Scappoose Bay
Watershed Assessment

January 2000

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Prepared for:

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Madelynne Sheehan, WAAC coordinator	Jeffrey Kee
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EXECUTIVE SUMMARY

The purpose of this report is to provide a broad foundation for effective restoration of native fish species and their aquatic habitat in the Scappoose Bay watershed. The report follows the guidelines of the Oregon Watershed Enhancement Manual (WPN 1999). The Scappoose Bay Watershed Assessment presents the existing baseline information on watershed conditions (based on available reports and data) and oral history interviews. A Geographic Information System (GIS) was built to display, analyze and store much of the data. Habitat factors for the decline of salmonids are compared, and major protection and restoration opportunities are identified and prioritized. This Phase I assessment does not generally provide the detailed field reconnaissance and comprehensive field studies that are necessary for proceeding with specific protection and restoration projects. Rather, this assessment lays out the groundwork for a second phase of assessment that bridges the gap between identifying major areas for action and conducting specific projects.

Although relatively small in size (85,000 acres), the Scappoose Bay watershed historically supported four of six species of salmon found in the Pacific Northwest. It contained a broad diversity of habitats, ranging from small, steep mountain streams to extended low-gradient stream valleys to the lowland floodplain of the Columbia River estuary. Over the past 150 years, the watershed has been impacted by a broad range of uses: agriculture, forestry, surface mining, and residential and industrial development. The dramatic decline in all species of salmonids in the watershed is not due to one or even several independent habitat-impacting activities, but rather to a complex interplay of activities that have degraded specific habitats used at particular times in the life histories of the fish. Included in this complex scenario is the effect of introduced hatchery fish and fishery management policies, as well as the shift to poor ocean conditions along the Oregon and Washington coasts throughout the 1980s.

CHAPTER SUMMARIES

The Scappoose Bay Watershed Assessment focuses on habitat conditions for salmonids (salmon, steelhead and trout) in the watershed. The following provides a brief summary of the findings in each chapter of the assessment.

Chapter 1, Preliminary Analysis of Existing Data, summarizes the process used by the assessment team to gather and organize all readily available data. Data sources included Geographic Information System (GIS) data, written reports, and interviews with agency representatives and local citizens. An annotated bibliography database, including all reports obtained, was developed as a tool for long term use by the Scappoose Bay Watershed Council and other groups and individuals working on watershed-related issues.

Chapter 2, GIS Base Map and Baseline Information, provides four distinct base maps and associated data for use in the assessment: 1) large scale (1:24,000) topographic map, 2) large scale (1:24,000) orthophoto map (black and white aerial photo coverage), 3) summary base map at 11”x17” for use in the report, and 4) summary base map with five sub-watersheds shown. The watershed encompasses 85,000 acres, with a total of 276 stream miles identified.

Chapter 3, Historic Habitat Conditions, summarizes the environmental history of the watershed based an analysis of 1853 General Land Office surveys, reports, and oral history interviews conducted by the assessment team. Three major ecological communities occurred in the watershed historically: lowland floodplain in the lower watershed (east of Highway 30), old growth forest in the hills of the upper watershed, and prairie on the gravel plain between the hills and the floodplain. These communities have all been drastically altered—the lowland floodplain by flood control measures, surface mining, and farming, the prairie by farming and residential and commercial development, and the forested hills by logging.

Archeological evidence indicates that Native Americans lived in the watershed for thousands of years, with extensive village sites located in the lowland floodplain**.** Euro-American activities in the watershed included fur trapping, logging, gravel mining, dairy and small farming, residential and commercial development, water withdrawal, introduction of exotic species (such as carp), and major flood control projects.

Chapter 4, Channel Habitat Typing, classifies channels based on gradient, confinement, size, and estuarine influence. Stream segments are grouped that are expected to function in a similar manner. Twelve of 24 potential channel type combinations occur, and the watershed is dominated by 9 of these channel types. The upper watershed hills are dominated by high gradient, confined and small streams. The mainstem reaches of the major streams in the valleys are generally low gradient and unconfined, with some confined reaches. The lower watershed of the lowland floodplain is dominated by low gradient, unconfined estuarine channels.

Chapter 5, Fisheries Resource and Habitat Assessment, uses available information to summarize the status, distribution and trend in abundance for coho, steelhead, chinook, chum and cutthroat trout. Limited habitat survey data from Oregon Department of Fish and Wildlife (ODFW) indicates that instream habitat conditions are highly variable, ranging from low (inadequate) to high (adequate). In addition, the assessment team transferred Oregon Department of Forestry (ODF) Water Classification maps and associated field survey forms to GIS. Numerous artificial and natural barriers were mapped based on available information from ODFW, ODF, and other sources.

Chapter 6, Channel Modifications, summarizes the extensive channelization of streams and floodplains in the lowland floodplain (dikelands) of the watershed and discusses the splash dams and log drives that occurred on Milton Creek, and probably Scappoose Creek, from the mid 1800s to the early 1900s. The single largest channel modification in the watershed appears to be the routing of Jackson Creek into Joy Creek with a diversion dam, eliminating flow to the lower five miles of Jackson Creek.

Chapter 7, Sediment Sources, identifies potential surface erosion and mass wasting areas in the watershed based on a GIS-based analysis of soil survey and landform data, such as percent slope. Roads and surface mines are also evaluated as sediment sources. Findings indicate that most of the watershed contains slopes with a moderate or high potential for surface erosion when disturbed. A small percentage of the watershed contains slopes rated as moderate or high hazard for mass wasting. A high road density in the watershed and quarries in the upper watershed also are potential sources of surface erosion that need field evaluation.

Chapter 8, Riparian and Wetland Conditions, evaluates riparian condition based on an aerial photo analysis of vegetation types conducted by the assessment team. A National Wetland Inventory map for the area is provided, and available survey data is evaluated. Findings indicate that most riparian zones are in poor condition. Oregon Department of Fish and Wildlife survey data indicates that amounts large woody debris levels are inadequate for fish habitat in most areas surveyed.

Chapter 9, Water Quality, summarizes the limited water quality data available for the watershed. 1998 monitoring results show high summer stream temperatures in the lower mainstems of Milton and Scappoose Creeks that exceed state temperature standards. Lower Columbia River Bi-State Program shows that Scappoose Bay samples exceeded recommended threshold levels for PCBs, heavy metals, fecal coliform, temperature and other parameters.

Chapter 10, Water Use and Hydrology, identifies surface and groundwater rights in the watershed and floodplain areas. A large number of surface water withdrawals occur in the watershed for residential, agricultural, and municipal purposes. These withdrawals are probably having a damaging effect on fish during the summer low flow period. However, little instream flow information exists to determine the severity of the impact. FEMA floodplain maps show that most of the area east of Highway 30 and the main stream valleys are within the 100-year floodplain.

Chapter 11, Refugia, identifies, classifies, and prioritizes potential refugia, or strongholds, for salmonids that remain in the watershed. Twenty-five potential refugia were identified. Scappoose Creek and Milton Creek were identified as key sub-watersheds. The next highest priority refugia, in order of priority, were identified as Scappoose estuary, South Scappoose Creek headwaters, Gourlay Creek, and the headwaters of North Scappoose creeks.

Chapter 12, Watershed Condition, synthesizes historic and current habitat conditions for four major stream habitat types found in the watershed. The analysis then relates the general habitat changes to the potential loss of fish use by life stage for each species. Loss of potential productivity of fish habitat was highest for all species and life stages in the valley floodplain stream type, which occurs mainly in the agricultural valleys of the mainstems of Scappoose and Milton Creeks.

Chapter 13, Data Gaps, identifies and prioritizes major areas which need further study in order to plan effective restoration projects. Of 16 major data gaps identified, four comprehensive field projects were recommended as top priorities: 1) a survey of juvenile and adult salmonid distribution and abundance, 2) a fish passage barrier survey, 3) an instream flow and water use monitoring survey, and 4) an aquatic habitat survey.

Chapter 14, Significant Legal and Public Issues, evaluates the effectiveness of the existing government regulatory system in protecting fish habitat, based on existing studies and the best professional judgement of the assessment team. The team's findings suggest that current regulations do not adequately provide for the protection or restoration of fish habitat from the potential impacts of forestry, agriculture, surface mining, residential/commercial development, and industrial development.

Chapter 15, Prioritized Preservation and Restoration Opportunities, recommends that protection projects be considered of higher priority than restoration projects. Specific types of projects are then prioritized based on selected criteria. Refugia were evaluated for the purpose of identifying the highest priority areas for protection through land acquisition or conservation easement from willing land owners. Protection is recommended for the four biologically highest priority refugia areas: Scappoose Estuary, the headwaters of North and South Scappoose creeks, and Gourlay Creek. The next highest priority recommended is to address the five most urgent data gaps. The third highest priority is to conduct a range of restoration projects, including fish passage barrier correction, road maintenance/removal projects, riparian planting, large woody debris placement, and floodplain restoration. In many cases, data gaps must be filled to effectively identify and plan specific restoration projects.

Chapter 16, GIS Metadata, provides detailed descriptions of the data as reference to the GIS coverages used in the watershed assessment.

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GLOSSARY

adjunct habitat – type of salmonid refugium; degraded stream reaches adjacent to focal watersheds and nodal habitats.

alluvial – pertaining to sand, mud or other sediment deposited by flowing water.

anadromous- migrating from saltwater to spawn in freshwater. All salmon exhibit this behavior.

ARC/INFO – widely used computer mapping and database program for spatial data.

aspect – surface or side of the hill facing a certain direction.

bed scour – removal of stream bottom material by high flows.

correlation- mutual relationship of two or more things.

critical contributing area – area with strong topographic or hydrologic links to nodal habitat, such as unstable slopes. This area is critical for maintaining the integrity of adjacent nodal habitat, but does not itself contain fish habitat.

culvert – metal or concrete pipe crossing under a road and providing drainage for a stream or runoff.

Date of Appropriation – date at which a right to use water was exercised.

digital orthophoto – aerial photographs that have been converted to be used in computerized applications.

digitized – data transferred from hardcopy maps to computerized maps.

effluent – sewage or other liquid waste discharged into a body of water.

estuary – the area where the stream or lower river's current meets the sea's tide. In the Scappoose Bay watershed, this is generally below 20 feet (6 meters) in ground elevation.

fecal coliform – a bacteria used as an indicator of water pollution from human or animal waste.

field assessment – evaluation or appraisal of a situation conducted in the field.

field verification – field study necessary to establish the accuracy of information previously collected.

filtration swale – shallow, vegetated drainage ditch designed to trap and filter out pollutants, such as nutrients, metals, and oils, contained in stormwater runoff.

fingerling – small salmon or trout, about one to three inches (2.5 to 8 centimeters) long.

Fish Commission of Oregon – the early version of the Oregon Department of Fish and Wildlife, prior to merging of the Department of Fisheries and Department of Wildlife.

floodplain – area adjacent to stream or river channels that historically flooded during large flow events.

focal watershed – type of salmon refugium; headwater drainage that contains a high percent of intact habitat areas and is known to contain salmon. This area is more resilient to catastrophic events and is expected to provide a stronghold for remnant salmonid populations.

forb – flowering plant whose stem does not become woody and that is not grass-like.

fry – small salmonid fish, usually recently emerged from the gravel and less than about one inch (2.5 centimeters) long.

geomorphic/geomorphology – pertaining to the shape or form of land surfaces/the study of the origins and characteristics of landforms.

habitat parameter – factor or characteristic of habitat that is useful for assessing general stream habitat conditions.

impervious surface – surface that has very low or no capacity to absorb rainwater, such as roads and building roofs.

intact habitat area – area of approximately 40 acres (16 hectares) or larger that contains either forest greater than 30 years old or wetlands that have not been drained or channelized.

key sub-watershed – major drainage area that currently produces most of the fish and contains the highest diversity of salmonids in a larger watershed.

line data – GIS spatial data that is displayed in linear format, such as stream segments.

lowland floodplain – in this report, the area of the Scappoose Bay watershed that is east of Highway 30 and less than 20 feet (6.1 meters) in elevation. Historically, this area was flooded annually by the Columbia River.

mass wasting – downhill movement of soil and rock fragments, as in a landslide.

metadata – text that describes the GIS spatial data.

mitigation – taking action to make another action less environmentally damaging.

National Wetland Inventory – federal wetland classification maps based on aerial photographic interpretation.

nodal habitat – type of salmonid refugium; an intact patch of stream habitat along the valley floor that is expected to be disproportionately important for salmon production due to the high quality of the riparian habitat, occurrence of springs, or connection to intact floodplain or wetland.

Oregon Lambert Projection – specific display orientation for GIS spatial data.

parent material – underlying rock type.

physical habitat – non-living components of the habitat, such as stream channel shape, large woody debris, and spawning substrates.

point data – GIS spatial data that is displayed as points, such as point locations of fish passage barriers.

potential focal watershed – type of salmonid refugium; same habitat considerations as for focal watersheds, but these areas are blocked to fish by artificial barriers, such as dams or culverts.

Refugium (plural, **refugia**) – area where special environmental circumstances have allowed species to survive after extinction or near extinction in surrounding areas.

riparian – pertaining to the banks of a stream or river.

riparian types (grass/forb, shrub/partial forest, forest) – stream bank vegetation types as defined in Chapter 8, Riparian and Wetland Conditions, of this report.

salmonid – fish belong to the Salmonidae family, including all trout, steelhead, and salmon.

secondary focal watershed – type of salmonid refugium; more degraded than focal watersheds, with a lower percent of intact habitat. However, this area is considered disproportionately important for salmonid production due to its size and location (tributary to the mainstem), underlying geomorphology, and history of salmonid use.

sediment – general term for silt, sand, and gravels.

seven-day running average maximum temperature – seven-day moving mean of daily maximum stream temperatures. It is the basis of the Oregon Department of Environmental Quality water quality standard for temperature.

smolt – salmonid that is outmigrating from freshwater to saltwater.

splash dam – temporary log dam built to store water for sudden release to float logs downstream.

stream clean-out – historic removal of large wood from streams conducted by early Euro-American settlers, and by Oregon Department of Fish and Wildlife and other organizations.

stream reach – section of a stream with consistent habitat characteristics, such as stream gradient throughout the length of section.

tidegate – gate in a dike or levee that opens outward to allow stream flow to exit, but restricts tidal movement upstream.

township/range/section – map grid coordinates used in US public land surveys. Each township/range is six miles square (approximately 15 square kilometers). Each township/range square is divided into 36 one square-mile (2.59 square-kilometer) sections.

water right – right to make use of water from a particular stream, lake, irrigation canal, or groundwater source.

water table – underground surface beneath which earth and rock are saturated with water.

watershed – region or area drained by a river, or stream; the drainage area.

LIST OF ACRONYMS

BLM	US Bureau of Land Management
DEA	David Evans and Associates, Inc.
DEM	USGS digital elevation model
DEQ	Oregon Department of Environmental Quality
DLG	USGS Digital Line Graphs
DOGAMI	Oregon Department of Geology and Mineral Industries
DOQ	USGS Digital Ortho Quadrangles
DRG	Digital Raster Graphics
DSL	Oregon Department of State Lands
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FEMAT	Federal Ecosystem Management Team
GIS	Geographic Information System
GLO	General Land Office
GPS	Global Positioning System
IAC	Washington Inter-Agency Committee for Outdoor Recreation
IMST	Independent Multidisciplinary Science Team
LCDC	Oregon Land Conservation and Development Commission
LWD	Large woody debris
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System

NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
ODA	Oregon Department of Agriculture
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ONHP	Oregon Natural Heritage Program
ODOT	Oregon Department of Transportation
OWEB	Oregon Watershed Enhancement Board
OWRD	Oregon Water Resources Department
PCBs	polychlorinated biphenols
PLSS	Public Land Survey System
SSCGIS	Oregon State Service Center GIS
STEP	Salmon Trout Enhancement Program
UNIGROUP	Oregon Prison CAD/CAM shop
USCOE	US Army Corps of Engineers
USDA	US Department of Agriculture
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WAAC	Watershed Assessment Advisory Committee
WPN	Watershed Professionals Network

CHAPTER 1. PRELIMINARY ANALYSIS OF EXISTING DATA

INTRODUCTION

This chapter summarizes the work required to gather and organize all readily available data, including Geographic Information System (GIS) data layers and written reports necessary to conduct the watershed assessment. A database of annotated bibliographies, including source, title, author, contents, summary, and judgement of quality for each piece of data, was also developed. The database is intended to be a tool for long-term use by the assessment team and by the Scappoose Bay Watershed Council (the Watershed Council) for storing and retrieving watershed information.

METHODS

Prior to beginning the assessment, the Watershed Council collected a substantial number of written reports. The Watershed Council gave David Evans and Associates, Inc. (DEA) the reports and a list of individuals to contact to obtain additional information. The DEA community outreach team interviewed numerous people and agencies to obtain as much applicable data as possible, including written reports and GIS map layers. DEA project manager and the GIS team obtained additional GIS information.

All applicable data was then entered into a computer database program called ProCite, which was purchased specifically for the watershed assessment and for the Watershed Council. This database uses a Windows 98/95/NT 4 operating system on an IBM computer. It was customized by DEA to make it easy to enter new records and search the database to retrieve specific types of information.

RESULTS

People interviewed and data obtained by the community outreach team are listed in Appendix A. Written reports needed to complete the tasks outlined in the scope of work were collected. Some data, such as the local wetlands inventory completed by the City of Scappoose, was not available in GIS format. Other GIS data, such as the wetlands inventory conducted for the City of St. Helens, was not in a suitable format for use in the assessment (data was not geo-referenced or ortho-rectified).

Report citations and summaries were then entered into the ProCite database. Citations for additional GIS map layers and reports generated by DEA were also added. Four categories of key words were added as “terms” in the database for use in conducting searches for specific types of data. These four categories are:

- Value of report (very useful, useful…)
- Type of report (published report, non-GIS map, GIS map…)
- Geographic area (Scappoose Creek, Milton Creek…)
- Subject (Task 1. Preliminary data analysis, Task 2. Historical habitat conditions …)

All reports and maps available were provided to the Watershed Council upon completion of the project. Paper copies of most of the reports cited are stored alphabetically by author's last name. Reports that are less than one-half inch thick are stored in hanging files in a file box. Larger reports are stored in a second file box.

DISCUSSION/CONCLUSIONS

Reports needed to complete the assessment were obtained and references were collected and entered into the ProCite database. GIS data sources were investigated and entered into the database as chapters were completed. However, some of the data needed to complete tasks outlined in the scope of work is not in a suitable GIS format for use in the assessment or covers only a portion of the watershed. Some data, such as oral histories and agency interviews, varied in quality. Where feasible, the information was digitized by DEA as described in the scope of work. A summary of data gaps is included in Chapter 13 of the assessment.

The ProCite database has a number of useful features. New records data entry is simple, and a custom data entry form was made for the Scappoose Bay watershed assessment. Searching and retrieving specific types of records is also simple. Records can also be marked as distinct groups for later reference or for printing out marked records in citation format. Basic operation of the database can be learned in about one hour by studying the manual. At the Watershed Council meeting in June, 1999, the DEA team demonstrated the use of the database.

Watershed Assessment Confidence Evaluation: High due to professional assessor and two outreach coordinators conducting the data search. Also, the Watershed Council has collected substantial information on the watershed.

RECOMMENDATIONS

Upon completion of this assessment report, the ProCite database program and Scappoose watershed assessment database will be transferred to the Watershed Council. DEA recommends that:

1. One person at the Watershed Council take responsibility for managing the ProCite database and keeping it updated with new information.

2. One person at the Watershed Council take responsibility for maintaining a reference library of paper copies of the reports and maps that are cited in the database.

3. One person at the Watershed Council manage the project GIS and keep it updated with new information.

Figures 1-1 and 1-2 – Photographs

Figures 1-3 and 1-4 – Photographs

CHAPTER 2. GIS BASE MAP AND BASELINE INFORMATION

INTRODUCTION

This chapter summarizes the work required to produce a GIS base map and baseline information for use in the assessment. The GIS base map includes the following features:

- Watershed boundaries and major sub-basins for the watershed based on analysis of digital elevation maps
- Stream mapping based on existing US Geological Survey (USGS) 1:24,000 scale GIS map data
- Relief topography based on 1:24,000 digital elevation maps
- Broad vegetation types as shown on the digital-orthophoto
- City and county GIS reference points
- City, county, US Bureau of Land Management (BLM) and state forest road and bridge
- Federal Emergency Management Agency (FEMA) floodplain data if available

METHODS

The following GIS data was used to construct base maps:

Topography
USGS digital elevation model (DEM)
30 meter resolution.
Scale: 1:24,000

Streams
USGS Digital Line Graphs (DLG).
Linework selected by DEA to reflect natural stream network
Multiple fields added by DEA to classify channels (e.g., gradient, confinement, flow accumulation)
Scale: 1:24,000

City Limits
Oregon State Service Center GIS (SSCGIS) coverage
Original source: digitized by Oregon Department of Transportation (ODOT) from USGS 7.5’ quads
Scale: 1:24,000

7.5’ USGS quadrangle boundaries
USGS DLG
Scale: 1:24,000

County Lines
  Oregon SSCGIS coverage
  Original source: USGS
  Scale: 1:500,000

Highways
  ODOT 1997 coverage

Watershed boundary
  Digitized on-screen from USGS 7.5' quadrangles (Digital Raster Graphics [DRG])
  Scale: 1:24,000

Sub-watershed boundaries
  Digitized on-screen from USGS 7.5' quadrangles (DRG))
  Scale: 1:24,000

Public Land Survey System (PLSS)
  Oregon SSCGIS coverage
  Original source: digitized by Oregon Water Resources Department (OWRD) from USGS 7.5' quads
  Scale: 1:100,000

Public Land Survey System without Donation Land Claims
  Oregon SSCGIS coverage
  Original source: derived from PLSS by UNIGROUP (Oregon Prison CAD/CAM shop)
  Scale: 1:100,000

Township/Range
  Oregon SSCGIS coverage
  Digitized from USGS maps
  Scale: 1:2,000,000

Digital Orthophotographs (21 files)
  USGS Digital Ortho Quadrangles (DOQ)
  1994 photo date
  Black and white photographs
  1 meter resolution

Digital USGS 7.5' quadrangle files (9 files)
  Scale: 1:24,000

Some GIS data specified in the scope of work was not used in the base maps. City and county GIS reference points were not included because of the minor value to the assessment. Major roads were added, but a BLM GIS layer showing a dense network of minor roads was not added to the base map to maintain clarity of the maps. The BLM road data is presented in

Chapter 7, Sediment Sources. FEMA data is presented in Chapter 10, Water Use and Hydrology. A summary table of data was developed by query of the GIS map layers.

RESULTS

Four distinct base maps were constructed:

1. Working topographic base map – combination of USGS topographic quad maps with watershed boundary added.

2. Working orthophoto map – combination of orthophotos showing broad vegetation types and with streams, roads and watershed boundary added.

3. Summary base map – 11”x17” color map showing topography as shaded relief and elevation, major roads, and streams (Figure 2-1 – Base Map).

4. Summary base map with sub-basins – same as #3, but with sub-basins added (Figure 2-2 – Subwatersheds Map).

Table 1-1 summarizes pertinent baseline information for the watershed and each sub-watershed, including total acreage and stream miles.

Table 1-1 - Acreage and Stream Miles Within Each Sub-Basin of Scappoose Bay Watershed

Sub-Basin	Acres	Percent	Stream Miles	Percent
Milton Creek	21,561	25	60	22
McNulty Creek	7,695	9	20	7
Honeyman Creek	4,573	5	12	5
Scappoose Creek	40,663	48	141	51
Jackson Creek	10,592	13	43	15
TOTAL	85,084	100	276	100

DISCUSSION/CONCLUSIONS

The summary table indicates that the watershed area encompasses approximately 85,000 acres, instead of the 50,000 acres originally estimated by the Watershed Council in the scope of work for the project. This area includes the Jones Creek and Joy Creek areas at the south end of the watershed. BLM's Tillamook District office requested that these areas be added to the assessment, and DEA received a formal commitment by BLM to join as a partner in funding the additional work.

Several qualifications need to be made regarding the base maps. Streams mapped do not include numerous smaller streams that are not shown on the USGS quads. Likewise, many smaller roads that are not mapped on the USGS quads are not mapped on the base maps. However, the data shown on the base maps is considered the best data available.

The two working base maps (topographic and orthophoto maps) provided a means for team members gathering data in the watershed to reference their data to specific locations. The summary maps are useful for presenting the results of each chapter. Fortunately, GIS data included complete coverage of the watershed to an accuracy and resolution that provided a solid foundation for building the assessment.

Watershed Assessment Confidence Evaluation: High due to a professional GIS analyst preparing the base map and obtaining complete data coverages.

RECOMMENDATIONS

Base map information was adequate to complete the assessment, but could be improved by purchase of ortho-rectified color aerial photos and associated planimetric features layer that show all roads and streams and elevations at finer resolution than the USGS data. The estimated cost of purchasing these additional data layers is approximately $20,000.

Figure 2-1 – Base Map

Figure 2-2 – Subwatersheds Map

CHAPTER 3. HISTORICAL HABITAT CONDITIONS

INTRODUCTION

This chapter summarizes the work required to produce a qualitative description of historical watershed and stream habitat conditions based on an analysis and synthesis of the following information as available:

- General Land Office (GLO) survey notes and maps
- Oregon Natural Heritage Program (ONHP) GIS data of Columbia County
- Oral histories from long time residents
- Historical photographs and maps
- Historical written accounts, such as may be found in the Columbia County Historical Museum and Historical Society

METHODS

GLO Survey notes and maps

These 1853 notes and maps were purchased from the Portland Office of BLM. DEA transcribed the handwritten survey notes to tabular form for selected section lines. DEA also transcribed summary township notes where available. Transcribed survey notes were referenced to the base map. GLO townships, township/range lines, and section lines were digitized on-screen to provide reference for use with the notes.

Oral histories from long-time residents

Oral histories were obtained through taped interviews with six long-time residents, conducted by community outreach team and Watershed Council members. A list of interview topics focusing on fish and fish habitat and land use changes was developed (Appendix B). A data form based on this list was used to guide the interviewer and summarize the information.

ONHP GIS data for Columbia County

This program has a map of historical vegetation types based on the Oregon Biodiversity project data. This data is very coarse resolution, containing only a few vegetation types (Douglas fir, wetland, oak) and is not considered useful for the assessment. However, a finer resolution map of the Scappoose Watershed based on GLO surveys, should be completed by Spring 2000.

Historical photographs and maps

These photographs and maps were gathered from the Columbia County Historical Society, Scappoose Bay Drainage District, Oregon Historical Society, US Army Corps of Engineers

(USCOE), residents of the watershed, and other sources. Many of these photos were scanned and saved in digital form.

Historical written accounts

Historical written reports were obtained from the Columbia County Historical Museum and Historical Society and from residents of the watershed.

RESULTS

GLO survey notes and maps

The locations of township and section line surveys selected for transcription are shown on the "GLO Survey Notes" GIS map (Figure 3-1 – GLO Survey Notes Map). The actual transcriptions are also included in Appendix B. Township summary notes from 1853 were helpful in identifying general habitat types within the watershed during the mid-1800s. Section line survey notes generally were not detailed enough to provide useful information.

Summary notes for townships and boundary lines of townships indicate three distinct ecological communities in the Scappoose Bay watershed: the lowland floodplain, the Scappoose prairie, and the hills covered in old growth forests and burns. Township summary notes for Township 3 north, 1 west describe the lowland floodplain (now referred to as the "dikelands") as follows (GLO 1853):

> All of this Township, except a part of sections 6 and 7, an oak ridge in sections 21 and 28, and a fir ridge in section 31, is low rich alluvial bottoms intersected with numerous lakes, ponds, marshes, and sloughs and subject to an annual inundation by the rise of the Columbia River in the months of May, June, and July. The land consists of strips and patches of prairie with willow swamps and swales and brushy ridges. The banks of the Columbia River and Willamette Slough are shored with ash, and crabapple with a thick undergrowth of briars, hardhack, and weeds. The lakes in this Township at the lowest stage of water are shoal and muddy and can be forded in many places. They are affected some by the tide which ebbs and flows with a very strong current through the Gilbert River their principal culvert. All the land in this township east of the Columbia River is claimed by the Hudson Bay Company.

Summary notes for the north boundary of this transect are also informative:

> The land along the eastern five miles of this boundary is a low bottom intersected with numerous lakes, ponds, and sloughs. It's timbered with ash, crabapple, etc. There is a low prairie covered with rank growth. It is all subject to inundation from 1 to 12 feet in the months of June and July.

Oral histories from long-time residents

As noted above, taped interviews were conducted with six long-time residents of the watershed. Summaries of the interviews are included in Appendix B.

All of the residents interviewed believed that the abundance of salmon, steelhead, and cutthroat trout in the watershed has declined dramatically in recent years. Several of the residents believed that extensive clear-cut logging and silting of pool habitat was a primary cause. They also stated that the streams had much less large wood in them than they remember in past decades. Residents also provided site-specific data that has been useful in later stages of this analysis.

Historical photographs and maps

Three historical photos give a better idea of the three major ecological communities that occurred in the watershed. The ponds and sloughs of the lowland floodplain are shown in a photo from about 1920, prior to construction of the dikes (Figure 3-2). The Scappoose prairie is shown in a second photo from about 1920 (Figure 3-3). Old growth forest of the uplands is shown in a third photo of loggers near Milton Creek (Figure 3-4).

Thirteen aerial photographs from 1929, 1938, 1948, and 1996 were obtained from the USCOE. These photos provide a sampling of the extensive historical photo record available at USCOE for the eastern portion of the watershed bordering Multnomah Channel and extending into the foothills of Scappoose. The photographs provide a better understanding of historical conditions in the lower watershed prior to extensive diking and during more recent floods in 1948 and 1996 (Appendix B).

Historical written accounts

The region has surprisingly good written historical information, probably because of its location at the confluence of the Willamette and Columbia rivers and heavy use by Native Americans, early explorers, and settlers. *The History of Scappoose*, by James Loring Watts (1984), provides an excellent overview of the environmental history of the watershed. He writes that when pioneers first entered the area:

> Waterfowl was plentiful. The bottom land lakes were covered with ducks, geese, and swan most of the year. Deer were plentiful and herds of elk would come down the Scappoose Creek canyons several times a year to browse on the bottom land grass. In fact, Hudson's Bay men called Scappoose their favorite elk hunting grounds. The Scappoose creeks, with their virgin timber watershed and lack of diversions, were much larger in early days. They contained many native trout, sea going trout, steelhead, and chub [*sic*] salmon in season. Also the uncontaminated Multnomah Channel had heavy runs of salmon both in the spring and the fall.

Wapato Indians, by Roy Franklin Jones (1972), is an excellent source of information on Native Americans of the Lower Columbia region. There are seven archaeological sites in the watershed. These sites strongly indicate that there was a large permanent settlement of Chinook Indians (sometimes called "Wapato") living in the present dikelands surrounding Scappoose Bay. "Wapato" is also the name of a tuber that grew in the lakes of the lowlands and was a primary food of the Native Americans of the area.

Figure 3-2 – Historic Floodplain Habitat Zone of Lower Scappoose Bay Watershed (circa 1920)

Figure 3-3 – Historic Prairie Habitat Zone in Scappoose Bay Watershed (circa 1920)

Figure 3-4 – Historic Old Growth Forest Habitat Zone of Upper Scappoose Bay Watershed (circa 1920)

The Clatskanie River Navigability Study, by James E. Farnell (1980), provides an excellent investigation of historical log drives and splash dams on Milton Creek. Findings of the report are discussed in Chapter 6, Channel Modifications.

DISCUSSION/CONCLUSIONS

The environmental history of the watershed is summarized in the historical timeline shown in Table 3-1. European settlement and exploitation of the watershed over the past 150 years has included fur trapping, logging, gravel mining, dairy and small farming, residential and commercial development, water withdrawal, introduction of exotic species (such as carp), and major flood control efforts. These changes have drastically altered historical habitats in the watershed for fish and wildlife. These land use changes are at least partially responsible for the noticeable decline in salmon and trout discussed by long-time watershed residents.

Three major ecological communities occurred in the watershed historically: lowland floodplain in the lower watershed, old growth forest in the hills of the upper watershed, and prairie on the gravel plain between the hills and the floodplain. These ecological communities have all been drastically altered – the lowland floodplain by flood control measures, surface mining, and farming, the prairie by farming and residential development, and the forested hills by logging.

Watershed Assessment Confidence Evaluation: Moderate-high due to a professional assessor obtaining information from a broad diversity of information sources.

RECOMMENDATIONS

DEA recommends that the Watershed Council obtain the historical vegetation types map (based on GLO surveys) from the ONHP when it becomes available in 2000.

Table 3-1 - Historical Timeline for the Scappoose Bay Watershed

Pre-1804	Prior to 1804 only Native Americans occupied the Scappoose Bay watershed. Recent archaeological data indicates that a large, permanent settlement of Chinook Indians was located on the Dikelands around Scappoose Bay. This settlement had between 1,200 and 4,000 inhabitants. The area was also a popular rendezvous and trading site. Portland State University has over 12,000 artifacts collected from the area. Three major excavation sites are located within the watershed: Powell site, near Milton Creek; Decker Site, south Scappoose Bay area, and Ede Site, near Honeyman Road.
1804	Lewis and Clark Expedition.
1828	Hudson Bay Company establishes a horse ranch in the "Scappoose Plains" near the present-day airport.
1828-30	Disease kills the majority of the Native American population.
1843	Westward migration begins.
1846	Splash dams and log drives begin to float millions of board feet of logs down streams during winter peak flows
1850	First U.S. Government land claims issued.
1852	Large waterwheel built at the junction of North and South Scappoose creeks.
1854	Columbia County formed.
1856	First dam built upstream from waterwheel (west of Maple Street) on South Scappoose Creek.
1863	Land issued through the Homestead Act. Agricultural enterprises begin.
1894	Record-setting flood.
1906	Large-scale logging begins. Railroad to Chapman constructed. (The railroad was removed in 1945.)
1916	Railroad transport replaces splash damming and log driving on Milton Creek.
1920	City of St. Helens constructs dam on Salmonberry Creek for water supply.
1922	City of Scappoose builds dam on Gourlay Creek for municipal water supply.
1922	Drainage District formed
1925-28	Dike built along Multnomah Channel to control flooding of lowland floodplain.
1930-50	Most of remaining old growth timber logged.
1944	Truck logging replaces railway logging on North Scappoose Creek.
1951	Bonnie Falls fish ladder constructed.
1955	City of Scappoose builds dam and water intake on South Scappoose Creek.
1956	City of St. Helens begins using wells for municipal water supply.
1956	Fish kills documented in Scappoose Bay due to pollution of Multnomah Channel.
1962	City of Scappoose builds Lacey Creek dam and water intake.
1970s	Noticeable declines in salmonid populations.
1985-91	Local Salmon Trout Enhancement Program (STEP) volunteers operate hatchboxes and begin stream restoration projects on North and South Scappoose creeks and Milton Creek.
1997	Scappoose Bay Watershed Council formed.
1998	Water quality monitoring begins by the Watershed Council.
1999	Adult salmonid and smolt traps placed on North Scappoose Creek; watershed assessment begins.

Figure 3-1 - GLO Survey Notes Map

CHAPTER 4. CHANNEL HABITAT TYPING

INTRODUCTION

Stream channels with similar geomorphic features, such as stream gradient, size, and floodplain width, generally respond in similar ways to watershed inputs of wood, water, and sediment (Watershed Professionals Network [WPN] 1999.) The purpose of channel habitat typing is to enable analysts to evaluate physical channel processes and fish habitats that would be expected based on channel types. This chapter summarizes the work required to produce a GIS channel habitat typing map that is a geomorphic classification of channel types using features such as stream gradient, stream flow size, channel confinement, and estuarine influence.

METHODS

The following methods were used to construct the GIS channel type maps:

Stream gradient map

Using the GIS system, all streams were segmented into 100-meter sections. Percent gradient was calculated for each section. Gradients were then grouped into the six gradient classes recommended in the Oregon Watershed Enhancement Manual (WPN 1999). For the summary classification, streams were grouped into three classes of gradient (low = less than 4 percent; moderate = 4 to 16 percent; high = greater than 16 percent).

Stream flow accumulation map

To obtain a quantitative estimate of relative stream size, the upstream contributing drainage area of each stream section was calculated using the digital elevation map. A stream section was first classified as having low, moderate or high flow, where the drainage area contributing flow to that stream section was calculated as less than 667 acres, between 667 and 2,224 acres, or greater than 2,224 acres. For the summary classification, streams were grouped into two classes: low (less than 667) and moderate-high (greater than 667).

Channel confinement

Using the topographic working base map, stream sections were manually identified as one of three classes of confinement, where floodplain width is greater than 4 x bankfull width (unconfined), 2 to 4 x bankfull width (moderately confined), or less than 2 x bankfull width (confined). The confinement classes were then digitized from the topographic maps for use in GIS. For the summary classification, channels were grouped into two classes of confinement (unconfined and moderately confined channels were combined as one class).

Estuarine channel

The major geomorphic distinction between channel types is between estuarine and non-estuarine channels. Estuarine channels occur in the lower watershed adjacent to Multnomah Channel. They are influenced by tidal action and floodplain soils. Stream substrates are usually mud. Estuarine channels were identified using the GIS system as all channels below 20 feet in elevation. The summary channel classification uses both estuarine and non-estuarine channel types.

Summary channel classification

The summary classification was obtained by combining the four channel types described above. Each channel type was condensed into two to three classes to reduce the total potential channel types to 24 combinations.

RESULTS

Five distinct maps were constructed as discussed in methods, above:

1. Stream gradient map (Figure 4-1 – Gradient Map)
2. Stream flow accumulation map (Figure 4-2 – Flow Accumulation Map)
3. Channel confinement map (Figure 4-3 – Channel Confinement Map)
4. Estuarine channel map (Figure 4-4 – Estuary Channel Map)
5. Summary channel classification map (Figure 4-5 – Summary Channel Classification Map)

Table 4-1 summarizes the approximate stream miles and percent of total stream miles included in each channel type. Table 4-2 summarizes the stream miles and percent of total stream miles in each summary channel type.

Table 4-1 – Stream Miles and Percent of Total Stream Miles for Each Channel Classification in the Scappoose Bay Watershed

Channel Classification	Criteria	Stream Miles	Percent
Flow accumulation (contributing acres)			
	low (<667)	189	68
	moderate (667-2224)	53	19
	high (>2224)	35	13
Channel confinement			
	confined	157	57
	unconfined	91	33
	moderately confined	28	10
Channel gradient (percent gradient)			
	<1	91	33
	1-<2	35	13
	2-<4	31	11
	4-<8	54	20
	8-<16	48	17
	>=16	16	6
Estuarine (elevation)			
	Yes- < 20 feet elev.	48	18
	No - > 20 feet elev.	228	82

Table 4-2 - Stream Miles and Percent of Total Stream Miles for Each Summary Channel Type (All Possible Combinations of Four Channel Classifications) in the Scappoose Bay Watershed

Channel Types[1]				**No. of Stream Miles**	**Percent**
Gradient	Flow Accumulation	Channel Confinement	Estuarine Channel		
lowg	lowa	con	Yes	0	0
lowg	hma	con	Yes	0	0
lowg	lowa	umc	Yes	40	15
lowg	hma	umc	Yes	8	3
lowg	lowa	con	No	33	12
lowg	hma	con	No	14	5
lowg	lowa	umc	No	11	4
lowg	hma	umc	No	51	19
modg	lowa	con	Yes	0	0
modg	hma	con	Yes	0	0
modg	lowa	umc	Yes	0	0
modg	hma	umc	Yes	0	0
modg	lowa	con	No	84	30
modg	hma	con	No	10	4
modg	lowa	umc	No	5	2
modg	hma	umc	No	3	1
hig	lowa	con	Yes	0	0
hig	hma	con	Yes	0	0
hig	lowa	umc	Yes	0	0
hig	hma	umc	Yes	0	0
hig	lowa	con	No	15	5
hig	hma	con	No	1	0
hig	lowa	umc	No	0	0
hig	hma	umc	No	0	0

1 = **gradient** – lowg = 0-<4 percent, modg = 4-<16 percent, hig = >16 percent
flow accumulation – lowa = <667 acres, hma= >667 acres
channel confinement – umc = unconfined or moderately confined, con = confined
estuarine channel – Y=yes, <20 feet elevation, N=no, >20 feet elevation

DISCUSSION/CONCLUSIONS

Channels are classified into group segments of the stream that are expected to function in a similar manner. Streams in the same channel type are expected to respond in similar ways to watershed inputs and in providing habitat for certain species. The Scappoose Bay watershed has a broad range of channel types in terms of size (flow accumulation), confinement, gradient, and estuarine influence (Table 4-1). Twelve of the 24 potential channel type combinations occur (Table 4-2). As shown on the summary map, the watershed is dominated by nine of these types (Figure 4-5 – Summary Classification Map).

The upper watershed hills are dominated by high gradient, confined, and small streams. These are sediment source and transport reaches. They usually have only limited fish habitat due to the high gradient. The streams are sensitive to the loss of large wood that fills in the channel and is important for storing sediment behind step pools.

The mainstem reaches of the major streams in the valleys are generally low gradient and unconfined, but with some confined reaches. These reaches are generally sediment transport and deposition channels that provide the bulk of the fish spawning and rearing habitat for most species. These channels are generally very sensitive to changes in watershed inputs of wood, flow, and sediment (WPN 1999).

The lower watershed is dominated by low gradient, unconfined estuarine channels of various sizes. Many of these smaller estuarine streams are channelized. These streams can serve as sediment deposition reaches, although tidal action and flooding can act as sediment transport mechanisms in these low gradient channels. These channels generally provide rearing habitat for coho, cutthroat, chum, and chinook.

Several qualifications need to be made regarding channel habitat typing. Channel habitat types are approximations. Channel gradient is based on 30-meter resolution digital elevation maps. Some local changes in elevation may be a result of the mapping resolution. Channel confinement was estimated from topographic maps. More precise estimates would require extensive fieldwork.

Watershed Assessment Confidence Evaluation: Moderate-high due to a professional GIS analyst and assessor making channel typing classifications based primarily on GIS mapping data, with little field verification conducted.

RECOMMENDATIONS

Channel habitat typing is a general descriptive tool for understanding conditions in the watershed. Prior to use of the channel typing on a site-specific project level, the channel type should be field verified.

Figure 4-1 – Gradient Map

Figure 4-2 - Flow Accumulation Map

Figure 4-3 - Channel Confinement Map

Figure 4-4 - Estuarine Channel Map

Figure 4-5 - Summary Channel Classification Map

CHAPTER 5. FISHERIES RESOURCE AND HABITAT ASSESSMENT

INTRODUCTION

This chapter summarizes the work required to produce GIS fish and fish habitat assessment maps that include the following features:

- Current distribution and abundance of steelhead, coho, chinook, chum, and cutthroat trout based on Oregon Department of Fish and Wildlife (ODFW) GIS data layers and other available stream survey data
- Historic distribution and abundance, referenced to the base map, of steelhead, coho, chinook, chum, and cutthroat trout based on interviews conducted by the community outreach team with ODFW biologists and local residents
- Potential distribution (addition to historic distribution) of each native salmon and trout species based on species requirements and stream gradient and natural barrier information
- Artificial barriers (road culverts, dams, and tidegates) identified in the databases of ODOT, Columbia County, relevant municipalities, and ODFW's fish passage and habitat survey databases. If data from any timber industry or other private landowner was in a compatible format and made available for use in this project, it was also included.

METHODS

The following methods were used to construct the GIS maps.

Current species distribution

The distribution of each salmonid species in the watershed was mapped based on ODFW and BLM data layers. These data layers were incorporated into the stream database. The BLM data layers were "completed" to show species occurrence in areas directly downstream of mapped species occurrences. ODFW survey data was mapped for coho salmon distribution for several stream reaches where data was available. Oregon Department of Forestry (ODF) Water Classification maps provide information on general fish distribution in the watershed, based on data provided by field surveys and other methods. The ODF classification map was digitized by DEA and included in the streams database. The essential fish habitat map produced by the Oregon Division of State Lands (DSL) was also digitized on-screen by DEA and included in the streams database.

Historic fish distribution

Information on the historic distribution of each species was limited, but suggests the same distribution as shown for current fish species. The one exception is fall chum salmon, which apparently occurred in Milton Creek and was suspected to have occurred in other streams also. Historic fall chum distribution that was mapped based on limited information, in Willis et al. (1960), does not indicate the upstream extent of the chum distribution.

Current and historic fish abundance

Trends in fish abundance were evaluated based on available reports, oral history, interviews, and 1998-99 monitoring of juvenile and adult salmonids at the fish trap at Bonnie Falls on North Scappoose Creek.

Potential fish distribution

The potential distribution of each salmonid species was mapped as an addition to the current fish distribution map. Potential distribution was based on general knowledge of each species' use of stream habitat based on stream size and gradient as follows:

- Steelhead – less than 20 percent gradient
- Coho – less than 4 percent gradient
- Cutthroat – less than 20 percent gradient
- Chinook – less than 4 percent gradient
- Chum – less than 1.2 percent gradient

The potential distribution map does not account for potential stream gradient barriers that may prevent access to an upstream area of low gradient.

Artificial barriers

The ODFW fish passage barrier database was used to map artificial barriers caused by county and state roads. The database contained only imited information on some barriers. Barriers with little information were distinguished by color coding on the map. Additional artificial barriers, such as water supply dams, mentioned in Willis et al. (1960) and in interviews, were digitized on-screen based on location descriptions. Finally, ODF data on culvert and other artificial barriers was obtained from ODF Water Classification maps and digitized on-screen.

Potential natural barriers:

Stream gradient greater than 20 percent was mapped to show areas of potential barriers, such as waterfalls.

In-stream habitat conditions

ODFW has conducted physical habitat surveys for several streams in the watershed. Habitat condition was rated for each stream reach by applying ODFW habitat benchmarks to selected habitat parameters (WPN 1999). An example of the condition ratings for one habitat parameter "pool frequency" was mapped on GIS.

RESULTS

The following GIS maps were produced:

1. Current fish distribution maps – one for each species (Figures 5-1 through 5-5)
2. Historic fish distribution maps – same as shown on current fish distribution maps
3. Potential fish distribution maps – included as layers on current fish distribution maps

4. Artificial barriers – includes state and county road barriers, dams, and other barriers (Figure 5-6 – Fish Passage Barriers Map)

5. Potential natural barriers – locations included on artificial barrier map (Figure 5-6 – Fish Passage Barriers Map)

6. In-stream habitat condition map (residual pool depth) for ODFW surveyed stream reaches (Figure 5-7 – Residual Pool Depth Map)

7. Essential fish habitat as defined by DSL (Figure 5-8 – Essential Fish Habitat [DSL] Map)

8. Water classifications map, per ODF (Figure 5-9 – ODF Water Classification Map)

The status of each salmonid species under the Endangered Species Act (ESA) is summarized in Table 5-1. Historical changes in species distributions in each sub-watershed, based on interviews and other historical information, are given in Table 5-2. A summary of hatchery stocking records is provided in Table 5-3. Artificial barriers identified by ODFW and other sources are described in Tables 5-4 and 5-5, respectively. Table 5-6 presents in-stream habitat data and ratings for ODFW-surveyed reaches in the watershed.

Table 5-1. Status of Salmonid Species and Their Critical Habitat That Occur in Scappoose Bay Watershed

Species	ESU*	ESA Status	Date Of Listing	Critical Habitat Status	Habitat Description	Date Of Listing
Chinook	Lower Columbia River	Threatened	March 24, 1999	Proposed	All accessible rivers, estuarine areas	March 9, 1998
Chum	Columbia River	Threatened	March 25, 1999	Proposed	All accessible rivers, estuarine areas downstream of Bonneville Dam, but excluding Oregon tributaries upstream of Milton Creek	March 10, 1998
Coho	Lower Columbia River/ Southwest Washington	Candidate	July 25, 1995	n/a	n/a	n/a
Steelhead	Lower Columbia River	Threatened	March 19, 1999	Proposed	All accessible rivers, estuarine areas including Willamette River	February 5, 1999
Coastal Cutthroat	Southwestern Washington/ Columbia River	Proposed Threatened	April 5, 1999	None proposed	n/a	n/a

* Evolutionarily Significant Unit

Table 5-2. Historic and Existing Salmonid Stocks Observed in Streams of the Scappoose Bay Watershed

Stream	Time-frame	Spring Chinook	Fall Chinook	Coho	Chum	Summer Steelhead	Winter Steelhead	Cutthroat	Source
Honeyman and Sly	Historic						X	X	1
	Existing							X	1
Jackson Creek	Historic			X			X	X	2
	Existing							X	2
McNulty	Historic						X	X	3
	Existing							X	3
Milton	Historic		X	X	X		X	X	3,4,8
	Existing			X			X	X	3,4
North Scappoose	Historic		X	X			X	X	3,5,6
	Existing	X		X			X	X	3,5,6
South Scappoose	Historic		X	X	X		X	X	2,3,6,7
Mainstem Scappoose	Historic		X	X	X	X	X	X	2,3,6,7,8
	Existing	X		X		X	X	X	2,3,6,7,9

Data sources:

1= interview with Tarbell (residents)
2= interview with Don Callahan, resident
3= interview with Don Bennet (ODFW biologist)
4= interview with Laurene McGilvera, Aaron Ostaj, Charles Werings, Jerry Belcher (residents)
5= interviews with Ollie Ede (resident)
6= interview with Fred Bernet (resident)
7= interview with Dick Kirtland (resident)
8= Environmental survey report…Fish Commission of Oregon (Willis et al. 1960)
9=Dave Sahagian (resident)

Table 5-3 - Summary of Hatchery Stocking History in the Scappoose Bay Watershed

Hatchery Release: Coho

Release Location	Brood Stock		Hatchery	Life Stage	Release Date	Est. Fish per lb.	No. of Fish
	Year	Location					
Honeyman Creek	81	Sandy River	Bonneville	fingerling	06/08/82	217.0	6,944
Honeyman Creek	82	Sandy River	Cascade	fingerling	05/17/83	202.0	11,312
Honeyman Creek	86	Tanner Creek	Bonneville	fingerling	05/28/87	221.0	9,945
Milton Creek	79	Sandy River	Bonneville	fingerling	06/03/80	235.0	45,600
Milton Creek	81	Sandy River	Bonneville	fingerling	06/08/82	217.0	56,203
Milton Creek	82	Sandy River	Cascade	fingerling	05/20/83	209.0	131,670
Milton Creek	83	Cowlitz River	Oxbow (Herman)	fry	06/28/84	362.5	55,463
Milton Creek	86	Tanner Creek	Bonneville	fingerling	05/28/87	221.0	49,725
Milton Creek	80	Sandy River	Sandy	fry	3/11//81	1,120.0	70,668
North Scappoose Creek	79	Sandy River	Bonneville	fingerling	06/03/80	235.0	100,000
North Scappoose Creek	80	Sandy River	Sandy	fry	03/11/81	1,120.0	97,037
North Scappoose Creek	81	Sandy River	Bonneville	fingerling	06/08/82	217.0	69,540
North Scappoose Creek	82	Klatskanine River	STEP	fry	03/15/83	1,100.0	24,000
North Scappoose Creek	82	Sandy River	Cascade	fingerling	05/17/83	202.0	70,094
Scappoose Creek	79	Sandy River	Bonneville	fingerling	06/03/80	235.0	40,000
South Scappoose Creek	80	Sandy River	Sandy	fry	03/11/81	1,120.0	70,668
South Scappoose Creek	81	Sandy River	Bonneville	fingerling	06/08/82	217.0	39,928
South Scappoose Creek	82	Sandy River	STEP	fry	02/06/83	1,100.0	52,730
South Scappoose Creek	82	Sandy River	Cascade	fingerling	05/17/83	202.0	71,104
South Scappoose Creek	83	Cowlitz River	Oxbow (Herman)	fry	06/28/84	362.5	55,100
South Scappoose Creek	86	Tanner Creek	Bonneville	fingerling	05/28/87	221.0	48,630

Table 5-3 - Summary of Hatchery Stocking History in the Scappoose Bay Watershed (continued)

Hatchery Release: Winter Steelhead

Release Location	Brood Stock Year	Brood Stock Location	Hatchery	Life Stage	Release Date	Est. Fish per lb.	No. of Fish
Milton Creek	75	Big Creek	Gnat Creek	yearling	12/15/75	30	14,854
Milton Creek	76	Big Creek	Gnat Creek	yearling	11/15/76	16.6	19,755
North Scappoose Creek	82	Big Creek	Gnat Creek	smolt	05/09/83	6.0	4,277
North Scappoose Creek	82	Big Creek	Gnat Creek	smolt	05/10/83	5.7	5,899
North Scappoose Creek	85	Big Creek	Gnat Creek	smolt	04/14/86	5.1	4,998
North Scappoose Creek	85	Big Creek	Gnat Creek	smolt	04/14/86	5.2	5,000
North Scappoose Creek	86	Big Creek	Trojan Pond	smolt	05/14/87	4.5	9,864
North Scappoose Creek	87	Big Creek	Trojan Pond	smolt	04/25/88	5.9	5,012
North Scappoose Creek	88	Big Creek	Trojan Pond	smolt	04/17/89	4.2	5,067
North Scappoose Creek	89	Big Creek	Trojan Pond	smolt	04/12/90	4.7	10,006
North Scappoose Creek	90	Big Creek	Gnat Creek	smolt	04/15/91	6.0	10,018
Spacious Creek	75	Big Creek	Gnat Creek	smolt	05/15/76	7.7	10,002
Scappoose Creek	76	Big Creek	Gnat Creek	smolt	04/15/77	6.4	10,240
Scappoose Creek	77	Big Creek	Gnat Creek	smolt	04/15/78	6.1	11,143
Scappoose Creek	78	Big Creek	Gnat Creek	smolt	04/15/79	6.5	10,205
Scappoose Creek	79	Big Creek	Gnat Creek	smolt	04/08/80	6.0	5,100
Scappoose Creek	79	Big Creek	Gnat Creek	smolt	04/08/80	6.1	5,246
Scappoose Creek	83	Big Creek	Gnat Creek	smolt	05/04/84	6.4	4,863
Scappoose Creek	83	Big Creek	Gnat Creek	smolt	05/04/84	6.6	5,279
Scappoose Creek	84	Big Creek	Trojan Pond	smolt	05/01/85	4.8	9,994
South Scappoose Creek	80	Big Creek	Gnat Creek	smolt	04/13/81	5.4	5,184
South Scappoose Creek	80	Big Creek	Gnat Creek	smolt	04/13/81	5.5	4,840
South Scappoose Creek	81	Big Creek	Gnat Creek	smolt	04/30/82	6.0	5,096
South Scappoose Creek	83	USFWS	STEP	fry	04/20/83	1,700.0	24,000

Table 5-4 - County and State Road Culverts Identified as Fish Passage Barriers by Oregon Department of Fish and Wildlife for the Scappoose Bay Watershed

Road	Culvert barrier specifications											
	River Mile	Stream	Subbasin	Length (ft)	Diameter (inches)	Drop at Outlet (inches)	Outlet Pool Depth (inches)	Percent Slope	* Species Present and (Suspected)	Upstream Miles of Fish Habitat	Habitat Quality	Priority for Correction
1001	0.50	Alder Cr	N Scappoose Cr	35	60	6	6	1	ct	3.8	Good	Moderate
3069	0.00	Mollenhour Cr	N Scappoose Cr	200	48	6	2	9	ct	0.3	Fair	Moderate
Hwy 30	18.27	Joy Cr	Multnomah Channel									
1136	0.05	Dart Cr	Milton Cr	80	60	16	12	1	ct	4.5	Fair	High
1050	3.65	Wolf Cr	S Scappoose Cr	40	60	24	24	1	ct	1.1	Fair	Low
1159	0.45	Coal Cr	S Scappoose Cr	50	60	0	4	.5	ct	1.1	Fair	Low
1020	2.70	Cox Cr	Milton Cr	35	48	15	10	.5	ct	1.3	Fair	Moderate
1020	0.60	Cox Cr	Milton Cr	60	96	0	10	.5	ct co (st)	1.6	Good	High
1031	0.55	Cedar Cr	N Scappoose Cr	50	72	0	15	1	ct	0.4	Good	Moderate
1030	0.10	Un Cr	Alder Cr	45	36	14	20	3	ct	0.7	Fair	Moderate
1001	0.10	Alder Cr	N Scappoose CR	45	60	4	12	1	st (co) ct	0.2	Good	High
Hwy 30	19.16	Jackson Cr	Multnomah Chnl									
1010	0.07	SF Scappoose Cr	Scappoose Cr									
1001	0.72	Alder Cr	NF Scappoose Cr.									
1001	1.04	Alder Cr	NF Scappoose Cr.									
1001	0.04	Alder Cr	NF Scappoose Cr.	No Data Available for These Streams								
1030	0.19	Alder Cr	NF Scappoose Cr.									
1031	0.90	Cedar Cr	NF Scappoose Cr.									
3069	12.79	Cedar Cr	NF Scappoose Cr.									
1040	0.44	Salmon Cr	Milton Cr									
1040	0.53	Salmon Cr	Milton Cr									
1040	0.82	Salmon Cr	Milton Cr									
1075	1.28	Un Cr	McNulty Cr									
1143	6.61	Alder Cr	SF Scappoose Cr.									
1014	1.69	Un Cr	McNulty Cr									
1014	1.74	Un Cr	McNulty Cr									
1102	1.31	McNulty Cr	Scappoose Bay									
1047	0.05	Un Cr	Jackson Cr									
1011	0.01	Dart Cr	Milton Cr									
1064	1.74	Dart Cr	Milton Cr									
1128	5.75	Un Cr	Milton Cr									
1128	10.68	Un Cr	Milton Cr									
1029	0.50	Milton Cr	Scappoose Bay									
1029	2.40	Milton Cr	Scappoose Bay									
Hwy 30	19.16	Jackson Cr	Multnomah Channel									

* co = coho; ct = cutthroat trout; st=steelhead.

Table 5-5 - Dams, Culverts and Other Potential Fish Passage Barriers Identified by Oregon Department of Forestry and Other Data Sources **

ID No.	Stream	Barrier	Type	Height (ft)	C/P*	Source of Information
1	Sierkes	Cascades	Natural Barrier	10	C	1960 Fish Commission Report
2	Fall	Cascades	Natural Barrier	0	C	1960 Fish Commission Report
3	Cedar	Possible-Unknown	Natural Barrier	0		1960 Fish Commission Report
4	Milton	Concrete Dam	Dam	3	P	1960 Fish Commission Report
5	Milton	Concrete Dam	Dam	6	P	1960 Fish Commission Report
6	Salmon	Waterfall	Natural Barrier	8	C	1960 Fish Commission Report
7	Milton	Woody Debris	Natural Barrier	0	P	1960 Fish Commission Report
8	Honeyman	Dam	Dam	0	C	1960 Fish Commission Report
9	Gourlay	Water Supply Dam	Dam	0	C	City of Scappoose
10	Lazy	Water Supply Dam	Dam	0	C	City of Scappoose
11	South Scappoose	Water Supply Dam	Dam	0		City of Scappoose
12	Joy	Tide Gate	Tide Gate	0	P	Dave Sahagian
2	Perry (Milton)	culvert	Culvert	?	?	ODF Water Classification Map
3	Joy	barrier	?	?	?	ODF Water Classification Map
4	North Scappoose	barrier	Culvert	?	?	ODF Water Classification Map

* C/P = Complete (C) or Partial (P) barrier to fish

** NOTE: Nine potential natural barriers and 19 additional potential culvert barriers identified in the ODF survey forms are not shown here.

Table 5-6 - In-Stream Habitat Parameters and Condition Ratings for Stream Reaches Surveyed by Oregon Department of Fish and Wildlife in the Scappoose Bay Watershed

Stream	Stream Reach	Length (meters)	Survey Date	Percent Pool	Rating	Complex Pools *	Rating	Percent Gravel	Rating
Salmon Creek	1	1,520	8/30/90	29.2	Moderate	0.0	Low	51.0	High
Sierkes Creek	1	575	9/4/90	33.8	Moderate	0.0	Low	70.0	High
Sierkes Creek	2	22	9/4/90	18.9	Moderate	0.0	Low	64.0	High
North Scappoose Creek	1	2,885	9/1/98	25.2	Moderate	1.7	Moderate	16.0	Moderate
North Scappoose Creek	2	1,877	9/3/98	26.2	Moderate	3.1	High	17.0	Moderate
North Scappoose Creek	3	1,493	9/9/98	44.3	High	3.6	High	15.0	Moderate
North Scappoose Creek	4	1,880	9/15/98	73.8	High	11.5	High	30.0	Moderate
North Scappoose Creek	5	1,823	9/17/98	76.2	High	9.0	High	36.0	High
North Scappoose Creek	6	1,307	9/22/98	54.7	High	13.0	High	35.0	High
Raymond Creek	1	2,440	9/5/90	29.8	Moderate	0.0	Low	70.0	High
Raymond Creek	2	1,117	9/5/90	10.1	Moderate	0.0	Low	41.0	High
Raymond Creek	3	1,054	9/13/90	20.2	Moderate	0.0	Low	51.0	High

* Pools associated with three or more pieces of wood per kilometer of stream channel length.

Source: ODFW 1999 habitat survey data

DISCUSSION/CONCLUSIONS

Fish distribution

Salmonid species that occur in the Scappoose Bay watershed include coho salmon, winter and summer steelhead, resident and sea-run cutthroat, fall chum salmon, and spring and fall chinook salmon. Four of the five species are listed or proposed for listing as threatened species under the federal ESA (Table 5-1). Coho salmon are a candidate for federal listing.

Salmonid distribution data from ODFW and BLM are consistent with written reports, interview data, and survey data dating back to 1948, with the exception of chum salmon, which are not included in the agency GIS database, but are known to have occurred in Milton Creek (Willis et al, 1960). The current status of chum salmon is unknown. "Current" salmonid distribution as presented by agency data is probably more a reflection of historic conditions and anecdotal information. Interviews with local residents suggest that, in the past several decades, species diversity has been greatly reduced in most sub-basins (Table 5-2).

Potential distribution of each species gives a rough approximation of habitat areas, but does not account for potential natural barriers. Fish presence/absence distribution based on survey data from ODF shows that fish occur throughout most of the watershed. In most cases, these fish are cutthroat trout, which generally can inhabit the headwaters of stream systems.

The record of hatchery stocking obtained from ODFW indicates that hatchery coho and steelhead were planted extensively in the major streams in the watershed (Table 5-3). Coho fry and fingerlings and steelhead fry, fingerling, and smolts were released into the North Scappoose Creek, South Scappoose Creek, Honeyman Creek, and Milton Creek between 1975 and 1990. The brood stock for coho included Sandy River, Cowlitz River, Klatskanine and Tanner Creek stock. The brood stock for steelhead was from Big Creek. The Salmon Trout Enhancement Program (STEP), organized by ODFW, released hatchbox steelhead into Scappoose Creek from 1983 to 1990. Hatchery stocking was discontinued by ODFW in 1990 due to their concern regarding the adverse effects of hatchery fish stocks on native stocks.

Fish abundance

Written reports and oral histories indicate that all fish species have declined dramatically in the watershed (see Willis et al. 1960 and Morgan et al. 1998 in database for the best available information on fish abundance). A summary of the juvenile and adult salmonid monitoring project initiated in 1998 at Bonnie Falls on North Scappoose Creek is provided in Appendix C.

Coho: Historically, coho was one of the most abundant anadromous fish species in the Scappoose Bay watershed. Coho has shown a drastic decline since the 1970s, with very few or no juvenile fish found in recent surveys (Figure 5-10, graph of coho abundance from Morgan et al. 1998). In contrast, an electronic counter used at the fish ladder installed in 1951 at Bonnie Falls on North Scappoose Creek recorded 152 coho and 376 steelhead in the winter of 1956-57, and 432 coho and 264 steelhead in the winter of 1957-58 (Willis et al. 1960). In 1999, juvenile and adult fish trapping was initiated at Bonnie Falls: 706 coho smolts were caught between

March 2 and June 21, with an estimated total migration of 1,317 individuals based on an overall mark/recapture trap efficiency of 54 percent (Appendix C).

Steelhead: According to local residents, winter steelhead was also abundant in the watershed until recent decades, with a drastic decline in recent years. In 1999, 33 adult steelhead were recorded at the adult fish trap installed at Bonnie Falls. Twenty-two of the 33 fish (66 percent) were estimated to be of hatchery origin based on presence of a clipped adipose fin (Appendix C). Ninety-five steelhead smolts were caught, with an estimated total out-migration of 409 smolts, based on an overall mark/recapture trap efficiency of 23 percent (Appendix C). Very litle is known about summer steelhead use of the watershed. ODFW's GIS shows summer steelhead occurring in the mainstem of Scappoose Creek.

Chinook: According to Willis et al. (1960), several hundred fall chinook spawned in the two-mile reach below the north and south forks of Scappoose Creek in the 1950s. Current status is unknown. Fall chinook have probably also occurred in small numbers in Milton Creek, although no data has been collected concerning them. According to residents, at least a few spring chinook also occur in the watershed. Spring chinook were observed spawning in lower North Scappoose Creek in 1997. An angler was observed catching a spring chinook in the mainstem of Scappoose Creek in 1998. Spring chinook may also be native to the watershed, although no historic references were found. The recent occurrences may be hatchery or native strays from the Willamette River stock.

Chum: Milton Creek was the largest producer of chum salmon in the watershed, with a total spawning run estimated to be about 200 fish per year according to Willis et al. (1960). However, the location of spawning grounds within Milton Creek is unknown.

Cutthroat: Sea-run cutthroat trout were historically abundant in the watershed but are currently scarce, according to oral history reports. Resident cutthroat occur throughout the watershed and can occupy higher gradient, smaller streams than those used by other species. The ODF fish presence map does not indicate what species were observed in field sampling, but fish observation data from field survey forms shows that in most cases cutthroat are the only species found at the upper limits of fish use in the watershed.

Fish habitat data

Several stream reaches were surveyed by ODFW. Physical habitat information for these reaches, such as large woody debris abundance, pool size, and canopy cover, are available (ODFW and BLM, 1998). However, these reaches cover only a small portion of the watershed. Condition ratings for selected habitat factors using ODFW's habitat benchmarks shows that most surveyed streams have variable in-stream habitat condition, ranging from low (undesirable) to high (desirable) (Table 5-6).

Numerous artificial and natural barriers are recorded in the watershed. Most of the barriers are for state and county roads surveyed by ODFW (Table 5-4). However, limited information exists for most of these barriers. Additional barriers were identified through a range of data sources (Table 5-5). Two water supply dams owned by the City of Scappoose, located on Lazy Creek and South Scappoose Creek, probably block fish. A third dam on Gourley Creek has long been recognized as a blockage to about two miles of upstream habitat (Willis et al. 1960). At least two additional old dams on Milton Creek may potentially block access by some fish species. Little information exists for barriers on private land. The tide-gate at the mouth of Joy Creek potentially blocks fish access during high flows when most species tend to migrate. The ODF maps located only a few barriers, but many additional potential barriers were located by referring back to field survey data forms used in fish verification surveys. Given the high road density and large number of road crossings on private lands in the watershed, it is highly likely that numerous additional barriers occur.

Watershed Assessment Confidence Evaluation: Moderate due to a professional fish biologist evaluating available data. However, the available fish distribution data from ODFW and BLM is based primarily on anecdotal and historic information. Only a few stream reaches in the watershed have been recently surveyed for fish or habitat conditions.

RECOMMENDATIONS

1. Recent field data on fish distribution and abundance is generally lacking in the watershed. The adult and juvenile fish counting program on North Scappoose Creek and the spawning surveys should be continued. Additional spawning surveys for adult salmon and a snorkel survey for juvenile salmon should be conducted throughout the watershed.

2. Physical habitat surveys exists for only a small fraction of the streams in the watershed. DEA recommends that agencies continue these surveys to obtain comprehensive coverage in the watershed.

3. Fish and habitat surveys should be conducted concurrently if possible to maximize the value of the data for analysis and restoration planning. If limited funding restricts the scope of the survey effort, the fish and habitat surveys should be focused in high priority subwatersheds (identified in Chapter 11, Refugia).

4. A comprehensive fish passage barrier field survey in the watershed is recommended. DEA recommends that the field survey be done by DEA and the Watershed Council in cooperation with major timber land owners, private land owners, Cities of Scappoose and St. Helens, and BLM.

Figure 5-10 - Coho Abundance from Morgan et al. 1998.

Figures 5-11 and 5-12 - Photographs

Figure 5-1 - Coho Distribution Map

Figure 5-2- Chum Distribution Map

Figure 5-3 - Chinook Distribution Map

Figure 5-4 - Steelhead Distribution Map

Figure 5-5 - Cutthroat Distribution Map

Figure 5-6 - Fish Passage Barriers Map

Figure 5-7 - Residual Pool Depth Map

Figure 5-8 - Essential Fish Habitat (DSL) Map

Figure 5-9 - ODF Water Classification Map

CHAPTER 6. CHANNEL MODIFICATIONS

INTRODUCTION

This chapter summarizes the work required to produce GIS channel modification maps that include the following features:

- Tidal diking areas based on National Wetlands Inventory (NWI) maps that identify diked tidelands and historical data, as available
- Historic splash dams, referenced to the base map, based on interviews conducted by the community outreach team with ODFW biologists and local residents
- Historic stream clean-outs, referenced to the base map, based on interviews conducted by the community outreach team with ODFW biologists and local residents
- Existing tidegates, based on interviews conducted by the community outreach team with ODFW biologists and local residents as referenced to the base map, as well as surveys conducted by the community outreach team and volunteers, as feasible
- Channelized streams, referenced to the base map, based on aerial photo interpretation and field surveys conducted by the community outreach team and volunteers, as feasible
- Fill removal records and 404 permits based on DSL and USCOE records.

METHODS

Tidal diking areas:

Tidal diking areas were mapped using Natural Resources Conservation Service (NRCS) GIS soil survey map coverage. Soils identified as "protected" by dikes were mapped. Actual dikes were not shown on the GIS coverage. NWI maps did not contain information on diking areas.

Historic splash dams and stream clean-outs

Splash dams and log drives on Milton Creek were identified based on a navigability study by Farnell (1980).

Existing tidegates

One existing tidegate was digitized on-screen based on interviews conducted by the community outreach team with ODFW biologists and local residents.

Channelized streams

Channelized streams were digitized on-screen based on aerial photo interpretation and information on Milton Creek in a navigability study by Farnell (1980). Straightened channels and ditches were obvious on the base map and were added as a new column in the streams database. Time did not permit field surveys, but one area identified by local residents was digitized on-screen and saved as line data.

Fill removal records and 404 permits

The community outreach team interviewed both DSL and USCOE representatives.

RESULTS

The following GIS map layers were produced for the watershed:

1. Channelized streams and dikelands (Figure 6-1 – Channel Modifications Map)

2. Point and line data digitized on-screen from various information sources for flooding areas, dams and tidegates. The dams and tidegate locations are included on the barriers map. Only one flooding area was identified in interviews and was not mapped, but has been saved in a unique line database.

DISCUSSION/CONCLUSIONS

The lowland floodplain adjacent to Multnomah Channel has been extensively modified by channelization and diking. This area historically flooded 12 to 20 feet on an annual basis and is within the 100-year floodplain (also see Chapters 3 and 10). Within the lowland floodplain, the south end of Scappoose Bay appears to be the only area relatively free of channelization and may serve as an important refugium habitat for salmon.

A navigability study by Farnell (1980) presents a thorough historical summary of log drives in the Clatskanie area, including Milton Creek. At least two splash dams were used on Milton Creek, one at Yankton (River Mile 6) and the other possibly upstream near Trenholm. Annual log drives of as much as 3 million board feet of timber occurred on Milton Creek been 1846 and 1915. The upper head of log navigation with natural stream flow was upstream of Yankton at River Mile 8. Logs were also driven down Cox Creek, a tributary of Milton Creek.
A holding dam at Yankton was also built to direct water and logs into a flume through which logs and cord wood ran six miles directly to St. Helens. In Farnell's (1980) report, he quotes A.H. Blakesly's description of the effects of 1889 log transport activities on his property:

> For the past six years the defendants have been continually and now are putting large quantities of large sawlogs into said stream above plaintiff's said lands, aggregating many millions of feet and have by means of dams and other contrivances in and along said stream willfully stopped and prohibited the water from flowing naturally down said stream… about once every month during the last six years they remove said obstructions to the flow of said stream and thus…cause a large and extraordinary body of water to flow down said stream, to carelessly…float the said saw logs down through and upon the said lands by means of which the banks of plaintiff's said lands have been overflowed and the fencing carried away and the said logs drifted on said lands and many left thereon from time to time and the banks of said stream cut out and widened and plaintiff's lands washed away and the orchard thereon ruined.

It is difficult to underestimate the potentially damaging effect of 69 years of log drives on fish habitat in lower Milton Creek. It is likely that log drives and splash dams also occurred on Scappoose Creek, especially in the more confined ravines similar to Milton Creek. According to Farnell (1980), all of the streams in Columbia County were "brought into service" to bring down timber because they were located on the major artery of early Oregon commerce between Portland and Astoria. As *The West*, a local newspaper, described the situation in June 1883:

> Every stream of any size has been cleared of obstructions, so that logs can be run down them in high waters season. Logs are also hauled to the bottom lands and when they are floated by the freshets are made up into rafts and towed to the mills on the river, to Portland and even to Astoria…..

Farnell's report also suggests that the lower two miles of Milton Creek were re-located from Jackass Canyon through the City of St. Helens: "In May 1861, there was a plan to divert the flow of the creek into St. Helens to power mills at that town when it was engaged in its struggle for metropolitan supremacy with Portland." However, inspection of the General Land Office township survey map from 1854 shows the location of the Milton Creek stream channel to be close to its current location in St. Helens. Thus, there is no indication that the creek was located in Jackass Canyon or was diverted from its historic and current location in St. Helens.

The largest channel modification in the watershed appears to be the routing of Jackson Creek into Joy Creek with a diversion dam. This dam eliminates flow to about five stream miles of lower Jackson Creek most of the time. During floods, the stream level in lower Joy Creek can back up over the diversion dam level. Three water supply dams operated by the City of Scappoose and at least one old dam owned by the City of St. Helens and one by a private landowner are also major channel modifications. The major impact of these dams may be to warm stream temperatures, flood potential habitat, and partially or fully block fish passage.

Although the upper valleys of most of the stream systems are at least partially within the 100-year floodplain, little channelization or diking has occurred in these areas. This is rather unusual, as most floodplain stream valleys in the Pacific Northwest dominated by agricultural uses have been extensively channelized for drainage control. However, in the Scappoose Bay watershed, clearing the valley floodplains and channels of large wood jams has probably greatly reduced the habitat functions of these areas. Streams are deeper in incised channels, resulting in less frequent flooding of the adjacent floodplains. Less connectivity between the stream and its floodplain probably reduced numerous side-channels and isolated the stream in a single main channel. However, the meander patterns of the main channel remain relatively intact throughout most of the upper watershed.

Watershed Assessment Confidence Evaluation: Moderate-high due to a variety of sources used by an experienced professional assessor and obvious location of channelized streams from aerial photographs. However, incomplete information is available on possible Milton Creek channel re-location, and for splash dam and log drive activity on streams other than Milton Creek.

RECOMMENDATIONS

1. Further investigation of the Jackson Creek-Joy Creek diversion is recommended to determine potential restoration opportunities.

2. The south end of Scappoose Bay appears to be one of the few remaining relatively intact portions of the lowland floodplain portion of the watershed. Protection of this area as important fish and wildlife habitat should be further explored.

Figures 6-2 and 6-3 - Photographs

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Figure 6-1 - Channel Modifications Map

CHAPTER 7. SEDIMENT SOURCES

INTRODUCTION

This chapter summarizes the work required to produce GIS sediment source maps that include the following features:

- Potential surface erosion areas classified by hazard rating (high, moderate, low) based on an analysis of GIS soils maps and slope maps (digital elevation maps)
- Potential unstable slopes classified by hazard rating (high, moderate, low) based on an analysis of GIS soils maps and slope maps (digital elevation maps) cross-checked with the Columbia County hazard mitigation report
- Potential bank erosion areas based on riparian vegetation types observed from available aerial photography
- Actual bank erosion areas, referenced to the base map, identified through interviews by the community outreach team with ODFW biologists and local residents
- Current active and permitted aggregate mining operations as available
- Locations of stormwater and point-source discharge permits as available

METHODS

Potential surface erosion areas

These areas were classified by a water erosion hazard rating (high, moderate/high, moderate, moderate/low, or low) based on the text description of soils in the Columbia County, Multnomah County, and Washington County Soil Surveys (Green 1983, 1982; Smythe 1986) (Table 7-1). The code columns in the table indicate the soil code and indicate in which county the soil occurs. Erosion hazard ratings refer to the probability of excessive erosion occurring as a result of soil exposure by farming, ranging, forestry practices, or wildfire. This rating is based on the soil erodibility factor, "K," which is a measure of how susceptible soil particles are to detachment and transport by rainfall and runoff, slopes, and local climate. Slight or low hazard ratings indicate no particular erosion control measures are needed under ordinary conditions; moderate indicates that some erosion control measures are needed; and severe or high ratings indicate that extra precautions are needed to control erosion in most activities.

To illustrate potential surface erosion related to roads, DEA also mapped a GIS layer obtained from the BLM showing roads in the watershed.

Table 7-1 - Soil Types in the Scappoose Bay Watershed and Associated Surface Erosion Factor (K) and Rating

Soil Codes			Code	Soil Name	Percent Slope	High Seasonal Water Table	Erosion Factor "K"	RATING
Multn	Wash	Colum						
na	na	1A	colu1A	Aloha silt loam	0 to 3	Yes	0.43	L
na	na	1B	colu1B	Aloha silt loam	3 to 8	Yes	0.43	L
na	1	na	wash1	Aloha silt loam	---	Yes	0.43	L
na	na	2	colu2	Aloha Variant silt loam	---	Yes	0.43	L
na	na	3E	colu3E	Alstony gravelly loam, north slopes	30 to 60	No	0.28	H
na	na	3F	colu3F	Alstony gravelly loam, north slopes	60 to 90	No	0.28	H
na	na	4E	colu4E	Alstony gravelly loam, south slopes	30 to 60	No	0.28	H
na	na	4F	colu4F	Alstony gravelly loam, south slopes	60 to 90	No	0.28	H
na	na	6D	colu6D	Bacona silt loam	3 to 30	No	0.28	MH
na	na	9F	colu9F	Braun-Scaponia silt loams, south slopes	60 to 90	No	0.28	H
7B	na	na	mult7B	Cascade silt loam	3 to 8	Yes	0.24	L
na	na	10B	colu10B	Cascade silt loam	3 to 8	Yes	0.24	L
na	na	10C	colu10C	Cascade silt loam	8 to 15	Yes	0.24	M
na	na	10D	colu10D	Cascade silt loam	15 to 30	Yes	0.24	H
na	7B	na	wash7B	Cascade silt loam	3 to 7	Yes	0.24	L
na	7C	na	wash7C	Cascade silt loam	7 to 12	Yes	0.24	M
na	7D	na	wash7D	Cascade silt loam	12 to 20	Yes	0.24	M
na	7E	na	wash7E	Cascade silt loam	20 to 30	Yes	0.24	MH
na	na	11E	colu11E	Caterl gravelly silt loam, north slopes	30 to 60	No	0.15	H
na	na	12E	colu12E	Caterl gravelly silt loam, south slopes	30 to 60	No	0.15	H
na	na	13	colu13	Cloquato silt loam	0 to 3	No	0.32	M
na	na	14B	colu14B	Cornelius silt loam	3 to 8	Yes	0.37	L
10C	na	na	mult10C	Cornelius silt loam	8 to 15	Yes	0.37	M
na	na	14C	colu14C	Cornelius silt loam	8 to 15	Yes	0.37	M
na	na	14D	colu14D	Cornelius silt loam	15 to 30	Yes	0.37	H
na	na	15	colu15	Crims silt loam, protected	0 to 3	Yes	0.37	L
na	na	16	colu16	Dayton silt loam	0 to 3	Yes	0.43	L
na	na	17C	colu17C	Delena silt loam	3 to 12	Yes	0.43	L
na	na	18E	colu18E	Dowde silt loam, north slopes	30 to 60	No	0.37	H
na	na	19E	colu19E	Dowde silt loam, south slopes	30 to 60	No	0.37	H
na	na	20	colu20	Eilertsen silt loam	0 to 3	No	0.37	L
17C	na	na	mult17C	Goble silt loam	3 to 15	Yes	0.28	LM
na	na	22C	colu22C	Goble silt loam	3 to 15	Yes	0.28	LM
17D	na	na	mult17D	Goble silt loam	15 to 30	Yes	0.28	H
na	na	22D	colu22D	Goble silt loam	15 to 30	Yes	0.28	H
17E	na	na	mult17E	Goble silt loam	30 to 60	Yes	0.28	H
na	17B	na	wash17B	Goble silt loam	2 to 7	Yes	0.28	L
na	17C	na	wash17C	Goble silt loam	7 to 12	Yes	0.28	M
na	17D	na	wash17D	Goble silt loam	12 to 20	Yes	0.28	M
na	17E	na	wash17E	Goble silt loam	20 to 30	Yes	0.28	H
na	18E	na	wash18E	Goble silt loam (broadly defined unit)	2 to 30	Yes	0.28	MH
na	18F	na	wash18F	Goble silt loam	30 to 60	Yes	0.28	H
na	na	23C	colu23C	Goble silt loam, warm	3 to 15	Yes	0.28	LM
na	na	23D	colu23D	Goble silt loam, warm	15 to 30	Yes	0.28	H

Rating: H = high; M =moderate; L = low; MH = moderate/high; ML = moderate/low

Table 7-1 - Soil Types in the Scappoose Bay Watershed and Associated Surface Erosion Factor (K) and Rating (continued)

Soil Codes			Code	Soil Name	Percent Slope	High Seasonal Water Table	Erosion Factor "K"	RATING
Multn	Wash	Colum						
na	na	24	colu24	Hapludalfs-Udifluvents complex	0 to 3	No	na	LM
19E	na	na	mult19E	Haploxerolls (broadly defined unit)	20 to 50	No	na	MH
na	na	27A	colu27A	Latourell silt loam	0 to 3	No	0.37	L
na	na	27B	colu27B	Latourell silt loam	3 to 8	No	0.37	LM
na	na	31	colu31	McBee silt loam	0 to 3	Yes	0.32	M
na	na	32	colu32	McNulty silt loam	0 to 3	No	0.43	M
na	na	33	colu33	Moag silty clay loam	0 to 2	Yes	0.28	M
na	na	36D	colu36D	Murnen silt loam	3 to 30	No	0.28	MH
na	33F	na	wash33F	Melby silt loam	30 to 60	No	0.32	H
na	35E	na	wash35E	Olyic silt loam	5 to 30	No	0.32	MH
na	35F	na	wash35F	Olyic silt loam	30 to 60	No	0.32	H
na	na	39A	colu39A	Quafeno loam	0 to 3	Yes	0.32	L
36B	na	na	mult36B	Quafeno loam	3 to 8	Yes	0.32	L
na	na	39B	colu39B	Quafeno loam	3 to 8	Yes	0.32	L
36C	na	na	mult36C	Quafeno loam	8 to 15	No	0.32	M
na	na	40A	colu40A	Quatama silt loam	0 to 3	Yes	0.32	L
na	na	40B	colu40B	Quatama silt loam	3 to 8	Yes	0.32	L
37C	na	na	mult37C	Quatama silt loam	8 to 15	Yes	0.32	M
na	na	40C	colu40C	Quatama silt loam	8 to 15	Yes	0.32	M
37D	na	na	mult37D	Quatama silt loam	15 to 30	Yes	0.32	H
39	na	na	mult39	Rafton silt loam	0 to 2	Yes	0.37	M
na	na	41	colu41	Rafton silt loam	0 to 2	Yes	0.37	M
na	na	42	colu42	Rafton silt loam, protected	0 to 2	Yes	0.37	L
na	na	43	colu43	Rafton-Sauvie-Moag complex	0 to 2	Yes	0.37	L
na	na	45	colu45	Rock outcrop-Xerumbrepts complex, undulating	0 to 10	No	na	M
44	na	na	mult44	Sauvie silt loam	0 to 2	Yes	0.32	MH
na	na	46	colu46	Sauvie silt loam	0 to 2	Yes	0.32	MH
na	na	47	colu47	Sauvie silt loam, protected	0 to 2	No	0.32	L
na	na	48	colu48	Sauvie silty clay loam, protected	0 to 2	No	0.32	L
na	na	49E	colu49E	Scaponia-Braun silt loams, north slopes	30 to 60	No	0.32	H
na	na	50E	colu50E	Scaponia-Braun silt loams, south slopes	30 to 60	No	0.32	H
na	na	51	colu51	Sifton loam	0 to 3	No	0.32	L
na	na	53D	colu53D	Tolany loam	3 to 30	No	0.37	MH
na	na	54E	colu54E	Tolany loam, north slopes	30 to 60	No	0.37	MH
na	na	55E	colu55E	Tolany loam, south slopes	30 to 60	No	0.37	MH
na	39E	na	wash39E	Tolke silt loam	5 to 30	No	0.28	MH
na	na	62D	colu62D	Vernonia silt loam,	3 to 30	No	0.28	MH
na	na	63	colu63	Wapato silt loam	0 to 3	Yes	0.32	M
56E	na	na	mult56E	Wauld very gravelley loam, (broadly defined unit)	30 to 70	No	0.24	MH
na	na	64E	colu64E	Wauld very gravelley loam, (broadly defined unit)	30 to 70	No	0.24	MH

Rating: H = high M =moderate L = low
MH = moderate/high ML = moderate/low

Table 7-1 - Soil Types in the Scappoose Bay Watershed and Associated Surface Erosion Factor (K) and Rating (continued)

Soil Codes			Code	Soil Name	Percent Slope	High Seasonal Water Table	Erosion Factor "K"	RATING
Multn	Wash	Colum						
na	na	69	colu69	Wollent silt loam	0 to 3	Yes	0.43	L
na	na	70E	colu70E	Xerochrepts	20 to 50	No	na	H
W	na	na	multW	lakes, ponds, and reservoirs --perennial	---	No	na	na
na	na	W	coluW	lakes, ponds, and reservoirs --perennial	---	No	na	na

Rating: H = high; M =moderate; L = low; MH = moderate/high; ML = moderate/low

Sources: Green (1983, 1982), and Smythe (1986)

Potential unstable slopes

Slopes were classified by hazard rating (high, moderate, low) based on intersecting GIS soils maps and slope maps (digital elevation maps).

The Scappoose Bay Watershed is underlain by the following geologic formations:

- Quaternary (recent) alluvium (Qal)
- Sand-sized and fine-grained flood deposits (Qs, Qlc, and Qc)
- Loess (Qes)
- Troutdale Formation (QTtd)
- Columbia River basalt group: Grande Ronde basalt (Tcr, Tgr)
- Scappoose Formation (Tso)
- Pittsburg Bluff Formation (Tpb)

Assessments of geologic hazards in areas adjacent to the watershed have shown that the following three geologic formations are prone to mass wasting at slopes between 15 and 25 percent under saturated soil conditions (Shannon and Wilson, Inc. 1978). Saturated soil conditions commonly occur in the winter.

1) loess deposits and deep colluvial soils on the Columbia River Basalt Group
2) older volcanic/sedimentary rocks (Scappoose and Pittsburg formations)
3) landslide deposits

Relative mass wasting hazards in the watershed were estimated by correlating soils in the soil surveys of Columbia, Multnomah, and Washington counties with geology. This was done by examining descriptions of parent materials and comparing soil and geology map units. Estimates of low, moderate, and high relative mass wasting hazards were then assigned to the soil mapping units using the matrix developed by Shannon and Wilson, Inc. (1978). Soil map units differentiate soil series by slope categories. For example, Aloha Silt loam 1A and 1B are considered to have a low hazard of mass wasting at slopes less than or equal to 25 percent. The results are summarized in Table 7-2.

Table 7-2 - Estimating Relative Mass Wasting Hazard from Soils Maps

Soil Name	Parent Material from Soil Survey	Estimated Equivalent Geologic Formation	Relative Mass Wasting Hazard
Aloha silt loam 1A, B	Older alluvium on terraces	Qal, recent alluvium Qlc, lacustrine silt/clay Qs, sand-sized flood materials	Low ≤25% Mod to High: 26-49% High: ≥50%
Alstony gravelly loam 3E, F 4E, F	Colluvium from igneous rock and volcanic ash	Tso, Scappoose Formation Tpb, Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%
Bacona silt loam 6D	Colluvium from siltstone, shale, sandstone with loess and volcanic ash	Tso, Scappoose Formation Tpb, Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%
Braun-Scaponia silt loam 9F	Colluvium derived from siltstone	Tso, Scappoose Formation Tpb, Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%
Cascade silt loam 10B, C, D 7B, C, D, E	Silt, loess	Qes (Portland Hills loess)	Low ≤25% Mod to High: 26-49% High: ≥50%
Caterl gravelly silt loam 12E, 11E	Colluvium from igneous rock and volcanic ash	Tcr Columbia River basalt (includes Grande Ronde)	Low: <50% Mod to High: 50-100% High: >100%
Cloquato silt loam 13	Recent alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Cornelius silt loam 14B, C, D 10C	Silty material, loess	Qes (Portland Hills Loess)	Low ≤25% Mod to High: 26-49% High: ≥50%
Crims silt loam 15	Organic material in recent alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Dayton silt loam 16	Older alluvium on terraces	Qlc, lacustrine silt/clay	Low ≤25% Mod to High: 26-49% High: ≥50%
Delena silt loam 17C	Silty material, loess	Qes (Portland Hills Loess)	Low ≤25% Mod to High: 26-49% High: ≥50%
Dowde silt loam 18E, 19E	Colluvium derived from igneous rock	Tgr Columbia River Basalts	Low: <50% Mod to High: 50-100% High: >100%
Eilertsen silt loam 20	Alluvium on terraces	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Goble silt loam 22C, D 23C, D 17B, C, D, E 18E, F	Silty material and volcanic ash	Tso, Scappoose Formation Tpb, Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%

Table 7-2 - Estimating Relative Mass Wasting Hazard From Soils Maps (continued)

Soil Name	Parent Material from Soil Survey	Estimated Equivalent Geologic Formation	Relative Mass Wasting Hazard
Hapludalfs-Udifluvents complex	Alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Latourell silt loam 27A, B	Alluvium on broad terraces	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
McBee silt loam 31	Silty alluvium on terraces	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
McNulty silt loam 32	Recent alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Moag silty clay loam 33	Recent clayey alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Murnen silt loam 36D, E	Colluvium and residuum from basalt with some volcanic ash	Tgr, Columbia River Basalts	Low: <50% Mod to High: 50-100% High: >100%
Melby silt loam 33F	Colluvium and residuum from sedimentary rock in uplands	Tso, Scappoose Formation Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%
Olyic silt loam 35E, F	Colluvium and residuum from basalt in uplands	Tgr , Columbia River Basalts	Low: <50% Mod to High: 50-100% High: >100%
Quafeno silt loam 39A, B	Silty alluvium on terraces	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Quatama silt loam 40A, B, C	Silty alluvium on terraces	Qs, Qc, fine-grained to sand-sized floodplain deposits	Low ≤25% Mod to High: 26-49% High: ≥50%
Rafton silt loam 41, 42	Recent silty alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Rafton-Souvie-Moag complex 43	Recent alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Rock Outcrop/xerumbrept complex 45	Basalt rock exposure	Tcr, Columbia River basalt (includes Grande Ronde)	Low: <50% Mod to High: 50-100% High: >100%
Sauvie silt loam 47	Recent silty alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Sauvie silty clay loam 48	Recent silty alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%

Table 7-2 - Estimating Relative Mass Wasting Hazard From Soils Maps (continued)

Soil Name	Parent Material from Soil Survey	Estimated Equivalent Geologic Formation	Relative Mass Wasting Hazard
Scaponia-Braun silt loams 49E 50E	Colluvium derived from siltstone	Tso, Scappoose Formation Tpb, Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%
Sifton loam 51	Gravelly alluvium, volcanic ash	Qs, sand-sized flood deposits	Low: 0-65% Mod to High: 66-100% High: >100%
Tolany loam 53D, 54E, 55E	Colluvium from mixed sources	Tso, Scappoose Formation Tpb, Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%
Tolke silt loam 39E	Colluvium from siltstone and shale, volcanic ash	Tso, Scappoose Formation Tpb, Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%
Vernonia silt loam 62D	Colluvium from siltstone and shale	Tso, Scappoose Formation Pittsburg Bluff Formation	Low: ≤15% Mod to High: 16-24% High: ≥25%
Wapato silt loam 63	Silty recent alluvium	Qal, recent alluvium	Low ≤25% Mod to High: 26-49% High: ≥50%
Wauld very gravelly loam 64E, 56E	Colluvium derived from basalt	Tcr ,Columbia River basalt (includes Grande Ronde)	Low: <50% Mod to High: 50-100% High: >100%
Wollent silt loam 69	Silty alluvium	Qal, recent alluvium Qlc, lacustrine sile/clay	Low ≤25% Mod to High: 26-49% High: ≥50%

Sources: Shannon and Wilson, Inc. (1978), Green (1983, 1982), and Smythe (1986)

Potential bank erosion areas

These areas were identified by visual comparison of the surface erosion hazard map and riparian condition map (Figure 8-1 – Riparian Vegetation Map). Stream lengths dominated by grass/forb or shrub/partial forest and with moderate or high surface erosion were considered potential bank erosion areas.

Actual bank erosion areas

These areas were identified through interviews by the community outreach team with ODFW biologists and local residents and then digitized on-screen as line data saved in a separate "outreach" file for line data.

Current active and permitted aggregate mining operations

These areas were identified through interviews by the community outreach team with ODFW biologists and local residents. Locations were digitized on-screen and saved in a separate "outreach" file for point data.

Locations of stormwater and point-source discharge permits

This information was unavailable in a form that could be used in GIS.

RESULTS

The following GIS map layers were produced:

1) Potential surface erosion hazard ratings for all soils (Figure 7-1 –Surface Erosion Map)
2) Roads in the watershed (from BLM) (Figure 7-2 – Roads Map)
3) Potential mass wasting hazard ratings for all soils (Figure 7-3 –Unstable Slopes Map)
4) Digitized location map of actual bank erosion areas and mines (Figure 7-4 – Potential Sediment Sources Map)

DISCUSSION/CONCLUSIONS

Most of the watershed contains slopes with a moderate or high potential for surface erosion when disturbed. These soil types are concentrated in the western two-thirds of the watershed in the hills. Roads are considered one of the largest potential sources of fine sediment from surface erosion in forested watersheds (WPN 1999). The BLM road data includes private and "undefined" roads. Although the BLM data is probably not a complete survey of roads in the watershed, the map indicates a high density of roads throughout the watershed. These roads may be a significant source of sediment; particularly roads located in the hills of Scappoose, where surface erosion hazards are higher.

A small percentage of the watershed contains slopes rated as moderate or high hazard for mass wasting. These areas are usually on steep slopes, although soils underlain by certain geologic types and generally with high water tables can be unstable at fairly low slope angles. This preliminary estimate of relative mass wasting hazards in the watershed should be refined by future studies of the risk. These studies should be based on more accurate slope maps, a GIS coverage of existing geologic maps, and mass wasting inventories that correlate events with underlying geology, slope, aspect, elevation, soils, previous disturbance, roadways, and vegetative cover.

Visual comparison of the riparian condition map and surface erosion hazard map shows overlapping areas that have both moderate and high surface erosion and grass/forb or shrub/partial forest riparian zones. These areas are potential areas of high bank erosion. However, the method is highly theoretical and needs substantial field verification to determine its validity. Instead of making a unique map for this topic, effort was put into digitizing outreach data. One area of actual bank erosion was digitized as line data.

Mining areas can be potential sources of fine sediment. Mine locations obtained from the City of Scappoose and interviews of outreach coordinators were digitized as point data. Scappoose Sand and Gravel owns and operates a gravel pit in Scappoose that borders Scappoose Creek (Figure 7-5). According to local residents, during the 1996 flood, the creek breached the dike and flooded the gravel pit. Scappoose Sand and Gravel also owns and operates a pit in St. Helens, near Milton Creek (Figure 7-6).

Watershed Assessment Confidence Evaluation: Moderate due to a professional experienced geologist conducting the surface and mass wasting assessment. However, no field verification of hazard calls was conducted and much additional information is needed as detailed below.

RECOMMENDATIONS

1. The preliminary estimate of relative mass wasting hazards should be refined by future studies of the risk. These studies should be based on more accurate slope maps, a GIS coverage of existing geologic maps, and mass wasting inventories that correlate events with underlying geology, slope, aspect, elevation, soils, previous disturbance, roadways, and vegetative cover.

2. A comprehensive road survey should be conducted. The road survey should identify existing and potential surface erosion and mass wasting hazards.

3. All mining areas should be assessed in the field to determine if they present a risk of fine sediment delivery to streams in the watershed.

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Figure 7-5 – Gravel Pit Owned by Scappoose Sand and Gravel, Bordering Scappoose Creek

Figure 7-6 – Gravel Pit Owned by Scappoose Sand and Gravel, near Milton Creek Figure 7-1 –Surface Erosion Map

Figure 7-2 –Roads Map

Figure 7-3 –Unstable Slopes Map

Figure 7-4 –Potential Sediment Sources Map

CHAPTER 8. RIPARIAN AND WETLAND CONDITIONS

INTRODUCTION

This chapter summarizes the work required to produce GIS riparian condition maps that include the following features:

- Riparian condition (poor, fair, good, unknown) of all GIS mapped streams, based on dominant vegetation types. ODFW habitat data was evaluated for streams that have been surveyed.
- Large woody debris (LWD) conditions were mapped based on ODFW physical habitat survey data available in GIS format.
- Wetlands were mapped based on NWI maps and local riparian wetland inventories (including those prepared by Scappoose and St. Helens) available in GIS format.

METHODS

Riparian condition

The condition of the riparian zone for each mapped stream in the watershed was assessed using 1998 aerial photographs (1 inch:1,000 foot scale) provided by Olympic Resources Management, Inc. These photographs cover all but the northwest corner of the watershed in upper Milton Creek. The condition was assessed for a width of 100 feet of the riparian zone on each side of the stream by inspection of the aerial photographs. Riparian condition along each stream was estimated to fall in one of three categories:

1. *Grass/Forb* – The stream reach is comprised of more than 50 percent grass/forb cover (non-woody vegetation) (less than 50 percent shrub or tree cover). This category includes pasturelands, crop lands and recent clear-cuts, usually less than five years old.

2. *Shrub/Partial Forest* – The stream reach is comprised of more than 50 percent shrubs or forest, but less than 90 percent coverage by forest. Forest is defined in this assessment as a stand of trees whose leaf canopy is dominated by trees greater than 30 years old. The shrub/partial forest category includes farm or residential lands with a higher percentage of shrubs or trees in the riparian zone, older clear-cuts that have regained shrub or young tree cover, and clear-cuts or partial cuts that retain a strip of forest along the riparian buffer.

3. *Forest* – The stream reach is comprised of more than 90 percent forest (conifer or deciduous) within the 100-foot wide assessment zone on each side of the creek. This category includes uncut forest with very few incursions and riparian forested buffers that are more than 100 feet wide on each side of the stream.

Each riparian type was color-coded on the digital orthophoto map by hand. The riparian vegetation types were then digitized on-screen from the orthophoto map. The GIS map product was re-checked for errors against the orthophoto map.

LWD condition

LWD condition comprises one element of the in-stream habitat conditions included in ODFW physical habitat surveys conducted on parts of three streams: South Scappoose Creek, North Scappoose Creek, and Milton Creek. DEA mapped condition ratings for two of the instream habitat factors— residual pool depth (presented in Chapter 5) and large woody debris pieces. DEA used ODFW habitat condition "benchmarks" to rate these habitat factors as low (undesirable), moderate, and high (desirable) for each stream reach surveyed (WPN 1999). To obtain an overview of physical habitat conditions, DEA developed a summary data table that rates selected habitat factors by reach.

Wetlands

DEA mapped wetlands using NWI maps as a basis. The City of Scappoose has completed a local riparian and wetland inventory, but it is not in GIS format and was not included. The City of St. Helens has its wetland and riparian inventory in GIS format for land within its urban growth boundary, but its GIS data is not ortho-rectified or geo-referenced, and thus is not suitable for use in this assessment.

RESULTS

The following GIS map layers were produced:

- Riparian condition (Figure 8-1 – Riparian Vegetation Map)
- LWD condition ratings for ODFW surveyed stream reaches (Figure 8-2 – Large Woody Debris Map)
- Wetlands as shown by NWI GIS coverage. This data was also mapped on a large scale map (1:24,000 scale) to show the detail of individual wetlands. (Figure 8-3 – National Wetlands Inventory Map)

A summary of physical habitat condition ratings for riparian and LWD parameters for each reach surveyed by ODFW is included in Table 8-1.

DISCUSSION/CONCLUSIONS

Most of the Scappoose Bay watershed's riparian zones are in grass/forb or shrub/partial forest classification. Relatively little of the riparian zones is in the forest classification. Agricultural uses account for the high percentage of grass/forb riparian zones in the lowland floodplain (dikelands) on the east side of the watershed. Higher in the watershed, most of the riparian zones along the stream valleys are dominated by pasture land or residential development. Most of these riparian areas are composed of shrubs along the streambanks or scattered trees and are classified as shrub/partial forest. Riparian zones along most of the tributaries have been converted from old growth forested riparian zones to clear-cuts with and without riparian buffers by decades of timber harvest. Most of the tributaries in the upper watershed that are classified as grass/forb were clear-cut within the past five years and are not yet dominated by shrubs or young trees.

Table 8-1 –Physical Habitat Condition Ratings for Selected Riparian and LWD Habitat Parameters Surveyed by Oregon Department of Fish and Wildlife

Stream Name	Stream Reach	Length (meters)	Survey Date	Percent Shade	Rating	LWD Pieces/ 100 m*	Rating	Key LWD Pieces/ 100 m **	Rating	No. Conifers >20 cm dbh ***	Rating
Salmon Creek	1	1,520	8/30/90	96	High	0.0	Low	0.0	Low	0.0	Low
Sierkes Creek	1	575	9/4/90	72	High	0.0	Low	0.0	Low	0.0	Low
Sierkes Creek	2	22	9/4/90	85	High	0.0	Low	0.0	Low	0.0	Low
North Scappoose Creek	1	2,885	9/1/98	76	High	6.5	Low	0.0	Low	46.0	Low
North Scappoose Creek	2	1,877	9/3/98	87	High	8.5	Low	0.3	Low	41.0	Low
North Scappoose Creek	3	1,493	9/9/98	76	High	7.7	Low	2.2	Moderate	20.0	Low
North Scappoose Creek	4	1,880	9/15/98	71	High	9.6	Low	0.0	Low	41.0	Low
North Scappoose Creek	5	1,823	9/17/98	75	High	8.9	Low	0.1	Low	30.0	Low
North Scappoose Creek	6	1,307	9/22/98	84	High	11.8	Moderate	0.1	Low	61.0	Low
Raymond Creek	1	2,440	9/5/90	81	High	0.0	Low	0.0	Low	0.0	Low
Raymond Creek	2	1,117	9/5/90	96	High	0.0	Low	0.0	Low	0.0	Low
Raymond Creek	3	1,054	9/13/90	100	High	0.0	Low	0.0	Low	0.0	Low

* LWD pieces counted were > 15 cm in diameter and more than 3 m in length

** Key LWD were > 60 cm in diameter and > 10 m in length

*** Number of conifers > 20 cm in diameter per 1,000 feet by 200 feet wide riparian zone, based on plot samples.

Source: ODFW 1999 habitat survey data

The current riparian conditions represent a major shift from historical conditions under which salmon evolved in the watershed. Historically, most of the watershed was dominated by mature and old growth coniferous forest in the hills to the west, by oak savanna in the prairie, and by a variety of shrub, deciduous forested and open-water wetlands in the Columbia River floodplain. Most of the riparian zones in the watershed are now in relatively poor condition.

On the east side of the watershed, most of the floodplain is still mapped as wetland in the NWI GIS data. However, most has been converted to agricultural uses. The south end of Scappoose Bay is one location where historic wetlands and channels appear to remain relatively intact.

On the west side of the watershed, detailed physical habitat surveys conducted on several stream reaches in the upper watershed by ODFW suggest that riparian zones are not functioning to provide adequate fish habitat. The surveyed reaches generally have low levels of LWD and relatively low shade cover and few pools (Table 8-1). Much of the large wood recruitment, shade, bank protection, and other functions historically provided by old growth forest riparian zones have been reduced by agricultural, residential, and forestry uses.

Watershed Assessment Confidence Evaluation: Moderate-high due to a professional assessor using 1998 aerial photos for riparian vegetation classification. However, little field verification of riparian vegetation types was conducted. Also, NWI maps cover only the east side of the watershed and are considered inaccurate by the local Soil Conservation District staff.

RECOMMENDATIONS

1. Protect the highest quality riparian zones classified as forest within the watershed due to their rarity and importance to fish habitat. Field assessment is needed to verify GIS mapping and better identify potential high-quality riparian areas.

2. Protect remaining high quality wetlands in the lowland floodplain, such as at the south end of Scappoose Bay. Field assessment is needed to verify GIS mapping and better identify high-quality wetland areas.

3. Restore forested riparian zones to agricultural and rural residential lands that have been converted to grass/forb or shrub/partial forest classes. Field assessment is needed to verify GIS mapping and better identify restoration areas.

4. Translate local wetland inventory hard copy maps conducted for the cities of Scappoose and St. Helens to ortho-rectified GIS format.

Figures 8-4 and 8-5 - Photographs

Figures 8-6 and 8-7 – Photographs

Figure 8-1 – Riparian Vegetation Map

Figure 8-2 – Large Woody Debris Map

Figure 8-3 – National Wetlands Inventory Map

CHAPTER 9. WATER QUALITY

This chapter summarizes the work required to produce GIS water quality maps based on available studies, such as the Lower Columbia River Bi-State Water Quality Report (1996). These maps were to include the following features:

- Water quality impaired stream segments based on 303(d) GIS data from the US Environmental Protection Agency (EPA)
- Maximum summer stream temperature recorded at each sampling station, based on data in available studies and compiled and referenced to a base map by the community outreach team
- Minimum dissolved oxygen recorded at each sampling station, based on data in available studies and compiled and referenced to a base map by the community outreach team
- Highest fecal coliform counts obtained at each sampling station, based on data in available studies and compiled and referenced to a base map by the community outreach team
- Hazardous waste sites and Superfund sites
- Land fills (active and inactive)
- Stormwater outfall locations
- Point source outfall locations under the National Pollution Discharge Elimination System (NPDES)

METHODS

Water quality impaired stream segments

EPA's 303(d) GIS data was searched and no 303(d) listed streams were found in the Scappoose Bay watershed.

Maximum summer stream temperature

Continuous reading thermometer data was collected at nine locations in the watershed by the Watershed Council during the summer of 1998. The Watershed Council provided DEA with Global Positioning System (GPS) locations for each site and a summary of the data. DEA mapped the seven-day running average maximum temperatures in two categories (greater than 59 degrees to less than 70 degrees F, greater than 70 degrees F) and attached the reference data to the points. A category of 55 degrees to less than 70 degrees F, corresponding to state water quality standards, was not used because no maximum average temperatures fell below 59.1 degrees F.

Minimum dissolved oxygen

The only data on oxygen that DEA found was collected by the Oregon Department of Environmental Quality (DEQ) at two sampling stations in Scappoose Bay (River Miles 1.0 and 2.0) in the 1960s and 1970s. Because sampling was discontinued at these stations, they have not been included on the water quality monitoring map.

Highest fecal coliform

Limited sampling was conducted in Scappoose Bay as part of the Bi-State Water Quality Sampling Program. In addition, the Watershed Council members conducted limited sampling in South Scappoose Creek in 1998.

Other water quality contaminants

Other water quality contaminants were also sampled in Scappoose Bay as part of the Bi-State Water Quality Sampling Program. The approximate location of the single sampling point within the watershed was digitized on-screen. Sampling results are summarized in the text.

Hazardous waste sites and Superfund sites

The community outreach team located two potential hazardous waste sites, an abandoned battery recycling plant and a former Pope and Talbot wood tratment plant, both located in St. Helens. DEA digitized the approximate locations on-screen.

Land fills (active and inactive)

The community outreach team located four inactive landfills in the watershed. DEA digitized the approximate locations on screen.

Stormwater outfall locations and point source permits (NPDES)

Stormwater outfall locations and point source permits (NPDES) were obtained from the City of Scappoose and DEQ respectively, but were not available in GIS format.

RESULTS

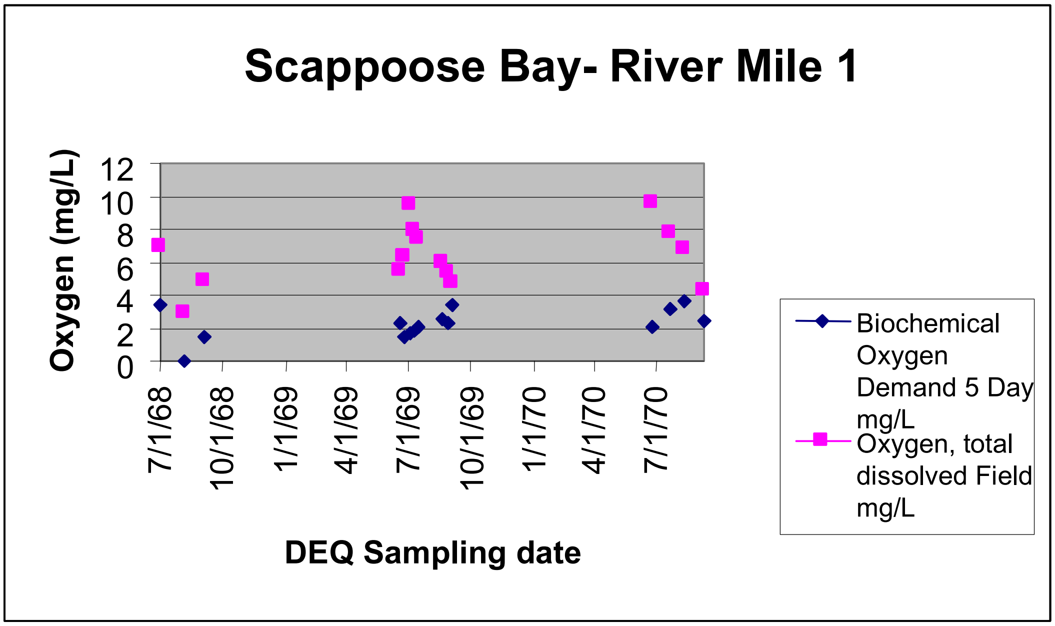
The following GIS maps were produced:

1. Water quality monitoring (1998 temperature monitoring and Bi-State monitoring) (9-1 – Water Quality Monitoring Map)

2. Potential water quality contaminant sources (landfills and hazardous waste sites) (Figure 9-2 – Potential Water Quality contaminant Sources Map)

DEQ oxygen and temperature data is summarized in Figures 9-3 and 9-4 and in Tables 9-1 and 9-2. Bi-state water quality monitoring data is summarized in the text.

Figures 9-3 and 9-4 - Dissolved Oxygen and Biochemical Oxygen Demand Measured by DEQ at River Miles One (Upper) and Two (Lower) in Scappoose Bay Between 1966 and 1970



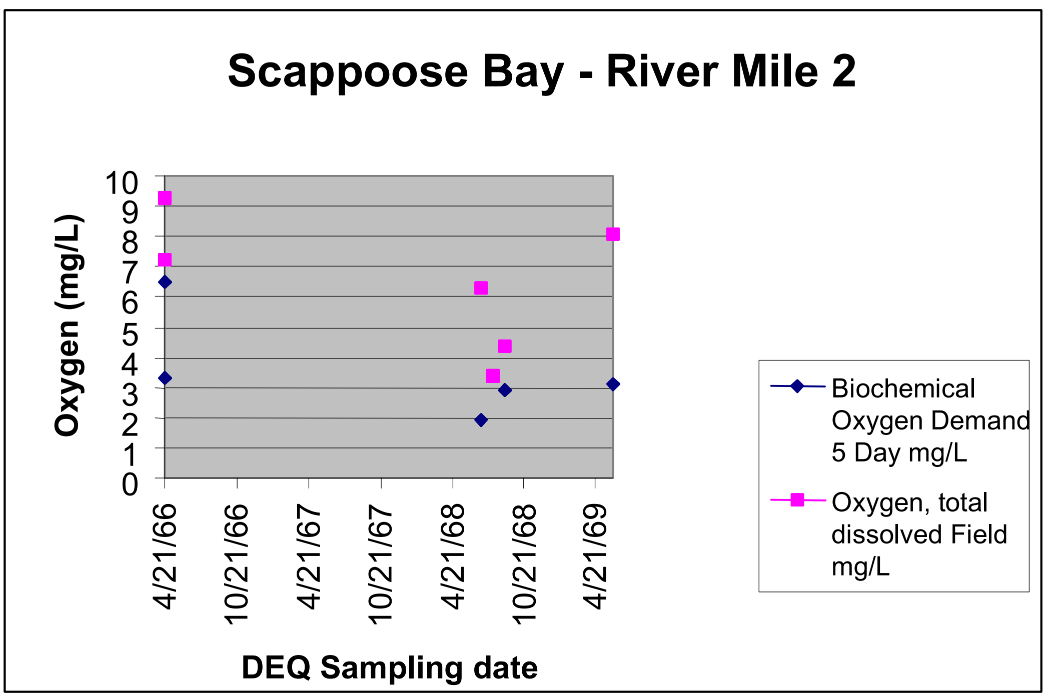


Table 9-1. Water Temperature Measurements Recorded by DEQ at Two Sampling Stations in Scappoose Bay (River Miles 1 and 2)

River Mile 1 Date	Water Temp. °F
7/1/68	69.3
7/1/68	69.3
8/5/68	70.7
8/5/68	70.7
9/3/68	65.3
9/3/68	65.3
6/18/69	73.4
6/18/69	73.4
6/25/69	64.4
6/25/69	64.4
7/2/69	62.6
7/2/69	62.6
7/9/69	66.2
7/9/69	66.2
7/15/69	68
7/15/69	68
8/19/69	68
8/19/69	68
8/27/69	86
9/3/69	66.2
9/3/69	66.2
7/20/70	74.3
7/20/70	74.3
8/10/70	69.8

River Mile 2 Date	Water temp. °F
4/21/66	53.6
4/21/66	53.6
4/21/66	53.6
4/21/66	53.6
7/1/68	70.5
7/1/68	70.5
8/5/68	69.8
8/5/68	69.8
9/3/68	66.2
9/3/68	66.2
6/4/69	66.2
6/4/69	66.2

DISCUSSION

Very little water quality monitoring has been conducted in the watershed. The monitoring that has been done suggests water quality problems exist in the watershed. The 1998 temperature monitoring shows that all stream reaches monitored exceeded the 55-degree F maximum average temperature standard. This 55-degree F standard is used as a state water quality standard for rearing and spawning of salmonids. The lower stream reaches exceeded 70 degrees F—near lethal thresholds for salmonids. These streams are potential summer rearing habitat for juvenile coho, chinook, steelhead, and cutthroat.

Historical information suggests that carp had a deleterious effect on the water quality of the sloughs and lakes of the lowland floodplain that would have provided rearing habitat for salmonids. In *The History of Scappoose* (1984), J. L. Watts writes:

> ….In about 1880, carp were introduced into the lower Columbia. They multiplied rapidly and devoured the roots and grasses of freshet time. Soon the wild hay became a thing of the past….A creek named after an early land claimer, Mr. Jackson, entered this bottom land near the south end, flowed north as a slough, connected with all the permanent lakes, and finally turned to the east into the Multnomah Channel. The Indians called the slough Santosh. Before the carp were introduced, many of these lakes were fairly clear and grew large amounts of wapato, the Indian potato relished not only by the Indians, but also by the thousands of wild fowl that wintered here.

In more recent years, the water quality of Scappoose Bay appears to have been heavily impacted by industrial sources of pollution. In 1960, the Fish Commission of Oregon (Willis et al. 1960) reported on a fish kill and the suspected cause:

> A serious pollution problem has existed in Scappoose Bay. The Crown Zellerbach paper mill in St. Helens and other plants discharge their effluents into Multnomah Channel, but tidal action occasionally backs up the discharge into the bay. The Kaiser Gypsum wallboard plant and the Pope and Talbot wood preserving plant empty their effluents directly into Scappoose Bay. Low stream flows coincident with high tides are believed to result in high concentration of waste materials in the bay. Evidences of severe pollution in Scappoose Bay occurred in December 1956….sporadic rains have attracted fall-run salmon into Scappoose Bay, but subsequent dry periods caused lethal conditions to occur when materials from polluting effluents became concentrated. Attempts to establish responsibility for the mortality of salmon in Scappoose Bay during December 1956 failed because the bay was flushed by rains during the time between the mortality occurrence and the appearance of the dead fish. The Scappoose Bay pollution situation is recommended for further investigation.

DEQ records contain only one water quality sampling study in the watershed. Oxygen and temperature data was collected between 1966 and 1970 by DEQ at two sampling stations in Scappoose Bay (River Miles 1 and 2). The data suggest that in late summer and early fall, oxygen and temperature approached lethal limits for salmonids. Dissolved oxygen regularly measured below 5.0 mg/L (Figures 9-3 and 9-4). However, biochemical oxygen demand was fairly low, and does not indicate a problem with excessive organic materials or effluents in the water. Rather, high temperatures and/or organic matter in sediments may have caused low dissolved oxygen. Water temperatures regularly exceeded 64 degrees F (Table 9-1). However, DEQ did not have information on how this data was collected or at what depths. Surface measurements may not reflect water quality conditions at lower depths, where oxygen and temperature may be at more tolerable levels for salmonids.

Seven NPDES permits have been issued for operations in the watershed, including permits issued to the City of Scappoose and City of St. Helens for sewage treatment plants and for the Boise Cascade veneer plant and pulp mill. In general, it appears that water quality impacts from industrial discharges have been greatly reduced since the fish kills in Scappoose Bay in the 1950s. Stormwater outfall information was available only from the City of Scappoose. In the City of Scappoose, 134 of 211 storm drains flow directly from the streets into Scappoose Creek. Outfall locations were not mapped since information is not available in GIS format.

The Lower Columbia River Bi-State Program included one sampling station in Scappoose Bay. Sediment, water, and fish tissue was sampled at the Scappoose Bay station in 1993. Summary results of this sampling are provided in *Health of the River 1990-1996* (Tetra Tech 1996). Results show that Scappoose Bay samples exceeded state, federal, or recommended threshold levels for the contaminants listed below:

Water sampling

- Fecal coliform
- Temperature
- Chlorophyll A
- Total recoverable iron
- Total recoverable lead
- Total recoverable aluminum

Sediment sampling

- Arsenic
- Cadmium
- Chromium
- Copper
- Iron
- Nickel
- p,p.-DDD (pesticide)

Tissue sampling (large scale sucker)

- total polychlorinated biphenols (PCBs)

Sampling for fecal coliform bacteria in South Scappoose Creek (Dutch Canyon area) showed elevated total coliform and e-coli levels. In addition, the results indicate that Scappoose Bay has been polluted by a range of industrial and agricultural contaminants.

Four landfills and two potential hazardous waste sites were located by the community outreach team. The landfills are all inactive, as garbage from the region is currently shipped to eastern

Oregon. The potential hazardous waste sites include the former Bledsoe battery recycling facility in St. Helens and the former Pope and Talbot wood treatment plant in St. Helens. According to a study conducted by GeoEngineers, Inc. for the Port of St. Helens and Pope and Talbot, contamination from wood treatment chemicals and PCBs at the former Pope and Talbot plant is limited solely to the property and is not a threat to groundwater or to the Multnomah Channel. The Port and Pope and Talbot are jointly developing a cleanup plan for that site (*The Chronicle* and *Sentinel Mist*, Oct. 6, 1999). Little is known about the potential surface or groundwater contamination that may have resulted from the landfills or the Bledsoe site.

Watershed Assessment Confidence Evaluation: Moderate due to a professional assessor working with a relatively small amount of water quality monitoring data.

RECOMMENDATIONS

1. Temperature monitoring should be continued and expanded in streams of the watershed to obtain a solid baseline of data and a better understanding of potential problems and needs for restoration.

2. Water column, sediment and tissue sampling should be continued and expanded in Scappoose Bay to gain a better understanding of current conditions, historic and current sources of pollution, and needs for remediation.

3. Data on stormwater and industrial outfalls in the watershed should be entered into the GIS database.

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Figures 9-5 and 9-6 – Photographs

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Figure 9-1 –Water Quality Monitoring Map

Figure 9-2 –Potential Water Quality Contaminant Sources Map

CHAPTER 10. WATER USE AND HYDROLOGY

This chapter summarizes the work required to produce GIS water use and hydrology maps that include the following features:

- Surface and groundwater rights based on available Water Resources GIS data and water master data, if available
- Existing stream flows based on available data collected and referenced to base maps by the community outreach team
- Potential flow-limited streams, referenced to the base map, based on a comparison of surface water rights to existing stream flows or estimated yields, and interviews conducted by the community outreach team with ODFW biologists, the Oregon Department of Water Resources (OWRD) staff, and local residents
- Drinking water sources (surface and ground), as available
- Potential and known flood areas, referenced to the base map, based on FEMA floodplain maps and interviews conducted by the community outreach team with ODFW biologists and local residents
- USCOE and Columbia and Willamette rivers flow data as available

METHODS

Surface and groundwater rights

The OWRD GIS data and databases were used to produce a GIS map that shows the location of all existing surface and ground water rights, the type of water right (agriculture, municipal…) and the amount (cubic feet/second). This necessitated linking three separate databases according to protocol provided by OWRD. A second map was produced that shows in-stream water rights reserved for fish and wildlife by ODFW, irrigated acres, and all surface and groundwater points of diversion.

Existing stream flows

In interviews with the local Water Master for OWRD and other agencies, the community outreach team could not find any data sources on existing stream flows.

Potential flow-limited streams

These streams were not mapped due to insufficient data on existing stream flows.

Drinking water sources (surface and ground)

These water sources are included in the OWRD GIS database as municipal or multiple use and were included on the map of water rights. City dams that serve as surface water impoundments are also mapped as potential barriers on the fish passage map (Chapter 5, Figure 5-6).

Potential and known flooding areas

The 100- and 500-year floodplains were mapped using FEMA GIS data. Interviews conducted by the community outreach team with ODFW biologists and local residents yielded little additional information on flooding. One area identified by local residents was digitized on-screen and saved as line data.

USCOE Columbia and Willamette rivers flow data

This flow data was not available in a GIS accessible format.

RESULTS

The following GIS maps were produced:

1. Water rights - surface and groundwater rights by type of use and amount (Figure 10-1 – Water Rights Map)

2. Water rights - instream rights (ODFW), diversion points and irrigated acres (Figure 10-2 – Water Rights [Instream Use and Diversion Points] Map)

3. Floodplain map showing 100- and 500-year floodplains (Figure 10-3 – Floodplains Map)

The data for water rights is contained in three large data tables that are linked together. These are saved in an electronic version for future reference.

DISCUSSION

A large number of surface water withdrawals occur in the watershed. The City of Scappoose operates three storage dams on Gourlay Creek, Lazy Creek, and South Scappoose Creek as the City's municipal water supply. The City of St. Helens owns an inactive dam on Milton Creek (Salmonberry Reservoir) and currently obtains water from two groundwater wells and a Ranby collector. The Ranby collector consists of drainage pipe located about 20 feet under the bed of the Columbia River that collects groundwater. Numerous smaller water rights for agriculture and domestic uses exist along most of the streams in the watershed. Irrigation water rights and irrigated acres are concentrated in the lowland floodplain (dikelands) and Scappoose prairie. The Scappoose Drainage District maintains a series of water pumps that pump water out of the canals and streams of the dikelands for flood control.

No stream flow data has been collected in the watershed other than some miscellaneous measurements taken in the early 1950s (Willis et al. 1960). In some streams, the total amount of water rights granted is probably larger than the natural summer stream flow. Analysis of water use is complicated by existing water rights that are not being used or are being used only for a small portion of the year. Other water withdrawals may be occurring without water rights.

FEMA floodplain data shows that floodplains cover most of the area east of Highway 30. Much of the historic floodplain is protected by the Multnomah Channel dike, which has shifted the flood frequency from a 100-year to a 500-year floodplain, or 0.2 percent chance of occurring. Historically, the lowland floodplain flooded 12 to 20 feet every year (see Chapter 3, GLO township notes). The 100-year floodplain extends upstream along most of the stream valleys. Floodplains in the lowlands and the stream valleys were probably very productive fish habitat, with numerous side-channels, sloughs and wetlands. In the Scappoose Bay watershed, historical information suggests that most floodplains and their habitats were converted to agricultural uses in the late 1800s and early 1900s. Dams constructed in the Willamette and Columbia Rivers further reduced flooding. Formation of the Scappoose Drainage District in 1922 and construction of drainage ditches, pumping stations, and the Multnomah Channel dikes over the next several years had the largest effect on reducing flood frequency in the lowlands.

Watershed Assessment Confidence Evaluation: Moderate due to professional assessor working with a detailed water rights data base, but an almost complete absence of stream flow data for the watershed. In addition, the reliability of water rights as a depiction of actual use is difficult to determine due to the lack of monitoring of water rights by the OWRD.

RECOMMENDATIONS

Instream flow information is one of the largest data-gaps in the watershed assessment. DEA recommends that the Watershed Council initiate a monitoring program for instream flows in major streams in the watershed in cooperation with OWRD. The project would probably entail installing and monitoring gauging stations.

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Figure 10-1 –Water Rights Map

Figure 10-2 –Water Rights (Instream Use and Diversion Points) Map

Figure 10-3 –Floodplains Map

CHAPTER 11. REFUGIA

INTRODUCTION

Many scientists have argued that functional ecological refugia, especially those perceptible at the scale of tributary watersheds or major valley segments within a river drainage, should be protected as key elements of a salmon restoration program. The term "core area" was used by ODFW in identifying specific areas critically important to the recovery of coho in the original Oregon Plan for Salmon. In a recent report to the Oregon Governor's Natural Resources Office, the Independent Multidisciplinary Science Team (IMST) recommended that ODFW should "complete 'core area' designation for all wild salmonids in Oregon and identify high priority protection/restoration areas that are not covered by current 'core area' designations" (recommendation 17, IMST 1999). The IMST also recommended increasing protection for core areas and adjacent stream reaches up and downstream (recommendations 7 and 18). Refugia represent habitats that presently function to provide a disproportionately large share of salmon production, and they can be critical for persistence of the population during major floods, drought, or other periods of adversity (Frissell 1998). Lands outside mapped refugia are not unimportant, they simply may be used less intensively and their relative conservation value for salmonids is less clear and imminent. The purpose of this chapter is to identify, classify, and prioritize potential refugia for salmonids in the Scappoose Bay watershed.

METHODS

Identification of salmonid refugia should be based primarily on the actual distribution and abundance of each salmonid stock in the watershed (Frissell 1998). In the Scappoose Bay watershed, little information exists on fish abundance, or "hot spots" for fish production at their various life history stages. For this analysis, DEA used salmonid distribution data and habitat data derived from earlier chapters of the watershed analysis to identify and classify potential refugia, using the classification scheme developed by Frissell (1998). The following GIS data layers were compiled onto a USGS topographic base map as the basic tools of analysis:

- Coho salmon distribution
- Riparian vegetation types
- Unstable slopes
- Intact habitat areas
- Potential high priority spawning areas (from Willis et al. 1960)
- Two channel classification types with high spawning and rearing habitat potential: 1) low gradient (less than 4 percent) and 2) moderate gradient (4-16 percent) streams, both types with moderate to high flow and low to moderate confinement and non-estuarine channels.
- Artificial fish passage barriers

In addition, other data layers developed as part of the watershed assessment, such as distribution of other salmonid species (chinook, steelhead, chum, and cutthroat salmon), water rights data, and stream temperature monitoring results, were also considered, but were not included on the working map.

The "intact habitat area" data is a new data layer that was produced specifically for the refugia analysis. Intact habitat areas are defined as areas of approximately 40 acres or larger that either contain forest greater than approximately 30 years old or wetlands that have not been drained or channelized. The map was developed by inspecting 1998 color aerial photographs and drawing the outline of identified intact habitat areas onto the hard copy orthophoto base map. The intact habitat areas were then digitized with a tablet into Auto-CAD and the data converted to GIS ARC/VIEW format.

"Potential high priority salmon habitat" refers to areas mentioned in a field survey report of the watershed by Willis et al. (1960) as important salmon habitat; in particular, spawning grounds. These areas were usually identified during field surveys based on suitable sized spawning gravels, low gradients, and lack of natural fish passage barriers below the reach. The written descriptions from Willis et al. (1960) were transcribed to a hardcopy topographic base map by hand. Although the report is almost thirty years old and contains qualitative descriptions of habitat, it is useful as the only comprehensive field survey of salmon use and habitat that is available for the watershed.

Based on an evaluation of the combined data layers and our accumulated knowledge of the watershed, salmonid refugia were identified and classified consistent with the classification scheme developed by Frissell (1998) (see Table 11-1). A summary of the refugia types used in this assessment is provided below:

- *Key sub-watershed* – This category is a new addition, not described by Frissell (1998). Key sub-watersheds are on a larger scale than focal watersheds and are intended to indicate the one or two major sub-watersheds that currently produce most of the fish and contain the highest diversity of salmonids in the larger watershed.

- *Focal watershed* – These are headwater watersheds that are known to contain salmon species and that contain a high percent of intact habitat areas. Historically, these areas generally did not support the diversity or abundance of salmonid populations that occurred in larger, lower gradient habitats downstream. However, these headwater areas are more resilient to catastrophic events, such as floods, and are expected to maintain remnant populations.

- *Potential focal watershed* – Same habitat considerations as for focal watersheds, but potential salmon access is blocked by a barrier. Comprehensive fish passage barrier surveys conducted in the future may indicate that some areas currently classified as part of focal watersheds or secondary focal watersheds should actually be considered *potential* focal watersheds due to existing barriers.

- *Secondary focal watershed*—This category is another new addition not described by Frissell (1998). Secondary focal watersheds are more degraded than focal watersheds, with a lower percent of intact habitat and generally fair to poor riparian conditions. However, secondary focal watersheds are considered to be disproportionately important for salmonid production in the larger watershed, generally due to their size and location (tributaries to the mainstem), underlying geomorphology, and history of salmon use, which indicates that they are relatively more productive and resilient salmonid habitat than other areas, even under degraded conditions. These watersheds would be a high priority for protection and restoration, although not as high as focal watersheds.

- *Nodal habitat* – An intact patch of stream habitat along the valley floor that is expected to be disproportionately important for salmonid production due to the high quality of the riparian habitat, occurrence of springs, or connection to intact floodplain or wetland.

- *Critical contributing area* – Areas with strong topographic or hydrologic linkages to nodal habitats, such as unstable slopes. These areas are critical for maintaining the integrity of adjacent nodal habitats, but do not themselves contain fish habitat. DEA did not include critical contributing areas because they are best identified in the field at the time that nodal habitats are field-identified.

- *Adjunct habitat* – Degraded reaches adjacent to focal watersheds and nodal habitats. These areas are considered to have been historically important and productive habitats that are most likely to be recolonized after being restored.

Refugia described above are listed in order of priority, from highest to lowest, based on their ecological importance in maintaining and restoring salmon to the watershed. This prioritization is based on the underlying philosophy that the preferred strategy for salmonid restoration is to protect the best habitats and use protected strongholds as the base upon which to restore adjacent habitats. Thus, focal watersheds are the highest priority, followed by secondary focal watersheds, followed by nodal habitats and associated critical contributing areas, and finally by adjunct habitats.

Within each classification, identified refugia areas are further prioritized based on an assessment of their distribution within key watersheds, habitat quality and quantity, extent of fish use, and other ecological factors, as discussed below. In Chapter 15, Protection and Restoration Recommendations, refugia are again prioritized for protection purposes (land acquisition, conservation easement) based on additional considerations, such as public support, cost effectiveness, and other factors.

RESULTS

The following GIS map layers were produced for the watershed:

1. Intact habitat areas map (Figure 11-1 – Intact Habitat Areas Map)

2. Potential salmonid refugia map (Figure 11-2 –Potential Salmonid Refugia Map)

Table 11-1. Categories of Habitat Refugia Described in This Report

Refuge Type	Examples	Salmonid Diversity/Productivity		Biotic Objectives	Restoration Tactics
		Historical	Present		
Key Sub-watershed	Major sub-basin within the watershed	High	High	Maintain and restore integrity	Focus protection and restoration efforts on refugia located within the subwatershed
Focal Watershed	Intact headwater tributary	Moderate to low	High; sustains remnant populations of sensitive taxa	Maintain existing populations and high-quality habitats	Prevent human disturbance of slopes or vegetation and "storm proof" problem roads
Secondary Focal Watershed	More impacted headwater or low elevation tributary	Moderate to high	Moderate	Maintain and restore integrity	Prevent human disturbance of slopes or vegetation and "storm proof" problem roads
Potential Focal Watershed	Low elevation tributary with intact habitat & watershed but fish migration blocked	Moderate to high	None	Allow recolonization	Remove biotic barrier(s) & prevent habitat deterioration
Nodal Habitat Corridor	Forested floodplain reach with spring-fed channels; intact estuarine delta	High	High-critical for migratory and low-elevation or near-coastal taxa	Maintain integrity & existing connections to focal watersheds	Maintain unrestricted channel migration zone, protect floodplain forest, protect critical contributing areas
Critical Contribut-ing Area	Steep or unstable slopes adjacent to nodal habitat & tributaries that feed nodal habitat	None (indirect contribution) since no fish habitat occurs in area	None (indirect contribution)	Protect watershed of nodal habitat	Prevent human disturbance of slopes or vegetation & remove or "storm proof" problem roads
Adjunct Habitat	Degraded reaches downstream of focal watershed(s) or nodal habitat	Moderate to high	Moderate to low; used in some seasons or years but not highly productive	Restore integrity so adjacent populations can colonize effectively	Restore riparian and floodplain processes once headwaters secured

Modified from Frisell (1998)

Table 11-2 provides a prioritized list of each potential refugium area in the watershed and associated descriptive data.

Table 11-2 – Salmon Refugia Classification

Priority	Refugia Identification Code	Refugia Name	Salmon Refugia Classification
1		Scappoose Creek Watershed	Key sub-watershed
2		Milton Creek Watershed	Key sub-watershed
3	18SC,19JA, 20JA,21JA	Scappoose Estuary	Nodal habitat
4	9SC	South Scappoose Creek Headwaters	Focal watershed
5	11SC	Gourlay Creek (South Scappoose Creek)	Potential focal watershed
6	8SC	North Scappoose Creek Headwaters	Secondary focal watershed
7	2MI	Cox Creek (Milton Creek)	Secondary focal watershed
8	10SC	Raymond Creek (South Scappoose Creek)	Secondary focal watershed
9	1MI	Salmon Creek (Milton Creek)	Secondary focal watershed
10	3MI, 4MI, 5MI, 6MI	Milton Creek areas	Nodal habitats
11	14MC,15MC, 16HO,17HO, 22JA, 23JA	Others	Nodal habitats
12	12SC, 13SC	Scappoose Creek	Adjunct areas
13	7MI	Milton Creek	Adjunct areas

DISCUSSION

Very few areas remain in the Scappoose Bay watershed that would appear to qualify as high quality habitat, or refugia, for salmonids. Fish habitats have been extensively degraded by over 150 years of forestry, agricultural, and residential and commercial development activities. Most of the watershed is in private ownership, with valleys extensively used for agriculture and residential and commercial development, and hills used for industrial forestry. Less than two acres of old growth forest remain in the 85,000-acre watershed (BLM 1996). Road density is also high throughout the watershed. Nevertheless, the analysis did identify some outstanding and other less than obvious potential refugia as summarized below.

Key sub-watersheds: Milton Creek and Scappoose Creek

These two streams are the largest in the watershed and historically had the highest diversity and largest populations of salmonids. They provided habitat for all five species of salmonids that occurred in the watershed. Numerous smaller independent tributaries to Scappoose Bay and Multnomah Channel also provided salmonid habitat, but did not have the species diversity or productive potential of Milton Creek and Scappoose Creek. Because most salmonid species still inhabit these two sub-watersheds, they are considered the highest priority areas for focusing protection and restoration activities.

Focal watershed: The headwaters of South Scappoose Creek

This area contains the greatest amount of intact habitat remaining in the entire watershed, representing forested land that has not been recently harvested. Most of this land is owned by Hancock and other private timber companies and is currently being logged or probably will be logged in the near future. The area contains a large percentage of steep and potentially unstable slopes. The area is used by coho, steelhead, and cutthroat trout and appears to provide the best remaining focal watershed refugium in the Scappoose Bay watershed.

Potential focal watershed: Gourlay Creek

The watershed contains a high proportion of intact forest habitat. Fish passage to at least two miles of high quality coho and steelhead habitat is blocked by a water supply dam owned by the City of Scappoose (Willis et al. 1960). Much of the watershed is owned by the City of Scappoose, which is planning to log the area.

Secondary focal watersheds: Raymond Creek, North Scappoose Creek headwaters, Cox Creek, Salmon Creek

Secondary focal watersheds identified include the headwaters of the North Scappoose Creek, a major tributary of South Scappoose Creek (Raymond Creek), and two major tributaries of Milton Creek (Cox and Salmon creeks). These watersheds are more heavily impacted, with little intact forest remaining and some agricultural clearing of riparian zones in the lower reaches. Nevertheless, the streams are probably of disproportionate importance as salmon refugia due to the amount of lower gradient tributary habitat available for coho, steelhead, and cutthroat.

Nodal habitats: Scappoose Estuary, Milton Creek, others

The highest priority refugium identified in the Scappoose Bay watershed is the large area of estuarine channels and wetlands at the south end of Scappoose Bay. This area represents the only remaining large tract of Columbia River floodplain habitat that was not drained, diked, and converted to farmland in the lower watershed. The area contains the mainstem of Scappoose Creek, numerous tidal sloughs and ponds, and extensive beds of wapato plants. The area provides critical habitat for a diversity of fish and wildlife, including long-legged wading birds, migratory waterfowl, and critical rearing habitat for salmonids. Beaver and otter also inhabit the area. The two-mile reach of Scappoose Creek downstream of the junction of North and South Scappoose creeks is known to have been spawning grounds for a chinook population (Willis et al. 1960) and was probably used by chum salmon as well. Most of the area is part of the Malarkey Ranch property. Other nodal habitats also occur on the lowland floodplain, comprising several smaller scattered pieces of remnant wetlands adjacent to Jackson Creek. Nodal habitats of Milton Creek are considered higher priority than those that occur on several independent tributaries to Scappoose Bay because Milton Creek is a key sub-watershed.

Adjunct areas: Milton Creek, Scappoose Creek

Adjunct areas were identified based on proximity to focal watersheds and nodal habitats, and on potential for salmon restoration in the stream reach. The channel classification system (see Chapters 4 and 12) was used as a tool to help identify potentially productive salmon habitats based on gradient, flow, and confinement. Streams classified as having low to moderate gradients, with moderate to high flows, low to moderate confinement, and upstream from the estuarine floodplain were identified on the Salmon Refugia Map (Figure 11-2). These stream reaches mainly occurred in the mainstem valleys of Scappoose and Milton creeks, and have been converted to pastureland and rural residential properties. Historically, these valleys were probably among the most productive salmon habitats in the watershed and important for the greatest diversity of species and life stages of salmonids. These reaches probably were highly connected with adjacent forested floodplains and contained numerous off-channel rearing areas, an abundance of side channels, large wood, deep holding pools, and spawning riffles. Restoring these adjunct areas would allow re-colonization of fish from nearby focal watersheds and nodal habitats.

Watershed Assessment Confidence Evaluation: Moderate due to lack of field verification and comprehensive data on fish populations and habitat conditions in the watershed. However, a professional fish biologist experienced in refugia identification conducted the assessment.

RECOMMENDATIONS

This analysis should be considered an identification of *potential* refugia. Existing data was not sufficient to provide more than a provisional identification and prioritization of refugia. However, in general, DEA considers the findings of this assessment adequate to use as a working foundation for guiding protection and restoration efforts. DEA does recommend field verification of all identified refugia by means of: 1) detailed field reconnaissance to assess habitat conditions in each refugium and specifically identify boundaries and critical contributing areas, and 2) comprehensive survey of salmon distribution and abundance in the watershed by snorkel and spawning surveys for juvenile and adult salmon.

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Figures 11-3 and 11-4 – Photographs

Figures 11-5 and 11-6 – Photographs

Figure 11-1 – Intact Habitat Areas Map

Figure 11-2 – Potential Salmonid Refugia Map

CHAPTER 12. WATERSHED CONDITION

INTRODUCTION

This chapter determines habitat limiting factors for major life history stages of each salmonid species. The evaluation is based on a comparison of historic and current conditions in major stream habitat types that occur in the watershed.

METHODS

Summary of watershed conditions

In this section, DEA summarizes habitat conditions by first classifying stream habitat into four major types based on geomorphic channel types and potential fish use characteristics as described in the Oregon Watershed Assessment Manual (WPN 1999). Channel classifications developed in Chapter 3 are condensed to stream types based on fish habitat considerations. Historic and current habitat conditions for each stream habitat type are discussed; then the general habitat changes are related to the potential loss of fish use for each species and each life stage. Watershed conditions are also summarized by providing answers to critical questions listed in the Oregon Aquatic Habitat: Restoration and Enhancement Guide (Oregon Plan Team 1999). (See Appendix D.)

RESULTS

1. The four major stream habitat types that occur in the Scappoose Bay Watershed and their defining channel characteristics are presented in Table 12-1.

2. The location of the major stream habitat types is presented in Figure 12-1 – Stream Habitat Type Map.

3. An assessment of the change in habitat parameters for each stream habitat type is presented in Table 12-2.

4. Change in potential fish habitat for major life history stages of each salmonid species is presented in Table 12-3.

Table 12-1. Four Major Stream Habitat Types in the Scappoose Bay Watershed and Their Channel Characteristics

Stream Habitat Type	Gradient	Flow	Confinement	Lowland Floodplain
Minor tributary	Low-high	Low	Unconfined-confined	No
Confined tributary/ mainstem	Low-moderate	Moderate-high	Confined	No
Valley floodplain	Low	Moderate-high	Unconfined-moderately confined	No
Estuarine	Low	Low-high	Unconfined- moderately confined	Yes

Table 12-2 – An Assessment of the Amount of Change from Historic to Existing Conditions for Selected Habitat Parameters for Each Stream Habitat Type in the Scappoose Bay Watershed

Habitat Parameter	Stream Habitat Types			
	Minor Tributary	Confined Tributary/Mainstem	Valley Floodplain	Estuarine
Fish passage barriers	Moderate	High	Moderate	High
Channel modifications	Low	Low	Moderate	High
Large woody debris	High	High	High	High
Sediment	Low	Moderate	High	Moderate
Riparian conditions	High	High	High	Moderate
Floodplain/wetland	Low	Low	High	High
Water temperature	Low	Moderate	Moderate	High
Dissolved oxygen	Low	Low	Low	High
Peak flow	Low	Moderate	High	High
Low flow	Low	Moderate	High	High

Darker shaded ratings indicate a greater change from historic to current conditions and potential limiting habitats

Table 12-3 – An Assessment of the Change in Relative Habitat Productivity from Historic to Existing Conditions (Historic Productivity/Current Productivity) for Each Species' Life History Stages and for Each Stream Type

Species	Life Stage	Stream Habitat Types			
		Minor Tributary	Confined Trib/Mainstem	Valley Floodplain	Estuarine
Coho	Spawn	Mod/low	Mod/low	High/low	Mod/low
	Summer rear	Low/low	Mod/low	High/low	Mod/low
	Winter rear	Mod/low	Mod/low	High/low	Mod/low
Steelhead	Spawn	Mod/low	Mod/low	High/low	Low/low
	Summer rear	Low/low	Mod/low	High/low	Low/low
	Winter rear	Mod/low	Mod/low	High/low	Low/low
Chinook	Spawn	None/none	Mod/low	High/low	High/low
	Summer rear	None/none	Mod/low	High/low	High/low
	Winter rear	None/none	Mod/low	High/low	High/low
Chum	Spawn	None/none	Mod/low	High/low	High/low
	Summer rear	None/none	Mod/low	High/low	High/low
	Winter rear	None/none	Mod/low	High/low	High/low
Cutthroat	Spawn	Mod/low	Mod/low	High/low	High/low
	Summer rear	Mod/low	Mod/low	High/low	High/low
	Winter rear	Mod/low	Mod/low	High/low	High/low

Darker shaded ratings indicate a greater change from historic to current conditions and potential limiting habitats

DISCUSSION

Although relatively small in size, the Scappoose Bay watershed historically supported five salmonid species found in the Pacific Northwest and contained a broad diversity of habitats, from small, steep mountain streams to extended low-gradient stream valleys to the lowland floodplain of the Columbia River estuary. Over the past 150 years, the watershed has been impacted by the full range of uses—agriculture, forestry, and residential and industrial development. The dramatic decline in all species of salmonids in the watershed is not a simple result of one or several habitat factors at work, but the complex interplay of numerous sources of degradation that have affected specific habitats used at particular times in the fishes' life histories. Added to this complexity is the role of introduced hatchery fish and fishery management policies in further impacting the viability of salmon populations in Scappoose Bay. Impacts to salmon stocks caused by loss of habitat, hatchery introductions, and harvest were probably further compounded by a shift to poor ocean conditions along the Oregon and Washington coasts that dramatically affected marine survival throughout the 1980s.

To address habitat factors for decline, streams in the watershed were grouped into four stream habitat types based on their channel types, location in the watershed, geomorphology, and historic fish habitat characteristics (Table 12-1). Stream habitat types vary in their sensitivity to disturbance and were also subjected to different land management practices. Table 12-2 summarizes the degree of disturbance as gauged by selected habitat parameters for each stream habitat type. Stream habitat types also vary in the types and amounts of fish habitats used by certain species at various stages in their life history. Based on a consideration of Table 12-2, the relative loss of specific habitats for each stream habitat type can be assessed using best professional judgement (Table 12-3). The following provides a brief discussion of each stream habitat type, its historic value as fish habitat, dominant impacts, and loss of habitat.

Tributaries

Most of the streams in this classification are small headwater tributaries in the hills that probably provided little salmon habitat due to low summer flows and high gradients. However, cutthroat trout probably occupied most of the streams with perennial flow. Major impacts are the loss of LWD and forested riparian zones due to forestry activities and the subsequent delivery of fine sediment to downstream areas. Many of these streams have culverts that block fish passage. A low to moderate amount of cutthroat, coho, and steelhead spawning and rearing habitats has probably been lost in these areas.

Confined larger tributaries/ mainstem streams

Most of the streams in this classification are larger tributaries or mainstem reaches that are confined within ravines and of low or moderate gradient. In many cases, these are tributary reaches immediately downstream of headwater tributaries. Steelhead, coho, and cutthroat use these areas for spawning and rearing, but the lack of floodplain development probably limited potential habitat, especially for over-wintering by coho. Chinook probably spawned in some of the larger mainstem reaches. These types of channels are generally considered "transport" reaches and are moderately sensitive to changes in wood, water, and sediment supply. Major impacts are the loss of LWD caused by historic log drives and splash damming along the mainstem streams, loss of forested riparian zones, and water withdrawals. A moderate amount of cutthroat, coho, and steelhead spawning and rearing habitats has probably been lost.

Valley floodplain streams

Most of the streams in this classification are larger tributaries or mainstem reaches of low gradient that are in broader valleys. Historically, these areas probably had extensive forested floodplains, with beaver ponds, complex channels and deep pools and channels rich in large wood. Lower in the watershed, the main streams ran through the Scappoose prairie, although large wood and active floodplains were still important components. Typically, these low gradient, larger streams provided the bulk of salmon habitat in the watershed for coho, steelhead, chum, cutthroat, and chinook. These types of channels are generally considered "depositional" reaches where sediment is deposited due to the low gradient of the stream channels. They are highly sensitive to changes in wood, water, and sediment supply (WPN 1999). The major impacts to these areas were the disconnection of the stream from its floodplain through early logging, log drives, LWD jam clean-outs, and clearing of valleys for agricultural uses. However, a surprisingly small number of these streams have been channelized, and most retain their basic meandering form. Additional impacts include water diversions, loss of coniferous riparian zones and large wood, increased peak flows that destabilized channels and caused bed scour and bank erosion, and increased sediment that filled pools and clogged spawning gravels. A large amount of habitat for sea-run cutthroat, coho, steelhead chum, and chinook has probably been lost in these areas.

Estuarine channels

All of the streams in this classification are within the lowland floodplain of the watershed. These streams are located less than 20 feet above sea level and historically were heavily influenced by the annual flooding of the Columbia River. The streams include large mainstem streams and small estuarine channels. Historically, these lowland floodplain channels were sinuous, with very low gradients and mud substrates. Riparian zones were dominated by shrubs, hardwood trees, and grasslands. Historically, these areas probably provided very productive rearing habitats for adult and juvenile sea-run cutthroat, and outmigrating coho, chinook and chum salmon. Chinook and chum salmon spawned in the lower reaches of the larger streams. Chinook and chum typically migrate to estuaries several weeks or several months after hatching, respectively, and lowland floodplains were probably most critical for rearing and habitat for these species. In addition, Scappoose Bay and the lower system reaches were probably critical as holding areas for returning adult salmon awaiting high flows. Typically, these channels are considered "depositional" reaches. However, historically, channel processes were dominated by the annual flooding from the Columbia River. Major impacts included conversion of most of the lowland floodplain from wetlands to agricultural fields. Major drainage projects, including the Multnomah slough dike, channelization, and diversion and pumping of Jackson Creek, greatly reduced fish habitats.

Watershed Assessment Confidence Evaluation: Moderate due to a professional assessor working with a lack of recent or historical field data on fish distribution, abundance and habitat conditions. The assessment is general and based on best professional judgement by necessity and is believed to provide a moderately robust interpretation of habitat changes.

RECOMMENDATIONS

The above interpretation of habitat conditions and losses in each habitat type provides a theoretical framework to address habitat protection and restoration in the watershed. However, more fish and habitat data is needed to confirm how the fish are using various habitats at each stage in their life cycle.

Figures 12-2 and 12-3 – Photographs

Figures 12-4 and 12-5 – Photographs

Figure 12-1 – Stream Habitat Type Map

CHAPTER 13. DATA GAPS

INTRODUCTION

This chapter identifies and prioritizes data gaps that were encountered in each step in the assessment and provides recommendations for how to obtain the missing information.

METHODS

Data gaps include a wide range of information that was not available while conducting this Phase I assessment and that is important in identifying the most effective protection and restoration opportunities. Data gaps were initially identified in each section of the assessment in the recommendations sections. In this chapter, all major data gaps are summarized.

The priority of each data gap was determined by evaluating the data gap in terms of the following question: How essential is it for the Watershed Council to obtain this information in order to conduct the most effective actions to restore salmon in the watershed? Rationale for each data gap priority ranking is given in the discussion.

Data gaps can be considered opportunities for further research. In the discussion of each data gap, the recommended approach and methods needed to gain the necessary information is summarized.

RESULTS

The following is a list of major data gaps, in order of priority, for the watershed:

1. Comprehensive data on juvenile and adult salmonid distribution and abundance
2. Comprehensive data on fish passage barriers
3. In-stream flow and water use monitoring data
4. Comprehensive aquatic habitat survey data
5. Comprehensive road condition survey for surface erosion and mass wasting
6. Unstable slope hazard assessment
7. Feasibility of Jackson Creek diversion
8. Field assessment of mining areas for sediment risk
9. Digital ownership map
10. High resolution digital aerial photographs
11. GIS data for City of Scappoose Local Wetland Inventory, zoning, and other data
12. GIS data for City of St. Helens road, zoning, wetland, and other data
13. Refugia field verification
14. Stream temperature monitoring
15. Scappoose Bay toxic contamination monitoring
16. ONHP historic vegetation type maps

DISCUSSION

Each major data gap, rationale for prioritization, and recommended approach for further study is discussed below.

1. Comprehensive data on juvenile and adult salmonid distribution and abundance

Existing salmonid information includes only distribution data, not abundance data, and is not based on recent field surveys. Comprehensive data on distribution and abundance of each species is needed to prioritize potential protection and restoration projects and for long-term monitoring purposes. Spawning surveys for adult fish and snorkel surveys for juvenile fish in the Scappoose Bay watershed are recommended. Fish surveys should be conducted together with habitat surveys to maximize the value of the data for analysis and restoration purposes.

2. Comprehensive data on fish passage barriers

Many potential barriers have been identified, but given the high cost of correction of a single barrier, more information is needed on each barrier to prioritize them for correction. A survey of all potential fish passage barriers in the watershed is recommended. The survey should identify all human-caused fish passage barriers, identify the type of barrier, provide preliminary designs and cost estimates for correction of each barrier, determine the amount of potential upstream habitat available, and prioritize them for correction.

3. In-stream flow and water use monitoring data

There has been virtually no monitoring of flow in the streams of the Scappoose Bay watershed. Water rights records and other information in the assessment suggest that both decreased summer stream flows and increased magnitude and frequency of peak flows may be major impacts to salmon in the watershed. DEA recommends establishing and monitoring stream gauges throughout the watershed to measure summer low and winter peak flows. A detailed analysis of water use and flow should then be conducted.

4. Comprehensive aquatic habitat survey

Physical habitat surveys have been conducted by ODFW for only a small percentage of stream reaches in the watershed. DEA recommends that the survey effort be expanded to include all potential fish habitat in the watershed. Although not directly useful for planning restoration projects, it is critical as a baseline for habitat data.

5. Road survey for surface erosion and mass wasting

Roads are known to be a major source of sediment that can impact salmon habitat and this watershed has a high road density. However, no information is available that identifies roads with surface erosion and mass wasting hazards that need correction. A road condition survey, using the Global Positioning System and GIS, is recommended. Under the Oregon Plan, timber companies agreed to conduct such surveys, so this is not recommended as a high priority for the Watershed Council.

6. Unstable slope hazard assessment

A significant percentage of the watershed was identified as containing slopes with moderate and high potential for mass wasting. By conducting a landslide inventory and correlating landslides with slopes, soils, and types of activity, a more detailed map could be developed that would provide a useful tool for planning forestry and development projects to avoid unstable slopes.

7. Feasibility of Jackson Creek diversion

The diversion dam that diverts the entire flow of Jackson Creek into Joy Creek cuts off the lower five miles of Jackson Creek and possibly prevents fish access into the Jackson Creek and Joy Creek systems. DEA recommends conducting a more in-depth feasibility study to determine restoration alternatives, including fish passage improvements at the Joy Creek tidegate and Jackson Creek diversion and augmenting flow to Jackson Creek.

8. Field assessment of mining sites for sediment risk

All surface mining sites should be assessed in the field to see if they present a risk of fine sediment delivery to streams in the watershed.

9. Digital ownership map

The only accurate ownership map available is a hardcopy of the Forest Grove Fire Protection Map available from ODF. Although the map is in Auto-Cad digital form, it is a rough draft and it was not possible to transfer information into GIS format. Road layers were transferred, but found to be missing major areas. DEA highly recommends that the Watershed Council urge ODF to complete the map for use in GIS. Because most of the watershed is owned by relatively few large commercial forest landowners, a GIS ownership map will be important for planning projects such as the fish passage survey.

10. High resolution digital aerial photographs

The digital orthophotos used in the assessment did not provide the high resolution needed to identify riparian condition or intact habitat areas. For these tasks it was necessary to piece together hard copies of aerial photos and transfer information to the orthophotos and GIS, a time consuming and inexact process. Digital aerial photographs that are ortho-rectified, and associated planimetric features, would be an excellent tool for further watershed analysis and project level planning. In particular, the planimetric features, which include streams and roads, would provide a more complete and accurate depiction of these features than is currently available.

11. City of Scappoose Local Wetland Inventory, zoning, and other data.

The City of Scappoose data is only available in hard copy and should be converted to GIS format. Because the wetland inventory covers only a small portion of the watershed, it is a fairly low priority.

12. City of St. Helens road, zoning, wetland and other GIS data

The City of St. Helens data is not ortho-rectified, making it of limited utility. The data should be ortho-rectified for use as GIS layers. Because the inventory covers only a small portion of the watershed, it is a fairly low priority.

13. Refugia field verification

DEA recommends field verification of all identified refugia by means of detailed field reconnaissance to assess habitat conditions in the area and specifically identify boundaries of the refugia and critical contributing areas. If funding permits, a more detailed level of assessment should be conducted by evaluating refugia in terms of comprehensive field information on salmon distribution and abundance and habitat conditions in the watershed (see #1 and #4, above).

14. Stream temperature monitoring

Temperature monitoring should be continued and expanded in streams of the watershed to obtain a solid baseline of data and a better understanding of potential problem areas and restoration needs.

15. Scappoose Bay toxic contamination monitoring

Water column, sediment, and tissue sampling should be continued and expanded in Scappoose Bay to gain a better understanding of current conditions, historic and current sources of pollution, and remediation needs. Because the high contamination levels sampled in past years are believed to be from historic sources, this data gap is not considered a high priority.

16. ONHP historic vegetation type maps

DEA recommends that the Watershed Council obtain the historical vegetation types map (based on GLO surveys) from the ONHP when available in about spring of 2000.

This watershed analysis is a Phase I assessment that identifies major protection and restoration opportunities and points out areas most in need of further study. In general, it does not provide the detailed field reconnaissance and comprehensive field studies that are necessary for identifying and prioritizing specific protection and restoration projects. In a sense, this section of the assessment is laying the groundwork for the second phase of assessment that bridges the gap between major areas identified for action and specific project-level planning.

Watershed Assessment Confidence Evaluation: High due to a professional assessor who has a strong understanding of the available data and additional studies needed to conduct effective restoration projects.

RECOMMENDATIONS

DEA recommends that the Watershed Council apply for grants to address high priority data gaps as soon as possible. Because the grant for a comprehensive fish passage survey (number 2 priority), submitted to the Oregon Watershed Enhancement Board (OWEB) Watershed Council, was officially approved as of December 1999, DEA recommends that the Watershed Council also apply for funding for a comprehensive survey of salmon distribution and abundance (number 1 priority), and stream flow and water use monitoring (number 3 priority), and a comprehensive aquatic habitat survey (number 4 priority).

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CHAPTER 14. SIGNIFICANT LEGAL AND PUBLIC ISSUES

INTRODUCTION

Numerous human activities, including forestry, agriculture, mining, urbanization, industrial developments, and recreational and commercial fishing, have the potential to impact such public resources as salmon and water quality. Most of these activities are regulated in some manner by federal, state, and/or local governments. Watershed councils do not have regulatory authority and generally seek to protect and restore salmon habitat through non-regulatory approaches with willing landowners. However, an understanding of government policies and their effectiveness in protecting and restoring watershed conditions is essential if the Watershed Council is to work effectively in the Scappoose Bay watershed. The purpose of this chapter is to summarize major policy issues at federal, state, and local levels that affect preservation and restoration of fish habitat in the watershed.

METHODS

Land use regulations were evaluated in terms of their effectiveness in preventing a range of impacts to salmon habitat. For the analysis, land use activities were classified into five major types – forestry, agriculture, surface mining, residential/commercial development, and industrial development. Policies and regulations pertinent to each land use are listed and summarized. The effectiveness of these policies and regulations is then evaluated based on published critiques, general research, and the best professional judgement of the assessment team. An evaluation of policy issues related to commercial and recreational fishing is beyond the scope of this analysis.

RESULTS

Table 14-1 lists major policies and regulations pertinent to each land use type.

Table 14-2 rates the effectiveness of the combined regulations that cover each land use in protecting and restoring specific fish habitat parameters. Two ratings are given for each parameter and land use – one for new and proposed actions and the second for historic or on-going actions. For example, road culverts are now carefully regulated to ensure fish passage, but the restoration of fish passage at culverts installed in the past is not required under existing regulations.

Table 14-1 – Regulatory Agencies and Policies That Attempt to Protect Fish Habitat Under Various Land Uses

Regulatory Agency	Policy/Regulation	Forestry	Agriculture	Surface Mining	Residential/Comm. Development	Industrial Development
City of Scappoose	Comp. Plan, other			X	X	X
City of St. Helens	Comp. Plan, other			X	X	X
Columbia County	Comp. Plan, other			X	X	X
Oregon Department of Forestry	Forest Practices Act	X		X		
Oregon Division of State Lands	Removal/fill permit	X	X	X	X	X
Oregon Water Resources Department	Water rights permit		X		X	X
Oregon Department of Environmental Quality	NPDES, other		X	X	X	X
Oregon Department of Geology and Mineral Industries	Surface Mine Reclamation			X		
U.S. Army Corps of Engineers	Clean Water Act		X	X	X	X
National Marine Fisheries Service	Endangered Species Act	X	X	X	X	X

Table 14-2. Evaluation of Habitat Parameters Protected (Yes) or Not Adequately Protected (No) under Existing Regulations for Each Land Use

1st Yes or No = protected (or not) for new land uses
2nd Yes or No = protected or restored (or not)for historic or on-going land uses

Habitat Parameter	Forestry	Agriculture	Surface Mining	Residential/Comm. Development	Industrial Development
Fish passage barriers	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Channel modifications	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Large woody debris	No/No	No/No	No/No	No/No	No/No
Sediment	No/No	No/No	No/No	No/No	No/No
Riparian conditions	No/No	No/No	No/No	No/No	No/No
Floodplain/ wetland	No/No	No/No	No/No	No/No	No/No
Water temperature	No/No	No/No	No/No	No/No	No/No
Dissolved oxygen	No/No	No/No	No/No	No/No	No/No
Contaminants	NA	No/No	No/No	No/No	No/No
Peak flow	No/No	No/No	No/No	No/No	No/No
Low flow	NA	No/No	No/No	No/No	No/No

DISCUSSION/CONCLUSIONS

The effectiveness of policies and regulations pertinent to each land use is discussed below.

Forestry

Private commercial forest land covers most of the hills in the Scappoose Bay watershed, while BLM owns about five percent of the forest land in the watershed (see Figure 14-1 – BLM Ownership Map). Timber harvest of private lands is regulated primarily by the Oregon Forest Practices Act. Activities in streams, such as construction of road crossings, is also regulated by DSL with input from ODFW. BLM lands are managed under the federal Northwest Forest Plan (US Forest Service [USFS] and BLM 1994).

An independent scientific team does not consider the Forest Practice Rules for private lands adequate to protect and restore salmonid habitat. In a recent report to the Governor's Natural Resources Office, the Independent Multidisciplinary Science Team concluded that the current rules for riparian protection, large wood management, sedimentation, and fish passage are not adequate to preserve depressed stocks of wild salmonids (IMST 1999). For example, agencies are not requiring removal of road culverts that may block fish passage. In addition, Forest

Practice Rules do not protect watershed hydrology. For example, a dense network of logging roads can increase the magnitude and frequency of peak flows that cause flooding (Beschta et al. 1987). However, Forest Practice Rules do not address road density.

Under the Northwest Forest Plan, BLM is required to meet Aquatic Conservation Strategy objectives, such as maintaining and restoring habitat for native fish species on the landscape level (5^{th} field watershed size). The objectives include standard buffer width requirements for riparian reserves (USFS and BLM 1994). The objectives are based on best available science as analyzed by top federal scientists and are generally considered adequate to protect salmonid habitat on federal lands (Federal Ecosystem Management Team [FEMAT 1993]). For example, the riparian buffer width on each side of a fish-bearing stream is 300 feet or greater, depending on slope, stability, floodplain conditions, and site potential tree height. In addition, prior to conducting timber harvest, BLM is required to carefully evaluate effects on fish habitat by conducting watershed assessments and additional project-specific environmental reviews. Under the Northwest Forest Plan, BLM has also designated some parcels in the Scappoose Bay watershed as connecting corridors and late-successional reserves (Figure 14-1 – BLM Ownership Map).

Agriculture

Agricultural activities that could impact fish habitat include a diverse range of activities, such as surface and groundwater withdrawals for irrigation, farm or grazing use of riparian zones and wetlands, or non-point pollution, such as manure-contaminated runoff from livestock operations. Water rights are regulated by the OWRD. Potential water quality impacts are regulated by DEQ in coordination with directives of the federal Clean Water Act, administered by EPA and Oregon Department of Agriculture (ODA). The local Soil and Water Conservation District works with willing landowners to develop voluntary farm plans that address water quality and habitat protection. DSL regulates most wetland and stream activities under the removal/fill permit program.

OWRD does not have the funding to monitor water rights or measure stream flows in the Scappoose Bay watershed. ODFW has reserved in-stream water rights for benefit of fish habitat, but it is unknown whether the reserved in-stream flows are being met. The watershed is also not closed to further surface water withdrawals. Given the large number of agricultural water rights, lack of monitoring, and sensitivity of streams to withdrawals during the low flow season, it is likely that regulation of this use is inadequate to protect fish habitat.

The Oregon State legislature has given ODA authority to develop agricultural area water quality management plans. Once the plans are completed, ODA can take enforcement action. A plan has not yet been completed for the area that covers the Scappoose Bay watershed.

DEQ does not have the funding to conduct monitoring or enforcement to address non-point agricultural pollution in the watershed. The situation is made more difficult because there are no regulations to protect riparian buffers from agricultural uses, such as livestock grazing or farming. Regulations to protect riparian zones and prevent water quality impacts do not apply to agricultural lands. DEQ generally has to have overwhelming evidence of a water quality violation before taking enforcement action. Water quality complaints are usually referred to the Soil and Water Conservation District which attempts to implement a voluntary farm plan with the landowner to address issues. Non-cooperation from the landowner can result in referral back to DEQ. The inadequacy of the current system to address protection of fish habitat and water quality is well known and is probably the largest on-going hole in the regulatory net.

Surface mining

Surface mining is a major industry in the watershed. Large sand and gravel mines occur in the lowland floodplain of the watershed. Quarries that mine basalt rock occur in the upper watershed. Quarries can pollute surface water runoff with very fine sediment and machinery oils. Surface water runoff from sand and gravel mines is contained within the pit, but can pose a threat to nearby streams when structures used to contain the runoff are breached by flood events, such as occurred on the mainstem of Scappoose Creek in 1996. However, both types of mines can directly impact riparian zones, floodplains, and other wetlands.

Surface mining is regulated state-wide by the Mined Land Reclamation Division of the Oregon Department of Geology and Mineral Industries (DOGAMI). For the past two years, DOGAMI has also administered DEQ's requirements that all mines have NPDES stormwater permits. However, most of the watershed occurs within Columbia County; the only county in Oregon where surface mining within county boundaries is not regulated by DOGAMI, but by the County itself. Columbia County's Surface Mining Ordinance (90-11) is very similar to DOGAMI regulations. The County's ordinance states that mining operations must meet all applicable state and federal laws and has some general provisions regarding protection of stream channels and water quality. However, the County does not enforce water quality regulations, but relies upon state agencies. In Columbia County, DEQ retains responsibility for administering the NPDES stormwater permit program and for taking enforcement action for water quality violations. DSL has regulatory authority for mining if it occurs within the bed or banks (below ordinary high water) of a stream or wetland.

Mines that were operating before 1972 are "grandfathered" and are not regulated under DOGAMI or County permits. No reclamation plans are required for these mines. However, expansion of these mines into new areas after 1972 is regulated. All mines, whether operating before or after 1972, must meet an approved NPDES stormwater permit. Surface mines that are used for forest management purposes (such as building logging roads) and that mine less than 5000 cubic yards are regulated under the Oregon Forest Practices Act. The current regulatory system for surface mining is generally inadequate to protect water quality for numerous reasons. First, stormwater regulations under NPDES require the operator to propose a "Stormwater Pollution Control Plan," but do not require specific mitigation measures to be used that have been proven effective elsewhere. Second, mine operators are required to submit monthly water quality self-inspection reports to DEQ (in Columbia County) or DOGAMI, a system that lends itself to poor reporting. In fact, according to sources at DOGAMI and the County, in recent years a significant number of mines have been operating without stormwater permits, and even many of those with permits have not been regularly reporting their testing results. Finally, DEQ has failed to conduct regular field monitoring at mines and failed to conduct enforcement action when needed to correct obvious water quality problems that have occurred.

Streams, wetlands, floodplains, and riparian areas are protected from new mining activity by Goal Five regulations adopted by the counties and by recommendations from other agencies. Columbia County is in the process of adopting stream protection rules under Oregon's Safe Harbor provisions. These rules require 50-foot buffers along each side of most streams, with a 75-foot wide buffer along major rivers (Columbia River, Multnomah Slough, and part of the Nehalem River). These riparian buffer widths would apply to most proposed development and new mining projects or mine expansions. These buffer widths are generally inadequate to maintain riparian functions for fish and wildlife habitat, according to the best available science (Knutsen and Naef 1997). Protection requirements can be expanded by Columbia County or DOGAMI based on comments on the proposed mining permit received from DSL, DEQ, ODFW, and NMFS. The regulatory system has improved protection of wetland and stream habitats from historic conditions, although protection standards remain inadequate. Also, because the regulatory system does not require reclamation of sites mined prior to 1972, restoration of habitats impacted by past mining is not required.

Residential and commercial development

Residential and commercial development with potential to impact fish habitat includes clearing or building in riparian zones, streams, floodplains, and wetlands, as well as the effects of increased impervious surface in increasing the magnitude and frequency of peak flows. Potential impacts also include fish passage barriers at road crossings, water withdrawals, and non-point pollution from urban run-off. The density and location of development and development standards are regulated by the cities of St. Helens and Scappoose, Columbia County, and the Oregon Land Conservation and Development Commission (LCDC). Specific development projects trigger review by these same local jurisdictions, and in some cases, other state and federal agencies.

The location and density of development is the major regulatory tool that can regulate the amount of impervious surface area in a watershed. Scientists have found that when impervious surfaces exceed about ten percent of the watershed area, irreversible degradation of stream channel habitat occurs (Booth and Jackson 1994). Recent research indicates that small increases in impervious surfaces above natural levels can initiate habitat degradation (May et al. 1997). Local jurisdictions have not adequately addressed this issue in their zoning and planning efforts. Fortunately, existing urban centers in the Scappoose Bay watershed are located at the lower ends of the major stream systems, reducing the potential effects of impervious surfaces on fish habitat. Development has, however, encroached on the floodplains of the Milton and Scappoose Creeks.

Water quality impacts of new development are regulated through the stormwater management standards of local jurisdictions. Research on the effectiveness of stormwater management measures (detention ponds, filtration swales) is limited, but suggests that they are only partially successful in protecting water quality. Most existing residential and commercial development and streets do not have any stormwater treatment facilities. For example, the City of Scappoose has 211 storm drains along the street system, of which 134 flow directly into Scappoose Creek. There is no regulatory requirement for treatment of existing stormwater problems.

Under Goal 5 of the Oregon Statewide Planning Goals, local jurisdictions are required to identify and protect critical natural resources and habitats. Both cities in the watershed have conducted local wetland inventories and the City of St. Helens is initiating a riparian habitat inventory of streams within its urban growth boundary. ODFW recommends riparian buffer widths along fish-bearing streams of 100 feet (each side). Washington Department of Fish and Wildlife conducted an extensive scientific literature review and recommends 200-foot wide buffers to adequately protect riparian functions (Knutson and Naef 1997). The National Marine Fisheries Service (NMFS) convinced several local jurisdictions to adopt, at a minimum, a 50-foot riparian buffer width. Wetland and stream impacts are regulated by DSL, which has designated certain streams in the Scappoose Bay watershed and across the state as "essential fish habitat." Virtually any fill or other disturbance within the ordinary high water of streams so designated is regulated by DSL under the removal/fill permit program. Removal/fill permits are reviewed by USCOE and other agencies under Section 404 of the federal Clean Water Act. Variances, flexibility and lack of enforcement under local and state regulations have generally reduced the effectiveness of these regulatory actions to protect fish habitat. In addition, "essential fish habitat" mapped by DSL includes only a fraction of the significant salmon habitat in the Scappoose Bay watershed.

Any federal permitting action or federally funded project that has the potential to affect a fish species listed under the federal ESA must undergo environmental review by NMFS. For projects with any in-stream work, or riparian impacts, such as a federally funded road crossing of a stream, NMFS would probably require a biological assessment to evaluate potential effects. NMFS has the regulatory authority to deny proposed projects or require substantial mitigation to protect listed species. In addition, NMFS has the regulatory authority to conduct enforcement actions against any non-permitted degradation of salmon habitat that could be considered a "taking" under the federal ESA. The term "take" is statutorily defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct" (ESA Section 3(19) (US Fish and Wildlife Service [USFWS] and NMFS 1998). Harm is further defined as an act that kills or injures a listed species. On November 8, 1999, NMFS issued its final rule defining the term "harm" (64 CFR 60.727 [1999]). (Italics in the paragraph below show additional wording in the NMFS definition as compared to the FWS definition.)

> Harm in the definition of 'take' in the Act means an act which actually kills or injures *fish or* wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures *fish or* wildlife by significantly impairing essential behavioral patterns, including breeding, *spawning, rearing, migrating,* feeding or sheltering.

The effectiveness of NMFS in protecting federally listed fish species and their habitat has yet to be determined.

Industrial development

Industrial development has similar potential impacts on fish habitat as residential and commercial developments, as well as the potential for unique water pollution impacts from point sources, such as pulp mill discharges. Point source pollution is regulated by DEQ under the NPDES. In the Scappoose Bay watershed, at least seven NPDES waste discharge permits have been issued, including permits for Boise Cascade's veneer plant and Kraft pulp mill (joint permit with City of St. Helens sewage treatment). Although Scappoose Bay water quality is known to be much better than it was in the 1950s when fish kills were reported, little monitoring in the Bay has been done by DEQ to determine the effectiveness of the current regulations in protecting water quality. The federal Clean Water Act regulations and programs, such as NPDES, have been fairly effective in eliminating point source pollution problems; if not through agency action, then through citizen action suits against the agency.

Summary

In summary, fish habitat in the Scappoose Bay watershed continues to be poorly protected under most current government policies and regulations. The severely depleted status of all salmonid stocks in the watershed is at least partially a result of decades of intensive habitat degradation with inadequate protective regulations and poor implementation of those regulations. Although beyond the scope of this analysis, over-fishing of mixed stock fisheries managed for hatchery production and poor ocean conditions have also been linked to the drastic decline in salmonid populations, especially salmon stocks of the lower Columbia River. The listing or proposed listing of four of five species in the watershed as federally threatened species does not appear to be making noticeable on-the-ground changes in recent habitat protection and restoration practices.

Watershed Assessment Confidence Evaluation: Moderate-high due to a professional fish biologist conducting the assessment who has extensive experience with land use policies and regulations and understanding of the best available science regarding impacts of various land uses on fish habitat.

RECOMMENDATIONS

DEA recommends that the Watershed Council stay informed about proposed changes in habitat protection and restoration regulations. The role of the Watershed Council in advocating positions or actions on politically charged issues or new regulations should be decided issue by issue. However, DEA suggests that the main role for the Watershed Council is to continue to take the non-confrontational approach to habitat protection and restoration and continue to work with willing landowners and communities to foster a cooperative approach to salmon habitat protection and restoration. The Watershed Council can also be a scientific and technical resource for citizens and local governments.

Figures 14-2 and 14-3 – Photographs

Figures 14-4 and 14-5 – Photographs

Figure 14-1 – BLM Ownership Map

CHAPTER 15. PRIORITIZED PRESERVATION AND RESTORATION OPPORTUNITIES

INTRODUCTION

For the purposes of developing priorities for restoration in the watershed, DEA recommends the general approach advocated in the Oregon Aquatic Habitat Restoration and Enhancement Guide (Oregon Plan Team 1999) as modified to encompass the refugia assessment:

- Protection projects are a higher priority than restoration projects. Protecting habitat is generally much more cost-effective and successful than trying to restore it after it is degraded. Salmon refugia areas, especially high priority focal watersheds and nodal habitats, are the most important areas in which to focus protection efforts.

- Salmon refugia areas should also be the focus for restoration efforts. Restoration is more critical in refugia areas that are strongholds for salmon production in the basin. For example, a higher priority would be placed on removing an unstable road that threatens habitat in a focal watershed than in a highly degraded watershed. Restoration projects should focus on identified high priority focal watershed and nodal salmon refugia areas and then expand to adjunct habitats.

- Finally, DEA recommends that initially the Watershed Council conduct projects with a low risk of potential environmental impacts and a high probability of success. For example, in most cases, a riparian planting project or fish passage barrier removal project would be of higher priority than a large wood placement project. As more is learned about the watershed, higher risk and more experimental projects can be pursued with more confidence and greater chance of success.

DEA assumes that the Watershed Council intends to use non-regulatory approaches for habitat protection and restoration. The projects proposed here are intended as cooperative projects with willing landowners. Regulatory means of protecting and restoring habitat are a critical tool for protecting habitat, but are not discussed here.

This chapter presents a prioritized list of protection and restoration opportunities following this general strategy.

METHODS

Protection

Refugia were evaluated for the purpose of identifying the highest priority areas for protection through land acquisition or conservation easement from willing land owners. Key criteria used to prioritize areas are based on the Washington Inter-Agency Committee for Outdoor Recreation's (IAC) criteria for evaluating critical habitat proposals for state funding, as listed below:

- Ecological quality
  - Salmonid species diversity
  - Other fish and wildlife species diversity
  - Rarity of habitat type in watershed and region
- Connectivity
  - Ecological importance to surrounding areas
- Long-term manageability
  - Agency or Land Trust for long term management
  - Risk of adjoining land uses impacting the area
- Public support
  - Likely support from the Watershed Council, county, agencies
  - Landowner support
- Cost efficiency
  - Opportunity for funding partners, cost-share
  - Cost per acre of habitat
- Threats
  - Likelihood of adverse impact if not protected

Restoration

A list of general restoration projects was developed and prioritized based on the following considerations.

- Addresses key habitat problem or limiting factor identified in assessment
- Cost efficiency (large habitat gain for cost)
- Long-term effectiveness
- High degree of confidence in successful project
- Non-confrontational approach
- Located in identified salmon refugia area
- Enough information is available to conduct project

RESULTS

Table 15-1 provides a prioritized list of protection and restoration opportunities in the Scappoose Bay watershed.

Table 15-1. Prioritized List of Protection and Restoration Opportunities for Scappoose Bay Watershed

Priority	Protection/Restoration Opportunity	Location	Comprehensive Study Needed	Field Recon. Needed
1	Protect Scappoose Estuary	Nodal refugia # 18SC, 19JA, 20JA, 21JA		X
2	Protect South Scappoose Creek Headwaters	Headwater refugium # 9SC		X
3	Protect North Scappoose Creek Headwaters	Headwater refugium # 8SC		X
4	Protect Gourlay Creek	Refugium # 11SC		X
5	Address 5 top priority data gaps		X	
6	Fish passage barrier correction projects	Undefined areas throughout watershed	X	
7	Road maintenance/ removal projects	Undefined areas throughout watershed	X	
8	Riparian planting	Adjunct refugia – grass/forb riparian vegetation type		X
9	Large woody debris placement	Adjunct refugia		X
10	Floodplain restoration	Adjunct refugia		X

DISCUSSION

Protection

Protection is recommended for the four biologically highest priority refugia areas (Table 15-1). Acquisition or a permanent conservation easement is recommended for all the Scappoose Estuary wetland areas, with highest priority being refugium 18SC at the south end of Scappoose Bay. As a means of protecting headwater refugia, BLM, the City of Scappoose, and private timber companies may be willing to increase protection standards for riparian areas and potential unstable slopes or sell conservation easements to protect these areas or entire watersheds. BLM owns a large percentage of the remaining headwater refugia areas (see Figure 14-1). BLM's cooperation in protecting these refugia may be critical to the survival and restoration of salmon populations in the watershed.

Restoration

Specific restoration recommendations are premature in most cases because of the lack of comprehensive field data. Thus, a high priority should be placed on further study directed at the top five data gaps. Completion of this work will provide a solid comprehensive baseline of fish and habitat data for the watershed and allow project level planning for specific fish passage and road maintenance projects.

As an interim step, riparian planting projects in adjunct refugia areas can be done at any time. These projects pose a low risk of unanticipated environmental impacts and are very good projects for gaining volunteer involvement in watershed restoration. Areas shown on the riparian condition map as "grass/forb" and some "shrub/partial forest" areas would be highest priorities for planting. Native conifer and hardwoods should be planted.

Riparian and channel treatments need more intense evaluation. LWD placement is probably warranted in much of the adjunct habitat areas, but high flows in the lower reaches make long-term success difficult. More intensive restoration includes restoring the floodplains of adjunct habitat areas. This can be done by placement of abundant large wood in the channel, restoring historic meanders and side-channels, riparian planting, and possibly even re-introduction of beaver following several years of site planting. These projects generally require engineered designs and careful consideration of the historical and current geomorphology of the site, as well as potential impacts to adjacent property owners.

Watershed Assessment Confidence Evaluation: Moderate-high due to a professional assessment team developing recommendations. However, the confidence in recommendations is lessened by the lack of comprehensive fish, habitat, and other data necessary for project-level planning in most cases.

RECOMMENDATIONS

DEA recommends that the Watershed Council endorse only those restoration projects with a solid monitoring plan to document pre-project and post-project conditions.

Figures 15-1 and 15-2 – Photographs

CHAPTER 16. GIS METADATA

This chapter provides GIS metadata as reference to the GIS data layers used in the watershed assessment (Tables 16-1 and 16-2).

Data sets are in either ARC/VIEW Shapefile format or ARC/INFO format. Coverages used in Table 16-1 are in a Lambert projection. Coverages used in Table 16-2 are in a Geographic projection. Projection details are described below.

Lambert Coordinate System Description (for Table 16-1)

- Projection: Lambert
- Datum: NAD83
- Units: Feet
- Spheroid: GRS1980
- 1st Standard Parallel: 43 0 0.0000
- 2nd Standard Parallel: 45 30 0.000
- Central Meridian: -120 30 0.000
- Latitude of Projection's Origin: 41 45 0.000
- False Easting (meters): 400000.00000
- False Northing (meters): 0.00000

Geographic Coordinate System Description (for Table 16-2)

- Projection: Geographic
- Datum: NAD83
- Units: Decimal Degrees
- Spheroid: GRS1980

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Table 16-1. Lambert Projection Metadata Used for Scappoose Bay Watershed Assessment

Legend Name	Coverage Name	Coverage Type	Database Field for Classification	Legend AVL	Data Source
1998 Temperature Results	temp_loc7.shp	Point	(7day>70) N = >59F abd =< 70F, Y = >70F	temp.avl	Scappoose Bay Watershed Council provided GPS locations and 1998 temperature data.
Adjunct Habitat	adjnct_hbt.shp	Line			DEA digitized, modified from channel typing map.
Bank Erosion	strmdt_dks.shp	Line	(bnk_ersn) Y = Yes, N = No		On screen digitizing from interviews by community outreach team with ODFW biologists and local residents.
Bi-State Water Quality Sampling Station	bistatewq.shp	Point			Location digitized by DEA as per DEQ sampling station location.
Channelized Stream	strmdt_dks.shp	Line	(Ditch) Y = Yes; N = No		USGS Streams selected by DEA GIS utilizing aerial photo interpretation and Farnell, 1980.
Chum	Chum.shp	Line			USGS Streams merging Willis et.al. 1960
City Limit	citylim	Polygon			SSCGIS, original source ODOT using a 7.5' quad; 1:24,000
City Limit Line	citylim	Line			SSCGIS, original source ODOT using a 7.5' quad; 1:24,000
Coho BLM	strmdt_dks.shp	Line	(Coho_blm) Y = Yes; N = No		USGS Streams merging BLM datalayers
Coho Observed (ODFW)	Odfwrch	Line	(fish1) CO = Coho		USGS Streams merging ODFW datalayers
Coho ODFW	strmdt_dks.shp	Line	(Coho_odfw) Y = Yes, N = No		USGS Streams merging ODFW datalayers
Columbia Co. Floodplain Area	covs/fema_colu/fema_colu1	Polygon	(Zone) A = 100 yr (1%) Chance floodplain, X500 = 500 Year (0.2%) chance floodplain	fld_areas.avl	FEMA Floodplain GIS data
Confinement	strmdt_dks.shp	Line	(class)	conf.avl	Utilizing a working topographic base map, USGS stream sections were manually identified as to confinement class and digitized.
Contour (100)	cntr100	Line			SSCGIS.
County Line	county	Line			SSCGIS, from USGS; 1:500,000
Cutthroat BLM	strmdt_dks.shp	Line	(Ctlht_blm) Y = Yes, N = No		USGS Streams merging BLM datalayers.
Elevation (ft)	grids/baseft	Polygon (grid)	(Value)		USGS Digital Elevation Model, 30 meter resolution; 1:24,000
Essential Fish Habitat (DSL)	strmdt_dks.shp	Line	(salm_dsl) Y = Yes, N = No		DSL data, captured on-screen by DEA using USGS Streams.
Estuary	estuary	Polygon			Utilizing the USGS Streams coverage, and the Digital Elevation Model, all streams below 20ft in elevation were classified as estuary channel type.
Fall Chinook (ODFW)	strmdt_dks.shp	Line	(Fall_chino) Y = Yes, N = No		USGS Streams merging ODFW datalayers.
Fish Use	strmdt_dks.shp	Line	(Odf_fish)	odf_fish.avl	ODF data from Columbia City maps digitized on-screen by DEA .
Flooding	strmdt_dks.shp	Line	(flooding) Y = Yes, N = NO		On-screen digitizing from interviews by community outreach team with ODFW biologists and local residents.
Flow Accumulation	strmdt_dks.shp	Line	(flow_accum)	facc.avl	The upstream contributing drainage area of each USGS stream section was calculated using the Digital Elevation Model; flow accumulation area to each 100m stream section was calculated as <667 acres, between 667 and 2,224 acres, or > 2,224 acres.
Focal Watershed	Fcl_wtr.shp	Polygon	(wtrshd)	focal_wtrshd.avl	DEA digitized, based on DEA analysis of multiple data sources.
Highway	highway	Line			ODOT 1997 coverage.
Hillshade	grids/hlshd1	Polygon (grid)	(Value)		USGS Digital Elevation Model, 30 meter resolution; 1:24,000
In Stream Use	Instruse.shp	Point			ODFW database capture.
Intact Habitat	acad/rip_lam	Polygon	(rip_lam-id)	intact_hab.avl	DEA digitized from 1998 aerial photo interpretation .
Known Extent of Log Drives	strmdt_dks.shp	Line	(log_drives) Y = Yes, N = No		USGS Streams, DEA GIS selected streams as per Farnell (1980).
Large Woody Debris ODFW Benchmarks (pieces/100m)	Odfwrch	Line	(Lwdpiece1)	bnch_debris.avl	DEA digitized ODFW habitat condition benchmarks.
Local Roads (BLM)	grtn_wtrshd.shp	Line			BLM Road layer.

Table 16-1. Lambert Projection Metadata Used for Scappoose Bay Watershed Assessment (continued)

Legend Name	Coverage Name	Coverage Type	Database Field for Classification	Legend AVL	Data Source
Multnomah Co. Floodplain Area	covs/fema_mult/mult_fema1	Polygon	(Zone) A = 100 yr (1%) Chance floodplain, X500 = 500 Year (0.2%) chance floodplain	fld_areas.avl	FEMA Floodplain GIS data.
National Wetlands Inventory	nwi	Polygon	(Attribute)	nwi.avl	NaWI GIS coverages available from the State Service Center GIS.
Nodal Habitat	Nodal_habitat.shp	Polygon		nodal.avl	DEA digitized, based on DEA analysis of multiple data sources.
ODF Barriers	Odf_bar.shp	Point	(Type)	odf_bar.avl	Barrier location, digitized by DEA per data in ODF maps and field survey forms.
ODFW Barriers Database	bar_lw2.shp	Point	Data / No Data		ODFW fish passage barriers database.
Other Barriers	barriers.shp	Point	(Type)	Other_bar.avl	Digitized on-screen based on interviews and text from Willis et.al. (1960).
Ownership, BLM	scapblua_wshd	Polygon			BLM data clipped from Ownership coverage obtained from Oregon State Services Center GIS.
Places of Use	placeuse.shp	Polygon			OWRD database capture.
Points of Diversion	ptsofd.shp	Point			OWRD database capture..
Potential Distribution	strmdt_dks.shp	Line	(Streamgrad)		USGS Streams, potential distribution was based on general knowledge of each species use of stream habitat based on stream size and gradient.
Potential Fish Barriers	fishbar	Line			USGS Streams selected by GIS with a stream gradient >20%.
Potential Sediment Sources, Surface Mines	pts.shp	Point	(Pt_Type) mine	sed_source.avl	On-screen digitizing from interviews by community outreach team with Columbia County and local residents.
Potential Water Quality Contaminant Sources	pts.shp	Point	(Pt_type) hazardous wste site, landfill		Digitized by DEA as per community outreach team.
Reach Survey (ODFW)	download/odfw/scaprch1	Line			USGS Streams merging ODFW datalayers.
Residual Pool Depth, ODFW Benchmarks (m)	Odfwrch	Line	(Residpd)	odfw_bench.avl	ODFW-conducted physical habitat surveys (GWEB, 1999) digitized by DEA.
Riparian Vegetation Type	strmdt_dks.shp	Line	(Dea_veg)	rip_veg.avl	Digitized by DEA into the GIS using 1998 aerial photographs provided by Olympic Resources Management, Inc.
River	grids/base2	Polygon (grid)	(value) 0 = river		USGS DLG; Line work was selected by DEA to reflect natural stream network; 1:24,000
Section Line w/ Survey Notes	Plsnod	Line	(Historical) 0 = Section line, 1-18 = Section line w/ survey note		SSCGIS, digitized from USGS maps; 1:1,000,000
Slope Hazard Rating	int_slp_soil.shp	Polygon	(erosn_haz)	slope_haz.avl	USGS Digital Elevation Model, 30 meter resolution; 1:24,000; GIS derived slope merged with NRCS GIS soil survey maps rated for hazard by DEA.
Soils Protected by Dikes	soil_wshed.shp	Polygon			NRCS GIS soil survey maps of "protected" soils.
Spring Chinook	strmdt_dks.shp	Line	(Spring_chi) Y = Yes, N = No		USGS Streams merging ODFW datalayers.
Steelhead BLM	strmdt_dks.shp	Line	(Stlhd_blm) Y = Yes, N = No		USGS Streams merging BLM datalayers.
Stream (USGS 1:24,000)	strmdt_dks.shp	Line			USGS DLG; Line work was selected by DEA to reflect natural stream network; 1:24,000
Stream (USGS 1:24,000) 11/99 Added	strmdt_dks_11.shp	Line			Line work was selected by DEA to reflect natural stream network at which point a new coverage was created 11/1999; 1:24,000
Stream Gradient	strmdt_dks.shp	Line	(Streamgrad)	gradstrmdet.avl	USGS Streams were segmented into 100 meter sections, with percent gradient calculated for each section.
Stream Habitat Types	strmdt_dks.shp	Polygon	(strm_hab)		USGS Streams merged with habitat data .
Subwatershed	sws	Line			Digitized on-screen from USGS 7.5' quadrangle, DRG; 1:24,000
Subwatersheds	grids/sws	Polygon (grid)	(S_value)		Digitized on-screen from USGS 7.5' quadrangle, DRG; 1:24,000
Summary Channel Classification	strmdt_dks.shp	Line	(sum_class2) lowg-hma-umc-N	strm_sum_class.avl	Utilizing the USGS Streams coverage, the following stream designations were merged: stream gradient, flow accumulation, channel confinement, and estuarine channel.

Table 16-1. Lambert Projection Metadata Used for Scappoose Bay Watershed Assessment (continued)

Legend Name	Coverage Name	Coverage Type	Database Field for Classification	Legend AVL	Data Source
Summer Steelhead (ODFW)	strmdt_dks.shp	Line	(Summer_ste) Y = Yes, N = No		USGS Streams merging ODFW datalayers.
Surface Erosion Hazard Rating	int_slp_soil.shp	Polygon	(erosion)	eros_hazard.avl	NRCS GIS soil survey maps rated by surface erosion hazard.
Topographic Gradient	grids/slope1	Polygon (grid)	(Value) 20-138 = source, 3-20 = transport, 0-3 = response		USGS Digital Elevation Model, 30 meter resolution; 1:24,000
Township Summary Notes	Plsnod	Line	(historical-tr) 1-4 = Township summary notes		Digitized from USGS maps; 1:2,000,000, based on GLO survey notes
Twp/Rge Boundary Notes	Plsnod	Line	(hist-trbnd) 1-3 = Twp/Rge Boundary notes		Digitized from USGS maps; 1:2,000,000, based on GLO survey notes
USGS 7.5' quadrangles	stream2	Line	(modn-id) 0 = USGS 7.5' quadrangle		USGS DLG; 1:24,000
Valley Flood Plain Type	strmdt_dks.shp	Line	(sum_class2) lowg-hma-umc-N	low_mod_strm.avl	Selected channel type.
Washington Co. Floodplain Area	covs/feam_wash/wash_fema1	Polygon	(Zone) A = 100 yr (1%) Chance floodplain, X500 = 500 Year (0.2%) chance floodplain	fld_areas.avl	FEMA Floodplain GIS data.
Water Use/ CFS; water rights	ptsofd_sws.shp	Point	(Ag_cfs, Dom_cfs, Ind_cfs, Mun_cfs, Misc_cfs, Mult_cfs)	water_use.avl	OWRD GIS data.
Watershed Boundary	Wsh1	Line			Digitized on-screen from USGS 7.5' quadrangle, DRG; 1:24,000
Winter Steelhead (ODFW)	strmdt_dks.shp	Line	(Winter_ste) Y = Yes, N = No		USGS Streams merging ODFW datalayers.

Table 16-2. Geographic Projection Metadata Used for Scappoose Bay Watershed Assessment

Legend Name	Coverage Name	Coverage Type	Data Source
Bank Erosion	int_slp_soil_prj.shp	polygon	On-screen digitizing from interviews by community outreach team with ODFW biologists and local residents.
BLM Coho	coho_blm	line	USGS Streams merging BLM datalayers
Intact Vegetation	rip.shp	polygon	DEA digitized from 1998 aerial photo interpretation, as per Governor's Watershed Enhancement Manual (1999)
ODF Fish Barriers	odf_bar.shp	point	ODF Artifical fish passage barriers database.
ODF Fish Barriers	odf_bar_dd	line	ODF Artificial fish passage barriers database.
ODFW Coho	coho_odfw	line	USGS Streams merging ODFW datalayers
ODFW Fish Barriers	bar_lw2_prj1.sp	point	ODFW fish passage barriers database.
Other Fish Barriers	barriers_prj.shp	point	Digitized on screen based on interviews and text from Willis et.al. (1960)
Stream	stream1	line	USGS DLG; Line work was selected by DEA to reflect natural stream network; 1:24,000
Stream	stream	line	USGS DLG) Line work was selected by DEA to reflect natural stream network; 1:24,000
Stream	strmdt_dks_dd	line	USGS DLG) Line work was selected by DEA to reflect natural stream network; 1:24,000
Stream	streamdt_dks_prj1.shp	line	USGS DLG; Line work was selected by DEA to reflect natural stream network; 1:24,000
Subwatershed	sws.shp	line	Digitized on-screen from USGS 7.5' quadrangle, DRG; 1:24,000
Watershed Boundary	wsh.shp	line	Digitized on-screen from USGS 7.5' quadrangle, DRG; 1:24,000

Information for the digital orthophotos and digital USGS topographic maps is provided below.

Digital Orthophotos: 1 m Resolution, 1994.

- 45122h81.tif
- 45123f12.tif
- 45123g12.tif
- 45123g13.tif
- Chapman_ne.tif
- Chapman_nw.tif
- Chapman_se.tif
- Chapman_sw.tif
- Deer_is_sw.tif
- Dixie_ne.tif
- Dixie_nw.tif
- Dixie_se.tif
- Sauvie_ne.tif
- Sauvie_nw.tif
- Sauvie_sw.tif
- St_hel_ne.tif
- St_hel_nw.tif
- St_hel_se.tif
- St_hel_sw.tif
- Trenhol_se.tif
- Trenhol_sw.tif

Scanned Digital USGS Topo Maps:

- 045122f7.tif
- 045122f8.tif
- 045122g7.tif
- 045122g8.tif
- 045122h7.tif
- 045122h8.tif
- 045123f1.tif
- 045123g1.tif
- 045123h1.tif

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APPENDICES

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APPENDIX D - Chapter 12, Watershed Condition

Summary Answers to OWEB Watershed Assessment critical questions

APPENDIX D – SUMMARY ANSWERS TO WATERSHED ANALYSIS CRITICAL QUESTIONS

Historical Conditions

1. What were the characteristics of the watershed's resources at the time of European exploration/settlement?

Historically, there were three major ecological communities that occurred in the watershed:

a. the lowland floodplain made-up of rich alluvial bottoms intersected with numerous lakes, ponds, marshes, and sloughs subject to annual inundation by the rise of the Columbia River in the months of May, June, and July.

b. the Scappoose prairie which consisted of strips and patches of prairie with willow swamps, swales and brushy ridges.

c. stream valleys and hills of the of the upper watershed covered in old growth forests and burns.

Seven archeological sites in the watershed indicate that there was a large permanent settlement of Chinook Indians living in the lowlands surrounding Scappoose Bay.

2. What are the historical trends and locations of land use and other management impacts in the watershed?

European settlement and exploitation of the watershed over the past 150 years has included fur trapping, logging, gravel mining, dairy and small farming, residential and commercial development, water withdrawal, introduction of exotic species (such as carp, Himalayan blackberry and Japanese knotweed) and major flood control efforts. Historical information suggests that most stream valley floodplains and their habitats were converted to agricultural uses in the late 1800s and early 1900s. The lowland floodplain in the lower watershed was altered by flood control measures and farming. The prairies on the gravel plain between hills and the floodplain were used for residential/commercial development and farming. The forested hills were altered by intensive logging begun in the 1840s, and associated transport of logs by splash dams, flume, railroad and roads.

3. What are the historical accounts of fish populations and distribution?

Fall chinook, coho, chum, winter steelhead, and cutthroat trout were historically present in Milton Creek and the Scappoose Creek subbasins. Coho, winter steelhead, and cutthroat were present in Jackson Creek. Winter steelhead and cutthroat were historically found in Sly Creek and Honeyman Creek.

4. Where are the locations of historic floodplain, riparian area, channel, and wetland modifications, and what was the type and extent of the disturbance?

The lowland floodplain adjacent to Multnomah Channel has been extensively modified by channelization and diking. The largest channel modification in the watershed appears to be the routing of Jackson Creek into Joy Creek with a diversion dam, cutting of flow from the lower five miles of Jackson Creek and blocking fish passage into the upper Jackson Creek watershed. Three water supply dams operated by the City of Scappoose and at least one old dam owned by the City of St. Helens and one by a private landowner are also major channel modifications. The major impact of these dams may be to warm stream temperatures, flood potential habitat, and partially or fully block fish passage.

Little channelization or diking has occurred in the upper valleys of most of the watershed. Major channel form and meander patterns appear to remain relatively intact throughout most of the upper watershed. However, clearing the floodplain and channels of large wood jams has probably severely reduced the fish habitat of the stream valleys by eliminating side-channels, beaver ponds, and a functioning floodplain.

Channel Habitat Type Classifications

1. What is the distribution of channel habitat types throughout the watershed?

The following table represents the stream miles and percent of channel types found in the Scappoose Bay watershed.

Channel Type	Stream Miles	%
Small estuarine channel (ES)	48	18%
Low gradient small floodplain channel (FP3)	109	40%
Alluvial fan channel (AF)	8	3%
Moderately steep narrow valley channel (MV)	94	34%
Very steep headwater (VH)	16	5%

2. What is the location of channel habitat types that are likely to provide specific aquatic habitat features, as well as those areas which may be the most sensitive to changes in watershed conditions?

The mainstem reaches of the major streams in the watershed and some of the major tributaries are generally FP3 channel type. These reaches are generally sediment transport and deposition channels that provide the bulk of the fish spawning and rearing habitat for most species. These channels are generally very sensitive to changes in watershed inputs of wood, flow and sediment. The lower watershed is dominated by ES channel type and many of the streams are channelized. These channels generally provide rearing habitat for coho, cutthroat, chum and chinook.

Hydrology and Water Use

1. What land uses are present in the watershed?

Farming, Logging, grazing, residential/commercial development, and gravel mining.

2. What is the flood history in the watershed?

Historically, the lowland floodplain flooded 12 to 20 feet every year. The 100-year floodplain extends upstream along most of the stream valleys. Dams constructed in the Willamette and Columbia rivers since the mid 1900s reduced flooding. Formation of the Scappoose Drainage District in 1922 and construction of drainage ditches, pumping stations and Multnomah Channel dikes over the next several years had the largest effect in reducing flood frequency in the lowlands.

3. Is there a probability that land uses in the basin have a significant effect on peak flows?

In-stream flow information is one of the largest data gaps in the watershed assessment. However, the high road density of logging roads throughout the hills of the upper watershed indicate the potential for significant increases in magnitude and frequency of peak flows. The historic loss of functional floodplains in the stream valleys by removal of large wood debris dams and beavers has probably also exacerbated flooding in the lower stream areas. Flood control measures (diking, channelization and dams) in the lowland floodplain and Willamette and Columbia River have greatly reduced the annual flooding of the lowland floodplain.

4. Is there a probability that land uses in the basin have a significant effect on low flows?

In-stream flow information is one of the largest data gaps in the watershed assessment. However, the water rights data show significant water withdrawals for municipal, domestic and agriculture purposes in the watershed. Considering that summer low flow is a natural limitation on fish habitat in this region due to a summer drought period, it is likely that the cumulative water withdrawals during this period represent a significant impact on fish habitat.

5. For what beneficial use is water primarily used in the watershed?

Water is used in the watershed for municipal water supply, salmonid spawning and rearing, industrial water supply, recreation, livestock operations, and crop irrigation

6. Is water derived from a groundwater or surface water source?

The source of water used in the Scappoose Bay watershed is derived from both surface water and groundwater. Scappooose has several surface water impondments and a groundwater well. The Warren and McNulty Water associations have groundwater wells. The City of St. Helens currently obtains water from two groundwater wells.

7. What type of storage has been constructed in the basin?

The City of Scappoose operates three storage dams on Gourlay Creek, Lazy Creek, and South Scappoose Creek as the City's municipal water supply. The City of St. Helens owns an inactive dam on Milton Creek (Salmonberry Reservoir).

8. Are there any withdrawals of water for use in another basin (interbasin transfers)? Is any water being imported for use in the basin?

A diversion dam eliminates flow to about five stream miles of lower Jackson Creek by diverting water into Joy Creek. There is no evidence of water being imported for use in the basin other than a groundwater intake system under the Columbia River that is used by the City of St. Helens.

9. Are there any illegal uses of water occurring in the basin?

None have been identified, but water use is not well monitored.

10. Do water uses in the basin have an effect on peak flows?

In-stream flow information is one of the largest data gaps in the watershed assessment. See #3, above.

11. Do water uses in the basin have an effect on low flows?

In-stream flow information is one of the largest data gaps in the watershed assessment. See #4, above.

Riparian/Wetlands

1. What are the current conditions of riparian areas in the watershed?

Most of the riparian zones in the watershed are now in relatively poor condition based on a comparison of historic to existing conditions.

2. How do the current conditions compare to those potentially present or typically present for this eco-region?

The current riparian conditions represent a major shift from historical conditions under which salmon evolved in the watershed. Historically, mature and old growth coniferous forest occurred in the hills of the upper watershed, oak savanna prairie occurred in the gravel plain prairie of the mid watershed, and a variety of shrub, deciduous forested and open-water wetlands occurred in the lowland floodplain.

The riparian classification map and field reconnaissance shows that most riparian zones in the hills have been converted to narrow buffer strips or clear-cut completely.

Riparian zones and associated forested floodplains along the stream valleys are now mostly a narrow shrub- or hardwood-dominated fringe between the stream and pasture, road, or second growth forest. Detailed physical habitat surveys conducted on several streams by ODFW suggest that riparian zones are not functioning to provide adequate fish habitat. The surveyed reaches generally have low levels of LWD and relatively low shade cover and few pools. Much of the large wood recruitment, shade, bank protection, and other functions historically provided by old growth forest riparian zones have been reduced by agriculture, residential, and forestry uses.

Riparian zones of the historic prairie and lowland floodplain have lost much of the shrub and hardwood component and are dominated by pasture or cropland.

3. How can the current riparian areas be grouped within the watershed to increase our understanding of what areas need protection and what the appropriate restoration/enhancement opportunities might be?

Protection opportunities exist in the highest quality riparian zones classified as mature forest due to their rarity and importance to fish habitat. Agriculture and residential lands that have been converted grass/forb or shrub/partial forest classes should be restored to forested riparian zones. Protection and restoration efforts should primarily focus in highest priority salmon refugia areas, and work out to adjunct habitats that located in Scappoose and Milton Creek mainstem valleys.

4. Where are the wetlands in this watershed?

Wetlands are primarily confined to the east side of the watershed in the lowland floodplain. Most streams in the upper watershed also have pockets of wetlands along floodplains and unconfined segments.

5. What are the general characteristics of wetlands within the watershed?

Most of the wetlands have been converted to agricultural, industrial, or residential use. The largest remaining wetlands are located in the lowland floodplain of the Columbia River and are severally considered a high priority for protection.

6. Where are the priority wetlands within the watershed?

The south end of Scappoose Bay is one location where historic wetlands and channels appear to remain relatively intact. Smaller intact wetlands occur along the lower end of Jackson Creek.

7. What opportunities exist to restore wetlands in the watershed?

The highest priority is to protect the large intact wetlands at the south end of Scappoose Bay.

Sediment Sources

1. What are important current sediment sources in the watershed?

In general, logging roads are considered the largest potential source of fine sediment from surface erosion. BLM road data indicates a high density of roads throughout the watershed.

Many of these roads are located in soils identified as moderate to high hazard for surface erosion or mass wasting. Aggregate mines are another potentially significant source of sediment as numerous rock quarry mines occur in the watershed close to streams. Bank erosion is another significant source of sediment. Many large areas of bank erosion were observed along the larger streams. A visual comparison of the riparian condition map and surface erosion hazard map indicates overlapping areas that are areas of potential bank erosion due to moderate or high surface erosion and grass/forb or shrub/partial forest riparian zones.

2. What are important future sources of sediment in the watershed?

Roads, agriculture and forestry practices, wildfire and mining.

3. Where are erosion problems most severe and qualify as high priority for remedying conditions in the watershed?

Along roads located in the hills on the west side of the watershed where surface erosion hazards are higher.

Channel Modifications

1. Where are channel modifications located?

The lowland floodplain adjacent to Multnomah Channel has been extensively modified by channelization and diking. The largest channel modification in the watershed appears to be the routing of Jackson Creek into Joy Creek with a diversion dam, cutting off flow from the lower five miles of Jackson Creek and blocking fish passage into the upper Jackson Creek watershed. In 1861, the lower two miles of Milton Creek was relocated from Jackass Canyon to its present location. Three water supply dams operated by the City of Scappoose and at least one old dam owned by the City of St. Helens and one by a private landowner are also major channel modifications. The major impact of these dams may be to warm stream temperatures, flood potential habitat and partially or fully block fish passage.

2. Where are historic channel disturbances, such as dam failures, splash damming, hydraulic mining, and stream cleaning, located?

Splash damming and log running occurred from 1849 to 1916 on the lower eight miles of Milton Creek. A flume was also used to transport logs to St. Helens. Logs were probably run down other streams and tributaries as well for at least 50 years.

3. What stream channel habitat types have been impacted by channel modifications?

Estuarine channel types have generally been impacted the most by channel modifications.

4. What are the types and relative magnitude of past and current channel modifications?

Most wood was probably removed from the larger streams and tributaries as part of the log driving. Historically, large log jams in the main stream valleys probably acted as dams that forced streams onto the valley floodplains. Currently, channels are downcut and relatively disconnected from the floodplain. Extensive channelization and diking occurred in the lowland floodplain. Within the lowland floodplain, the south end of Scappoose Bay appears to be the only area relatively free of channelization and may serve as important refugia habitat for salmon.

Water Quality

1. What are the designated beneficial uses of water for the stream segment?

Salmonid fish spawning, salmonid fish rearing, resident fish and aquatic life, domestic water supply, fishing, and aesthetic quality.

2. What are the water quality criteria that apply to the stream reaches?

Water Quality Attribute	Criteria
Temperature	Daily maximum of 64 F and 55 F for salmonid spawning and rearing
Dissolved Oxygen	8.0 mg/l
pH	6.5 to 8.5 units
Total Phosphorus	0.05 mg/l
Total Nitrate	0.30 mg/l
Bacteria	406 E. coli/100 ml
Turbidity	50 NTU maximum above background
Contaminates:	
Organic	Above detection limits
Metals	Chronic toxicity threshold

3. Are the stream reaches identified as water quality limited segments on the 303(d) list by the state?

EPA's 303(d) geographic information system data was searched and no 303(d) listed streams were found in the Scappoose Bay watershed.

4. Are any stream reaches identified as high quality waters or Outstanding Resource Waters?

No stream reaches are identified as high quality waters or Outstanding Resource Waters in the Scappoose Bay watershed.

5. Do water quality studies or evaluations indicate that water quality has been degraded or is limiting the beneficial uses?

Very little water quality monitoring has been conducted in the watershed. The monitoring that has been done suggests the following problems: 1) elevated summer stream temperatures in the lower reaches of Scappoose and Milton creeks based on nine temperature recorders used in 1998; 2) toxic contamination, including heavy metals and PCBs, in the water and sediment of Scappoose Bay based on one sampling station including as part of the Lower Columbia River

Estuarine Program water quality monitoring project; and 3) fecal coliform bacteria above state standards in the Dutch Canyon reaches of South Scappoose Creek.

Fish and Fish Habitat

1 What salmonid species are documented in the watershed? Are any of these currently ESA or candidate species? Are there any fish species which historically occurred in the watershed which no longer occur in the watershed?

Current salmonid species documented in the watershed include spring chinook, coho, and winter steelhead. Chinook and steelhead are threatened species and coho is a candidate species. Historically, fall chinook and chum were present but have not been observed in the watershed for many years.

2. What is the distribution, relative abundance and population status of salmonid species in the watershed?

Coho was one of the most abundant fish species in the Scappoose Bay watershed. Coho has shown a drastic decline since the 1970s. In 1999, juvenile and adult fish trappings was initiated at Bonnie Falls on North Scappoose Creek: 706 smolts were caught between March 2 and June 21, with an estimated total migration of 1317 individuals based on an overall mark/recapture trap efficiency of .54.

Winter steelhead were also abundant in the watershed until recent decades, with a drastic decline in recent years. In 1999, 38 adult steelhead were recorded at the adult fish trap installed at Bonnie Falls. Twenty-five of the 38 fish (66 percent) were estimated to be of hatchery origin. Ninety-five steelhead smolts were caught, with an estimated total out-migration of 409 smolts, based on an overall mark/recapture trap efficiency of .23.

According to Willis et al. (1960), several hundred fall chinook spawned in the two mile reach below the forks of North and South Scappoose creeks in the 1950s. Current status is unknown. Spring chinook were observed spawning in lower North Scappoose Creek in 1997. An angler was observed catching a spring chinook in the mainstem Scappoose Creek in 1998.

Milton Creek was the largest producer of chum salmon in the watershed, with a total spawning run estimated to be about 200 fish per year according to Willis et al. (1960). The location of the spawning grounds within Milton Creek is unknown.

3. Which salmonid species are native to the watershed, and which have been introduced to the watershed?

Coho, winter steelhead, fall chinook, chum, and cutthroat trout are native to the watershed. Spring chinook may also be native to the watershed, although no historic references were found.

4. Are there potential species interactions?

Hatchery stocking was discontinued by ODFW in 1984 due to their concern regarding the impacts of hatchery stocks on native fish stocks. Smallmouth bass, pike minnow, walleye, and other warm water fish inhabit the Columbia River, Scappoose Bay, and probably most stream channels in the lowland floodplain of the watershed. These warm water non-native species are potential predators of juvenile salmonids from the watershed.

5. What is the condition of fish habitat in the watershed (by sub-basin) where habitat data has been collected?

Several stream reaches were surveyed by ODFW. However, these reaches cover only a small portion of the watershed. Conditions of fish habitat for those subbasins are as follows:

Stream	Percent Pool Rating	Complex Pool Rating	Percent Gravel Rating
Salmon Creek	Fair	Undesirable	Desirable
Sierkes Creek	Fair	Undesirable	Desirable
North Scappoose Creek	Mostly Desirable	Mostly Desirable	Mostly Fair
Raymond Creek	Fair	Undesirable	Desirable

6. Where are potential barriers to fish migration?

Numerous artificial and natural barriers are recorded in the watershed. Given the high road density and large number of road crossings, it is highly likely that culverts are significant barriers to fish migration. Two water supply dams owned by the City of Scappoose on Lazy Creek and South Scappoose Creek may block fish. A third dam on Gourlay Creek has long been recognized as a probable blockage to about two miles of upstream habitat. At least two additional old dams on Milton Creek may potentially block some species. The tide-gate at the mouth of Joy Creek potentially blocks fish access during high flows when most species tend to migrate.

Watershed Condition Evaluation

1. What are the information and data gaps identified in the assessment process?

The following is a list of major data gaps, in order of priority, for the watershed:

1. Comprehensive data on juvenile and adult salmonid distribution and abundance
2. Comprehensive data on fish passage barriers
3. In-stream flow and water use monitoring data
4. Comprehensive aquatic habitat survey data
5. Comprehensive road condition survey for surface erosion and mass wasting
6. Unstable slope hazard assessment
7. Feasibility of Jackson Creek diversion
8. Field assessment of mining areas for sediment risk
9. Digital ownership map
10. High resolution digital aerial photographs
11. GIS data for City of Scappoose Local Wetland Inventory, zoning, and other data
12. GIS data for City of St. Helens road, zoning, wetland, and other data
13. Refugia field verification
14. Stream temperature monitoring
15. Scappoose Bay toxic contamination monitoring
16. ONHP historic vegetation type maps

2. What were the historical conditions of the aquatic-riparian areas within the watershed?

Historically, most of the watershed was dominated by mature and old growth coniferous forest in the hills on the west and oak savanna prairie and a variety of shrub, hardwood forested and open-water wetlands in the Columbia River floodplain. According to local sources, "The Scappoose Creeks, with their virgin timber watersheds and lack of diversions, were much larger in early days. They contained many native trout, sea going trout, steelhead, and chum salmon in season." The streams had much more large wood in them historically.

3. What are the historical changes (legacies) and current activities that have contributed to impacts in habitat quality, and fish presence and abundance?

The forested hills were altered by logging and associated road building. T he major stream valleys were altered by clearing floodplains for agriculture and clearing streams for log running. The prairies on the gravel plain between hills and the floodplain was altered by farming and residential/commercial development. The lowland floodplain in the lower watershed was altered by flood control measures and farming.

4. What ongoing resource management/land use activities are contributing to continued impacts on the watershed resources?

Agriculture and forestry practices, residential/commercial development, road construction/maintenance and gravel mining.

5. What are important issues and key aquatic-riparian areas that need to be addressed to restore and protect watershed resources?

Protection and restoration opportunities are of highest priority in identified salmon refugia areas. Within these areas, protection is recommended for the highest quality riparian zones classified as Mature Forest due to their rarity and importance to fish habitat. Agriculture and residential lands that have been converted grass/forb or shrub/partial forest classes should be restored to forested riparian zones. Protection is also a high priority for remaining high quality wetlands in the lowland floodplain, such as at the south end of Scappoose Bay and on Jackson Creek.