SECTION I

REACH FILE OVERVIEW

The purpose of this document is to provide a tool for describing the location of rivers or portions of rivers in Oregon. This guide is intended to complement applications of the United States Environmental Protection Agency's (EPA) river reach file used by the Oregon River Information System (ORIS), Bonneville Power Administration's (BPA) Northwest Environmental Database (NED), and the Northwest Power Planning Council (NWPPC). Included in this document are:

1. a brief description of the development of the EPA river reach system and examples of how to use this guide to encode a stream location with a river reach number, or to locate geographically a river reach number **(SECTION I)**;

2. an atlas of Oregon Water Resources Department (OWRD) maps and complimentary river reach plots **(SECTION II)**;

3. a table listing Oregon streams and the river reaches within each stream **(SECTION III)**;

4. a table listing the river reaches in Oregon and their stream names **(SECTION IV)**; and

5. documentation of the variables and values used in the electronic river reach file that will be used by Oregon Department of Fish and Wildlife's (ODFW) Coordinated Information Services staff and that was used to create the tables in Sections III and IV **(SECTION V)**.

6. An errata sheet at the end of this section that lists errors identified in this guide prior to its distribution.

OVERVIEW

This guide uses the so called "Council-enhanced 1:250,000 scale river reach file". The "enhanced reach file" was developed from the original EPA reach file.

ORIGINAL REACH FILE

Prior to 1986, the EPA created a national data base of information on surface water features in the U.S. for purposes including:

1. to list stream names, location attributes, and hydrologic features;

2. to maintain a standard consistent with United States Geological Survey (USGS) basin codes and Federal Information Processing Standards (FIPS);

3. to allow computer representation of river systems for water resource analyses that require information on hydrologic structure;

4. to display graphically water bodies and other geographic features; and

5. to provide information on watersheds to support water quality analyses and reporting (Horn 1986).

Streams named on 7.5-min maps were traced. Reaches were identified and assigned unique numbers. Attributes of the reaches were determined and encoded in a computer file along with the reach number and stream name. Stream characteristics encoded in the reach file include reach lengths, latitude and longitude of points within the reach, and sinuosity. Other attributes of reaches include adjacent reaches and the order within a stream or basin in which reaches are connected.

A typical reach is defined by a downstream beginning point that begins at the mouth of a stream or the point where a tributary enters the stream, and an upstream ending point at the headwaters of the stream or the point where another tributary enters the stream. These reaches are called "transport" reaches because they describe a path along which water flows. "Non-transport" reaches were also identified to describe the shores of lakes, islands, or bays (*see* **SECTION V, REACH FILE DOCUMENTATION** for specific descriptions of types of reaches).

A reach number consists of an 8-digit "hydrologic cataloging unit" number that identifies the basin in which the reach exists; a 3-digit "segment" number that identifies a reach or series of reaches; and a four-digit two-place fixed decimal number called a "river mile index" that in conjunction with the segment number identifies one single reach. The number 1708000106000.00 identifies the reach at the mouth of Cedar Creek. 17080001 identifies the Sandy River Basin and 06000.00 is the lowest downstream reach of Cedar Creek (Section II, Oregon City map and hydrologic plot; Section III, Table 1, page 14; Section IV, Table 2, page 31).

PRESENT REACH FILES

In 1985, BPA convened a Geographic Information System (GIS) task force to direct its effort in conducting mapping and spatial analysis of water resources to determine how much future hydroelectric power could be obtained in the Pacific Northwest (Pansky 1988, Oregon Department of Energy 1987). The task force determined that information pertaining to water bodies should be tied to the EPA's tabular and graphic river reach file at 1:250,000 scale. This information compilation effort became known as the "Northwest Environmental Data Base" (NED). NED currently consists of BPA's regional GIS and four state "River Information Systems" maintained by Idaho, Montana, Oregon, and Washington. The Oregon River Information System (ORIS) is administered by Oregon Department of Fish and Wildlife (ODFW) under contract to BPA.

Concurrent to the development of the river information system, NWPPC conducted a regional evaluation of portions of the Pacific Northwest's anadromous fish resources (Forsberg 1994). In support of NWPPC's anadromous fish evaluation, fisheries management agencies began creating subbasin plans to be integrated into a NWPCC "System Plan" that could be used in identifying salmon and steelhead production options to realize the NWPPC Fish and Wildlife Program goal of doubling anadromous fish runs in the Columbia River Basin (NWPPC 1987; memorandum dated 6 June 1988 from System Planning Group of the Columbia Basin Fish and Wildlife Authority, Portland, Oregon). The subbasin planning process was perhaps one of the most thorough applications of the EPA river reach system to describe stream locations in Oregon, and was largely responsible for the "enhancement" of the EPA river reach file.

NWPPC added attributes to the reach file including stream widths. It also began providing higher resolution to the reach file by adding additional streams and reaches that appeared on USGS 1:100,000 scale maps. The order in which reaches were added to the original EPA file has been arbitrary, based on the order in which subbasin planners and NWPPC staff identified a need for additional reaches or inconsistencies in the original reach file. As well as adding reaches and reach attributes, NWPPC (and BPA) simplified, changed, or deleted original EPA reach attribute variables (Horner 1986; Forsberg 1994; personal communication on 30 August 1994 with Duane Anderson, Pacific States Marine Fisheries Commission, Gladstone, Oregon; memorandum dated 22 May 1992 from Cathleen Woore, Washington Department of Ecology, Olympia, Washington).

Presently, NWPPC and ORIS maintain reach files and use them in different applications. The reach file that is used and documented in this guide was created by standardizing variables among NWPPC and ORIS files, and reconciling inconsistencies identified in both files.

Efforts are currently being made to create a reach file that has the same resolution as USGS 1:100,000 scale maps. BPA is coordinating these efforts with agencies in Idaho, Montana, Oregon, and Washington that are conducting the work in their states. The Oregon State GIS Service Center of the Oregon Department of Energy is creating the 1:100,000 scale reach file for Oregon under contract to BPA.

USING THE REACH FILES

Use of the EPA reach files to encode river locations provides several advantages over other location coding conventions. The EPA reach system has a finer resolution than other state-wide coding conventions used in Oregon such as ODFW's "IBM" stream codes or the numeric code used by OWRD to designate an entire stream (rather than a reach within a stream). Attributes in the file relate each reach to other reaches within a river system allowing greater flexibility in manipulating subsets of data associated with reach numbers. The EPA reach file is recognized as a regional standard and in theory allows EPA reach-encoded data sets pertaining to locations in different states to be easily combined and manipulated across political or jurisdictional boundaries.

The greatest disadvantages of using the EPA reach files are the difficulties encountered when attempting to:

1. understand what values are used for different variables;
2. understand what the variables represent;
3. identify where reaches are located;
4. coordinate the transmission of changes or corrections to reach files among those who use the reach files; and
5. describe lakes, bays, or very large rivers.

The only formal documentation of variable definitions and values for Oregon reach attributes is provided in the ORIS user's manual (Forsberg 1994). However, the ORIS reach file has been modified to meet specific applications and does not include all EPA reaches in Oregon. Its documentation does not completely explain some of the variables or allowable values of variables in the reach file. It also contains variables that are not relevant to describing locational or physical attributes of reaches.

Maps that show reach locations are available from PSMFC or NWPPC, but those maps plot relative reach positions and reach numbers only and do not show the names of streams or any geographic features that would be helpful to find or verify a reach's geographic location. Determining who is accountable for changes or corrections to reach files is sometimes unclear. Because the reach system focuses primarily on streams and rivers, its use in describing Oregon lakes, bays, or the Columbia River is limited.

HOW TO USE THIS GUIDE

The maps and tables in this guide can be used to encode a stream location with a river reach number or find the location and stream name for a reach number. Some streams and reaches will be difficult to find. Some streams may not appear on the maps or tables and some reaches may not appear on the hydrologic plots. If you need assistance using this guide, note any inconsistencies, or have any comments please call or write:

Eric Tinus
Oregon Department of Fish and Wildlife
Columbia River Research
17330 SE Evelyn Street
Clackamas, Oregon 97015

Telephone: 503-657-2035
Facsimile: 503-657-6823

Ray Beamesderfer
Oregon Department of Fish and Wildlife
Fish Division
P.O. Box 59
Portland, Oregon 97207

Telephone: 503-229-5410 ext. 316
Facsimile: 503-229-5602

ABOUT THE MAPS

Section II contains maps of Oregon streams and rivers and plots of the rivers and streams with reaches labeled by reach number. The maps and plots show areas depicted in USGS 1:100,000 scale quadrant maps, are labeled by USGS name, and ordered alphabetically. For each named quadrant, maps appear on the left-facing page and plots appear on the right-facing page. Maps show waterbody names and geographic features. Plots show river system traces and river reach numbers only. The plots show hydrologic cataloging units ("HUC") bounded with bold lines. Within the hydrologic unit, reaches are numbered. The maps are

photocopies of OWRD water resource maps of watersheds in Oregon. OWRD maps were photo-reduced or enlarged and spliced to approximate the scale and area of USGS quadrant maps. The plots are modified copies of EPA plots produced and distributed by NWPPC.

The first page of Section II shows where EPA hydrologic cataloging units and OWRD watersheds are located in Oregon. The second page of Section II shows where in the state each USGS quadrant is located.

Because the maps are colored black and white, distinguishing between streams and roads or other lines on the maps may prove difficult. Because the maps have been spliced, some stream names near the margins of splices may be missing or difficult to read. Color maps of 18 watersheds in Oregon may be purchased by calling OWRD Maps and Publications (503-378-8455). USGS 1:100,000 scale maps may be purchased through the Oregon State Nature of Oregon Information Center (503-731-4444). About 70 1:100,000 scale USGS maps cover the state of Oregon.

ABOUT THE TABLES

Table 1 in Section III lists all the stream names alphabetically for all the transport and non-transport reaches in Oregon. For each stream name, the attributes "Tributary of:", "Map name", and "Reach position" are listed as well as the numbers for the reaches in the streams. "Tributary of:" is the body of water into which the stream flows. "Map name" is the name of the USGS 1:100,000 scale map that shows the stream. "Reach position" describes where the numbered reach lies within the stream. In a stream that has only a single reach, the reach position is described as "ONLY ONE". In a stream with two or more reaches, reach position is described as "MOUTH" if the numbered reach lies at the mouth of the stream and "HEAD" if the numbered reach lies at the headwaters of the stream. In streams with three reaches or more, the position of numbered reaches that lie between the "MOUTH" reach and the "HEAD" reach are described as "MIDDLE".

Table 2 in Section IV lists all the river reach numbers ordinally for all the stream names listed in Table 1, Section II. In addition to the attributes listed in Table 1, the variables "Downstream reach number" and "Upstream reach number" are listed for each reach. The downstream reach number is the number of a reach that connects into the downstream end of the listed reach. The upstream reach number is the number of a reach that connects into the upstream end of the listed reach. If no reach connects into the upstream end of the listed reach, "Upstream reach number" is blank.

ASSIGNING REACH NUMBERS TO STREAM LOCATIONS

To encode a stream location with a river reach number, look in Section III, Table 1 for the name of the stream. If more than one stream with the same name appears, determine which stream is the correct one by looking under "Tributary of:" for the name of the river the stream flows into. If you wish to designate the entire stream with a reach number, or if you know the point you wish to describe is near the mouth of the stream, look under the heading "Stream position". If the entry is "ONLY ONE" or "MOUTH", the reach number listed will correctly describe the location.

If the stream location you wish to encode is in a stream with more than one

reach, locate the stream on the appropriate map. Find the location within the stream. Look on the right facing page at the same relative location within the quadrant as that on the left facing page. Trace along the stream on the plot to the point that best approximates the point on the stream on the map. Record the hydrologic unit number (8 digits), and then the segment number (3 digits), and finally the river index number (4 digits with two decimal places). To verify the reach number is the correct one, find an adjacent reach that appears to be in a different stream and record its reach number, look at the map to find the name of that different stream, and look up the reach number in Table 2, Section IV. If the name on the map is the same as the stream name listed in Table 2, the stream location was encoded with the correct reach number.

LOCATING REACHES BY NUMBER

To locate a reach by number, look up the reach number in Table 2, Section IV. If the reach is a transport reach (not printed in bold face type), record the stream name and map name. Turn to the named map in Section II. Look at the plot and identify what area of the quadrant to look at by finding the reach's hydrologic unit number. Within the hydrologic unit find the segment number and river index number. Look at the same relative location on the map. Verify the location is correct by looking at the stream name and surrounding geographic features.

If you are unable to easily find the reach number on the plot, look in Table 2 again, and record the numbers of upstream or downstream adjacent reaches. Try to find these reaches on the plot to help locate the first reach. If you are still unable to find the reach, the reach may not be shown on the plot because it is an "artificial" reach (*see* **SECTION V, REACH FILE DOCUMENTATION** for specific descriptions of types of reaches).

An alternative way to locate a reach by number is to look at the first page of Section II, find the hydrologic unit in which the reach exists, turn to the second page and find the map quadrants that approximate the area of the hydrologic unit, and turn to those maps. This method of locating reaches may be slower than using Table 2 for reaches within a hydrologic unit that falls within multiple map quadrants.

ACKNOWLEDGEMENTS

Duane Anderson and Brent Forsberg assisted greatly to explain what is in the "Council-enhanced 1:250,000 scale" reach file and to help reconcile inconsistencies in the file. They also provided reach file copies that became the basis for the tables included in this guide. Ray Beamesderfer provided helpful comments on earlier versions of this guide. The EPA plots in the map section are reproduced from materials provided by NWPPC. The maps featuring hydrologic features were reproduced from watershed maps purchased from and created by OWRD. Preparation of this guide was supported through funding provided by Bonneville Power Administration for the Coordinated Information System Project administered by PSMFC.

REFERENCES

Forsberg, B. 1994. Oregon rivers information system operation manual. Habitat and Conservation Section, Oregon Department of Fish and Wildlife, Portland.

Horn, C.R. 1986. Reach file manual. U.S. Environmental Protection Agency (Unpublished draft).

NWPPC. 1987. Columbia River Basin fish and wildlife program. Northwest Power Planning Council, Portland.

Oregon Department of Energy. 1987. Oregon final summary report for the Pacific Northwest rivers study. Oregon Department of Energy, Salem.

Pansky, T.E. 1988. EPA reach file enhancement using USGS 1:100,000-scale digital hydrography for applications in the Pacific Northwest Environmental Data Base. Bonneville Power Administration, Portland (Unpublished briefing paper).

ERRATA

Please note the following corrections to errors identified in this guide prior to its distribution. This section can also be used to log errors identified by you or others in the future.

Error location	Error	Correction	Comment
Sect. IV, pp 1-104, Table 2, 6th column header	'Upstream'	'Downstream'	Transpose last two column headers
Sect. IV, pp 1-104, Table 2, 7th column header	'Downstream'	'Upstream'	Transpose last two column headers
Sect. II, p 28, 3rd column, 16th record	'VYA (CALIFORNIA)'	'VYA (NEVADA)'	VYA map is in Nevada
Sect. II, p 79, 3rd column, 33rd record	'VYA (CALIFORNIA)'	'VYA (NEVADA)'	VYA map is in Nevada
Sect. III, p 101, 5th column, 102nd record	'VYA (CALIFORNIA)'	'VYA (NEVADA)'	VYA map is in Nevada
Sect. III, p 101, 5th column, 103rd record	'VYA (CALIFORNIA)'	'VYA (NEVADA)'	VYA map is in Nevada

Error location	Error	Correction	Comment