicator: Bank Erosion = Moderate in Non-Point Source Details Window).
- 0 = < 15% of banks have accelerated erosion. (ORIS indicator: Bank Erosion is not listed as a problem in Non-Point Source Details Window).

Note: Add 2 points to any score (but not to exceed total of 5 points) if streambank in this reach is typically higher in elevation than the floodplain.

6. **Riparian Quality (Vegetation Width and Diversity) Criteria** –

- 5 = Average width of naturally functioning riparian vegetation is < 25 feet on each side of the stream.
- 3 = Average width of naturally functioning riparian vegetation is 25 – 50 feet on each side of the stream.
- 0 = Average width of naturally functioning riparian vegetation is > 50 feet on each side of the stream.

Note: Determine above widths from measuring random samples from original 1 inch = 660 feet aerial photographs, if available (use most recent photographs available). Add 1 point to any score (but not to exceed a total of 5 points) if riparian area in this reach is typically grazed by livestock.

7. **Potential for Anadromous Fish Use Criteria –**
   - 5 = The reach is a 3rd order stream containing a man-made barrier which impairs migratory movement upstream.
   - 3 = The reach is a 2nd order stream containing a man-made barrier which impairs migratory movement upstream.
   - 0 = No man-made barrier present or migratory movement not impaired.

   Note: 0 points if fish passage at the man-made barrier is infeasible.

8. **Connected to Wildlife Corridor Criteria** –
   - 5 = the riparian area in this stream reach has potential to serve as a wildlife corridor.
   - 3 = the riparian area in this reach already serves as a wildlife corridor.
   - 0 = the riparian area in this stream reach has little or no potential to serve as a wildlife corridor.

9. **Overall Rating Score** – this score is an average of the weighted scores for all 8 criteria for a stream reach. Five is the maximum score. The higher the overall rating for a particular stream, the more important for stream restoration to occur.

Appendix C:

Matrix of Priority Stream Reaches with Additional Run Strength Scoring

Matrix of Priority Stream Reaches					Habitat Conditions										Additional Information			
					Anadromous Salmonid	Resident Salmonid												
Major Stream Tributary to the Tualatin River	Minor Stream Tributary to a Major Stream	Tributary to a Minor Stream	Minor Tributary to Tributary	Stream Reach	Spawning/ Rearing (x5)	Spawning/ Rearing (x5)	303(d) Listed (x3)	Temp Limiting (x4)	Accelerated Erosion (x4)	Riparian Quality (x5)	Potential for Anadromous Fish Passage Past Barrier (x5)	Connected to Wildlife Corridor (x3)	Overall Priority Rating	Avg. of Habitat Condition Values	Reach Length (mi)	Run Strength	Total Score	Final Priority Score
Dairy Cr.	Council Cr.			Mouth to Headwaters	0	5	2	0	5	5	0	0	2.24	2.13	4.6	0	76	1.95
Dairy Cr.	E. Fork Dairy Cr.	Big Canyon Cr.		Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88		0	30	0.77
Dairy Cr.	E. Fork Dairy Cr.	Bledsoe Cr.	Bausch Cr.	Mouth to Headwaters	0	4	1	0	5	5	0	0	2.00	1.88	4.4	0	68	1.74
Dairy Cr.	E. Fork Dairy Cr.	Bledsoe Cr.	Wirtz Branch	Mouth to Headwaters	0	4	1	0	3	4	0	0	1.62	1.50	2.5	0	55	1.41
Dairy Cr.	E. Fork Dairy Cr.	Bledsoe Cr.		Bausch to Wirtz Branch	0	4	1	0	5	5	0	0	2.00	1.88	2	0	68	1.74
Dairy Cr.	E. Fork Dairy Cr.	Bledsoe Cr.		Mouth to Bausch Cr.	0	4	1	0	5	5	0	0	2.00	1.88	1	0	68	1.74
Dairy Cr.	E. Fork Dairy Cr.	Bledsoe Cr.		Wirtz Branch to Headwaters	0	4	1	0	3	4	0	0	1.62	1.50	4.8	0	55	1.41
Dairy Cr.	E. Fork Dairy Cr.	Campbell Cr.		Mouth Headwaters	3	3	1	0	3	3	0	0	1.76	1.63	2.6	3	75	1.92
Dairy Cr.	E. Fork Dairy Cr.	Denny Cr.		Mouth to Headwaters	3	3	1	0	3	0	0	0	1.32	1.25	4	3	60	1.54
Dairy Cr.	E. Fork Dairy Cr.	Gum Cr.		Mouth to Headwaters	0	4	1	0	3	5	0	0	1.76	1.63	2	0	60	1.54
Dairy Cr.	E. Fork Dairy Cr.	Murtaugh Cr.	Whiskey Cr.	Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	2.3	0	30	0.77
Dairy Cr.	E. Fork Dairy Cr.	Murtaugh Cr.		Mouth to Whiskey Cr.	3	3	1	0	3	0	0	0	1.32	1.25	0.9	3	60	1.54
Dairy Cr.	E. Fork Dairy Cr.	Murtaugh Cr.		Whiskey to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	4.1	0	30	0.77
Dairy Cr.	E. Fork Dairy Cr.	Panther Cr.		Mouth to Headwaters	3	3	1	0	3	0	0	0	1.32	1.25	3	0	45	1.15
Dairy Cr.	E. Fork Dairy Cr.	Plentywater Cr.		Mouth to Headwaters	3	3	1	0	3	0	0	0	1.32	1.25	2	0	45	1.15
Dairy Cr.	E. Fork Dairy Cr.	Rock Cr.		Mouth to Headwaters	3	3	1	0	3	0	0	0	1.32	1.25		0	45	1.15
Dairy Cr.	E. Fork Dairy Cr.	Roundy Cr.		Mouth to Headwaters	3	3	1	0	3	3	0	0	1.76	1.63	3	0	60	1.54
Dairy Cr.	E. Fork Dairy Cr.			Big Canyon to Murtaugh Cr.	4	5	2	5	3	1	0	0	2.59	2.50	1.1	5	113	2.90
Dairy Cr.	E. Fork Dairy Cr.			Bledsoe to Gum	3	4	2	5	3	3	0	0	2.59	2.50	9.9	5	113	2.90
Dairy Cr.	E. Fork Dairy Cr.			Campbell to Headwaters	4	4	1	0	3	0	0	0	1.62	1.50	3.2	5	80	2.05
Dairy Cr.	E. Fork Dairy Cr.			Denny to Rock Cr.	4	4	1	0	3	0	0	0	1.62	1.50	0.8	5	80	2.05
Dairy Cr.	E. Fork Dairy Cr.			Gum to Big Canyon Cr.	3	3	2	5	3	2	0	0	2.29	2.25		5	103	2.64
Dairy Cr.	E. Fork Dairy Cr.			Mouth to Bledsoe Cr.	0	4	2	5	3	2	0	0	2.00	2.00	3	5	93	2.38
Dairy Cr.	E. Fork Dairy Cr.			Murtaugh to Plentywater Cr.	4	5	1	5	3	2	0	0	2.65	2.50	1.3	5	115	2.95
Dairy Cr.	E. Fork Dairy Cr.			Panther to Roundy Cr.	4	4	1	0	3	0	0	0	1.62	1.50	0.6	5	80	2.05
Dairy Cr.	E. Fork Dairy Cr.			Plentywater to Denny Cr.	4	4	1	3	3	2	0	0	2.26	2.13	0.8	5	102	2.62
Dairy Cr.	E. Fork Dairy Cr.			Rock to Panther Cr.	4	4	1	0	3	0	0	0	1.62	1.50	0.8	5	80	2.05
Dairy Cr.	E. Fork Dairy Cr.			Roundy to Campbell Cr.	4	4	1	0	3	0	0	0	1.62	1.50	0.2	5	80	2.05

Matrix of Priority Stream Reaches					Habitat Conditions										Additional Information			
					Anadromous Salmonid	Resident Salmonid												
Major Stream Tributary to the Tualatin River	Minor Stream Tributary to a Major Stream	Tributary to a Minor Stream	Minor Tributary to Tributary	Stream Reach	Spawning/ Rearing (x5)	Spawning/ Rearing (x5)	303(d) Listed (x3)	Temp Limiting (x4)	Accelerated Erosion (x4)	Riparian Quality (x5)	Potential for Anadromous Fish Passage Past Barrier (x5)	Connected to Wildlife Corridor (x3)	Overall Priority Rating	Avg. of Habitat Condition Values	Reach Length (mi)	Run Strength	Total Score	Final Priority Score
Dairy Cr.	McKay Cr.	Brunswick Canyon		Mouth to Headwaters	0	4	1	0	3	0	2	0	1.32	1.25		0	45	1.15
Dairy Cr.	McKay Cr.	EF McKay Cr.	Neil Cr.	Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88		0	30	0.77
Dairy Cr.	McKay Cr.	EF McKay Cr.		Mouth to Neil Cr.	3	3	1	0	3	0	0	0	1.32	1.25	1	1	50	1.28
Dairy Cr.	McKay Cr.	EF McKay Cr.		Neil to Headwaters	2	3	1	0	3	0	0	0	1.18	1.13	5	1	45	1.15
Dairy Cr.	McKay Cr.	Jackson Cr.		Jackson Falls to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88		0	30	0.77
Dairy Cr.	McKay Cr.	Jackson Cr.		Mouth to Jackson Falls	0	4	1	0	5	5	0	5	2.44	2.50	6	0	83	2.13
Dairy Cr.	McKay Cr.	Waible Gulch	Storey Cr.	Mouth to Headwaters	0	4	1	0	5	5	0	0	2.00	1.88		0	68	1.74
Dairy Cr.	McKay Cr.	Waible Gulch		Mouth to Storey Cr.	0	3	1	0	3	3	0	0	1.32	1.25		0	45	1.15
Dairy Cr.	McKay Cr.	Waible Gulch		Storey to Headwaters	0	4	1	0	5	5	0	0	2.00	1.88		0	68	1.74
Dairy Cr.	McKay Cr.			Brunswick Canyon to E. Fork	3	3	2	5	3	0	0	0	2.00	2.00	5.7	1	73	1.87
Dairy Cr.	McKay Cr.			E. Fork to Headwaters	1	4	1	0	3	0	0	0	1.18	1.13	3.5	1	45	1.15
Dairy Cr.	McKay Cr.			Jackson Cr. to Brunswick Canyon	4	4	2	5	3	4	0	5	3.32	3.38	4.2	1	118	3.03
Dairy Cr.	McKay Cr.			Mouth to Waible Gulch	0	5	2	5	3	1	0	0	2.00	2.00	5.3	1	73	1.87
Dairy Cr.	McKay Cr.			Waible to Jackson Cr.	4	4	2	5	3	3	0	3	3.00	3.00	11.4	1	107	2.74
Dairy Cr.	W. Fork Dairy Cr.	Burgholzer Cr.	Paisley Cr.	Mouth to Headwaters	0	5	1	0	3	0	0	0	1.18	1.13	1.5	0	40	1.03
Dairy Cr.	W. Fork Dairy Cr.	Burgholzer Cr.	Poliwaski Cr.	Mouth to Headwaters	0	4	1	0	3	0	0	0	1.03	1.00	2.5	0	35	0.90
Dairy Cr.	W. Fork Dairy Cr.	Burgholzer Cr.		Mouth to Paisley Cr.	0	4	1	0	3	3	0	0	1.47	1.38	0.4	0	50	1.28
Dairy Cr.	W. Fork Dairy Cr.	Burgholzer Cr.		Paisley Cr. to Poliwaski Cr.	0	3	1	0	3	3	0	0	1.32	1.25	0.3	0	45	1.15
Dairy Cr.	W. Fork Dairy Cr.	Burgholzer Cr.		Poliwaski Cr. to Headwaters	0	4	1	0	3	0	0	0	1.03	1.00		0	35	0.90
Dairy Cr.	W. Fork Dairy Cr.	Cedar Canyon Cr.	Park Farms Cr.	Hofer Pond to Headwaters	0	2	1	0	3	0	0	0	0.74	0.75		0	25	0.64
Dairy Cr.	W. Fork Dairy Cr.	Cedar Canyon Cr.	Park Farms Cr.	Mouth to Hofer Pond	0	4	1	0	5	5	0	5	2.44	2.50	2.5	0	83	2.13
Dairy Cr.	W. Fork Dairy Cr.	Cedar Canyon Cr.	Sadd Cr.	Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	4.8	0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Cedar Canyon Cr.		Mouth to Park Farms Cr.	0	4	1	0	5	5	0	0	2.00	1.88	1.2	0	68	1.74
Dairy Cr.	W. Fork Dairy Cr.	Cedar Canyon Cr.		Park Farms to Sadd Cr.	0	4	1	0	5	5	0	5	2.44	2.50	0.2	0	83	2.13
Dairy Cr.	W. Fork Dairy Cr.	Cedar Canyon Cr.		Sadd to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	3.8	0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Cummings Cr.		Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	2.8	0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Garrigus Cr.	Rock Cr.	Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88		0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Garrigus Cr.		Mouth to Rock Cr.	0	5	1	0	5	5	0	0	2.15	2.00		0	73	1.87

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Dairy Cr.	W. Fork Dairy Cr.	Garrigus Cr.		Rock to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88		0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Kuder Cr.		Mouth to Headwaters	0	4	1	0	3	0	0	0	1.03	1.00	3	0	35	0.90
Dairy Cr.	W. Fork Dairy Cr.	Louisgnont Cr.		Mouth to Headwaters	0	5	1	0	5	5	0	0	2.15	2.00	2.1	0	73	1.87
Dairy Cr.	W. Fork Dairy Cr.	Mendenhall Cr.		Mouth to Railroad	0	4	1	0	3	3	0	0	1.47	1.38	6.5	0	50	1.28
Dairy Cr.	W. Fork Dairy Cr.	Mendenhall Cr.		Railroad to Headwaters	0	4	1	0	3	0	0	0	1.03	1.00		0	35	0.90
Dairy Cr.	W. Fork Dairy Cr.	Upper Un-named Cr.		Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	1.9	0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Whitcher Cr.		Mouth to Headwaters	0	4	1	0	3	1	0	0	1.18	1.13	4.8	0	40	1.03
Dairy Cr.	W. Fork Dairy Cr.	Williams Cr.	Brooke Cr.	Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	1.1	0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Williams Cr.	Genzer Cr.	Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	1.4	0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Williams Cr.		Brooke to Genzer Cr.	0	3	1	0	3	0	0	0	0.88	0.88	1.1	0	30	0.77
Dairy Cr.	W. Fork Dairy Cr.	Williams Cr.		Mouth to Brooke Cr.	0	3	1	0	3	1	0	0	1.03	1.00	1.8	0	35	0.90
Dairy Cr.	W. Fork Dairy Cr.			Burgholzer to Williams Cr.	4	4	3	5	3	5	0	0	3.12	3.00	1.4	1	111	2.85
Dairy Cr.	W. Fork Dairy Cr.			Cedar Canyon to Garrigus Cr.	0	5	3	5	3	4	0	0	2.53	2.50	4.7	1	91	2.33
Dairy Cr.	W. Fork Dairy Cr.			Cummings to Lower Un-named C	4	3	3	5	3	0	0	0	2.24	2.25	0.7	1	81	2.08
Dairy Cr.	W. Fork Dairy Cr.			Garrigus to Kuder Cr.	5	5	3	5	3	3	0	0	3.12	3.00	1.1	1	111	2.85
Dairy Cr.	W. Fork Dairy Cr.			Kuder to Whitcher Cr.	5	5	3	5	3	3	0	0	3.12	3.00	1.1	1	111	2.85
Dairy Cr.	W. Fork Dairy Cr.			Lousignont to Cedar Canyon Cr.	0	5	3	5	3	5	0	0	2.68	2.63	6.2	1	96	2.46
Dairy Cr.	W. Fork Dairy Cr.			Lower Un-named to Upper Un-na	4	3	3	5	3	0	0	0	2.24	2.25	1	1	81	2.08
Dairy Cr.	W. Fork Dairy Cr.			Mendenhall to Burgholzer Cr.	4	4	3	5	3	3	0	0	2.82	2.75	0.5	1	101	2.59
Dairy Cr.	W. Fork Dairy Cr.	?		Mouth to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	2.4	1	35	0.90
Dairy Cr.	W. Fork Dairy Cr.			Mouth to Lousignont Cr.	0	5	3	5	3	4	0	0	2.53	2.50	2	1	91	2.33
Dairy Cr.	W. Fork Dairy Cr.			Upper Un-named to Headwaters	1	3	3	5	3	0	0	0	1.79	1.88	2.2	1	66	1.69
Dairy Cr.	W. Fork Dairy Cr.			Whitcher to Menhenhall Cr.	5	5	3	5	3	3	0	0	3.12	3.00	1.2	1	111	2.85
Dairy Cr.	W. Fork Dairy Cr.			Williams to Cummings Cr.	4	4	3	5	3	0	0	0	2.38	2.38	0.7	1	86	2.21
Dairy Cr.				Council to EF Dairy Cr.	0	5	2	5	3	3	0	0	2.29	2.25	6.4	1	83	2.13
Dairy Cr.				McKay to Council Cr.	0	5	2	5	3	3	0	0	2.29	2.25	1.8	1	83	2.13
Dairy Cr.				Mouth to McKay Cr.	0	5	2	5	5	0	0	0	2.09	2.13	2.3	1	76	1.95
Gales Cr.	Bateman Cr.			Mouth to Headwaters	0	3			3	0	0	0	0.79	1.00	1.5	0	27	0.69
Gales Cr.	Beaver Cr.			Mouth to Headwaters	3	3			3	0	0	0	1.24	1.50	5	0	42	1.08
Gales Cr.	Clear Cr.	Deep Cr.		Mouth to Headwaters	2	2			3	0	3	0	1.38	1.67	1	4	67	1.72

Matrix of Priority Stream Reaches					Habitat Conditions										Additional Information			
					Anadromous Salmonid	Resident Salmonid												
Major Stream Tributary to the Tualatin River	Minor Stream Tributary to a Major Stream	Tributary to a Minor Stream	Minor Tributary to Tributary	Stream Reach	Spawning/ Rearing (x5)	Spawning/ Rearing (x5)	303(d) Listed (x3)	Temp Limiting (x4)	Accelerated Erosion (x4)	Riparian Quality (x5)	Potential for Anadromous Fish Passage Past Barrier (x5)	Connected to Wildlife Corridor (x3)	Overall Priority Rating	Avg. of Habitat Condition Values	Reach Length (mi)	Run Strength	Total Score	Final Priority Score
Gales Cr.	Clear Cr.	Roaring Cr.		Mouth to Headwaters	2	2			3	0	3	0	1.38	1.67	4.2	4	67	1.72
Gales Cr.	Clear Cr.	Thomas Cr.		Mouth to Headwaters	3	3			3	0	3	0	1.68	2.00	1.4	4	77	1.97
Gales Cr.	Clear Cr.			Deep to Roaring Cr.	2	2			3	0	3	0	1.38	1.67	0.5	4	67	1.72
Gales Cr.	Clear Cr.			Mouth to Thomas Cr.	3	3			3	0	0	0	1.24	1.50	1.2	4	62	1.59
Gales Cr.	Clear Cr.			Roaring to Headwaters	1	2			3	0	3	0	1.24	1.50	2.1	4	62	1.59
Gales Cr.	Clear Cr.			Thomas to Deep Cr.	2	2			3	0	0	0	0.94	1.17	0.4	4	52	1.33
Gales Cr.	Coffee Cr.			Mouth to Headwaters	0	2			3	0	3	0	1.09	1.33	2.4	0	37	0.95
Gales Cr.	Godfrey Cr.			Mouth to Headwaters	0	3			3	5	0	4	1.88	2.50	0.8	0	64	1.64
Gales Cr.	Iler Cr.			Mouth to Headwaters	3	2			3	1	0	0	1.24	1.50	4	4	62	1.59
Gales Cr.	Little Beaver Cr.			Mouth to Headwaters	0	3	2	3	3	3	0	0	1.76	1.75	4	0	60	1.54
Gales Cr.	Low Divide Cr.			Mouth to Headwaters	0	2			3	0	0	0	0.65	0.83	1.4	0	22	0.56
Gales Cr.	NF Gales Cr.			Mouth to Headwaters	2	2			3	0	3	0	1.38	1.67	3	4	67	1.72
Gales Cr.	Prickett Cr.			Mouth to Headwaters	0	4			3	5	0	0	1.68	2.00	1.6	0	57	1.46
Gales Cr.	Roderick Cr.			Mouth to Headwaters	4	4			3	5	0	0	2.26	2.67	2	4	97	2.49
Gales Cr.	SF Gales Cr.			Mouth to Headwaters	3	3			3	0	0	0	1.24	1.50	3	4	62	1.59
Gales Cr.	White Cr.			Mouth to Headwaters	0	3			3	3	0	0	1.24	1.50	2.4	0	42	1.08
Gales Cr.				Bateman to Beaver Cr.	3	3	2	0	3	1	0	0	1.56	1.50	1.8	4	73	1.87
Gales Cr.				Beaver to Coffee Cr.	3	3	2	0	3	0	0	0	1.41	1.38	2	4	68	1.74
Gales Cr.				Clear to Iler Cr.	3	3	2	0	1	3	0	0	1.62	1.50	0.9	4	75	1.92
Gales Cr.				Coffee to SF Gales Cr.	3	3			3	0	0	0	1.24	1.50	0.9	4	62	1.59
Gales Cr.				Godfrey to Clear Cr.	4	3	3	5	3	5	0	0	2.97	2.88	1.6	4	121	3.10
Gales Cr.				Iler to Little Beaver Cr.	3	3	2	3	3	4	0	0	2.35	2.25	1	4	100	2.56
Gales Cr.				Little Beaver to White Cr.	3	3	2	0	3	4	5	0	2.74	2.50	1.5	4	113	2.90
Gales Cr.				Low Divide to Headwaters	0	2			3	0	0	0	0.65	0.83	5.6	0	22	0.56
Gales Cr.				Mouth to Prickett Cr.	4	4	3	5	3	2	0	0	2.68	2.63	6.6	4	111	2.85
Gales Cr.				NF Gales to Low Divide Cr.	2	2			3	0	0	0	0.94	1.17	1.2	4	52	1.33
Gales Cr.				Prickett to Roderick Cr.	4	4	3	5	3	4	0	0	2.97	2.88	2.4	4	121	3.10
Gales Cr.				Roderick to Godfrey Cr.	4	4	3	5	3	3	0	4	3.18	3.25	1.3	4	128	3.28
Gales Cr.				SF Gales to NF Gales Cr.	2	2			3	0	0	0	0.94	1.17	1	4	52	1.33
Lee Cr.				Mouth to Headwaters	3	3	1	0	3	0	0	0	1.32	1.25	6.2	0	45	1.15
Maple Cr.				Mouth to Headwaters	0	2	1	0	2	0	0	0	0.62	0.63		0	21	0.54
Patton Cr.				Mouth to Headwaters	0	2	1	0	2	0	0	0	0.62	0.63		0	21	0.54
Roaring Cr.				Mouth to Headwaters	2	2	1	0	3	0	0	0	1.03	1.00	4.5	0	35	0.90
Rock Cr.	Beaverton Cr.			Bronson to Willow Cr.	0	0	4	5	3	4	0	0	1.88	2.00	0.9	0	64	1.64
Rock Cr.	Beaverton Cr.			Cedar Mill to Johnson Cr.	0	0	4	5	3	4	0	0	1.88	2.00	2	0	64	1.64
Rock Cr.	Beaverton Cr.			Johnson to Wesenger Cr.	0	0	4	5	3	5	0	0	2.03	2.13	1	0	69	1.77
Rock Cr.	Beaverton Cr.			Mouth to Bronson Cr.	0	0	4	5	3	3	0	3	2.00	2.25	1.9	0	68	1.74
Rock Cr.	Beaverton Cr.			Wesenger to Headwaters	0	0	4	5	3	5	0	0	2.03	2.13	2.6	0	69	1.77
Rock Cr.	Beaverton Cr.			Willow to Cedar Mill Cr.	0	0	4	5	3	1	0	0	1.44	1.63	1.1	0	49	1.26
Rock Cr.				Dawson to Beaverton Cr.	0	4	5	5	3	3	0	0	2.41	2.50	1.4	1	87	2.23
Rock Cr.				Mouth to Dawson Cr.	0	5	5	5	3	4	0	0	2.71	2.75	3.2	1	97	2.49
Scoggins Cr.	Parsons Cr.			Reservoir to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88		0	30	0.77
Scoggins Cr.	Sain Cr.			Reservoir to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	7.5	0	30	0.77
Scoggins Cr.	Tanner Cr.			Reservoir to Headwaters	0	3	1	0	3	1	0	0	1.03	1.00		0	35	0.90
Scoggins Cr.				Mouth to Dam	5	5	2	0	3	3	0	0	2.44	2.25	5.8	1	88	2.26
Scoggins Cr.				Parsons to Headwaters	0	3	1	0	3	0	0	0	0.88	0.88	5.9	0	30	0.77
Sunday Cr.				Mouth to Headwaters	0	2	1	0	2	0	0	0	0.62	0.63	5.4	0	21	0.54
Tualatin R.				Wapato to Blackjack Cr.	5	5	1	0	5	3	0	0	2.59	2.38	7.5	3	103	2.64
Tualatin R.				Butternut to Rock Creek	5	5	2	5	5	3	0	0	3.26	3.13	3	1	116	2.97
Tualatin R.				Chicken to McFee Creek	5	5	2	5	5	0	0	5	3.26	3.38	13	1	116	2.97
Tualatin R.				Dairy to Gales Creek	5	5	1	0	5	2	0	0	2.44	2.25	13	1	88	2.26

Matrix of Priority Stream Reaches					Habitat Conditions										Additional Information			
					Anadromous Salmonid	Resident Salmonid												
Major Stream Tributary to the Tualatin River	Minor Stream Tributary to a Major Stream	Tributary to a Minor Stream	Minor Tributary to Tributary	Stream Reach	Spawning/ Rearing (x5)	Spawning/ Rearing (x5)	303(d) Listed (x3)	Temp Limiting (x4)	Accelerated Erosion (x4)	Riparian Quality (x5)	Potential for Anadromous Fish Passage Past Barrier (x5)	Connected to Wildlife Corridor (x3)	Overall Priority Rating	Avg. of Habitat Condition Values	Reach Length (mi)	Run Strength	Total Score	Final Priority Score
Tualatin R.				Fanno to Chicken Creek	5	5	2	5	5	2	0	0	3.12	3.00	7.5	1	111	2.85
Tualatin R.				Gales to Scoggins Creek	5	5	1	0	5	3	0	0	2.59	2.38	3.8	1	93	2.38
Tualatin R.				Lee to Patton Creek	0	2	1	0	3	0	0	0	0.74	0.75	0.3	0	25	0.64
Tualatin R.				Maple to Headwaters	0	2	1	0	3	0	0	0	0.74	0.75	2	0	25	0.64
Tualatin R.				McFee to Butternut Creek	5	5	2	5	5	2	0	0	3.12	3.00	7.7	1	111	2.85
Tualatin R.				Mouth to Saum Creek	5	5	2	5	5	3	0	0	3.26	3.13	6.8	1	116	2.97
Tualatin R.				Patton to Sunday Creek	0	2	1	0	3	0	0	0	0.74	0.75	0.9	0	25	0.64
Tualatin R.				Roaring to Lee Creek	3	3	1	0	3	0	0	0	1.32	1.25	5.7	3	60	1.54
Tualatin R.				Rock to Dairy Creek	5	5	2	5	5	3	0	0	3.26	3.13	7	1	116	2.97
Tualatin R.				Saum to Fanno Creek	5	5	2	5	5	3	0	0	3.26	3.13	2.5	1	116	2.97
Tualatin R.				Scoggins to Wapato Creek	5	5	1	3	5	5	0	5	3.68	3.63	1.3	1	130	3.33
Tualatin R.				Sunday to Maple Creek	0	2	1	3	3	0	0	0	1.09	1.13	0.8	0	37	0.95
Blackjack Cr.				Mouth tho headwaters	0	2	1	0	3	5	0	0	1.47	1.38		0	50	1.28
Tualatin R.				Blackjack to Williams Canyon	5	5	1	0	5	3	0	0	2.59	2.38		3	103	2.64
Tualatin R.				Williams Canyon to Roaring Cr.	5	5	1	0	5	4	0	0	2.74	2.50		3	108	2.77
Williams Can.				Mouth to Mercer Cr.	0	3	1	0	3	3	0	0	1.32	1.25		0	45	1.15
Williams Can.				Mercer to Headwaters	0	3	1	0	3	3	0	0	1.32	1.25		0	45	1.15
Williams Can.	Mercer Cr.			Mouth to Headwaters	0	3	1	0	3	3	0	0	1.32	1.25		0	45	1.15
Roaring Cr.				Mouth to Headwaters	2	2	1	0	3	0	0	0	1.03	1.00		4	55	1.41
Wapato Cr.				Mouth to Ayers Cr.	0	5	1	0	5	3	0	5	2.29	2.38		0	78	2.00
Wapato Cr.				Ayers to Headwaters	0	3	1	0	3	5	0	0	1.62	1.50		0	55	1.41
Wapato Cr.	Ayers Cr.			Mouth to Headwaters	0	3	1	0	3	5	0	5	2.06	2.13		0	70	1.79
												mean	**1.68**	**1.69**				
												s.d.	**0.69**	**0.67**				
												mean + s.d.	**2.37**	**2.35**				
Gales				**White to Bateman**									1.74			4	79.16	2.03

Task Rating System: 0 = No or Not Present, 5 = Yes or Very Limiting/Degraded

Overall Rating:

A = 5 x Anadromous Spawning/Rearing Area

B = 5 x Resident Spawning/Rearing Area

C = 3 x 303(d) List

D = 4 x Temperature Limited

E = 4 x Accelerated Erosion

F = 5 x Riparian Quality

G = 5 x Potential for Anadromous Fish Use

H = 3 x Connected to Wildlife Corridor

. / 34

Overall Rating = (A + B + C + D + E + F + G + H) / 34

Note: The overall rating is the average of the weighted scores for all eight habitat conditions criteria. The value in the habitat conditions column mulitplied by the respective weighting factor for all habitat conditions are summed together then divided by 34 to get the overall rating. The number 34 is the sum of the weighing factors as shown at left. The higher the overall rating for a particular stream reach, the greater the importance for stream restoration. This speadsheet is incomplete for some reaches and may display incorrect data. The overall priority rating is shown as the priority rating in Table 2-2.

Note on Additional Information: The run strength or fish dispersal rating is based upon the ODFW fish survey reports. A value was assigned from 0 to 5 based upon the number of fish found in population surveys. The run strength scoring is shown in Table 2-3.
The Total Score is calculated from the overall priority rating and the run strength multiplied by 5.
The Final Priority Score is calculated from the Total Score divided by the sum of the overall rating (34) plus 5. The resulting Final Priority Score is shown as the Priority Score in Table 2-4.

Appendix D:

Gales Creek Watershed Landowner Survey Results

Gales Creek Watershed Landowner Survey Results
As of 10/26/2001 (24 surveys)

1. Which statement comes closest to describing your situation?

14	Farming accounts for 0-10% of my income.
2	I don't farm myself, but more than 10% of my income is from leasing land to commercial farmers.
2	I farm: my main operation is raising livestock.
1	I farm: my main operation is dryland crops (grain and seeds).
	I farm: my main operation is nursery crops.
2	I farm: my main operation is berries, fruits or vegetables.
5	I farm: my main operation is Christmas trees.
	I farm: my main operation is: _____
3	trees for timber
1	wine grapes

2. What watershed do you live in?

	McFee Creek
	Christensen Creek
	McKay Creek
23	Gales Creek
	Other:_____
1	I don't know.
1	Entire watershed.
1	Tualatin River

3. Approximately how much land do you own in this watershed?

4	Less than 10 acres.
7	Less than 25 acres.
8	Less than 100 acres.
6	100 acres or more.
	I don't know.

4. What kind of livestock do you own (please check all that apply)?

17	None.
3	Beef cattle.
	Dairy cattle.
3	Horses.
1	Sheep, goats, llamas, alpacas.
	Other: _____
1	Pigs

5. What are the major problems affecting people in your area (please check all that apply)?

2	None.
1	Difficult to make a living in town and own a home in the country.
15	Difficult to make a living farming.
1	Long term farm productivity is at risk because of erosion.
11	Too many regulations on farming.
3	People complain about their neighbor's farms and threaten lawsuits.
1	Well water might get contaminated from bacteria, pesticides or fertilizers.
4	Too many properties that are poorly maintained.
	Other:_____
1	Difficult to farm when you can't live on the land, so you commute to the farm.
1	Balancing and integration of water resources management.
1	Unknown.
1	We have problem with too much flow of water down Tualatin River. It floods our crops.
1	Too many elk destroying my garden.

6. What do you think is the best way to solve these problems affecting people?

	Loosen up restrictions for the property owners.
	Help riparian land owners control creek erosion with riprap. The silt is too deep, vegetation type erosion control is ineffective - the creek just cuts underneath during high water when the current is much stronger.
	Reduce the $80,000 income before a home can be built.
	Coordination and communication between all natural resource users and managers.
2	N/A
	Adopt new regulations to help family farmers.
1	Don't know

7. How important is it to solve these problems affecting people?

	Not important at all.
5	Low priority.
4	Medium priority.
10	High priority.
3	Very high priority.
1	N/A

8. What do you think are the major problems affecting steelhead and cutthroat trout in your area (please check all that apply)?

9	None.
3	Not enough water in the stream in the summer.
6	Summer stream temperature is too high.
3	Too many nutrients in the stream.
3	Too many pesticides in the stream.
4	Too much sediment (eroded soil) in the stream.
3	Not enough logs and boulders in the stream.
	Other:_____
1	Contamination of stream water watched better from nursery runoff.
1	Too much rock in the stream.
1	No running water on my property.
1	Too many polutants other than nutrients and pesticides.
2	Don't know.
1	N/A - unknown.
1	So many nutrea and beaver in our area of river.
1	Too many people, over use.

9. What do you think is the best way to solve these problems affecting fish?

1	If we could keep the main flow channel of water open so fish could get through it would vastly improve fish migration. There seems to be plenty of gravel etc for them to spawn.
1	Dredge - make a place for the fish to spawn - not keep letting these streams fill up to where the streams are shallow, then spread out all over farmland when the water rises in the winter.
1	Create stream enhancement projects, make industry and other stop polluting streams, periodic water samples on a timely basis. A more aggressive attempt needs to be made for education, cleanup, and prevention of pollution.
2	N/A
1	Leave more vegetation near the bank.
1	Build more dams
1	Build healthy stream systems and we need flow, cold water and shade.
1	Maintain streams in as natural condition as possible. Regulate pesticides and fertilizer use in watershed. Educate farmers in organic methods.
1	I'm not a scientist or biologist so don't presume to know. All I do know is coho and salmon are on the endangered list and we seem to have a bumper return. I'm not sure the magic rests in anything we have done. Maybe it is a cycle?
1	Remove them.
1	Greater use of hatcheries in these watersheds.

10. How important is it to solve these problems affecting fish?

2	Not important at all.
7	Low priority.
8	Medium priority.
6	High priority.
1	Very high priority.
1	We need flowing water and main creeks with rock build up and vegetation growth alsom closing the whole channel does not help fish or the farmer.
1	It won't matter, no one is going to allow the streams to be dredged. They will be allowed to fill up and overflow.
1	N/A
1	The problems affecting fish - are actually affecting water which will ultimately affect people.

11. What difficulties would people face in planting trees along creeks in your area? Please explain.

Our portion of creek is pretty well treed.
Government.
When it floods, the small ones will be wiped out.
None that we're aware of.
No creeks on my land.
Too much rock. Private landowners.
When the water is high, like in the winter of '96, the current just cuts away the soil under the trees and they fall into the creek. Without rock and vegetation, erosion control is doomed.
Beaver chewing them down. Flooding washing them out.
Red tape and disinterest.
None as long as they were small dogwood - vine maple.
Just the competition from the black berries and some soil erosion.
Removing land from production and less revenue. Maintaining the newly planted trees, water, fertilizer and weeds. Volunteers to do the work and plant material.
Unknown
Flooding and Beavers.
I have planted and as fast as I did beaver cut them off. I notice ash trees that have been girdled and subsequently die. Beaver have been around a long time so I presume the creek has been as it is now for a long time.
We have plenty of trees and brush along creek banks.
Elk destroy them.
Increased flooding hazards from clogging the floodways with vegetation. This would likely occur as it did in the 1960s.
Already tree lined with trees. Why bother?

12. What conservation practices should be included in programs that offer technical and financial help for farms in your area? Please check all that apply.

8	Manure storage facilities.
4	Pesticide mixing/storage facilities.
10	Using new technology to manage irrigation water, pest control and crop nutrients.
5	Erosion control on cropland.
5	Erosion control in road ditches.
10	Erosion control on streambanks.
5	Fencing and water troughs to allow better pasture management.
5	Fencing and planting trees along streams.
6	Wetland restoration and wildlife habitat improvement.
	Other:_____

1	Every time the stream floods the fences are wiped out. Financial help to restore them would be helpful and an incentive.
1	Erosion control on streambanks using rock riprap.
1	None

13. Would you participate in a Soil and Water Conservation District program that offered technical and financial help for improving natural resources on farms in your area?

1	Definitely no.
3	Probably no.
11	Maybe.
7	Probably yes.
3	Definitely yes.

1	"Technical help" is another name for "We will tell you what, when, where, and how to do something." Not particularly user-friendly.

Appendix E:

Channel Condition Assessment Criteria

Appendix E

Channel Condition Assessment Criteria

HABITAT CATEGORY	HABITAT FACTOR	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Channel Conditions[1]	Streambank Condition	>90% stable; i.e., on average, less than 10% of banks are eroding	80 - 90% stable	<80% stable
	Floodplain Connectivity	off channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	sever reduction in hydrologic connectivity between off-channel wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly
	Channel Modifications[2]	Channel impacts are not readily apparent; Impacts only affect a small area; Channel characteristics such as pattern, width, substrate type, bank erosion, pool features, and large wood distribution are largely unchanged	Impacts are localized but apparent; Changes to channel characteristics such as pattern, width, substrate type, bank erosion, pool features, and large wood distribution are detectable but not obvious	Impacts are obvious; gross changes in channel characteristics such as pattern, width, substrate, and bank erosion; A significant length of the channel is affected;
Riparian Conditions	Width of Riparian Area[2]	>100 feet	50 - 100 feet	< 50 feet
	Vegetation Characteristics[3]	More than 90% of the streambank surfaces and immediate riparian zones covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing is minimal or not evident; almost all plants allowed to grow naturally	70-90% of the streambank surfaces covered by native vegetation, but one class is not well represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of potential plant stubble height remaining	Less than 70% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
	Stream Shading[4]	> 70% shade; stream surface not visible, or slightly visible in patches	40 - 70 % shade; stream surface visible, but banks not visible	< 40% shade; stream surface visible, banks visible or visible at times
	Riparian Recruitment Potential	meets properly functioning criteria for width of riparian area and vegetation characteristics	is properly functioning or at risk for width of riparian areas and is at risk for vegetation characteristics	is not properly functioning or at risk for width of riparian areas and is not properly functioning for vegetation characteristics
	Bank Stability[3]	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion	Moderately unstable to unstable; >30% of bank in reach has areas of erosion; high erosion potential during flooding
Water Quality[1]	Temperature	50 - 57˚ F	50 - 57˚ F (spawning) 57 - 64˚ F (migration and rearing)	> 60˚ (spawning) > 64˚ (migration and spawning)
	Sediment	< 12% fines (<0.85mm) in gravel, turbidity low	12 - 17% fines in gravel, turbidity moderate	> 17% fines in gravel; fines at surface or depth in spawning habitat, turbidity high
	Chem Contam/Nut	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients

Appendix E

Channel Condition Assessment Criteria

HABITAT CATEGORY	HABITAT FACTOR	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Water Quantity[1]	Peak/Base Flows	watershed hydrograph indicates peak flow, base flow and flow timing characteristics comparable to an undisturbed watershed of similar size	some evidence of altered peak flow, baseflow and or flow timing relative to an undisturbed watershed of similar size and geography	pronounced changes in peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography
	Diversions[4]	no diversions	total of diversions < 0.5 cfs and all diversions are screened	total of diversions > 0.5 cfs and not all diversions are screened
	Drainage Network	zero or minimum increases in drainage network density due to roads	moderate increases in drainage network density due to roads (e.g., 5%)	significant increases in drainage network density due to roads (e.g., 20 - 25%)
Habitat Access[1]	Physical Barriers	any man-made barriers present in watershed allow upstream and downstream fish passage at all flows	any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows	any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows
Habitat Elements[1]	Substrate	dominate substrate is gravel or cobble (interstitial spaces clear) or embeddedness < 20%	gravel and cobble is subdominant, or if dominant, embeddedness 20 - 30%	bedrock, sand, silt or small gravel dominant, or if gravel and cobble dominant, embeddedness > 30%
	Large Woody Debris	>80 pieces/mile; >24" diameter >50 ft. length	currently meets standards for properly functioning, but lacks potential sources from riparian areas of woody debris recruitment to maintain that standard	does not meet standards for properly functioning and lacks potential large woody debris recruitment
	Pool Frequency channel width ~ 35 feet # pools/mile ~ 35	meets pool frequency standards (left) and large woody debris recruitment standards for properly functioning habitat (above)	meets pool frequency standards but large woody debris recruitment inadequate to maintain pools over time	does not meet pool frequency standards
	Pool Quality	pools > 1 m deep (holding pools) with good cover and cool water, minor reduction of pool volume by fine sediment	few deeper pools (> 1m deep) present or inadequate cover/temperature, moderate reduction of pool volume by fine sediment	no deep pools (> 1m deep) and inadequate cover/temperature, major reduction of pool volume by fine sediment
	Off-Channel Habitat	backwater with cover, and low energy off channel areas (ponds, oxbows, etc.)	some backwaters and high energy side channels	few or no backwaters, no off-channel ponds
	Refugia	habitat refugia exist and are adequately buffered (e.g., by intact riparian reserves); existing refugia are sufficient in size, number and connectivity to maintain viable populations or sub-populations	habitat refugia exist but are not adequately buffered (e.g., by intact riparian reserves); existing refugia are insufficient in size, number and connectivity to maintain viable populations or sub-populations	adequate habitat refugia do not exist

1 National Marine Fisheries Service (1996). Making Endangered Species Act Determinations of Effect for individual or Grouped Actions at the Watershed scale, NMFS, Environmental and Technical Services Division, Habitat Conservation Branch: 26pp

2 Gales Creek Watershed Assessment (1998) - adapted from information presented on page 26 (Riparian/Wetland Assessment)

3 Environmental Protection Agency (1999). Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers; Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. Epa 841-B-99-002

4 Oregon Watershed Enhancement Board - Oregon Watershed Assessment Manual (July, 1999). Component V - Riparian/Wetland Assessment

Appendix F:

Summary of Degree of Impairment Scoring and Supporting Tables

Tualatin River Watershed Council - Lower Gales Creek Project

Environmental Baseline

Project Reach:	Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower		
Sub-Reach:	GL01			GL02			GL03			GL04			GL05			GL06			GL07		
HABITAT CONDITION	Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline		
HABITAT FACTOR	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning
Channel Conditions[1]																					
Streambank Condition			x		x			x				x		x			x				x
Floodplain Connectivity		x				x	x			x				x				x			x
Channel Modifications[2]			x			x		x			x				x			x		x	
Riparian Conditions[2]																					
Width of Riparian Area			x		x		x			x			x			x				x	
Vegetation Characteristics			x		x			x			x			x			x			x	
Stream Shading			x		x				x			x	x				x				x
Riparian Recruitment Potential			x		x				x			x		x		x				x	
Bank Stability			x	x			x					x		x			x				x
Water Quality[1]																					
Temperature			x			x			x			x			x			x			x
Sediment		x			x			x			x			x			x			x	
Chem Contam/Nut		x			x			x			x			x			x			x	
Water Quantity[1]																					
Peak/Base Flows		x			x			x			x			x			x			x	
Diversions			x			x	x			x			x					x			x
Drainage Network		x			x			x			x			x			x			x	
Habitat Access[1]																					
Physical Barriers	x			x			x			x			x			x			x		
Habitat Elements[1]																					
Substrate		x			x			x			x				x		x			x	
Large Woody Debris			x			x			x			x			x			x			x	
Pool Frequency			x			x			x			x			x			x				x
Pool Quality			x		x				x		x				x			x			x	
Off-Channel Habitat			x			x		x			x				x			x				x
Refugia			x			x		x			x				x			x				x

Tualatin River Watershed C

Environmental Baseline

Project Reach:	Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower		
Sub-Reach:	GL08			GL09			GL010			RI01			RI02			CL01		
HABITAT CONDITION	Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline		
HABITAT FACTOR	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning
Channel Conditions[1]																		
Streambank Condition			X		X			X			X				X	X		
Floodplain Connectivity		X			X			X			X				X	X		
Channel Modifications[2]			X			X			X		X				X		X	
Riparian Conditions[2]																		
Width of Riparian Area	X			X				X			X				X	X		
Vegetation Characteristics		X				X			X		X				X	X		
Stream Shading			X			X			X	X					X	X		
Riparian Recruitment Potential		X				X			X		X				X	X		
Bank Stability			X		X			X			X				X	X		
Water Quality[1]																		
Temperature			X			X			X			X			X		X	
Sediment		X				X			X		X				X	X		
Chem Contam/Nut		X			X			X			X			X			X	
Water Quantity[1]																		
Peak/Base Flows		X			X			X			X			X			X	
Diversions	X			X					X		X			X				X
Drainage Network		X			X			X			X			X		X		
Habitat Access[1]																		
Physical Barriers	X			X			X					X			X			X
Habitat Elements[1]																		
Substrate		X				X			X		X				X	X		
Large Woody Debris			X			X			X		X				X	X		
Pool Frequency			X			X			X		X				X	X		
Pool Quality		X				X			X		X				X	X		
Off-Channel Habitat			X			X			X		X				X	X		
Refugia			X			X			X		X				X	X		

Table 3-3
Summary of Degree of Impairment Ranking

			Habitat Conditions[1,2]							
			Channel Conditions	**Riparian Conditions**	**Water Quality**	**Water Quantity**	**Habitat Access**	**Habitat Elements**	**Score x Weighting Factor**	**Overall Rating[4]**
		Weighting Factor[3]	2	3	2	2	1	3		
Project Reach	***Creek***	***Sub-Reach***								
Gales Lower	Gales	GL01	1.7	1.0	2.3	2.3	5.0	1.3	24.7	1.9
Gales Lower	Gales	GL02	1.7	3.4	2.3	2.3	5.0	1.7	32.9	2.5
Gales Lower	Gales	GL03	3.7	3.0	2.3	3.7	5.0	2.0	39.3	3.0
Gales Lower	Gales	GL04	3.0	2.2	2.3	3.7	5.0	2.3	36.6	2.8
Gales Lower	Gales	GL05	2.3	3.8	2.3	3.7	5.0	1.0	36.1	2.8
Gales Lower	Gales	GL06	1.7	3.8	2.3	2.3	5.0	1.3	33.1	2.5
Gales Lower	Gales	GL07	1.7	2.2	2.3	3.0	5.0	2.0	31.6	2.4
Gales Lower	Gales	GL08	1.7	2.6	2.3	3.7	5.0	1.7	33.1	2.5
Gales Lower	Gales	GL09	2.3	2.2	1.7	3.7	5.0	1.0	29.9	2.3
Gales Lower	Gales	GL10	2.3	1.8	1.7	2.3	5.0	1.0	26.1	2.0
Gales Lower	Roderick	RL01	3.0	3.4	2.3	3.0	1.0	3.0	36.9	2.8
Gales Lower	Roderick	RL02	1.0	1.0	1.7	3.0	1.0	1.0	18.3	1.4
Gales Lower	Clear	CL01	4.3	5.0	3.7	3.0	1.0	5.0	53.0	4.1
[1]Habitat conditions from Gales Creek Project Matrix of Pathways and Indicators										
[2]Scoring from Gales Creek Project - Environmental Baseline Table: Values assigned are; Properly Functioning = 5; At Risk = 3; Not Properly Functioning = 1										
[3]Weighting Factors are derived from the stream functional analysis assessment. See main body of report for more in-depth description										
[4] Overall Rating is the score x weighting factor divided by 13 (sum of all weighting factors).										
Sorted By Overall Rating										
Project Reach	**Creek**	**Sub-Reach**								
Gales Lower	Roderick	RL02	1.0	1.0	1.7	3.0	1.0	1.0	18.3	1.4
Gales Lower	Gales	GL01	1.7	1.0	2.3	2.3	5.0	1.3	24.7	1.9
Gales Lower	Gales	GL10	1.7	1.8	1.7	2.3	5.0	1.0	24.7	1.9
Gales Lower	Gales	GL09	2.3	2.2	1.7	3.7	5.0	1.0	29.9	2.3
Gales Lower	Gales	GL07	1.7	2.2	2.3	3.0	5.0	2.0	31.6	2.4
Gales Lower	Gales	GL02	1.7	3.4	2.3	2.3	5.0	1.7	32.9	2.5
Gales Lower	Gales	GL06	1.7	3.8	2.3	2.3	5.0	1.3	33.1	2.5
Gales Lower	Gales	GL08	1.7	2.6	2.3	3.7	5.0	1.7	33.1	2.5
Gales Lower	Gales	GL05	2.3	3.8	2.3	3.7	5.0	1.0	36.1	2.8
Gales Lower	Gales	GL04	3.0	2.2	2.3	3.7	5.0	2.3	36.6	2.8
Gales Lower	Roderick	RL01	3.0	3.4	2.3	3.0	1.0	3.0	36.9	2.8
Gales Lower	Gales	GL03	3.7	3.0	2.3	3.7	5.0	2.0	39.3	3.0
Gales Lower	Clear	CL01	4.3	5.0	3.7	3.0	1.0	5.0	53.0	4.1

Tualatin River Watershed Council - Lower Gales Creek Project

Project Reach:	Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower		
Sub-Reach:	GL01			GL02			GL03			GL04			GL05			GL06			GL07		
HABITAT CONDITION	Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline		
HABITAT FACTOR	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning
Channel Conditions[1]																					
Streambank Condition			1		3			3				1		3			3				1
Floodplain Connectivity		3				1	5			5				3				1			1
Channel Modifications[2]			1			1		3			3				1			1		3	
Average Score			1.67			1.67			3.67			3.00			2.33			1.67			1.67
Riparian Conditions[2]																					
Width of Riparian Area			1		3		5			5			5			5				3	
Vegetation Characteristics			1		3			3			3			3			3			3	
Stream Shading			1		3				1			1	5				3				1
Riparian Recruitment Potential			1		3				1			1		3		5				3	
Bank Stability			1	5			5					1		3			3				1
Average Score			1.00			3.40			3.00			2.20			3.80			3.80			2.20
Water Quality[1]																					
Temperature			1			1			1			1			1			1			1
Sediment		3			3			3			3			3			3			3	
Chem Contam/Nut		3			3			3			3			3			3			3	
Average Score			2.33			2.33			2.33			2.33			2.33			2.33			2.33
Water Quantity[1]																					
Peak/Base Flows		3			3			3			3			3			3			3	
Diversions			1			1	5			5			5					1		3	
Drainage Network		3			3			3			3			3			3			3	
Average Score			2.33			2.33			3.67			3.67			3.67			2.33			3.00
Habitat Access[1]																					
Physical Barriers	5			5			5			5			5			5			5		
Average Score			5.00			5.00			5.00			5.00			5.00			5.00			5.00
Habitat Elements[1]																					
Substrate		3			3			3			3				1		3			3	
Large Woody Debris			1			1			1			1			1			1		3	
Pool Frequency			1			1			1			1			1			1			1
Pool Quality			1		3				1		3				1			1		3	
Off-Channel Habitat			1			1		3			3				1			1			1
Refugia			1			1		3			3				1			1			1
Average Score			1.33			1.67			2.00			2.33			1.00			1.33			2.00

Tualatin River Watershed C

Project Reach:	Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower			Gales Lower		
Sub-Reach:	GL08			GL09			GL010			RL01			RL02			CL01		
HABITAT CONDITION	Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline			Environmental Baseline		
HABITAT FACTOR	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning	Properly Functioning	At Risk	Not Properly Functioning
Channel Conditions[1]																		
Streambank Condition			1		3			3			3				1	5		
Floodplain Connectivity		3			3			3			3				1	5		
Channel Modifications[2]			1			1			1		3				1		3	
Average Score			1.67			2.33			2.33			3.00			1.00			4.33
Riparian Conditions[2]																		
Width of Riparian Area	5			5				3			3				1	5		
Vegetation Characteristics		3				1			1		3				1	5		
Stream Shading			1			1			1	5					1	5		
Riparian Recruitment Potential		3				1			1		3				1	5		
Bank Stability			1		3			3			3				1	5		
Average Score			2.60			2.20			1.80			3.40			1.00			5.00
Water Quality[1]																		
Temperature			1			1			1			1			1		3	
Sediment		3				1			1		3				1	5		
Chem Contam/Nut		3			3			3			3			3			3	
Average Score			2.33			1.67			1.67			2.33			1.67			3.67
Water Quantity[1]																		
Peak/Base Flows		3			3			3			3			3			3	
Diversions	5			5					1		3			3				1
Drainage Network		3			3			3			3			3		5		
Average Score			3.67			3.67			2.33			3.00			3.00			3.00
Habitat Access[1]																		
Physical Barriers	5			5			5					1			1			1
Average Score			5.00			5.00			5.00			1.00			1.00			1.00
Habitat Elements[1]																		
Substrate		3				1			1		3				1	5		
Large Woody Debris			1			1			1		3				1	5		
Pool Frequency			1			1			1		3				1	5		
Pool Quality		3				1			1		3				1	5		
Off-Channel Habitat			1			1			1		3				1	5		
Refugia			1			1			1		3				1	5		
Average Score			1.67			1.00			1.00			3.00			1.00			5.00

Appendix G:

Student Watershed Research Project Data for Gales Creek at Isaac Walton/County Property Site

SWRP Data 7312
Issac Walton Park (County Property) 5280
MacroInvertebrate Data 138.5%

Date	Common_Name	Level	Taxon	Number in Sample	Percent of Total	Pollution Tolerance
10/17/1995 12:00	Aquatic Earthworms	Class	Oligochaeta	1	4	Tolerant
10/15/1992 12:00	Beetle Larvae	Order	Coleoptera	3	11	Somewhat Tolerant
10/25/1994 12:00	Beetle Larvae	Order	Coleoptera	4	8	Somewhat Tolerant
10/17/1995 12:00	Beetle Larvae	Order	Coleoptera	1	4	Somewhat Tolerant
10/13/1999 12:00	Beetle Larvae	Order	Coleoptera	2	25	Somewhat Tolerant
10/15/1992 12:00	Blackfly Larvae	Order	Diptera	4	14	Somewhat Tolerant
10/25/1994 12:00	Caddisfly	Order	Tricoptera	7	15	Not Tolerant
5/6/1998 12:00	Caddisfly	Order	Tricoptera	4	15	Not Tolerant
10/27/1998 12:00	Caddisfly	Order	Tricoptera	1	11	Not Tolerant
10/13/1999 12:00	Caddisfly	Order	Tricoptera	1	12	Not Tolerant
10/13/1999 12:00	Caddisfly, Fall Caddis	Order	Tricoptera	1	12	Not Tolerant
10/17/2001 9:30	Caddisfly, Fall Caddis	Order	Tricoptera	5	11.4	Not Tolerant
10/13/1999 12:00	Caddisfly, Spotted Sedge	Order	Tricoptera	1	12	Not Tolerant
10/25/1994 12:00	Crayfish	Order	Decapoda	3	7	
10/17/1995 12:00	Crayfish	Order	Decapoda	1	4	
10/13/1999 12:00	Crayfish	Order	Decapoda	1	12	
10/17/2001 9:30	Crayfish	Order	Decapoda	1	2.3	
10/27/1998 12:00	Lamprey		Other	1	0	
10/15/1992 12:00	Mayfly	Order	Ephemeroptera	1	4	Not Tolerant
10/22/1996 12:00	Mayfly	Order	Ephemeroptera	10	40	Not Tolerant
5/6/1998 12:00	Mayfly	Order	Ephemeroptera	4	15	Not Tolerant
10/27/1998 12:00	Mayfly	Order	Ephemeroptera	4	44	Not Tolerant
10/17/2001 9:30	Mayfly, Blue-winged Olive	Order	Ephemeroptera	1	2.3	Not Tolerant
10/17/2001 9:30	Mayfly, Pale Evening Dun	Order	Ephemeroptera	17	38.6	Not Tolerant
10/17/2001 9:30	Mayfly, Western March Brown	Order	Ephemeroptera	1	2.3	Not Tolerant
5/6/1998 12:00	Midge Larvae	Order	Diptera	3	11	
10/15/1992 12:00	Mite	Class	Arachnida	3	11	
10/17/2001 9:30	Roundworm	Order	Nematoda	1	2.3	
10/17/1995 12:00	Scud	Order	Amphipoda	1	4	
5/6/1998 12:00	Scud	Order	Amphipoda	5	18	
10/25/1994 12:00	Sculpin		Other	3	7	
10/15/1992 12:00	Snail	Class	Gastropoda	11	39	
10/25/1994 12:00	Snail	Class	Gastropoda	11	24	
10/17/1995 12:00	Snail	Class	Gastropoda	17	65	
10/22/1996 12:00	Snail	Class	Gastropoda	6	24	
10/17/2001 9:30	Snail	Class	Gastropoda	10	22.7	
10/25/1994 12:00	Spider	Class	Arachnida	3	7	
10/25/1994 12:00	Stonefly	Order	Plecoptera	15	32	Not Tolerant
10/17/1995 12:00	Stonefly	Order	Plecoptera	5	19	Not Tolerant
10/22/1996 12:00	Stonefly	Order	Plecoptera	3	12	Not Tolerant
5/6/1998 12:00	Stonefly	Order	Plecoptera	6	22	Not Tolerant
10/27/1998 12:00	Stonefly	Order	Plecoptera	4	44	Not Tolerant
10/13/1999 12:00	Stonefly	Order	Plecoptera	1	12	Not Tolerant
10/13/1999 12:00	Stonefly, Little Yellow Stone	Order	Plecoptera	1	12	Not Tolerant
10/17/2001 9:30	Stonefly, Roach-like Stone	Order	Plecoptera	1	2.3	Not Tolerant
10/17/2001 9:30	Stonefly, Yellow Stone	Order	Plecoptera	1	2.3	Not Tolerant
10/17/2001 9:30	Unknown		Other	5	11.4	
10/22/1996 12:00	Water Strider	Order	Hemiptera	6	24	
5/6/1998 12:00	Waterboatman	Order	Hemiptera	5	18	
10/17/2001 9:30	Waterboatman	Order	Hemiptera	1	2.3	

Requery

SWRP Data
Issac Walton Park (County Property)
Nutrient Chemistry

Date	REM	O-Phos STUD (mg/L P)	REM	O-Phos QC (mg/L P)	REM	Total Phos STUD (mg/L P)	REM	Total Phos QC (mg/L P)	REM	Ammonia STUD (mg/L N)	REM	Ammonia QC (mg/L N)	REM	Nitrate STUD (mg/L N)	REM	Nitrate QC (mg/L N)	REM	Chloride STUD (mg/L Cl-)	REM	Chloride QC (mg/L Cl-)
4/24/2002 9:30		0.092		0.01	NM	0	<	0.025	NM	0	<	0.01		0.183		0.085		5		3.24
10/17/2001 9:30	NM	0		0.024	NM	0	<	0.025	NM	0	<	0.01	NM	0		0.025	NM	0		9.79
11/1/2000 10:30	NM	0		0.012	NM	0	E	0.035	NM	0	<	0.01	NM	0	<	0.02	NM	0		7.91
10/13/1999 12:00		0.16		0.02	NM			0.03		0.01		0.01	L	0.01		0.02		27		9.72
4/20/1999 12:00		0.08		0.01		0.01		0.03	L	0.01		0.01		0.09		0.08		20		3.16
10/27/1998 12:00	NM			0.01	NM			0.03	NM			0.01	NM			0.1	NM			7.56
5/6/1998 12:00	NM				NM				NM				NM				NM			
10/29/1997 12:00		0.31		0.03	NM			0.19	L	0.04		0.02	HI	0.28		0.32	NM	15		3.03
4/22/1997 12:00	NM			0.01		0.07		0.04	ZERO	0		0.02		0.08		0.12	NM			2.41
10/22/1996 12:00		0.05		0.02		0.1		0.04		2.4		0.02		0.05		0.4		2.9		4.54
4/9/1996 12:00		0.24		0.01	NM			0.03	L	0.03		0.02		0.05		0.11		5.3		3.39
10/17/1995 12:00		0.05		0.01	L	0.01		0.03	L	0.03		0.02		5		0.27	NM			6.49
4/13/1995 12:00		0.1				23.67			L	0.02				0.57			NM			
10/25/1994 12:00		0.08		0.02		0.02		0.03	L	0.03		0.02		0.53			NM			11

Requery

SWRP Data
Issac Walton Park (County Property)
Physical Chemistry

Date	Temp at Site (deg C)	Temp Upstream (deg C)	pH STUD	pH QC Lab	DO (mg/L)	DO Solubil (mg/L)	DO % Sat.	BOD (mg/L)	Turbidity STUD (NTU)	Turbidity QC Lab (NTU)	TSS (mg/L)	Conduct (uS/cm)
4/24/2002 9:30	8.9	0	6.9	7.5	12	11.56557	103.7562		2.056	1.2		
10/17/2001 9:30			0	7.8					0	0.7		
11/1/2000 10:30			0	7.5					0	0.7		
10/13/1999 12:00	12.16	12.1	7.7	7.6	10.5	10.7118	98.02276	5.2		3.2		
4/20/1999 12:00	8.3	8.1	7.2	7.7	12	11.73567	102.2523	0.7	2.89	1.3		
10/27/1998 12:00	10		7.3	7.8	11.5	11.2645	102.0907		1.14	1.4		
5/6/1998 12:00	14	13	7.25		5.67	10.27834	55.16453					
10/29/1997 12:00	11.7		6.36	7.6	4	10.8254	36.95015	1.5		33		
4/22/1997 12:00	10.1		7.3	7.5	10.67	11.2378	94.94739	5		3		
10/22/1996 12:00	9.8		7.5		9.8	11.31822	86.58604			5.1		
4/9/1996 12:00	12.17	12.1	7.53	7.6	10.67	10.70935	99.63254	8.3				
10/17/1995 12:00	12.5		7.34	7.7	8.83	10.62921	83.07295	10				
4/13/1995 12:00	8		7.1		11.67	11.82232	98.71156	10.5				
10/25/1994 12:00	8.3		6.07	7.8	10	11.73567	85.21027	3.4				

Requery