BULL TROUT PASSAGE AND TAKE MONITORING AT WELLS DAM AND TWISP RIVER WEIR

FINAL STUDY PLAN

WELLS HYDROELECTRIC PROJECT

FERC NO. 2149

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ABSTRACT

Bull Trout (*Salvelinus confluentus*) originating from the Methow, Entiat and Wenatchee rivers are known to interact with Wells Hydroelectric Project and the Twisp River. During relicensing studies at Wells Dam bull trout moved upstream and downstream past Wells Dam freely with no observed mortality or passage delay. The new 40-year Federal Energy Regulatory Commission (FERC) Operating License for the Wells Project, owned and operated by the Public Utility District No. 1 of Douglas County (Douglas PUD), requires Douglas PUD to determine the survival and passage success rates for bull trout at Wells Dam and the Twisp Weir.

This study plan outlines the methods that will be employed to examine if survival and passage success rates for adult marked bull trout are greater than 95% and greater than or equal to 90%, respectively, at Wells Dam and the Twisp Weir as part of the implementation of the Bull Trout Management Plan and the United States Fish and Wildlife Service’s Section 18 Fishway Prescription for the Wells Hydroelectric Project.

Although the study is narrowly focused on meeting requirements in the BTMP and Section 18 Fishway Prescriptions, the study is designed such that new behavioral data may be obtained that could aid in understanding bull trout ecology in the mid-Columbia. Specific tools such as genetics, radio telemetry, and PIT tags will help provide this information.
1.0 INTRODUCTION

Bull Trout (Salvelinus confluentus) background and the species interaction with the Wells Hydroelectric Project (Wells or Wells Project) are reviewed in this section.

1.1 Bull Trout Biology and Status

Bull trout currently occur in lakes, rivers and tributaries in Washington, Montana, Idaho, Oregon, Nevada, two Canadian Provinces (British Columbia and Alberta), and several cross-boundary drainages in extreme southeast Alaska. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta, and the Mackenzie River system in Alberta and British Columbia (Cavender 1978; McPhail and Baxter 1996; Brewin and Brewin 1997). Bull trout are believed to have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993). Growth, survival, and long-term persistence are dependent upon habitat characteristics such as clean, cold, connected, and complex instream habitat (USFWS et al. 2000), and stream/population connectivity. Stream temperature and substrate type, in particular, are critical factors for the sustained long-term persistence of bull trout. Spawning is often associated with the coldest, cleanest, and most complex stream reaches within basins. However, bull trout may exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1995), and should not be expected to occupy all available habitats at the same time (Rieman et al. 1997). Bull trout exhibit four distinct life history types: resident, fluvial, adfluvial, and anadromous. Of all salmonids, bull trout are excellent indicators of water quality.

Because of historical declines of bull trout, in November 1999, the U.S. Fish and Wildlife Service (Service) listed all populations of bull trout within the coterminous United States as a threatened species pursuant to the Endangered Species Act of 1973, as amended (Act) (64 FR 58910; November 1, 1999). This 1999 listing rule applied to one distinct population segment (DPS) of bull trout within the coterminous United States by including bull trout in the Coastal-Puget Sound populations (Olympic Peninsula and Puget Sound regions) and Saint Mary-Belly River populations (east of the Continental divide in Montana) with previous listings of three separate distinct population segments of bull trout in the Columbia River, Klamath River, and Jarbidge River basins (63 FR 31647, June 10, 1998; 64 FR 17110, April 8, 1999).

In April 2008, the USFWS completed the 5-year status review for Columbia River bull trout with two recommendations: maintain “threatened” status for the species and evaluate whether distinct populations segments exist and merit the ESA’s protection.

A second status review completed by the USFWS in 2015 reconfirmed that the bull trout should remain listed. New critical habitat was proposed throughout the range of bull trout in January 14, 2010 (75 FR 2270), including all of the Wells Project waters except the Okanogan River since the Project is a migratory corridor and provided foraging and overwintering habitat. In 2015, the USFWS issued a new Final Bull Trout Recovery Plan in the coterminous of the United States that finalized new recovery units of which the Mid-Columbia Recovery Unit encompasses the Well Project Area. The plan generally focuses on managing bull trout threats in order to facilitate bull trout recovery. Recovery criteria include managing threats across core areas and local population and providing connected forage, migration, and overwintering
(FMO) habitat. The associated Mid-Columbia Recovery Unit Implementation Plan (RUIP) outlines recovery criteria, threats, a recovery actions narrative, and a recovery implementation table specific to bull trout in the Wells Project area. Many threats have been identified as factors effecting bull trout in the Middle Columbia including but not limited to climate change, logging, road networks, invasive species, fragmentation, water use practices, water quality, and dams and diversions. The RUIP describes actions for connectivity and passage and prioritize connecting Forage, Migration, and Overwintering habitat to spawning and rearing habitat. An example action (#1.2.5) for the Methow Core Area is to minimize ongoing impacts from hydropower dams and the Twisp Weir through adaptive management of Wells Dam FERC relicensing and actions #1.2.2 and 1.2.3) for the Okanogan FMO area is to develop/maintain passage between FMO habitats outside of core areas to spawning and rearing areas.

1.2 General Description of the Wells Hydroelectric Project Area

The Wells Project is located at river mile (RM) 515.6 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam. The Wells Project is the chief generating resource for the Public Utility District No. 1 of Douglas County (Douglas PUD). It includes 10 generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides of the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet mean sea level (msl) in height. The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre-feet at elevation of 781 feet msl. The normal maximum water surface elevation of the reservoir is 781 feet msl.

1.3 Previous Douglas PUD Bull Trout Studies at Wells Dam

During relicensing investigations Douglas PUD attempted to identify potential project-related impacts on upstream and downstream passage of adult bull trout (fish ≥ 400 mm in length) through Wells Dam and the reservoir. During these investigations radio telemetry was used to monitor upstream and downstream passage.

Between 2005 and 2008, 26 adult bull trout were trapped at Wells Dam and radio-tagged. Concurrent with the implementation of the Bull Trout Plan, the USFWS and Chelan PUD radio-tagged and released 136 adult bull trout at other mid-Columbia River basin locations including the Methow River, and Rock Island and Rocky Reach dams (50 USFWS tags 2006-2008, 86 Chelan PUD tags 2005-2007). From 2005 to 2008, 25 downstream passage events and 52
upstream passage events by 40 individual bull trout were recorded at Wells Dam. Of these, 17
downstream and 41 upstream passage events occurred within one year of tagging and release. Of
all tags released from 2001 to 2004, there were 2 downstream passage events and 41 upstream
passage events. Of these, 2 downstream and 38 upstream passage events occurred within one
year of release.

The take estimates for the Wells Project were based upon the number of unique upstream and
downstream passage events that took place within one year of each bull trout being tagged and
released. During the six year study and eight years of monitoring, 19 downstream and 79
upstream passage events took place at Wells Dam by radio-tagged bull trout within one year of
release. Taking into account all observed passage events, a total of 27 downstream and 93
upstream passage events took place at Wells Dam. All 27 of the radio-tagged bull trout that
passed downstream through the dam passed using either the turbines or spillways. Out of the 19
downstream passage events that occurred within one year of tagging, zero bull trout injury or
mortality was observed at the Wells Project. Out of the 79 upstream passage events that
occurred within one year of tagging, zero bull trout injury or mortality was observed at the Wells
Project.

Upstream passage of adult bull trout through the fish ladders at Wells Dam has historically
occurred between early May and late October, with peak passage typically occurring in May and
June (mean = 89%; Figure 1). During the 2005 and 2008 study, 214 adult bull (24% of which
were radio tagged; n = 52) trout were counted passing upstream through Wells Dam. Annual
counts of bull trout at Wells Dam have ranged between 43 and 109 during the years of 2000 to
2015 (Figure 2). At Wells Dam east and west side ladders operate year round with bull trout
showing some amount of favoritism each year to specific ladders (Figure 3), but no multi-year
preference or trend.
Figure 1. Annual Percentage (y-axis) of Bull Trout that Passed Wells Dam During the Month of May and June in a Given Year.

Figure 2. Total Annual Bull Trout Counts (y-axis) at Wells Dam Count Windows from 2000-2015 and the 16-Year Average (blue bar).
1.4 **Douglas Aquatic Settlement Agreement and Bull Trout Management Plan and Study Objectives**

Following the completion of bull trout radio-telemetry studies the Bull Trout Management Plan (BTMP) was developed. The BTMP is one of six Aquatic Resource Management Plans within the Aquatic Settlement Agreement (Agreement). The Agreement was developed as part of the Integrated License Process for the Wells Project. The BTMP is largely consistent with Fishway Prescriptions and a Biological Opinion (BIOP) issued by the USFWS in 2012 as part of the relicensing of Wells Dam. The BTMP is incorporated into the BIOPs incidental take statement and referenced in the terms and conditions section. This study is being proposed in order to satisfy two sections of requirements found in the BTMP and the USFWS Incidental Take Statement for the Wells Project (emphasis added):

“... **BTMP 4.1 Bull Trout Passage Performance Standard (BIOP RPM#1; Terms and Condition #2):** The Licensee shall implement the upstream and downstream measures contained in the Wells Hydroelectric Project BTMP to provide safe, timely, and effective upstream and downstream passage for adult and sub-adult bull trout at the Wells Hydroelectric Project. **Safe, timely and effective** passage shall be achieved when the Licensee has demonstrated that the survival and passage success rates for adult marked fish are greater than 95% and greater than or equal to 90%, respectively, and when passage studies demonstrate that the fishway facilities at Wells Dam do not impede the passage of bull trout. To ensure that safe, timely and effective passage at Wells Dam is maintained during the term of the new license, the Licensee
shall implement the following bull trout upstream and downstream measures consistent with the BTMP.

... 

4.6 Bull Trout Upstream and Downstream Passage Evaluation (BTMP Section 4.2.1; BIO RPM #5 Terms and Conditions #10): The Licensee shall periodically monitor upstream and downstream passage of bull trout through Wells Dam and in the Wells Reservoir through the implementation of a radio-telemetry study. Specifically, in years 5 and 10 of the new license, and continuing every 10 years thereafter during the new license term, the Licensee shall conduct a 1-year monitoring study to verify continued compliance with the bull trout passage performance standard (Section 4.1 of this Prescription). These monitoring studies shall employ the same study protocols and radio-telemetry assessment methodologies used at Wells Dam in 2006 and 2007. If the monitoring results demonstrate continued compliance with the bull trout passage performance standard (Section 4.1 of this Prescription), then no additional actions are needed. If the monitoring results demonstrate that the Licensee is no longer in compliance with the bull trout passage performance standard (Section 4.1 of this Prescription), then the monitoring study will be replicated to confirm the results. If the results after 2 years of monitoring demonstrate that the Licensee is no longer in compliance with the bull trout passage performance standard (Section 4.1 of this Prescription), then the Licensee shall, pursuant to Section 4.8 of this Prescription, develop and implement additional measures to improve bull trout passage until compliance with the bull trout passage performance standard (Section 4.1 of this Prescription) is achieved. If the bull trout counts at Wells Dam increase more than two times the existing 5-year average or if there is a significant change in the operation of the fish ladders, bypass, or hydrocombine, then the Licensee shall, in consultation with the FWS, the Aquatic SWG, and the Wells HCP Coordinating Committee (WCC), shall conduct a 1-year, follow-up monitoring study to verify continued compliance with the bull trout performance standard (Section 4.1 of this Prescription).

4.7 Adult Bull Trout Passage Evaluation at Brood Stock Collection Facilities (BTMP Section 4.2.2; RPM #5; Terms and Conditions #11): The Licensee shall, beginning in year 1 of the new license, conduct a 1-year radio-telemetry evaluation to assess upstream and downstream passage of adult bull trout at the adult salmon and steelhead brood stock collection facilities associated with the Wells AFA/HCP, including but not limited to, the Twisp weir adult collection facility. The Licensee shall capture and tag up to 10 adult, migratory bull trout (>400mm) per assessment per year and use fixed receiver stations upstream and downstream of the collection facilities. Assessments shall employ the same study protocols and radio-telemetry assessment methodologies used at Wells Dam in 2006 and 2007. If the evaluation demonstrates that the Licensee is not in compliance with the bull trout passage performance standard (Section 4.1 of this Prescription), then the evaluation will be replicated to confirm the results. If the results after 2 years of evaluation demonstrate that the Licensee is not in compliance with the bull trout passage performance standard (Section 4.1 of this Prescription), then the Licensee shall develop, implement, and evaluate additional measures, in consultation with the FWS, WCC and the Aquatic SWG, until the FWS determines that the bull trout passage performance standard has been achieved. At such time as the
FWS determines the bull trout passage performance standard has been achieved, the implementation of this Condition shall be integrated into the 1-year telemetry monitoring program that is to be conducted every 10 years (beginning in year 10 of the new license) at Wells Dam as identified in Section 4.6 above.”

1.5 Twisp Weir Study Deferral and Consolidation of Studies

On September 6, 2013, Douglas PUD, licensee for the Wells Hydroelectric Project, FERC No. 2149, filed an extension of time request, which was related to conducting an adult bull trout passage study at the Twisp River Weir (Twisp Weir). Specifically Douglas PUD, on behalf of the USFWS, requested that the deadline for conducting the study be postponed until year five of the license term, or, November 2017. As recommended by the USFWS, postponement would allow Douglas PUD to combine the Twisp Weir study with a bull trout passage study that is scheduled to take place at Wells Dam during year five of the license term. Consolidating both studies would provide a more comprehensive analysis of project impacts to bull trout in the upper Columbia River region, and would also require the use of fewer study fish compared to two independent studies, thereby reducing handling impacts on federally-protected bull trout.

Included in Douglas PUD’s request to the Federal Energy Regulatory Commission (FERC) was a consultation record with the USFWS and the Aquatic Settlement Work Group (Aquatic SWG) recommending the study deferral. Meeting minutes from the Aquatic SWG meeting dated July 10, 2013 indicate that all members of the work group approved the deferral. Additionally, the USFWS requested that the study be deferred by letter dated June 27, 2013 and filed with the FERC on July 22, 2013. In the same letter, the USFWS reiterated the Aquatic SWG’s concurrence with the request. This letter was also included as part of Douglas PUD’s deferral filing. FERC approved Douglas PUD’s, the Aquatic SWG’s and the USFWS’s request deferring the Twisp Weir Study to year five of the license in an Order Granting Extension of Time issued on October 15, 2015.

In addition, the USFWS and Douglas PUD coordinated with other agencies to anticipate study fish efficiencies that might be realized with the other agencies conducting bull trout projects in 2016 or 2017. WDFW, USFWS and Chelan PUD are agencies with an interest or ongoing efforts specific to bull trout monitoring. Coordination among these groups was expected to allow some minimization of impact to numbers of bull trout handled or harmed and may allow for additional cost share and a larger pool of data to assist with Douglas PUD analysis.

1.5.1 Twisp River Weir

The Twisp River Weir (Weir) is comprised of a series of hydraulically-controlled panels and two trap boxes (Figure 4A). The panels of the Twisp Weir are permanently installed and kept in the fully lowered position throughout the fall and winter. In the spring the trap boxes are installed and the pickets are raised enough to encourage upstream migrating fish to swim along the sill and through the passage notches. Once fish enter into one of the two passage notches, the fish volitionally enters a trap box.

Each year Douglas PUD installs the trap boxes around March 15th. During the spring (March 15th to mid-July) the trap is operated by Washington Department of Fish and Wildlife (WDFW)
Science Division staff as part of Douglas PUD’s steelhead broodstock and spring Chinook collection activities. Operations are supervised by WDFW Methow Hatchery staff that collect spring Chinook salmon broodstock and Twisp WDFW staff that collect steelhead in the early spring. The trap boxes are usually removed in August or early September and the slide gates (trap exit doors) on the traps are removed during the interim between the end of the Chinook trapping season and the removal of the traps.

During operation/trapping fish are sampled a minimum of once daily. The Twisp Weir, however, is monitored throughout the day and adjusted, as needed, to ensure that upstream migration fish are directed to pass the weir through one of the two notched gates. They also adjust the weir in order to compensate for changing flow levels, and to allow debris passage, as needed. During trapping, the panels are raised only enough to discourage fish from swimming over the Twisp Weir and instead try to pass the weir via the trap boxes. Depending on water levels, the panels are off the river bottom but still at a negative angle in relation to the river bed. This negative angle allows fish and debris moving downstream to pass safely over the Twisp Weir. The Twisp Weir is monitored throughout the day and raised and lowered for short periods of time to pass debris at the operator’s discretion (debris loads can change quickly during spring freshets). The upstream exits of the trap boxes are protected by a temporary debris boom. The debris boom is installed and removed annually during the same days that the trap boxes are installed and removed. The Twisp Weir is considered to be operating whenever the trap boxes are in and the trap box doors are closed. No trapping or fish sampling is conducted during high flow events because conditions are not safe for personnel to enter the traps to remove captured fish (see the below photo; Figure 4B). The Twisp Weir is operated under guidelines specified in the annual Broodstock Collection Plan and the annual Monitoring and Evaluation Work Plan developed and approved by the Wells HCP Hatchery Committee (USFWS, National Marine Fisheries Service, Tribal agencies, and Douglas PUD) and the Twisp Weir Operations Plan that was developed in early 2015 (Appendix A).

A)            B)

Figure 4. Twisp River Weir A) during September removal, illustrating the hydraulic pickets and B) during a high flow event (not operating).
1.6 Bull Trout Encounters at the Twisp Weir

The Twisp River is an important spawning and rearing area for bull trout in the Methow Core Area. Some proportion of bull trout in the Twisp River local population uses the Columbia River, the Methow River, and the lower Twisp River as FMO areas. The upper Twisp River is considered mostly spawning and rearing (S&R) habitat. PIT tag histories suggest that adult bull trout are often repeat spawners in the Twisp but spawning frequency is poorly understood. Adults can be present in the FMO habitat both within and outside of their Core Area. Migratory bull trout are encountered at the Twisp Weir on a seasonal basis. Bull trout appear to primarily make upstream spawning migrations past the Twisp Weir during the months of June and July and numbers seem to be increasing (Figure 5). The total number of new (untagged) bull trout that were observed by WDFW staff at the Twisp Weir over the last 5 years is summarized in Figure 5.
Note: Captures are not standardized by trapping efficiency or effort precluding detailed annual comparisons. No bull trout were tagged at the Twisp Weir in 2015. Of the fish encountered in 2015 48% were tagged in 2014, 29% were tagged in 2013, 10% were tagged in 2012, 3% were tagged in 2011 and 3% were tagged in 2010.

Figure 5. Number of new and previously PIT tagged adult bull trout encountered at the Twisp River Weir from 2010-2015.

Bull trout observations were low in 2011 compared to recent years and is likely partly related to above average freshet flows that prevent the trap from being safely operated. Previously Passive Integrated Transponder (PIT) tagged bull trout arrive at the Twisp Weir in the months of June and July (Figure 6). Bull trout arrived at the Twisp Weir earlier in 2015 (Figure 6B) compared to 2014 (Figure 6A), which is likely due to lower flows in 2015 and warmer water temperatures. Earlier run-timing was also observed at Wells Dam in 2015 (data not shown), whereby 52% of the run arrived in the month of May and the 16-year average is 36%.
Figure 6. Arrival of previously PIT tagged bull trout at the Twisp Weir in A) 2014 and B) 2015. Bins are 5 days long with numbers above the bars representing bin count, and percent of annual run that bin represents.
2.0 GOALS, ASSUMPTIONS AND HYPOTHESES

2.1 Goals

The primary goal of the 2015 Bull Trout Study is outlined in measure 4.2.1 and 4.2.2 of the BTMP (See section 1.4 of this study plan):

Specifically, Douglas PUD aims to determine if survival and passage success rates for adult marked bull trout are greater than 95% and greater than or equal to 90%, respectively, at Wells Dam and the Twisp Weir.

2.2 Sample Size

Although section 4.2.1 and 4.2.2 of the BTMP call for N = 10 fish at the Wells Dam and the Twisp Weir, Douglas PUD, the USFWS, and the Aquatic SWG recognize the value in conducting a survival and passage study using a sufficient sample size. As such, Douglas PUD and its contractor(s) aim to tag thirty fish (N = 30) at Wells Dam and thirty fish (N = 30) at Twisp Weir. In both cases fish will be ≥450 mm. Previous studies of radio tagged bull trout above Wells Dam indicate that some fish around 450 mm might not spawn (Nelson 2015) and therefore fish over 500 mm might be targeted if available. In previous Douglas PUD bull trout studies only ten fish (N = 10) were tagged at Wells Dam in a given year and therefore it is unknown if tagging thirty (N = 30) bull trout is feasible at both sites. However, an estimate of expected sample size at Wells Dam can be developed using the following assumptions:

- Trapping will occur 5 of 7 days\(^1\)
- Trapping will occur for up to 29 days during the peak of bull trout migration
- Trapping will occur for up to 10 hours a day during peak bull trout usage
- Only one of two ladder traps will be employed at Wells Dam
- N = 73 bull trout will pass Wells Dam in 2016 (16-year average)

Using these assumptions the following table and sample size estimate can be derived (Table 1).

Table 1. Number of Bull Trout Expect to be Captured at Wells Dam in 2016.

<table>
<thead>
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<th>2016 Ladder Count Estimate (N = 73; 16-yr mean +/- N= 25 stdev)</th>
<th>Ladder Favoritism (East Ladder Trapping 16-yr mean)</th>
<th>Trapping Time (Peak Passage 8-6 PM; 2015 data)</th>
<th>Trapping Days (May 20- June 30)</th>
<th>5 days a week of a 7 Day week</th>
<th># RT tagged (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Case</td>
<td>98</td>
<td>0.6</td>
<td>0.85</td>
<td>0.81</td>
<td>0.71</td>
<td>29</td>
</tr>
<tr>
<td>Worst Case</td>
<td>48</td>
<td>0.4</td>
<td>0.85</td>
<td>0.76</td>
<td>0.71</td>
<td>9</td>
</tr>
<tr>
<td>Actual est.</td>
<td>73</td>
<td>0.53</td>
<td>0.85</td>
<td>0.8</td>
<td>0.71</td>
<td>19</td>
</tr>
</tbody>
</table>

\(^1\) HCP Coordinating Committee and NMFS approval will need to be obtained to increase or approve trapping schedule in order to meet ESA listed salmonid trapping conditions and permit requirements.
PIT tag histories of fish tagged at the Twisp Weir show that ~7% of these fish interact with Wells Dam (Douglas PUD unpublished data) and therefore tagging more fish at the Twisp Weir may allow for a better sample size at Wells Dam. Therefore, if tags go unused at Wells Dam the balance may be added to the Twisp Weir tagging effort. Given the number of adult bull trout that have been encountered at the Twisp Weir in recent years (Figure 5), it is expected that N > 30 will be met during the study.

Although not part of the scope of this study the USFWS has indicated a desire to PIT tag subadult bull trout that are encountered during trapping at Wells Dam. A small number (<10/year) of subadult bull trout have been documented using Wells Dam fish ladders each year. Given the efficiencies, Douglas PUD will work with the USFWS to determine the number of subadult fish that will be PIT tagged during study fish capture in addition to any new tagged adults.

2.3 Hypotheses

Null and alternative hypotheses are as follows:

Ho: survival and passage success rates for adult marked fish are greater than 95% and greater than or equal to 90%, respectively.

Ha: survival and passage success rates for adult marked fish are less than 95% and less than 90%, respectively.

2.4 Assumptions and Treatment

We assume that handling (e.g. electro-anesthesia, surgery, netting, etc.) and moving captured bull trout downstream may have some effect on the migration behavior of radio and PIT tagged bull trout (e.g. Kelly Ringel et al. 2014). After a multi-day recovery period, tagged bull trout are assumed to be representative of the untagged population. As such, fish tagged at the Twisp Weir and Wells Dam that are transported below these facilities after tagging will only be assessed for downstream survival and passage through the Project (Wells Dam or Twisp Weir) starting after September 15, 2016 and running through September 2017 (2017; See section 3.5 below). This sampling and treatment procedure will allow for a long recovery period prior to survival and passage verification and is aimed at eliminating, to the extent practical, the impacts of handling and tagging on bull trout survival and passage success rates.

3.0 METHODOLOGY

3.1 Capture and Release Details

Fish will be captured at the Twisp Weir and Wells Dam in the months of May, June, and July. Tagging and fish availability will be coordinated between the contractor, Douglas PUD’s contract manager and the WDFW (weir operators), USFWS Wenatchee ES, and Mid-Columbia FRO. Historical information on fish availability will be provided to the contractor to assist in
predicting tagging periods in June and July (e.g. see Figure 1 & 6). Water temperatures and total dissolved gas during trapping will be recorded daily.

After tagging, fish will be recovered and transported to a designated area downstream of the Twisp Weir and Wells Dam. The Carpenter Island Boat Launch and slightly upstream of the TWR PIT array will serve as the release locations for Wells Dam and Twisp Weir tagged fish, respectively. These sites are easily accessed. At a minimum, all receiver stations will be operating to detect and monitor fish passage from May 15, 2016 to August 30, 2017.

In June and July of 2016 the weir trap will be closed during night time hours to facilitate bull trout capture. Once target sample size is met (N = 30+) and tagging is complete, the trap will not operate during night time hours which is consistent with the normal trapping operations at the Twisp Weir and consistent with the 2015 Twisp Weir Operating Plan (See Appendix A). In the spring and summer of 2017 the Twisp Weir Operating Plan guidelines will be employed to mimic conditions that migrating bull trout would normally experience absent bull trout collection for tagging:

“...June 1 through August Operations:

a. The weir will be fished selectively during this time period to trap spring Chinook broodstock. Normally the weir will be fished daily from 6:00 AM until 9:00 PM, but overnight trapping may be used if greater trapping effort is needed to collect spring Chinook broodstock. The weir will be attended by WDFW personnel at all times while the weir is fishing, as mandated under ESA Section 10 Permit 1196. When the weir is not fishing, the weir panels will be lowered and/or the traps will be opened to allow passage.

b. Trapping effort will be based on meeting the spring Chinook broodstock collection target of approximately 20 adult spring Chinook of natural origin with equal sex ratio (~10 males and ~10 females). In-season information derived from sampling and counts at Wells Dam and PIT tag detections at in-river arrays will inform trapping operations in order to target spring Chinook while reducing effort when spring Chinook are not likely to be available.

c. Trapping will not necessarily occur every day or for 24 consecutive hours per day, dependent on efficiency of trapping operation in obtaining broodstock. Fine-scale scheduling of trap operations will be determined on a day-to-day basis.

d. No more than 118 adult and 50 sub-adult bull trout (also includes 19 juveniles) handled in the entire trapping season. Trapping would be suspended with one lethal take of any size bull trout.

e. Trapping will be suspended when the broodstock target is met. When the weir is not fishing the traps will be opened to allow passage and the weir panels will be lowered. The traps will be removed from the river in mid- to late August.

f. High flows typically occur during the spring Chinook trapping season. High flows significantly limit the efficiency of the weir or prevent fishing the weir entirely. In these cases, the weir panels are lowered and the traps are opened for

---

2 PIT tag data at TWR suggest bull trout move upstream in the Twisp River during the night. During tagging in 2016 the Twisp Weir will be fished during these night time hours until sample size is reached. Once tagging is complete the Twisp Weir will be operated according to the protocols described above.
3.2 Tagging Procedures

Tagging procedures will follow methods described in previous bull trout radio telemetry studies conducted at Wells Dam (LGL and Douglas PUD, 2007; 2008) and will consider recent advances in knowledge and understanding of fish health and condition (e.g., Cooke et al. 2011a; b; Harnish et al. 2011; Oldenburg et al. 2011; Wagner et al. 2011). Effort will be made to minimize impacts to fish’s biological and physiological condition. Specific attention will be made to minimize incision length, possibility of infection, handling time, water temperature stressors, and air exposure. Tagging logistics will follow handling and holding procedures approved by the USFWS. Staff with experience implanting active tags will perform all surgeries. DC electro-anesthesia will be used while tagging fish.

During tagging a scale sample and small fin clip (genetic sample; see section 3.3 below) will be taken by the contractor and preserved in ethanol and furnished to Douglas PUD. Other biological observations will be made and include but limited to sex (if determination can be made), fork length, total length, and fish weight.

Tags will be purchased by Douglas PUD from Lotek Wireless (New Market, Ontario). Tags (MCFT2-3A) will have an expected tag life of 1376 days<sup>3</sup> and a pulse rate interval (PRI) of 5 seconds. Tag burden estimates are provided in Table 2 and are considered reasonable based on other tag studies (Brown et al., 2006). In addition, each fish will be given a 12 mm RFID PIT tag. Radio tags will be outfitted with a motion or mortality sensor whereby receivers will be able to determine if the study fish is still active and/or alive.

### Table 2. Estimated Tag Burden Using 16.0 Gram MCFT2-3BM Radio Tags and 0.1 g PIT Tag.

<table>
<thead>
<tr>
<th>Fish TL (mm)</th>
<th>Fish Mass (g)*</th>
<th>Combined Pit Tag + RT Tag Mass (g)</th>
<th>Tag burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>846.1</td>
<td>16.1</td>
<td>1.9%</td>
</tr>
<tr>
<td>500</td>
<td>1159.4</td>
<td>16.1</td>
<td>1.4%</td>
</tr>
<tr>
<td>550</td>
<td>1541.7</td>
<td>16.1</td>
<td>1.0%</td>
</tr>
<tr>
<td>600</td>
<td>1999.8</td>
<td>16.1</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

* As determined from wild Walla Walla River bull trout length weight curves; where mass (g) = 9.87x10^-6x(TL)^2.99 (Budy et al. 2007).

---

<sup>3</sup> A longer tag life will allow for a subsequent study to be conducted if standards are not achieved and allow for other researchers in the basin to make use of the study fish if they so choose in years 2-3. PIT tag will be followed indefinitely by Douglas PUD staff.
3.3 Genetics

3.3.1 Study Fish

Douglas PUD will provide genetic samples to the USFWS Abernathy, WA office for genotyping. All N = 60 samples will be analyzed using similar methods as described in DeHaan et al. (2014) and will be similarly analyzed and compared against baseline local population genotypes determined in DeHaan and Neibauer (2012). Fish will be assigned back to sub-basin and local population and confidence in assignment will be reported on a probability scale of 0-1. Genetic samples should allow Douglas PUD to determine if fish intended to pass upstream of the Project location, especially if fish are over 500 mm (Nelson 2015).

3.3.2 Previous Samples

Douglas PUD will work together with the USFWS to identify obligations for funding the analysis of previous bull trout genetic samples (E.g. N=30 taken from bull trout sampled and tagged at Wells Dam during previous radio telemetry studies in the Mid-2000s). Previous samples and current samples will be analyzed by a qualified laboratory (e.g. the WDFW Genetic Lab, the USFWS Abernathy Genetics Lab, or other qualified laboratory).

3.4 Monitoring

Monitoring will involve fixed station radio telemetry receivers (herein referred to as “stations”) and existing basin wide PIT tag arrays. Stations will be similar to previous radio telemetry studies at Wells Dam, but will focus on the forebay and entrance locations at Wells Dam, since these receivers will serve as virtual release locations. Table 3 provides a summary of receiver locations and green cells indicate those that will be used when counting study fish (virtual release fish).

3.4.1 Radio-Tag Tracking

Private small aircraft tracking activities will occur in weekly, bimonthly or monthly depending on movements observed in August, September, October and November, or when needed to identify the fate of tags or tagged fish. Mobile tracking will be conducted as field verification and when necessary and will focus on locating “lost fish”, which as necessary will include boat tracking above and below Wells Dam and in tributary tracking. Tracking will occur by foot and boat as needed.

3.4.2 PIT Tag Monitoring

In addition, Douglas PUD will summarize PIT tag behaviors of bull trout tagged during the study using existing basin wide PIT arrays, including but not limited to those featured in Figure 7. Douglas PUD will also examine tag histories of existing PIT tagged fish at Wells Dam and other interrogation locations and compared study fish to PIT histories of fish tagged prior to 2016.
<table>
<thead>
<tr>
<th>SRX (Receiver) #</th>
<th>Antenna #</th>
<th>Location Description</th>
<th>Antenna Type</th>
<th>Virtual Release Fish?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>Gateway Below Wells (3 Mi Downstream)</td>
<td>Aerial</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>Wells Hatchery Outfall</td>
<td>Coax</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>WLF Left Entrance Inside</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
<td>WLF Left Weir 1</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>WLF Left Weir 7</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A</td>
<td>WUF Left Above Trap</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>WUF Left Above Count</td>
<td>Coax</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>WUF Left Exit</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A</td>
<td>Wells Left Tailrace</td>
<td>Aerial</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A</td>
<td>WLF Right Entrance Inside</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>B</td>
<td>WLF Right Weir 1</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>C</td>
<td>WLF Right Weir 7</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>WUF Right Above Trap</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>B</td>
<td>WUF Right Above Count</td>
<td>Coax</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>C</td>
<td>WUF Right Exit</td>
<td>Fixed Dipole</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>A</td>
<td>Wells Right Tailrace</td>
<td>Aerial</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>A</td>
<td>Wells Forebay (Various along deck)</td>
<td>Aerial</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>U 1&amp;2</td>
<td>Aerial</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>C</td>
<td>U 3&amp;4</td>
<td>Aerial</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>D</td>
<td>U 5&amp;6</td>
<td>Aerial</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>E</td>
<td>U 7&amp;8</td>
<td>Aerial</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>G</td>
<td>U9&amp;10</td>
<td>Aerial</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>Methow Aerial (Columbia confluence)</td>
<td>Aerial</td>
<td>No</td>
</tr>
<tr>
<td>11</td>
<td>A</td>
<td>Okanogan Aerial (Columbia confluence)</td>
<td>Aerial</td>
<td>No</td>
</tr>
<tr>
<td>12</td>
<td>A</td>
<td>Twisp Aerial (Methow Confluence - below release)</td>
<td>Aerial</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>A</td>
<td>Below</td>
<td>Aerial Directional</td>
<td>Yes</td>
</tr>
<tr>
<td>13</td>
<td>B</td>
<td>At</td>
<td>Aerial Directional</td>
<td>Yes</td>
</tr>
<tr>
<td>13</td>
<td>C</td>
<td>Above Weir</td>
<td>Aerial Directional</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>A</td>
<td>Twisp Above Weir (~5 miles)</td>
<td>Aerial</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>A</td>
<td>Wells</td>
<td>Hand</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>A</td>
<td>Twisp Weir</td>
<td>Hand</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>A</td>
<td>Flights</td>
<td>Hand</td>
<td>NA</td>
</tr>
</tbody>
</table>
Although tagging will take place in year one only, fixed station radio telemetry will be conducted over two seasons (15 month target). Stations will be maintained and operable immediately following the release of the first tagged fish (no later than May 15, 2015). The months of June through October, in both years will be considered the key monitoring period since bull trout pass the Twisp Weir primarily during these months. Study fish carrying PIT tags will be tracked for the remainder of the life on an annual basis with these results being provided in the annual BTMP report and Incidental Take Report filed in May and April of each year respectively.

Figure 7. Distribution of PIT tag arrays in the Upper Mid-Columbia.
3.5 Statistical Analyses and Reporting

The emphasis of the analyses will be made on passage criteria as outlined in the goals and hypotheses of this study plan. In order to determine passage and survival statistics virtual releases will be used, whereby only fish detected on stations immediately above and below the Twisp Weir or Wells Dam will be used as sample fish that contribute to denominators (see equations below). Fish may pass the upstream of facility locations more than once in a given monitoring period and as such may be used as two data points (i.e. passage, fallback and passage).

Passage_{Weir} = \frac{\text{Number of unique fish observed at the weir [fall 2016 to summer 2017]} - \text{Number of unique fish that failed to pass the weir [fall 2016 to summer 2017]}}{\text{Total number of unique fish observed at the weir [fall 2016 to summer 2017]}}.

Passage_{Wells} = \frac{\text{Number of unique fish observed at the fish ladder entrance at Wells Dam [fall 2016 to summer 2017]} - \text{Number of unique fish that failed to pass the dam after being observed inside ladder entrance [fall 2016 to summer 2017]}}{\text{Total number of unique fish observed at the fish ladder entrance at Wells Dam [fall 2016 to summer 2017]}}.

Survival_{Weir} = \frac{\text{Number of unique fish alive at the weir [fall 2016 to summer 2017]} - \text{Number of unique fish dead at the weir [fall 2016 to summer 2017]}}{\text{Total number of unique fish alive at the weir [fall 2016 to summer 2017]}}.

Survival_{Wells} = \frac{\text{Number of unique fish alive at Wells Dam [fall 2016 to summer 2017]} - \text{Number of unique fish dead at Wells Dam [fall 2016 to summer 2017]}}{\text{Total number of unique fish alive at Wells Dam [fall 2016 to summer 2017]}}.

Whereby passage and survival statistics will be calculated as follows:

- A fish that is detected inside the fishway entrance at Wells Dam or is detected immediately below the weir in the summer of 2017 but is subsequently detected alive downstream of each structure will be considered a passage failure in the applicable passage equation above. The same assumption will be made for downstream movements in the fall of 2016 using immediately upstream arrays.
- A fish that is observed dead or whose tag is detected as being a dead tag 48 hours after passage and in the immediate vicinity of the Project following an up- or downstream passage event, at either facility, will be considered a mortality and be subtracted from the numerator or total number of unique fish observed at the applicable structure.
- In the fall of 2017 total post September 15, 2016 (or fall cutoff) total approaches will be summed, and total post September 15, 2016 failures will be summed to determine the passage statistic for both structures.
- Fish that are genetically assigned to a local population or sub-basin that is located downstream of the Project will be removed from passage statistics analyses if the fish does not safely pass a Project facility (e.g., a fish is tagged at Wells Dam and is assigned to the Mad River in the Entiat Basin). The fish that is genetically typed as a non-Methow origin fish that enters the Wells Dam fish ladders but never passes the Dam and instead
moves downstream will not be counted as a failed passage event. Fish that are typed downstream of the Project area but fail to pass will be reported independently.

- If a fish is clearly missed as a “virtual release” fish, Douglas PUD will include these missed fish in analyses (e.g., fish was last detected at the mouth of the Methow River and is subsequently detected in the Wells Tailrace; missed on the forebay array).
- Fall downstream passage at Wells Dam in some cases may be removed from analyses since bull trout are not required to overwinter below Wells Dam and may simply overwinter in the Wells Dam forebay/pool. However, overwintering locations and all behavior will be reported in the final report for committee review.

### 3.5.1 Wells Dam Example Statistical Analyses

Table 4 is provided to consider an example scenario of tagging at Wells Dam in 2016. The yellow cells indicate a tagging and handling effects period where fish are considered to be recovering from the handling procedure. Light green cells indicate the first treatment group where Douglas PUD and contractors are monitoring downstream movement and approach as the Wells Dam. Dark green cells are aimed at summarizing upstream movements in tagged fish during the year subsequent to tagging. Table 5 shows the summation from Table 4 and the resulting passage and survival statistics.

#### Table 4. Example Tagging and Passage Results at Wells Dam.

<table>
<thead>
<tr>
<th>Tagging and Handling Effects 2016</th>
<th>Downstream Treatment 2016/2017 (Fall/Winter/Spring)</th>
<th>Upstream Treatment 2017 (Spring/Summer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tagged @ Wells</td>
<td>Released Below Wells</td>
<td>Arrive Back at Wells (10 d later)</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Tagged @ Twisp Weir</td>
<td>Released Below Twisp</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>18</td>
</tr>
</tbody>
</table>

#### Table 5. Example Summation and Calculated Survival/Passage Statistics Using Example Data from Table 3.

<table>
<thead>
<tr>
<th>Totals</th>
<th>Sum</th>
<th>Total</th>
<th>Statistic</th>
<th>Goal</th>
<th>Standards Achieved?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Release (Arrival)</td>
<td>20+16</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passage</td>
<td>18+15</td>
<td>33</td>
<td>91.67%</td>
<td>90%</td>
<td>Yes</td>
</tr>
<tr>
<td>Survival</td>
<td>19+16</td>
<td>35</td>
<td>97.22%</td>
<td>95%</td>
<td>Yes</td>
</tr>
</tbody>
</table>
If standards are achieved by September 2017 Douglas PUD will discontinue dedicated telemetry tracking and instead will focus on tracking PIT tags of study fish. In addition, vehicle and ground mobile tracking will continue for the life of the radio tags. Tag frequencies will also be provided to regional fish managers and researchers.

3.5.2 Effect of Small Virtual Release Sample Size

Given the small sample size expected in the study only one fish can be killed at a Project facility provided virtual release totals are at or above N=20. If virtual release sample size is <20 no fish may be killed in order to meet standards. The following sample size and standards tolerance table illustrates this survival and sample size relationship (Table 6). Red cells in Table 6 would indicate standard not achieved and green cells indicate standards achieved.

Table 6. Relationship Between Sample Size and Mortality Towards Meeting Survival Standards.

<table>
<thead>
<tr>
<th>Mortality</th>
<th>N</th>
<th>Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>90.00%</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>90.91%</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>91.67%</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>92.31%</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>92.86%</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>93.33%</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>93.75%</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>94.12%</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>94.44%</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>94.74%</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>95.00%</td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>95.24%</td>
</tr>
<tr>
<td>1</td>
<td>22</td>
<td>95.45%</td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td>95.65%</td>
</tr>
<tr>
<td>1</td>
<td>24</td>
<td>95.83%</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
<td>96.00%</td>
</tr>
<tr>
<td>1</td>
<td>26</td>
<td>96.15%</td>
</tr>
<tr>
<td>2</td>
<td>27</td>
<td>92.59%</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>92.86%</td>
</tr>
<tr>
<td>2</td>
<td>29</td>
<td>93.10%</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>93.33%</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
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</tr>
<tr>
<td>2</td>
<td>32</td>
<td>93.75%</td>
</tr>
<tr>
<td>2</td>
<td>33</td>
<td>93.94%</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>94.12%</td>
</tr>
<tr>
<td>2</td>
<td>35</td>
<td>94.29%</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>94.44%</td>
</tr>
<tr>
<td>2</td>
<td>37</td>
<td>94.59%</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>94.74%</td>
</tr>
<tr>
<td>2</td>
<td>39</td>
<td>94.87%</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>95.00%</td>
</tr>
<tr>
<td>2</td>
<td>41</td>
<td>95.12%</td>
</tr>
<tr>
<td>2</td>
<td>42</td>
<td>95.24%</td>
</tr>
<tr>
<td>2</td>
<td>43</td>
<td>95.35%</td>
</tr>
</tbody>
</table>

3.5.3 Standards Not Achieved

If standards are not achieved the study may continue into 2017/2018 as permitted by section 4.2.1 and section 4.2.1:

“If negative impacts to passage associated with Off-Project collection facilities are observed or the authorized incidental take level is exceeded during any one-year period, Douglas will conduct another monitoring study in the succeeding year. If negative impacts to passage...
continue to be observed or the authorized incidental take level is exceeded in this second year, Douglas will develop a plan, in consultation with the Aquatic SWG, to address the identified factors contributing to passage impacts or the exceedance of the allowable level of incidental take.”

4.0 REPORTING

Reporting will be a collaborative effort between the contractor and the Douglas PUD contract manager. The contractor will provide a draft report including an introduction, methods, results/statistical analyses, and discussion or conclusion sections by Sept 30, 2017. The draft report will be made available to the Douglas PUD’s contract manager and will be furnished to the Aquatic SWG for comment before finalizing the document. The report will be appended to the 2017 Bull Trout Incidental Take Report due to the USFWS April 15 2018 (per BIOP requirements) and will also be filed and appended to the 2017 Bull Trout Management Plan Annual Report filed with the FERC on or before May 31, 2018.

If passage and survival metrics are not met, Douglas PUD will work with the Aquatic SWG to repeat and conduct a second year of the study with any recommended adaptive modifications to the study. If following a second year of study metrics are not met, Douglas PUD will refer to the Fishway Prescriptions and BTMP to identify improvements to address effects to bull trout.

See Table 7 for a more comprehensive timeline.
<table>
<thead>
<tr>
<th>#</th>
<th>Item</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Study Plan development</td>
<td>December 2015/January 2016</td>
</tr>
<tr>
<td>2</td>
<td>Study Plan review by ASWG</td>
<td>Second week of January 2016</td>
</tr>
<tr>
<td>3</td>
<td>Study Plan finalized</td>
<td>February 10(^{th}), 2016</td>
</tr>
<tr>
<td>4</td>
<td>Contractors/Scope of Work and budget request</td>
<td>Late February 2016</td>
</tr>
<tr>
<td>5</td>
<td>HCP CC trapping consultation</td>
<td>Late February 2016</td>
</tr>
<tr>
<td>6</td>
<td>Order tags</td>
<td>March 1(^{st}), 2016</td>
</tr>
<tr>
<td>7</td>
<td>Scope or Work and budget deadline</td>
<td>March 15th 2016</td>
</tr>
<tr>
<td>8</td>
<td>Internal review and recommendation</td>
<td>Late March 2016</td>
</tr>
<tr>
<td>9</td>
<td>Professional Services Agreement development</td>
<td>Late March/Early April 2016</td>
</tr>
<tr>
<td>10</td>
<td>Professional Services Agreement signed by contractor</td>
<td>Middle/late April 2016</td>
</tr>
<tr>
<td>11</td>
<td>Notice to Proceed delivered to contractor</td>
<td>Late April 2016</td>
</tr>
<tr>
<td>12</td>
<td>Receiver install and tagging</td>
<td>May/June/July 2016</td>
</tr>
<tr>
<td>13</td>
<td>Monitoring</td>
<td>June 2016-August 31 2017</td>
</tr>
<tr>
<td>14</td>
<td>Draft Interim due to District</td>
<td>January 1(^{st}), 2017</td>
</tr>
<tr>
<td>15</td>
<td>Draft report due to Aquatic SWG</td>
<td>September 2017</td>
</tr>
<tr>
<td>16</td>
<td>Aquatic SWG approval of Report and standards met(^4)</td>
<td>October 2017</td>
</tr>
<tr>
<td>17</td>
<td>File Final Report with Incidental Take Report</td>
<td>April 15, 2018</td>
</tr>
<tr>
<td>18</td>
<td>File with FERC</td>
<td>May 31(^{st}), 2018</td>
</tr>
</tbody>
</table>

\(^4\) If standards are not met in the study Douglas PUD will work with the Aquatic SWG to revise (if necessary) the study and implement a second year of study towards meeting achievements. If standards are not met following the second study Douglas PUD will implement Section 18 Fishway Prescriptions and the BTMP to identify items to address effect to bull trout passage and survival.
5.0 REFERENCES


Appendix A
Twisp Weir Trapping Operations Plan

Douglas PUD

May 2015

Prepared by:
Douglas County Public Utility District
and the Washington Department of Fish and Wildlife
Background:

On November 9, 2012 the Federal Energy Regulatory Commission (FERC) issued a new Operating License (license) for the Wells Hydroelectric Project. This 40-year license is retroactive to Nov 1, 2012 and contains a host of fisheries and aquatic resource requirements that Douglas County Public Utility District (Douglas PUD) must meet during the course of the license including being subject to:

(E) the conditions submitted by the Secretary of the U.S. Department of Commerce under section 18 of the Federal Power Act (FPA).
(F) the conditions submitted by the Secretary of the U.S. Department of the Interior under section 18 of the FPA.
(G) the incidental take terms and conditions of the biological opinion submitted by the National Marine Fisheries Service on March 7, 2012, under section 7 of the Endangered Species Act.
(H) the incidental take terms and conditions of the biological opinion submitted by the U.S. Fish and Wildlife Service on March 19, 2012, under section 7 of the Endangered Species Act.

These various biological opinions and terms and conditions found in the above regulatory guidelines redundantly require the implementation of the Wells Anadromous Fish Agreement and Habitat Conservation Plan (HCP). Within the HCP is a requirement to achieve no net impact (NNI) for spring Chinook, summer/fall Chinook, sockeye, Coho and summer steelhead (Plan Species) through habitat and hatchery actions to address unavoidable loss of said Plan Species through the operation of Wells. These Hatchery actions require collection of adult broodstock for steelhead and spring Chinook from various locations, including the Twisp Weir; Monitoring and Evaluation of the hatchery programs including evaluation of returning adult salmon and steelhead; removal of hatchery origin fish (i.e., “adult management”) to control the proportion of hatchery spawners in the wild relative to wild spawners. The HCP Hatchery Committee, comprising signatories to the HCP, includes the U.S. Fish and Wildlife Service, National Marine Fisheries Service, Washington Department of Fish and Wildlife, Confederated Tribes of the Colville Reservation, Yakima Nation, and Douglas PUD.

The Twisp Weir is located in the Twisp River, a tributary of the Methow River. The panels of the weir are operated hydraulically to allow the weir to be set so downstream-moving fish can descend over the weir while upstream-moving fish are diverted into either of two traps, one located on the river-left bank and the other approximately ten feet to the center of the channel from the left bank. The current weir has been operated since March of 2008.

WDFW is currently contracted by Douglas PUD, under the HCP hatchery operations and monitoring and evaluation program, to operate the weir and has done so since the weir went into operation in 2008.

Potential bull trout encounter

Bull Trout were listed as threatened in 1998. The history of their Federal listing can be found in Appendix 1.
Following the issuance of the United States Fish and Wildlife Service’s 2012 Biological Opinion for bull trout found within the Wells Project Area, Douglas PUD was issued a not to exceed, non-lethal, and annual take of $N = 118$ adult bull trout at the Twisp River Weir. From 2010 – 2012, less than 100 adult bull trout were captured in each year. However, bull trout encounters have increased since 2011 and in the 2014 trapping season $N = 135$ unmarked adult bull trout were incidentally captured. In the same year, an additional $N = 80$ previously PIT tagged adult bull trout were incidentally encountered. Collectively in 2014, $N = 215$ adult bull trout were captured at the Twisp Weir (Figure 1). All incidentally encountered bull trout have been PIT tagged as described in Douglas PUD’s Bull Trout Stranding Entrapment and Take Study Plan. 2014 was the first year that the $N = 118$ take non-lethal threshold was exceeded. Bull trout encounters at the Twisp River Weir have generally tracked closely to the number of bull trout annually counted passing over Wells Dam. Large counts of bull trout at Wells Dam generally resulting in large counts at the Twisp Weir. The number of bull trout encountered at the Weir has increased year over year from 2010, with a low of $N = 26$ in 2011 and a peak of $N = 215$ in 2014 (Figure 1). The observed increasing trend may signify an increase in the number of bull trout in the Twisp River and be the result of strong adult spawning and juvenile escapement from 2009-2010 year classes (Figure 1). However, trap efficiency and effort, and the relatively short time period of the observation are sources of uncertainty in interpreting the data (Table 1). For example, high flows in 2011 prevented weir trap operation during the peak of the adult bull trout spawning migration and, as such, encountering $N = 26$ adult bull trout that year is probably more indicative of reduced trapping effort as opposed to true abundance. PIT tag detections beginning in 2010 suggest that most bull trout that are handled, tagged, and released at the Weir leave the Twisp River in late September and October during a post-spawn migration as bull trout seek post-spawn forage and overwintering habitat. These detections suggest that bull trout handled at the Weir not only survived the handling process but completed spawning events following release from the Weir. In addition, PIT tag data suggest that the majority of fish return in subsequent years to spawn again, often within a week of the previous year. Bull trout encounters with the Twisp River peak between June 9 and July 23 historically (Figure 2). Specifically, over 97% of incidental encounters at the Weir occur during this period, and no bull trout have been encountered before June 5 or after August 13$^5$ (Figure 2). The peak period for Spring Chinook migration into the Twisp River and trapping to collect broodstock at the Weir also occur during the of the peak bull trout migration. However, incidental captures of bull trout provide an opportunity to collect vital information on bull trout population status, survival, repeat spawning propensity, life history and growth information: all areas where little to no information exists for the species in the Methow Basin.

$^5$ Historically, the Twisp Weir is not operated in August since both Spring Chinook and Steelhead trapping are completed by then.
Figure 1. Number of adult bull trout PIT tagged and recaptured at the Twisp Weir (left axis) over the last five years over the last ten years.

Figure 2. Proportion of adult bull trout captured at the Twisp Weir during the spawning migration in the Twisp River. The shaded area illustrates that over 97% of the adult bull trout that have been encountered at the Twisp Weir since 2010 were captured between June 9 and July 23.
Purpose

The purpose of this plan is to describe a new operations plan for the Twisp Weir that will simultaneously meet the HCP Plan Species spring Chinook and summer steelhead program requirements, including broodstock collection, monitoring and evaluation activities, and adult management activities, while minimizing the exposure of bull trout to incidental capture and handling and maintaining incidental take of bull trout within previously authorized take limits.

Twisp River Weir

For 2015, WDFW and the District propose the following plan:

2) General Weir Operating Parameters:
   a. Weir fished from ice out in late February/early March through mid-August.
   b. Steelhead trapping occurs from late February/early March through June 1.
   c. Spring Chinook Trapping occurs from June 1 until brood stock and adult management targets are achieved (usually mid-August).
   d. The height of the weir panels is hydraulically controlled and panels are set at the water surface level when the weir is fishing to allow downstream migrating steelhead, spring Chinook and bull trout to safely and effectively pass the weir.
   e. Weir is tended by WDFW personnel whenever the trap is operated. WDFW is contracted by Douglas PUD under the HCP Monitoring and Evaluation Plan and HCP hatchery operations and maintenance to monitor the trap.
   f. Operation of the weir under ESA is currently authorized by Section 10 Permits 1196 and 1395 (permits extended by NMFS on September 20, 2013).
   g. Real-time monitoring and trap operations: Throughout all trapping activities described in this plan, PIT tag interrogation locations WEL and WEA (Wells Dam), LMR (Lower Methow River) and TWR (Twisp River) will be monitored by WDFW and DCPUD staff for detections of previously PIT tagged steelhead, spring Chinook, and bull trout. Detections at Wells Dam are nearly 100% efficient. However, detections at LMR and TWR during the higher flows, particularly when spring Chinook and bull trout are migrating, may be less than 20% efficient (comparing fall downstream movements to upstream movements). Data will be examined on a yearly basis to determine if there are peak periods when bull trout are most likely to pass the weir.
   h. When the weir is not fishing, the weir panels will be lowered to the stream bottom, or the traps will be opened to passage, or both. If only the weir panels are lowered the entrances to the traps will be closed.
   i. Limitation in staffing or other unforeseen problems: If WDFW staff are not available to staff the trapping facility (according to this plan) for any reason, or the trap will not be checked within 24 hours, then full passage will be allowed by lowering the weir panels or opening the traps or both, dependent on flow conditions until staff are able to return.
   j. Unforeseen scenarios and in-season observations: If during the trapping period, observations from field staff warrant reconsideration of any part of the plan as described above, WDFW and the District will alert the National Marine Fisheries Service.
Service, HCP Hatchery Committee, and/or the USFWS, as appropriate, and work cooperatively with these parties to minimize incidental take or otherwise ensure that take is maintained at the manner and extent previously approved by the USFWS.

k. Trapping effort monitoring: Trapping effort in the form of daily trap operation time will be recorded by WDFW operators. Trapping effort will be used in subsequent years to refine this plan.

l. Nocturnal vs diurnal use: Species composition during trapping hours will be recorded to document times of day when various species are trapped.

m. Trapping will be suspended prior to exceeding the take limits specified by USFWS for bull trout and by NMFS for summer steelhead and spring Chinook.

n. Broodstock collection target numbers are established annually prior to trapping based on predicted age composition, fecundity, and survival of broodstock and rearing in-hatchery.

o. This Plan does not limit other ESA Permit (1395 and 1196, Wells Bull Trout Biological Opinion) conditions that also apply under this plan.

3) Late February/Early March through June 1 Operations:

a. Weir begins fishing in late February or early March as environmental conditions allow.

b. The weir will be fished constantly during this time to trap steelhead, as conditions allow. The weir will be tended by WDFW personnel at least once daily, but twice daily or more when fish are present. An attempt will be made to capture all adult steelhead during this time period:

   i. Steelhead are trapped during this period for Twisp River broodstock collection for the Douglas PUD Twisp Steelhead Conservation Program (N~26).
   
   ii. Steelhead are trapped for population census data collection and for a relative reproductive success study of hatchery and wild steelhead required of Douglas PUD under the Wells HCP.
   
   iii. Steelhead are trapped to control the relative abundance of hatchery and wild steelhead adults upstream of Twisp Weir. Currently the wild to hatchery ratio is 1:1 under the relative reproductive success study. Steelhead removed via adult management may be used as broodstock for other Douglas PUD and WNFH programs.

c. Bull trout have not been observed or trapped at the Twisp Weir prior to June 5th.

d. No more than 118 adult and 50 sub-adult bull trout (also includes 19 juveniles) handled in the entire trapping season. Trapping would be suspended with one lethal take of any size bull trout.

e. High flows that may occur during the steelhead trapping season can significantly limit the efficiency of the weir or prevent fishing the weir. In these cases, the weir panels are lowered or over-topped by the water and the traps are opened for passage. During such flow episodes that prevent trapping, the weir and trap boxes are fully passable to all species.
4) June 1 through August Operations:
   a. The weir will be fished selectively during this time period to trap spring Chinook broodstock. Normally the weir will be fished daily from 6:00 AM until 9:00 PM, but overnight trapping may be used if greater trapping effort is needed to collect spring Chinook broodstock. The weir will be attended by WDFW personnel at all times while the weir is fishing, as mandated under ESA Section 10 Permit 1196. When the weir is not fishing, the weir panels will be lowered and/or the traps will be opened to allow passage.
   b. Trapping effort will be based on meeting the spring Chinook broodstock collection target of approximately 20 adult spring Chinook of natural origin with equal sex ratio (~10 males and ~10 females). In-season information derived from sampling and counts at Wells Dam and PIT tag detections at in-river arrays will inform trapping operations in order to target spring Chinook while reducing effort when spring Chinook are not likely to be available.
   c. Trapping will not necessarily occur every day or for 24 consecutive hours per day, dependent on efficiency of trapping operation in obtaining broodstock. Fine-scale scheduling of trap operations will be determined on a day-to-day basis.
   d. No more than 118 adult and 50 sub-adult bull trout (also includes 19 juveniles) handled in the entire trapping season. Trapping would be suspended with one lethal take of any size bull trout.
   e. Trapping will be suspended when the broodstock target is met. When the weir is not fishing the traps will be opened to allow passage and the weir panels will be lowered. The traps will be removed from the river in mid- to late August.
   f. High flows typically occur during the spring Chinook trapping season. High flows significantly limit the efficiency of the weir or prevent fishing the weir entirely. In these cases, the weir panels are lowered and the traps are opened for passage. During high flow episodes that prevent trapping the weir is fully passable to all species.

Expected Performance:
1) Late February/Early March through June 1 Operations:
   a. Wild steelhead broodstock collected for the Twisp Steelhead Conservation Program.
   b. No more than 33% of the wild steelhead run collected for broodstock.
   c. Census sampling of all steelhead for the steelhead relative reproductive success study.
   d. Steelhead spawning escapement upstream of weir managed for pHOS ~ 0.5.
   e. Surplus hatchery steelhead removed for broodstock or adult management.
   f. No bull trout are expected to be encountered.
   g. Trap operated continuously as environmental conditions allow.
   h. Trapping operations will be halted prior to exceeding ESA take levels for any ESA listed species. No more than 118 adult and 50 sub-adult bull trout (also includes 19 juveniles) trapped and handled in the entire annual Twisp Weir trapping season (late February – mid-August). No lethal take is expected.
2) **June 1 through August Operations**:  
   a. Wild spring Chinook collected for broodstock for the Twisp Spring Chinook Conservation program (N≈20).
   b. No more than 33% of the wild spring Chinook run collected for broodstock.
   c. Expected escapement of spring Chinook with no handling is 35% via fish moving past the weir during non-fishing periods.
   d. Expected escapement of bull trout with no handling at least 40% via fish moving past the weir during non-fishing periods.
   e. All fish removed from the traps within 1 hour.
   f. Trapping operations will be halted prior to exceeding ESA take levels for any ESA listed species. No more than 118 adult and 50 sub-adult bull trout (also includes 19 juveniles) trapped and handled in the entire annual Twisp Weir trapping season (late February – mid-August). No lethal take is expected.

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6 This plan is intended to be consistent with pHOS management requirements. In the future the Twisp Weir may be used to manage the number of hatchery Chinook spawners that access the Twisp in accordance with NMFS permitting requirements and HCP obligations.
**Bull Trout Handling Protocol**

Bull trout captured will not be PIT tagged unless otherwise approved by the USFWS. Bull trout will be allowed to pass volitionally out of the trap when operators open the top end trap slide gate.

**Reporting and Annual Review**

Bull Trout reporting will be carried out through the development of an annual Incidental Take Report furnished to the Service by April 15 of every year. In season updates will be provided. Dead bull trout will be reported immediately. When possible the carcass will be recovered and furnished to the United States Fish and Wildlife Service.

Douglas PUD will meet annually with the USFWS to discuss previous year’s operations and the upcoming year.
Appendix 1

Bull Trout Listing Status

On June 10, 1998, the USFWS listed bull trout within the Columbia River Basin as threatened under the ESA (FR 63(111)). Later (November 1, 1999), the USFWS listed bull trout within the coterminous United States as threatened under the ESA (FR 64(210)). The USFWS identified habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, and grazing; blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species as major factors affecting the distribution and abundance of bull trout. They noted that dams (and natural barriers) have isolated population segments resulting in a loss of genetic exchange among these segments (FR 63(111)). The USFWS believes many populations are now isolated and disjunct. In October 2002, the USFWS completed the first draft of a bull trout recovery plan intended to provide information and guidance that will lead to recovery of the species, including its habitat (USFWS 2002). Threatened bull trout population segments are widely distributed over a large area and because population segments were subject to listing at different times, the USFWS adopted a two-tiered approach to develop the draft recovery plan for bull trout (USFWS 2002). In November 2002, the USFWS published in the federal register a proposed rule for the designation of critical habitat for the Klamath River and Columbia River distinct population segments of bull trout (67 FR 71235). In October 2004 the USFWS published a final rule in the Federal Register Designating critical habitat for the Klamath River and Columbia River populations of bull trout (69 FR 59995).

In April 2008, the USFWS completed the 5-year status review for Columbia River bull trout with two recommendations: maintain “threatened” status for the species, and determine if multiple distinct population segments exist within the Columbia River and merit protection under the ESA. The recommendations intend to facilitate analysis of project effects over more specific and biologically appropriate areas, ultimately allowing a greater focus of regulatory protection and recovery resources (USFWS 2008a). The review also identified specific issues that limit the overall ability to accurately and quantitatively evaluate the current status of bull trout. Seven recommendations were made to improve future evaluation and management decisions, all of which are largely based on improvement and standardization of monitoring and evaluation techniques, better delineation and agreement of core areas and Recovery Units, and multi-agency cooperation and management (USFWS 2008b).

The USFWS published a Revised Draft Recovery Plan for Bull Trout on Sept. 4, 2014. The Revised Draft updated the recovery criteria proposed in the 2002 and 2004 draft recovery plans to focus on effective management of threats to bull trout, and de-emphasizes achieving targeted population numbers in specific areas. The USFWS intends to publish a Final Recovery Plan by Sept. 30, 2015. The Final Bull Trout Recovery Plan will include individual Recovery Unit Implementation Plans (RUIP) for each recovery unit. RUIPs will be developed through collaboration of interested and knowledgeable federal, tribal, state, private, and other parties prior to completion of the final Recovery Plan (USFWS 2014).
Per the Revised Draft Recovery Plan, the Wells Project is situated within the Mid-Columbia River Recovery Unit. Within this recovery unit, the USFWS has identified 25 occupied core areas in four geographic regions. The Wells Project is situated within the Upper Mid-Columbia geographic region and relevant core areas include the Wenatchee, Entiat and Methow rivers. A core area represents the closest approximation of a biologically functioning unit for bull trout. A core area functions as a metapopulation for bull trout. Not all core areas are equal and each has specific functions that are unique. For example, the Entiat River Core Area depends heavily on the mainstem Columbia River to provide overwinter, migration, and forage habitats. The Wenatchee River Core Area has populations using lake and riverine (both the Wenatchee and Columbia rivers) habitat for overwintering, migration, and foraging. Within a core area, many local populations may exist. A local population is assumed to be the smallest group of fish that is known to represent an interacting reproductive unit. Nineteen local populations have been identified in the Wenatchee (7), Entiat (2) and Methow (10) core areas (USFWS 2014).
Appendix 2

Data Analysis

Various sets of data have been examined in order to develop the Weir Operations Plan towards limiting the number of ESA listed fish handled. They are summarized in short sections below.

Justification for different weir operating criteria for steelhead and spring Chinook
Steelhead trapping at the Twisp Weir begins in March and ends May 31 each year. Spring Chinook trapping at the Twisp Weir begins June 1 each year. Since 2010 June 5th has been the earliest bull trout arrival date at the Twisp Weir. For example, in 2014, bull trout arrived at the Twisp Weir between June 7 and July 22 (Figure 3). Together, results suggest the bull trout arrived at the Weir exclusively during the Spring Chinook trapping period.

Figure 3. Bull trout arrival at the TWR PIT-tag-detection array in 2014.

Justification for opening the trap boxes at night during spring Chinook brood collection efforts

N = 72 detections occurred at TWR PIT antenna location from March 23 to August 23 2014 (generally upstream spawning movements). Results show that 91% of the movements occurred between 9:00 pm and 6:00 am (Figure 4). Similarly, N = 131 post spawning and downstream detections occurred at TWR PIT antenna location from September 1 to November 15, 2014. Results show that more than 97% of the downstream movements occurred between 6:00 pm and 6:00 am (Figure 5). As such, both upstream and downstream movements near the weir appear to occur almost exclusively at night. Since spring Chinook trapping is proposed to occur predominately during daytime hours and data suggest that bull trout move during nighttime hours, the proportion of bull trout expected to be captured should be under 40% of the run.
Figure 4. Frequency distribution for the hour of the day (x-axis) that upstream detection of bull trout at TWR occurred in the spring and summer of 2014, where the number above each bar is the proportion of total detections.

Figure 5. Frequency distribution for the hour of the day (x-axis) that downstream detections of bull trout occurred at TWR in the fall of 2014, where the numbers above each bar are proportion of total detections (left) and sample size per bin (right).
Justification for daytime Spring Chinook Trapping

Forty-two percent of spring Chinook detections occurring at TWR over the years 2009-2014 occurred during the hours of 6 am - 9 pm (Figure 6; n = 245). The remaining 58% of the run moved upstream in the Twisp during nighttime hours. As such, fishing the weir from 6-9pm should provide adequate opportunity for collecting necessary broodstock while minimizing collection to ≤ 33% of the natural-origin returns to the Twisp River.

Figure 6. Hour of the day frequency distribution of Spring Chinook tagged at Wells Dam and arriving at the TWR PIT tag array in 2014. The number above each bar is the proportion of total detections.
**Justification for Removing Twisp Weir in late August**

PIT tag data suggests that adult bull trout leave the Twisp post spawn predominately in the month of October (72% in 2014; Figure 7) with some downstream detections occurring in late September and early November. No downstream movements have been observed at TWR PIT array in the month of December, January or February. As such, dropping the weir panels to the stream bottom and removing the two trap boxes in August should protect downstream moving bull trout. The weir is designed and operated to allow downstream passage when fishing and not fishing.

![Figure 7. Distribution of downstream detections of bull trout at TWR in 2014, where the left bar represents the month of September (20%), the middle the month of October (72%), and the right the month of November (8%).]