4.4 ASSESSMENT OF POTENTIAL ANADROMOUS FISH HABITAT UPSTREAM OF MERWIN DAM (AQU 4)

4.4.1 Study Objectives

The objectives of this study are to: (1) delineate the stream segments in the upper North Fork Lewis River (above Merwin Dam) that would be accessible to anadromous fish under any fish passage option; (2) estimate the area (in square feet) of stream that would be accessible to anadromous fish under any fish passage option and estimate production potential; (3) calculate stream gradient of habitat accessible to anadromous fish under any fish passage option; and (4) provide qualitative descriptions of anadromous fish habitat when information is readily available from existing sources or incidentally collected or observed during field studies.

4.4.2 Study Area

The study area includes the entire Lewis River watershed upstream from Merwin Dam.

4.4.3 Methods

The following are key pieces of existing information to be used in this assessment. Continued research of existing information will occur throughout the study.

- Chambers' (1957) report on the 1956 survey of the North Fork of the Lewis River above Yale Dam.
- Kray's (1957) report on the 1956 survey of resident game fish resources on the North Fork of the Lewis River.
- USFS physical stream survey reports and fish population studies.
- PacifiCorp physical stream survey reports and fish population studies.
- Washington Stream and Salmon Utilization Catalog and WDFW habitat utilization reports or records.
- PacifiCorp maps based on Chambers and other sources.
- USGS topographic maps.
- Aerial photographs.
- Anecdotal information.

A qualitative characterization of potential anadromous fish habitat upstream of Merwin Dam will be accomplished in 3 steps. The first step will be to fully research and summarize existing information. The product of this step will be a matrix similar to the following example:

Example stream inventory matrix					
Stream Name	Linear Distance	Stream or Segment Gradient (n=?)	Stream or Segment Width (n=?)	Stream or Segment Area	Habitat Quality Comment

Once the matrix has been completed, PacifiCorp and Cowlitz PUD, working with the ARG, will identify data gaps. Field studies will be conducted to fill the data gaps, as described below for the following tasks.

Task 1: Delineate Accessible Stream Segments

Lengths of stream reaches potentially accessible to anadromous fish will be assessed using existing reports or, if necessary, ground truthed. The presence of a permanent barrier to upstream fish migration will define the uppermost limit of anadromous fish use. If a permanent barrier does not exist but other factors (primarily gradient) would likely limit utilization beyond a certain point, utilization will be delineated up to that point. Decisions regarding the upper end of all delineations will be explained and justified. Ground surveys will occur up to the first natural and permanent impassable barrier encountered.

Physical features that have been identified in previous investigations as permanent barriers will be evaluated by the "weight" of the evidence cited by the investigator and by corroboration from other sources. If there is any doubt about whether the obstruction is passable, it will be measured in the field.

Field verification of barriers will be performed in accordance with criteria of Powers and Orsborn (1985). The type of barrier (total, partial, or temporary) will be determined by measuring (among other parameters) the depth of the exit pool, slope and height of the barrier, and depth and location of the entrance zone. These field parameters will be examined with respect to leaping criteria for coho salmon and steelhead and using a coefficient of fish condition (CFC) of 1.00. Results of this evaluation (and other data) will be used to determine whether or not the obstruction is passable by salmon and steelhead. All potential barriers encountered in field will be photographed and, as accurately as possible, classified according to table below. Segment lengths and barrier type will be incorporated into a matrix with stream segment gradient and stream segment area.

Classification of barriers to upstream fish migration (based on Powers and Orsborn, 1985).

1. Total Impassable to all of the fish all of the time	**2. Partial Impassable to some fish all of the time**	**3. Temporary Impassable to all fish some of the time**
Single Falls – SF Entire stream flows through a single opening offering one path for fish passage.		
Multiple Falls - MF Flow divides through two or more channels offering the fish several passage routes of varying difficulty.		
Simple Chute – SC Unvarying cross sections and constant bottom slope (steep), with supercritical flow at all stages.		
Complex Chute – CC Varying cross sections, several changes in bed slope and/or curved alignment in plan view. White water at all stages.		

Classification of barriers to upstream fish migration (based on Powers and Orsborn, 1985) (cont.).

1. Total Impassable to all of the fish all of the time	2. Partial Impassable to some fish all of the time	3. Temporary Impassable to all fish some of the time
Boulder Cascades – BC Large instream boulders which constrict the flow creating large head losses from upstream to downstream sides of boulders. Intermediate resting areas in very turbulent pools.		
Turbulent Cascades – TC Large instream roughness elements, wood, or jutting rocks which churn the flow into surges, boils, eddies, and vortices. No good resting areas.		
Compound – C Combinations of single falls and/or simple chutes (e.g. Culvert with high velocity and outfall drop).		
Minimum Depth 1 – MD Adult coho and steelhead: 0.6 feet Adult Chinook: 0.8 feet		
Artificial Features – AF Culverts, dams, or other man-made structures.		
From Thompson, 1972.		

Example: 3BC = A temporary impassible barrier to all fish created by a boulder cascade.

Task 2: Determine Accessible Stream Segment Area - Stream segment area will be estimated by multiplying the accessible stream segment length by the average width. Stream width data will be derived from existing stream survey reports, as available. Average stream widths will be measured in the field when existing data do not exist, are suspect, or are incomplete. However, widths of ephemeral and stream segments that are expected to have a mean annual discharge of less than approximately 2 cfs will be estimated. Procedures for measuring stream widths in the field are as follows:

- For this task, a stream segment will be defined as that segment of the stream lying between the stream mouth and a perennial tributary that appears to contribute at least 25 percent of the total flow or between 2 perennial tributaries that appear to contribute at least 25 percent of the total flow of the primary stream.

- Stream widths will be measured at the bankfull point of the channel profile and the wetted perimeter.

- Bank full width and wetted perimeter will be measured at no fewer than 15 points along each stream segment. Average stream width will be calculated from the central 50 percent of the range of values (high and low quartiles will be discarded).

- Widths will be measured in tenths of feet using a surveyor's tape or a range finder for wider stream segments.

Task 3: Determine Stream Segment Gradient - Stream segment gradient will be calculated from USGS 1:24,000 scale topographic maps with 40-foot contours. To ensure measurement accuracy, distance between contours will be measured twice. Coordinates will be input to a spreadsheet program and converted to an x-y graph. In

addition to the slope line, data labels on the graph will display the percent gradient between contours.

Task 4: Qualitative Descriptions of Anadromous Fish Habitat - Qualitative descriptions of anadromous fish habitat found in the existing information will be included and cited in a report. As available, this will include historic use by anadromous fish and descriptions of physical parameters such as general substrate size and distribution, summer and fall low flows and temperatures, riparian quality, and instream cover. Field observations of habitat quality will be made and reported as time permits.

4.4.4 Key Questions

The study objectives identified in Section 4.4.1 were derived from "key" questions developed through the watershed scoping process in 1997. A summary of these key questions follows:

- How much habitat would potentially become accessible to each species of anadromous fish if they were reintroduced to upstream habitat areas?

  A summary of the amount of potential habitat that would be accessible to anadromous fish if they were reintroduced above Merwin, Yale and Swift dams is presented in Table 4.4-1 in the 2000 Technical Study Status Reports (PacifiCorp and Cowlitz PUD 2001). This table describes the length, width, area, and average gradient of accessible anadromous fish habitat and the percent of total accessible habitat in 3 reaches (the Lake Merwin reach, Yale Lake reach and Swift Reservoir reach).

- What is the location and type of natural and artificial fish barriers present in the basin?

  The locations of anadromous fish migration barriers encountered during the field survey and derived from existing literature sources are presented in Figure 4.4-1. Photographs of barriers encountered during the field survey and classifications of barrier types [using methods described in Powers and Orsborn (1985)] are included in AQU 4 Appendix 1. AQU 4 Appendix 1 also includes photographs of representative habitat in the surveyed streams, a narrative qualitative description of habitat quality, Rosgen (1996) stream channel classifications and detailed charts illustrating channel gradient.

- What is the estimated fish production potential for each fish species that may be reintroduced to upstream areas?

  Mobrand Biometrics, Inc. and the ARG are currently developing an EDT-based assessment of production potential for the upper basin tributaries. Using the habitat data collected by the USFS and the Licensee (referenced in AQU 4), the EDT model should provide a fairly robust estimate of production potential for the 3 Lewis River reaches.

4.4.5 Results

Based on a review of existing information and field surveys conducted in September and October of 1999 and September 2000, there are approximately 96.1 miles (155 km) of potentially accessible anadromous fish habitat in the North Fork Lewis River basin upstream from Merwin Dam (Figure 4.4-1; Table 4.4-1). Of this potentially accessible habitat, 6.2 miles (9.9 km) (6.5 percent) are located between Merwin Dam and the base of Yale Dam. Approximately 15.8 miles (25.4 km) (16.4 percent) are between Yale Dam and the base of Swift Dam, and the remaining 74.1 miles (119 km) (77.1 percent) are upstream from Swift Dam.

In addition to the stream length information described above, detailed habitat area estimates (in square feet) were calculated using wetted width measurements collected in the field or taken directly from existing survey data. Because these wetted width measurements were usually collected during low flow conditions, the area calculations (generated by the length and width data) typically represent an estimate of the minimum amount of potentially accessible habitat.

As expected, the total area and percent area calculations paralleled the length-based calculations. The North Fork Lewis River basin above Merwin Dam contains an estimated 20,583,173 square feet (1,912,239 m^2) of potentially accessible anadromous fish habitat. Of this habitat area, 361,702 square feet (33,603 m^2) (1.8 percent) are located between Merwin Dam and the base of Yale Dam. Approximately 2,753,035 square feet (255,765 m^2) (13.4 percent) are between Yale Dam and the base of Swift Dam, and the remaining 17,468,436 square feet (1,622,871 m^2) (84.9 percent) are upstream of Swift Dam.

Average stream gradients range from 0.6 to 22.5 percent, but typically were variable throughout the surveyed potions of the stream (Table 4.4-1). More detailed descriptions of potentially accessible habitat, detailed charts illustrating individual stream gradients (by 40-foot [12 m] contour intervals), descriptions of each barrier using methods developed by Powers and Orsborn (1985), Rosgen (1996) channel types, and photographs of each stream surveyed in the field were prepared and are presented in AQU 4 Appendix 1.

Descriptions of individual Rosgen (1996) channel types are also included in this appendix. These descriptive summaries are presented in a downstream to upstream order and separated by reservoir reach. Anadromous salmonid production potential estimates are currently being developed by the WDFW, USFS, and other members of the ARG.

4.4.6 Discussion

Merwin, Yale and Swift dams block the upstream and downstream migration of both resident and anadromous fish, and inundate over 39 miles of historical riverine habitat. This loss of historical habitat, combined with other factors, has contributed to an overall decline in the abundance of both native and wild (non-hatchery) resident and anadromous fish populations.

During the watershed study scoping and planning process in 1997 and 1998, the ARG identified the need for a series of studies designed to determine the feasibility of reintroducing anadromous fish into the upper Lewis River Basin. The primary objective of this study (AQU 4) was to quantify the amount of potentially accessible anadromous fish habitat in the North Fork Lewis River above Merwin, Yale and Swift dams. The results of this study, as presented in PacifiCorp and Cowlitz PUD (2001), indicate that there are over 96.1 miles of potentially accessible riverine habitat still available above Merwin

Dam. The Lake Merwin reach, located between Merwin Dam and Yale Dam, contains 6.2 miles of potentially accessible anadromous fish habitat. The Yale Lake reach, located between Yale Dam and Swift Dam, contains 15.8 miles of potentially accessible habitat, and the Swift Reservoir reach contains 74.1 miles of accessible habitat. As can be seen from these data, the vast majority of this habitat (77.1 percent of the total) is located in the mainstem and tributary reaches above Swift Dam.

Prior to the completion of Merwin, Yale and Swift dams, the river and stream reaches in the upper Lewis River Basin supported large numbers of spring and fall Chinook, coho and winter steelhead (Smoker et al. 1951). The majority of the Lewis River fall Chinook spawned in the mainstem Lewis River downstream from the Merwin Dam site and in the mainstem reaches that are now inundated by Lake Merwin, Yale Lake and Swift Reservoir. As can be seen from the results of this study, the river and stream reaches located in the upper basin still contain a substantial amount of relatively high quality habitat capable of supporting one or more species of anadromous fish.

With the information collected during this assessment, the ARG members can move forward in their analysis of anadromous fish production potential and in their development of one or more ecologically sound reintroduction alternatives. The reintroduction alternatives or "actions" developed by the ARG will be based on the ability of a reservoir reach (or multiple reaches) to support self-sustaining populations of anadromous fish, the effects of the reintroduction action on ESA-listed fish species, interactions with other resource measures, and the costs associated with implementation (including the costs of appropriate fish passage facilities and supplementation efforts).

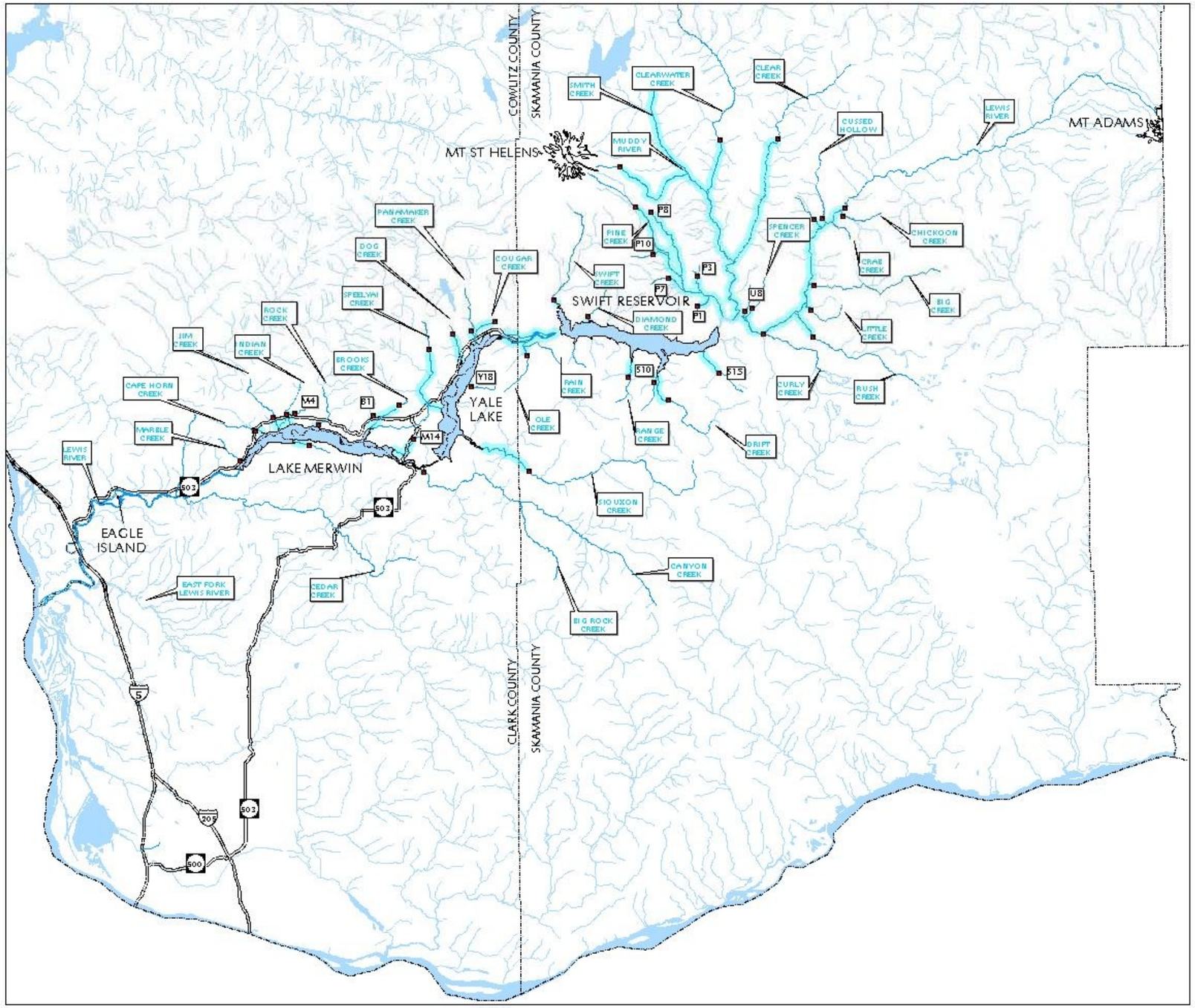
4.4.7 Schedule

This study is complete.

Lewis River
Hydroelectric Projects
Figure 4.4.1

Barriers to Anadromous Fish Migration

LEWIS RIVER REGION



- Barrier
- Potential Anadromous Fish Habitat
- Major Tributary
- Major Road
- County

5 0 5 10
Miles

GIS PACIFICORP
Property Mgt. Geographic Information System

/bull/proj_wrk/mapapr/lewisriver/fishbarriers.apr
March 23, 2001

Table 4.4-1. The length, width, area, and average gradient of accessible anadromous fish habitat and the percent of total accessible habitat in 3 reaches of the North Fork Lewis River upstream of Merwin Dam.

Reach Name*	Length of Accessible Habitat (ft)	Length of Accessible Habitat (miles)	Average Wetted Width (ft)	Average Bankfull Width (ft)	Total Wetted Area (ft^2)	Average Gradient (%)	Estimated Flow (cfs)	Percent of Total Accessible Habitat (by area)	Percent of Total Accessible Habitat (by length)	Source
LAKE MERWIN										
Marble Creek	40	0.0	8.2	15.2	328	22.5	1.0	0.0%	0.0%	Harza (1999)
Cape Horn Creek	1,744	0.3	13.1	23.3	22,846	6.5	5.0	0.1%	0.3%	Harza (1999)
Jim Creek	3,140	0.6	11.7	21.5	36,738	3.4	4.0	0.2%	0.6%	Harza (1999)
Indian George Creek	4,760	0.9	9.7	21.9	46,113	5.0	2.0	0.2%	0.9%	Harza (1999)
Buncombe Hollow Creek	4,168	0.8	6.7	10.9	27,926	3.9	1.5	0.1%	0.8%	Harza (1999)
M4	3,900	0.7	6.1	11.5	23,790	10.0	0.5	0.1%	0.8%	Harza (1999)
Rock Creek	320	0.1	15.0	47.5	4,789	6.1	20.0	0.0%	0.1%	Harza (1999)
Brooks Creek	5,714	1.1	14.8	19.5	84,662	4.0	8.0	0.4%	1.1%	Harza (1999)
B1	2,650	0.5	13.8	23.4	36,526	7.0	5.0	0.2%	0.5%	Harza (1999)
M14	6,507	1.2	12.0	35.7	77,984	2.5	0.2	0.4%	1.3%	Harza (1999)
Canyon Creek	0	0.0	NA	NA	NA	NA	NS	0.0%	0.0%	Harza (1999)
Lake Merwin Total	**32,943**	**6.2**			**361,702**			**1.8%**	**6.5%**	
YALE LAKE										
Siouxon Creek	18,350	3.5	55.3	81.5	1,014,143	1.5	150.0	4.9%	3.6%	Harza (2000)
North Siouxon Creek	10,982	2.1	33.6	66.9	369,074	2.7	22.0	1.8%	2.2%	Harza (2000)
Speelyai Creek	16,758	3.2	21.1	48.0	353,594	3.8	4.0	1.7%	3.3%	Harza (1999)
West Fork Speelyai ***	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Y8	1,260	0.2	5.7	23.4	7,182	15.6	0.5	0.0%	0.2%	Harza (1999)
Dog Creek	7,369	1.4	3.6	28.2	26,528	4.3	0.0 to 1.0	0.1%	1.5%	Harza (1999)
Cougar Creek	8,912	1.7	32.9	40.2	293,208	3.0	75.0	1.4%	1.8%	USFS (1995a)
Panamaker Creek	1,584	0.3	5.0	40.0	7,920	5.8	0.5	0.0%	0.3%	Harza (1995)

Table 4.4-1. The length, width, area, and average gradient of accessible anadromous fish habitat and the percent of total accessible habitat in 3 reaches of the North Fork Lewis River upstream of Merwin Dam (cont.).

Reach Name*	Length of Accessible Habitat (ft)	Length of Accessible Habitat (miles)	Average Wetted Width (ft)	Average Bankfull Width (ft)	Total Wetted Area (ft^2)	Average Gradient (%)	Estimated Flow (cfs)	Percent of Total Accessible Habitat (by area)	Percent of Total Accessible Habitat (by length)	Source
North Fork Lewis River	14,048	2.7	46.7	175.0	656,042	0.7	10.0	3.2%	2.8%	Harza (1995)
Ole Creek	4,224	0.8	6.0	18.0	25,344	3.4	0.0 to 1.0	0.1%	0.8%	Harza (1995)
Rain Creek ****	0	0	0	NS	0		0	0	0	Harza (1999)
Yale Lake Total	**83,487**	**15.8**			**2,753,035**			**13.4%**	**16.4%**	
SWIFT RESERVOIR										
Swift Creek	1,639	0.3	29.8	NA	48,842	8.4	128.0	0.2%	0.3%	USFS (1995b)
Diamond Creek	655	0.1	4.1	20.8	2,686	10.0	0.5	0.0%	0.1%	Harza (1999)
Range Creek	3,486	0.7	19.0	45.1	66,234	8.9	3.5	0.3%	0.7%	USFS (1995c)
S10	1,855	0.4	5.3	24.7	9,832	6.8	0.5	0.0%	0.4%	Harza (1999)
Drift Creek	8,506	1.6	26.7	48.1	227,110	11.2	24.6	1.1%	1.7%	USFS (1995d)
S15	6,680	1.3	13.4	29.7	89,512	6.7	4.0	0.4%	1.3%	Harza (1999)
North Fork Lewis River	69,350	13.1	103.9	187.1	7,203,509	0.6	500**	35.0%	13.7%	Harza (1999)
Pine Creek	42,240	8.0	27.5	37.5	1,161,600	3.5	127.8	5.6%	8.3%	USFS (1994a)
P1	4,500	0.9	5.9	10.1	26,719	4.3	1.0	0.1%	0.9%	Harza (1999)
P3	5,245	1.0	6.6	10.2	34,617	5.5	0.5	0.2%	1.0%	Harza (1999)
P7	5,750	1.1	12.7	31.0	72,833	4.0	6.0	0.4%	1.1%	Harza (1999)
P8	22,070	4.2	11.6	17.3	255,571	4.1	10.0	1.2%	4.3%	Harza (1999)
P10	1,355	0.3	20.8	29.1	28,229	5.7	12.0	0.1%	0.3%	Harza (1999)
Muddy River	72,864	13.8	48.3	116.3	3,519,687	3.0	263.9	17.1%	14.4%	USFS (1995e)
Clear Creek	65,050	12.3	35.9	NA	2,335,050	2.1	54.6	11.3%	12.8%	USFS (1997)
Clearwater Creek	27,456	5.2	53.1	155.7	1,459,090	1.4	25.0	7.1%	5.4%	Harza (2000)
Smith Creek	30,269	5.7	17.8	NA	537,477	2.2	20.2	2.6%	6.0%	USFS (1998)

Table 4.4-1. The length, width, area, and average gradient of accessible anadromous fish habitat and the percent of total accessible habitat in 3 reaches of the North Fork Lewis River upstream of Merwin Dam (cont.).

Reach Name*	Length of Accessible Habitat (ft)	Length of Accessible Habitat (miles)	Average Wetted Width (ft)	Average Bankfull Width (ft)	Total Wetted Area (ft^2)	Average Gradient (%)	Estimated Flow (cfs)	Percent of Total Accessible Habitat (by area)	Percent of Total Accessible Habitat (by length)	Source
U8	1,819	0.3	2.7	15.7	4,911	13.0	0.2	0.0%	0.4%	Harza (1999)
Pepper Creek	2,112	0.4	10.1	27.5	21,331	7.4	1.5	0.1%	0.4%	USFS (1989a)
Rush Creek	8,976	1.7	25.9	54.3	232,168	8.0	100**	1.1%	1.8%	USFS (1994b)
Little Creek	1,600	0.3	10.1	NA	16,160	10.6	20.3	0.1%	0.3%	USFS (1990)
Big Creek	1,742	0.3	22.5	45.0	39,195	14.8	23.0	0.2%	0.3%	USFS (1991)
Spencer Creek	3,116	0.6	10.8	30.5	33,549	7.8	0.2	0.2%	0.6%	Harza (1999)
Cussed Hollow Creek	1,320	0.3	17.4	30.5	22,990	8.0	9.2	0.1%	0.3%	USFS (1989b)
Chickoon Creek	1,584	0.3	12.3	33.0	19,536	11.8	6.8	0.1%	0.3%	USFS (1989c)
Swift Reservoir Total	**391,239**	**74.1**			**17,468,436**			**84.9%**	**77.1%**	
Grand Total (all reaches)	**507,670**	**96.1**			**20,583,173**			**100.0%**	**100.0%**	

* The "Lake Merwin" reach extends from Merwin Dam to the base of Yale Dam, the "Yale Lake" reach extends from Yale Dam to the base of Swift Dam and the "Swift Reservoir" reach extends from Swift Dam to the lower falls on the North Fork Lewis River.

** Estimate based on historical gage data.

*** West Fork Speelyai Creek was not surveyed due to access difficulties and time constraints.

**** Rain Creek lacked surface flow in September 1999 (during low flow conditions).

NS = Not surveyed.

4.4.8 References

Chambers, J.S. 1957. Report on the 1956 survey of the North Fork of the Lewis River above Yale Dam. State of Washington Department of Fisheries. Prepared for Pacific Power & Light.

Kray, A. 1957. A survey of resident game fish resources on the North Fork of the Lewis River with a post flooding management plan. State of Washington Department of Fisheries. Prepared for Pacific Power & Light.

PacifiCorp and Cowlitz PUD. 1999, as amended. Study Plan Document for the Lewis River Hydroelectric Projects. Portland, OR and Longview, WA. March 29, 1999, as amended.

PacifiCorp and Cowlitz PUD. 2001. 2000 Technical Study Status Reports for the Lewis River Hydroelectric Projects. Portland, OR, and Longview, WA. March 2001.

Powers, P.D., and J.F. Orsborn. 1985. Analysis of barriers to upstream migration. An investigation of the physical and biological conditions affecting fish passage success at culverts and waterfalls. Final report part 4 of 4, development of new concepts in fish ladder design. Project No. 82-14, Bonneville Power Administration, Portland, OR. August 1995.

Rosgen, D.R. 1996. Applied River Morphology. Wildland Hydrology, Pasoga Springs, CO.

Smoker, W.A., J.M. Hurley, and R.C. Meigs. 1951. Compilation of observations on the effect of Ariel Dam on the production of salmon and trout in the Lewis River. State of Washington Department of Fisheries and State of Washington Department of Game. Olympia, WA.

4.4.9 Comments and Responses on Draft Report

This section presents stakeholder comments provided on the draft report, followed by the Licensees' responses. The final column presents any follow-up comment offered by the stakeholder and in some cases, in italics, a response from the Licensees.

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
TWHB	5	AQU 04	Habitat Data Summary	Section not in volume	We regret this apparent error by the printer. This material is present in other copies.	
USDA Forest Service: John Kinney	1	AQU 04	General Comment	There needs to be an identifiable linkage between AQU-1 fish habitat requirements and the interpretation and results of AQU-4	This linkage will be developed in detail in the Conceptual Foundation document (Lewis River Fish Planning Document) currently being prepared by the Licensee's consultants.	
USDA Forest Service: John Kinney	1	AQU 04	Objectives 1-4 In particular #4	The data is of limited value when describing the quality of accessible anadromous aquatic habitat. There was no substantive description or discussion of habitat units or stream channel characteristics that would provide an indication of overall stream condition (presence of large wood, riparian health, boulders etc). Recently, the Forest Service provided a draft copy of a stream summary report with some of the necessary aquatic habitat information to the ARG and proponents. Therefore, this study was considered incomplete by the Forest Service.	Qualitative descriptions of habitat characteristics found in each of the surveyed streams (including substrate composition, riparian condition, channel type, channel gradient, and cover characteristics) are provided in the "Habitat Data Summary Sheets" (provided in the Appendices to the 2000 Technical Study Status Reports). Photographs of representative habitat and barriers are also included in these summary sheets. This information will be	USDA Forest Service crews found most juvenile coho salmon occupying un-named side tributaries to named streams. Many of those un-named tributaries have not, or were not, surveyed for aquatic habitat attributes or for length of accessible habitat. In other words, the amount of accessible habitat reported may be underestimated. To what extent is yet to be determined. We would suggest discussing this situation.

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
					incorporated into the Appendices to the final report. We agree that the draft USFS stream summary report provides valuable information describing habitat conditions in the basin and we encourage the ARG members to review this information in addition to other referenced USFS stream habitat surveys.	**Licensees' Response:** *We concur that there likely IS more habitat than has been measured*.
WDFW – JIM BYRNE	1	AQU 04	Habitat Assessment Above Merwin.	Only physical characteristics are provided: stream lengths to barriers, gradients and wetted widths. More qualitative and quantitative descriptions of habitat, substrate composition, riparian vegetation, etc., would be more useful. A creek may be 1,132 feet to an impassible barrier, but it is all bedrock it is of no value to fish.	Qualitative descriptions of habitat characteristics found in each of the surveyed streams (including substrate composition, riparian condition, channel type, channel gradient, and cover characteristics) are provided in the "Habitat Data Summary Sheets" included in the Appendices to the 2000 Technical Study Status Reports. Photographs of representative habitat are also included in the Summary Sheets. This information will be incorporated into the Appendices to the final report.	I have the 2000 Technical Study Status Reports but no appendices. Descriptions in the 1999Technical Study Status Reports are just a few sentences. **Licensees' Response**: *The information is presented in this report.*
WDFW – KAREN	1	AQU 04	Stream habitat.	Were the streams looked at from Chinook or sea-run cutthroat habitat	Because anadromous fish reintroduction may occur in	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
KLOEMPKEN				point? Some of the streams mentioned as anadromous and resident use, but mostly only mention of anadromous. Why not more resident? There is a statement about the Muddy River is "poor fish habitat." Weren't coho radio tracked going up the Muddy to spawn? Reference to Smith Creek – What about anadromous habitat? The Little Creek sounds like perfect anadromous juvenile rearing/over wintering habitat. Was only habitat for adults considered?	the surveyed stream reaches, professional opinion was used to qualitatively assess potential use by anadromous salmonids. Focus species were Chinook, coho and steelhead; however; many of these stream reaches are currently used by resident cutthroat trout and rainbow trout. We agree that Muddy River and Smith Creek have the potential to support anadromous salmonids including coho, Chinook and steelhead. Despite the effects of the Mt. St. Helens eruption, radio telemetry studies showed that coho definitely prefer the Muddy River. Although spawning habitat may be limited in Little Creek, we also agree that it does contain valuable rearing/over wintering habitat especially for coho salmon and cutthroat trout.	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
TWHB	1	AQU 04-1	Methods	The methods are not described but referenced in a separate document. This makes understanding difficult and requires regressing to that document. At least a synthesis of methods should be described.	The methods description for this study is over 3 pages long, so it was not reproduced here. We will provide a more thorough summary of the methods for the final report.	
TWHB	1	AQU 04-1	Key Questions: How much habitat would potentially become acc.. And what is location and type …	The referenced table and figures included and appendix with the document. I could not find the appendix in volume 4.	This information is presented in Volume 5.	
WDFW – JIM BYRNE	1	AQU 04-1	Objectives.	The objectives call for estimating area and estimating production potential. Production estimates are not available.	Mobrand Biometrics, Inc. and members of the ARG developed an Excel-based model designed to derive the number of juvenile outmigrants that could potentially be produced by habitat located upstream from Merwin Dam. The ARG is also currently evaluating the need for an EDT-based assessment of production potential for the upper basin tributaries.	We need to do EDT. **Licensees'Response:** *An EDT study is being performed*.

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
TWHB	1	AQU 04-2	"An Excel-based model designed to derive the production potential of habitat located upstream of Merwin"	This is an inaccurate statement. The model was developed to assess fish passage alternatives and given a starting point of juvenile out migrants based on number of river miles. This is not analogous to a habitat based production model (EDT and others are directed at the production issue). The fish passage model is being oversold as an analytical tool and this is example of its miss use. I will have more to say about this model if it remains in use, but the models utility, strengths, and shortcoming needs to be described.	This statement will be revised in the final report to reflect its utility and limitations. The model output will play a pivotal role in the development of the Lewis River Fish Planning Document (AQU 18), and in the reintroduction planning effort (desired future conditions). Mobrand Biometrics, Inc. and the ARG are currently evaluating the need for an EDT based assessment of production potential for the upper basin tributaries. Using the habitat data collected by the USFS and the Licensee (referenced in AQU 4), the EDT model should provide a fairly robust estimate of production potential for the three Lewis River reaches.	
TWHB	1	AQU 04-2	Results	The general physical descriptions provided are useful components of a full watershed assessment. The USFS level 2, EDT or protocols and others can be utilized to evaluate value of the information for recovery planning. The Gifford Pinchot National Forest has provided additional information on the tributaries that needs to be included.	Agreed, more detailed habitat information collected by the USFS and the Licensees will be reviewed and entered into the EDT model.	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
				The fish management framework document proposed by the ARG on July 8, 2002 would be a starting place to evaluate desired future conditions (the puzzle, mentioned above) and the relevance of this and the other habitat /water quality studies to that end.		
USDA Forest Service: John Kinney	1	AQU 04-8 para 1	Last sentence: production potential	At this time, I am unsure who is developing this information for the ARG.	Mobrand Biometrics, Inc. and the ARG developed an Excel-based model designed to derive the number of juvenile outmigrants that could potentially be produced by habitat located upstream from Merwin Dam (the Lake Merwin reach, Yale Lake reach and Swift Reservoir reach). The ARG is also currently evaluating the need for an EDT based assessment of production potential for the upper basin tributaries. Using data collected by the USFS and the Licensee, the EDT model will provide a fairly robust estimate of production potential.	