RECLAMATION
Managing Water in the West

Project Alternatives Solution Study (PASS)

Winthrop National Fish Hatchery Steelhead Management – RPA Action 40 Implementation Proposals

Conducted by and for the Bureau of Reclamation in cooperation with the U.S. Fish and Wildlife Service, Bonneville Power Administration, NOAA Fisheries/NMFS, Yakama Nation, Washington Department of Fish and Wildlife, and Upper Columbia Salmon Recovery Board

U.S. Department of the Interior
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U.S. Department of the Interior

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Cover Photograph: View of the Winthrop National Fish Hatchery, Winthrop, Washington.

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1. Summary of PASS Process

The Project Alternative Solution Study (PASS) process is used by the Bureau of Reclamation (Reclamation) to facilitate viable solutions that meet owner and stakeholder requirements for projects. The multi-functional Team for this study met for three days (October 4, 5, and 6, 2011) and developed 4 proposals that addressed the project requirements to collect local broodstock for and manage returning hatchery adults from the Winthrop National Fish Hatchery (NFH), as verified by the agency stakeholders. The purpose of this document is to capture the collaborative process and present the alternatives that were developed over the three day study period. These alternatives were developed to meet the Project Statement and Sideboards developed in previous meetings.

The PASS process is designed to quickly develop alternatives for initial planning and comparison by management. Further development of all alternatives developed by the PASS Team is required. These alternatives may require more detailed analysis and possible engineering, survey, design, field analysis and cost estimation.

The PASS Team Members are:

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2. Project Introduction

Winthrop NFH is near Winthrop, Washington. The hatchery produces spring Chinook salmon (*Oncorhynchus tshawytscha*) and summer steelhead (*Oncorhynchus mykiss*) as mitigation for habitat lost due to development and operation of Grand Coulee Dam on the Columbia River. Both of these species are listed under the Endangered Species Act (ESA); as such the effects of hatchery production on wild fish are a concern. In order to comply with ESA and minimize effects to listed fish, a problem statement has been identified that actions should be taken to enable collection of local broodstock and manage hatchery fish on the spawning grounds.

3. Summary of Background Information

Winthrop NFH summer steelhead and spring Chinook salmon programs are funded by Reclamation, and operated and maintained by the U.S. Fish and Wildlife Service (FWS). Reclamation, BPA, and the U.S. Army Corps of Engineers (collectively the Action Agencies) are currently implementing the Federal Columbia River Power System (FCRPS) 2008 Biological Opinion (BiOp) and 2010 Supplemental BiOp. Reasonable and Prudent Alternative (RPA) Action 39 of the BiOp directs Action Agencies to continue funding hatchery programs and specifies site-specific ESA consultations for the operation and maintenance of hatchery programs. RPA Action 40 outlines specific reforms to be included in the ESA consultations. Specific to Winthrop NFH, RPA Action 40 includes measures to transition to local steelhead broodstock and to manage the number of Winthrop NFH-produced steelhead on the spawning grounds. These measures are to be identified through ESA consultation, and implementation is contingent on a finding, in consultation with NOAA, that the measures are biologically and economically feasible and effective. Implementation of reforms will be prioritized and sequenced. Progress on these reforms to date includes construction of a new adult holding and spawning facility at Winthrop NFH completed in May, 2012, and steps towards transitioning to local broodstock.

The current effort described in this report is to develop alternatives to move forward on more effective broodstock collection measures and alternatives for managing returning adults on the spawning grounds. A preliminary planning conference call held April 18, 2011 indicated a high degree of uncertainty regarding the appropriate course of action to meet RPA Action 40. A "Group Objectives and Logistics (GOAL) meeting was held to bring together stakeholders in a structured process to focus further progress towards managing the number of Winthrop NFH-produced steelhead on the spawning grounds. The GOAL meeting held June 14, 2011 generated much discussion and resulted in development of a problem statement, sideboards for a project, and criteria by which alternatives could be evaluated. These are listed below:

Project Statement

Develop means to collect local broodstock for the Winthrop NFH steelhead program and to manage steelhead on the spawning grounds.

Sideboards Developed

Definition of "Sideboard" – It is a project requirement that will either make or break the project (if an idea does not meet one of the sideboards) it will not go forward. Ideas must meet all the sideboards in order to be considered. All alternatives shall:

1. Comply with ESA
    a. Meet RPA Action 40
    b. Be biologically effective
    c. Be economically feasible

   d. Be permittable
   e. Be compatible with other species recovery programs

2. Meet mitigation requirements (100,000 steelhead annually) for Winthrop National Fish Hatchery.

3. Meet safety requirements (during construction, O&M, and public safety)

4. Be permittable - All other permits other than ESA (County, State, Federal, etc.)

5. Not prevent other agencies from meeting their mitigation requirements

6. Be implementable

Criteria Developed

Definition of "Criteria" – It is a project requirement that can be changed or worked around in order to make the project work for all interested parties. To what extent does/is the alternative:

1. Minimize additional ESA issues (other species).

2. Allow for quick implementation.

3. Effectively collect local broodstock for the Winthrop NFH.

4. Effectively manage steelhead on the spawning grounds.

5. Cost effective from a Life Cycle Costs perspective.

6. Minimize biological risk (fish stress, passage delay, all species, etc.).

7. Compatible with other habitat projects.

8. Consistent with the agreement in U.S. vs. Oregon

9. Impact local communities and economies.

10. Implementable in terms of social and cultural acceptance.

11. Implementable in terms of:
    a. Ease of Construction
    b. Ease of Operation and Maintenance
    c. Logistically feasible and technically feasible

12. Consistent with tribal management objectives and/or affect tribal fisheries.

13. Consistent with non-tribal management/mitigation objectives and/or affect non-tribal fisheries.

14. Compatible with current resources and infrastructure.

4. Pass Study Discussion

Initial alternatives (prior to this meeting) were focused on management solutions in the vicinity of Winthrop NFH. Reclamation developed a concept design for a permanent weir installation at Foghorn Dam. Through discussions early in the PASS study, the group raised some common issues with this focus. First, there was considerable discussion throughout the study indicating a fairly strong aversion to permanent weirs, in general. Realizing a permanent weir option anywhere in this area would be difficult, expensive, and time-consuming to implement, the team expanded the focus of the management alternatives. The brainstorming session suggested several non-structural and/or temporary measures of value to address the problem statement that were expected to be less controversial and could be implemented in a timely manner. An important component of these non-structural or temporary measures would be monitoring effectiveness and the ability to adapt actions in response to monitoring results.

Second, there was some discussion as to the best place in the basin, from a biological perspective, to manage returning adults. This led to the following discussion of steelhead spawning distribution.

Steelhead Spawning Distribution

When considering alternatives to manage returning adult hatchery steelhead, the distribution of spawning adults throughout the Methow Basin is an important consideration. Alternatives that consider managing adults at various locations are only effective for managing the returning adults that spawn upstream of that location. In other words, spawning that occurs lower in the basin than at the proposed location would be unaffected by management efforts. Additionally, efforts aimed at specific tributaries would only affect the spawning adults that pass the specific location. For example, an action aimed at capturing and sorting returning adults in the Lost River would only be able to remove the hatchery fish from approximately 1 percent of the returning spawning population, even if the action were 100 percent effective. The team asked Charlie Snow, Washington Department of Wildlife, to discuss what is known on this subject with the group during the PASS study. Based on redd surveys in 2010, the proportion of spawning adults in tributaries is distributed as follows:

Upper Methow (upstream of the Chewuch River) – 32 percent including 1 percent in Lost River, less that 1 percent in Wolf Creek)

Chewuch River – 19 percent

Twisp River – 21 percent

Methow mainstem below Chewuch confluence – 26 percent

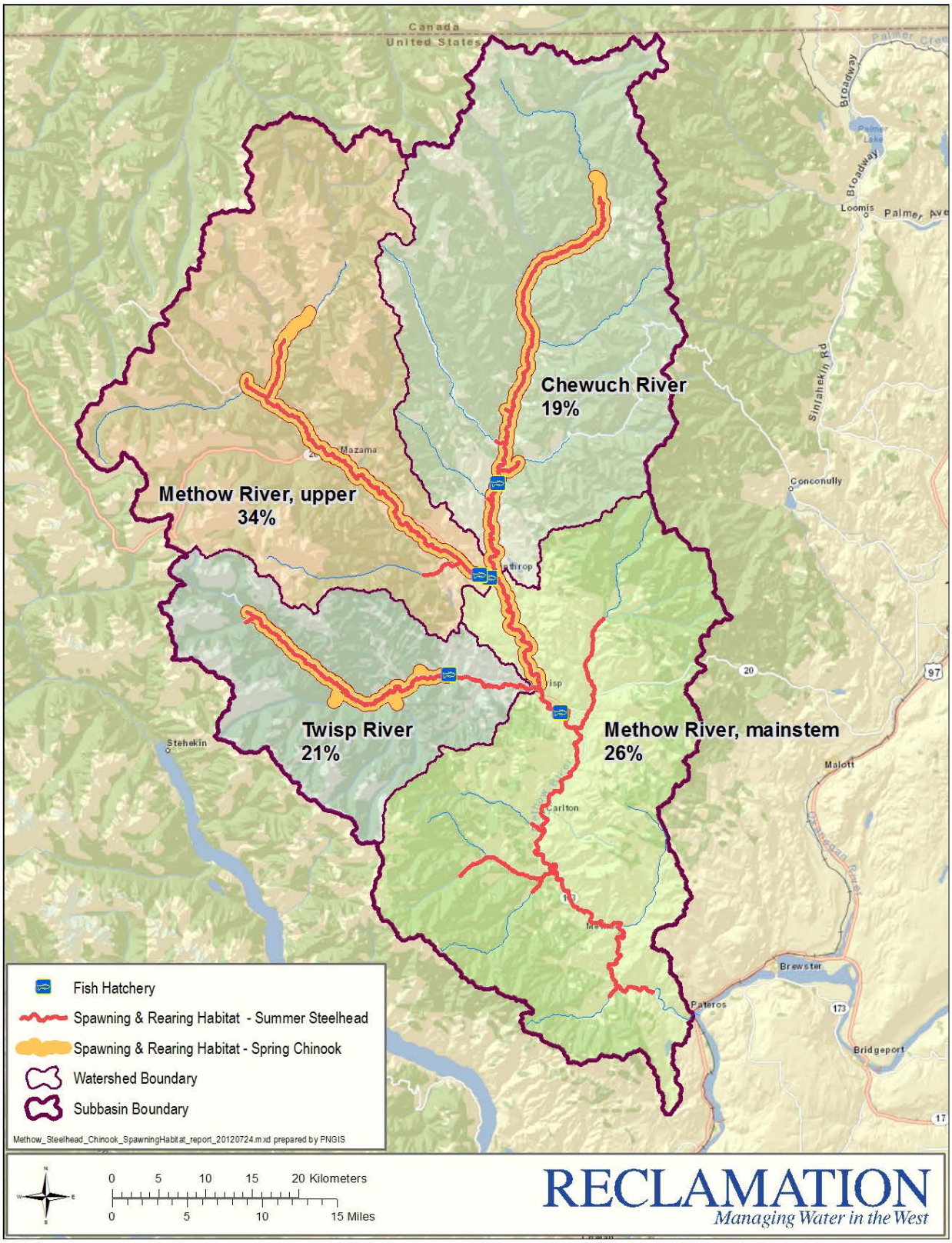


Figure 1. Map of the Methow Basin showing relative distribution of spawning steelhead based on 2010 surveys.

Other Discussion Notes

Several other items were noted for consideration during the PASS study including the following:

- Any actions to be implemented in the Methow basin should be thoroughly coordinated and communicated to the public. The Upper Salmon Recovery Board could be a valuable resource for working with the local community in this respect, and the FWS has processes in place to inform the public.

- Passage and other needs for other species of fish such as bull trout and Pacific lamprey would be important and should be a consideration in alternatives. FWS has bull trout movement data. Westslope cutthroat needs would be similar to steelhead. Also, steelhead kelts would be expected to be migrating downstream and would need to be considered in any alternatives.

- The Methow River above Foghorn Dam is more stable and a higher gradient than further downstream.

- There has been some work experimenting with behavioral guidance such as strobes and sonics for steelhead, and we may want to further investigate this.

- May be able to "customize" when hatchery fish return by shifting place of release.

- There is a sport fishery on the Methow beginning about March 30, need to be mindful of this component of the public. Conservation fishery for steelhead is October 1.

- Adult collection numbers are now 50 pairs of fish for a 200K release program; 25 pairs for a 100K release program. Use now is about half local broodstock and half stock collected at Wells Dam.

- Could explore technique of laser ablation and elemental analysis to identify Methow fish at Wells Dam.

- Monitoring and evaluation would need to clearly define the measure of success to determine biological responses to hatchery reforms. We would need to evaluate the proportion of hatchery origin spawners (pHOS) in the basin. Don't know what this is now. In the Twisp River it is measured at a weir and is about 60 percent.

- The Wells program also releases steelhead, and 90K – 100K of these are not ad-clipped (this protects them from harvest because they are a conservation program), though they do have a visual implant tag and coded wire tag.

Site Visits

During this study, the group made two site visits. One was to Foghorn Dam on the Methow River where the Winthrop NFH diverts water for the hatchery. This is the proposed site for modification under Alternatives 3 and 4.

Photograph No. 1. Site visit at Foghorn Dam.

The group also visited the Twisp Weir, a picketed weir on the Twisp River currently used for broodstock collection and adult management. A weir, such as this one built elsewhere in the basin, is one way of implementing Alternative 4.

Photograph No. 2. The PASS study team visits a weir on the Twisp River.

5. Creativity

During the creativity phase of the study, the PASS Team brainstormed multiple solutions to manage steelhead on the spawning grounds and collection of steelhead broodstock (See Table 1 below). This phase followed the discussion outlined previously, and many of the discussion bullets transitioned into brainstorm ideas.

Table 1. Summary of Initial Ideas/Concepts

Initial Idea/Concept:	Disposition:	Management or Collection*
Conservation fishery	Incorporated into Proposal 1	Management
Changing release location	Incorporated into Proposal 1	Management
Reduce number of fish released in Methow	Incorporated into Proposal 1	Management
Remove fish at hatchery	Incorporated into Proposal 1	Management and Collection
Better attraction flow	Incorporated into Proposal 4	Management and Collection
Remove fish at Wells Dam	Incorporated into Proposal 1	Management and Collection
Acclimation facilities	Incorporated into Proposal 4	Management
Remove fish at barrier in Methow	Incorporated into Proposal 3	Management and Collection
Remove fish at barriers in tributaries	Incorporated into Proposals 2 and 4	Management and Collection
Monitor and evaluate distribution productivity	Incorporated into Proposal 1	Management
Increase angling effort for broodstock and evaluate effectiveness	Incorporated into Proposal 1	Collection
Temporary weirs	Incorporated into Proposal 2	Collection
Retrofit Foghorn with a Velocity Barrier – Option 1A	Incorporated into Proposal 3	Collection
Evaluate fish on spawning grounds compared to release locations	Incorporated into Proposal 1	Management
Seine at appropriate locations	Incorporated into Proposal 1	Collection

Use gill nets at appropriate locations	Incorporated into Proposal 1	Collection
Improve and expand U.S. Fish and Wildlife Collection Program	Incorporated into Proposal 1	Management and Collection
Use volunteer anglers	Incorporated into Proposal 1	Collection
Ask anglers for ideas on collecting broodstock	Incorporated into Proposal 1	Collection
Elemental analysis to identify stock at Wells Dam	Incorporated into Proposal 1	Collection
Parentage analysis	Incorporated into Proposal 1	Collection
Snorkelers herd fish into gill nets	Incorporated into Proposal 1	Collection
Rework fish ladder at the Foghorn site to improve attraction and flow to the ladder	Incorporated into Proposal 3	Collection and Management
Enhance capability for adult fish removal at Wells Dam (East ladder)	Incorporated into Proposal 4	Management

6. Proposals

Following the creativity phase, team members recognized that many of the brainstorming ideas fell into either structural solutions that would require construction/installation or non-structural solutions that could be implemented using existing facilities and infrastructure. Of the structural ideas, there were some that would require major construction and associated time-consuming decision-making and permitting processes, and others that could be done with installation of temporary structures, thus allowing short-term implementation. Further, the long-term, permanent construction ideas could be grouped by location into either specific to the existing Foghorn Dam area, or permanent construction ideas elsewhere in the Methow basin based upon where the most effective adult management may be according to the spawning area discussions outlined earlier.

Following this natural division of ideas, the team decided to develop four proposals as follows:

- Use existing infrastructure to more effectively manage returning adults and collect broodstock.

- Build temporary structures throughout the basin to manage adults and collect broodstock.
- Modify Foghorn Dam to enhance capability to manage adults and collect broodstock.
- Implement new permanent structures throughout the basin to manage hatchery adult escapement and collect broodstock.

The team then divided into groups to further develop the four proposals. Each proposal includes a brief description, ideas to enhance the proposal, potential risks with implementing the proposal, and a bulleted list of the proposal's advantages and disadvantages. Some proposals are displayed with different options to implement, and Proposal 4 is written with four different sub-proposals to enable comparison between the different locations proposed for the new permanent structures.

Proposal 1 – Use existing infrastructure to more effectively manage returning adults and collect broodstock

Proposal 1 includes a suite of activities that could use existing facilities but employ various techniques to be more effective at collecting fish. Many of these techniques are currently used and/or outlined in existing Hatchery and Genetic Management Plans (HGMP). A coordinated effort to implement these ideas may provide adequate broodstock collection and adult spawning fish management to meet ESA objectives without major construction in the Methow River. Adequate monitoring would be needed to determine if these measures are sufficiently effective. These ideas are presented as a suite from which a coordinated effort would select items to implement for best broodstock collection and adult management.

USFWS is currently implementing some aspects of these ideas to collect broodstock to facilitate their efforts to transition the program to using a local Methow broodstock. These items currently being used are listed as "Existing", then "Ideas to Enhance" are provided in five broad categories. Potential risks associated with this proposal are listed. Advantages and disadvantages are presented for this non-structural concept, as a whole, and then specific advantages and disadvantages applicable to each category are also listed.

Existing

- Conservation fishery to remove excess hatchery fish
- Angling by FWS personnel to collect broodstock
- Use hatchery fish ladder to collect broodstock and remove excess hatchery fish

Ideas to Enhance

- Enhance Conservation fishery
  - Use angler incentives to encourage additional angling and retention of hatchery fish
  - Provide awards/prizes for volunteer involvement

  - Release prize-tagged fish
  - Expand limits, seasons, and/or geographical area of fishery
- Consider external marking all hatchery fish
- Enhance broodstock collection efforts
  - Increase angler effort
  - More FWS staff effort
  - Other agencies provide angler effort
  - Allow select volunteers to fish beyond the set season to collect broodstock
  - Other collection techniques
    - Gill nets where suitable
    - Snorkelers herd fish into gill nets
    - Seines where suitable
- Improve Research, Monitoring, and Evaluation (RM&E)
  - Need RM&E to evaluate effects of enhanced adult management on population performance
  - Need good estimates of hatchery and wild components of population basin/tributary
    - Robust PIT tag program (tags and arrays)
    - Expand radio telemetry studies
  - Evaluate return location compared to release location
  - Tributary productivity investigation
  - Spawn timing and location of hatchery and wild fish
  - Explore parental and/or elemental analysis to identify wild Methow fish at Wells Dam to collect broodstock
- Change release locations to manage adult returns
  - Consider releasing fish in Columbia mainstem or lower in Methow
  - Consider off-station acclimation of hatchery fish
- Use Wells Dam to remove excess hatchery fish
  - Existing fish traps in both ladders, but trap in East ladder may require improvements to meet this objective

Potential Risk

Proposal in General

- May not be able to adequately collect broodstock and/or manage returning adults, so may not sufficiently meet intent of RPA Action 40 in the long-term. Potential risk that perception of not implementing a structure being viewed as not responding to RPA Action 40.
- May not be effective; if not, may have to implement further actions

Advantages

Proposal in General

- Uses existing infrastructure so don't have to implement a construction project
  - Permitting issues
  - Fewer landowner issues
  - Generally fewer public issues
  - Consistent with current activities
- Expands knowledge base for future management

Enhance Conservation fishery

- Fishermen would like it
- Provides boost to local economies
- Enhances wild fish ratios on spawning grounds
- Beneficial use of excess hatchery fish

Enhance broodstock collection efforts

- Improves probability of meeting broodstock objectives

Improve RM&E

- Increased certainty of management actions
- Increases knowledge and certainty of spawning ground ratios

Change release locations to manage adult returns

- Could increase effectiveness for removal of hatchery fish
- May enhance wild fish ratios on spawning grounds
- Acceptability already being considered

Use Wells Dam to remove excess hatchery fish

- Effective management of hatchery fish ratios

Disadvantages

Enhance conservation fishery

- Impacts to wild fish through incidental take due to handling
- Expensive to monitor
- Requires strong models to forecast returns

May not achieve goals for management of hatchery escapement

Enhance broodstock collection efforts

- May not fully meet target for broodstock collection
- Requires more coordination

Improve RM&E

- Increases personnel and associated costs
- Does not directly address goals of collecting broodstock and managing hatchery fish

Change release locations to manage adult returns

- Could have fishery impacts if reduces Methow fisheries
- Could increase straying
- Could require additional equipment (fish trucks)
- Is already implemented to some extent in Wells FH HGMP; additional changes may not be feasible

Use Wells Dam (West ladder) to remove excess hatchery fish

- Impacts to sport fisheries/loss of harvest opportunity
- Disposition of removed fish
- Anticipate hostile public reaction

Proposal 2: Build temporary structures throughout the basin to manage adults and collect broodstock

Proposal 2 would use a suite of techniques employing temporary structures throughout the basin to more effectively collect broodstock and/or manage returning adults.

Option 1: Temporary weirs such as picket panel weirs could be deployed in tributaries during the steelhead migration season. A typical picket weir would consist of weir panels or a continuous roll of fence anchored to stakes in the stream channel. Sandbags could also be used to secure the structure. The weir would be placed perpendicular or at a diagonal to the flow, with a fish trap to capture upstream migrating fish. Captured fish would be sorted (wild/hatchery); fish could be used for broodstock, returned to the stream, or removed according to management objectives. The temporary weir in this option would be similar to one installed on the North Fork of the Boise River in Idaho for bull trout collection.

Photograph No. 3. Temporary weir installed on North Fork of the Boise River, Idaho.

Option 2: Temporary trapping devices such as pound nets could be deployed to capture fish for broodstock or management purposes. Pound nets are a trap consisting of an arrangement of nets directing fish into an enclosure. This technique requires relatively slow water such as in the tail end of pools. This would be most effective in tributaries.

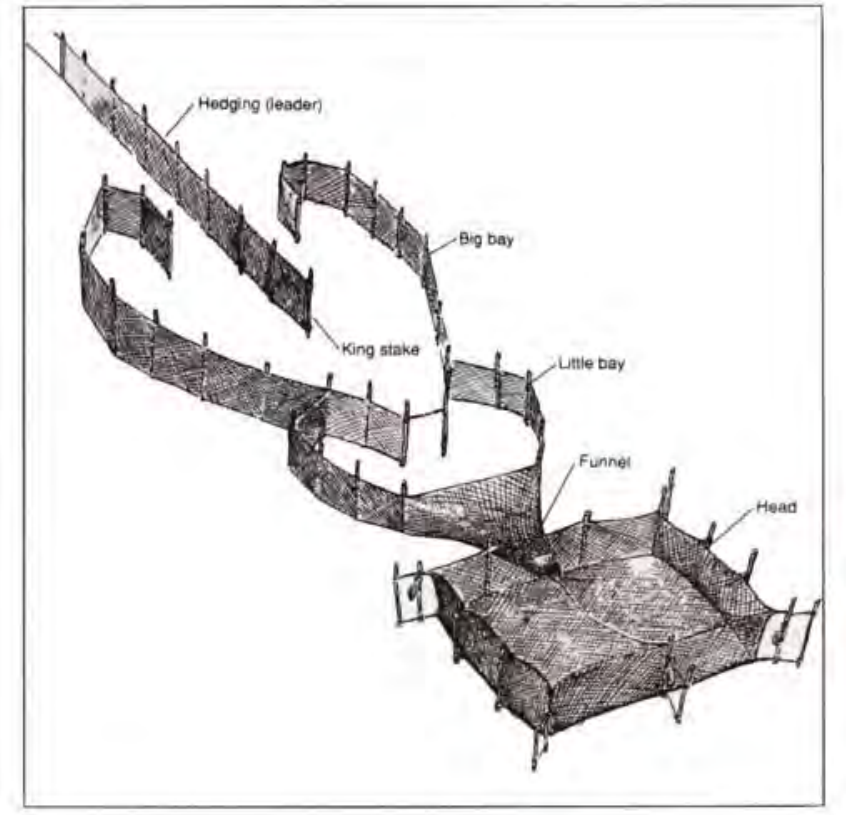


Figure 2. Schematic of typical pound net fish trap.

Either of these options or other temporary fish collection devices would be deployed in tributaries of the Methow basin. If this option is selected, a protocol considering the best locations in which to deploy them would need to be developed. Recent redd survey data could inform this effort. WDFW indicated the approximate percentages of the overall Methow population that spawned in specific tributaries in 2010. The upper Methow (above the confluence of the Chewuch River) contained about 32 percent of the basin's population and could probably not be managed with these methods. The Lost River is within the Upper Methow basin and accounted for about 1 percent of redds. The Twisp River contained about 21 percent of the population; this river currently has a weir installed for adult management. The Chewuck River accounted for about 19 percent of the redds. The lower Methow (below Chewuch River) includes several tributaries that could be managed with these temporary methods and accounted for about 26 percent of spawning.

Potential Risk

- Broodstock would be collected from a small component of the population, so the hatchery population may not be representative of the overall population. Recommend using other collection methods or locations to get diverse representation. Would need to develop a protocol for broodstock collection.
- Holes can be washed out below the picket weir; have to secure with sandbags.
- Could affect spawning distribution if fish change location due to presence of weir.

Advantages

- Low capital cost
- Minimal footprint, temporary, low construction activity
- Less likely to impact river function
- Portable and reusable, easily adapted to different locations
- Readily available materials

Proposal 3: Modify Foghorn Dam to enhance capability to manage adults and collect broodstock

Proposal 3 would modify the existing structure at Foghorn Dam for collection of broodstock and management of hatchery escapement into areas above Foghorn Dam. The current rock structure would be removed and replaced with a new concrete or rock velocity barrier. To accommodate flood flows, a variable crest flood gate would be incorporated in the dam crest. The existing fish ladder and trap would be modified to allow sorting and transport of fish to the hatchery and to meet current fish passage criteria.

Other barrier techniques considered to modify Foghorn Dam included picketed, hydraulic, and experimental style barriers. However, none of these barriers would result in improvements to upstream passage of salmonids nor improve diversion capacity of Foghorn Dam. Major concerns exist with respect to installation/removal of a floating picketed style barrier at the Foghorn damsite. The necessity to remove the barrier as flows increase would limit the capability to catch enough steelhead. Use of experimental barrier technology (e.g. audio, lighting, or electric barrier techniques) has not been proven to be successful for adult steelhead.

Operation of any these barriers will be greatly hindered by bedload movement and floating woody debris. Consequently, a modification to Foghorn Dam which improves passage and provides steelhead collection appears to be a more viable option.

Design Issues

- If rock is chosen as the primary material structural stability and seepage are important concerns to explore.
- Consider design constraint on the flood gate so that natural fish passage is allowed during the bulk of the non-fish trapping period.
- Acceptable flow separation between attraction flow for the ladder, auxiliary water supply (AWS), ladder flow, and diversion canal flow.
- Change of hyporheic flow through dam with use of a hydraulic cutoff may pose a concern to regulating agencies
- Handling of large woody debris
- Accommodating boat traffic/use (i.e. portage trail or bypass route)
- Potential backwater effects
- Accommodating passage of non-target species

Construction Issues

- If rock is chosen as the primary material, availability of large rock may be a concern.
- Work window constraints.
- Control of river during construction.
- Impacts to fish during construction and dewatering.
- Contractor must provide power to the site.

Risk

- Liability associated with public use of river (i.e. recreational boaters)
- Permitting and regulatory acceptance
- Public acceptance
- Loss of current fish habitat

- If large wood captured by the dam is removed and re-inserted downstream of the structure (as a surrogate to natural behavior), it could pose a liability risk for entity handling the wood.

Advantages

- A proven fish barrier technique.
- Provides a high degree of efficiency at blocking upstream passage of steelhead
- Provides a more efficient diversion technique for Foghorn Dam canal delivery
- Will facilitate passing of floating debris better than the existing rock dam
- Use of a concrete velocity barrier section would manage removal of large floating debris accumulation on dam
- New barrier facility keeps within existing Government-owned right-of-way
- Provides opportunity to partially re-use existing upstream fish passage facility (ladder/trap)
- Provides opportunity to provide more attraction/auxiliary flow to ladder for upstream passage
- Minimal change to backwater effects upstream with new barrier at this location when crest is set to similar crest elevation of existing rock dam
- Good access to the site
- Provides a means to improve RM&E, including a better estimate of hatchery and wild ratios on spawning grounds because of efficient fish collection

Disadvantages

- Considerable cost may be entailed in modifying the existing ladder to meet today's passage criteria, particularly if less than one foot of hydraulic drop is required in ladder.
- There may be aesthetic objections to a concrete dam style structure in the area
- A barrier may pose a risk to boaters due to the 7.5 foot hydraulic drop during trapping operations.
- The current infrastructure in place at Foghorn Dam and aforementioned modification(s) may be inconsistent with ongoing efforts to improve natural river function and process and allow unimpeded movement of woody debris.

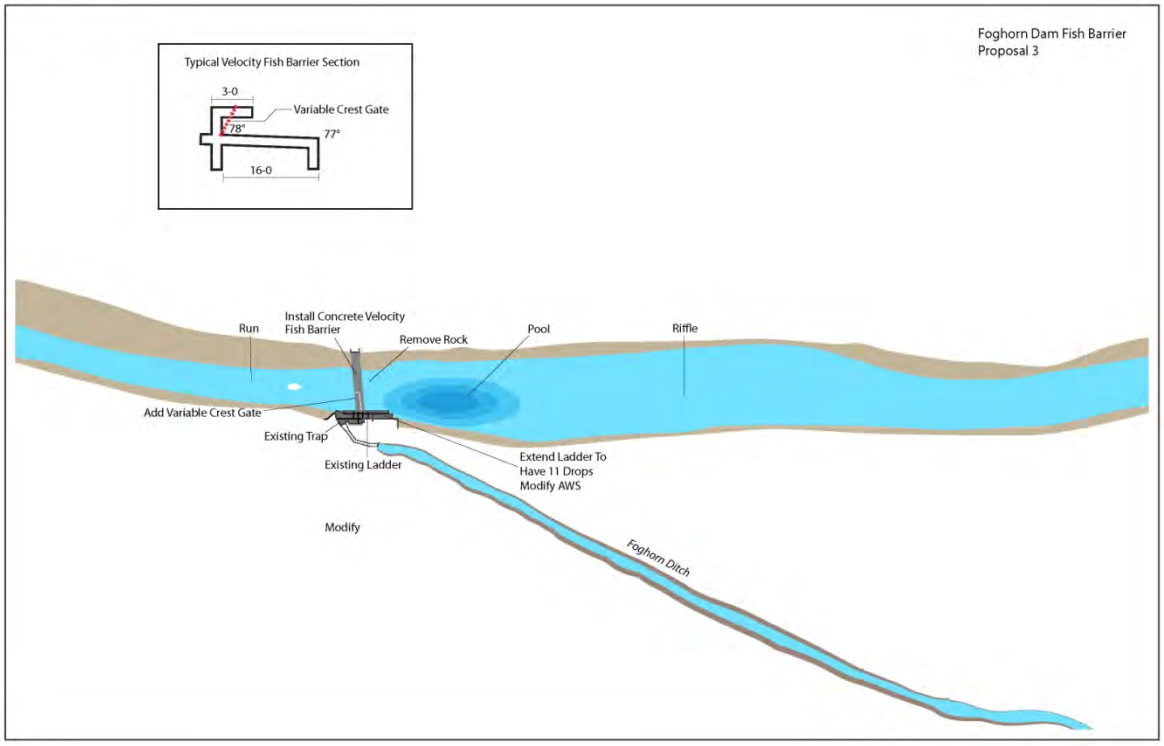
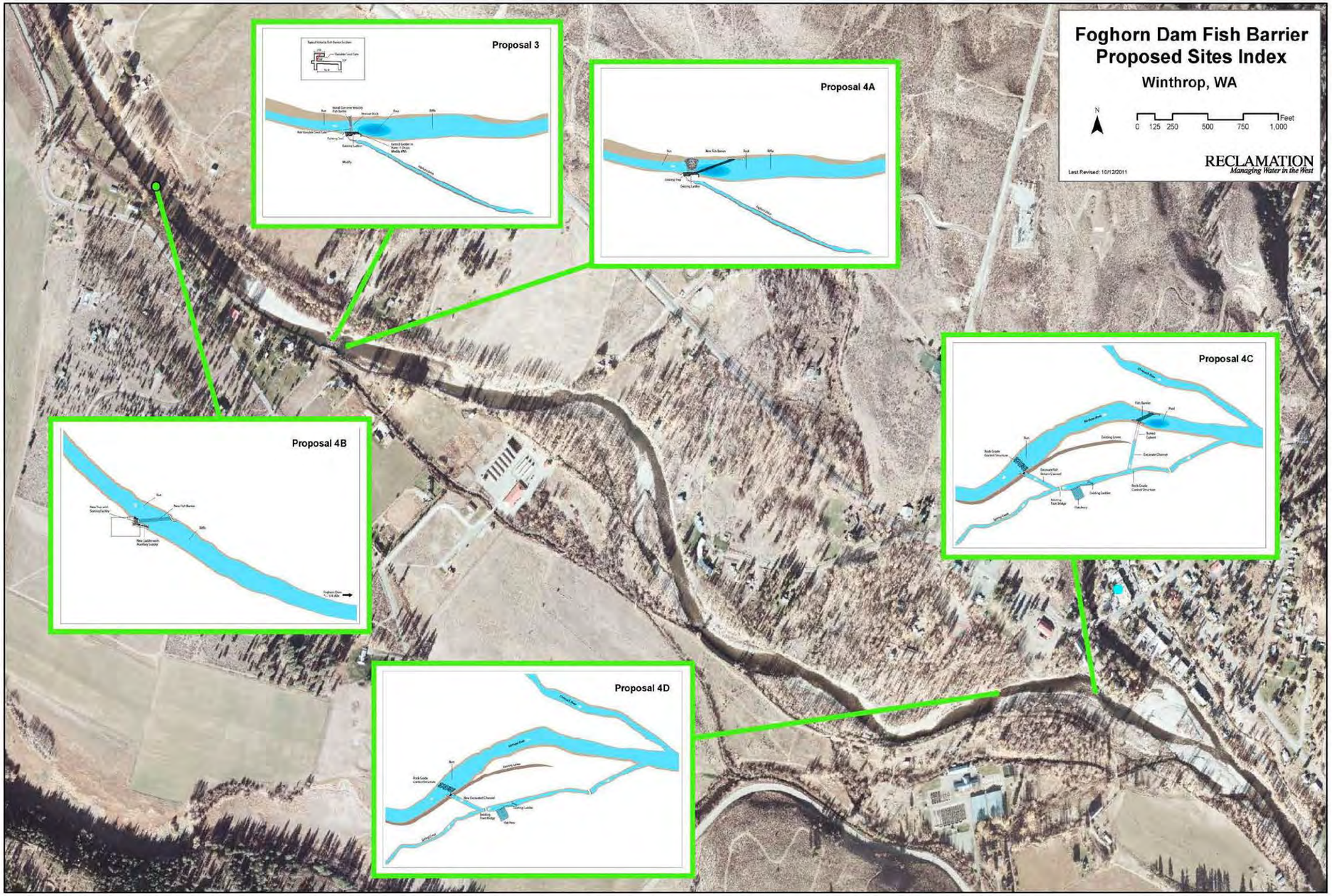


Figure 3. Illustration of a velocity barrier installation at Foghorn Dam, Winthrop, WA.

Proposal 4: Implement new permanent structures throughout the basin to manage hatchery adult escapement and collect broodstock

Proposal 2 involves erecting temporary collection and barrier facilities throughout the Methow River basin. Proposal 4 would place permanent collection and barrier structures throughout the Methow River basin, sited specifically above the confluence with the Chewuch River. Proposal 4 consists of four options to manage adult steelhead and collect broodstock. Techniques considered include picketed, hydraulic, electric, and experimental barriers. None of these techniques result in improvements to upstream passage of salmonids. Major concerns exist with respect to installation/removal of a floating picketed style barrier at Foghorn Dam due to site constraints. The necessity to remove the barrier as flows increase would limit the capability to catch enough steelhead. Use of electric barriers was not recommended in light of public safety concerns, protection of other fish species and wildlife, as well as effective operation of electric sensors and electrodes. Use of experimental technology (e.g. audio, lighting, or bubbler techniques) has not been proven to be successful for adult steelhead aside from the fact that operations of this technology will be greatly hindered by bedload movement and floating woody debris. Use of permanently mounted picket panels in a new permanent barrier structure each of which raise and lower are studied below. These options are presented below as Proposals 4A, B, C, and D. It should be noted that no picketed barrier is associated with Proposal D.


Foghorn Dam Fish Barrier
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Proposal 4A: Implement new permanent structures throughout the basin to manage hatchery adult escapement and collect broodstock. Installation of a fixed picket style barrier below Foghorn Dam.

Proposal 4A would locate a fixed picket style weir at the tailwater of Foghorn Dam, attached to the existing fish ladder entrance wall. The existing ladder would be modified to comply with current fish passage criteria. The existing ladder and trap will be modified, if necessary, to allow sorting and transport of fish to the hatchery.

Design Issues

- Deep hole in tailwater of Foghorn Dam poses design, construction, and operational challenges.
- Bed load deposition and floating debris acting to block pickets and picket operation and movement in the water column.
- Acceptable flow separation between attraction flow for the ladder, auxiliary water supply (AWS), ladder flow, and diversion canal flow.
- Handling of large woody debris.
- Accommodating boat traffic/use.
- Accommodating passage of non-target species.

Construction Issues

- Work window constraints.
- Control of river during construction.
- Impacts to fish during construction and dewatering.
- Contractor must provide power to the site.

Risks

- Public liability to recreational boaters
- Permitting and regulatory acceptance
- Public acceptance

- Potential structural failure due to floating debris striking or attaching to the picket sections.

- Ice accumulation and or anchor ice impacts to the operation of the pickets.

Advantages

- Stable channel w/barrier at the "Fix Point"

- Ladder and trap in place and can be re-used with modifications and sorting facility added

- Facility is already owned by Federal Government and no new easement would be needed

- No additional facility needed on the river for fish to migrate through

- No backwater effect felt upstream with new barrier at this location

- Good access to the site

- Average channel velocity is slightly less downstream of dam than upstream due to slightly flatter stream gradiant (slope = 0.30 ft/ft VS o.40 ft/ft)

Disadvantages

- Deep hole at tailwater of existing rock dam will have greater dewatering cost involved during construction

- Deep hole at dam tailwater will result in irregular approach velocity across a barrier and hydraulic "hot spots"

- Operation of a barrier located in such a deep hole along the barrier alignment will result in turbulent hydraulic conditions and subsequent structural stresses on barrier members and/or pneumatic components i.e., air bladders, compressors, motors, etc.

- Any floating debris will be difficult to remove on picketed style barrier

- Maintenance of barrier will be problematic in deep water conditions

- Bankfull width is much greater downstream (38 percent more) of the dam than above. This will mean a greater capital and Operation, Maintenance, Replacement, and Power (OMR&P) cost for a barrier with greater axis length.

- Modifying the existing ladder to meet current passage criteria will be costly, particularly if less than one foot of hydraulic drop is required in ladder.

- Barrier would be located partially in a bedload bar area which may disrupt barrier performance should deposition occur on the barrier
- There may be aesthetic objections to a barrier in the area
- A barrier may pose a risk to boaters

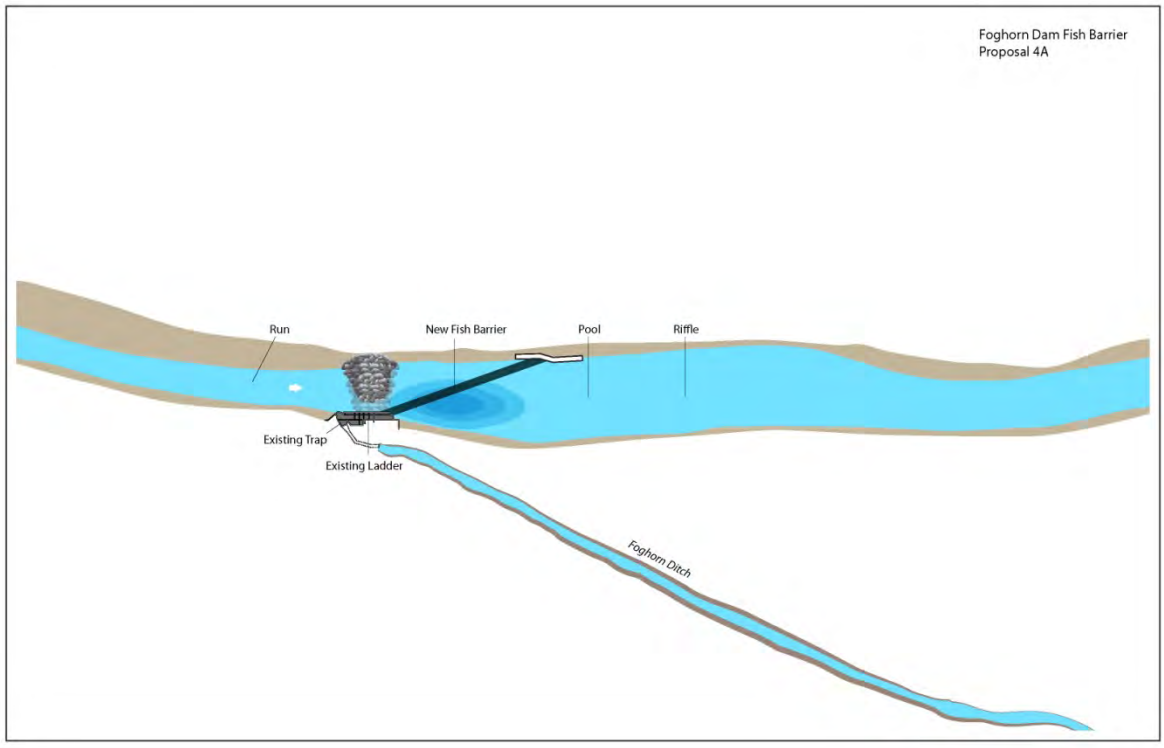

Figure 4. Illustration of new fish barrier at Foghorn Dam, Winthrop, WA.

Proposal 4B: Implement new permanent structures throughout the basin to manage hatchery adult escapement and collect broodstock. Installation of a fixed picket style barrier at a new site upstream of Foghorn Dam

Proposal 4B would locate a fixed picket style weir at a new site located approximately ½ mile upstream from Foghorn Dam. This site would be located in an area of greater geomorphological stability (greater width/depth ratio than downstream) and presumed shallower depth which would favor a picket style barrier.

Design Issues

- Property acquisition would be required.
- Access to the site must be obtained.
- Bed load deposition and floating debris acting to block pickets and picket operation and movement in the water column.
- Acceptable flow separation between attraction flow for the ladder, auxiliary water supply (AWS), and ladder flow.
- Handling of large woody debris.
- Accommodating boat traffic/use.
- Excess stream velocity may be a constraint to picket operation.
- Accommodating passage of non-target species.

Construction Issues

- Work window constraints.
- Control of river during construction.
- Impacts to fish during construction and dewatering.
- Contractor must provide power to the site.
- Risks
- Public liability to recreational boaters.
- Permitting and regulatory acceptance.
- Public acceptance
- Potential structural failure due to floating debris striking or attaching to the picket sections.
- Ice accumulation and or anchor ice impacts to the operation of the pickets.

Advantages

- Stable channel with barrier at the "Run"
- Straight segment of river and more uniform cross section should mean excellent barrier hydraulic performance as approach into the barrier will be more uniform and minimal "hot spots" will occur.
- Good access to the proposed location.
- Bankfull width is 72 percent of the downstream width at Foghorn Dam tailwater which means a barrier with shorter axis length equates to lesser capital and OMR&P cost.
- Width to Depth ratio is 67 percent that of the area downstream of Foghorn Dam which should mean a shallower operating depth for better barrier hydraulic performance and lesser cost.
- Barrier style with minimal backwater can be built which will have minimal sedimentation impacts upstream.
- Barrier could more easily be constructed in halves and simpler dewatering involved.
- Barrier would be located outside of any bedload bar areas with less concern about disruption to barrier performance due to deposition occurring on the barrier.

Disadvantages

- Average channel velocity is slightly greater upstream of dam than downstream due to slightly steeper stream gradient (slope = 0.40 ft/ft VS 0.30 ft/ft).
- Barrier site would be on private land and appropriate acquisition of permanent and temporary easements would be required.
- There may be aesthetic objections to a barrier in the area.
- A barrier may pose a risk to boaters.

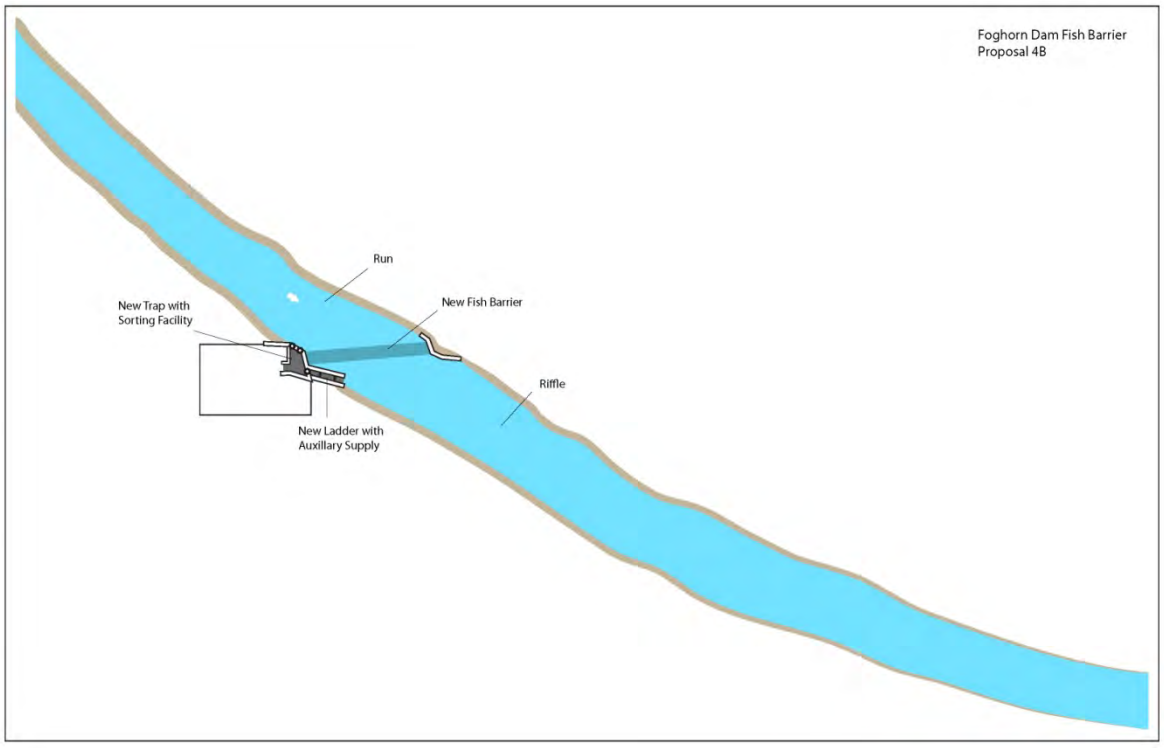

Figure 5. Illustration of the new trap with sorting facility and new ladder with auxillary supply.

Proposal 4C: Implement new permanent structures throughout the basin to manage hatchery adult escapement and collect broodstock. Installation of a fixed picket style barrier on the Methow River upstream of the confluence of the Chewuch River.

Proposal 4C would locate a new fixed picket style barrier downstream from Foghorn Dam (due north of WNFH) near the hatchery. Fish would ascend the existing hatchery ladder. Excavation of a small return channel to the river at the upstream end of this channel would be needed for native adult fish. A low-lying rock grade control structure at this point on the river would be installed to maintain flows in the new small return channel. Culverts would be installed in the levee with flood shut-off gates.

Design Issues

- Property acquisition would be required.
- Access to the site must be obtained.
- Bed load deposition and floating debris acting to block pickets and picket operation sand movement in the water column.
- Acceptable flow separation between the newly excavated fishway and Spring Creek.

- Handling of large woody debris.
- Accommodating boat traffic/use
- Excess stream velocity may be a constraint to picket operation.
- Location of barrier in relation to pool depth.
- Adequate water flow into Spring Creek to enable homing fidelity particularly at higher flow levels.
- Accommodating passage of non-target species.
- Instability in channel plan form.
- Site located in a deposition zone.
- Flood control.

Construction Issues

- Work window constraints.
- Control of river during construction.
- Impacts to fish during construction and dewatering.
- Contractor must provide power to the site.
- Access to site during construction.
- Dewatering for construction will likely be difficult or challenging.

Risks

- Public liability to recreational boaters
- Permitting and regulatory acceptance
- Public acceptance
- Potential structural failure due to floating debris striking or attaching to the picket sections.
- Ice accumulation and or anchor ice impacts to the operation of the pickets.
- Reluctance of adults to ascend the fishway channel with culvert.

- Fish passage delay.
- Flooding of hatchery property during high water events

Advantages

- Cool water in Spring Creek should be inviting to upstream migrants to enter the channel when entering off the barrier during summer/fall months.
- Bringing more water into the Spring Creek channel should be more attractive for adults at the downstream confluence of Spring Creek and the Methow River. More fish may ascend the Spring Creek channel due to this increased flow.
- Opportunity exists in the Spring Creek channel near the existing ladder to install sorting facilities, if desired.

Disadvantages

- Unstable channel however, with the levee and hard point on the left bank of the river, the channel may be more stable but may still experience minor changes in lateral migration and elevation changes on streambed.
- Upstream migrants encountering the barrier will be required to pass through either a buried pipe or buried box as they come off the barrier structure. This would be required to get the fish through the levee as well as across the point bar at low streamflow.
- Barrier would be located close to the confluence where a depositional zone exists. Sedimentation may be a problem with respect to the operations/maintenance associated with keeping the barrier clean and operational.
- Poor access for operations and maintenance of barrier.
- Maintaining sufficient flow splitting on river with flows being sent into Spring Creek off the Methow River may be a problem if flow is not always adequate in the Methow River.
- Chance of increased sedimentation and floating debris issues along Spring Creek in light of bringing additional water into the channel off of the upper Methow River. This may mean increased operations and maintenance on the channel.
- Possibly adult migrants coming off the barrier will be confused and reluctant to enter through the culvert passing through the point bar and levee.
- Even if all hatchery fish go up the Spring Creek channel, they all might not ascend the fish ladder.

- There may be aesthetic objections to a barrier in the area
- A barrier may pose a risk to boaters
- The levee was constructed following the 1948 flood and it currently protects the hatchery from extreme high water events. Breaching the levee may result in flooding the hatchery property during extreme high water events.

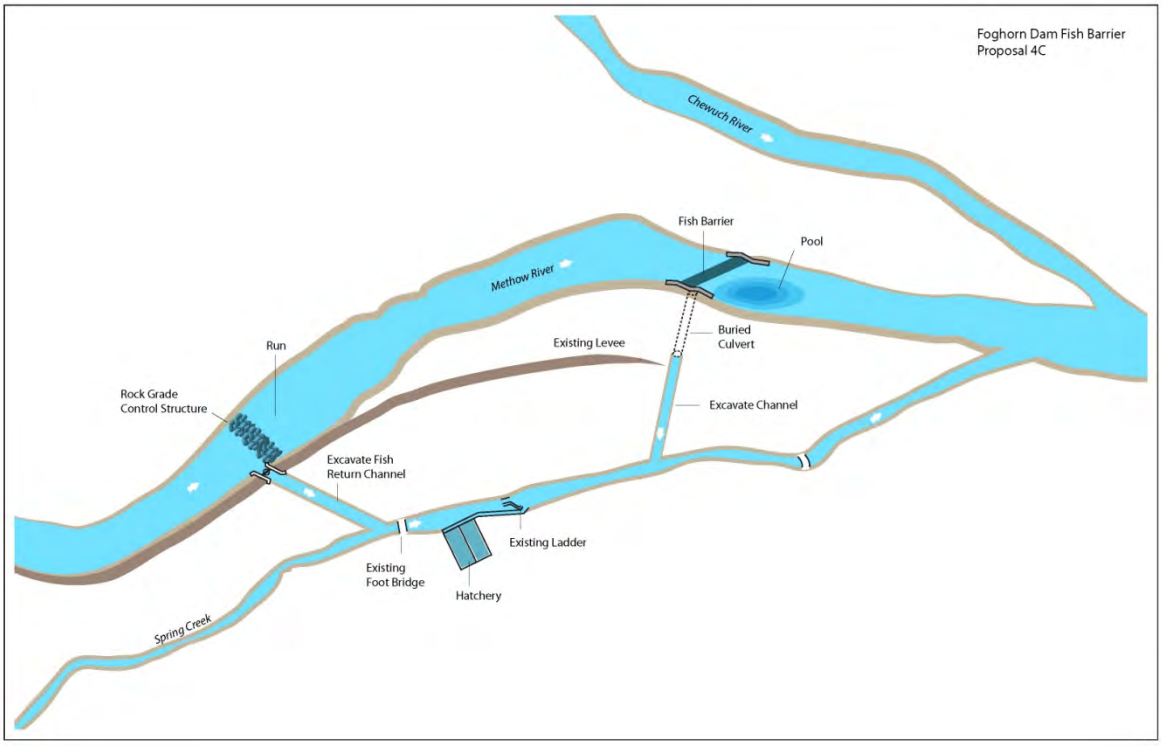

Figure 6. Illustration of Proposal 4 locating a new fixed picket style barrier downstream from Foghorn Dam.

Proposal 4D: Implement new permanent structures throughout the basin to manage hatchery adult escapement and collect broodstock. Installation of a structure to augment flow in Spring Creek.

This proposal would construct a low-lying rock grade control structure in the Methow River. It would be designed to send a maximum of approximately 10 percent of the 5 percent river exceedance flow down a newly excavated fish return channel located on the backside of the river levee to the Spring Creek channel at the hatchery. Channel flow would be considerably higher for 95 percent river exceedance flow. Water in the newly excavated channel would flow into the existing Spring Creek channel and then to the existing hatchery ladder entrance. This increased flow in Spring Creek may improve the attraction of adults passing up the Methow River below the Chewuch confluence into Spring Creek and into the vicinity of the hatchery ladder. The existing infrastructure near the hatchery ladder would be used to sort adult salmonids. Non-target fish will be returned upstream of the hatchery and allowed to return to the Methow River using the newly excavated fish return channel.

Design Issues

- Property acquisition may be required.
- Bed load deposition and floating debris acting to block culvert entrance.
- Acceptable flow separation between the newly excavated fishway and Spring Creek.
- Adequate water flow into fish return channel to enable homing fidelity particularly at higher flow levels.
- Accommodating passage of non-target species through the Spring Creek channel.
- Instability in channel plan form.
- Mouth of Spring Creek located in a deposition zone, potentially impairing entrance of fish.
- Flood control

Construction Issues

- Work window constraints.
- Control of river during construction.
- Impacts to fish during construction and dewatering.

- Risks
- Permitting and regulatory acceptance
- Public acceptance
- Reluctance of adults to ascend Spring Creek.
- Fish passage delay for fish ascending Spring Creek.

Advantages

- No fish barrier required on the Methow River.
- No OMR&P required as associated with a river barrier.
- Simpler construction than a fish barrier in the river.
- More aesthetically acceptable compared to a fish barrier in the river.
- Good access for maintenance of the intake channel on the backside of the river levee.
- Cool water in Spring Creek should be inviting to upstream migrants to enter the Spring Creek channel during summer/fall months.
- Higher flows in the Spring Creek channel should be more attractive for adults at the downstream confluence of Spring Creek and the Methow River. More fish may ascend the Spring Creek channel due to this increased flow.
- Opportunity exists in the Spring Creek channel near the existing ladder to install sorting facilities if desired.
- River morphology is more conducive to uniform flows and desired flow splitting.
- Decreased safety risk to boaters and fishermen compared to a barrier.

Disadvantages

- The Methow River has an unstable channel, but is constrained from moving laterally by the river levee. However, vertical change in streambed elevation is possible.
- Chance of increased sedimentation and floating debris issues along Spring Creek if increased flows are introduced into the channel from the upper Methow River. This may mean increased operations and maintenance on the intake channel and Spring Creek in the Hatchery area.

- There is a risk that insufficient flow from the intake channel will not attract upstream migrants to ascend the Spring Creek channel at the confluence, and these fish will remain in the main Methow River channel to proceed upstream to Foghorn Dam. Even if all hatchery fish go up this channel, they may not ascend the fish ladder.

- Low flows in the Methow River may prevent sufficient flows being sent into Spring Creek.

- Scent of Methow River water introduced on Spring Creek may be disorienting or not sufficiently strong enough to attract migrants to ascend the Spring Creek channel at the confluence with the Methow River.

- The levee was constructed following the 1948 flood and it currently protects the hatchery from extreme high water events. Breaching the levee may result in flooding the hatchery property during extreme high water events.

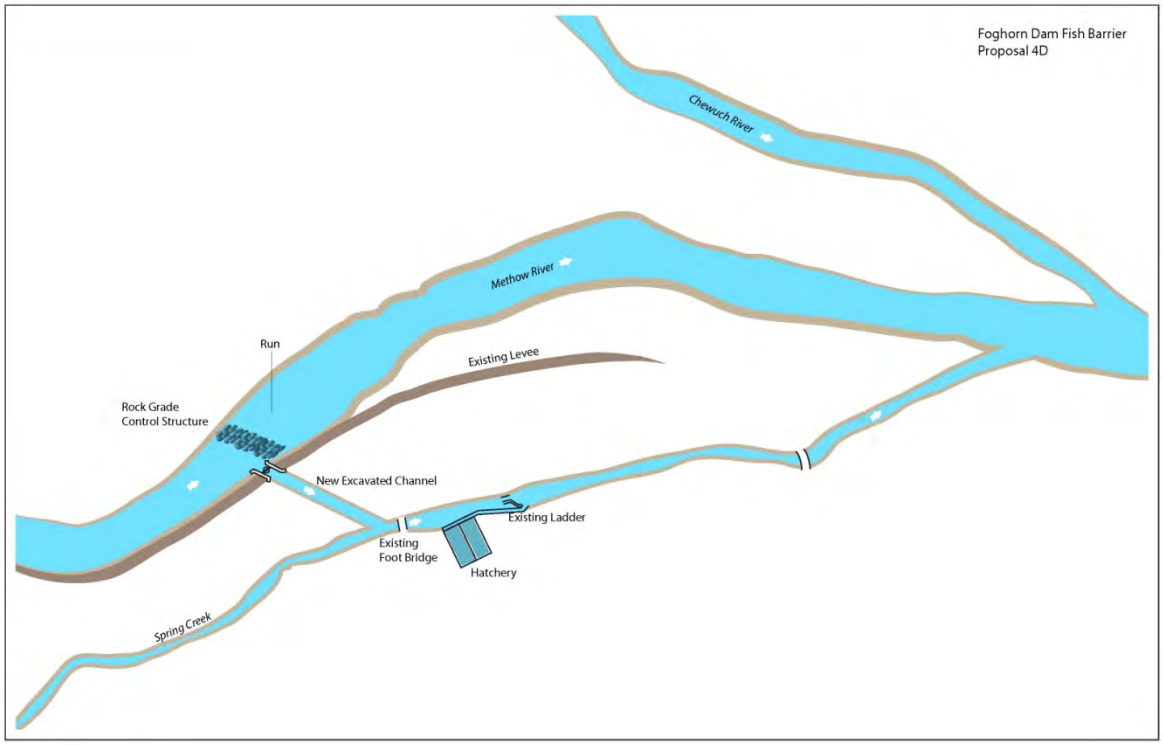

Figure 7. Illustration of proposal 4D to install a structure to augment flow in Spring Creek.

7. Conclusions

This report presents several proposals for collecting local broodstock and managing adult hatchery steelhead on spawning grounds developed through the brainstorming and proposal development process of the PASS study. Proposal 1 is a suite of actions that could use existing infrastructure to collect fish. Proposal 2 outlines further efforts that would use temporary structures. Proposals 3 and 4 are variations on structural solutions such as modifications to Foghorn Dam and/or permanent weirs and would involve a long-term process of permitting, public involvement, ESA consultation, and design.

In the short-term, the team recommends a plan be collaboratively developed for a coordinated effort using techniques presented in Proposals 1 and 2, including monitoring to determine efficacy of these measures to meet adult management and broodstock collection objectives. Concurrently, project proponents recommend additional work should continue to further evaluate and develop structural solutions such as Proposals 3 and 4. Preliminary evaluations favor Proposal 3, modification of Foghorn Dam. There are other processes that must occur at the same time. USFWS, NOAA Fisheries, and Action Agencies (in this case Reclamation) are currently involved in consultations under the ESA for permitting the Winthrop NFH summer steelhead program. NOAA Fisheries is also consulting with WDFW and Douglas County PUD on the Wells steelhead program. Consultation on the two programs would be aligned to meet ESA requirements. Specific adult management and broodstock collection objectives will be developed through these processes.

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