Water Resource Inventory Area 22

Fish Passage Inventory within Grays Harbor County

Final Report – Volume 1

Mason Conservation District

January, 2007

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Summary

In April 2003, the Mason Conservation District received a grant from the Salmon Recovery Funding Board (SRFB) to conduct a fish passage inventory for streams contained in the Water Resource Inventory Area (WRIA) 22 within Grays Harbor County. The study area includes all tributaries to the north banks of both Grays Harbor and the Chehalis River, west of Middle Satsop Road. Potential fish passage barriers were assessed following Washington State Department of Fish & Wildlife (WDFW) Salmonid Screening, Habitat Enhancement, and Restoration (SSHEAR) survey protocols.

The Salmon and Steelhead Limiting Factors Analysis, WRIA 22 and 23, noted a tremendous lack of detailed field information for the study area. Despite being the second largest drainage in Washington State (second to the Columbia), the basin fell behind most other areas regarding assessment and prioritization of fish habitat blockages. Very few surveys of blockages had been conducted that included impacts to salmonids, and the existing information was scattered among various landowners. The potential impact of blockages to fish habitat is considerable because of the high road densities. The Chehalis Basin Plan for Habitat Restoration, created by the WRIA 22 Technical Advisory Group, ranked the Grays Harbor estuary, Humptulips, Hoquiam, Wishkah, Wynoochee, and Satsop River sub-basins as high in their restoration prioritization matrix.

To address the identified data gaps, field crews surveyed the Humptulips, Hoquiam, Wishkah, Wynoochee, and Satsop (west of Middle Satsop Road) sub-basins. Surveys were conducted from June 2003 through June 2005.

A total of 2432 water crossings were located and assessed. 1360 sites were located on anadromous streams; 937 on non-anadromous streams; and 135 on streams whose anadromous fish use was unable to be determined.

Of the 1495 culverts with known or suspected anadromous fish use, 1049 were determined to be partial or complete barriers to fish passage, 155 were determined to be non-barriers, and the barrier status of 291 sites were unable to be determined using SSHEAR protocols.

The following document contains fish passage inventory data for all surveyed water crossings, including those located on streams of known or suspected anadromous fish use and those on streams without anadromous fish use. The report is comprised of 7 volumes.

Volume 1 (this document) describes the project area, survey methods, results, completed priority indices, and database metadata. A set of map tiles for the project area is included.

Volumes 2, 3, 4, 5, and 6 include the following reports for the Humptulips, Hoquiam, Wishkah, Wynoochee, and West Fork Satsop River watersheds, respectively:

Culvert Site Descriptions
SSHEAR Level A Barrier Assessments

Volume 7 includes the following reports:

- Barrier Priority Index Reports
- Physical Survey Data
- FPDSI Database

Project Area Overview

WRIA 22, Lower Chehalis Basin, encompasses approximately 1,468 square miles within Grays Harbor and Mason Counties. The scope of this report includes all streams and tributaries to the Humptulips, Hoquiam, Wishkah, Wynoochee, and Satsop (west of Middle Satsop Road) drainages in Grays Harbor County.

The area has a history of commercial timber, agricultural, and recreational use. Presently, the area continues to be used predominantly for timber and agricultural production. The largest landowners include Green Diamond Resource Company, the Weyerhaeuser Company, Rayonier Northwest Forest Resources, USDA Forest Service, and Port Blakely Tree Farms.

Humptulips River sub-basin

The drainage area of the Humptulips sub-basin encompasses 276 square miles, of which 119.6 are upstream of the confluence of the East and West Forks at river mile 28.1. The upper two thirds of the East and West Fork drainages are in the Olympic National Forest, with the headwaters originating from the southern Olympic Mountains. The vast majority of the lower East and West Fork Humptulips Rivers, and the remainder of the drainage, consists of private timberlands owned and managed by Rayonier Northwest Forest Resources, Green Diamond Resource Company, Mason Timber, and Green Crow Timber Company.

In the lower drainage, the uplands are almost exclusively private timberlands, while the floodplain of the mainstem Humptulips is predominantly rural residential or agricultural land, with only a few active livestock farms remaining. In addition to logging and farming, the basin is used for gravel mining, fishing, and recreation. The Humptulips River still has a rural character with less than 3,000 people living within the drainage.

There are 187 miles of known habitat in the Humptulips River sub-basin that support fall chinook, fall chum, coho salmon, plus winter and summer steelhead trout. This includes approximately 8.6 miles of rearing habitat in Burg, Campbell, Jessie, and Gillis Sloughs, which enter the tidal zone of the lower river. Chenois and Grass Creeks enter North Bay immediately southeast of the Humptulips River, and they also provide rearing habitat. A majority of the habitat is located in the mainstem, East Fork, and West Fork Humptulips Rivers, as well as in Big and Stevens Creek. Other tributaries with greater than one mile of accessible habitat are Newbury, O'Brien, Donkey, Brittain, Deep, Fairchild, and Hansen Creeks (Martin and McConnell 1999;WDFW/QIN Escapement Survey Data).

Hoquiam River sub-basin

The Hoquiam River drains a 98 square mile area, and consists of three major forks. The East Fork confluence is at RM 2.5, and the West and Middle Fork confluence is at RM 7.1. The Little Hoquiam River enters the lower mainstem from the west, just upstream of the East Fork, at RM 3.5. The lower five miles of the mainstem Hoquiam flows through the City of Hoquiam where most of the riparian vegetation has been permanently converted into residential and commercial lands. Rural residences are scattered along the remainder of the mainstem and the lower West Fork Hoquiam Rivers. The City of Hoquiam owns 7,500 acres of forested land within the West Fork Hoquiam River drainage that is protected as a municipal watershed and closed to public access. Within the municipal watershed, diversion dams on Davis Creek and the West Fork Hoquiam River provide water storage for the City of Hoquiam.

The Middle Fork Hoquiam drainage is not accessible by public roads, and has been exclusively managed for commercial timber. The East Fork Hoquiam watershed has dense residential development along the lower 0.75 miles, with sparse development further upstream. Most of the Little Hoquiam drainage consists of second growth commercial timber and residential development in the uplands. There has been no agricultural development in the Hoquiam River drainage due to the poorly drained soils in the floodplain. Outside of the developed floodplain areas and the West Fork municipal watershed, the remainder of the Hoquiam River drainage is managed commercial timberlands of second growth forest.

The Hoquiam River sub-basin supports fall chinook, chum, and coho salmon, and winter steelhead trout. The only summer run steelhead trout are located in the West Fork Hoquiam River (Streamnet 2000). Chum are distributed throughout the floodplain reaches of the area, but the distribution limits have note been well documented. The East Fork Hoquiam River and the Wishkah River and their tributaries are believed to have the largest chum runs in this area. Fall chinook spawning is primarily concentrated in the East and West Forks, with some spawning in Davis Creek and the Middle Fork. Hoquiam chinook stocks are considered “native”, with only one documented fingerling release of 1,600 native-origin brood fall chinook raised at the Stevens Creek Hatchery in 1985.

Wishkah River sub-basin

The Wishkah River drains a 102 square mile area with the mainstem, East, and West Forks originating in the foothills of the southern Olympic Mountains. The Wishkah River enters the Chehalis River at river mile 0 and is tidally influenced in its lower 7 miles. The lower 3 miles of the Wishkah are exclusively commercial and residential lands, with only small areas containing streamside vegetation. From this point upstream to the upper end of tidal influence at RM 8, the river meanders through reforested mature alder and mixed conifer that is currently undeveloped. Upstream of the tidal zone to RM 23, the floodplain consists of agricultural and rural residential development. The floodplain upstream of this point is mostly commercial timberlands. The uplands throughout the drainage have been intensely managed for commercial timber and are a patchwork of clearcuts in various successional stages of reforestation. The Malinowski Dam at RM 32.1 of the upper mainstem created the 2.8 acre Aberdeen Reservoir, which serves as the water supply for the City of Aberdeen.

The Wishkah River sub-basin supports fall chinook, chum, and coho salmon, and winter steelhead trout. Chum salmon are distributed throughout the floodplain reaches, but the distribution limits have not been well documented except for known presence up to Wishkah River Falls at RM 29.4. The East Fork Hoquiam River and Wishkah River and their tributaries are believed to have the largest chum runs in this area. Chinook spawning is concentrated in the mainstem, with additional distribution into the upper reaches of the West and East Forks. Fall chinook in the Wishkah watershed are described as “native”(WDFW and WWTIT 1993). Since 1985, the stock has been supplemented by the Long Live the Kings native broodstock hatchery located on the upper mainstem at RM 26 (WDFW and WWTIT 1993). It is likely that winter steelhead are present in most accessible tributaries where coho spawning has been documented. Wishkah Falls, at RM 29.4, is the upstream barrier for salmon, but steelhead are able to pass the falls at high flows and use the river up to the Malinowski Dam at RM 32.2 (Raines et al. 1992).

Wynoochee River sub-basin

The Wynoochee River drains the southwest side of the Olympic Mountains with the uppermost headwaters contained within the Olympic National Park and the upper 17 miles of the mainstem (including 4.4 miles in Wynoochee Lake) within the Olympic National Forest. The total drainage area of the Wynoochee sub-basin is 195 square miles, of which 53.5 square miles are upstream

of the National Forest Boundary (U.S. Forest Service 1996). The remainder of the drainage is primarily in private ownership. The Wynoochee River enters the Chehalis River at RM 13.0 near the upper limit of the tidal influence of Grays Harbor. The lowest mile of the Wynoochee River is tidally influenced.

Upstream of RM 26, land is almost exclusively commercial forestland. Green Diamond Resource Company owns the timberlands downstream of the U.S. Forest Service property and Weyerhaeuser Company owns timberlands in the lower valley. While the uplands are managed for commercial timber, the floodplain of the lower valley has been converted to agricultural land. Currently, the agricultural land is used either for livestock or for crop farms. Dairy farms have not operated since the 1980's. Development within the floodplain is limited to residences associated with farms and some residential subdivisions on the terrace lands in the lower two miles of the Wynoochee valley. The only community in the sub-basin is the City of Montesano, located about one mile northeast of the mouth of the Wynoochee River.

Wynoochee Falls, at RM 58.1, was historically the natural upstream barrier to chinook and coho salmon and steelhead trout, prior to the construction of the Wynoochee Dam at RM 50.1. In 1994, the use of the Wynoochee Dam was converted from flood control to hydroelectric generation, which eliminated spawning habitat for an estimated 1,500 coho salmon and 570 steelhead trout adults. To mitigate impacts of the conversion of 4.4 miles of anadromous river into reservoir, a fish collection facility was constructed at RM 47.8. The 20' water supply dam for the fish collection facility became the upstream extent of salmon and steelhead migrations, blocking a total of 6.6 miles of spawning habitat, 4.4 miles with the reservoir, and 2.2 miles of habitat between the water supply dam and the Wynoochee Dam. Salmon and steelhead captured at the collection facility are transported 7.5 miles upstream, and released in the river above the reservoir.

Coho are widely distributed in the Wynoochee drainage with primary spawning in the middle and upper reaches of the mainstem and tributaries of Carter, Schafer, and Big Creeks. Black, Helm, and Wedekind Creeks support spawning populations in the lower drainage (WDFW WWTIT 1994). Prior to construction of the dam, coho salmon utilized habitat up to Wynoochee Falls at RM 58.1, but now the upper limit is RM 47.8 at the fish collection facility. Since the construction of the dam, coho salmon have been transported upstream of the reservoir to spawn in the 2.5 miles of habitat below the falls. Annual coho transports ranged from 236 to 5,698 adults, comprising an average of 24% of the total Wynoochee River coho salmon escapement.

Fall chinook salmon historically distributed to Wynoochee Falls, but now range to RM 47.8 below the dam. Primary spawning areas are the mainstem upstream of RM 10.5 with key tributary production in Carter, Schafer, Helm, Big, and Anderson Creeks. Winter steelhead trout are native to the basin with their historic distribution extending to Wynoochee Falls. Typical of chum salmon distributions, their upper range of habitat is lower in the drainage than chinook and coho salmon or steelhead trout. Chum salmon are known to utilize habitat up to RM 39 near the confluence of Save Creek. The river above this point enters a confined canyon for over 5 miles where increased water velocities prevent further upstream migration.

Satsop River sub-basin

The Satsop River sub-basin drains over 300 square miles, and is formed by the confluence of the East, Middle, and West Fork Satsop Rivers. The various forks of the Satsop River drain the Olympic Mountains, with the East Fork Satsop considered a continuation of the mainstem. Below the forks, the mainstem Satsop River flows through a broad, flat valley, currently utilized for agriculture and rural residences. The East and Middle Forks Satsop are predominantly contained in Mason County, while the West Fork Satsop Drainage is located primarily in Grays Harbor County. Numerous small streams flowing directly into the Chehalis River are contained in the Satsop sub-basin, including Sylvia Creek, Camp Creek, Metcalf Slough, and several unnamed tributaries.

The West Fork Satsop empties into the mainstem Satsop at RM 6.3, and is a glacial stream with flow patterns and turbidity that differ from the remaining Satsop sub-basin. Its headwaters are in the steep foothills of the Olympic Mountains. The headwaters' geology consists of a mix of volcanic rocks, which are stronger and weather more slowly than the rocks in the lower watershed, producing gravel and boulders (Weyerhaeuser and Simpson Timber Co 1995). Coho salmon and steelhead trout spawn in these upper waters to about RM 34.5 and 33.4, respectively. A series of falls and cascades occur near RM 35.5, and are natural blocks to anadromous salmon (Phinney and Bucknell 1975). Both coho and steelhead spawn up to RM 0.8 (to the falls) in the Little River (Weyerhaeuser 1995), a tributary to the upper West Fork. Chinook salmon also spawn in the mainstem West Fork up to RM 32, and chum salmon spawn up to RM 21.8 (Streamnet 1999).

In the middle West Fork, the landform changes to moderate and low relief with short, steep tributaries. The geology changes to materials that break down quickly to gravels, sands, silts and clays. Canyon River is a major tributary that joins at RM 20. It supports steelhead trout spawners up to a falls at RM 10.3 (Jay Hunter, WDFW, personal communication), and coho and chinook salmon up to RM 8 (Streamnet 1999).

Black Creek joins the West Fork at about RM 18.2, and its lower 0.9 miles support chinook, coho, and steelhead (WDFW Spawning Ground Database). Rolling hills with sandstone geology surround the lower West Fork Satsop. Singer Creek joins at RM 14.9 and provides spawning habitat for chinook salmon up to RM 0.8 and coho salmon up to RM 0.5 (WDFW Spawning Ground Database). Unnamed stream 22.0372 joins the West Fork at RM 7.1, with chinook spawning in its lower 0.8 miles, and coho salmon in the lower 1.1 miles. Still Creek enters the West Fork at RM 3. Chinook and chum salmon spawn up to RM 2.5, while coho salmon spawn up to RM 4.5 (WDFW Spawning Ground Database).

Survey Methods

Culvert surveys were completed to specifications outlined in the SSHEAR *Fish Passage Barrier Assessment and Prioritization Manual* (August 2000). Basic location and physical data was collected for each site, fish use was determined, and a Level A Barrier Assessment was completed. If necessary, a Level B Barrier Assessment was performed. Habitat surveys were conducted for selected barrier culverts and the corresponding priority indices were calculated. Figure 1 provides an outline of the barrier assessment process.

Site Identification and Culvert Evaluation Field Forms were completed for each site. For each culvert evaluated, the location was established by the use of a hand held GPS receiver. Basic site and physical information was collected including: road name, county, township, range, section, ¼ section, fish use (and species), fish use criteria, ownership, comments, site ID, culvert sequencer, culvert shape, material, span, and rise. See Table 3 for complete field descriptions.

Fish use for each culvert was determined from a variety of sources, including:

- Chehalis Basin Plan for Habitat Restoration: Chehalis Basin Partnership, April 2001
- Salmon and Steelhead Habitat Limiting Factors Report, WRIA 22 and 23
- Streamnet/Sassi 2002
- WDFW 2002 Spawning Survey and Escapement databases
- personal communication with WDFW and DNR biologists
- visual observation of salmonid use

In addition, all watercourses with ordinary high water widths greater than 0.6 meters and a stream gradient less than 20 percent were evaluated as anadromous bearing. Stream types, as determined from Washington State Department of Natural Resources (WDNR) hydrologic maps, were used as a general (but not deterministic) guide in evaluating anadromous fish use.

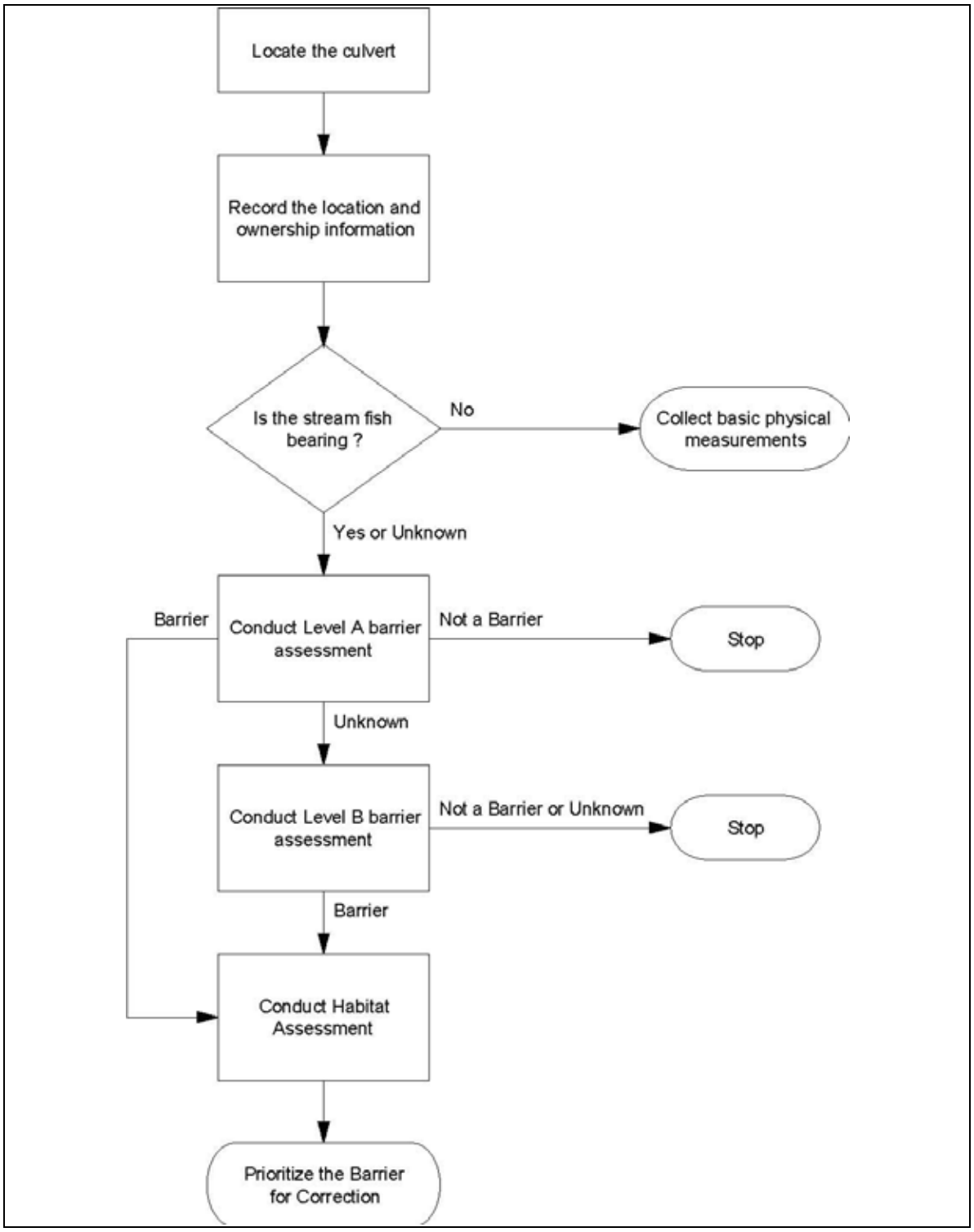

Figure 1. Barrier Assessment Overview.

Level 'A' Barrier Assessment

On fish bearing streams, detailed physical measurements of the stream and culvert were taken to describe the site and allow for Level A barrier assessment. In addition to the site and physical data described above, the following information was collected: water depth in culvert, outfall drop, length, slope, presence of streambed material, presence of apron, presence of tidegate, fill depth, plunge pool length, plunge pool maximum depth, plunge pool ordinary high water width, average streambed toe width, culvert span to toe width ratio, barrier status, problem, repair status, and comments. See Table 4 for complete field descriptions. Culvert lengths and slopes were obtained using a laser level with a reflector mounted on a survey pole. Figure 2 provides an outline of the Level A barrier assessment. Culverts determined to be barriers were assigned a percent passability rating of 0%, 33%, 67%, or 100% based on the professional judgment of the field crew.

If the barrier status was determined, no further data was collected. If the barrier status was unable to be determined, a Level B assessment was completed. The Level B assessment involved collecting more detailed information in order to run a hydraulic model.

Level 'B' Barrier Assessment

A Level B assessment was performed for culverts whose barrier status was unable to be determined through initial Level A assessment. A Level B Analysis Elevations Worksheet was completed for each of these sites. A laser level was used in conjunction with a stadia rod and reflector to complete channel cross-sections and to determine culvert elevations. See Table 5 for complete field descriptions.

The purpose of the Level B hydraulic analysis is to calculate the maximum velocity and corresponding depth in the culvert at the high fish passage design flow. These values are compared to the criteria for adult trout > 6 inches (150 mm), as outlined in WAC 220-110-070, section (b)(ii).

The velocity and depth values were calculated using the Level B 2.3 Barrier Analysis spreadsheet, prepared by the WDFW. The spreadsheet uses Manning's equation to calculate flow velocity and depth. In addition, a backwater analysis was performed if either the flow velocity or depth did not meet established criteria.

In some instances, the Level B assessment could not be performed. The spreadsheet is not applicable to sites with multiple culverts. Barrier assessment for these sites was completed by WDFW using data collected by field crews. Sites with a gradient changes within the culvert or an inaccessible downstream control were assigned an UNKNOWN barrier status. See Figure 3.

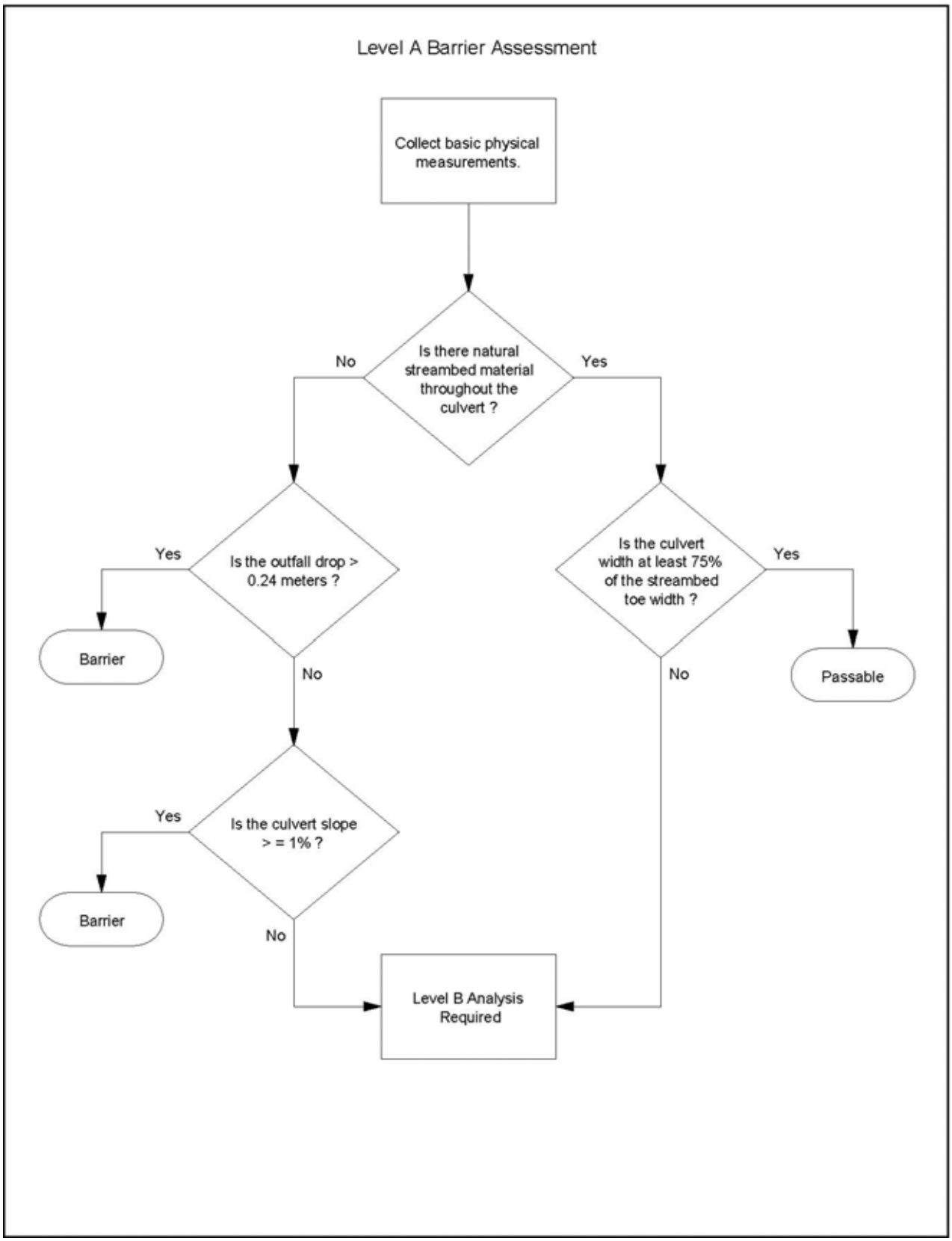

Figure 2. Level A Barrier Assessment

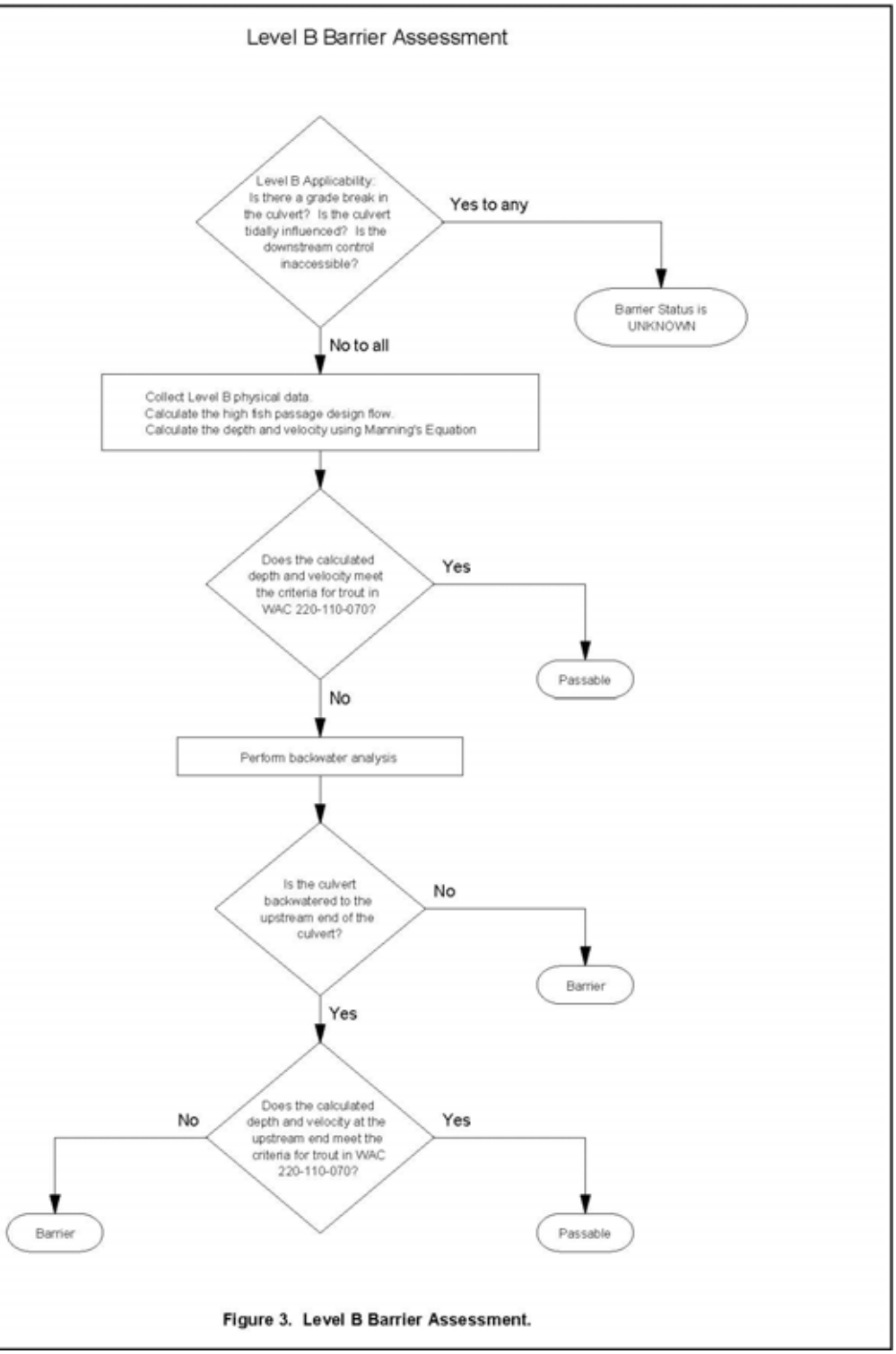

Figure 3. Level B Barrier Assessment.

Habitat Assessment and Priority Index Calculation

Physical surveys were conducted for selected barrier culverts to assess the potential habitat gain should the barrier be repaired. A downstream check was first completed, to determine if the barrier culvert was physically accessible to anadromous salmonids. Access was verified by walking downstream to a point known to be free of barriers.

The Full Physical Survey method was utilized for all stream surveys conducted, as it provided the most reliable estimate of available habitat. A sampling frequency of 60 meters out of every 320 meters was utilized. Within each 60-meter sample, the stream was divided into 4 habitat types – pools, riffle, rapids, and ponds. The length, wetted, and ordinary high water width was recorded for the first 4 representative habitat types found in the sample. Substrate composition was recorded by visually estimating the percentage of boulders, cobble, gravel, and fines within each pool, riffle, rapid, and pond measured. Stream survey distances were recorded to the nearest meter by using a belt chain. Habitat sample measurements were recorded to the nearest 0.1 meter, using a stadia rod, measuring tape, or laser level.

The stream was divided into reaches with similar stream flow, gradient, and bed form. Within each reach, a habitat quality modifier was assigned, to subjectively estimate the spawning and rearing habitat quality. Canopy composition and cover, additional barriers, instream cover, juvenile abundance, spring influence, and limiting factors were recorded for each reach. Qualitative habitat notes were recorded during the stream survey, describing instream, riparian zone, and flood plain features. Examples included substrate quality, instream cover, under- and over-story composition, quality and quantity of woody debris, additional barriers, fish species observed, etc. The river distance to the nearest meter was recorded for each feature described.

Physical habitat survey data was used to estimate habitat gains in terms of fish production potential. Habitat gain was expressed in square meters of spawning and summer rearing habitat. These values were used in the Priority Index Model to prioritize barrier correction. Spawning area was used for those species (chum, pink, and sockeye) whose production is limited by spawning habitat. Rearing area was used for those species (coho, chinook, steelhead, cutthroat, rainbow, bull, brook, and brown trout) whose production is limited by rearing habitat.

Physical habitat survey data was processed in a customized spreadsheet developed by the SSHEAR program. The spreadsheet generates a detailed report for each stream surveyed, which contains the total habitat gain per species, habitat measurements for each stream reach, and the total survey, habitat quality information, and other fundamental survey data.

Spawning area was calculated as the sum of the areas of each habitat type, measured at ordinary high water, multiplied by the gravel percentage in each habitat type. Widths at ordinary high water were determined by using the bank vegetation line and other hydrologic evidence. Rearing area was calculated using a projected 60-day low flow, based on basin area, spring influence, and a regional constant. The Habitat Quality Modifier was used to adjust both the spawning and rearing areas.

Results

A total of 2432 road water crossings were surveyed, including 2380 culverts, 2 dams, 1 fishway, 6 wet crossings, 24 puncheons, 4 timber bridges, 1 abandoned mill and 14 sites where a fish passage structure could not be located. Of the 2432 water crossings surveyed, 1360 sites were located on anadromous streams, 937 on non-anadromous streams, and 135 sites on which anadromous fish use was unable to be determined (Figure 4).

Of the 1495 sites with known or suspected anadromous fish use (1360 anadromous + 135 undetermined), 1049 were determined to be partial or complete barriers to fish passage, 155 were determined to be non-barriers, and the barrier status of 291 sites were unable to be determined using SSHEAR protocols (Figure 5).

Of the 1049 barrier culverts with known or suspected fish use, 509 were owned by private timber companies, 242 were owned by the US Forest Service, 162 were owned by Grays Harbor County, 84 were privately owned, 52 were owned by municipalities within Grays Harbor, and 3 were owned by the State of Washington (Figure 6).

Figure 4. Fish Bearing Status of 2432 Sampled Sites

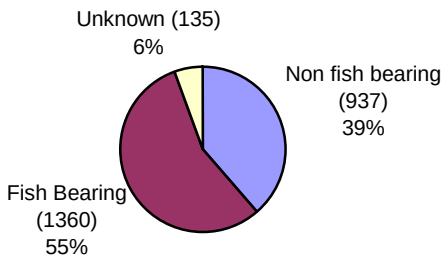

Figure 5. Barrier Status of 1495 Fish Bearing Sites
(Fish Use = Yes or Unknown)

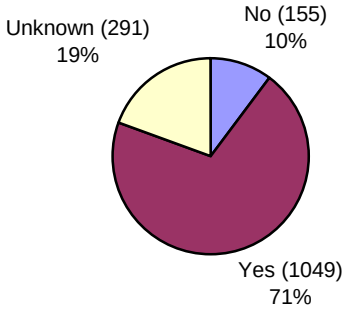

Figure 6. Ownership of 1053 Barrier Sites

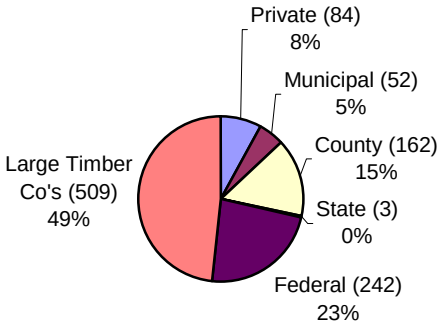

Table 1. WRIA 22 Fish Passage Inventory Summary of Results.

Fish Use	Barrier Status	Ownership	
Yes - 1360	Yes - 956	Private Landowner	77
		Municipal	50
		County	157
		State	3
		Federal	224
		Large Private Timber Companies	445
	Unk - 249	Private Landowner	37
		Municipal	28
		County	66
		State	3
		Federal	26
		Large Private Timber Companies	89
	No - 155	Private Landowner	22
		Municipal	8
		County	19
		State	0
		Federal	11
		Large Private Timber Companies	95
Unk - 135	Yes - 93	Private Landowner	7
		Municipal	2
		County	5
		State	0
		Federal	18
		Large Private Timber Companies	61
	Unk - 42	Private Landowner	6
		Municipal	3
		County	2
		State	1
		Federal	0
		Large Private Timber Companies	30
	No - 0	Private Landowner	0
		Municipal	0
		County	0
		State	0
		Federal	0
		Large Private Timber Companies	0
No - 937	n/a	Private Landowner	50
		Municipal	39
		County	120
		State	16
		Federal	257
		Large Private Timber Companies	455

Completed Physical Surveys and Priority Indices

Full physical stream surveys and priority indices (PI) were completed for a total of 17 culverts. As the survey process requires a large investment of time and resources, only a subset of all fish bearing barrier culverts were considered for the priority index model. Culverts were selected on their likelihood to generate high priority indices. Stream size, species use, and quality and quantity of potential habitat gain were used as determining factors. Moreover, only culverts eligible for SRFB funding (county or privately owned) were considered as starting points for physical surveys. Priority indices were calculated, however, for all barrier culverts upstream of the starting culvert regardless of ownership.

Table 2. Calculated Priority Indices.

Site ID	Stream	WRIA	Trib to	Owner	PI
127Q0250	Unnamed	22.0184	Davis Cr 22.0180	City of Hoquiam	32.2
127S0051	Unnamed	22.0000	WF Satsop 22.0364	Private	21.2
127H0758	Fairchild Cr	22.0051	Big Cr 22.0042	Private	20.6
127S0263	Unnamed	22.0000	WF Satsop 22.0364	Weyerhaeuser	20.2
127Q0001	Polson Cr	22.0176	Hoquiam 22.0137	Grays Harbor County	18.8
127Q0003	Polson Cr	22.0176	Hoquiam 22.0137	Grays Harbor County	18.4
127Q0002	Polson Cr	22.0176	Hoquiam 22.0137	Grays Harbor County	17.2
127Q0253	Unnamed	22.0000	Unnamed 22.0184	City of Hoquiam	14.8
127S0264	Unnamed	22.0000	WF Satsop 22.0364	Weyerhaeuser	13.7
127Q0006	Unnamed	22.0177	Polson Cr 22.0176	Private	12.3
127Q0004	Unnamed	22.0177	Polson Cr 22.0176	Grays Harbor County	11.8
127Q0122	Unnamed	22.0000	Unnamed 22.0177	Private	10.8
127Q0008	Unnamed	22.0177	Polson Cr 22.0176	Grays Harbor County	9.6
127Q0128	Unnamed	22.0000	Polson Cr 22.0176	Private	9.6
127Q0129	Unnamed	22.0000	Polson Cr 22.0176	Private	9.2
127Q0123	Unnamed	22.0000	Unnamed 22.0177	Private	8.8
127WC001	Wildcat Cr	22.0503	Cloquallum Cr 22.0501	Private	5.7

Watershed Descriptions

Priority Indices were calculated for selected culverts within the following watersheds.

Hoquiam River Watershed

Polson Creek Watershed

Polson Creek (22.0176) is a major tributary of the Hoquiam River (22.0173), joining at RM 9.7. The watershed comprises 2.5 square miles (660 hectares). Land-use in the watershed is a mix of rural residential and forestry, with residences mainly found near the banks of Polson Creek and forestry concentrated in the uplands. Rayonier Northwest Forest Resources, Green Crow Timber, and several small private forest owners manage lands for commercial timber. County roads Dekay Road and Ocean Beach Road lie within the watershed, with multiple water crossings of Polson Creek and its tributaries located beneath Dekay Road. An extensive network of private logging roads provides access to the commercial timber holdings.

Juvenile coho salmon were observed throughout Polson Creek and its tributaries. Winter steelhead trout use has been documented in the mainstem of Polson Creek (Sassi 2002). Sea-run and resident cutthroat trout use was attributed to the entire watershed, based on physical stream characteristics. Even though chum salmon use has not been documented, there is suitable habitat available. The Hoquiam River has chum salmon present above the confluence with Polson Creek (Sassi 2002), and habitat surveys identified no natural barriers to chum migration. Additionally, the extent of tidal influence on the Hoquiam River is near the confluence of Polson Creek. Extensive sections of high quality spawning gravel are found in the lower reaches of Polson Creek. Several wetlands and beaver ponds are located in the upper reaches of Polson and its smaller tributaries. Spring influence is high in the area, resulting in relatively robust summer low flows.

24 water-crossings were assessed within the watershed; 18 on anadromous streams and 6 on non-anadromous streams. Of the 18 water-crossings on streams with known or potential anadromous use, 17 were determined to be partial or complete barriers to fish passage and the barrier status of 1 water crossing was unable to be determined using SSHEAR protocols. The lowest barrier is located approximately 170 meters upstream of the confluence with the Hoquiam River, and limits or prevents the access to approximately 6,200 meters of potential anadromous habitat.

Full physical stream surveys were performed to generate priority indices for the following 10 water-crossings: 127Q0001, 127Q0002, 127Q0003, 127Q0004, 127Q0006, 127Q0008, 127Q0122, 127Q0123, 127Q0128, and 127Q0129. A total of 6400 meters of stream were surveyed within the Polson Creek watershed.

Davis Creek Watershed

Davis Creek (22.0180) is a major tributary of the Hoquiam River (22.0137), joining at RM 10.7. The watershed encompasses 5.7 square miles (1,478 hectares). The entire watershed is owned by the City of Hoquiam and closed to the public. The uplands are managed for commercial timber and the reservoir behind Boyer Dam, at RM 0.4 of Davis Creek, supplies water to the City of Hoquiam. Boyer Dam is equipped with a fishway that is 100% passable (FPDSI database). A network of logging roads managed by the City of Hoquiam provides access throughout the forestlands.

Juvenile coho salmon were observed throughout Davis Creek and its tributaries. Chum salmon, coho salmon, winter steelhead trout, and sea-run cutthroat trout use has been documented in the mainstem of Davis Creek (Sassi 2002). Resident cutthroat trout use was attributed to the entire watershed, based on physical stream characteristics. Extensive sections of high quality spawning gravel are found within the lower and middle reaches of Davis Creek and its tributaries. Several wetlands and beaver ponds are present in the upper reaches of Davis Creek and its smaller tributaries. Spring influence is high in the area, resulting in relatively robust summer low flows.

17 water crossings were assessed within the watershed, 13 on anadromous streams and 4 on non-anadromous streams. Of the 13 water-crossings on streams with known or potential anadromous use, 11 were determined to be partial or complete barriers and 2 were completely passable according to SSHEAR protocols. The lowest barrier, site 127Q0250, is located at RM 2.2 upstream of the confluence with the Hoquiam River. Additionally, there are barriers near the mouths of several tributaries.

Full physical stream surveys were performed to generate priority indices for sites 127Q0250 and 127Q0253. A total of 8671 meters were surveyed within the Davis Creek watershed.

Humptulips River Watershed

Fairchild Creek Watershed

Fairchild Creek (22.0051) is a major tributary to Big Creek (22.0042). The Fairchild Creek watershed is located on the western flanks of the Olympic Mountains and encompasses 4.2 square miles (1,075 hectares). Land-use in the watershed is predominantly commercial forestry, with scattered rural residences near Highway 101. Rayonier Northwest Forest Resources and several small private landowners own the lower reaches. The upper reaches are owned exclusively by Rayonier Northwest Forest Resources. US Highway 101 crosses near the middle of the Fairchild drainage, and several logging roads provide access to most of the watershed.

Adult coho salmon were observed in the lower and middle reaches of Fairchild Creek. Chum salmon, coho salmon, winter steelhead trout, and sea-run cutthroat use have been documented in the Fairchild Creek mainstem (Sassi 2002). Resident cutthroat trout use was attributed to the entire watershed, based on physical stream characteristics. High quality spawning gravel is abundant in the middle and upper reaches of Fairchild Creek and it tributaries. A large wetland, several log jams, and a short confined section comprises the lower reaches.

4 water crossings were assessed within the watershed; 2 on anadromous streams and 2 on non-anadromous streams. Of the 2 water-crossings on streams with known or potential fish use, both were found to be partial or complete barriers to fish passage. The lowest barrier culvert on Fairchild Creek, site 127H0758, is located approximately 2,790 meters upstream of the Big Creek confluence and limits or prevents the access to approximately 4,800 meters of potential anadromous habitat. A 100% passable WDFW fishway is located beneath US 101, approximately 550 meters upstream of 127H0758.

A full physical stream survey was performed to generate a priority index for site 127H0758.

West Fork Satsop Watershed

Unnamed (22.0000) Watershed

Unnamed stream (22.0000) is a small volume tributary to the West Fork Satsop River, located at RM 2.7 upstream of the confluence of the West Fork Satsop and Satsop Rivers. The watershed comprises 0.4 square miles (113 hectares). Land-use in the lower portion of the watershed is agricultural, and is primarily used for livestock grazing. The Weyerhaeuser Company owns the entire middle and upper watershed. Several logging roads encircle the watershed, two of which cross the unnamed stream (22.0000), and an agricultural/logging access road crosses near the bottom of the watershed.

Juvenile coho salmon were observed in the lower and middle reaches of the unnamed stream (22.0000). Coho salmon, sea-run cutthroat trout, and resident trout use was attributed to the watershed, based on physical stream characteristics and close proximity to documented populations in the West Fork Satsop River (Sassi 2002). Wetlands are located in the lower reaches, with scattered patches of spawning gravel in the upper reaches.

5 water crossings were assessed within the watershed, 4 of which where on anadromous streams and 1 on a non-anadromous stream. Of the 4 water crossings on streams with known or

potential anadromous use, 3 were determined to be partial or complete barriers to fish passage and 1 was determined to be completely passable. The lowest barrier on the unnamed stream (22.0000), site 127S0051, is located approximately 275 meters upstream of the confluence with the West Fork Satsop River.

Full physical surveys were performed to generate priority indices for the following 3 culverts within the unnamed 22.0000 watershed: 127S0051, 127S0263, and 127S0264.

Cloquallum Creek Watershed

Wildcat Creek Watershed

Wildcat Creek (22.0503) is a major tributary to Cloquallum Creek (22.0501). The watershed is located in northeastern Grays Harbor County and south-central Mason County and comprises 21.6 square miles (5,595 hectares). The upper reaches of the watershed are comprised of commercial timberland and rural residences, with some limited agriculture. The City of McCleary is south of the middle reaches and Highway 12 is located just north of the lower reaches of Wildcat Creek. Public roads Tornquist Road, Summit Road, Simpson Avenue, Highway 12, and Highway108 all lie within the watershed. Logging roads managed by Port Blakely Tree Farms and Green Diamond Resource Company access forest stands in the upper reaches.

Juvenile coho were observed in all reaches of Wildcat Creek. Chum salmon, coho salmon, winter steelhead trout, and sea-run cutthroat trout use have all been documented in Wildcat Creek (Sassi2002). Resident cutthroat trout use was attributed to the entire watershed, based on physical stream characteristics. High quality spawning beds are present in the middle and lower reaches. Wetlands and beaver dams are abundant and can be found throughout the lower, middle and upper reaches.

4 water crossings were assessed within the Wildcat Creek watershed, 3 of which were located on anadromous streams and 1 on a non-anadromous stream. Of the 3 water-crossings on streams of known or potential fish use, 1 was determined to be a partial barrier to fish passage and 2 water crossings were determined to be 100% passable. The lowest barrier in the system, site 127WC0001, is located approximately 7,030 meters upstream of the Highway 8 crossing. The downstream check yielded no additional downstream barriers to fish passage on the mainstem Wildcat Creek.

A full physical stream survey was performed to generate a priority index for site 127WC0001. A total of 7868 meters were surveyed within the Wildcat Creek drainage.

WDFW Fish Passage and Diversion Screening Inventory database

Data collected during the WRIA 22 Fish passage Inventory was compiled in the Fish Passage and Diversion Screening Inventory database (FPDSI). The FPDSI database serves as a repository for data collected during inventory efforts. WDFW maintains a centralized copy of the database, consolidating data collected by various inventory groups.

The following tables, excerpted from the FPDSI manual, contain descriptions of the fields and values used in the database.

Table 3. Field descriptions for the 'Site' form and table. Predefined field values are indicated in **bold.**

Form Field Name	Table Field Name	Description
Site ID	SiteID	Unique identifier for each stream crossing. Format is open, may contain both alpha and numeric characters. For example: XXYYYY format, where XX = inventory code assigned to WSDOT (99), YYYY = crossing number, arbitrarily assigned (*e.g.* 990023). Field is used as a table key and to create links to associated tables and data.
Reported By	Idby	Name of group, agency, or individual reporting the feature data. For features identified by WDFW staff the entry should be WDFW. Always use the largest entity possible at this point. Individual names should only be used if they are not associated with a formal agency or inventory group.
Project	Project	Specifies WDFW project responsible for the data. Also identifies origin of legacy data. Current projects include; **WSDOT, WLARETRO, THURSTON, JEFFCO, UFPP, FPDB** (fishways**), FPGRANT, NCOAST, NSOUND, SRFBGRANT.**
Latitude	Lat	Northerly geographic position of feature in decimal degrees (WGS84) using 9 decimal places. Latitude should be expressed as a positive number without the sign (*e.g.* 48.873459247). Do not include N.
Longitude	Long	Westerly geographic position of feature in decimal degrees (WGS84) using 9 decimal places. Longitude should be expressed as a negative number (*e.g.* -122.098217359). Do not include W.
Easting	East	Geographic position of feature in State Plane coordinates (Washington South, NAD27).
Northing	North	Geographic position of feature in State Plane coordinates (Washington South, NAD27).
Road Name	RoadName	Name of road, includes WSDOT Highway numbers (*see data entry protocols*).
Mile Post	MilePost	Highway mile post (to 0.01 mile) where feature is located, where applicable.
County	County	Proper name only of county where feature is located (*e.g.*. Thurston, Jefferson).
WDFW Region	Region	WDFW region. Values are **1 - 6**.
Quarter Section	Qsec	Quarter section where feature is located. Enter as **NW, NE, SW**, or **SE.**
Section	Section	Section where feature is located.
Township	Township	Township where feature is located. Enter as **##N**, where ## is the Township number, include leading zeros.
Range	Range	Range where feature is located. Enter as **##E** or **##W**, where ## is the range number and E is east and W is west. Include leading zeros.
Location/ Directions	Location	Location of feature relative to landmarks or driving directions. No character limit.
Stream Name	Stream	Name of the stream where the feature is located. If the stream is unnamed, enter unnamed.
Tributary To	TribTo	Name of the water body to which STREAM (above) is connected. If unnamed, enter unnamed. May include WRIA & stream number.
WRIA	WRIA	Water Resource Inventory Area number for STREAM (above), 8-character maximum consisting of 6 digits, 1 decimal point, and 1 upper case letter (00.0000A). The first two digits are the WRIA number (1-62), the remaining 4 digits and alpha character are the stream number. If the stream has no number enter at least the WRIA number. Do not use X's as place holders.
River Mile	RM	Distance from mouth of stream to the feature location. Reported in miles to the nearest 0.01.
Fish Use Potential	FishUse	Indicator of fish habitat viability in stream where feature is located. Determines level of feature evaluation. Values are **Yes, No, or Unk** (unknown).
FUP Criteria	FUCriteria	Basis for Fish Use Potential determination: **Mapped** indicates that stream is typed as 1 - 4 on DNR water type maps, **Physical** means the stream meets the minimum physical dimensions specified in the Forest Practice Regulations, **Biological** means fish have been directly observed, and **Other** means criteria other than those listed was used (explain in comments). A "yes" determination may be based on mapped, physical, biological or other criteria. A "No" determination may be based on physical, biological or other criteria. If unknown leave blank.
Owner Type	OwnerType	General category of ownership. Values are **Private, State, Federal, Tribal, County, City, Unknown**. Select from list.
Owner Name	OwnerName	Name of owner, include organizational subdivision (*e.g.* district, region) separated by hyphen.
Address	Address	Street address of feature owner.

Form Field Name	Table Field Name	Description
Address 2	Address2	Mailing address of feature owner if different from street address.
City	City	Name of city.
State	State	Two character abbreviation for state (*e.g.* WA).
Zip code	Zip	Standard Zip code or zip+4.
Phone	Phone	Include area code in phone number. Format (123)456-7890.
Contact	Contact	Name and phone number of specific contact if other than the owner. Include area code in phone number.
Comments	SiteComments	Concise comments (254 character limit) pertinent to the site.
Evaluation Level	RL, FR, DC, PS, TD, ETD	Type of feature and habitat evaluation conducted and completed at site. This field is used to track progress of inventory efforts. It is critical to keep it updated. Check all that apply.
Associated Features	Culvert, Fishway, Dam, Other, Gravity, Pump	Fish passage and surface water diversion structures present at the site for which information has been recorded in the database. Check all that apply.

Table 4. Field descriptions for the 'Culvert' form and table. Predefined field values are indicated in **bold.**

Form Field Name	Table Field Name	Description
Site ID	SiteID	Unique identifier for each stream crossing. Must be identical to the Site ID for the site. Field is used as a table key and to create links to associated tables and data.
Sequencer	Sequencer	Identifies individual culverts at multiple culvert stream crossings. Format X.Y, where X = specific culvert number and Y = total number of culverts in crossing. For example at a triple culvert crossing, the first pipe would be 1.3, the second 2.3 and the third 3.3. Used in conjunction with Site ID to create a unique record ID. If culverts are subsequently added to the site the second digit of the sequencer must be updated for each culvert to reflect the increased number.
Field Review Crew	FRCrew	Last names of individuals responsible for collecting field data on culverts. Separate names with /.
Field Review Date	FRDate	Date of the field review. MM/DD/YYYY format.
Shape	Shape	Specify the shape of the culvert using one of the following codes; **RND** = round, **BOX** = rectangular, **ARCH** = bottomless arch, **SQSH** = squash (pipe arch), **ELL** = ellipse, **OTH** = other.
Material	Material	Specify the material of which the culvert is constructed using one of the following codes; **PCC** = precast concrete, **CPC** = cast in place concrete, **CST** = corrugated steel, **SST** = smooth steel, **CAL** = corrugated aluminum, **SPS** = structural plate steel, **SPA** = structural plate aluminum, **PVC** = plastic, **TMB** = timber, **MRY** = masonry, **OTH** = other.
Span/Diameter	Span	The horizontal dimension of the culvert. Expressed in meters to the nearest 0.01. Used in conjunction with Average Streambed Width to calculate Culvert Span to Streambed Width Ratio.
Rise	Rise	The vertical dimension of the culvert. Expressed in meters to the nearest 0.01. For round culverts, this value will be the same as the span.
Culvert Water Depth	WDIC	Depth of water inside the culvert, measured at the downstream end away from the influence of outlet conditions. Expressed in meters to the nearest 0.01.
Outfall Drop	OutfallDrp	Distance from the water surface at the downstream end of the culvert to the water surface of the plunge pool. Expressed in meters to the nearest 0.01.
Length	Length	The length of the culvert measured to the nearest meters to the nearest 0.1. Include aprons if present.
Culvert Slope	CulvSlope	Slope of the culvert, reported in percent (*e.g.* 4.3). May be positive or negative number. *Must be accurate to within 0.5%.* May be shot directly with laser or derived from invert elevations and culvert length.
Bed Material Present	BedMat	Indicates whether the culvert is countersunk in the streambed through the presence of streambed material *throughout* the length of the culvert. Values are **Yes** or **No**.
Velocity	Velocity	Water Velocity Inside Culvert. Field estimate of water velocity through the culvert in meters per second. Use flow meter or 3 chip method.

Form Field Name	Table Field Name	Description
Apron	Apron	Indicates presence and location of an apron. Values are; **No =** none, **US =** upstream**, DS =** downstream, **BE =** both ends.
Tidegate	Tidegate	Indicates presence of a tidegate. Values are **Yes** or **No.**
Fill Depth	FillDepth	Depth of road fill over culvert. Measured in meters to nearest 0.1.
Plunge Pool Length	PPLength	Distance from the outlet of the culvert to the downstream control. Measured in meters to the nearest 0.01.
Plunge Pool Maximum Depth	PPMaxDepth	Maximum depth of plunge pool. Expressed in meters to the nearest 0.01. Informational. Informational.
Plunge Pool OHW Width	PPOHWwidth	Width of the plunge pool at its widest point measured at Ordinary High Water. Expressed in meters to the nearest 0.1. Informational.
Average Stream Width	AvBedWidth	The average width of the streambed. Measured at the second riffle downstream of the culvert. Used in conjunction with culvert span to calculate Culvert Span to Streambed Width Ratio.
Culvert Span / Stream Width Ratio	CulToeRa	The ratio of culvert width (span or diameter) to streambed width. Derived by dividing culvert span by average streambed width. Expressed as a decimal fraction between 0 and 1.
Barrier	Barrier	Results of the Level A or B fish passage assessment. Values are; **Yes** = culvert is a barrier; **No =** culvert is not a barrier; **Unk** (unknown) = Level B analysis not applicable or Level B analysis required but not completed. If the culvert is on a stream with no fish use potential the field is left blank as no fish passage assessment would have been conducted.
Method	Method	Assessment method used to determine barrier status above. Values are **LA** = Level A**, LB =** Level B, **LBNA =** Level B not applicable, **LBRQ =** Level B Required but not completed, and **OT =** Other.
Passability	FishPass	Percent passability based on field crews professional judgment. Values are **0, 33, 67, or 100**. This value is used in the PI model to derive B (proportion of fish passage improvement). Make sure values in the Passability and Barrier fields are consistent. Leave blank if no fish use potential. For non-WDFW crews the passability for barrier culverts is assumed to be 0.33 unless the individuals making the assessment have an advanced level of expertise.
Repair Status	RepairStatus	Indicates the need for barrier repair. If the culvert is not a barrier, enter **OK**. If the threshold determination (TD) reveals less than 200 meters of habitat gain, enter **NG** (no gain). If habitat gain is greater than 200 meters enter **RR** (repair required). If a TD has not been made enter **UD** (undetermined). If the stream does not have fish use potential the field is left blank
Problem	Problem	Factor that determined barrier status. Applies only to barrier culverts. Entries include **Outfall Drop, Slope, Velocity,** and **Depth.** Enter outfall drop if the measured outfall drop is > 0.24m or enter slope if the slope is > 1%(analysis Level A). The results of the hydraulic analysis (Level B) will indicate either water depth or velocity. Enter all that apply, separate each entry with a semicolon.
Comments	FcComments	Concise (254 character limit) description of culvert problem and explanation of any attribute where OTHER was selected.

Table 5. Field descriptions for the Level B form and table. Predefined field values are indicated in **bold.**

Form Field Name	Table Field Name	Description
Site ID	SiteID	Unique identifier for each stream crossing. Must be identical to the Site ID for the site. Field is used as a table key and to create links to associated tables and data.
Sequencer	Sequencer	Identifies individual culverts at multiple culvert stream crossings. Format X.Y, where X = specific culvert number and Y = total number of culverts in crossing. For example at a triple culvert crossing, the first pipe would be 1.3, the second 2.3 and the third 3.3. Used in conjunction with Site ID to create a unique record ID. If culverts are subsequently added to the site the second digit of the sequencer must be updated for each culvert to reflect the increased number.
Datum	Datum	Reference Point Datum. Specify the datum of the reference point (benchmark). Expressed in meters to the nearest 0.01. May be an established datum or a local assumed datum.
Datum Location	DatumLoc	Reference Point Location. Describe the location of the survey reference point (benchmark), 254 character limit.
Basin Area	BasinArea	Total drainage area above feature. Reported in square miles to the nearest 0.1. Calculate from 7.5-minute USGS quadrangles.
Basin Precipitation	BasinPrecip	Average annual or 2-year 24-hour precipitation dependant on region. See Powers and Saunders 1996 (Appendix C) of the Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual (WDFW, 2000).
Upstream Invert Elevation	USIE	Culvert Invert Elevation - Upstream. Elevation of the culvert bottom (invert) at the upstream end. Expressed in meters to the nearest 0.01
Upstream Culvert Bed Elevation	USCBE	Culvert Streambed Elevation - Upstream. The surface elevation of any streambed material inside the culvert at the upstream end. Expressed in meters to the nearest 0.01. This measure is independent of, but can be related to, the presence/absence question above. Used to determine culvert bed slope and actual flow area in hydraulic model. If streambed material is not present throughout the length of the culvert, leave blank.
Corrugation	Corrug	For corrugated pipes, record the dimensions of the corrugations. These are used in the hydraulic model to determine roughness coefficient. Dimensions are depth by width (peak to peak), measured in inches. The following three corrugations will cover 95% of corrugated pipes; **0.5 x 2.66**, **1 x 3**, and **2 x 6**. If different specify using the same format. For paved pipes, enter **Paved.** For non-corrugated pipes, enter **Smooth**. Anything else, enter **Othe**r.
Downstream Invert Elevation	DSIE	Culvert Invert Elevation - Downstream. Elevation of the culvert bottom (invert) at the downstream end. Expressed in meters to the nearest 0.01
Downstream Culvert Bed Elevation	DSCBE	Culvert Streambed Elevation - Downstream. The surface elevation of any streambed material inside the culvert at the downstream end. Expressed in meters to the nearest 0.01. This measure is independent of, but can be related to, the presence/absence question above. Used to determine culvert bed slope and actual flow area in hydraulic model. If streambed material is not present throughout the length of the culvert, leave blank.
Downstream Control Cross Section	Dsst0 – Dsst6 Dsel0 – Dsel6	The downstream control is typically the head of the first riffle below the culvert (3 – 10m downstream). The cross section is derived from 7 points (stations) across the channel. Data is recorded for each station in distance and elevation. Start at the top of the left bank (Top LB), looking downstream, and work to the right. Measure elevations at the top of each bank, each toe, the thalweg, and other grade breaks. The distance value for Top LB will always be 0. Values for the other stations will be the distance in meters measured to the nearest 0.01 from Top LB. Elevations are measured in meters to the nearest 0.01. Each station and elevation is a separate field in the associated table. Fields Dsst0 - Dsst6 contain the distances and fields Dsel0 – Dsel6 contain the elevations.
Downstream Control H2O Surface Elevation	DSCWSE	Elevation of the water surface at the downstream control. Measured in meters to the nearest 0.01. Derived by adding water depth to the bed elevations at the control.
Downstream Control OHW Surface Elevation	DSOHWElv	Elevation of the ordinary high water (OHW) mark at the downstream control. Measured in meters to the nearest 0.01.
Water Surface Elevation 15m Downstream of Downstream Control	DSWSElv	Water surface elevation at the channel centerline, 15m downstream of the downstream control. Measured in meters to the nearest 0.01. Derived by adding Downstream Bed Elevation and water depth. Used in hydraulic model. Also used in conjunction with upstream water surface elevation to estimate stream gradient through the reach.
Channel Substrate	CHDomSub	Best description of the dominant substrate in the channel between the downstream control and the point 15m downstream of the downstream control. Select one of the following; riprap, boulder, cobble, gravel, sand, mud, bedrock. Needed for the hydraulic model.

Table 6. Field descriptions for the 'Other' form and table. Predefined field values are in **bold.**

Form Field Name	Table Field Name	Description
Site ID	SiteID	Unique identifier for each stream crossing. Must be identical to the Site ID for the site. Field is used as a table key and to create links to associated tables and data.
Field Review Crew	FRCrew	Last name(s) of the field review team responsible for data, individuals separated by / (e.g. Gower/Cox).
Field Review Date	FRDate	Field review date. **mm/dd/yyyy**
Description	Comments	Description of this feature, 254 character limit.
Barrier	Barrier	Results of fish passage evaluation - barrier determination. Values are; **Yes =** feature is a barrier; **No =** feature is not a barrier; **Unk =** barrier status unknown. If the stream does not have fish use potential the field is left blank.
Passability	FishPass	Percent passability based on field crews professional judgment. Values are **0, 33, 67, or 100**. This value is used in the PI model to derive B (proportion of fish passage improvement). Make sure values in the Passability and Barrier fields are consistent. If the stream does not have fish use potential the field is left blank.
Repair Status	RepairStatus	Indicates the need for barrier repair. If the dam is not a barrier, enter **OK**. If the threshold determination (TD) reveals less than 200 meters of habitat gain, enter **NG** (no gain). If habitat gain is greater than 200 meters enter **RR** (repair required). If a TD has not been made enter **UD** (undetermined). If the stream does not have fish use potential the field is left blank.

Table 7. Field descriptions for the 'Species' form and table. Predefined field values are indicated in **bold.**

Form Field Name	Table Field Name	Description
Sockeye	Sockeye	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Pink	Pink	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Chum	Chum	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Chinook	Chinook	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Coho	Coho	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Steelhead	Steelhead	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Sea Run Cutthroat	Sea Run Cutthroat	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Resident Trout	Resident Trout	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Bull Trout	Bull Trout	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Brook Trout	Brook Trout	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.
Brown Trout	Brown Trout	Indicates whether the species has potential to benefit from barrier removal or diversion screening. Check = **Yes**, uncheck = **No**.

Table 8. Field descriptions for the 'Habitat' form and table. Predefined field values are indicated in **bold.**

Form Field Name	Table Field Name	Description
Site ID	SiteID	Unique identifier for each stream crossing. Must be identical to the Site ID for the site. Field is used as a table key and to create links to associated tables and data.
Survey Type (Habitat Assessment Method)	SurveyType	Habitat assessment method used to determine Repair Status and/or Priority Index. **TD** = Threshold Determination, **ETD** = expanded threshold determination, **FS** = full physical survey, **RSFS** = reduced sampling physical survey. (Legacy data includes codes depicting full survey methodologies PS1 PS4)
Survey File (s)	PsFile	Name of the spreadsheet file where habitat assessment data resides.
Downstream Check Date	DsckDate	Date when downstream check was completed. **MM/DD/YYYY** format
Downstream Check Length	DsLength	Length of downstream check in meters.
No. of Barriers Downstream	NoDsBarr	Number of artificial barriers downstream of the target feature.
Downstream Check Comments	DsComments	Brief comments on downstream survey. 254 character limit.
Upstream Survey Date	PsDate	Date of the physical habitat survey. **MM/DD/YYYY** format
Upstream Survey Crew	SurveyCrew	Last names of the survey crew.
Upstream Survey Length	PsLength	The length of stream surveyed during an FS, RSFS, ETD, or TD in meters.
No. of Barriers Upstream	NoUsBarr	Number of artificial barriers between upstream end of target feature and end of habitat survey.
Basin Area	BasinArea	Total drainage area above feature. Reported in square miles to the nearest 0.1. Calculate from 7.5-minute USGS quadrangles.
Upstream Survey Comments	UsComments	Brief comments on upstream survey. 254 character limit.
Potential Habitat Gain Length	LinealGain	Amount of habitat upstream of barrier feature, measured in lineal meters. This would be the survey length from a physical survey or the estimated length from and ETD.
Potential Habitat Gain Spawning Area	SpawnArea	Amount of spawning habitat available upstream of target feature, in square meters.
Potential Habitat Gain Rearing Area	RearArea	Amount of rearing habitat available upstream of target feature, in square meters.

Table 9. Field descriptions for the BPI form and table. Predefined field values are indicated in **bold.** In the table, species (xx) are denoted by the following two character suffixes (e.g. Bso); so = sockeye, ch = chum, pk = pink, co = coho, ck = chinook, sh = steelhead, ct = cutthroat, rt = resident trout, db = bull trout, eb = brook trout, bt = brown trout.

Form Field Name	Table Field Name	Description
Site ID	SiteID	Unique identifier for each stream crossing. Must be identical to the Site ID for the site. Field is used as a table key and to create links to associated tables and data.
B	Bxx	B = Proportion of passage improvement. Values can range between 0.1 and 1.0. This value is based on the % Passability estimate made for barrier features. A total barrier would have a value of 1 indicating a 100% improvement in fish passage if the barrier were corrected. Based on current barrier assessment methodologies input values should be; 0% passable = **1.0**, 33% passable = **0.67**, 67% passable = **0.33**.
H	Hxx	H = gain in production habitat (m^2) above a barrier. This value is taken from the adjusted production area table in the habitat assessment spreadsheet.

Form Field Name	Table Field Name	Description
M	Mxx	M = mobility modifier. Values include; **2** (anadromous species), **1** (resident species), and **0** (species whose increased mobility would have negative impacts). Default values have been programmed into the form. They can be changed if conditions require.
D	Dxx	D = stock condition modifier. Valid entries include; **3** (stock status critical), **2** (stock status depressed or of concern), or **1** (stock status not meeting the conditions for 2 or 3).
C	Cxx	C = cost modifier. Valid entries include; **3** (estimated project cost $100,000), **2** (estimated project cost >$100,000 and $500,000, or **1** (estimated project cost >$500,000).
PI Species	PIxx	Species PI value. Read only, calculated by form.
PI Total	PITOTAL	Sum of all species PI values. Read only, calculated by form.