Project Completion Report:

Aquatic & Riparian Habitat Evaluation for the McKenzie-Willamette River Confluence

Project No. 99-101

Submitted to the Oregon Watershed Enhancement Board

By

John Runyon
Project Manager
McKenzie Watershed Council

August 31, 2000

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Description of Project

The McKenzie-Willamette River Confluence area, which historically had extensive side channel areas and flood plain habitats, is a key to successfully restoring some flood plain function to the Willamette River system. The McKenzie Watershed Council, through their action planning process, identified restoration of the confluence area as the highest priority in the watershed. Previous studies, and the McKenzie Watershed Council's ongoing subbasin assessment, have identified the confluence area as having the potential to restore key refuge habitat (pools and side channels) for juvenile Upper Willamette River spring chinook salmon. Juvenile rearing habitat appears to be a strong limiting factor for chinook salmon production in the McKenzie River system. Since the McKenzie Watershed holds the only self-sustaining run of native chinook salmon in the upper Willamette River Basin, restoration of juvenile rearing habitat in the confluence area will be a key component of species recovery.

The confluence area has very valuable infrastructure in place, historically dynamic channel migration patterns, key fish and wildlife resources, and restoration potential, all of which requires very detailed habitat assessment, planning and engineering analysis to complete a successful project that enhances fish and wildlife habitat and accounts for flood protection requirements. The value of the aquatic and flood plain habitats, complexity of the issues, the requirement to involve multiple interests, and the proximity of the gravel industry and residential areas created the need for a site-specific characterization and evaluation of historical and current habitat conditions.

List of Project Participants

The project oversight was provided by a steering committee comprised of representatives of the local aggregate industry, state and federal agencies, environmental groups, and the McKenzie Watershed Council. This steering committee will continue with the action planning process. Local consultants completed the habitat evaluation field work, analysis, and reporting. John Runyon, McKenzie Watershed Council, provided overall project management.

Project Steering Committee

Name	Organization
Chris Thoms	U.S. Army Corps of Engineers
Gary Lynch	Oregon Division of Geology & Mineral Industries
Jeff Ziller	Oregon Dept. of Fish and Wildlife
Randy Hledik	Wildish Land Company
Bob Bumstead	McKenzie River Flyfishers
Jim Turner	National Marine Fisheries Service

Earle Johnson	Oregon Division of State Lands
John Runyon	McKenzie Watershed Council
Jim Thrailkill	McKenzie Watershed Council

Project Consultants

Name	Organization
John Gabriel	Alsea Geospatial
Chip Andrus	WaterWork Consulting
Paul Adamus	Adamus Resource Assessment

Methods

The local aggregate operators and the Oregon Concrete and Aggregate Producers Association (OCAPA) funded ($150,000) a geomorphic, hydrologic, and hydraulic study of the McKenzie-Willamette River confluence area for the purpose of developing a flood management plan. The hydraulic study provided the foundation for the riparian-aquatic assessment study funded by the Oregon Watershed Enhancement Board. The assessment evaluated historic and current habitat and developed principals for protecting or improving conditions for native fish and wildlife in the confluence area. The assessment area encompasses 11,123 acres of river channel, riparian and terrestrial habitats. The area includes the Willamette River downstream of river mile 178.2 (Beltline Road Bridge) to river mile 171.5 and the McKenzie River from its confluence with the Willamette River to the Interstate Highway 5 bridge (about 4 miles long). Included are the main channels of both rivers and off-channel areas that have connection to the main channels at any time. For purposes of the wildlife habitat, the study area includes land and water bodies within the historic flood areas of the two rivers (see map).

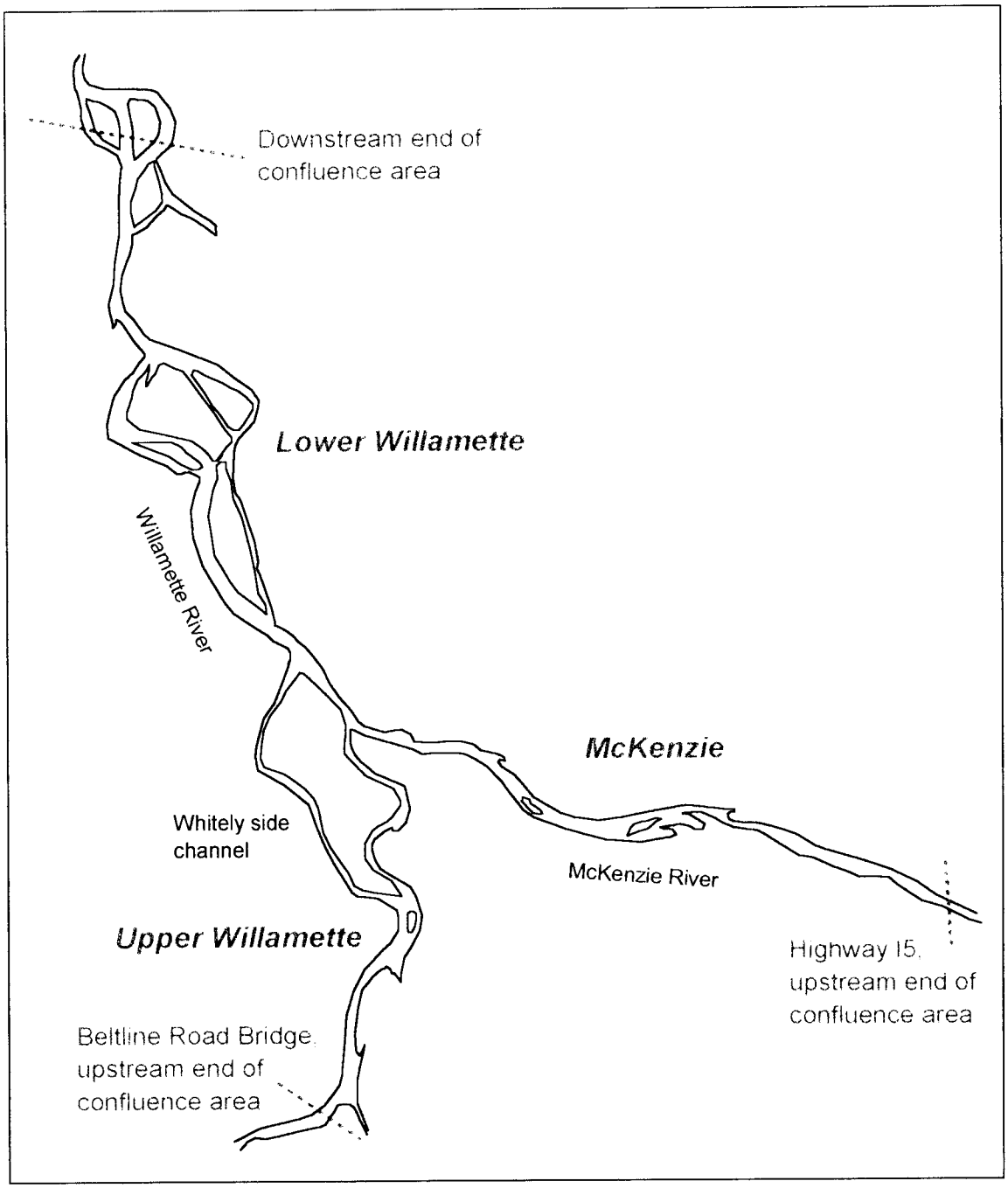
Both of these studies provide detailed and site-specific information on habitat features, fish and wildlife population status, water quality, hydraulic conditions, and habitat enhancement and flood protection opportunities. In addition to detailed reports, the studies provide GIS data layers describing the area and fish and wildlife habitat and populations.

The hydraulic study investigated the history of geomorphic changes in the vicinity of the confluence and developed a computer model of the river system. The model was used to estimate the existing capacity of the river channels to transport flood flows and identify areas where floods may overtop or flow around existing flood protection berms.

Integrating the hydraulic study with the findings about fish and wildlife habitat provided the foundation for developing principals for protecting and enhancing fish and wildlife

populations and habitat in the confluence area. The final report concluded with a list of recommend actions that will be used, in the next action planning phase of the project, to develop site-specific projects to protect and enhance habitat.

Map of the McKenzie-Willamette River confluence project planning area.



Results

The assessment products included a detailed study report, a summary report, maps and associated GIS database, and a slide show summarizing the findings and depicting the habitat and land use features in the confluence area.

The results of the assessment will be used to develop habitat enhancement efforts focused on channel, riparian and terrestrial habitats within the project area. The biological assessment describes principals for enhancing fish and wildlife habitat. These principals, to be used to guide the action planning process and help establish priorities, include:

- Looking for opportunities to increase the width of the active channel.
- Recovering or excavating alcoves and side channels where appropriate.
- Providing year-round connection of low-lying gravel ponds to the main channel.
- Protecting or establishing large trees close to river channels or off-channel features.
- Avoiding or minimizing the conversion of riparian woodlands to other uses.
- Creating conditions favorable for long-term re-establishment of cottonwoods in some of the floodplain areas.
- Placing logs in sloughs and ponds to provide resting habitat for western pond turtles.
- Attempting to minimize the extent and spread of reed canarygrass.

In addition to the habitat protection/restoration principals, the assessment provides information and detailed GIS layers describing conditions including:

- Historic and current channel position and aquatic habitat features.
- Fish and wildlife populations based on field inventories.
- Historic and current vegetation patterns.
- Current land use patterns.

The GIS database will be used in the next phase of the project where the steering committee will develop a restoration "vision" for the confluence area and detailed habitat restoration projects for implementation over a range of time horizons: near-term (over the next year), hort-term (1-5 years), and long-term (5-30 years).

Accounting of Expenditures and In-Kind Services

The attached table from the fiscal administrator, Cascade Pacific Resource Conservation and Development, provides the details on the expenditure of OWEB grant funds. In-kind services were provided by the members of the steering committee and their organization's staff. In-kind services included activities such as attendance at meetings and field tours, providing professional advice and information for the study, reviewing the consultants' work products, and interacting with the McKenzie Watershed Council. Accounting for time expenditures, by organization, is estimated as follows:

- Local Aggregate Operators and OCAPA: 180 hours
- McKenzie Flyfishers: 80 hours
- McKenzie Watershed Council Coordinator (BPA funding): 80 hours

- Oregon Department of Fish and Wildlife: 120 hours
- Oregon Department of Geology and Mineral Industries: 100 hours
- Oregon Division of State Lands: 100 hours
- National Marine Fisheries Service: 100 hours
- Army Corps of Engineers: 80 hours

Conclusions

The Aquatic and Riparian Habitat Evaluation for the McKenzie-Willamette River Confluence, in combination with the hydraulic study, provides a scientific foundation for the development of a long-term habitat restoration/protection plan for the area.

There are a number of key elements that contributed to the success of this project:

- Steering committee members who are committed to the development of a long-term habitat restoration vision for the confluence area. Having continuity of steering committee membership through the habitat evaluation and project planning phases will be essential for the success of the restoration efforts.
- Selecting local consultants who were familiar with the confluence area and the aggregate industry.
- Selecting consultants who have extensive knowledge of the Willamette Basin's wildlife and fish populations, and experience with habitat restoration actions in the Willamette River channel.
- Having a project manager who worked directly with the consultants through each phase of the project: Developing of the scope of work; field inventory of fish and wildlife populations and habitat; analysis; and report writing.

OWEB 99-101
cKenzie Confluence Evaluation

380.00	$1,080.00	$8,760.00	$16,380.00	$3,520.00	$6,594.00	86,014.00			OWEB Releases		
bitat	Water	GIS	Products	Equip. Supplies Travel	Admin.	Total	Check #	Ck Date	Req / Rec Date	Req. Amt.	Rec'd
						1,200.00	842	12/21/99	08/23/99	3600.00	
	600.00	1200.00	540.00	2427.76		19,032.76	860	01/04/00	10/15/99		3,600.00
						1,200.00	869	01/14/00	12/15/99	35,342.76	
		1460.00		418.40		5,138.40	1025	03/02/00	01/31/00		35,342.76
						1,200.00	1026	03/02/00			
	120.00	2000.00		287.50		4,327.50	1062	04/06/00			
						1,200.00	1067	04/18/00			
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						1,200.00	1053	03/30/00			
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			8930.00			4,591.80	1144	07/12/00			
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Remaining Balance to Request	$8,603.50
Remaining Balance to Receive	$8,603.50
Remaining Unspent Balance	$0.00
Current Cash on Hand	$0.00
Previous Requests:	$77,410.50
Current Request:	$8,603.50
Total To Date:	$86,014.00
10% Remaining:	$0.00
Grant Award	$86,014.00

Work plan
October 27, 1999

Aquatic and riparian assessment and project evaluation for the confluence areas of the McKenzie River and Willamette River

AWA Resource Network

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(541-745-7092)

: Attachment A

We present in this document a plan for conducting the aquatic / riparian habitat assessment of the McKenzie and Willamette Rivers confluence area. The confluence area includes the Willamette River downstream of river mile 178.2 (Beltline Road bridge) to river mile 171.5 and the McKenzie River from its confluence to the Interstate Highway 5 bridge (about 4 miles long). Included are the main channels of both rivers and off-channel areas that have connection to the main channels at any time. For purposes of wildlife habitat, the study area also includes land and water bodies up to a mile from the main channel of the rivers.

For each major topic included in the analysis (fish, wildlife, water quality) we present a discussion of the dominant issues that concern the audience of this assessment, sources of information that we will use to address the issues, and approaches to analyzing the information. We end with a discussion of the final products associated with this assessment. Each topic includes specific tasks that are provided at the end of the document. A summary of the tasks and a time line for finishing each task is provided in Table 1.

Fish

Issues

The lower McKenzie River has long been considered one of the best trout fisheries in Oregon. Strict fishing regulations, along with high water quality, has resulted in high densities of large native cutthroat and rainbow trout. The McKenzie River also hosts one of the last remaining wild stocks of spring chinook salmon in the Willamette Basin. Since their listing as Threatened under the Federal Endangered Species Act in 1998, there has been a special focus on protecting spawning and rearing opportunities for these fish. A host of other native species occupy the McKenzie River and upper Willamette River, as well as introduced fish that may negatively influence both native fish and wildlife.

The overall purpose for evaluating fish in the confluence area is to develop an understanding of the fish currently occupying the area and develop strategies for protecting or improving conditions for native fish. In order to accomplish this we will:

1. Evaluate the current quality and use of habitat along natural and altered river banks.

2. Determine the historical quality of fish habitat.

3. Explore interactions between introduced and native fish species.

4. Focus special attention on the habitat needs of AThreatened@ fish species (spring chinook salmon, bull trout, and Oregon chub).

5. Identify restoration principles that will improve native fish habitat within main channel and off-channel features of the confluence area, in light of land use activities that occur in the area.

Sources of fish information

Information on fish habitat and species interactions are sparse for the confluence area. We will use existing information gathered on stretches of the rivers upstream and downstream of the confluence area, as well as new data gathered during the course of this assessment. Fish information can be classified as representing current conditions or as representing recent or past historical conditions and are discussed below.

Current information on fish abundance and habitat characteristics

We will sample fish in the confluence area during late summer, 1999 and late winter, 2000 in order to develop relationships between habitat type and the relative abundance and community structure of fish. Thirty sites will be sampled (electrofishing at night) in the fall, representing a variety of main channel, side channel, pond, and alcove features. Main channel sites will include both riprapped (regular and with barbs) and natural banks. Site information gathered during sampling will include water temperature, dissolved oxygen, conductivity, depth, velocity, and bank characteristics. Sampling in the fall provides an examination of fish assemblages immediately following the period when water temperature, dissolved oxygen, and predation are most limiting to survival and growth.

Thirty to forty sites will be electrofished in the late winter, the time when high velocity water can potentially limit fish communities in the study area. A special focus will be on refuge habitat used by juvenile spring chinook during the winter. The 30 sites sampled in fall will be included in the winter sampling, as much as possible. Additional sites will be added to increase sampling effort in off-channel areas. Habitat parameters gathered during the winter will be the same as those gathered in the fall.

Information on fish relative abundance and community structure for sites in the Willamette River from Corvallis to the McKenzie River confluence are available from the EPA Research Laboratory for summer, 1998 (56 sites) and spring, 1999 (18 sites). They plan to continue sampling (18 sites) in late winter 2000. A site includes a main channel reach and an adjacent off-channel area. Sampling methods used by the EPA are compatible with methods used during our sampling periods.

The Oregon Department of Fish and Wildlife (ODFW), research laboratory has recently installed a screw trap in the McKenzie River immediately upstream of its confluence with the Willamette River. They will track about 3000 marked juvenile chinook this fall and another 3000 in the early spring to understand more about the timing of their downstream migrations. A second screw trap will be installed near Harrisburg in the spring.

The ODFW office near Corvallis has seined trout holes during August from 1993 to the present These sites are distributed from Corvallis to the McKenzie River confluence, with about 10 sites upstream of Harrisburg. These data provide a seven year record of fish community and size class distribution during a period when fishing regulations tightened.

Current aerial photographs (summer, 1999) provide information on habitat characteristics that can be gleaned from remote sensing. These photos will provide information on the quantity and spacial distribution of main channel and off-channel characteristics.

Historical information on fish abundance and habitat characteristics

Fish sampling conducted by ODFW (electrofishing during the day) in the early 1990's may be useful for understanding fish community structure within the McKenzie River upstream of the Interstate 5 bridge. An additional data set for the 1970's that includes the reach downstream of the bridge may also provide information on fish community structure during a period when fishing regulations were relatively lax.

We have heard reference of fish habitat information gathered between 1936 and1942 by the U.S. Bureau of Fisheries for the McKenzie River. We will track down this information and determine whether or not this historical data has bearing on the current study.

Historic aerial photographs (1936) can provide information on habitat characteristics that existed prior to major human disturbance. We will use these photos to provide information on the quantity and spacial distribution of main channel and off-channel characteristics.

Analysis

1. We will use project and EPA data to establish relative fish abundance and community structure for: a) natural banks, b) riprapped banks, c) riprapped banks with barbs, d) alcoves, e) natural ponds, and f) gravel removal ponds for the confluence area. We will also identify complicating factors such water depth and velocity, aquatic plant abundance, water temperature, dissolved oxygen, fishing pressure, connectivity to the main channel and upstream influences.

2. We will use the above relationships and inventories of past, current, and proposed future abundance of each water or bank type to estimate changes in fish relative abundance and community structure from 1936 to the present.

3. We will use project, EPA, and ODFW Research data to determine downstream movement and areas of refuge for juvenile chinook salmon during the spring and summer.

4. We will use 1993-1999 ODFW data of trout holes in the upper Willamette River and 1970's ODFW data of the McKenzie River to determine whether or not restrictive fishing regulations has changed the size structure for cutthroat and rainbow trout.

5. We will use project, EPA, and ODFW data to determine negative interactions between predator fish and prey fish (squawfish predation on introduced fish and salmonids,

introduced fish predation on salmonids and other prey fish).

6. We swill use all sources of information, including results of the engineering study for the confluence area, to develop restoration principles for enhancing native fisheries while providing reasonable flood protection for gravel extraction operations.

Wildlife

Issues

Past activities in the confluence area have created a mosaic of heavily disturbed land, as well as areas of undisturbed riparian forest. In addition, ponds created during aggregate removal currently provide unique features with some mimicing natural wildlife habitat features. Overlain on this landscape is a variety of introduced species of wildlife and fish that interact with native wildlife in various ways.

The overall purpose for evaluating wildlife in the confluence area is to develop an understanding of the wildlife currently occupying the area and develop strategies for protecting or improving habitat for native wildlife. In order to accomplish this we will:

1. Identify and map current quality and use of habitat on disturbed and undisturbed land in the confluence area.

2. Determine the historical quality of wildlife habitat.

3. Explore interactions between native wildlife and introduced wildlife and fish species.

4. Focus special attention on the habitat needs of certain high-profile species (osprey, bald eagle, red-legged frog, and western pond turtle).

6. Identify restoration principles that will improve native wildlife habitat, in light of the traditional land uses that occur in the confluence area. Furthermore, we will identify areas that provide the best habitat to the widest variety of native wildlife species.

Sources of wildlife information

Knowledge of Willamette Valley wildlife and habitat associations has increased greatly in the last few years. While little is known of wildlife abundance and habitat relationships prior to European settlement, patches of riparian vegetation that has been relatively undisturbed by humans provide a glimpse of those relationships. Relationships between wildlife and vegetation type, once understood, can then be used to estimate relative wildlife abundance for current conditions and those that existed in the 1930's, a time when undisturbed riparian vegetation was more dominant in the confluence area.

Current wildlife abundance and habitat characteristics

Initially, we will compile and synthesize previously published information and databases pertaining to wildlife in the confluence area. These sources include information gathered by the Oregon Department of Fish and Wildlife (Springfield office), Oregon Natural Heritage Program, Army Corps of Engineers, Bureau of Land Management, and the Lane County Bird Atlas Project.

About 29 basic habitat categories have already been mapped from 1994 satellite imagery for the Willamette Valley at a resolution of 100' by 100' pixels by the Ecosystems Research Consortium (a group of university and government scientists). Relationships between these habitat categories and about 200 wildlife species have already been developed by Adamus Resource Assessment Inc. and will be applied to the confluence area. We will enhance the sensitivity of these relationships by overlaying information about soil wetness and distance to open water.

We will conduct a qualitative (presence/absence) inventory of amphibians and reptiles from February to April, 2000. Timed search methods will be used to survey salamanders, frogs, and turtles. In addition, we will set out artificial substrates and check them periodically for snakes. Particular attention will be given to identifying areas of current or potential use by the rare western pond turtle and red-legged frog and the introduced bullfrog.

In addition, we will conduct a quantitative inventory of wintering and migrant waterfowl, shorebirds, osprey, and bald eagle from January to June, 2000. We will estimate relative abundance of species in various mapped habitats. The inventory will not be comprehensive, but rather will focus on representative habitats within the confluence area where information is most lacking (e.g. gravel extraction areas). Relative abundance will be expressed in terms of heavy, moderate, and light use within a habitat type.

We will verify vegetation mapping from aerial photographs and satellite imagery through field visits. During these visits we will also note where introduced plants (e.g. Himalayan blackberry and Scot=s broom) is most severe and to identify fragments of locally uncommon but important habitat types.

Historical fish abundance and habitat characteristics

We will use aerial photographs from the mid 1930's to develop a vegetation and wetland type map for Alesser disturbed@ conditions in the confluence area. The wildlife habitat relationships discussed above will then be applied to this historic landscape to estimate relative abundance and species composition throughout the confluence area.

Analysis

1. Information from the amphibian and bird inventories will be used to refine relationships between wildlife species and habitat types. A revised map of vegetation types and wildlife distribution will the be developed for the confluence area. By summing the individual species range maps, we will be able to identify areas that potentially provide the best habitat to the widest variety of native wildlife species or, alternatively, to the largest number of uncommon native wildlife species. We will then categorize ownership and existing land uses on these wildlife-rich areas. We will do this for both current conditions and for Alesser disturbed@ (mid-1930's) conditions.

2. We will use information from a variety of sources mentioned above to describe special habitat needs of certain high profile species such as osprey, bald eagle, great blue heron, western pond turtle, and red-legged frog.

3. We will use information from a variety of sources mentioned above to describe negative interactions between certain introduced and native species.

4. We will use all sources of information, including the engineering report on flooding in the confluence area, to develop restoration principles for enhancing native wildlife while providing reasonable flood protection for gravel extraction operations. We will include descriptions of strategies already being implemented in the Pacific Northwest to enhance wildlife. We will assess the success potential of these strategies in the confluence area. Examples of these strategies include: a) moist soil management to benefit shorebirds and waterfowl, b) restoration of wet prairie, cottonwood stands, and oak woodlands, c) construction of shorebird scrapes, and nest platforms for osprey and other species, and d) control of introduced wildlife species that threaten native wildlife through habitat modification.

Water Quality

Issues

The McKenzie River is known for exceptionally high water quality. High clarity, low temperature, and high dissolved oxygen levels of the river are a result of the underlying geology and management of the river. The Willamette River upstream of the McKenzie River confluence drains a different geology and human influences. As a result, the Willamette River has a different level of water quality. Most notably, the Willamette River has less clarity than the McKenzie River. Because water characteristics can influence the quality of habitat for some fish and wildlife, we will:

1. Examine current and historical patterns of water temperature, dissolved oxygen, and nutrients within main channel and off-channel features and compare these to the habitat needs of fish and wildlife.

2. Determine the quality of water exiting gravel extraction areas.

3. Evaluate the quality of water discharged immediately upstream of the confluence area at the City of Eugene sewer treatment plant outfall.

4. Identify restoration principles that will improve water characteristics that influence fish and wildlife within main channel and off-channel features of the confluence area.

Sources of information

Information on water characteristics for the confluence area is relatively extensive due, in part, to an extensive study being conducted by the EPA Research Laboratory (1996 to the present) for the upper Willamette River. About 20 parameters for water quality have been gathered in longitudinal transects from the Yamhill River confluence to the McKenzie River confluence. These data have been gathered for both summer and winter conditions and include samples for alcoves and the main channel. Separate samples of the McKenzie River and Willamette River upstream of the confluence are also included. Water parameters of special interest to the confluence project are water temperature, dissolved oxygen, conductivity, turbidity, pH, nitrogen (all species), phosphorus, and chlorophyll *a*.

We will also gather water characteristics (water temperature, dissolved oxygen, and conductivity) while sampling fish and conducting other field work during the confluence study. We will pay particular attention to identifying off-channel features that have very low dissolved oxygen levels at night due to plant decay and/or interception of groundwater.

Water discharged at the sewer treatment plant outfall is monitored by the City of Eugene

and will provide us information on water characteristics of the Willamette River upstream of the confluence. These data extend for a number of years and will include the influence of a water treatment upgrade that occurred prior to summer 1998 and resulted in a marked reduction of ammonium and phosphorus at the outfall.

We will have current aquatic insect data downstream of sewer treatment plant outfall provided by the City of Eugene for the Willamette River and for the McKenzie River provided by the McKenzie Watershed Council. These data will allow us to compare the type of food available to fish in each river and provide some evidence on differences in fish communities between the two rivers.

Analysis

1. We will use project and EPA data to describe current water quality for the main channel and off-channel areas and note where water conditions could negatively influence fish and wildlife habitat.

2. We will use EPA and City of Eugene water quality data to examine possible negative influences of water quality on fish habitat downstream of the sewer treatment plant outfall.

3. We will use City of Eugene and McKenzie Watershed Council aquatic insect data to determine relationships between food supply for fish and water quality.

4. We will use all sources of information to develop restoration principles for enhancing water quality that would benefit native fish and wildlife, while providing reasonable flood protection for gravel extraction operations.

Products

We intend to produce a variety of products that will satisfy the needs of the diversity of customers that we anticipate will use the study results. We will provide both easy-to-understand summary products and detailed technical products.

1. We will produce a 30-page summary document directed at a general audience that includes color figures and maps. Include in this document will be the major findings on fish, wildlife, and water quality in the confluence area. We will also include discussions about interactions between flood protection and fish/wildlife habitat, as well as restoration principles aimed at conditions in the confluence area.

2. We will produce an easy-to-operate MapObject computer product that will allow users to view maps and data summaries for historic, current, and restored conditions. They will be able to make basic queries of the data sets (for example, display areas of high quality refuge for juvenile chinook salmon for historic and current conditions).

3. We will also produce ArcInfo data layers that will allow experienced users of GIS software to view information behind the MapObject product.

4. We will produce a detailed report with graphics presenting information on fish, wildlife, and water quality. Included in the report will be sampling techniques, information limitations for each source, evaluation details, and scenario descriptions and assumptions.

5. Finally, we will produce a slide show presentation (including script) that would be suitable for anyone on the steering committee to deliver to a general audience.

The following is a list of tasks associated with the assessment process that was outlined above:

A. General project management

Task 1. Conduct activities needed for startup and operating the project including, periodic meetings with steering committee members and the contract administrator, development of a final project plan, and talking to landowners to gain permission for access to sites in the study area.

B. Create composite aerial photograph for field work

Task 2. Create a rectified composite aerial photograph of the study area for marking the location of sampling sites and for general orientation. Overlapping aerial photographs from July, 1999 will be used to construct the composite and USGS quad maps will be used for rectification. The composite aerial photograph will be the foundation for other mapped features in later stages of the study.

C. Fish sampling

Task 3. Design and conduct a late summer fish sampling procedure for the confluence area that includes main channel, alcove, and pond sites. The fish sampling procedure will include systematic sampling of various habitat types at night using electrofishing gear. Fish information includes species, fork length, hatchery markings, and outer anomalies. Site information includes water temperature and dissolved oxygen, water velocity and depth, and a description of the length and type of bank sampled for fish at each site. The late summer fish sampling will include about 30 sites.

Task 4. Input late summer fish sampling information into a computer database and create tables and charts to summarize data. Data will be summarized by fish functional groups (scrapers, predators, salmonids, other native fish, and introduced fish) and size class. Additional summaries will be created for species of special interest (trout, juvenile salmonids, introduced largemouth bass). Associations between fish relative abundance (and assemblage composition) and habitat features will also be identified.

Task 5. Design and conduct a late winter fish sampling procedure for the confluence area that includes main channel, alcove, and pond sites. The fish sampling procedure will include systematic sampling of various habitat types using electrofishing gear. Fish information includes species, fork length, hatchery markings, and outer anomalies. Site information includes water temperature and dissolved oxygen, water velocity and depth, and a description of the length and type of bank sampled for fish at each site. The late winter fish sampling will include about 30 sites.

Task 6. Input late winter fish sampling information into a computer database and create tables and charts to summarize data. Data will be summarized by fish functional groups

(scrapers, predators, salmonids, other native fish, and introduced fish) and size class. Additional summaries will be created for species of special interest (trout, juvenile salmonids, introduced largemouth bass). Associations between fish relative abundance (and assemblage composition) and habitat features will also be identified.

D. Wildlife sampling

Task 7. Conduct an inventory of amphibians and reptiles in the study area. This will be a qualitative (presence/absence) inventory, to estimate the kinds of amphibians and reptiles associated with particular habitats during the February B April period. Timed search methods will be used to survey salamanders, frogs, and turtles in representative plots in selected habitat types. In addition, artificial substrates will be placed and checked in each habitat in order to survey for snake species. Information will be used to check the accuracy of the models used in Objective 2. Particular attention will be given to identifying areas of current or potential use by Western Pond Turtle, Red-legged Frog, and Bullfrog, and measuring habitat and water chemistry features in those areas.

Task 8. Conduct preliminary inventory, by habitat, of wintering/migrant waterfowl, shorebirds, osprey, and bald eagle. This will be a quantitative inventory, to estimate relative abundance of species in various mapped habitats, and distribution of species within the study area. The inventory will not be comprehensive, but rather will focus on representative habitats and geographic areas within the planning area where information is most lacking, e.g., gravel-mined riparian areas. Habitat conditions in areas with heavy, moderate, and light use by various species will be noted.

E. Compile and summarize other fish information

Task 9. Compile, evaluate, and summarize data sets from other fish sampling efforts in the study area. These other fish sampling efforts include summer, 1998 and spring, 1999 electrofishing of the upper Willamette River by the EPA Research Laboratory; summer, 1993-1999, trout hole seining of the upper Willamette River by ODFW; early 1990's electrofishing of McKenzie River upstream of I5 bridge by ODFW; 1970's electrofishing of McKenzie River by ODFW; and 1936-1942 fish habitat and fish surveys by U.S. Bureau of Fisheries.

F. Compile and summarize other wildlife information

Task 10. Compile and synthesize previously published information and databases pertaining to wildlife and terrestrial resources of the planning area. We will obtain and compile wildlife information, for example, from the Oregon Department of Fish and Wildlife (Springfield office), Oregon Natural Heritage Program, Army Corps of Engineers, BLM, and EPA. Also included will be information from the Oregon Breeding Bird Atlas Project and the Lane County Bird Atlas Project. This information will be referenced, when possible, to specific gravel/riparian management areas.

Task 11. Identify distribution of habitat categories using existing aerial imagery and GIS. Some 29 basic habitat categories have already been mapped from 1994 satellite imagery for most of the study area at a resolution of 30 meters by the Ecosystems Research Consortium (a group of university and government scientists). The use of each of these categories by each of 280 wildlife species is characterized by models developed by Adamus Resource Assessment, Inc. We will enhance the sensitivity of the models by overlaying existing digital maps of soils and other features to broaden the categories, and will revise the models accordingly. Preliminary maps that predict the distribution of each of 200+ wildlife species in the study area will then be generated and used to focus the field inventories.

G. Current and historic habitat features

Task 12. Map and compare current and historic fish habitat features in the study area. Water features related to fish habitat will be mapped and compared using 1999 and 1930's aerial photographs. Aerial photographs from various periods within this 65-year span may be used to identify abrupt shifts in fish habitat features.

Task 13. Map and compare current and historic wildlife habitat features in the study area. Vegetative and water features related to wildlife habitat will be mapped and compared using 1999 and 1930's aerial photographs. Aerial photographs from various periods within this 65-year span may be used to identify abrupt shifts in wildlife habitat features.

H. Water characteristics

Task 14. Compile and summarize water quality data for the study area. Water characteristics that potentially explain current patterns of fish and wildlife use will be compiled and synthesized using the following studies: a) water temperature, dissolved oxygen, and conductivity data gathered during fish sampling and other times by ourselves, b) extensive water parameter evaluation in 1996-1999 by EPA Research Laboratory for the Willamette River upstream of Corvallis, c) aquatic insect monitoring downstream of sewer treatment plant outfall by City of Eugene and, d) aquatic insect monitoring within the McKenzie River by McKenzie Watershed Council.

I. GIS development

Task 15. Develop GIS overlays on field site locations and data summaries. Site locations for our study or other studies on fish, wildlife, and water quality will be mapped and summary information included for each site. Habitat features gathered from aerial photographs or site visits will also be included. Modeling data on wildlife will provide an additional overlay.

Task 16. Incorporate pertinent information from the flood and hydrology study. Information developed by Northwest Hydraulics that is related to fish and wildlife habitat

and that may be useful for developing specific restoration principles applicable to the study area will be incorporated into the GIS.

Task 17. Develop a MapObject product that can be used to display summary information on fish, wildlife, and water quality in the study area. This GIS product will allow users easy access to data gathered for the project, as well as, summaries that relate fish and wildlife abundance to habitat features. MapObject is a stand-along GIS product that can provide pre-defined queries for users and display results on the computer screen.

J. Synthesis and final products

Task 18. Synthesize information and write a draft detailed report. Upon synthesizing all available information for the study area, we will prepare a draft version of a report that provides details on methods, information sources and summaries, data quality and limitations, fish and wildlife quality/quantity for historic and current conditions, bottlenecks that limit fish and wildlife, and habitat restoration principles specific to the confluence area.

Task 19. Develop final version of the detailed report. Following review of the draft detailed report by the steering committee, we will develop a final version that takes under consideration changed recommended by the committee.

Task 20. A final MapObject product will be developed that provides users an easy-to-use interface with the GIS information.

Task 21. Create a summary report. We will create a 30-page summary document with color figures and pictures that highlights findings and recommended restoration principles for the confluence area.

Task 22. Create a slide show. We will create a slide show with written script that is suitable for presenting project findings to a general audience.

Table 1. Summary of tasks and time lines.

Tasks	Time line
A. General project management Task 1. Startup, steering committee, project plan	Sept. 1999-July 2000
B. Composite aerial photograph Task 2. Create rectified composite aerial photograph	Sept. 1999
C. Fish sampling Task 3. Conduct late summer field work Task 4. Summarize late summer fish sampling data Task 5. Conduct late winter field work Task 6. Summarize late winter fish sampling data	Sept. 1999 Oct.-Nov. 1999 Jan.-Feb. 2000 March-April 2000
D. Wildlife sampling Task 7. Field inventory of amphibians and reptiles Task 8. Field inventory of selected birds	Feb.-April 2000 Jan.-June 2000
E. Other fish information Task 9. Compile and summarize other fish data	Nov. 1999-Jan. 2000
F. Other wildlife information Task 10. Compile and summarize other wildlife data Task 11. Evaluate modeling results	Dec. 1999-March 2000
G. Current and historic habitat features Task 12. Current and 1930's fish habitat Task 13. Current and 1930's wildlife habitat	Dec. 1999-Jan. 2000 Dec. 1999-Jan. 2000
H. Water characteristics Task 14. Compile and summarize water quality data	Dec. 1999-Feb. 2000
I. GIS development Task 15. Develop fish/wildlife site and data layers Task 16. Incorporate flood/hydrology study results Task 17. Develop MapObject product	Oct. 1999-May 2000 Oct.-Dec. 1999 Feb.-May 1999
J. Synthesis and final products Task 18. Synthesis and draft detailed report Task 19. Final detailed report Task 20. MapObject final product Task 21. Summary report Task 22. Slide show	April-May 2000 June 2000 June 2000 July 2000 July 2000