# Lewis River Hydroelectric Projects Settlement Agreement
# Aquatic Coordination Committee (ACC)
# Meeting Agenda

**Date & Time:** **Thursday, September 12, 2013**
**9:00 a.m. – 11:15 a.m.**

**Place:** **Merwin Hydro Control Center**
**105 Merwin Village Court**
**Ariel, WA 98603**

**Contacts:** **Frank Shrier: (503) 320-7423**
**Lore Boles (Merwin Desk): (360) 225-4412**

| Time | Discussion Item |
|---|---|
| 9:00 a.m. | Welcome<br>➢ Review Agenda & 8/8/13 Meeting Notes<br>➢ Comment & accept Agenda & 8/8/13 Meeting Notes |
| 9:15 a.m. | 2013/2014 Aquatic Fund Update |
| 9:30 a.m. | Acclimation Pond/Crab Creek<br>➢ Water intake screen size – new obstacle |
| **10:30 a.m.** | **Break** |
| 10:45 a.m. | Study/Work Product Updates<br>o Woodland Release Ponds - Status<br>o Hatchery Upgrades - Status<br>o Hatchery and Supplementation Plan - Status<br>o Clear Cr. and Muddy R. Acclimation Pond Construction – Status<br>o Merwin Upstream Construction - Status<br>o Swift Downstream Collector - Status<br>o Future Fish Passage Facilities New Information – Status<br>o Yale Spillway Barrier Net – Status |
| 11:00 a.m. | ➢ Next Meeting's Agenda<br>➢ Public Comment Opportunity<br>Note: all meeting notes and the meeting schedule can be located at: http://www.pacificorp.com/es/hydro.html |
| **11:15 a.m.** | ***Adjourn*** |

Join by Phone
+1 (503) 813-5252 [Portland, Ore.]
+1 (855) 499-5252 [Toll Free]

Conference ID: 1814916

# FINAL Meeting Notes
# Lewis River License Implementation
# Aquatic Coordination Committee (ACC) Meeting
# September 12, 2013
# Ariel, WA

**ACC Participants Present (12)**

Kimberly McCune, PacifiCorp Energy (via conference)
Frank Shrier, PacifiCorp Energy
Todd Olson, PacifiCorp Energy (via conference)
Chris Karchesky, PacifiCorp Energy
James Samagaio, PacifiCorp Energy
Erik Lesko, PacifiCorp Energy
Diana Gritten-MacDonald, Cowlitz PUD (via conference)
Peggy Miller, WDFW (via conference)
Eric Kinne, WDFW
Aaron Roberts, WDFW
Pat Frazier, LCFRB (via conference)
Jim Malinowski, Fish First

**Calendar:**

| | | |
|---|---|---|
| October 10, 2013 | ACC Meeting | Merwin Hydro |
| November 14, 2013 | ACC Meeting | Merwin Hydro |

| **Assignments from September 12, 2013 meeting** | |
|---|---|
| Kinne – Provide ACC other intake system screen designs that fit small streams for the Crab Creek Acclimation Pond site. | **Complete – 9/12/13 (Attachment C)** |

**Opening, Review of Agenda and Meeting Notes**
Frank Shrier (PacifiCorp) called the meeting to order at 9:05 a.m. Shrier requested all attendees identify themselves for the benefit of all participating via conference call. The ACC reviewed the agenda and no additions were requested.

The August 8, 2013 meeting notes were reviewed and approved with one change on page four in the Acclimation Pond Crab Creek Update. Modify the word, "float" to read, "sloped".

Eric Kinne (WDFW) suggested a *sloped*/self-cleaning screen…….

The meeting notes were approved at 9:15 a.m. to include the above-requested change. Kimberly McCune (PacifiCorp) will finalize the August 8, 2013 meeting notes for posting to the Lewis River website.

**2013/2014 Aquatic Fund Update**
McCune informed the ACC attendees that the insurance language was added to the *Aquatic Fund – Strategic Plan and Administrative Procedures* as approved by the ACC. Comments were received from Pat Frazier (LCFRB) and included into the Procedures. McCune notified the

ACC, TCC and interested parties on September 5, 2013 that the Lewis River Aquatic Fund 2013/2014 Pre-Proposal Form submission is due on or before October 7, 2013.

Jim Malinowski (Fish First) expressed concern that the insurance expense for each project will be difficult to determine in advance when an approved project may not actually take place until one year after the approval. The actual insurance cost will likely be higher after the project is awarded.

Todd Olson (PacifiCorp) responded that proof of insurance is required at the time of contracting the approved project. An insurance estimate will be included at the time of the pre-proposal and full proposal stages. The project proponent will include as solid a commitment as possible and include in the proposal. PacifiCorp will never release more funds without concurrence of the ACC.

**Acclimation Pond/Crab Creek**

Shrier informed the ACC attendees that after experiencing our first year with the Swift smolt collector (same screen size) and seeing the amount of clogging that can occur from small debris it quickly became apparent that a fry-criteria screen at Crab Creek could clog in a matter of hours (the primary culprit being pine needles) and shut off the flow to the pond, thus killing the fish. Shrier felt that it is highly unlikely that spawning occurs upstream of the proposed diversion so fry criteria did not make sense.

NMFS approved a smolt criteria screen given a description of the creek and the intake location and he said he could accept a ¾" screen in this case.

Anne Friesz (WDFW) responded on September 11, 2013 (see, **Attachment A**) and did not approve the current design or large screen NMFS and the rest of the ACC approved. WDFW suggested PacifiCorp engineers design an intake system that will not clog the screens and provide a bypass for debris and small fish to flow over or around, etc. Eric Kinne can provide examples of other devices that fit small streams.

Shrier further stated that in order to put screens in to meet the criteria, a larger footprint may be required than was already approved by the US Forest Service in the NEPA process. If the US Forest Service decides we have to re-consult then PacifiCorp will have to push out the project another year until December 2015. We currently have FERC approval until December 2014. Malinowski asked if one person can make this decision. Olson responded that PacifiCorp could request a waiver from WDFW. However, Shrier responded that we had done that and the response from Ann today was that they are complying with the Wash. Admins. Code and there is no alternative or waiver from the requirements. Malinowski expressed that policy should be what's good for the fish. There should be trade-offs such as is the positive results of what we are doing outweigh the negative. He considers WDFWs response to be rigid thinking which causes a lot of trouble.

Kinne said that the intake designs available out there can provide the cleaning in a pretty small footprint.

Olson expressed concern that PacifiCorp has spent over $300,000 to figure out how to get the Crab Creek site to work. At this point PacifiCorp expects that the ACC needs to find something

that works with the footprint the US Forest Service has already approved or this project is not going to move forward.

Malinowski asked what alternatives are available if Crab Creek does not work. Kinne responded that either direct release or the Crab Creek fish can be released at the Muddy River site or the Clear Creek site.

Shrier expressed that these two acclimation ponds are being built larger to hold more fish which is our backup plan if Crab Creek is not constructed. Shrier further notes that PacifiCorp is not required to build three acclimation pond sites, however they will do their best to make it work.

**Study/Project Updates**

**Woodland Release Ponds**
NMFS was to respond regarding Eulachon consultation to the FERC by the end of July 2013. Response is still pending. The Cowlitz Tribe called PacifiCorp recently inquiring about the delay. They were instructed to contact Michelle Day at NMFS. Permit process for Woodland Release Ponds is approximately six months. If NMFS continues to delay the process until the end of 2013 this project will likely be delayed another year.

**Hatchery and Supplementation Program**
We have a number of issues related to the 2014 Annual Operating Plan (AOP) that need to be resolved. Nothing major just agreement on the approach for 2014. The meeting request will go out in the next couple of days to the H&S Subgroup. One or two meetings are expected in order to be able to submit a draft for review with finalization by December 2013.

**Lower River Surveys**
Surveys are underway for spring Chinook. There appears to be a lot of fish in the lower river based on trap counts and angler creel.

**Upper River Surveys**
Surveys are ongoing and seem to be moving forward pretty smoothly with very few inaccessible areas relative to the sample draw this year. Meridian Environmental will begin the mainstem surveys this weekend. Transport of adult early S-Coho began September 5, 2013. To date, a total of 1,751 early coho have been release at the head of Swift Reservoir. An additional 107 adult spring Chinook salmon were also released upstream on Sept. 11, 2013. These fish were surplus from Speelyai Hatchery. This release increased the total number of spring Chinook transported upstream to 545 this year.

**Hatchery Upgrades**
Below is the current schedule for remaining hatchery upgrade projects detailed in Section 8.7 of the Settlement Agreement
Projects scheduled for completion in 2013

- Merwin Hatchery – Upgrades to the PLC, metering and alarming at the ozone facility remains on schedule for 2013
- Speelyai Hatchery – Conversion of Pond 14 to raceways; this project remains on schedule for completion by September 20, 2013.
- Merwin and Speelyai hatcheries - Roofs will be replaced starting next week.

Projects scheduled for 2014

- Speelyai Hatchery – Project is scheduled for completion by October 1, 2014 as previously discussed
- Lewis River Hatchery – Modifications and structural support for the downstream intake is scheduled pending Eulachon ESA coverage is obtained.

**Acclimation Pond/Muddy River and Clear Creek Update**

Construction is under way at the Muddy pond site which is near completion. Shrier is supervising the placement of logs and rocks for both the Muddy and Clear Creek sites. The contractors were able to keep the swath for the trench smaller than expected (less terrestrial impact). At Muddy River the infiltration gallery is installed; intake chamber and pipe are in. 3 – 6" gravel lining; space for fish to escape and a place for fish to hide to avoid predation. The soil is very sandy and we expect the same with Clear Creek.

**Merwin Upstream Construction Status**

Construction is continuing and is on schedule. It is expected that preliminary operation testing will begin sometime in November, 2013.

**Swift Downstream Collector Construction Status**

The number of fish collected in August remained low (**Attachment B**); surface water of Swift reservoir remains warm (20-21 $^{o}$C). The Floating Surface Collector on September 3-5, 2013 was de-ballasted for a four-week maintenance outage to allow contractors to complete some work left undone on the FSC when it was put into service. It is anticipated that the collector will be back in service in early October.

A general discussion took place regarding the FSC barrier net repair; location of tears; repair schedule; bolstering turning points to prevent tears in the future, improving structural design to 5 yr. life expectancy and annual review to monitor structure.

**Development of New Information to Inform Fish Passage**

Clear Creek pit tag detection system is in; 7 hits in the first day (acclimation fish PacifiCorp planted in Spring 2013).

**Yale Spillway Barrier Net**

No additional updates; Shrier will ask for feedback and update from PacifiCorp's engineering group and report back to the ACC.

**Other Topics**

McCune informed the ACC that the Lewis River High Runoff Public Open House will take place on October 7, 2013 at the Port of Woodland. The notice has been placed in three local newspapers, the Woodland Chamber of Commerce September newsletter and updated refrigerator magnets have been distributed. All are invited to join PacifiCorp at the meeting.

Shrier notified the ACC attendees that after today's ACC meeting he is meeting with the Forest Service managers today to tour the Acclimation Pond Muddy River site and to view the floating surface collector from afar. A tour of the FSC is not possible at this time as it is de-ballast through the month of September.

*<10:00 a.m. meeting adjourned >*

**Agenda items for October 10, 2013**

- Review September 12, 2013 Meeting Notes
- 2013/2014 Aquatic Fund Pre-Proposals Update
- Study/Work Product Updates

**Public Comment**
None

**Next Scheduled Meetings**

| | |
|---|---|
| October 10, 2013 | November 14, 2013 |
| Merwin Hydro Control Center | Merwin Hydro Control Center |
| Ariel, WA | Ariel, WA |
| 9:00 a.m. –11:00am | 9:00 a.m. – 3:00pm |

**Meeting Handouts & Attachments**

- Notes from 8/8/13
- Agenda for 9/12/13
- **Attachment A** – Email from Ann Friesz (WDFW), dated September 11, 2013
- **Attachment B** – Swift Floating Surface Collector – Fish Facility Report, August 2013
- **Attachment C** – Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual – Chapter 8 as provided by WDFW

## McCune, Kimberly

**To:** McCune, Kimberly
**Subject:** RE: Crab Creek

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**From:** Friesz, Anne R (DFW) [mailto:Anne.Friesz@dfw.wa.gov]
**Sent:** Wednesday, September 11, 2013 3:45 PM
**To:** Shrier, Frank
**Cc:** Kinne, Eric B (DFW); Howe, David (DFW); Kolb, Samuel S (DFW)
**Subject:** RE: Crab Creek

Good afternoon Frank,
I've looked into this issue at the Crab Creek screening of a new intake system. After meeting with our Fish Program biologists it was unanimous that upper Crab Creek is functional fish habitat and they would expect fish to use the upper portion above the area the intake will be installed. This is of special concern since it is planned to stock three different ESA listed species into Crab Creek in the very near future.

Washington State Law says under WAC 220-110-010:
"It is the intent of the department to provide protection for all fish life through the development of a statewide system of consistent and predictable rules….this chapter establishes regulations for the construction of hydraulic project(s) or performance of other work that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters of the state….The department will incorporate new information as it becomes available, and to allow for alternative practices that provide equal or greater protection for fish life."
Under water diversions, WAC 220-110-190:
"(5) Any device used for diverting water from a fish bearing watercourse shall be equipped with a fish guard to prevent passage of fish into the diversion device pursuant to RCW 75.20.040 and 77.16.220."

Therefore WDFW suggests your engineers design an intake system that will not clog the screens and provide a bypass for debris and small fish to flow over or around, etc. Eric Kinney can provide you some other devices that fit small streams.

If you have any questions, feel free to email or call.

Anne Friesz
Assistant Regional Habitat Program Manager

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Non-business hours HPA Emergency Hotline: 360-902-2537

"Eventually, all things merge into one, and a river runs through it." - Norman Maclean

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**From:** Shrier, Frank [mailto:Frank.Shrier@pacificorp.com]
**Sent:** Friday, August 30, 2013 11:12 AM
**To:** Friesz, Anne R (DFW)
**Cc:** Kinne, Eric B (DFW)
**Subject:** Crab Creek

Ann, I'm sorry we just missed each other. I am in the office until about 1 pm today then out until Tuesday morning. Here's the issue I would like to discuss:
PacifiCorp is currently in the process of designing the Crab Creek acclimation facility for the fourth time due to the GPNF's inability to accept previous designs. The acclimation facility is currently being designed with a small intake screen that meets fry criteria and will withdraw 0.6 cfs from the creek for about a six-week period in April to mid-May.
After experiencing our first year with the Swift smolt collector (same screen size) and seeing the amount of clogging that can occur from small debris it quickly became apparent to me that a fry-criteria screen at Crab Creek could clog in a matter of hours (the primary culprit being pine needles) and shut off the flow to the pond, thus killing the fish.
If you have not yet seen this site, Crab Creek is just downstream of the Lower Falls on the mainstem Lewis River. It is a very small rain-fed system with estimated flows (based on a short-term level-logger) ranging from 0.5 cfs in the summer to over 3 cfs in the winter. Crab Creek has a gradient in the 10 to 13% range (see first two photos). PacifiCorp and staff from GPNF did an electrofishing survey of the creek in 2010 and found a few small (~5" ) trout in the lower 50 to 75 ft. of the creek but nothing above that. I know this is classified as a fish-bearing stream and I am fine with that but I really do not believe trout can or want to pass as high as the intake location which is about 150 ft. upstream of the mouth. Logically then, there is a very low probability of spawning occurring in the upper portions of Crab Creek due to accessibility and an even lower probability that fry would be present near or above the intake. Please keep in mind that I have been adamant that we need to rely on gravity to make this system work. Because of its remote location, any mechanical means of getting water to the ponds is more risky than clogging screens.

So I started with Bryan Nordlund at NMFS and asked him if he could accept a smolt criteria screen given a description of the creek and the intake location and he said he could accept that in this case. I then took it to the Aquatics Coordination Committee and the members agreed with Bryan with the exception of WDFW. Eric was kind enough to suggest a Farmer-type screen and I looked into an infiltration gallery concept. Neither of these will work because of the small size of the creek and the substrate type. For example, a farmer-type screen would need to be nine to ten feet long and two feet wide. There just isn't enough space plus I am certain this screen would suffer the same clogging issues as a horizontal screen which is in the current design. An infiltration gallery would likely need to be twice the size of a famer-type screen.

# Fish Facility Report

## Swift Floating Surface Collector

August 2013

| | Coho | | Chinook | | Steelhead | | Cutthroat | | | Bull Trout | | | Planted |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | fry | smolt | fry | smolt | fry | smolt | fry | < 13 in | > 13 in | fry | < 13 in | > 13 in | Rainbow |
| 01 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 02 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 09 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | | | | | | | | | | | | | |
| **Monthly** | 0 | 1 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Annual** | 0 | 14851 | 0 | 976 | 0 | 162 | 47 | 531 | 6 | 0 | 8 | 1 | 814 |

No adult steelhead (kelts) were collected.

All coho, Chinook and steelhead smolts and cutthroat were transported downstream.

All fry, bull trout, and planted rainbow were returned to Swift Reservior.

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**Wednesday, September 4th, 2013**

# CHAPTER 8

*Revised 12/21/09*

# SURFACE WATER DIVERSIONS

Surface water diversions are common instream features in agricultural areas where the water is used for irrigation. Throughout the state, water is also diverted for hydropower, industrial, recreational, residential, municipal, and hatchery purposes. Washington State law (RCW 77.57.070 and RCW 77.57.010) requires that all surface water diversions be screened to prevent fish from being drawn into the diversions where they are at risk for injury or mortality. Appendix I outlines the screening requirements for surface water diversions.

There are three primary inventory goals for surface water diversions:

- Locate and describe the type of diversion.
- Determine the presence and condition of screening.
- Collect information necessary to prioritize unscreened or inadequately screened diversions for correction.

Surface water diversions are often screened to keep debris out, but not necessarily to protect fish. Additionally, many diversions are unscreened.

For technical assistance with evaluating diversions and screening, contact the WDFW Habitat Program at (360) 902-2534, or TAPPS@dfw.wa.gov.

## 8.1 Locate & Describe

Standard site data (Chapter 2) are collected for all surface water diversions to define the location. Data elements collected in the field to describe the diversion are summarized in Table 8.1, with detailed descriptions of key elements provided below.

***Diversion Type***

Surface water diversions are categorized into two general types, gravity and pump. Gravity diversions are typically characterized by open channels or canals leading off the stream channel where flow is controlled by differences in elevation (gravity). They are often accompanied by dams that divert flow into the channel. Pump diversions employ mechanical pumps to remove water from the stream. The pumps are either located directly in the stream (submersible) or on land with an intake pipe in the stream.

***Access***

Identifies the means by which the diversion site can be accessed (e.g. by foot, vehicle, boat, or off-road vehicle).

***Point of Diversion***
Identifies which stream bank the diversion is located on, right or left, looking downstream.

***Intake Location***
More detailed description of where the diversion intake is located. The three options are riverbank, offshore, and lagoon. Riverbank means the intake is at or immediately adjacent to the shoreline of the main channel. Offshore indicates the intake is in the channel away from the shoreline. A lagoon is out of the main flow and often isolated from the river by a channel or pipe. Gravity diversion intakes are usually located along the riverbank or offshore (infiltration galleries). Pump intakes are found at all locations.

***Diversion Dam***
Many diversions use a dam to deflect water into the intake location. This data element is a flag to indicate the presence or absence of a diversion dam. If present, the dam needs to be assessed for fish passage per the protocol in Chapter 4.

***Headgate***
A headgate is a structure used to control the amount of water being diverted. They are typically associated with gravity diversions and are located upstream of a screen (if present). Headgates can range in form from a simple weir to a screw valve. This data element is a flag indicating the presence or absence of a headgate. Figure 8.1 shows examples of some common headgate styles.

***Diversion Comments***
The comments section is used to briefly describe important aspects of the diversion not captured by the standard data elements. It is also a space for explanations when "Other" or "Unknown" are selected for items on the field forms.

***Screen Presence***
This data element indicates the presence or absence of a screen at the diversion. It provides documentation that a screen is present even when access to the screen is restricted and the information in Section 8.2 cannot be collected. If it is not possible to determine if a screen is present or absent (see Section 8.4), "Unknown" should be selected.

Table 8.1. Field descriptions for the Surface Water Diversion data collection form for diversions (Appendix C). Items in bold text represent predefined choices on the form.

| Field Form Name | Description |
|---|---|
| Site ID | Unique identifier for each diversion. Must be identical to the Site ID for the site. |
| Field Crew | Last names of individuals responsible for collecting field data on culverts. Separate names with a semicolon. (e.g. Johnson;Collins) |
| Diversion Type | Indicate type of surface water diversion: **Gravity** or **Pump** diversion. |
| Access | Type of transportation capable of accessing site: **Boat, Vehicle, Foot,** or **ORV** (off-road vehicle). |
| Point of Diversion | Point of diversion (POD): **LB** = left bank, **RB** = right bank, referenced looking downstream. |
| Intake Location | **RB** = riverbank (or stream bank), **OS** = offshore, **LN** = lagoon, **CV** = cove. A lagoon is separated from the river by a pipe or channel. A cove is open to the river. |
| Diversion Dam | Presence of an instream diversion dam structure: **Yes** = present or **No** = not present. If yes, also complete a dam form. |
| Headgate | Presence of headgate: **Yes** = present or **No** = not present. |
| Diversion Comments | Diversion specific comments. |
| Screen Presence | Reports the presence of some type of screening device: **Yes** = present, **No** = not present, or **Unknown** = unable to determine presence or absence. |


Figure 8.1. Examples of common headgate styles.

## 8.2 Screens

When screens are present, the data elements summarized in Table 8.2 are collected to describe the screen and its general condition. Detailed descriptions of key elements are provided below.

### *Screen Type*

Surface water diversion screens have been classified into a small number of general types; however, each type may have a number of variations due to size and cleaning strategies. Gravity diversion screens are commonly categorized as traveling belt, rotary drum, vertical fixed plate, non-vertical fixed plate, or infiltration gallery. Screens configurations that do not fit these categories are identified as "Other".

Traveling belt screens (figures 8.2 and 8.3) consist of an endless mesh (wire or plastic) conveyor belt that excludes debris while allowing surface water to be diverted to an irrigation system.

A rotary drum screen (figures 8.4 and 8.5) is a cylindrical drum constructed with mesh (wire or plastic) which allows water to flow through while excluding debris.

Fixed plate screens are simply a flat plate mesh aligned in a stream channel at a gravity diversion. Vertical fixed plate screens (figures 8.6 and 8.7) are aligned vertically in the stream. "Active" cleaning plate screens require an additional debris removal system (e.g. brush or wiper). "Passive" plate screens have no cleaning system. Non-vertical fixed plate screens (figures 8.8 and 8.9) may be aligned horizontally or sloping upward or downward in the direction of the stream flow and typically do not require debris removal systems.

Infiltration galleries (figures 8.10 and 8.11) include one or more horizontal screens, perforated pipe manifolds, or single pipes, buried in a streambed or bank. Another type of infiltration gallery is a "Ranney well", which is simply a depression dug off-channel (in a stream or river) with a pump and/or pipe present. Infiltration galleries are generally used for pump diversions but can be use for gravity diversions in steep channels. The screen area is the area of the streambed or bank through which the water flows rather than the area of the intake pipe.

Pump diversion screens attached to the end of a pump include box, barrel, cylinder, or cone (figures 8.12 and 8.13). Pump diversions may also be screened by an infiltration gallery.

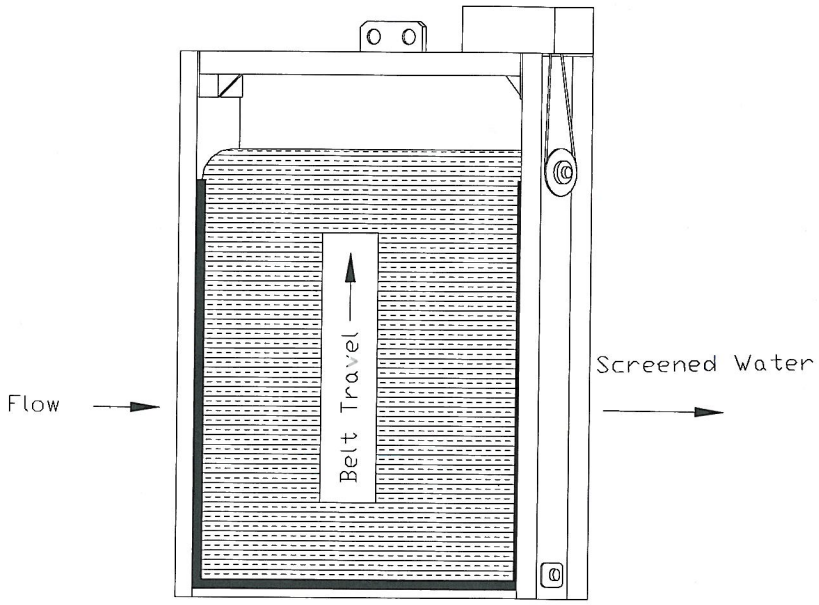
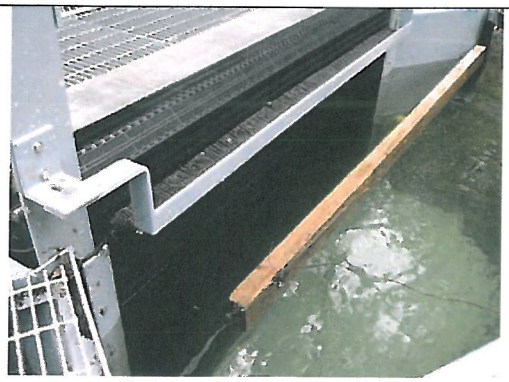


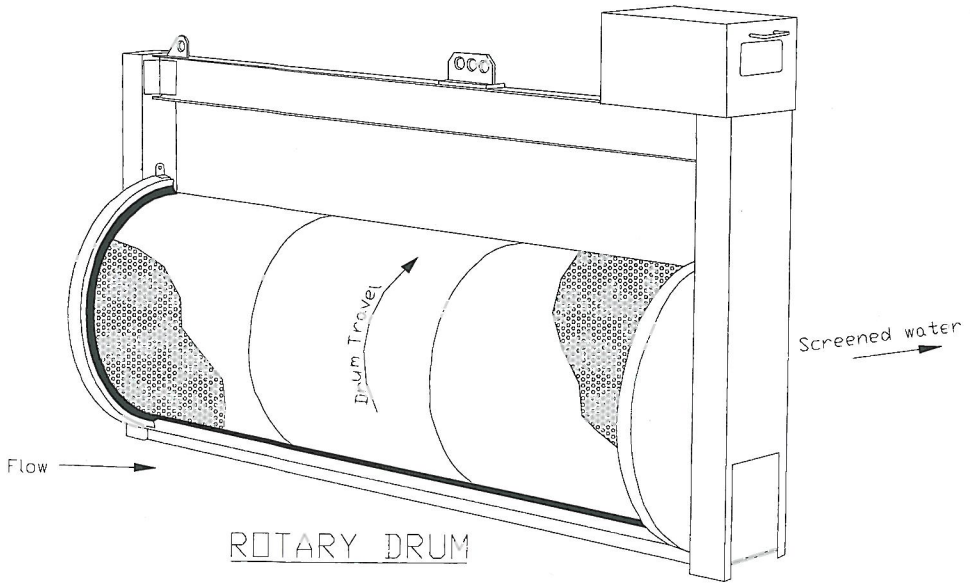

Figure 8.2. Traveling belt screen.

traveling belt screen



traveling belt screen shown with cleaning brush

Figure 8.3. Photo examples of traveling belt screens.



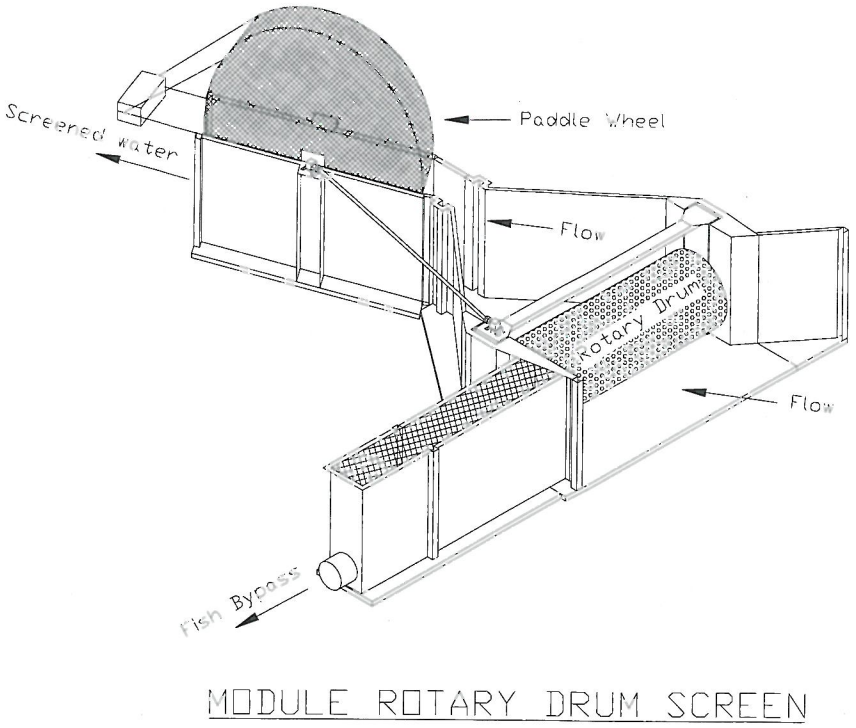




Figure 8.4 Rotary drum screen.

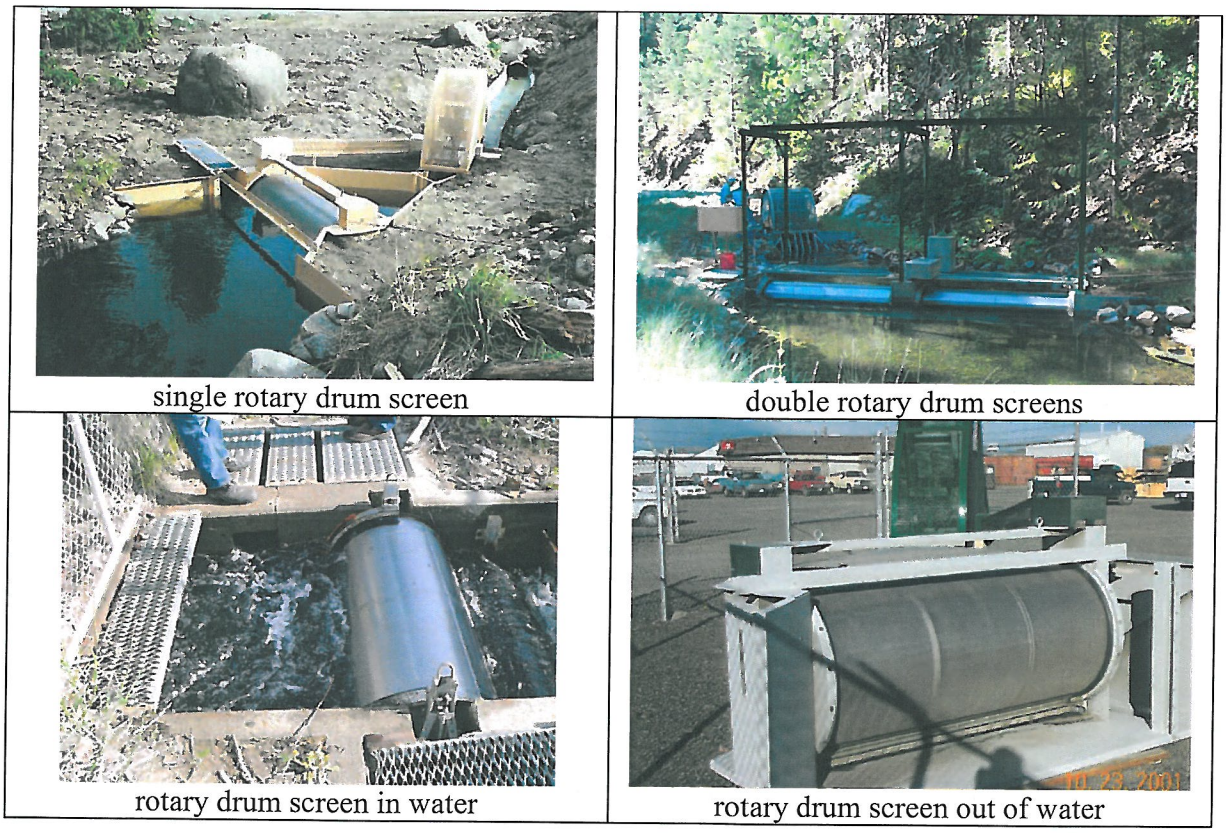



Figure 8.5. Photo examples of rotary drum screens.

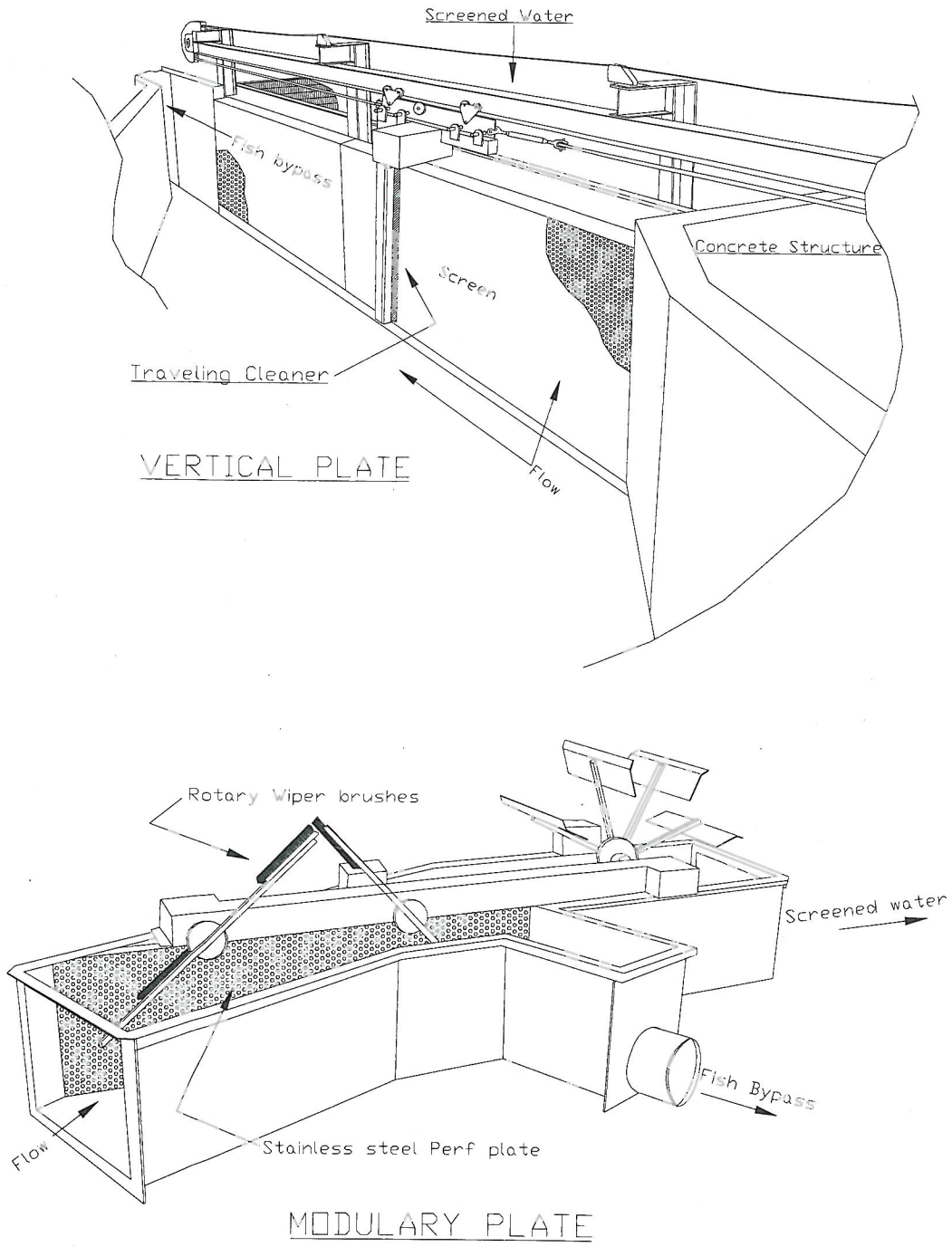
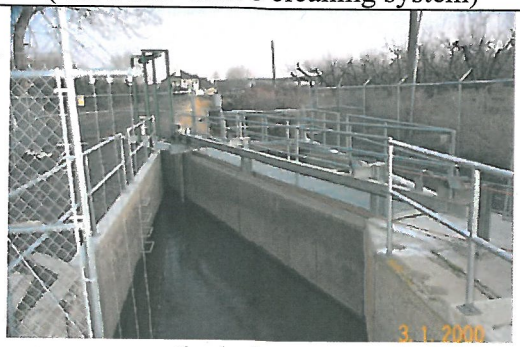



Figure 8.6 Vertical fixed plate screen.

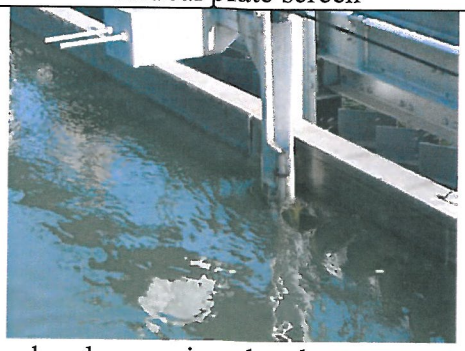
vertical plate screen
('air burst' active cleaning system)

vertical plate screen
('passive'; no cleaning system)



vertical plate screen

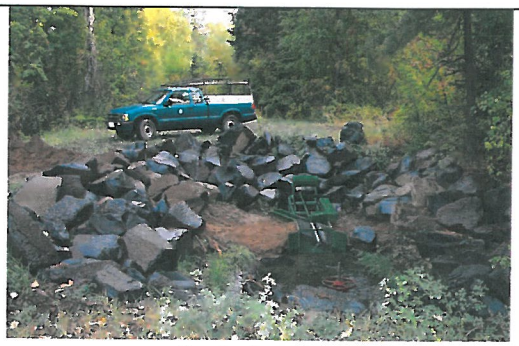
vertical plate dewatered



brush sweeping the plate screen
('sweeping brush' active cleaning system)

brush used to clean plate screen

vertical plate screen ('rotary wiper' cleaning)



vertical plate screen

Figure 8.7. Photo examples of vertical plate screens.

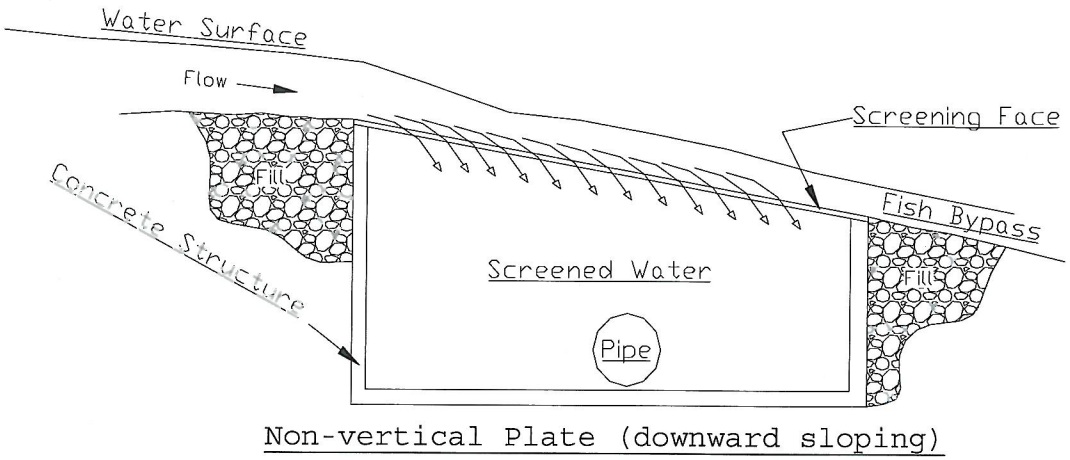



Figure 8.8 Non-vertical plate screen.

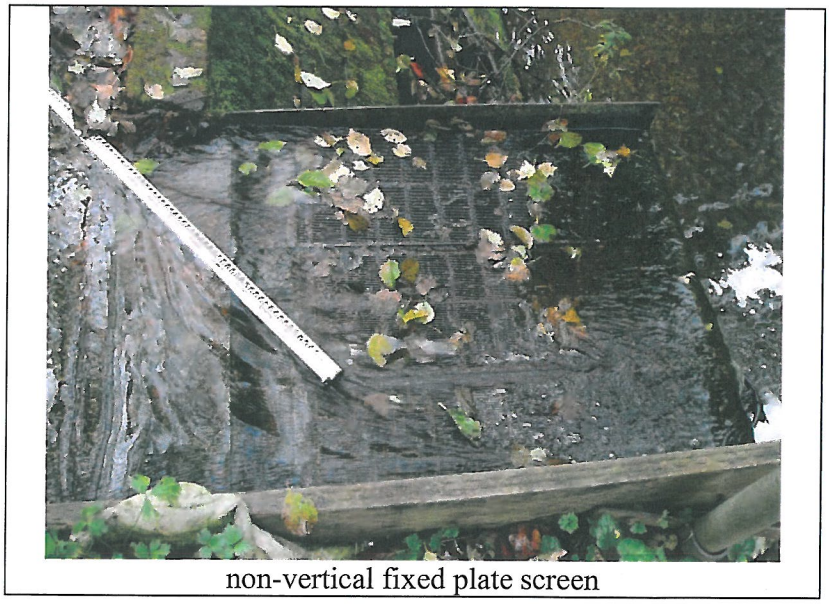



Figure 8.9. Photo example of non-vertical plate screen.

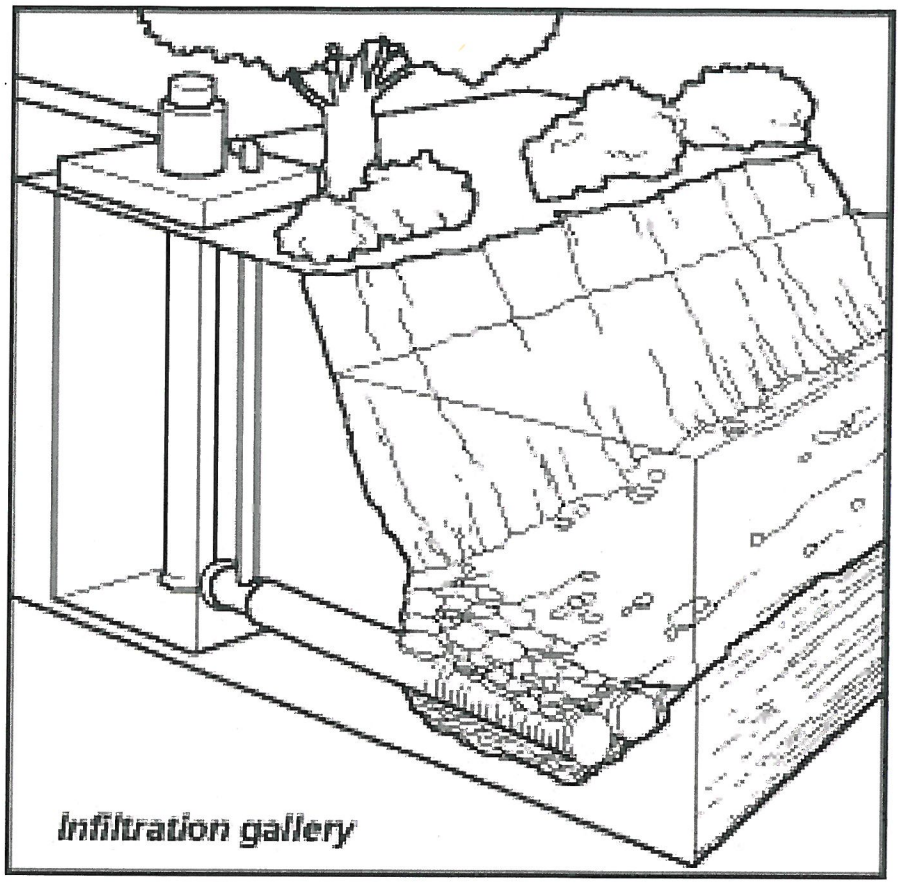
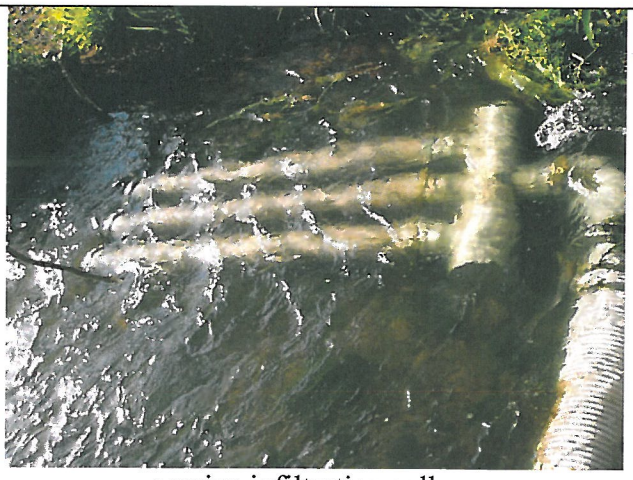



Figure 8.10 Infiltration gallery screen.



passive infiltration gallery

Figure 8.11. Photo example of passive infiltration gallery

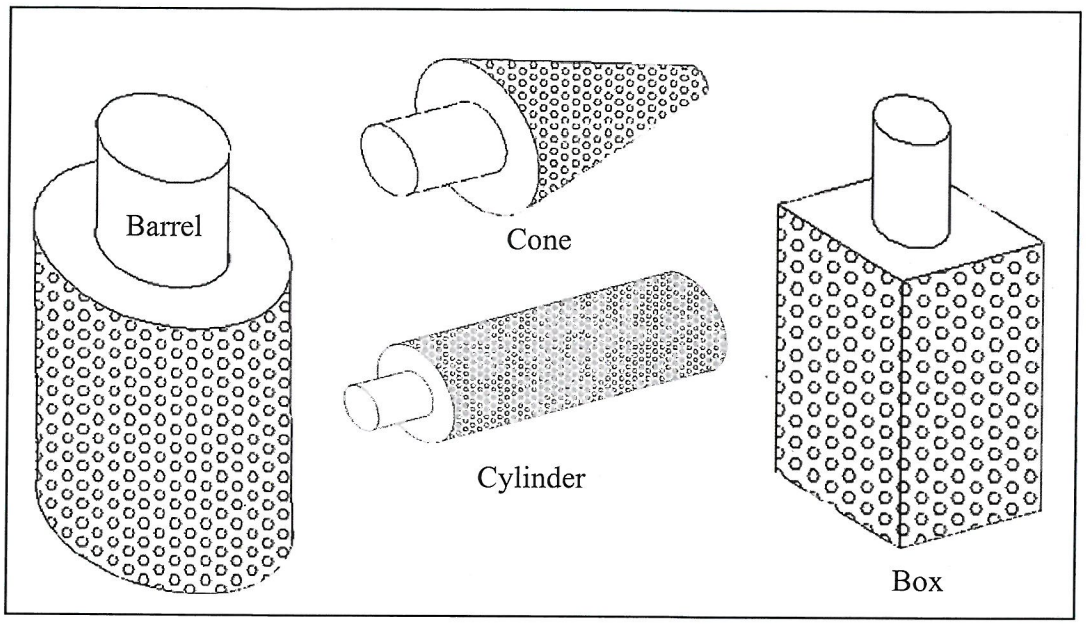



Figure 8.12. Common types of end of pump screens.

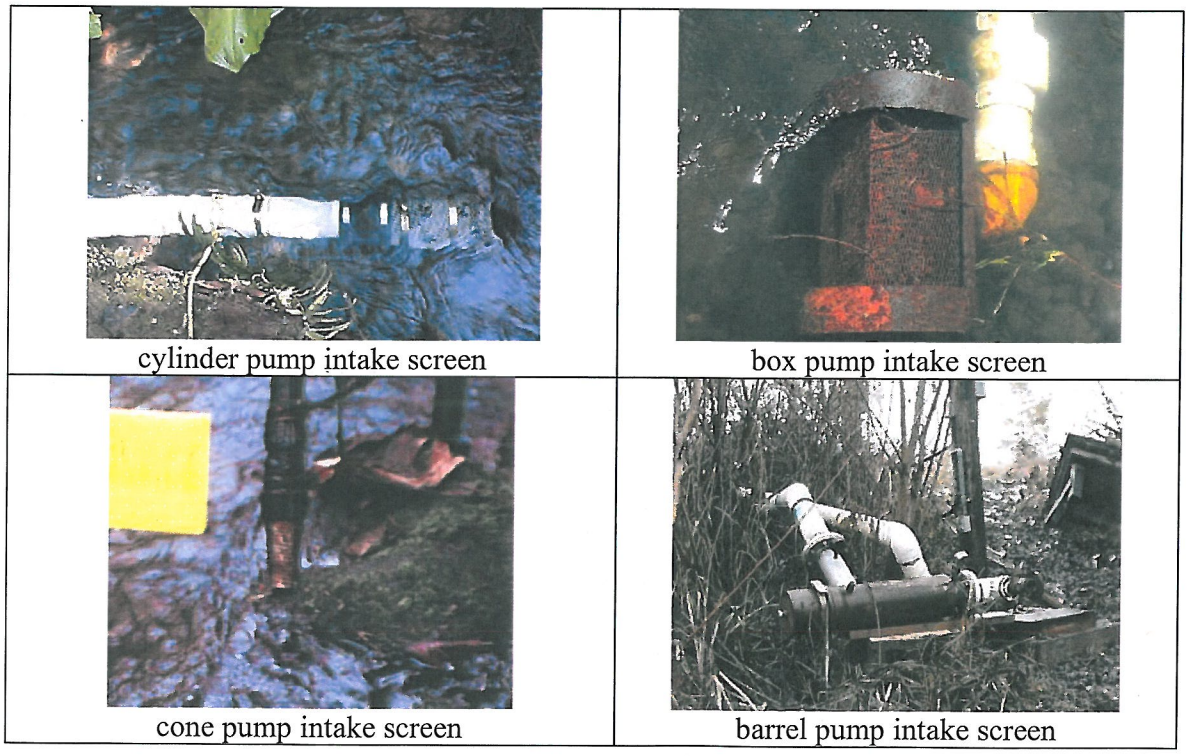



Figure 8.13. Photo examples of common pump intake screens.

***Screen Material***

Screen material refers to the porous part of the diversion screen. Common materials are woven wire mesh, plastic mesh, perforated plate (stainless steel, aluminum or brass with round or slotted holes), stainless steel profile bar (also called wedge wire or well screen), and slotted polyvinyl chloride pipe (PVC). Figure 8.14 illustrates these common screen material types. Materials not meeting these descriptions are designated as "Other".

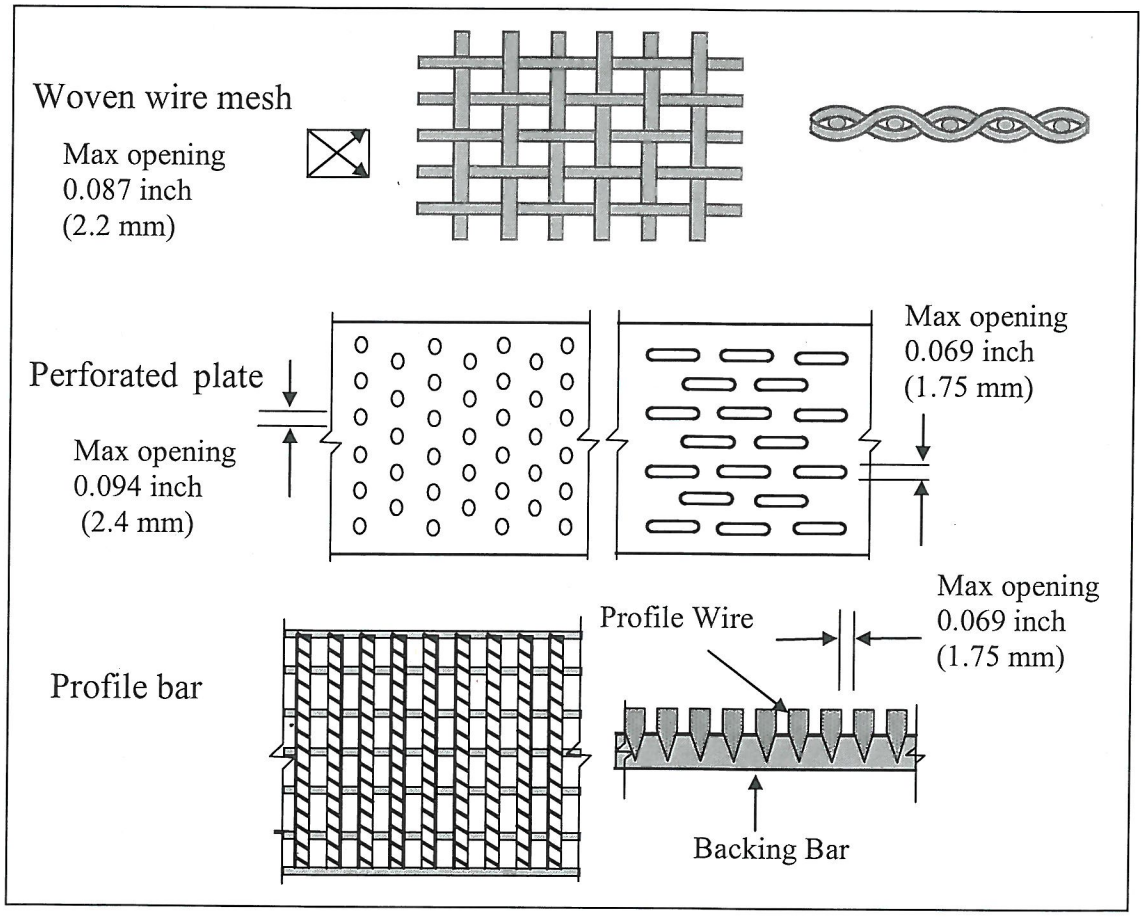



Figure 8.14. Common fish screening materials.

***Mesh Size***

Mesh size refers to the opening in the screen material. Screen mesh diameter can easily be measured using a set of calipers. How mesh size is measured is dependent on the type of screen material (Figure 8.14). For wire or plastic mesh, measure the largest diagonal dimension. For perforated plate measure the diameter of the hole or the narrowest dimension of the slot. For profile bar and slotted PVC measure the narrowest dimension of the slot. On damaged screens, measure the undamaged mesh opening and note the screen damages in the comments section. Mesh size is reported in inches to the nearest to the nearest ten thousands (10000's).

***Fish Bypass***

Gravity diversions with fish screens installed downstream of a headgate and pump diversions withdrawing water from a lagoon, usually require a "fish bypass system" to collect fish from in front of the screen and safely transport them back to the stream. Gravity diversion bypass systems consist of an entrance/flow control section and a fish conveyance channel or pipeline. Lagoons must be configured with an outlet channel (or pipe) having sufficient flow away from the pump intake to carry fish back to the parent water body. The intake channel or pipe to a lagoon does not constitute a bypass channel, since it requires fish to swim upstream to get back to the parent water body. This data element is a flag indicating the presence or absence of a bypass system at the diversion.

***Comments on Bypass Condition***

Describe the condition of the bypass at the time of the site visit. Evaluate and comment on the following items:

- Is the bypass entrance or return pipe blocked with debris?
- Is there sufficient flow to allow fish to find and enter the bypass and return to the river?
- Do the flows in front of screens allow fish bypass without delay or impingement?
- Does the bypass return have an outfall drop? What is the height and condition of the outfall?

*Note: there are cases during low river flow when the bypasses are shut off to enable the diverter to obtain the water right.*

***Screen Dimensions***

*The following general measurements are taken to help characterize the screen. Not all dimensions apply to all screen types. Measurements are reported in English units.*

- Screen mesh/slot opening diameter (to the nearest 0.0001 inch)
- Screen width (to the nearest 0.01 feet)
- Screen height (to the nearest 0.01 feet)
- Screen area (to the nearest 0.01 square feet)
- Diameter (to the nearest 0.01 feet)

***Screen Condition***

Screen condition reflects whether a screen is clean and intact or if it is in need of maintenance. *It is not an evaluation of compliance with federal and/or state screening requirements.* Inadequately maintained screens can result in entrainment (passage through, around or under the screen) or impingement (involuntary contact and immobilization on the screen surface) of fish.

The following items should be considered when evaluating screen condition:

- Holes or dents in the screen surface or frame that would allow small fish to pass through the screen or be injured by contact with the surface. Screens should be adequately sealed to prevent fish injury or entrainment.
- Screen mesh openings that exceed the maximum allowable opening diameter for type of screen (see Table 8.14)
- Gaps and spaces greater than 0.094 inches (2.4 mm) between the screens, structural frames, and/or civil works (wood, metal or concrete section in the channel that the screen fits into).
- Side and bottom rubber seals **not** intact and in continuous contact with the screen.
- Screens or trash racks plugged with debris.

If any of these situations exist the screen condition should be indicated as "maintenance needed".

***Screen Comments***

The comments section is used to briefly describe important aspects of the screen not captured by the standard data elements. It is also a space for explanations when "Other" or "Unknown" are selected for items on the field forms.

***Screen Compliance***

Survey crews may not always be able to determine whether a screen is compliant and meets WDFW screening criteria. Advanced expertise is needed for determining whether the approach velocity, sweeping velocity, and minimum screen area criteria are met. However, if the screen mesh size exceeds the WDFW criteria (see maximum openings in Figure 8.14 and Appendix I), then screening is not compliant. Likewise, if the diversion is unscreened, then the screening is non-compliant. When the screening criteria cannot be adequately evaluated, then compliance is 'unknown'.

Table 8.2. Table 8.2 Field descriptions for the Surface Water Diversion data collection form for screens (Appendix C). Items in bold text represent predefined choices on the form.

| Field Form Name | Description |
|---|---|
| Site ID | Unique identifier for each diversion. Must be identical to the Site ID for the site. |
| Screen Type | Specify the type of screen. For Gravity Diversions: **RD** = rotary drum, **VFP** = vertical fixed plate, **NVFP** = non-vertical fixed plate, **TB** = traveling belt, **IG** = infiltration gallery, **OT** = other. For Pump Diversions: **BX** = box, **BR** = barrel, **CY** = cylinder, **CN** = cone, **IG** = infiltration gallery, **OT** = other. |
| Screen Material | Material screen is constructed of: **WM** = woven wire mesh, **PM** = plastic mesh, **PP** = perforated plate, **PB** = profile bar, **EM** = expanded metal, **SP** = slotted PVC, **OT** = other. |
| Mesh Size | Largest dimension of the screen material opening, measured in inches (0.0001). |
| Screen Height | Height of screen, measured in feet (0.01). |
| Screen Width | Width of screen, measured in feet (0.01). |
| Screen Condition | Indicate screen condition: **OK**= screen clean and intact, **MN** = maintenance needed. |
| Fish Bypass | Presence of fish bypass. **Yes** = present, **No** = not present, or **Unknown** = unable to determine presence or absence. |
| Bypass Condition | Indicate whether fish bypass is in operation and comment on the condition of the bypass. |
| Screen Comments | Screen specific comments. |
| Screen Compliant | Is the screen compliant with WDFW criteria? Indicate **Yes**, **No**, or **Unknown**. |

## 8.3 Diversion Flow

Determining maximum diverted flow is a critical piece of information used by WDFW to prioritize the diversion for screening, establish the size and type of screen needed, and to estimate construction costs. Table 8.3 summarizes the data elements collected or recorded for diversion flow calculations. Key elements are described in detail below.

Flow is the volume of water moving through the diversion for a specified unit of time (e.g. cubic feet per second, gallon per minute). Some of the methods described in this section yield flow in cubic feet per second (cfs), however, the Screen Priority Index (Chapter 10) requires flow in gallons per minute (gpm). To convert cfs to gpm, multiply by 449 (1.0 cfs = 449 gpm).

The preferred value for flow is that allowed by the diverters water right permit or certificate. Most surface water diversions require authorization from the Washington State Department of Ecology (WDOE). The water right permit or certificate defines the legal, maximum instantaneous flow allowed for the diversion. Water right information can be requested from WDOE's public disclosure office at (360) 407-6040, or obtained from the agency's Water Right Tracking System (WRTS), available online at: http://www.ecy.wa.gov/PROGRAMS/wr/rights/tracking-apps.html. If flow cannot be obtained from water rights then it can be measured or calculated by the techniques described below.

***Pump Diversions***

For diversions equipped with an in-line flow meter, the instantaneous flow in gpm can be read directly from the meter if the diversion is in operation. Unfortunately, most diversions are not equipped with flow meters. Pump flow may also be estimated based on the outside diameter or circumference of the intake pipe. Table 8.4 provides estimated flow in gpm based on these dimensions.

***Gravity Diversions***

Some gravity diversions are equipped with calibrated staff gages from which flow can be read directly when the diversions are in use. Figure 8.15 shows photo examples of staff gages. Otherwise, flow is calculated by multiplying water velocity (ft/sec) times the cross-sectional area ($ft^2$) of the diversion channel. The result is flow in cubic feet per second (cfs). Velocity can be measured with a portable flow meter or by the three-chip method (described below) when the diversion is in use. If the diversion is not in operation, an average velocity (described below) can be used as a surrogate. The cross-sectional area of the channel is calculated based on simple measurements.

***Cross-Sectional Area***

The bank full, cross-sectional area of the channel should be calculated from measurements taken approximately 100-300 feet downstream of the point of diversion where the normal waterline is readily apparent on the bank. Measure the width of the channel at the waterline elevation. Then measure the vertical distance (depth) from the horizontal waterline elevation to the channel bottom. Multiply the width times the depth to generate the bank full cross-sectional area. The area must be expressed in square feet to the nearest tenth of a foot (0.1 $ft^2$). If the ditch cross-section is not rectangular, calculate area as accurately as possible by using the formula for a trapezoid (Area = ½ (width $_{waterline}$ + width $_{bottom}$) x depth).

***Three Chip Method***

With the three chip method, velocity is estimated by measuring the time it takes a floating object to travel a set distance, then dividing the distance traveled by the time. For example, if the object travels ten feet in twenty seconds, the velocity is 0.5 feet per second (10 ft / 20 sec = 0.5 ft/sec). This is repeated three times with the results used to compute an average velocity. Multiply the average velocity by the diversion channel cross-sectional area to generate flow in cfs. Multiply the result by 449 to obtain gpm.

***Average Velocity***

An average velocity of 0.75 ft/sec, based on velocities measured by WDFW crews in a number of diversion channels, may be used. To calculate flow, multiply the diversion channel cross-sectional area by 0.75 ft/sec. The result will be flow in cfs. Multiply the result by 449 to obtain gpm. The flow generated by this method is not as accurate as the other methods described above.

Table 8.3. Flow calculation data elements, collected on the Surface Water Diversion Data Form (Appendix C). Items in bold text represent predefined choices on the form.

| Field Form Name | Description |
|---|---|
| Cross-Sectional Area | Bank full, cross-sectional area of the diversion ditch, canal, flume, or pipe, in square feet (0.1). *For Gravity Diversions only.* |
| Intake Pipe Outside Diameter | Measured outside diameter of the intake pipe in inches (0.001). *For Pump Diversions only.* |
| Diversion Flow | Volume of water diverted in gallons per minute (gpm). |
| Flow Derivation | How flow was determined: **Staff Gauge, Flow Meter, Three-Chip Method, Water Right, WDFW Average Velocity, Pipe Capacity, Other.** Non-standard ("Other") flow derivation methods require explanation in diversion comments section (e.g. landowner provided information; from a report; from an HPA; etc). |
| Water Right Number | Water Right number issued by the Washington Department of Ecology, if known. |
| Power Meter Number | Number issued to Power Meter servicing the diversion, if known. |

Table 8.4. Pump diversion pipe flow estimation table.

| Standard PVC & Steel Pipe Sizes (inches) | | Outside Diameter (inches) | | Outside Circumference (inches) | | Estimated Flow |
|---|---|---|---|---|---|---|
| Fraction | Decimal | Fraction | Decimal | Fraction | Decimal | GPM |
| 1 | 1 | 1 5/16 | 1.313 | 4 1/8 | 4.125 | 14 |
| 1 1/4 | 1.25 | 1 11/16 | 1.688 | 5 3/16 | 5.188 | 25 |
| 1 1/2 | 1.50 | 1 7/8 | 1.875 | 6 | 6 | 35 |
| 2 | 2 | 2 3/8 | 2.375 | 7 7/16 | 7.438 | 40 |
| 2 1/2 | 2.50 | 2 7/8 | 2.875 | 9 1/16 | 9.063 | 65 |
| 3 | 3 | 3 1/2 | 3.500 | 11 | 11 | 90 |
| 4 | 4 | 4 1/2 | 4.500 | 12 3/4 | 12.750 | 160 |
| 5 | 5 | 5 9/16 | 5.563 | 20 | 20 | 180 |
| 6 | 6 | 6 5/8 | 6.625 | 28 7/8 | 28.875 | 280 |
| 8 | 8 | 8 5/8 | 8.625 | 27 1/8 | 27.125 | 460 |
| 10 | 10 | 10 3/4 | 10.750 | 33 3/4 | 33.750 | 750 |
| 12 | 12 | 12 3/4 | 12.750 | 40 1/16 | 40.063 | 1100 |

Figure 8.15. Examples of staff gages.

## 8.4 Field Considerations

If screening facilities are fenced, locked, or otherwise inaccessible, there may be an existing record of the facility at WDFW; please check with WDFW/TAPPS screening experts in Yakima or contact the WDFW Habitat Program.

Fish screening facilities at gravity diversions are usually present near the point of diversion, but in some cases they are a significant distance downstream. At a minimum, the inventory crew should walk a 200-meter reach of the diversion channel to search for a screening facility. If the entire diversion channel cannot be walked, and a screening facility is not found within 200-meters, then select 'Unknown' on the data collection form for "Screen Presence" and report in the comments section the distance (meters) walked.

Pump diversions are usually screened at the intake. When evaluating pump diversions, do not pull pumps or pump intake lines out of the water or remove the pump housing; this may result in damage or personal injury. If you are unable to collect the data without disturbing the pump equipment, then leave the data entry fields blank and explain the situation in the comments field.

## 8.5 Additional Reading

NMFS (National Marine Fisheries Service). 2008. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon. http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish_Passage_Design.pdf

Nordlund, B. and K. Bates. 2000. Fish Protection Screen Guidelines (WDFW) – DRAFT 4/25/00. Co-published by the NOAA Fisheries and Washington Department of Fish and Wildlife. Olympia, Washington. http://wdfw.wa.gov/hab/ahg/screen51.pdf