W.T. Wooten Floodplain Management Plan (2014)

Washington Department of Fish and Wildlife

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INTRODUCTION

The Wooten Wildlife Area Floodplain Management Plan (FMP) was developed by the Washington Department of Fish and Wildlife (WDFW) as an integrated, cross-program effort to improve conditions within the Tucannon floodplain. Over the years the Tucannon River floodplain function has been compromised by certain factors including infrastructure encroachment and deterioration, large wood removal, degradation of riparian habitats, channel straightening, dike building and devastating floods and fires. The goals of the FMP were developed to address these factors: 1) protection and restoration of ecosystem functions of the Tucannon River, floodplain, and riparian habitats, 2) enhancement of fishing, hunting, camping, wildlife viewing and other recreational activities, 3) improvement of habitat conditions for Endangered Species Act (ESA) listed salmonids (as well as other aquatic species), 4) improvement of wildlife habitats, and 5) protection and enhancement of critical infrastructure.

These goals are consistent with the agency mission ("preserve, protect and perpetuate fish, wildlife and ecosystems while providing sustainable fish and wildlife recreational and commercial opportunities"), the 2011-17 WDFW Strategic Plan, and will compliment ongoing habitat restoration efforts to recover spring Chinook and other ESA listed stocks within the Tucannon basin. The WDFW Strategic Plan has guiding principles to conserve and restore biodiversity, ensure the health of ecosystems, and ensure sustainable social and economic use of Washington's fish and wildlife and their habitats. It emphasizes both conservation and recreation as equal priorities for WDFW. Goal 1 of the Strategic Plan is to "Conserve and protect native fish and wildlife." This is complimented by Goal 2: "Provide sustainable fishing, hunting and other wildlife-related recreational experiences". The goals of the FMP stated above and the proposed actions following in this document will help the Department meet these two goals in the W.T. Wooten Wildlife Area (Wildlife Area). This FMP addresses issues associated with the Tucannon Lakes and other WDFW infrastructure while seeking to enhance recreational uses and complement the habitat enhancement goals of federal, tribal, state, and other watershed partners. The FMP is a model for the Conservation Initiative approach that has been initiated within WDFW. The Conservation Initiative is an agency-wide commitment to emphasizing conservation and improving how we work together -- both internally across programs, and externally in cooperation with other governments,

organizations and citizens -- to better maintain healthy ecosystems for the benefit of all species, including humans.

The FMP is driven by several factors including the current condition of the Tucannon Lakes and associated infrastructure, and the increased focus on recovery of spring Chinook in the Tucannon River. Large portions of many of the Tucannon Lakes are currently within the floodplain of the Tucannon River. This restriction of the river reduces many important ecological functions of the floodplain. In addition to direct impacts to the floodplain the deteriorated condition of the Tucannon Lakes have other associated issues including: non-compliance with Washington Department of Ecology's (WDOE) Dam Safety regulations, failing surface diversions, continued intake and outlet operation/maintenance or needed upgrades, potential thermal degradation of the river environment, and sedimentation in the lakes that reduces carrying capacity for stocked rainbow trout and recreational fishing. We have separated our proposed actions in this FMP into 6 initiatives: 1) Outreach; 2) Tucannon Lakes; 3) Habitat Enhancement; 4) Campgrounds; 5) Roads, Bridges, Culverts; 6) Camp Wooten.

The Snake River Salmon Recovery Board (SRSRB), Northwest Power Planning Council (NPPC) and Bonneville Power Administration (BPA) will have an increased emphasis in implementing habitat enhancement projects in the Tucannon River over the next 6 years in order to meet obligations to recover spring Chinook as outlined in the Columbia River Power System Biological Opinion. BPA, in cooperation with the SRSRB, is prepared to spend between $6-9 million on river and floodplain habitat enhancement projects in the Tucannon basin before 2018, much of it directed to the Wildlife Area. In addition the SRSRB distributes funds from the State of Washington Salmon Recovery Funding Board (SRFB), much of which is directed to the Tucannon basin to help recover spring Chinook and three other federally listed species (summer steelhead, fall Chinook, and bull trout). This provides a unique opportunity for WDFW, co-managers, partners and interested public to restore habitat conditions, and river and floodplain functions on the Wildlife Area and to build partnerships for restoration off of the Wildlife Area, while at the same time enhancing educational opportunities and recreational experiences.

W.T. WOOTEN WILDLIFE AREA DESCRIPTION

The Wildlife Area was recommended for purchase in 1940 as "Tucannon Deer and Elk Range" and the majority of the purchases took place between 1941 and 1943. The original land purchase (12,000 acres) was intended to minimize conflicts between wildlife and livestock and provide land preserved exclusively for the use of wildlife and outdoor enthusiasts. Since then the total acreage has increased to more than 16,000. The Tucannon River originates on US Forest Service (USFS) lands south of the Wildlife Area. The river flows 17 miles through the Wildlife Area and includes major tributaries such as Cummings Creek and the Little Tucannon River. The Tucannon River supports a wide variety of aquatic

life including four species of ESA listed salmonids (fall and spring Chinook, summer steelhead and Bull trout), all federally designated as threatened. Lands in and around the Tucannon River are historic wintering areas for big game and receive year-round use by a variety of game and non-game species of wildlife. During the 1970's access to the Wildlife Area was improved with modifications to the roadway and public-use increased dramatically. The majority of visitors (75-80 percent) come from the Tri-Cities (Kennewick, Richland and Pasco), with the remainder coming from Spokane, Walla Walla, the Lewiston/Clarkston valley, Dayton, and Pomeroy, etc. (see Appendix A, as an example). The Wildlife Area currently averages 120-140,000 visitor days per year, with each major holiday attracting 3,000 to 5,000 visitors.

Eight artificial lakes were created in the 1950's along with the Tucannon Fish Hatchery. Approximately 88,000 "catchable" sized rainbow trout (~10-12 inches each), and over 2,000 "jumbo" sized rainbow trout (~15-17 inches and 1.5-2 lbs each), are stocked by the Lyons Ferry/Tucannon hatchery complex into the Tucannon Lakes annually to provide popular put-and-take fisheries. In addition, the Tucannon Hatchery serves a valuable role within the Lyon's Ferry Hatchery Complex towards meeting Lower Snake River Compensation Plan (LSRCP) mitigation and ESA recovery goals for steelhead and spring Chinook in the Tucannon River. This hatchery complex spawns adults, incubates eggs, rears juveniles and releases smolts of both species for the Tucannon River, as well as other hatchery production programs for southeast Washington.

THE IMPORTANCE OF FLOODPLAINS

River floodplains are important for a variety of reasons. A floodplain and its associated water body form a complex and dynamic system that supports many ecological functions that benefit the natural system and humans. For example, floodplains may reduce the severity of floods by allowing floodwaters to spread out and slow down. This dissipates floodwater energy which reduces erosion and degradation of stream banks and channels. When floodwaters slow down, sediments settle out on the floodplain - maintaining or improving water quality. These sediments, in turn, provide fertile soils for riparian vegetation growth in the floodplain. Another function is the filtration of nutrients and pollutants from runoff. As floodwaters rise, the nutrients and pollutants they carry are filtered through the vegetation of the floodplain and some are captured for use by plants. Properly functioning floodplains affect stream channel function and fish habitat by improving or maintaining channel sinuosity (meanders), which captures and retains more large woody debris (LWD), and salmon carcasses. Both of these biotic inputs increase productivity of the ecosystem, and LWD and meanders create pools and cover that are favored by many fish life stages and increase abundance and production of salmonids. These floodplain functions also help recharge groundwater by encouraging more rainfall and snowmelt to infiltrate the floodplain rather than flow overland and be carried downstream. The groundwater is then more slowly

filtered to aquifers and streams. This can mean more flow and moderated water temperatures during those times of year (summer *and* winter) when flows and temperatures may reach critical levels in relation to fish life. As stated in the previous paragraph, the sediments that are filtered out of high flows improve the soil quality of the floodplain, making it an area of high plant growth and diversity. This in turn provides habitat for a number of wildlife species. Riparian areas are generally the highest value wildlife habitats on the landscape of southeast Washington and approximately 85% of terrestrial species in Washington use riparian habitats for essential life activities. Riparian habitats support higher diversity and abundance of fish and wildlife than any other habitat, and some species are strongly associated with riparian habitats. Protecting riparian habitat may yield the greatest gains for fish and wildlife across the landscape while involving the least amount of area (Knutson, K. L., and V. L. Naef. 1997).

CAPITAL REQUEST

(This section updated Sept. 2014) Funding to implement this FMP is anticipated from a variety of sources. WDFW will seek state capital funding and use those funds to match funding from BPA, SRSRB, and other grant sources. A request for Capital funding was developed and submitted for consideration in the 2013 legislative session. This request was partially successful and resulted in funding available to complete relocation of two campgrounds and to begin public outreach and feasibility. This 2015 legislative session Capital Request is a result of this plan, and its funding is the key to accomplishing the goals of the FMP. In particular, matching state capital funds with habitat restoration funds provided by our local and federal partners provides an opportunity to cost share on projects that accomplish conservation, infrastructure and recreation goals. This capital request is divided into 4 phases (including the 2013-2015 capital projects):

1. **2013-2015, Feasibility.** (Development, design and permitting of projects, outreach and early action projects)
    a. 2015-2017 Project Design and Permitting (partially funded)
    b. Public Outreach (partially funded)
    c. Campground 6 and 9 Relocation (Complete Summer 2014)
    d. Habitat Enhancement (Spending Authority-BPA, ongoing)
2. **2015-2017, Project Implementation Part 1.** (Implementation of projects designed and permitted under Phase 1)
    a. Public Outreach (ongoing)
    b. Rainbow Lake Construction
    c. 2017-2021 Feasibility and Project Design and Permitting
    d. Habitat Enhancement (Spending Authority-BPA)
3. **2017-2019 Project Implementation Part 2.** (Final implementation of projects developed, designed and permitted under Phase 1)
    a. Public Outreach (ongoing)
    b. Deer Lake Construction
    c. Beaver-Watson Lake Construction
    d. 2019-2021 Project Design and Permitting
    e. Habitat Enhancement (Spending Authority-BPA)
    f. Additional Projects Developed Under Phase 2
4. **2019-2021 Project Implementation Part 2.** (Final implementation of projects developed, designed and permitted under Phase 1)
    a. Public Outreach (ongoing)

b. Big Four Lake Decommissioning
c. Spring Lake Construction
d. Tucannon Powerline
e. Habitat Enhancement (Tentative: Spending Authority-BPA)
f. Additional Projects Developed Under Phase 3
g. Habitat Enhancement (Spending Authority-BPA)
h. Additional Projects Developed Under Phase 1

The 2015-2017 biennium (began in 2014) is dedicated to feasibility. This includes project development, design and permitting, as well as public outreach and some early action projects. Feasibility and associated public outreach are described below. The early-action projects currently consist of relocating two campgrounds (2013-2105) out of the floodplain and construction work on Rainbow Lake (2015-2107).

Lakes Initiative projects are prominent in the second, third and fourth biennia (2015-2021). The FMP team has identified lake rehabilitation as a priority, designed to improve and enhance recreation, reduce impacts to ESA listed species, and improve stream and floodplain function for the Tucannon River. The current condition and configuration of most of the 8 Tucannon Lakes is an ecological detriment to Tucannon River floodplain function and causes the need for nearly constant maintenance. All but 2 lakes constrict portions of the Tucannon River floodplain, causing the river to be channelized, incised, and stream habitats to be simplified and degraded. All of the lakes drain back into the river, potentially leading to increased river temperatures. The dams of 6 lakes are in violation of the WDOE Dam Safety regulations. The lakes retain sediment and have to be periodically dredged. Six of the lakes rely on surface diversions from the Tucannon River. The current diversions have had periodic failure issues in recent years impacting both the public fishing availability of the lakes and potentially entraining or impinging ESA listed salmonids. Carrying capacity of these lakes is impacted by the factors mentioned above, threatening the viability of the trout fishery provided as mitigation for construction of the lower Snake River Dams. The WDFW request for funding for state funds for capital projects is $16 million over three biennia, including $1.8 million for 2013-2015.

Habitat Enhancement is a part of all 3 of the biennial requests. BPA has established programmatic funding through the SRSRB to restore spring Chinook habitat in the Tucannon basin. BPA will spend about $1.3 million per year through 2018. Restoration strategies and recommendations were developed based on limiting factors identified in the Tucannon Subbasin Plan (2004), Snake River Salmon Recovery Plan (2006 and 2011), and The Tucannon River Geomorphic Assessment and Habitat Restoration Study (Anchor QEA, 2011, Appendix D). A list of projects organized into tiered groups was developed; 75 % of the top tiered projects are located on the Wildlife Area. This means that between $6-9 million could be spent on habitat enhancement projects on the Wildlife Area between 2013 and the end of the 2017-2019 biennium. Our Capital Request includes a request for spending authority to

utilize up to $2.6 million per biennium to address the habitat enhancement funding that could come from federal sources to WDFW for habitat enhancement work on the Wildlife Area.

WDFW has completed its prioritization of Capital Projects and submitted this list to the Office of Financial Management in preparation for the 2015 legislative session. The Capital Request titled "Wooten Wildlife Area-Improve Floodplain" was identified as a priority project by the agency. The request is over three biennia and totals $21.6 million. This includes $15.6 million in state funds and $6.0 million in federal fund spending authority as described above.

FEASIBILITY, PERMITTING AND DESIGN

Much of the success of the FMP depends on the successful relocation or reconfiguration of a majority of the Tucannon Lakes. Several conceptual plans for the lakes have been developed and discussed with WDFW Capital Projects and Asset Management Program (CAMP) staff. There is a great deal of uncertainty and risk (operationally and fiscally) associated with these projects at this stage of development. Most of these plans call for increasing both the surface area and depth of the lakes, as well as identifying alternative water sources to reduce the need and/or amount of surface diversion currently taken from the Tucannon River. The availability of water and the unknown geomorphology of the areas that would need to be excavated contribute to the high risk and uncertain costs of the proposed projects. A feasibility study would alleviate many of these unknowns and solidify the costs for the implementation phases (biennia 2015-2021). In addition to managing risk, the Tucannon Lakes and the Wildlife Area are a vital part of the local economy and culture, therefore it is incumbent on us to conduct a thorough public outreach at the same time we are designing these projects to gather important public input and increase public awareness. In order to be successful, projects associated with the FMP must be well supported by the public and cooperating agencies.

The focus of the feasibility study would be the Lakes Initiative projects, however, given the interconnectedness of activities within the floodplain all initiatives should be considered as part of the study, whether or not projects identified undergo analysis. Suggested areas to be covered by the feasibility include:

1. Tucannon Lakes
    a. Cost Estimates
    b. Hydro-geology analysis (Geo Tech analysis)
        i. Water supply, water rights
        ii. Geological conditions
    c. Channel Migration Zone Analysis
    d. Full Design-Construction Ready
    e. Permitting

i. Cultural
ii. SEPA (on full FMP?)
iii. Federal Consultation
iv. County/State

f. Prioritization/scheduling

2. Campgrounds (*Note: The two WDFW Campgrounds remaining in the floodplain will be relocated in the Fall of 2014)*
    a. Explore other improvements to campgrounds, both to improve aesthetics and habitat conditions.
    b. Infrastructure-Roads/Crossings/Facilities/other
    c. Develop Plan(s)-
    d. Synchronize with Lakes Projects - Note: Any plans to reconfigure lakes will potentially affect other infrastructure including roads, bridges and access sites
    e. Power Line Plan (burial or alternative energy source, or other?)
    f. Hatchery Facilities
    g. Develop Long term Recommendations

3. Camp Wooten
    a. Develop alternatives to Improve Facilities and Reduce Floodplain Footprint in *current location*.
    b. Designs-Costs

4. Habitat Enhancement
    a. Feasibility study will not be necessary for planning and designing Habitat Enhancement Projects. Ongoing planning efforts within the Basin adequately address this need.
    b. Study should consider these efforts and planning documents to ensure that designs and plans are well coordinated.
    c. The development of the study should be in collaboration with coordinating groups already working in the Tucannon basin, including the Tucannon Technical Committee, the Snake River Board RTT, and the SRSRB and staff.

5. Outreach
    a. Develop Outreach Plan – early action
    b. Outreach should be conducted during the Feasibility study
    c. Assist WDFW (WDFW to be the lead) in outreach functions
    d. Assist with materials and handouts

- NOTE: Any feasibility study should take into account, and be consistent with, the Snake River Salmon Recovery Plan and Columbia Conservation District Tucannon Geomorphic Analysis. The consultant should work closely with the WDFW District 3 Team.

INITIATIVES

The balance of the FMP is divided into 2 sections. The Initiatives define the major areas of work that must be completed to make the FMP successful. The Initiatives should serve as the focus of the FMP and will not change (though additional Initiatives could be added). Following the Initiatives, the Projects section outlines discrete projects that will be conducted as part of these Initiatives. Any projects developed for the FMP should be consistent with a listed or newly identified Initiative. The goals of the FMP will be accomplished by developing, designing and implementing projects under 6 Initiatives: 1) Outreach; 2) Tucannon Lakes; 3) Habitat Enhancement; 4) Campgrounds; 5) Roads, Bridges, Culverts; 6) Camp Wooten.

OUTREACH

Outreach is included as an Initiative in the FMP because of the importance of coordinating with watershed co-managers, user groups, the public, and maintaining or building public support for management of the Wildlife Area. The FMP cannot be considered successful without the input, awareness and support of the public and our partners. The Wildlife Area is managed for use by the public for a variety of recreational activities and it is key to salmon habitat improvement efforts. It is important that outreach efforts contact as much of the interested public and as wide a variety of user groups and co-managers as possible.

While development of a specific strategy will identify user groups and organizations to target, there are several organizations that will be the key to outreach efforts. The Wildlife Area has a Wildlife Area Advisory Committee (WAAC) that meets annually to review the Management Plan Updates and give input on activities on the Wildlife Area. The WAAC consists of local landowners, sportsmen, and stakeholder groups (e.g.. Confederated Tribe of the Umatilla Indian Reservation (CTUIR), Wenaha Game Association, SRSRB, Columbia County commissioner, Last Resort KOA owners). The WAAC is a useful tool in obtaining public input, as well as getting the word out about projects we are planning on the Wildlife Area. The SRSRB was formed as a result of the Salmon Recovery Act of 1998. This board is

responsible for the implementation of the Snake Region Salmon Recovery Plan and thus has a vested interest in the Tucannon system, which features 4 ESA listed salmonid species. The SRSRB has regional representation including local governments, tribes, citizens and conservation groups. Washington Department of State Parks (State Parks) leases (from WDFW) and operates the Camp Wooten Environmental Learning Center (Camp Wooten) within the Wildlife Area to educate youth about the environment. Camp Wooten is within the floodplain and may be affected by the FMP, and thus discussions with State Parks should occur early in the process. Several sportsmen's organizations (e.g. Tri-state Steelheaders-, Richland Rod and Gun Club, etc.) will also be contacted by WDFW to discuss concepts and to maintain communications regarding the FMP.

An outline of the major components of the outreach strategy is contained in the Projects section of this document. Some initial outreach by WDFW is currently underway. WDFW staff has met with the SRSRB and the WAAC to present and discuss the FMP. Other stakeholder groups will be contacted in fall and winter of 2012. The formalized outreach strategy will be developed and begin to be implemented during the 2013-2015 biennium. This will allow 1-2 years for initial outreach prior to major projects being conducted. WDFW will continue to build the relationships with the public and our stakeholder groups during the implementation phase of the FMP. We will hold periodic public meetings to inform the public about the status of ongoing projects and to inform/seek input on any new proposed projects. Similar meetings will involve the watershed habitat restoration partners and fisheries co-managers.

TUCANNON LAKES

The artificial lakes on the Wildlife Area (Figure 1) were mostly constructed between 1953 and 1955. The Tucannon Lakes are some of the most popular fishing lakes in southeast Washington and they are of high value for meeting LSRCP mitigation goals for resident trout fisheries in Washington. The Tucannon Lakes' current recreational purpose is primarily to mitigate for lost fishing opportunities due to the construction and operation of the four lower Snake River Dams. These fisheries are provided via funding from the LSRCP (USFWS) to achieve an annual goal of 67,500 angler days of fishing for resident species. The trout fisheries in just four (Rainbow, Deer, Spring and Blue) of the Tucannon Lakes during the first half of the fishing season in 2003 have been estimated to provide nearly 20,000 angler days, and contribute over $750,000 per year to the economy (Mendel and Trump 2008). The lakes provide very popular fishing for the nearby residents of Columbia, Garfield, Walla Walla, and Asotin Counties, as well as the Tri-cities (Pasco, Kennewick, and Richland, WA (Appendix A).

The current condition and configuration of most of the lakes is an ecological detriment to the Tucannon River floodplain function and causes the need for nearly constant maintenance. All but Spring and Blue lakes constrict the floodplain of the Tucannon River, causing the river to be channelized and incised. Six

of the eight lakes are in violation of the WDOE's Dam Safety regulations. The WDOE Dam Safety regulations and the issues and opportunities for each of the lakes are summarized in Appendix C. WDOE has very strict vegetation restrictions and the dams themselves are visibly leaking in spots. The lakes retain sediment and are losing carrying capacity for maintaining put-and-take trout fisheries, therefore they should periodically be dredged out. At least 6 of the lakes are currently in need of dredging (Curl and Blue Lakes were recently dredged). All of these issues have led to increased operational expenses. Spring and Blue Lakes are also the only lakes that do not rely on a surface diversion from the Tucannon. The current diversions from the Tucannon River have had periodic failure issues; a condition that will only increase as the floodplain function is restored and the river becomes more dynamic. In recent years the Deer Lake and Beaver-Watson Lake intakes have been particularly problematic impacting both agency financial resources and the availability of these lakes to the fishing public.

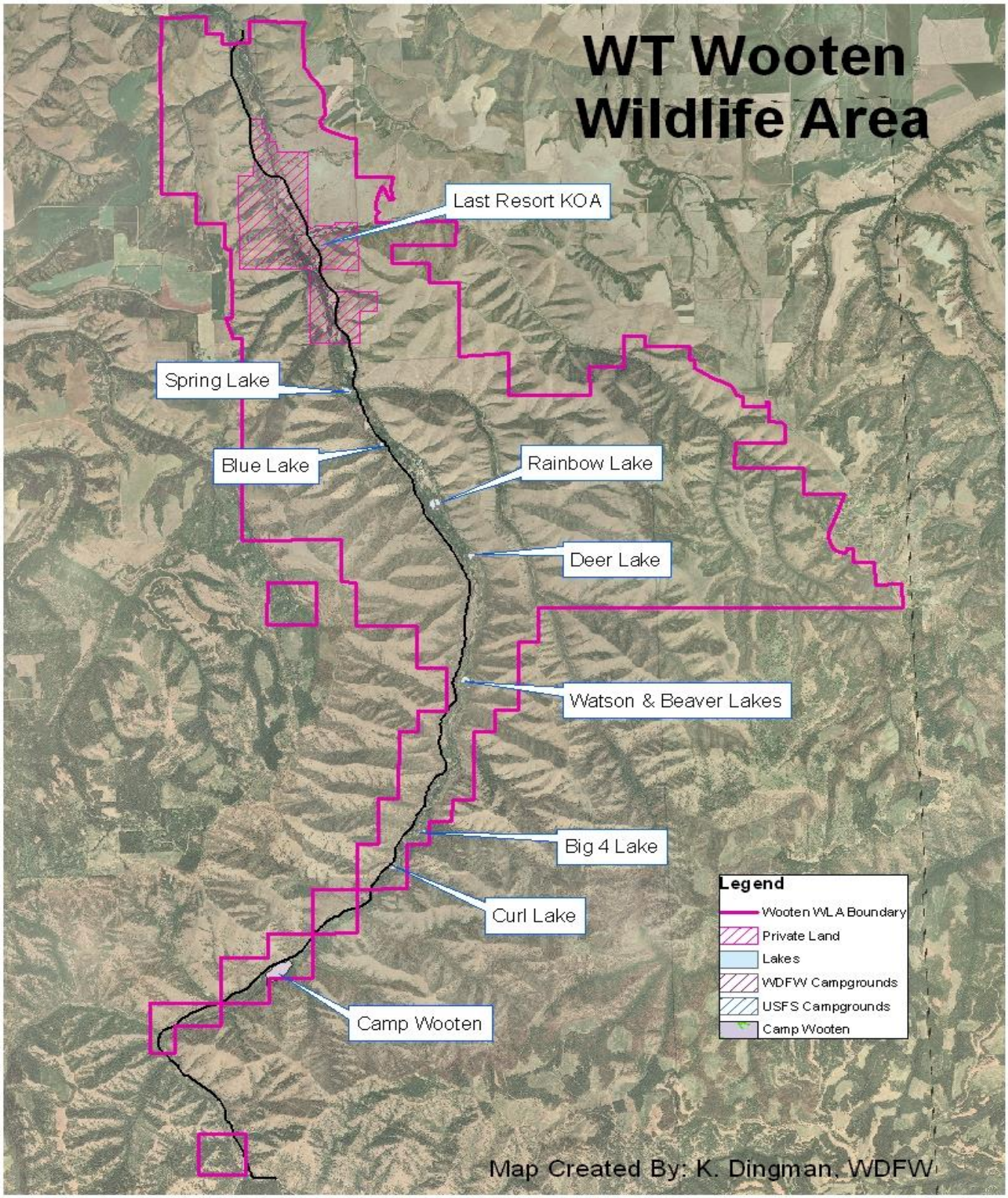

Figure 1: Map of the Tucannon Lakes located on the W.T. Wooten Wildlife Area.

The goals of the Lakes Iinitiative and associated projects are to enhance the Tucannon Lakes to create more fishing opportunity and a more enjoyable fishing experience, comply with WDOE Dam Safety regulations, address reduced carrying capacity and ongoing maintenance issues, and reduce the adverse impacts of the lakes to the Tucannon River and its floodplain. The lakes will be deepened and enlarged to create more usable fish habitat and angler access, improve water temperatures in the lakes and reduce the need for surface diversions, and decrease the water temperature that is flowing back into the Tucannon River. The lakes will also be relocated or reshaped to allow the Tucannon River to have more available floodplain to improve stream channel function and to enhance riparian habitat conditions. With this reconfiguration and relocation the water intake systems will also be modified or replaced to reduce impacts to fish and maintenance costs and to increase reliability. The dams around the lakes will be lowered, if possible, so there is less risk of catastrophic failure and so they would comply with WDOE Dam Safety regulations. These changes in the dams would allow vegetation to be grown on them to provide shade and reduce water temperatures in the lake and to benefit recreationists, as well as enhance habitat for wildlife and aesthetics for the public.

The Tucannon Lakes and associated structures currently have a significant impact on the function of the Tucannon River floodplain within the Wildlife Area. They are also the biggest public draw to this Wildlife Area. Thus the Lakes Initiative's broad proposal for change has the most potential for positively impacting the goals of the FMP.

HABITAT ENHANCEMENT

The restoration objective for the Tucannon River is to improve habitat conditions for ESA listed species for all life history stages. In 2010/2011, a system-wide geomorphic assessment was completed by Anchor QEA (Appendix D) through a contract with the Columbia County Conservation District (CCCD) and the SRSRB. A Conceptual Restoration Plan resulted from the geomorphic assessment for Reaches 6 through 10 (RM 20-50), which were identified as critical habitat for Spring Chinook and Steelhead populations in the Tucannon River. The Wildlife Area encompasses Reaches 7 through 10 in the Restoration Plan, with 19 project sites. The entire process resulted in 28 site specific projects throughout the 30-mile study reach, which were subsequently ranked by priority. The priority ranking utilized four criteria: 1) Expected biological response, 2) Consistency with natural geomorphic processes, 3) Benefit-to-cost ratio, and 4) Reach priority (emphasizing spawning and rearing capacity). The priority projects were grouped as Tier 1 projects to be considered for early implementation, Tier 2 projects are high to moderate priorities for strategic implementation, and Tier 3 projects have lower priority due to considerations such as less certainty of benefit or high cost of implementation. This, along with the Tucannon Subbasin Plan and the Snake River Salmon Recovery Plan, forms the basis for planned habitat enhancement.

LARGE WOODY DEBRIS

Large woody debris (LWD) is a critically important component of streams, fish habitat, and stream function. Historically, streams in this area would have had large amounts of LWD throughout the system. Human activity has removed much of the LWD from the river system. The lack of LWD is a limiting factor for creation and maintenance of pools, providing fish cover, and stream function, and is therefore critical for salmonid recovery. The Tucannon River is currently in the process of recovering from human disturbance and is re-establishing more natural conditions. It has been slowly recovering from clearing and straightening of the channel, although many simplified portions of the channel remain because of confinement by infrastructure. In unconfined areas, the channel is attempting to recover via channel migration, recruitment of LWD, and deposition of LWD and sediment. Through time, additional channel migration will further extend the length of the channel network, increase floodplain connectivity and side channels, and reduce in-channel water velocities (Anchor QEA, 2011, see Appendix D).

Wood collected along the stream bank can redirect or absorb the energy of high stream flow events. This reduces the erosive force of the water and therefore reduces bank erosion. Wood in the stream can also aid in controlling the gradient of the stream by stabilizing the channel or stream bed, developing pools, slowing or stabilizing the movement of fine sediment particles and/or larger bedload material, and retaining salmon carcasses to help fertilize the stream and riparian vegetation and increase primary productivity.

LWD in the stream creates pools that are very important deep water habitats for many life stages of salmonids and other fish species, especially in low flow periods. LWD that is embedded in the bank and protrudes into the stream or sticks out of the stream bed provides valuable cover for fish. These areas provide overhead cover, shelter from high velocity flows, and may provide complexity in the form of many small hiding places among roots or branches (especially for juveniles). LWD also provides critical hiding and resting habitat for adult salmonids. The increased complexity and cover allows for higher densities of salmon, steelhead and trout.

Another function of LWD is the decrease of water velocities and aggradation of gravel, which often raises the water table. This helps create side channels and off channel habitat that is utilized by fish species, particularly juveniles, and all life stages in high water events. These side and off channel areas provide more edge habitat and increased productivity of all aquatic life. The raised water table also provides for vigorous riparian vegetation growth.

LWD is an ideal substrate for algae or periphyton to colonize and for accumulation of other organic material, such as salmon carcasses. These organic materials provide food sources for many invertebrates and some fish species. These invertebrates and small fish are major food components in the diets of many other fish, and wildlife such as dippers, kingfishers, otters, and garter snakes. This highly productive habitat provides food and protection for many aquatic and terrestrial species of insects, fish, and wildlife.

LEVEE REMOVAL/MODIFICATION

There are existing levees and remnants of old levees along reaches of the Tucannon River within the Wildlife Area. Some levees protected farm infrastructure or fields before the Wildlife Area was created by WDFW. These levees constrict the river and prevent the river from having access to the floodplain. Potential projects would be to remove all or portions of levees to promote increased floodplain connectivity over time (See Conceptual Restoration Plan, Reaches 6 to 10 Tucannon River Phase II in Appendix D). Several of the reaches in the Restoration Plan have levee removal projects proposed. Also see Lakes section and Camp Wooten section regarding dams and levees.

POWERLINE RELOCATION, BURIAL OR ALTERNATIVE ENERGY SOURCE

The Columbia Rural Electric Association (REA) transmission line that transects the Wildlife Area supplies electrical power to Camp Wooten (operated by State Parks), the Tucannon Fish Hatchery, and the fish screens at several lakes.

Between August 5 and August 19, 2005, the School Fire burned nearly 52,000 acres of terrain in the Tucannon Valley and adjacent area, causing millions of dollars in damage and firefighting costs. The fire's origin was traced to a dead pine tree falling over power lines, which caused the lines to arc and sent sparks to the ground, thereby igniting dry grass.

The Columbia REA has a maintenance plan that requires clearing an area under and around the power line to prevent trees from falling on the line. This maintenance activity clears a large swath of trees through the Wildlife Area and crosses the river and riparian area several times, resulting in a loss of habitat and riparian cover. Because the 2005 fire was caused by a line damaged by a dead tree or branch, and the Columbia REA was sued by the state for damages, the Columbia REA states they will need to maintain a clear-cut along the power line up to 1-1/2 tree lengths on each side. This will potentially result in a clear-cut about 300 feet wide along the entire 8.5 miles, crossing the river several times, thus destroying large portions of the riparian zone of the Tucannon River, and other terrestrial habitat. This is critical habitat for many species in eastern Washington. The Tucannon River contains four ESA listed salmonid species and high water temperature is an important factor limiting production

of these listed fish. Destroying riparian habitat that shades the stream and provides LWD is detrimental to these fish species. Obviously, other species, both aquatic and terrestrial would be negatively impacted by the loss of this critical riparian habitat. WDFW has been seeking to initiate a project to bury or relocate the power line from at least the Tucannon Fish Hatchery to Camp Wooten since 2006. This project is very important because it would potentially eliminate the problems of overhead power line maintenance, potential fire problems from downed or damaged lines (the cause of the School Fire), and the clear-cutting of wildlife habitat in the power line right of way. Therefore, burying or relocating the power line would increase and improve the riparian canopy and function in those areas currently being cleared. Another option to address the issues associated with powerline would be to examine alternative power sources for the facilities needing electrical power so the power line could be removed or reduced.

STREAM MEANDER RECONSTRUCTION

Properly functioning stream systems of moderate or low gradient typically have a meandering channel, or footprint, and an associated floodplain. The meandering of the stream allows proper dissipation of energy as it slows water flows down. This channel form also causes the formation of pools, deposition of gravel/bedload and LWD, areas of reduced velocities on the inside of bends, and other stream functions. Floodplains also allow dissipation of energy as flows spread out when high water events occur. Many other important functions occur such as deposition of sediments and debris on the floodplain, seed transport and deposition, groundwater retention, etc.

One project being considered is at the Beaver/Watson Lake area of the Tucannon River. The existing parking lot, footbridge, and roadway on the west side of the Tucannon River, and the Watson Lake dam on the east have created a constriction and isolation of the river from its floodplain. The river is forced against the base of the Tucannon Road prism just downstream of the footbridge. A proposed project is to change the physical footprint of Watson Lake by removing the existing dam and moving it eastward to narrow the lake, while the lake would be elongated north to south. This would remove the stream constriction and allow the river access to its floodplain. Once the lake is moved a meander reconstruction is proposed to restore proper stream function and to eliminate the erosive pressure on the Tucannon Road prism.

RIPARIAN ENHANCEMENT OR RESTORATION

Riparian areas are critical components of a healthy stream system and they provide important habitats for terrestrial and avian wildlife species. The trees provide shade, perches, hiding cover, LWD, and food

sources for various organisms in the food chain. Sediment, nutrients, and pollutants are filtered through riparian areas, and these areas have high biological diversity and productivity.

The riparian areas vary in quality throughout the Wildlife Area, from healthy and of high quality, to very poor or nonexistent. The School Fire (mentioned earlier) burned large areas of the riparian habitats reducing or eliminating the riparian trees. Some areas are re-vegetating fairly well while others are not. The Conceptual Restoration Plan developed by Anchor QEA lists several river reaches where riparian restoration is recommended.

CAMPGROUNDS

(NOTE: Campground 6 and Campground 9 will be re-located in the fall of 2014) The Tucannon Campgrounds are a popular place for people from the Tri-Cities, Walla Walla, and elsewhere, to come to recreate. Most of the visitors to the Wildlife Area come to camp in the campgrounds and fish in the lakes, hunt, and/or view wildlife on public lands. There are currently 10 designated campgrounds on the Wildlife Area that are maintained by WDFW. These campgrounds have metal fire rings, outhouses, and a few concrete picnic tables. There are also four USFS designated campgrounds in the Tucannon drainage. All four of the USFS designated campgrounds are located in the floodplain and are experiencing the same riparian damage issues as the WDFW campgrounds.

Campgrounds have been included in the FMP as an Initiative because there are still some campgrounds that are located in the floodplain. Several of the campgrounds were relocated out of the floodplain after the 2005 School Fire and 2006 salvage logging. The campgrounds that are remaining in the floodplain are located in the riparian area and could potentially be in danger of the Tucannon River shifting and damaging or eliminating the campground. The campgrounds in the riparian area also result in the public trampling or removing the riparian vegetation, and garbage being dumped in the river or the riparian area.

The goal of the FMP is to relocate the remaining campgrounds out of the floodplain and allow for the Tucannon River to reconnect with the historic floodplain and reduce damage to the riparian vegetation due to human activity. This will be achieved by constructing new campgrounds in suitable areas on higher ground, closing the campgrounds in the floodplain and restoring these disturbed areas to natural conditions (removing outhouses, replanting, etc.).

The campgrounds that will be relocated are Campgrounds 6 and 9. Campground 6 will be moved to the west side of the road from its current location. Campground 9 will be removed and two smaller campgrounds will be constructed to replace it. The new Campground 9 will be located at a log landing site that was created for the salvage logging project in 2006. The campground will have 4-5 campsites

and be located on the west side of the road just north of the mouth of the Little Tucannon River, out of the floodplain and riparian area. The New Campground 10 will be constructed on higher ground just south of the current Campground 9. The campground will have 4-5 campsites and will have barriers in place to keep the public from driving and/or camping in the riparian area. The current Campground 10 will be renamed as Campground 11. In addition to relocations, opportunities to improve existing campgrounds will be identified during the feasibility study phase of the floodplain management plan.

ROADS, BRIDGES, CULVERTS

Specific projects to address roads and public access will be developed as part of the feasibility study. Potential changes in road infrastructure must take into account the eventual footprint of the Tucannon Lakes and associated access needs. In addition, the needs of the USFS should be considered. The lands in the Wildlife Area are adjacent to, and interspersed with, USFS lands. The USFS owns and manages the main road (USFS Road 47) up the valley and some of the uplands or riparian areas. This road bisects WDFW lands for approximately ten miles.

There are several potential projects that should be considered. The Deer to Watson Lake administrative access road was identified as a "Stream Adjacent Parallel Road" in the Road Management and Abandonment Plan. Portions of the road were moved up slope to avoid the riparian area, however a spring fed stream located near the downstream portion of the road remains a stream ford. Archeological finds in the area prevented a complete solution. This section of roadway should be re-evaluated and possibly moved away from the river, with a crossing structure installed. The footbridge and parking area for public access to Beaver-Watson lakes constricts the river channel and should be relocated. This would be planned as part of the Tucannon Lakes planning process.

The USFS is considering several road improvement projects. We must integrate their actions into our future road planning. One project currently being discussed is moving the USFS Road 47 up slope behind the Tucannon Guard Station. This avoids an area where the existing road is very close to the river.

CAMP WOOTEN

Camp Wooten was originally a Civilian Conservation Corps (CCC) site called Camp Tucannon. State Parks now operates Camp Wooten, which is the largest environmental learning center in eastern Washington, and hosts many educational groups from the spring into fall. The site is historically important because of its use as a CCC camp and because many generations of children have participated in outdoor experiences at Camp Wooten. WDFW owns the land and leases the site to State Parks.

The Tucannon River flows along the western boundary of Camp Wooten (see illustration below), and is constricted between Camp Wooten and the Tucannon Road (USFS Road 47). The east side of the river has a levee to protect Camp Wooten infrastructure from high stream flows. The bridge across the Tucannon to access Camp Wooten also constricts the stream, and past bank protection work just upstream of the bridge, along with a vortex weir, force the river channel to remain under the bridge.

As described above, some portions of the current location of Camp Wooten are within the floodplain. This impacts floodplain function and also leaves structures vulnerable to flood damage. Reconfiguration of Camp Wooten will be considered during the feasibility portion of FMP. Reconfiguration could involve: 1) removal and replacement of the current bridge and road to a new location, 2) moving some infrastructure, such as cabins, away from the river, 3) removing portions of current levees that constrict the river and constructing setback levees to allow the river some access to the floodplain, and 4) re-establishing a pre-existing side channel for off-channel rearing. Reconfiguration considerations of Camp Wooten will not include relocation of the Camp. Any reconfiguration activities will be done with the Camp at its present, historical location.

WDFW recognizes the importance of Camp Wooten both historically and to communities in southeast Washington that have had generations of children learn to appreciate the outdoors while attending camp sessions. Reconfiguration of Camp Wooten will not occur without a full public review/comment process. In addition WDFW commits to the people of southeast Washington that reconfiguration activities will not occur unless they can be done in a way that enhances, rather than retracts, from the historical and cultural aspects that the community values.

PROJECTS

OUTREACH

Many of the discrete Outreach project(s) will be developed with a consultant during the feasibility portion of the FMP. However, WDFW will begin outreach to discuss the intent, conceptual plans, and the draft FMP with stakeholders. In fact, outreach has already begun on a local basis. This has included briefings to both the SRSRB and the CAG. Outreach for the FMP can be divided into 3 stages: early outreach, feasibility stage outreach, and construction phase outreach.

Early outreach to the community regarding the FMP and associated actions is currently occurring and will continue through the rest of 2012 and into 2013. This outreach is targeted to particular stakeholders, traditional partners, user groups and legislative bodies to inform them of the FMP and the conceptual project plans contained therein. Besides information sharing, the purpose is to gauge the amount of support for our proposed actions; and if not well supported, to gather information on how

the projects could be changed to increase support. This outreach would be developed, coordinated and implemented by WDFW staff.

The feasibility stage outreach will occur approximately from the summer of 2013 through the winter of 2016. While targeted outreach and briefings would continue as described above, the purpose of this outreach would be information sharing and gathering from the general public. The outreach plan for this time period would be developed with the assistance of a consultant, though most of the outreach itself will be conducted with WDFW personnel. The main vehicle of outreach will be a series of public presentations and open houses. Though other work would also be presented, the main focus of this outreach will be the work to be performed on the Tucannon Lakes. The early meetings would have detailed graphics and descriptions of conceptual plans. The emphasis would be to inform and listen to public comment. Later meetings would feature complete plans and would be more informational in nature.

Construction of most of the projects is scheduled to occur from about the summer of 2017 through 2021. It is important to continue to inform the public of the progress of the floodplain management plan. These meetings would likely take the form of open houses, perhaps in the early spring (emphasis on proposed work) and late fall (emphasis on completed work) of each year. The main purpose of this outreach would be information sharing. This would allow the public to be informed of the work to be done that year and how it may impact use of the Wildlife Area, and to track the progress of construction.

The description above should be considered a conceptual framework for outreach. A complete outreach plan will be developed with the assistance of a professional outreach consultant and be presented in a later version of the floodplain management plan.

TUCANNON LAKES

RAINBOW LAKE ENHANCEMENT AND REHABILITATION PROJECT

DESCRIPTION

Rainbow Lake, located just south of the Tucannon Fish Hatchery in Columbia County and adjacent to the Tucannon River, is a 10-acre, off-channel impoundment that was reportedly constructed in 1955. The water supply is directly from the river via an open channel. Water is diverted from the Tucannon River at the Tucannon Fish Hatchery diversion dam (with a recently improved fish ladder). The impoundment serves two important purposes: it provides water (and acts as an ice free supply in winter) to the

Tucannon Fish Hatchery, and supports a very popular put-and-take recreational trout fishery within the Wildlife Area.

Many public camp grounds are located around Rainbow Lake. Campground 3 specifically serves as recreational attractions for Rainbow Lake fishing and other outdoor activities. Statistically, the most fishing effort within the Tucannon Lakes likely occurs at Rainbow Lake (Mendel and Trump 2008), as it is the largest of the eight impoundments knows as the Tucannon Lakes. Up to 15,000 catchable sized, and 325 jumbo sized, rainbow trout are planted annually in Rainbow Lake. The estimated economic value of the fishery in the four northern Tucannon Lakes, including Rainbow Lake, is estimated to be at least $780,000 annually (Mendel and Trump 2008).

The outlet water flow structure is in need of restoration and repair work. The outlet structure consists of a large drop-inlet concrete structure with a revolving drum screen and adjustable stop logs. The mechanically screened outlet structure provides constant water flows back to the river, or through an above ground pipeline that runs north approximately 2,000 feet to the hatchery facility. . This pipeline was replaced in 2005 following the School Fire. It is the sole source of water for the earthen pond that typically is utilized for rearing catchable-sized rainbow trout for the area lakes, including Rainbow Lake. The water supply from Rainbow Lake is not used for hatchery operations during the late spring and summer months due to increased temperatures. During the fall and winter months, the water supply is critical for fish rearing and the reservoir is a vital safety factor for maintaining flows. Icing on the river, and reduced flows at the intake that supplies Rainbow Lake, can impact water availability to the lake and hatchery. In these events, the lake acts as an important reserve for continued water supply to the hatchery.

In recent years, the buildup of sediment and vegetative growth has diminished the capacity of Rainbow Lake and hatchery trout stocking levels have been reduced. Not only has it reduced the amount of water available to the hatchery in low flow events, it is reducing carrying capacity for stocked trout and it may be causing increased water temperatures in the spring and summer months. The shallow water column is not conducive to maintaining a cool environment for the fish or the fishery. Trout that carry over through the winter into the next spring are currently uncommon because of high water temperatures in the lake. Also, any increase in temperature of the river potentially caused by Rainbow Lake outflow is a concern for ESA listed fish in the river because river temperatures are near upper limits of tolerance for salmonids. If the lake was dredged and/or excavated to restore impoundment capacity and improve water quality for fish, it is possible that not only carryover trout would survive to the next year, but water could be used for hatchery rearing year around. This is especially important considering that rearing ESA listed spring Chinook is being tested as a future production option at the Tucannon Fish Hatchery.

Prior to some repair efforts in 2009, the intake structure for the lake was being undermined at the front of the concrete slab (in the fishway), reducing head for flows to the lake and hatchery. In a low flow season, this undermining was potentially harmful to the fish program. With reduced flows and warmer temperatures in the summer months, the potential for pathogen outbreaks increases dramatically. Restoration work is also necessary to resolve current safety issues with various components of the lake impoundment structures, to improve water flows within Rainbow Lake, and water flow from this storage lake to the Tucannon Fish Hatchery.

Figure 2: Current photos of Rainbow Lake at left and inlet channel at right (May 2012).

CONCEPTUAL PLAN

WDFW would like to significantly reconfigure and enhance Rainbow Lake to increase water depth, reduce water temperatures, eliminate dam safety concerns, increase trout stocking capacity, and increase angler opportunity. The lake would be elongated to the south towards the current inlet, the west bank would be moved toward the east, and the lake would be dredged to make a larger, narrower, deeper, irregularly shaped lake and increase the available floodplain to the west of the lake (Figure 3). The inlet canal would be piped and would form a "Y" at the south end of the lake, with the west arm of the "Y" going around the west side of the lake and feeding directly into the pipeline from the lake to the hatchery. The east arm of the "Y" pipeline would feed directly into the lake and the upper end of each arm would have flow control gates. This would increase operational flexibility by allowing the hatchery to pull water from the lake, or directly from the river, to take advantage of the most appropriate water temperatures. Sediment ponds with spits and submerged berms would be built into the south end of

the lake to allow for incoming sediments to settle out and to make it easier and less expensive for future maintenance dredging, as needed.

The dam height is proposed to be reduced, if feasible, to reduce or eliminate safety concerns and remove WDOE Dam Safety regulations that require clearing vegetation from the dam. The lake bottom is proposed to be excavated deeper into the ground to enable us to potentially lower the dam and utilize groundwater to fill and maintain the lake. Two docks or spits should be placed in the lake to allow increased angler access to near the middle of the lake (although docks are preferred for better angling opportunities, water flow patterns, and to maximize the lake volume for fish use). A set-back levee could be constructed to the west to protect the lake from the river, but it would be vegetated with trees. A protective levee would allow for trees on the lake shoreline without being considered a dam safety concern. A forested shoreline is more natural appearing, provides wildlife habitat and shade for anglers, and is consistent with the intent of the Wildlife Area management goals.

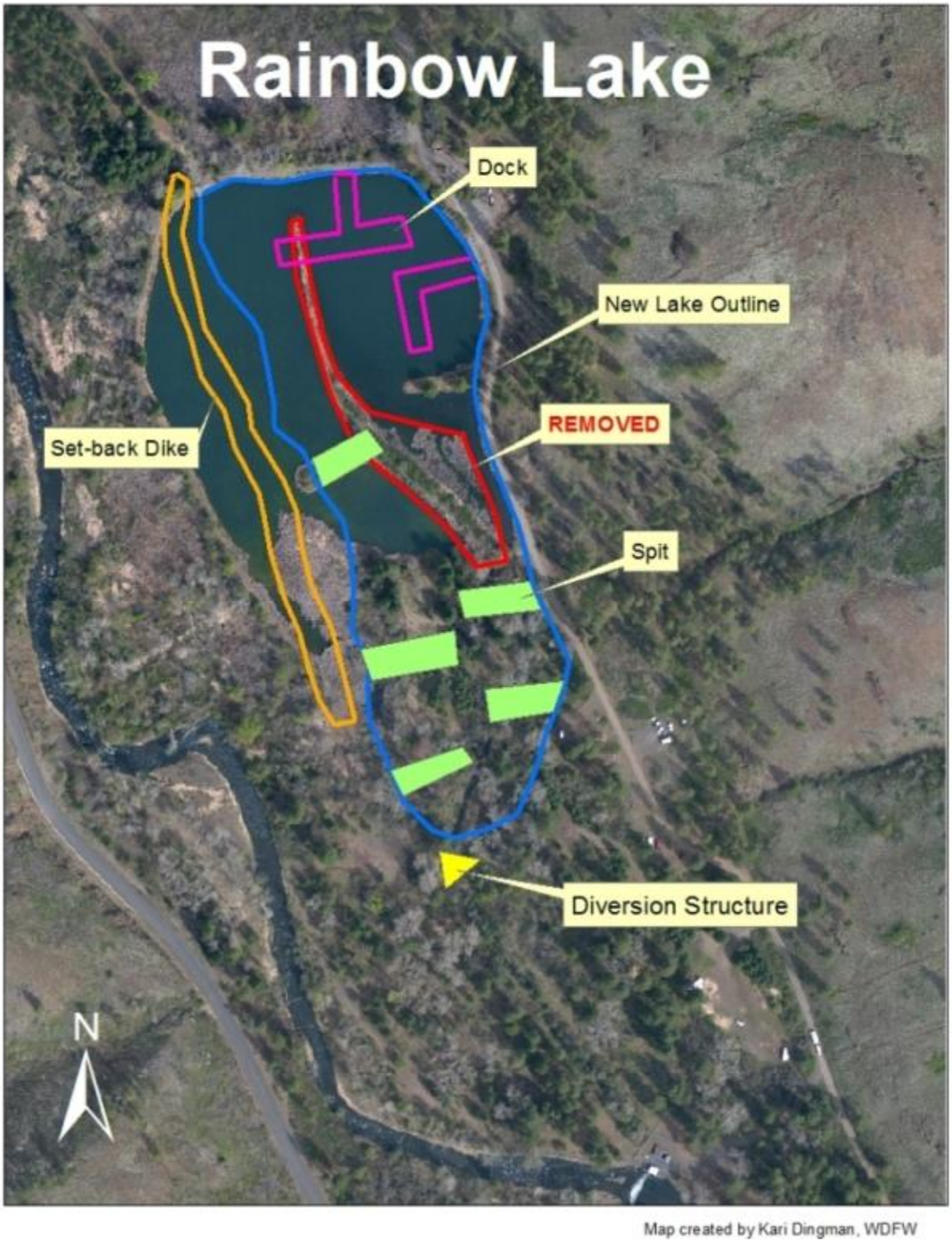

Figure 3: Rainbow Lake Conceptual Design.

DEER LAKE ENHANCEMENT AND REHABILITATION

DESCRIPTION

Deer Lake is approximately 4.4 acres in size and is the fourth lake in the valley traveling north to south. It is a designated as a walk-in only lake and it is located about ¾ of a mile South of Rainbow lake. From a parking area the public must walk ¼ mile south to access the lake. Historically, an aluminum foot bridge was used to access the lake from a nearby campground located on the west side of the Tucannon River. High water and flooding in 1996 and 1997 destroyed the footbridge and campground. The river now flows through the remains of the old campground. Deer Lake is adjacent to the Tucannon River and on the eastern portion of the floodplain.

Figure 4: Deer Lake.

CONCEPTUAL PLAN

Enhancement plans call for enlarging the lake at the southern end to create a larger, deeper, irregularly shaped lake (Figure 5). The existing dam is proposed to be reduced in height, if feasible, to reduce safety concerns and WDOE Dam Safety regulations that require vegetation clearing on the dam. The lake is proposed to be excavated deeper into the water table to help maintain water quantity and quality in the lake. An adjacent spring could be developed to provide another source of water, but water may have to be pumped to the lake. By utilizing spring water and ground water, there should be adequate flow to keep the lake full and of high water quality. Lake outflow would be channeled into a concrete outlet structure at the north end of the lake near the existing drain. The advantage to using

this concept to fill and maintain the lake is elimination of the existing river inlet structure and associated canal between the lake and river. Elimination of the inlet means silt and other debris from the river no longer would enter the lake, which means less need for costly dredging operations to maintain depth and volume in the lake. And, probably most importantly, no river inlet means no more manipulation of the Tucannon River channel to ensure water is flowing into the inlet structure, and the river is then free to move because it does not have to be locked in place at the intake site.

Enhancement of Deer Lake is intended to help offset the eventual loss of Big Four Lake which is proposed for closure and removal. Making Deer lake larger and more attractive to fishermen will provide a better experience for the public. Discussions with the public will occur to consider changing Deer Lake regulations to be more restrictive and allow fly fishing to replace the loss of Big Four Lake, which is the sole "fly fishing only" water in southeast Washington. Other fishing regulation changes will be considered here and at the other Tucannon Lakes. Other enhancements include the addition of two fishing docks or spits to increase angler access to the middle of the lake. The irregular shape and docks mean more shoreline length and places to fish, which is desirable to fishermen. A protective levee is proposed to be constructed to the west to protect the lake from the river during high water events. If this is not a dam used to impound water in the lake, it will be vegetated with trees and other woody vegetation. With a protective levee in place and dam height reduced, trees may be planted or maintained on the lake shoreline without being considered a dam safety concern. A forested shoreline will provide shade for the lake, habitat for wildlife, and a more aesthetically pleasing shoreline area than exists now. It also provides shade for anglers and is consistent with the intent of the Wildlife Area management goals.

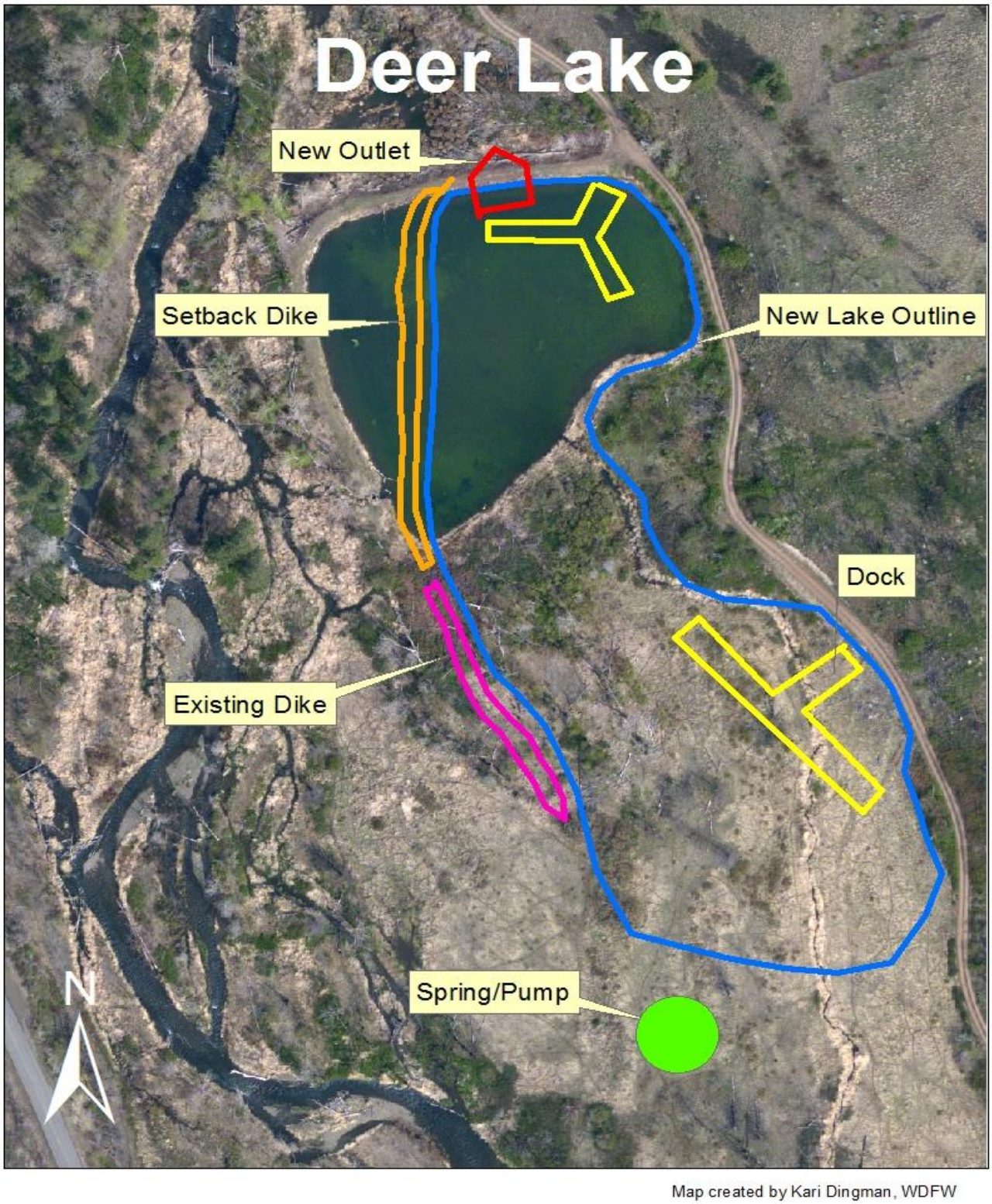

Figure 5: Deer Lake Conceptual Design.

BEAVER-WATSON LAKE ENHANCEMENT AND REHABILITATION

DESCRIPTION

The Watson Lake / Beaver Lake Complex suffers from a variety of problems causing management, maintenance and environmental concerns. Currently the lakes are in the floodplain between the eastern valley hillside and the river to the west. They are located in the historic channel migration zone of the Tucannon River. This location restricts the normal floodplain functions of the river and tends to direct the river towards the roadway, adjacent to the river.

Beaver and Watson lakes were constructed in 1953 and 1954, respectively. Beaver Lake was initially just over 2 acres and Watson was 6.7 acres. These two lakes are grouped together because they have a common intake and inflow channel, and the screened river water passes through Beaver Lake before passing into Watson Lake. Beaver Lake has become filled with sediment and weeds and it is no longer stocked with trout to provide a fishery. Watson Lake also has filled in and become quite shallow.

The impounding dams are covered in woody vegetation, plus Watson Dam has substantial leaks. Both of these dams are in violation of WDOE Dam Safety regulations to protect public safety, and therefore they require substantial and costly repairs.

So little water currently flows into Watson Lake and/or leaks out of the dam that water does not flow out of the lake outlet for a majority of the summer. In 2011, the problem with inflow and outflow was increased because the river channel changed near the intake and very little water was able to be directed into the diversion canal and into these two lakes. A temporary project was constructed in March 2012 to try and improve inflow into these lakes so Watson Lake could be stocked with trout and provide a fishery. Watson Lake normally has a very popular trout fishery because it is one of the larger Tucannon Lakes and it is easily accessible.

Figure 6: Beaver-Watson intake, with the Tucannon River in the left channel.

CONCEPTUAL PLAN

Beaver Lake may be combined with Watson Lake and the new lake would be elongated, with a north-south orientation against the east hillside. This configuration should provide a similar, or larger, surface acreage, more lake volume, and enhanced fishing opportunities for the public. Habitat for salmon, steelhead and bull trout, plus river and floodplain functions, will be improved, and roadway maintenance and flood risk will likely be reduced by opening up the floodplain and removing the constrictions caused by the current dams, parking lot, and short span footbridge (Figure 7). Because of differences in elevation between the two lakes, a stair step configuration may be necessary. In this case the upper lake (Beaver Lake) may serve as a settling basin for the main, lower lake (Watson Lake).

The new lake is proposed to be extended into the wet area north of the current Watson Lake and excavated deep enough to use groundwater for maintaining the water levels. The lake enhancement goals will be to increase water depth and reduce water temperatures, eliminate dam safety concerns, increase trout stocking and carrying capacity, and increase angler opportunity. The lake will be

narrowed and the west bank will be moved toward the east to make a larger, deeper, irregularly shaped lake and increase the available floodplain to the west of the lake (Figure 8).

Depending on the elevation difference, it may be necessary to have two distinct lakes. This may require a connection between the two lakes. A constructed riffle may be used. In this case the existing Beaver Lake outlet structure would be replaced with a more natural looking structure.

The inlet and diversion canal will hopefully be eliminated and springs from the east will be piped into the new lake to help maintain the water level and provide water inflow. If surface water from the river is no longer needed, the lake should receive less sediment and therefore need less maintenance dredging in the future, and the river would not have to be manipulated to maintain the inflow for the lake. The outlet will be moved to provide a better flow pattern in the lake and improve the connection with the river. The dam height is proposed to be substantially reduced to eliminate safety concerns and remove it from WDOE Dam Safety regulations that require clearing vegetation from the dam. Two docks or spits may be constructed in the lake to allow increased angler access to the middle of the lake (although docks are preferred for better angling opportunities, improve flow patterns within the lakes, and to maximize the lake volume for fish use). A set-back levee will be constructed to the west to protect the lake from the river and it will be vegetated with trees. The protective levee will allow for trees on the lake shoreline without being considered a dam safety concern. A forested shoreline is more appealing as a natural setting, provides wildlife habitat, provides shade for anglers, and is consistent with the intent of the Wildlife Area management goals.

Figure 7: Access Bridge to Beaver Watson.

Some major infrastructure will need to be changed in this proposed plan. The current footbridge will probably be replaced with a suspension bridge in a different location with a much longer span so the river does not have to remain in its current constrained channel. The current parking lot will be removed and a new parking lot will be constructed on higher ground next to the new footbridge. The administrative access road (from Deer Lake) on the east side of the river will be moved towards the east to reduce its footprint in the floodplain to allow the river to meander.

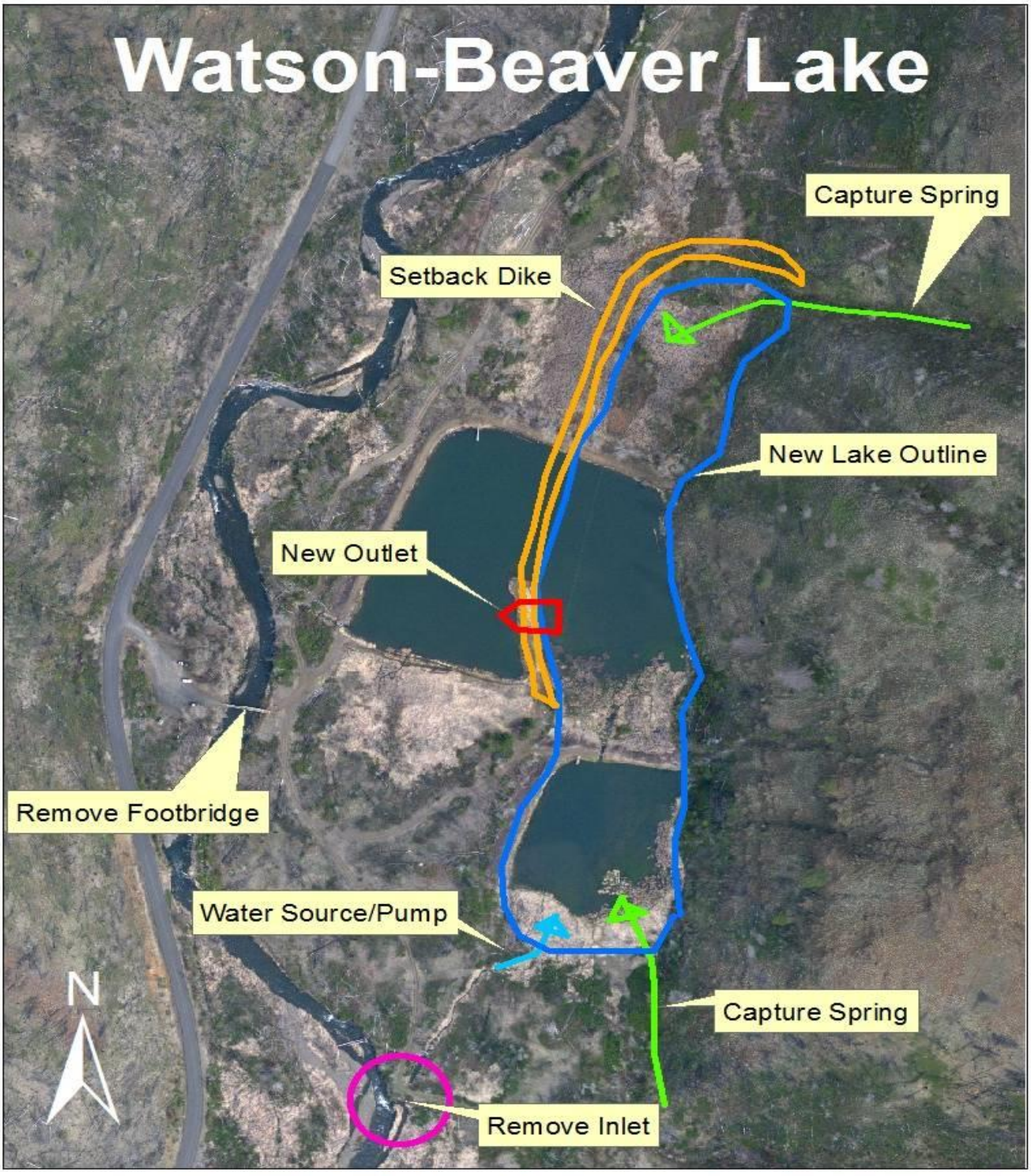

Figure 8: Beaver-Watson Conceptual Design.

BIG 4 LAKE CLOSURE AND REMOVAL

DESCRIPTION

Big 4 Lake was constructed in 1954 at about 2.1 acres. It is need of substantial work to maintain the dam, lake volume, and the outlet structure. This lake is unique because it is currently the one designated "fly fishing only" water that exists in southeast Washington (stream or lake). It has two spits that make access and fly casting easier in this lake because of minimal woody vegetation obstructing casting. The lake is secluded and requires foot access across the Tucannon River, which can be dangerous during high spring river flows.

CONCEPTUAL PLAN

Big 4 Lake is proposed by WDFW to be closed and removed because of its need for substantial maintenance and the difficulty in repairing and maintaining this lake. There are no roads for vehicle access for maintenance, repair, or fish stocking in this lake. The lake has become shallow and weedy because of sediment and vegetation accumulating over the years, resulting in reduced trout stocking rates and frequency of stocking. The dam is overgrown by woody and herbaceous vegetation and it leaks substantially, violating the WDOE Dam Safety regulations. The lake is very difficult to stock with fish and requires a temporary pipeline across the river when flows are low enough in February or March so fish can be planted, and therefore it is only stocked once per year. A beaver dam has blocked the outlet of the lake in the past. The Tucannon River has been threatening to erode the west dam and potentially capture the lake. The lake would need to be dredged, the dams repaired, and protection from the river, if it were to be maintained.

Removal of this impoundment will consist of breaching and/or removal of much of the dam material, including the intake and outlet structures. Some portions of the dams or spit structures near the east side of the floodplain will be left to reduce costs and promote wetland development with some ponding of water. Permits, timing, and manner of heavy equipment access to decommission this lake will be sensitive because of potential adverse effects on ESA listed fish and their habitats.

It is our intent to enhance one of the other lakes before closure and removal of this lake to mitigate for the loss of Big 4 Lake. Changes to regulations on one of the other lakes (possibly Deer Lake) to require more restrictive gear types (such as fly fishing only) will be considered to compensate for the loss of this unique fishing opportunity in southeast Washington.

Figure 9: Big 4 Lake Conceptual Design.

SPRING LAKE ENHANCEMENT AND REHABILITATION PROJECT

DESCRIPTION

Spring Lake is located approximately a mile north of the Tucannon Fish Hatchery in Columbia County, and adjacent to the Tucannon River. It was constructed around 1955 and is 6-acres in size. The water supply for Spring Lake comes from runoff and springs, hence it's name. This impoundment supports a very popular put-and-take recreational trout fishery. Over the years the lake has filled in with sediment and vegetation, resulting in a loss of volume or carrying capacity for hatchery stocked "catchable-sized" and "jumbo-sized" rainbow trout. The overgrowth of vegetation is also limiting the open fishing area available to anglers. Thus, trout stocking and angler opportunities have decreased.

As with all eight of the Tucannon Lakes, many public campgrounds are located near Spring Lake. Campground 1, specifically, serves as a recreational attraction for Spring Lake fishing and other outdoor activities. Up to 11,000 catchable sized and 325 jumbo sized rainbow trout are planted annually into Spring Lake. The relative economic value of the fishery in the northern four Tucannon Lakes, including Spring Lake, is estimated as at least $780,895 annually (Mendel and Trump 2008).

CONCEPTUAL PLAN

The proposed lake rehabilitation would primarily include dredging and/or excavation to restore its depth and carrying capacity. That would provide a more enjoyable experience to the recreational public (e.g. better access, more open water etc.) and better fish and wildlife habitat because it would include deeper water and a more diverse environment. The lake would also be more accessible. To allow for handicap accessibility and improved fishing in deeper waters, a dock could be installed which would also provide more fishing access, and better fishing success. The lake currently does not have full access from all sides.

With a deeper lake, it is expected that the water temperatures would likely decrease and potentially extend the fishing season into the summer and minimize the release of elevated water temperature into the river. The dam also needs to be repaired or reconstructed to prevent leakage or seepage. It should also be increased to the recommended width of 12 feet; thereby reducing dam safety concerns and violation of WDOE Dam Safety regulations, and future dam maintenance costs.

A screened bottom draw outlet should be installed to reduce thermal loading into the river that currently contributes to reduced habitat quality for ESA listed salmonids. Spring Chinook, summer steelhead and bull trout in the Tucannon River are genetically unique, geographically isolated, and critical for recovery of the Snake River Basin ESUs or DPSs for these species. An emergency spillway

may be added if deemed necessary by the engineering analysis. The access trail around the lake would be improved to allow for greater angling opportunity on the south and west sides of the lake.

The future of fisheries in this lake are dependent upon these improvements for sustaining recreational opportunities and maintaining a stable environment for the species in the Tucannon River.

Figure 10: Spring Lake with direction of flow towards the outlet shown.

Figure 11: Spring Lake Conceptual Design.

HABITAT ENHANCEMENT

The Tucannon Large Wood Restoration Projects section below describes some recently implemented projects. Immediately below are some other projects that have been completed on the Wildlife Area since 2005 that benefit the floodplain and ecosystem.

1. **Campgrounds:** After the 2005 School Fire and the 2006 Columbia Complex Fire, several campgrounds were moved out of the floodplain and relocated to higher ground farther from the river. There were also several fords that had been used to access campgrounds that were across the river from the main Tucannon Road, and those fords were eliminated. The infrastructure associated with the campgrounds that were moved was also removed from the floodplain, including outhouses and campfire rings, and the areas were planted with grass seed to reduce erosion.

2. **Tree Plantings:** In 2008, 1.5 million tree seedlings were planted in the areas on the Wildlife Area that had been salvaged logged after the 2005 fire. The hillsides were planted to help establish trees and vegetation on the slopes to reduce the erosion down into the floodplain and the Tucannon River. The old campgrounds and some floodplain areas were also planted to help establish vegetation growth.

3. **Spring Branch Restoration/Russell Unit:** In 2010, WDFW partnered with the CTUIR to improve and reconnect a spring channel on the Russell Unit of the Wildlife Area that feeds into the Tucannon River. This spring branch historically had spring Chinook spawn in it, but over time it had been straightened out and had become overgrown with reed canary grass. The spring channel was altered to create meanders and small logs were placed in it to create pools and riffles. Approximately 24 car bodies were removed, along with about 40 cubic yards of miscellaneous household and farming trash. An engineered log jam (ELJ) was constructed near the mouth of the spring channel to create a fish holding pool and to protect adjacent property.

4. **Spring Branch Restoration/Hartsock Unit:** In 2011, WDFW partnered with the CTUIR to do some channel reconstruction work on a spring channel on the Hartsock Unit of the Wildlife Area, near the sediment catchment basins, to improve fish access to these off-channel habitats. This spring branch feeds into the Tucannon River and had become very shallow and choked with reed canary grass. The project included the channel being deepened, some meanders constructed, logs placed in the channel to create pools and riffles, matting laid along the banks to control the reed canary grass, and willow whips planted along the channel. An existing stream ford was removed and replaced by an ATV bridge.

5. **Infrastructure Removal**: In 2012, WDFW utilized a grant from BPA to remove the metal Quonset hut and the cinderblock bunkhouse from the Hartsock Unit of the Wildlife Area. During spring flows the Tucannon River tended to overflow its banks and flood the structures. The buildings and all associated infrastructure (power line, well, foundations, concrete pads and several culverts) were removed from the floodplain. The area will be leveled and reseeded into natural grasses in the near future. The Tucannon River is now free to access the floodplain on the Hartsock Unit.

6. **Remnant Fish Weir Removal:** The remaining sheet piling in the river channel was removed in 2010 from the old fish trap weir site at the Tucannon Fish Hatchery outlet.

TUCANNON RIVER LARGE WOOD RESTORATION PROJECTS

COMPLETED LWD PROJECTS

LWD restoration efforts for the Wildlife Area started in 2006 following the 2005 School Fire. Fires have historically played a major role in LWD recruitment to rivers, and subsequently, WDFW staff concluded that the event was a natural starting point for LWD restoration for the Tucannon River and its tributaries on the Wildlife Area. Two small scale LWD projects were conducted (2006, 2008), one in Cummings Creek and the other in the Tucannon River. Both projects were successful at meeting project objectives and goals, most noteworthy the enhancement to instream habitat complexity and reconnecting the river and its floodplain (Figure 12).

Figure 12: Habitat complexity resulting from LW restoration in the Tucannon River (site treated 2006, 2008), photo 2011.

The August 2012 Large Wood Project (Area 10 from Anchor Geomorphic Assessment) was completed based on the conceptual design that was developed in 2010 and 2011 by a technical team of collaborating partners from the SRSRB Regional Technical Team (RTT) and the Tucannon River Coordination Committee (TCC) with WDFW serving as the project lead. Approximately 260-270 large trees, most with root balls, 25 boulders (10K-15K lbs.), and 600-700 smaller "racking" trees (4-10" dbh, 30ft, with root) were placed by design with a S64 Sky Crane Helicopter in the Tucannon River between Big 4 Lake and Beaver Lake (river miles 42-44). The helicopter makes it possible to treat large reaches that have poor accessibility with minimal impact to the riparian area. Additionally, the helicopter provided an opportunity to use whole trees with the root ball and branches intact. Utilizing whole trees is a major design feature intended to enhance the longevity and stability of the LWD structures. The helicopter phase of the project followed construction of 4 ELJs at the downstream end of the project. The location of the constructed ELJs is a natural narrow reach of the river valley and it was chosen as an area where multiple large log jams would have naturally occurred. The ELJs are to function as control structures at the downstream end of the treated reach. Collectively, the project installed 60 separate structures in the roughly 2 mile reach. This project was funded for construction by the SRSRB and BPA.

TUCANNON RIVER RESTORATION PROJECT AREA 14

DESCRIPTION

(NOTE: Project Area 14 was completed in the summer of 2014) Project Area 14 is located on the Tucannon River starting at the Tucannon Fish Hatchery bridge (RM 39.2) downstream to near Spring Lake (RM 37.15). Project Area 14 is one of the 28 site specific projects identified by the Conceptual Restoration Plan in the Tucannon Geomorphic Assessment. The project is a Tier 1 priority and was the first project selected for implementation by the TCC, CCCD, and SRSRB.

CONCEPTUAL PLAN

The majority of the restoration action proposed is construction of 8 types of ELJs designed to function in various ways, including; localized scour to develop pools and gravel bars, improve pool frequency, improve habitat complexity and cover, decrease channel confinement through aggradation of bed-load, restore conditions or activate secondary channels currently isolated on the floodplain, increase inundation frequency within the riparian zone, and restore seasonal off channel habitat. The Project Area 14 design includes more than 60 individual ELJ structures within the 2 mile reach. The proposed design is intended to function collectively throughout the reach to achieve a reach scale geomorphic response. Another key feature to the proposed project is a cobble or gravel augmentation program. Spoil piles located in the floodplain, possibly historically dredged from the river, will be used for the gravel source. The recommendation is to implement the gravel augmentation over the course of 5-10 years until the existing spoil piles are depleted. Approximately 1,000 cubic yards of gravel will be placed at 3 key locations throughout the project reach. The main site for augmentation is below the Tucannon Fish Hatchery bridge, designed to increase bed-load at the upper extent of the project to stop an existing head-cut adjacent to the hatchery. The project proposal also includes removal of floodplain infrastructure such as dredge spoil dikes, removal of bank armoring downstream from the hatchery, removal of an old fish intake, and the removal of an obsolete bridge (referred to as the “foot bridge”), located just downstream from the main road bridge near Spring Lake. The removal of the old bridge will reduce a constricted area below the Tucannon Road bridge and relieve hydraulic impacts to the bridge during flood conditions. Many of the ELJs are designed to capture channels that are currently isolated on the floodplain to increase surface water habitat availability and improve habitat diversity and linkages between those habitats.

Tucannon River LWD restoration efforts have developed into a cooperative partnership involving WDFW, USFS, the SRFB, SRSRB, BPA, CCCD, CTUIR, and the Nez Perce Tribe. Additional projects on the Wildlife Area will be developed and designed utilizing these partners.

POWER LINE BURIAL PROJECT

Note: The project detailed below is the current proposal. The Power Line Burial Project will be a topic of the Feasibility portion of the FMP process. The final solution to this issue is dependent on the outcome of the feasibility study and could be different then what is outlined below.

The School Fire of 2005 damaged much of the Wildlife Area, burning and destroying large areas of timber, and some of the electrical power lines and poles crossing the area. It was the largest fire of 2005 in the lower 48 states at about 52,000 acres. The cause of the fire was determined to be a tree or tree branch falling on the power line and damaging the line near the Tucannon Guard Station at the mouth of School Canyon. Burying the power line would preclude this from happening again, and reduce required maintenance of the line, and prevent habitat degradation from the power line maintenance activities.

This project consists of working with the Columbia REA to bury the electrical power line that serves the Wildlife Area, Tucannon Fish Hatchery and associated infrastructure, Tucannon Lakes' fish screens, USFS Guard Station, and Camp Wooten. This project would eliminate the main overhead power line and associated poles and replace it with a buried line across the Wildlife Area from at least the Tucannon Fish Hatchery to its terminal end at Camp Wooten, approximately 7 miles. If buried along its current route, the line would cross approximately 12 small tributary streams to the Tucannon River, and cross the river once on the Camp Wooten bridge (tentatively). Most, if not all, of these tributaries are non-fish bearing. There may still possibly be 4 or 5 overhead lateral lines that service the lakes' fish screens, however, under the Tucannon Lakes Projects, most of these fish screens and river withdrawals would be removed.

In 2006, Qwest was contacted to learn how they buried their telephone line in the same area, and how they avoided environmental issues and concerns. Their representative stated that Qwest buried their phone line in the road prism, under the shoulder. At any of the tributary crossings, they were able to bore under, or over the culverts and avoid any stream crossings needing permits, or causing any environmental concerns. Their representative did mention that the power line could be placed near the phone line, but said power companies needed to dig a trench to place the line in conduit. Utilizing the existing road prism is an alternative that should be explored. It avoids many environmental concerns during construction and may reduce the cost of installation. Columbia REA has stated that burial costs are approximately $70,000 per mile over "average" ground.

Figure 13: (Left) Power line crossing Tucannon River to Camp Wooten. (Right) Power line within cleared riparian area.

CAMPGROUNDS

CAMPGROUND 6 RELOCATION

(NOTE: CG 6 and CG 9 are scheduled to be re-located in the Fall of 2014) The current Campground 6 is located in the floodplain of the Tucannon River. Some of the campsites are located very near the edge of the river, resulting in soil compaction along the banks, trash in the river, and damaged or removed riparian vegetation. WDFW is currently working on several projects to reconnect the floodplain of the Tucannon River, and one of those projects is located adjacent to, and north of, the current Campground 6.

A new campground will be constructed across the Tucannon Road from the existing campground. The new campground will be out of the floodplain and in an area with trees to provide shade. A driveway

into the campground will be built and graveled. A new concrete outhouse will be installed, 8 camp sites will be leveled, gravel will be placed on the parking pads, a concrete picnic table will be placed, and campfire rings will be set in concrete.

The current Campground 6 will be removed and the site restored. The fiberglass outhouses will be removed. The campfire rings and concrete picnic table will be removed and used in the new campground. The riparian area will be rehabilitated and replanted with native riparian vegetation. The campground will be planted into native grasses and shrubs. The area will be closed to vehicle entry and will be allowed to return to floodplain.

This project is necessary to the success of the floodplain management plans' ultimate goals of restoring floodplain function for the benefit of fish and wildlife and improving the recreational experience of the public on the Wildlife Area.

CAMPGROUND 9 RELOCATION

The current Campground 9 is located in the floodplain of the Tucannon River and it will be relocated outside the floodplain. Some of the campsites are located very near the edge of the river, resulting in soil compaction along the banks, trash in the river, and damaged or removed riparian vegetation. The current Campground 9 will be replaced with 2 smaller campgrounds that are located outside of the floodplain.

One of the new campgrounds will be located just south of the current Campground 9 on a little rise (Figure 14). One of the concrete outhouses from the current Campground 9 will be moved to the new campground. Four to five camp sites will be constructed in the new campground with gravel placed on the parking pads and the campfire rings set in concrete. The perimeter of the new campground will be lined with boulders to keep campers from driving vehicles down to the river or camping outside of the designated campground. A driveway into the new campground will be constructed and graveled. The new campground will be named Campground 10 and the current Campground 10 will be renamed Campground 11.

The second replacement campground will be located in the log landing site located northeast of the mouth of the Little Tucannon River, across the Tucannon Road from a previous WDFW campground that was closed because it was located in the floodplain. This new campground will give the public another campground that is near the section of the Tucannon River that is open to fishing. The driveway into the new campground will be improved and graveled. The second concrete outhouse from the current Campground 9 will be moved and installed in the new campground. Four campsites will be constructed in the campground with gravel placed on the parking pads and the campfire rings set in concrete. Trees

will be planted in the new campground to provide future shade trees for the campground. The new campground will be named Campground 9.

The current Campground 9 will be closed and the habitat restored. The outhouses and campfire rings will be removed and used in the 2 new campgrounds. The riparian area will be cleaned up of garbage. The campground will be replanted with native grasses and shrubs. The riparian area will be rehabilitated and replanted with willows and riparian vegetation. The area will be closed off to all vehicle entry and allowed to return to floodplain. The boulders lining the current Campground 9 will be used to line the new Campground 10 and to close the current Campground 9 to vehicle access. Some riparian enhancement will be done along the south bank of the Tucannon River along the north edge of Campground 11.

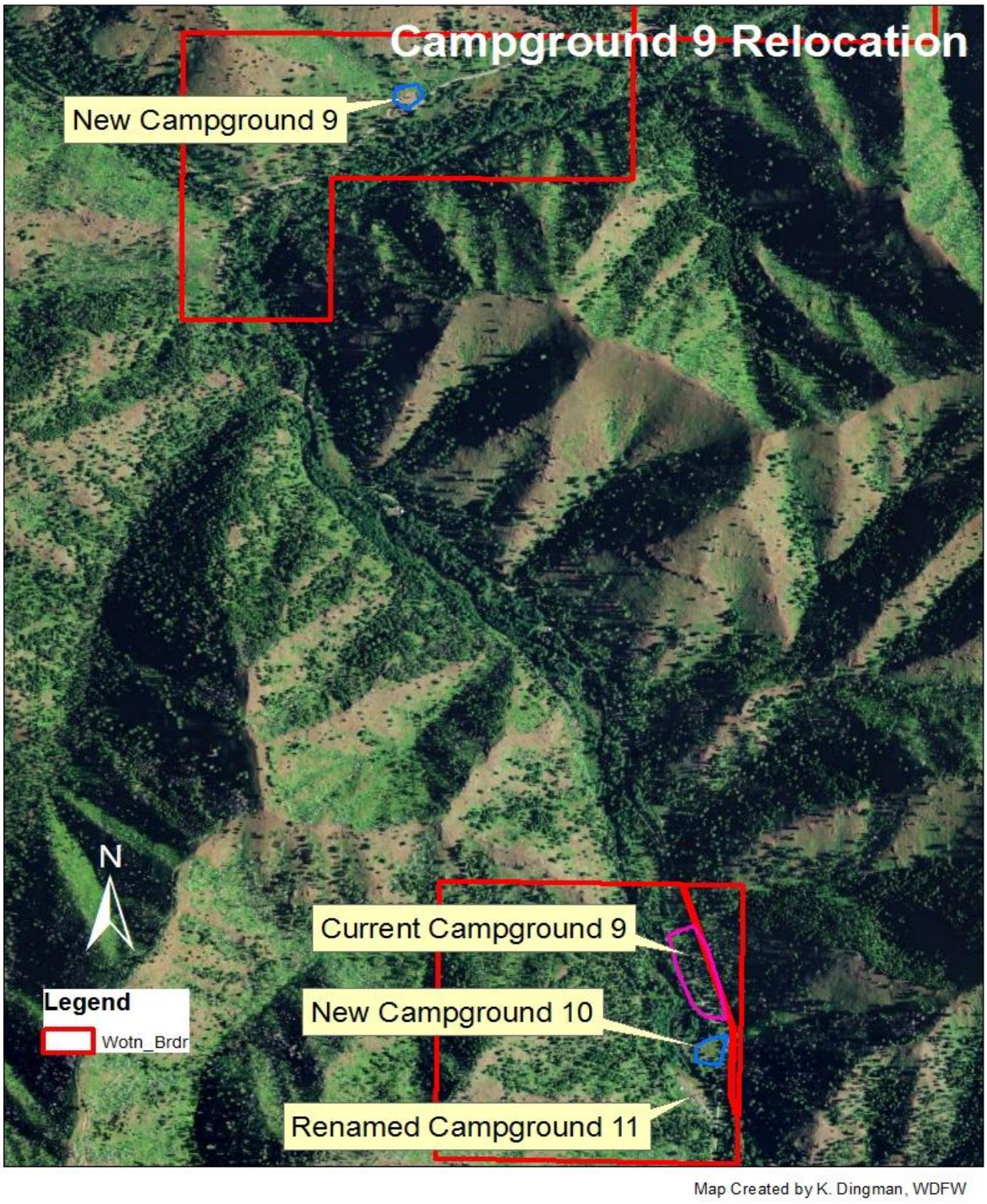

Figure 14: Campground relocations aerial view.

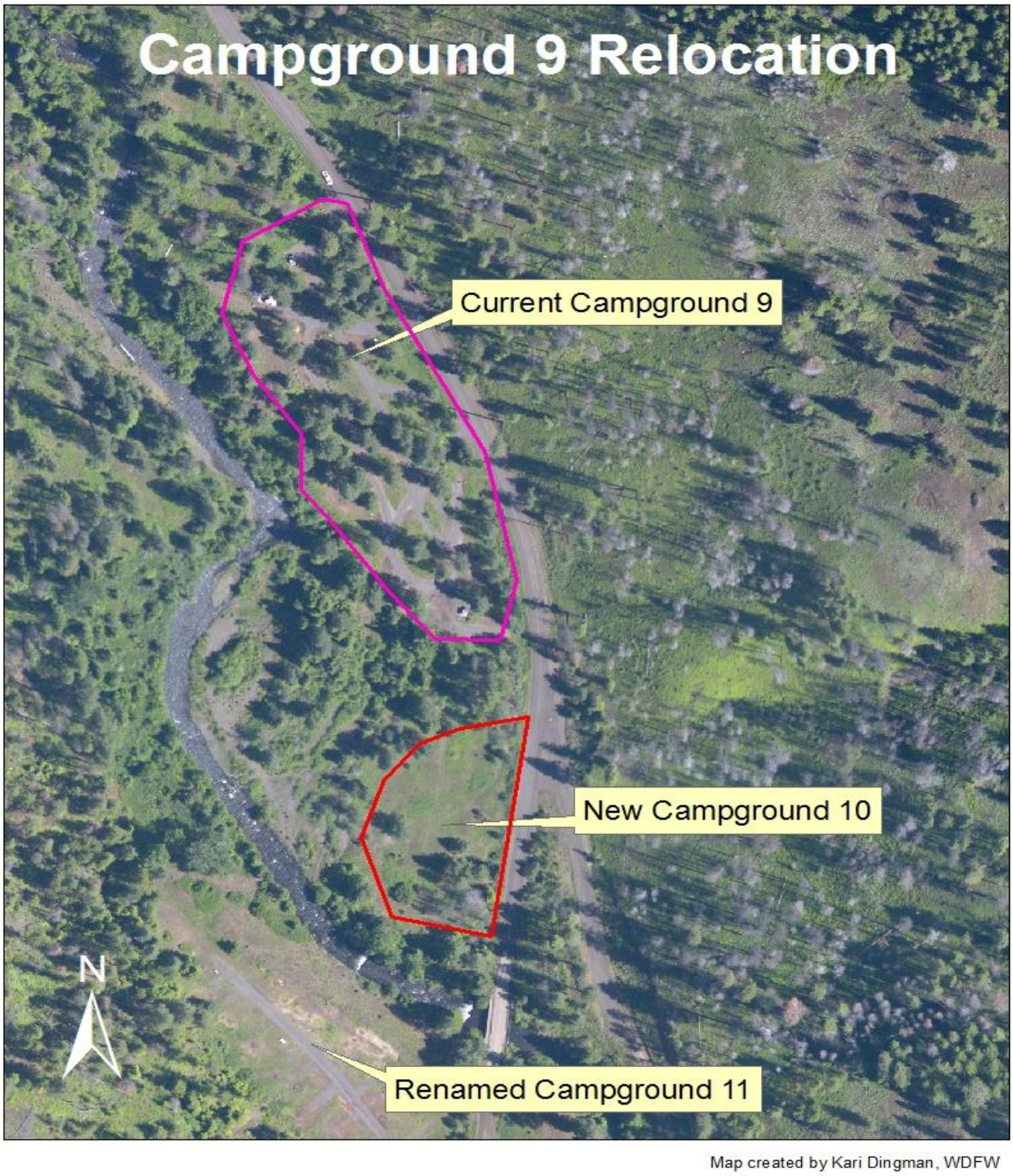

Figure 15: Campground 9 location and the new Campground 10 location.

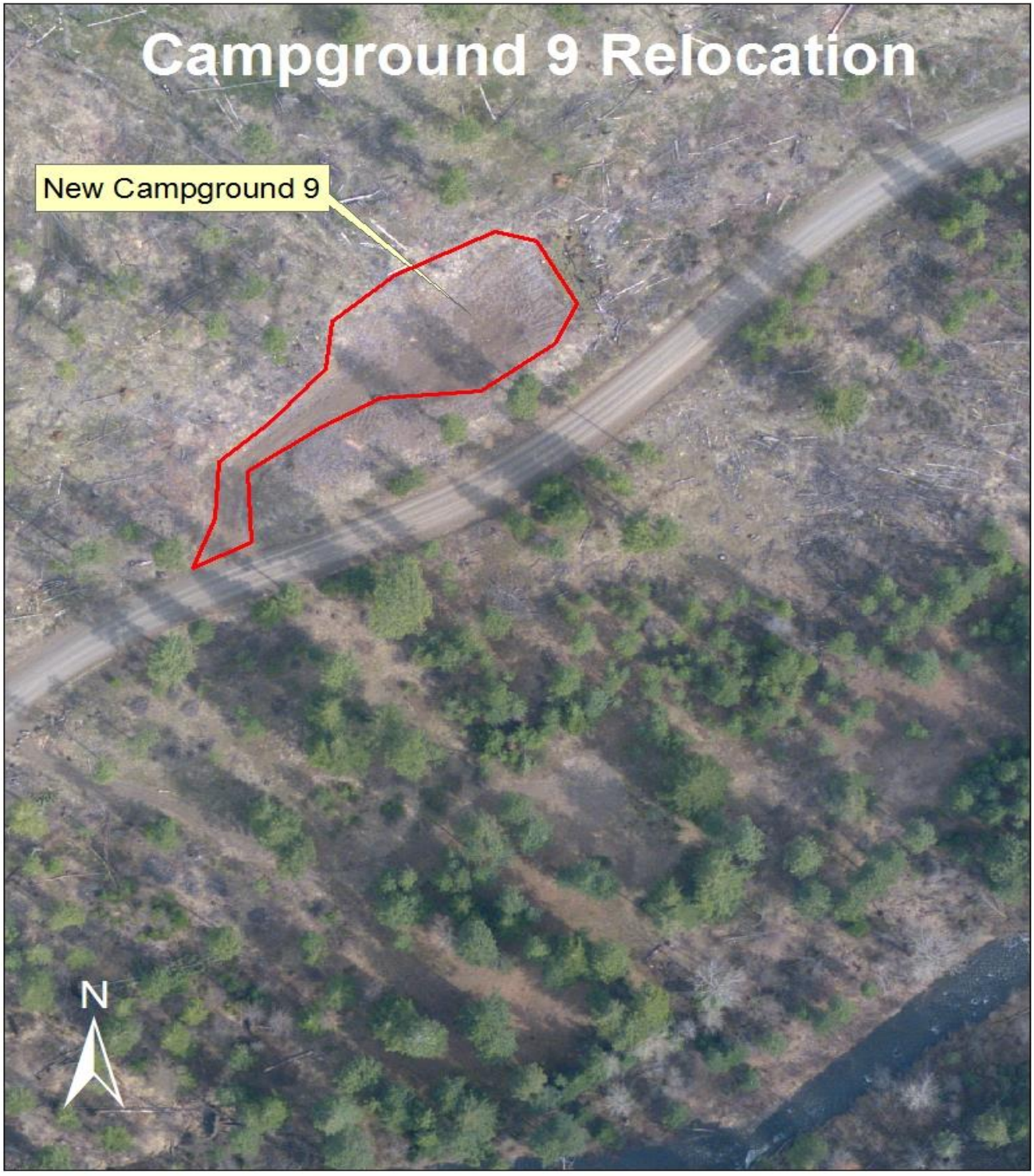

Figure 16: New Campground 9 Location.

ROADS, BRIDGES, CULVERTS

No specific projects are currently proposed for roads, bridges and culverts except for those that are associated with the conceptual Tucannon Lakes projects (e.g Beaver-Watson lakes). Projects for roads, bridges and culverts are dependent upon the Feasibility Study portion of this floodplain management plan scheduled for implementation in 2013-2015.

CAMP WOOTEN

No specific projects are currently proposed for Camp Wooten. Projects will be developed during Feasibility.

REFERENCES

Anchor QEA. 2011. Tucannon River Geomorphic Assessment and Habitat Restoration. Prepared for the Columbia Conservation District and the Snake River Salmon Recovery Board.

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Mendel, G., and J. Trump. 2008. Tucannon Lakes Fishery Monitoring Report for 2003. WDFW Project Report FPA 08-02. 22 pp, plus appendices.

Columbia County Conservation District. 2004. Tucannon Subbasin Plan. Submitted to NPCC.

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APPENDIX- AVAILABLE AT:
HTTP://WDFW.WA.GOV/LANDS/WILDLIFE_AREAS/WT_WOOTEN/

APPENDIX A: SOURCES OF ANGLERS SAMPLED AT THE FOUR NORTHERN TUCANNON LAKES IN 2003.

APPENDIX B: CAPITAL REQUEST WOOTEN WILDLIFE AREA IMPROVE FLOOD PLAIN.

APPENDIX C: TUCANNON LAKES SUMMARY OF ISSUES AND OPPORTUNITIES.

APPENDIX D: TUCANNON RIVER GEOMORPHIC ASSESSMENT AND HABITAT RESTORATION STUDY FLOODPLAIN MAPS.

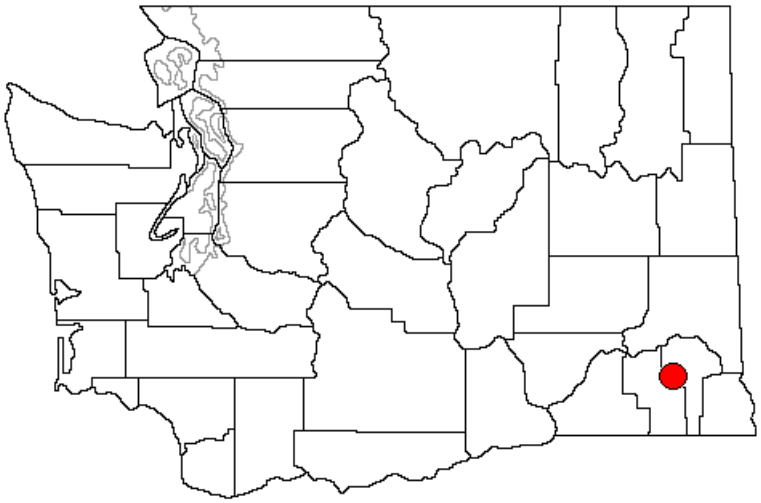
STATE OF WASHINGTON December 2010

Tucannon Lakes Fishery Monitoring Report for 2003

by Glen Mendel and Jeremy Trump

Washington Department of
FISH AND WILDLIFE
Fish Program
Management Divison

Tucannon Lakes Fishery Monitoring Report for 2003



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Abstract

In 2003, WDFW conducted trout fishery monitoring on four of the eight Tucannon Lakes to evaluate fishery statistics (e.g. angler effort, catch rates, exploitation rates, and numbers of trout harvested and released), compare results between 2003 and 1985 surveys, and estimate economic return on investment for the fishery. Angler residence locations were also documented.

Sampling to determine angler effort was based on stratified random sampling every week on each of the four lakes. We sampled one weekend day and one or two weekdays per week. Angler counts at each lake were conducted multiple times per day at predetermined intervals, after a random start time was determined. Anglers were interviewed between count periods to determine their catch and harvest rates, to examine their catch, and to determine their origin (place or residence).

This study provided valuable information regarding the trout fisheries in the Tucannon Lakes in 2003. Angler effort on four of the Tucannon Lakes was estimated to be 38,116 angler hours and 19,749 angler days (with a completed angler day averaging 1.9 hrs). This partial fishing season estimate of angler days on only four of the Tucannon Lakes exceeded 29% of the LSRCP mitigation goal of 67,500 angler days for all of southeast Washington. An estimated 27,436 rainbow trout were harvested during the first 4.5 months of the fishing season (March 1 to mid-July). Approximately 58-78% of hatchery trout were removed from the lakes by anglers, excluding hooking mortalities for released fish. Jumbo trout were retained in the fishery at a higher rate than catchable-sized trout. Most anglers (79-82%) used bait when fishing the Tucannon Lakes. Anglers were generally satisfied with the numbers and quality of trout they caught, but satisfaction levels decreased temporarily in April as the catch rate and size of available hatchery trout decreased. Anglers in March were mostly from relatively nearby areas of southeast Washington, but later in the season a portion of anglers were from very distant areas. The Tri-cities area was the source of the largest percentage (>50%) of anglers using the Tucannon Lakes, but some anglers from distant states also fished these lakes.

Estimated angling expenditures for fishing at these four lakes were $780,895 (derived from economic expenditures per day in put-and-take trout lakes in nearby areas of northern Idaho). Cost to produce the trout in the four surveyed Tucannon Lakes was $88,088 in 2003. Therefore, the estimated economic return on investment ratio was 8.9/1. The Tucannon Lakes are in need of maintenance (dredging and levee maintenance) soon to maintain these trout fisheries.

We recommend that fisheries at Bennington Lake be the next southeast Washington Lake to be surveyed in the near future.

Introduction

Trout fishing in Washington is a popular pastime. A recent survey found that 78% of all licensed anglers in Washington fish for rainbow trout and that 33% of Washington licensed resident (in-state) anglers prefer fishing in lowland lakes (Responsive Management 2008, Michael 2004).

Eight small man-made impoundments (Tucannon Lakes) are stocked with hatchery rainbow trout annually in the Washington Department of Fish and Wildlife's (WDFW) Wooten Wildlife Area (WWA), along the upper Tucannon River in southeast Washington. These ponds, constructed in the 1950's, are popular fishing areas with the public. The Lower Snake River Compensation Program (LSRCP) hatchery trout program is intended to mitigate for lost fishing opportunities associated with the construction and operation of the four lower Snake River dams. The WDFW raises the mitigation fish for the LSRCP and also supplements those "catchable" hatchery trout (fish are usually 7-12 inches, 18-30 cm, long) in the Tucannon Lakes with 100-300 large rainbow trout per lake from a state funded "jumbo" trout program (fish are 12-19 inches, 30-48 cm long, and 1.5-2.5 lbs, 0.67-0.90 kg each). In the late 1990s, WDFW ceased all stocking of catchable trout in southeast Washington streams and rivers to minimize any adverse effects on salmon, steelhead and bull trout that are listed as threatened under the Endangered Species Act (ESA). Therefore, the importance of these lakes has increased for maintenance of hatchery trout fisheries to meet LSRCP mitigation goals and public demand.

The Tucannon "Lakes" range in size from about 1 to 10 acres (0.4-4.0 hectares). Curl Lake, the uppermost of these lakes, does not open for fishing until the last Saturday in April because it is used as an acclimation facility for spring chinook until mid-April. After the Chinook are released, the lake is drained, refilled, and stocked with rainbow trout for anglers. All the other lakes are open for fishing from March 1 to October 31 each year. The daily limit is five trout of any size and fishing is limited to shore anglers only (no boats or floating devices allowed). Anglers can use bait, flies, or lures.

The WDFW desired to evaluate the amount of angler use and the success of the LSRCP and jumbo trout releases in these lakes in 2003. Because of a very limited budget and conflicts for staff time with spring Chinook salmon fishery monitoring, we were unable to monitor more than four of the eight lakes. The four lakes (Spring, Blue, Rainbow and Deer lakes) were selected because they were near each other, which increased efficiency of our monitoring efforts (Figure 1). The upper four lakes (Watson, Beaver, Big Four and Curl) were not sampled as part of this fishery monitoring effort. This is the first time we have surveyed the Tucannon Lakes fisheries since 1985 (Schuck and Mendel, 1987) when all the lakes were monitored during spring and early summer. We terminated the 2003 creel surveys shortly after the July 4th weekend because

our past experience indicated that angler effort declined significantly after that time (Schuck and Mendel 1987) and funding was limited. Therefore, even though these surveys do not include the entire fishing season, we believe that we have captured the majority of angling effort and harvest expected for the entire season.

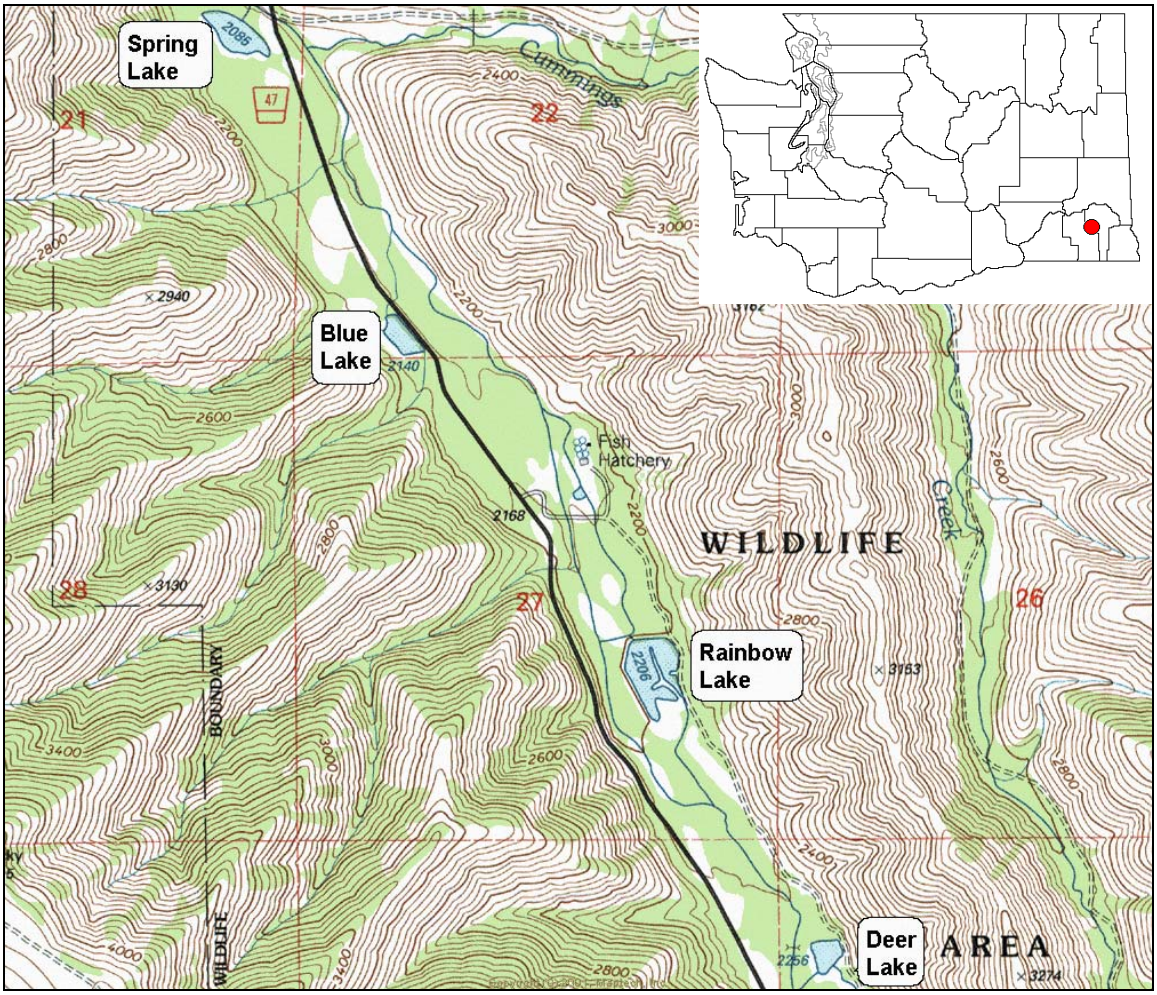

Figure 1 Map of the four sampled Tucannon Lakes in the WDFW Wooten Wildlife Area, in Columbia County, southeast Washington.

The objectives of this fishery monitoring effort were as follows:

1) Determine angler effort, catch, harvest, angler-day (and angler-trip) length, and exploitation rates for hatchery rainbow trout in four of the Tucannon Lakes from opening day (March 1) through mid-July, as an indicator of the level of angler use and success in all the Tucannon Lakes.

2) Evaluate how opening day angler results compare with results from opening week, and other intervals.

3) Compare results of these Tucannon Lakes fishery surveys with similar fishery surveys conducted here in the mid 1980s.
4) Compare results with LSRCP goals for this program.

5) Summarize and evaluate other aspects of the fishery (e.g. the use of bait, angler satisfaction, etc.).

6) Determine the residence of anglers and how far they are traveling to fish these lakes and recreate on the WDFW WWA.

Methods

Fish Management staff from the WDFW Dayton office began conducting angler counts and interviews initially at Spring, Blue and Rainbow lakes. In late March of 2003, Deer Lake was added to the creel surveys because it was small and very close to Rainbow Lake, and thus it could be included in the surveys with minimal effort. The sampling design was a stratified random roving creel survey (Hahn et al. 2000, Malvestuto 1983). We rolled dice to randomly select one weekend and one or two weekdays to be sampled per week. Opening day was included with weekends because of the expected increase in anglers during opening day. Initially, one weekend day and one weekday were randomly selected each week for monitoring the fisheries at these four lakes. Monitoring was increased to up to two weekdays per week during May through mid-July, except during May 1-15 when staff shortages and schedule conflicts prevented us from sampling on weekdays. Weekends during the first two weeks of May were sampled. We applied the averages from the nearest weekday creel surveys and angler counts on either side of the missing creel survey sampling period to estimate the angler effort, catch and harvest for all weekdays during May 1-15, and for use in the total estimates for the sampled season. The last weekday surveyed during the season was Tuesday, July 8, and the last weekend sampled was Saturday, July 12.

Angler counts were completed by walking a small portion of the shoreline of each lake to a point where all of the lake shore could be observed and all anglers quickly enumerated during four to six times per monitoring day, depending on day length and other factors. The first count time was randomly selected (0630, 0700, 0730, 0800 hrs) and subsequent counts were predetermined for every 2.5-3.5 hrs to cover the fishery from daylight until dark. The last count of the day was as late as 2100 hrs (9 pm), depending on day light. The goal was to complete all angler counts in less than one hour so statistically they could be considered "instantaneous" counts. On average, counts of the three largest lakes only took about 15-20 minutes. Angler counts were averaged over a two-week period and multiplied by the number of daylight hours, and days, available during weekends and weekdays for each two-week period. These results were summed per month, and for the entire sampling season, to estimate angler effort. Angler interviews were conducted before or after angler counts. Fish in the angler's creel were counted and approximately half of the harvested fish were selected randomly and measured. The angler was asked the number of anglers in their party and when they started fishing so we could estimate angler effort and catch rate (see Appendix A for angler creel instructions and forms). The average catch rate for each two week block was multiplied by angler effort during that period, by day type, to estimate the number of fish kept, or caught and released (Hahn et al. 2000). These values were summed over the season to arrive at sampling season totals for angler effort, catch and harvest.

Results and Discussion

Angler Effort, Catch and Harvest

We monitored the fisheries on opening day (March 1) for Rainbow, Blue and Spring lakes and found that catch rates were similar from opening day throughout the first two weeks or more of the fishing season (Table 1). However, we noticed that catch rates were often highest during weekends throughout the season at all three of these lakes when compared with weekdays (Appendix B). Deer Lake was added to the creel survey on March 28th. This lake had few anglers and variable catch rates during the season.

Angler effort was low during the first week of creel surveys in early March because the lakes were partially or mostly ice-covered and the temperatures were cold on opening morning. The first weekday surveyed (March 7) had cool temperatures and heavy rain/sleet all day, which likely contributed to the low angler turnout.

The most fishing effort occurred on Rainbow Lake, but it is larger than all the other Tucannon Lakes. Blue Lake had the highest estimated trout harvest and nearly the same amount of angling effort as Rainbow Lake (Figure 2). Blue Lake is also the deepest and the most recently dredged and restored lake of all the Tucannon Lakes. Total estimated angler effort for the four sampled lakes combined, for that portion of the fishing season sampled, was 38,116 angler hours.

Total rainbow trout harvest during the sampling season was estimated to be 27,436 (summed from Table 1). The most trout were removed from Blue Lake (12,066) and Rainbow Lake (9,992). Anglers caught and released 29-48% as many trout as were harvested per lake, with the highest percentage of released fish in Blue Lake (47.9% of trout harvested).

Interview data from anglers with completed fishing trips (the angler was finished fishing for the day in that lake) indicated that few anglers caught their limit of five fish, except from Blue Lake in March (Table 2). Sample sizes of anglers with completed trips from Spring and Deer Lakes were too small to partition the data by month, so only totals for the sampling season are shown. Completed fishing trips averaged 1.93 hours per angler (March 1 to mid July) for the four sampled lakes. Therefore, 19,749 angler days were completed by trout anglers fishing these four Tucannon Lakes (38,116 angler hours / 1.93 hours per completed fishing trip). This estimate of angler-days does not include the entire fishing season, nor does it include the fishery results for the early part of March on Deer Lake (we began surveys on Deer Lake on March 28 and expanded the data to provide estimates for the period of March 16-30). The number of angler days also does not include the other four Tucannon Lakes, plus many other ponds or lakes

stocked in southeast Washington with hatchery trout. Yet, this estimate of angler days on four Tucannon Lakes slightly exceeds 29% of the 67,500 angler days the LSRCP mitigation program was expected to provide with the hatchery trout program in all of southeast Washington. The LSRCP program stocked a total of 31 lakes with trout in 2003.

Table 1 Comparison of opening day, the first week, the first two weeks, and monthly effort and harvest during the Tucannon Lakes creel surveys, 2003.

	Angler Counts		Angler Interview Data					Expanded Totals		
	Number of Anglers	Average # of Anglers	Total Hours	Rainbow Trout Harvested	Rainbow Trout Released	Average Catch Rate (hrs/fish harvested)[a]	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)[b]**	**Total Estimated Rainbow Trout Harvested**	**Total Estimated Rainbow Trout Released**
Spring Lake										
Opening Day	128	32.00	194.66	77	3	2.528	64.887	**368.00**	**145.57**	**5.67**
1st Week (March 1-7)	132	16.50	197.84	80	3	2.473	65.947	**1,328.25**	**537.10**	**20.14**
1st Two Weeks (March 1-15)	175	10.94	240.10	138	3	1.740	80.033	**1,886.72**	**1,084.32**	**23.57**
1st Month (March 1-31)[c]	277	8.66	378.74	240	41	1.578	9.238	**2,501.25**	**1,686.34**	**378.94**
April (1-30)	289	5.78	399.27	128	60	3.119	6.655	**2,058.52**	**608.95**	**267.06**
May (1-31)	241	3.65	257.83	172	89	1.499	2.897	**1,522.91**	**1,061.43**	**436.97**
June (1-30)	178	2.97	228.69	171	49	1.337	4.667	**1,213.58**	**932.71**	**419.74**
July (1-15)[d]	107	3.69	119.58	58	38	2.062	3.147	**764.68**	**373.11**	**227.49**
Monthly Totals								**8,060.94**	**4,663**	**1,730**
Blue Lake										
Opening Day	236	59.00	184.80	147	27	1.257	6.844	**678.50**	**539.78**	**99.14**
1st Week (March 1-7)	247	30.88	195.65	151	35	1.296	5.590	**2,485.84**	**1,918.09**	**444.69**
1st Two Weeks (March 1-15)	324	20.25	294.26	241	46	1.221	6.397	**3,493.13**	**2,860.87**	**546.06**
1st Month (March 1-31)[c]	566	17.69	566.62	636	168	0.891	3.373	**5,134.38**	**5,742.47**	**2,786.43**
April (1-30)	530	10.60	539.14	330	101	1.634	5.338	**4,445.41**	**2,939.43**	**854.35**
May (1-31)	339	5.14	354.23	339	138	1.045	2.567	**2,238.70**	**2,134.92**	**921.90**
June (1-30)	263	4.38	336.77	207	175	1.627	1.924	**1,717.27**	**1,102.91**	**1,013.90**
July (1-15)[d]	62	2.14	57.17	19	27	3.009	2.117	**458.90**	**146.14**	**202.87**
Monthly Totals								**13,994.66**	**12,066**	**5,779**
Rainbow Lake										
Opening Day	126	31.50	159.11	142	25	1.120	6.364	**362.25**	**323.44**	**56.92**
1st Week (March 1-7)	145	18.13	180.33	152	25	1.186	7.213	**1,459.47**	**1,230.58**	**202.34**
1st Two Weeks (March 1-15)	212	13.25	242.28	209	46	1.159	5.267	**2,285.63**	**1,972.07**	**433.95**
1st Month (March 1-31)[c]	485	15.16	617.78	629	207	0.982	2.984	**4,446.88**	**4,718.02**	**1,807.96**
April (1-30)	514	10.28	539.79	219	79	2.465	6.833	**4,162.38**	**1,757.51**	**701.87**
May (1-31)	479	7.26	599.96	377	176	1.591	3.409	**3,021.93**	**1,863.15**	**1,032.36**
June (1-30)	334	5.57	476.02	249	110	1.912	4.327	**2,365.24**	**1,422.04**	**585.76**
July (1-15)[d]	135	4.66	140.11	30	11	4.670	12.737	**980.12**	**231.22**	**79.37**
Monthly Totals								**14,976.55**	**9,992**	**4,207**
Deer Lake										
Opening Day	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0.00**	**0.00**	**0.00**
1st Week (March 1-7)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0.00**	**0.00**	**0.00**
1st Two Weeks (March 1-15)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**0.00**	**0.00**	**0.00**
1st Month (March 16-31)[c,e]	11	1.38	17.00	10	5	1.700	3.400	**171.88**	**101.10**	**50.55**
April (1-30)	33	0.66	44.29	26	1	1.703	44.290	**255.33**	**113.26**	**3.38**
May (1-31)	60	0.91	73.55	62	12	1.186	6.129	**396.02**	**337.39**	**81.83**
June (1-30)	29	0.48	10.14	5	3	2.028	3.380	**209.80**	**80.52**	**45.55**
July (1-15)[d]	8	0.28	7.49	9	2	0.832	3.745	**51.30**	**82.63**	**27.70**
Monthly Totals								**1,084.33**	**715**	**209**

[a] Average catch rate for the month was calculated for all creels conducted including weekends and weekdays.
[b] Average release rate for the month was calculated for all creels conducted including weekends and weekdays.
[c] Angler effort for the month was calculated on 12 hour day length, an average of the first two week period (11.5 hrs) and the second two week period (12.5 hrs).
[d] July totals only represent July 1-15, no creels were conducted in the second half of July.
[e] March totals are calculated from two creels near the end of the month, therefore expanded totals only reflect the March 16-31.

Figure 2 An example of observed angling effort on Blue Lake in 2003.

Table 2 Rainbow trout caught per angler for anglers with completed fishing trips for the season, or by month, during Tucannon Lakes creel, 2003.

Two Week Period	Number of Anglers Interviewed	Total Hours Fished	Trout Harvested	Trout Released	Ave. Number of Trout Harvested per Angler	Ave. Hours per Angler-Day
Spring Lake						
Spring Lake Total	**66**	**132.87**	**106**	**56**	**1.61**	**2.01**
Blue Lake						
March	31	60.81	154	0	4.97	1.96
April	14	24.81	28	1	2.00	1.77
May	43	73.28	111	57	2.58	1.70
June	16	28.93	27	23	1.69	1.80
July	0	N/A	N/A	N/A	N/A	N/A
Blue Lake Total	**104**	**187.83**	**320**	**81**	**3.08**	**1.80**
Rainbow Lake						
March	51	89.32	148	2	2.90	1.75
April	33	84.76	64	3	1.94	2.57
May	50	103.24	57	30	1.14	2.06
June	33	71.91	55	33	1.67	2.18
July	20	32.70	4	0	0.20	1.63
Rainbow Lake Total	**187**	**381.93**	**328**	**68**	**1.75**	**2.04**
Deer Lake						
Deer Lake Total	**23**	**30.83**	**18**	**3**	**0.78**	**1.34**
Weighted Average	**380**	**733.46**	**772**	**208**	**2.03**	**1.93**

The range of exploitation rates (percent harvested of the total catchable-sized hatchery trout stocked) were similar to those reported in 1985 for the three larger lakes. In 1985, exploitation rates were 56-77 % for these three lakes (Schuck and Mendel, 1987), but in 2003 they ranged from 58-78% for Spring, Blue and Rainbow Lakes (Table 3). The exploitation rates for individual lakes in 1985 were 69% in Spring Lake, 56.5% in Blue Lake, and 77.7% in Rainbow Lake. The Blue Lake exploitation rate of 78% in 2003 exceeded the 1985 rate, but the other two lakes had lower rates in 2003 than in 1985. The very low exploitation rate (23.56 %) for trout harvest in Deer Lake does not include those fish removed the first two weeks of March because our creel surveys did not begin there until March 28 (the data however, were expanded for March 16-30). Exploitation rates in Spring, Rainbow and Deer lakes may be reduced because these lakes have become shallow and weedy and need to be excavated. Fishing is more difficult in these lakes because of the large quantities of aquatic vegetation so angler effort and harvest is probably reduced as a result. The cold, wet opening week of the fishing season in 2003 also may have contributed to the reduced exploitation rates.

Exploitation rates undoubtedly exceeded those noted in Table 3 because a portion of released trout are expected to have died from hooking and handling, especially when bait is used (Mongillo 1984, Muoneke and Childress 1994). If we apply a conservative hooking mortality rate of 10% to the released trout (Table 3) and include that in total exploitation, the estimates would increase by 2-3% in the three larger lakes, and by 0.6% in Deer Lake.

Table 3 Monthly rainbow trout stocked (including jumbo trout), expanded harvest and release, and percent cumulative exploitation rates during the Tucannon Lakes creel, 2003.

Lake/ Month	Number of Jumbos Stocked	Number of Catchable-Sized Trout Stocked[a]	Expanded Totals		% Cumulative Exploitation[b]
			Total Estimated Number Harvested	Total Estimated Number Released	
Spring Lake					
March	200	4,022	1,686	379	41.92
April	100	2,024	609	267	37.96
May	0	1,976	1,061	437	41.83
June	0	0	933	420	53.47
July	0	0	373	227	58.13
Season Total	**300**	**8,022**	**4,663**	**1,730**	**58.13**
Blue Lake					
March	201	8,295	5,742	2,786	69.22
April	100	1,702	2,939	854	86.84
May	0	4,399	2,135	922	75.14
June	0	1,047	1,103	1014	77.19
July	0	0	146	203	78.13
Season Total	**301**	**15,443**	**12,065**	**5,779**	**78.13**
Rainbow Lake					
March	200	7,140	4,718	1,808	66.08
April	100	3,965	1,757	702	58.31
May	0	3,130	1,863	1,032	58.57
June	0	1,762	1,422	586	61.01
July	0	0	231	79	62.46
Season Total	**300**	**15,997**	**9,991**	**4,207**	**62.46**
Deer Lake					
March	0	1,002	101	51	10.08
April	0	1,007	113	3	10.65
May	0	1,022	337	82	18.18
June	0	0	81	46	20.82
July	0	0	83	28	23.59
Season Total	**0**	**3,031**	**715**	**210**	**23.59**

[a] Rainbow trout stocking for the month of March also include fish planted in February for the March 1st fishing opener.

[b] Exploitation is the percentage of catchable sized rainbow trout harvested divided by the number stocked; calculated cumulatively throughout the season.

Small numbers of jumbo (> 33 cm FL per fish) rainbow trout were stocked (Table 3) in some of the Tucannon Lakes to create more angler excitement and anticipation of catching a large fish (Figure 3). The total harvest estimate for each lake was partitioned into jumbo trout and "catchable-sized " (about 18-30 cm FL) hatchery trout releases from Lyons Ferry (LFH) and Tucannon (TFH) fish hatcheries. An average of 2.8% of the harvested fish were jumbo trout (Table 4). The jumbo trout harvest rate is higher than the jumbo trout stocking rate (2.1%) and suggests that those large fish were more likely to be harvested than "catchable-sized" trout. The jumbo trout harvest is estimated to have been approximately 768 (27,436 total trout harvested x 2.8%). Therefore, the jumbo trout exploitation rate would be 85.2% (768 harvested divided by

901 stocked), which is well above the average calculated exploitation rate for all rainbow trout (Table 3).

Figure 3 An example of the size range of harvested fish (one "jumbo" and two"catchable-sized" trout) observed in angler creels in 2003.

Table 4 Numbers of harvested and released rainbow trout, and number of catchable (< 33.0cm) and jumbo (≥ 33.0cm) rainbow trout harvested (and percent of total harvested) derived from Tucannon Lakes creel survey interviews, 2003.

Area	Total Rainbow Trout Kept	Total Rainbow Trout Released	Rainbow kept < 33.0 cm FL	Rainbow kept ≥ 33.0 cm FL
Spring Lake	769	277	749 (97.4%)	20 (2.6%)
Blue Lake	1,531	609	1,490 (97.3%)	41 (2.7%)
Rainbow Lake	1,504	583	1,455 (96.7%)	49 (3.3%)
Deer Lake	112	23	112 (100.0%)	0 (0.0%)[a]
Total for all Lakes	**3,916**	**1,592**	**3,806 (97.2%)**	**110 (2.8%)**

[a] No Jumbo rainbow trout (≥ 33.0cm) were planted in Deer Lake so none were observed during the catch.

Fishing Gear, Angler Satisfaction, and Other Species Harvested

Most anglers using the Tucannon Lakes preferred to use bait (78-82%), but lures and flies often produced better catch rates (Table 5). It may be that more experienced anglers used lures or flies and therefore had higher success rates. Bait use at the Tucannon Lakes was much higher than the Washington statewide average (25%) for rainbow trout fishing (Responsive Management 2008).

We asked anglers whether they were satisfied with the number of fish they were catching and the quality of the fish they caught in 2003. Satisfaction levels generally exceeded 65 % except during April and July (Table 6). The decrease in satisfaction in April of 2003 is probably a reflection of the smaller sized trout stocked that month that came from the Tucannon Fish Hatchery. Lyons Ferry Hatchery had provided all the stocked trout in February and March, but Tucannon Hatchery stocked the trout in April, May and June. The Tucannon Hatchery has cold water temperatures in winter and spring and, therefore, is not able to consistently produce 8-12 inch (20-30 cm) fish by April. Lyons Ferry Hatchery can produce large trout as early as February or March because of the use of constant temperature well water at this facility (Table 7). The catch of smaller fish, and relative dissatisfaction in April could be alleviated by having additional rainbow trout produced at Lyons Ferry Hatchery for April releases and delaying use of Tucannon Hatchery releases until later to allow additional growth and increased size at release. In addition, most or all the jumbo trout may have been harvested from the lakes by early April so that probably contributed to angler dissatisfaction with the size of fish caught during that month. Also, we had expected, and indeed found, lower satisfaction levels in July because of poorer fishing conditions and fewer trout remaining for harvest

Table 5 Summary of gear type used by anglers interviewed during Tucannon Lakes creel surveys, and catch success (in numbers of fish caught and released and catch rates) for each gear type, 2003.

Lake/ Gear Type	Number of Anglers Interviewed (% of Total)	Number of Fish Harvested	Number of Fish Released	Catch Rate for Rainbow Trout		
				Fish Harvested per Angler (hrs./fish harvested)	Fish Released Rate (hrs./fish released)	Total Fish Caught per Angler (hrs./fish caught)
Spring Lake						
Bait	765 (81.9%)	637	138	0.8 (1.79)	8.27	1.0 (1.47)
Lure	50 (5.4%)	35	44	0.7 (1.67)	1.32	1.6 (0.74)
Fly	19 (2.0%)	17	44	0.9 (1.73)	0.67	3.2 (0.48)
Bait/Lure	96 (10.3%)	77	51	0.5 (1.97)	2.97	1.3 (1.18)
Bait/Fly	4 (0.4%)	3	0	0.7 (1.56)	0.0	0.7 (1.56)
Total	**934**	**769**	**277**	**0.8 (1.80)**	**5.00**	**1.1 (1.32)**
Blue Lake						
Bait	1,151 (78.9%)	1,239	214	1.1 (1.14)	6.63	1.3 (0.98)
Lure	56 (3.8%)	40	98	0.7 (1.56)	0.64	2.5 (0.45)
Fly	66 (4.5%)	36	160	0.5 (2.54)	0.57	3.0 (0.47)
Bait/Lure	95 (6.5%)	144	65	1.5 (1.34)	2.08	2.2 (0.82)
Bait/Fly	56 (3.8%)	61	32	1.1 (1.18)	2.25	1.7 (0.77)
Lure/Fly	16 (1.1%)	8	10	0.5 (1.57)	1.25	1.1 (0.70)
Bait/Lure/Fly	19 (1.3%)	3	30	0.2 (12.87)	1.29	1.7 (1.17)
Total	**1,459**	**1,531**	**609**	**1.0 (1.21)**	**3.04**	**1.5 (0.87)**
Rainbow Lake						
Bait	1,309 (79.0%)	1,245	294	0.9 (1.51)	6.39	1.2 (1.22)
Lure	93 (5.6%)	75	124	0.8 (1.51)	0.91	2.1 (0.57)
Fly	61 (3.7%)	38	104	0.6 (2.49)	0.91	2.3 (0.67)
Bait/Lure	152 (9.2%)	131	43	0.9 (1.92)	5.85	1.1 (1.45)
Bait/Fly	37 (2.2%)	15	17	0.4 (2.03)	1.79	0.9 (0.95)
Lure/Fly	2 (0.1%)	0	1	0.0 (0.00)	5.84	0.5 (5.84)
Bait/Lure/Fly	4 (0.2%)	0	0	0.0 (0.00)	0.00	0.0 (0.00)
Total	**1,658**	**1,504**	**583**	**0.9 (1.58)**	**4.07**	**1.3 (1.14)**
Deer Lake						
Bait	112 (81.2%)	93	15	0.8 (1.28)	7.96	1.0 (1.11)
Lure	7 (5.1%)	10	4	1.4 (0.27)	0.67	2.0 (0.19)
Fly	3 (2.2%)	0	2	0.0 (0.00)	7.71	0.7 (7.71)
Bait/Lure	11 (8.0%)	7	1	0.6 (1.43)	10.01	0.7 (1.25)
Bait/Fly	5 (3.6%)	2	1	0.4 (2.50)	5.00	0.6 (1.67)
Total	**138**	**112**	**23**	**0.8 (1.36)**	**6.63**	**1.0 (1.13)**

Table 6 Angler satisfaction with the number of rainbow trout and quality of trout caught during the Tucannon Lakes creel surveys, 2003.

	Satisfied with number of trout?			Satisfied with quality of trout?		
Lake/Month	# Anglers Interviewed	Yes	No	# Anglers Interviewed	Yes	No
Spring Lake						
March	201	155 (77.1%)	46 (22.9%)	188	158 (84.0%)	30 (16.0%)
April	276	117 (42.4%)	159 (57.6%)	228	122 (53.5%)	106 (46.5%)
May	135	91 (67.4%)	44 (32.6%)	89	88 (98.9%)	1 (1.1%)
June	123	94 (76.4%)	29 (23.6%)	123	94 (76.4%)	29 (23.6%)
July	64	40 (62.5%)	24 (37.5%)	64	40 (62.5%)	24 (37.5%)
Total	**799**	**497 (62.2%)**	**302 (37.8%)**	**645**	**507 (78.6%)**	**138 (21.4%)**
Blue Lake						
March	346	308 (89.0%)	38 (11.0%)	346	288 (83.2%)	58 (16.8%)
April	457	163 (35.7%)	294 (64.3%)	390	196 (50.3%)	194 (49.7%)
May	250	200 (80.0%)	50 (20.0%)	150	150 (100.0%)	0 (0.0%)
June	186	132 (71.0%)	54 (29.0%)	145	135 (93.1 %)	10 (6.9%)
July	48	17 (35.4%)	31 (64.6%)	23	23 (100.0%)	0 (0.0%)
Total	**1,287**	**820 (63.7%)**	**467 (36.3%)**	**1,054**	**792 (75.1%)**	**262 (24.9%)**
Rainbow Lake						
March	365	310 (84.9%)	55 (15.1%)	365	300 (82.2 %)	65 (17.8%)
April	385	134 (34.8%)	251 (65.2%)	271	158 (58.3%)	113 (41.7%)
May	320	213 (66.6%)	107 (33.4%)	192	187 (97.4%)	5 (2.6%)
June	251	172 (68.5%)	79 (31.5%)	188	185 (98.4%)	3 (1.6%)
July	109	14 (12.8%)	95 (87.2%)	17	16 (94.1%)	1 (5.9%)
Total	**1,430**	**843 (59.0%)**	**587 (41.0%)**	**1,033**	**846 (81.9%)**	**187 (18.1%)**
Deer Lake						
March	11	9 (81.8%)	2 (18.2%)	11	9 (81.8%)	2 (18.2%)
April	36	20 (55.6%)	16 (44.4%)	30	8 (26.7%)	22 (73.3%)
May	51	43 (84.3%)	8 (15.7%)	32	32 (100.0%)	0 (0.0%)
June	16	6 (37.5%)	10 (62.5%)	8	8 (100.0%)	0 (0.0%)
July	10	3 (70.0%)	7 (70.0%)	3	3 (100.0%)	0 (0.0%)
Total	**122**	**81 (66.4%)**	**41 (33.6%)**	**84**	**60 (71.4%)**	**24 (28.6%)**

Table 7 Number and average size (number of fish per pound, or per 0.45 kg) of catchable-sized trout (excluding jumbo trout) released into four of the Tucannon Lakes in 2003 from the Tucannon Fish Hatchery (TFH) and Lyons Ferry Hatchery (LFH) (information from Jon Lovrak, pers. comm. 2008).

Lake/ Hatchery		February	March	April	May	June
Spring Lake/	TFH			2,024 (4.4)	1,976 (3.8)	
	LFH	2,006 (3.2)	2,016 (2.8)			
Blue Lake/	TFH			1,702 (4.4)	4,399 (4.3)	1,047 (2.3)
	LFH	3,978 (3.4)	4,317 (2.7)			
Rainbow Lake/	TFH			3,965 (4.4)	3,130 (4.3)	1,762 (3.1)
	LFH	3,060 (3.4)	4,080 (2.8)			
Deer Lake/	TFH			1,007 (4.4)	1,022 (3.8)	
	LFH	1,002 (3.0)				

Anglers did catch species of fish other than hatchery trout, particularly in Spring and Rainbow lakes (Table 8). Smallmouth bass, a favored gamefish, were harvested from Spring Lake. Redside shiners are a small native fish that seldom exceeds 4-5 inches (10-13 cm). Northern pikeminnows, a species native to the Tucannon River, were commonly caught in Rainbow Lake. One bridgelip sucker was also caught. No other species were observed or reported during angler interviews.

Table 8 Species of fish other than rainbow trout observed during Tucannon Lakes creel surveys, 2003.

Lake	Other Species Caught	Number Caught
Spring Lake	Smallmouth bass	62
Blue Lake	Redside shiner	1
Rainbow Lake	Northern pikeminnow	109
	Redside shiner	6
	Bridgelip sucker	1
Deer Lake	None	

Comparison of 2003 and 1985 Creel Results

In 1985, the trout fishing in the Tucannon Lakes opened on April 21. In 2003, opening day was March 1. Additionally in 1985, the Tucannon River was stocked with hatchery trout and was open for fishing in late May (25th), but in 2003 the river was not stocked and it did not open until June 1. In 1985, the random sampling of Tucannon Lakes was stratified between weekends and weekdays, and AM and PM periods per day. Two or three counts were made each sampling period (half day). The creel surveys extended into August in 1985, but counts were decreased to

only one per half day in August because of low numbers of anglers. July and August accounted for a very small percentage of the season's total angler effort, except at Curl Lake, which did not open until May 25, in 1985. Completed angling trips averaged 1.77 hrs per day (less than the 1.93 hrs/day in 2003), resulting in an estimated 26,094 angler days at the eight Tucannon Lakes during the spring and summer of 1985 (Schuck and Mendel 1987). Anglers caught an average of 2.89 fish each and harvested 52-107 % of the fish stocked into the lakes in 1985, compared with 2.03 fish per angler and 24-78% of the trout stocked in 2003. In 1985, Curl Lake anglers apparently harvested many steelhead smolts that had not left the lake before the trout season opened and the lake had been restocked with rainbow trout, thus accounting for greater than 100% exploitation. Also, Rainbow Lake angling in 1985 may have been artificially low because of a "Hatchery Closed" sign at the bridge that may have deterred anglers from crossing the bridge to access Rainbow Lake. In 1985, bull trout were harvested from Spring Lake, Blue Lake, and Big 4 Lake. No ESA threatened bull trout were caught in the 2003 fishery in the four lakes sampled in this study, probably because of improved screening practices that excluded bull trout from entering the lakes.

Cost estimates for the catchable trout program can be made and compared between 1985 (Schuck and Mendel 1987) and 2003. In 1985, 79,513 trout weighing 22,664 lbs were produced and stocked in all the Tucannon Lakes at a cost of $56,660 ($0.71 per trout). Those fish provided over 46,186 angling hours of recreation. By contrast in 2003, the total cost to produce the rainbow trout for all trout releases in southeast Washington was estimated at $440,795 (TFH and LFH average in 2003 was $2.03 per trout, or $6.05 per lb with both catchable and jumbo trout combined (Doug Maxey and Jon Lovrak, TFH and LFH, respectively, personal communication). In 2003, a total of 43,393 hatchery trout were stocked in these four lakes at a cost of $88,088.

We were able to estimate the economic value of the Tucannon Lakes trout fisheries by using specific information from five similar "put and take" hatchery trout lakes in nearby counties of northern Idaho (Latah, Lewis, and Nez Perce counties). Based on an Idaho Fish and Game economic study of the value of trout fishing in various Idaho lakes (Grunder et al. 2008), we were able to extract a range of $24-67 expended per angler-trip (average of $51.40/trip), or $18-51 per angler-day (based on the statewide average of 1.3 days per trip, and 5.1 hrs per day) We converted the estimated cost per trip that economists use (which may include more than one day of fishing if anglers camp in the area) to estimate economic values or direct expenses of fishing to costs per angler-day that we then applied to a completed angler-day. Applying the average costs ($39.54 per day) to our estimate of angler-days (19,749) produced an economic expenditures value for the fisheries at the four Tucannon Lakes of $780,895. Comparison of the cost of trout production with angler expenditures in the fisheries at the four Tucannon Lakes provides a ratio of economic activity/cost (or return on investment) of 8.9/1. This ratio falls

within the range of values determined in the 1985 Tucannon Lakes creel study of 6.6/1 and 13.1/1 (and $374,246-740,025 in economic expenditures -Schuck and Mendel 1987).

Residence of Anglers Interviewed

On March 13, we began asking anglers their residence location (a.k.a. "origin") when we did angler interviews for determination of angling effort and catch rate (the three earliest creel survey days in March were not sampled for angler origin). The results of our query regarding angler residence indicated that anglers from a large geographic area used the Tucannon Lakes in 2003 (Table 9). Because some anglers were interviewed more than once during a sampling day, we evaluated angler origin data by using the total angler interviews (Appendix C) and compared that with randomly selected angler interview periods per sampling-day (Table 9). We did not find much difference in the percentage of anglers by geographic origin using these two interview datasets. Local area anglers from Columbia and Garfield Counties comprised about 9% of the anglers in both datasets, while the larger population areas of nearby Asotin and Walla Walla counties comprised about 22%. Anglers from the Tri-Cities and that general geographic area comprised about 52-54% of the anglers interviewed, depending on whether all anglers are included or only those from one interview period per day.

Some anglers from very distant areas were found fishing the Tucannon Lakes. They were likely visiting friends or family in the local area, as they were usually associated with more local anglers. Anglers from as far away in Washington as Seattle, Hoquiam and Whidbey Island were interviewed, as well as anglers from distant states such as Florida and Wisconsin. Anglers from Oregon and Idaho made up 1-2% of anglers we interviewed at the Tucannon Lakes, except during March. Most anglers during March were from relatively local areas such the Tri-cities (Pasco, Kennewick and Richland -35%), Walla Walla (27%), and nearby areas of Columbia and Garfield counties (19% - Table 10). No anglers from Oregon, Idaho or states other than Washington were contacted in March, but anglers from distant areas comprised over 2.6% of the total anglers over the entire sampled fishing season (Table 9 and Appendix C).

Table 9 Angler residence data from one interview period per day for the entire season of the Tucannon Lakes creel surveys, 2003.

Residence	Number of Anglers	% of Anglers
Washington State Anglers		
Columbia and Garfield County Anglers		
Blind Grade	4	0.41
Dayton	46	4.73
Lyons Ferry	0	0.00
Pomeroy	35	3.60
Starbuck	4	0.41
Tucannon	0	0.00
Columbia and Garfield County Totals	**89**	**9.35**
Walla Walla and Asotin County Anglers		
Asotin	0	0.00
Burbank	4	0.42
Clarkston	4	0.42
College Place	1	0.11
Dixie	0	0.00
Prescott	5	0.53
Touchet	17	1.79
Waitsburg	28	2.94
Walla Walla	144	15.13
Wallula	4	0.42
Walla Walla and Asotin County Totals	**207**	**21.74**
Other Cities in Washington State		
Arlington	0	0.00
Bellevue	0	0.00
Benton City	10	1.05
Chehalis	0	0.00
Cheney	1	0.11
Cle-Elum	0	0.00
Colfax	0	0.00
Connell	9	0.95
Ellensburg	0	0.00
Eltopia	0	0.00
Finley	1	0.11
Gig Harbor	8	0.84
Goldendale	0	0.00
Grandview	7	0.74
Hoquiam	0	0.00
Ione	0	0.00
Kahlotus	9	0.95
Lind	4	0.42
Mesa	0	0.00
Moses Lake	7	0.74
Olympia	0	0.00
Othello	11	1.16
Prosser	24	2.52
Pullman	8	0.84
Puyallup	3	0.32
Reardon	1	0.11
Redman	0	0.00
Ridgefield	0	0.00
Ritzville	0	0.00
Sammamish	1	0.11
Seattle	2	0.21
Silverdale	0	0.00
Snohomish	1	0.11
Soap Lake	2	0.21
Spokane	13	1.37
Sunnyside	3	0.32
Tri-Cities	492	51.68
Union Town	1	0.11
Vancouver	3	0.32
Washtucna	3	0.32
Wenatchee	1	0.11
Whidbey Island	2	0.21
Yakima	3	0.32
Zillah	0	0.00
Washington Totals	**927**	**97.37**
Oregon State Anglers		
Glide, OR	0	0.00
Hermiston, OR	3	0.32
Irrigon, OR	1	0.11
Medford, OR	0	0.00
Milton-Freewater, OR	5	0.53
Portland, OR	0	0.00
Salem, OR	2	0.21
Wallowa, OR	0	0.00
Oregon Totals	**11**	**1.16**
Idaho State Anglers		
Bothell, ID	0	0.00
Lewiston, ID	0	0.00
Peck, ID	0	0.00
Pocatello, ID	3	0.32
Whinchester, ID	11	1.16
Idaho Totals	**14**	**1.47**
Anglers from other U.S. Cities and States		
Alabama	0	0.00
Arizona	1	0.11
Mesa, AZ	0	0.00
California	0	0.00
Sacramento, CA	0	0.00
Florida	0	0.00
Michigan	0	0.00
Missouri	0	0.00
Nebraska	0	0.00
Las Vegas, NV	0	0.00
Carson City, NV	0	0.00
Texas	0	0.00
Salt Lake City, UT	0	0.00
Wisconsin	0	0.00
Other Totals	**1**	**0.11**

Table 10 Angler residence data from one interview period per day during the first month of the Tucannon Lakes creel surveys, 2003.

Residence	Number of Anglers	% of Anglers
Washington State Anglers		
Columbia and Garfield County Anglers		
Blind Grade	0	0.00
Dayton	23	9.70
Lyons Ferry	0	0.00
Pomeroy	21	8.86
Starbuck	0	0.00
Tucannon	0	0.00
Columbia and Garfield County Totals	**44**	**18.57**
Walla Walla and Asotin County Anglers		
Asotin	0	0.00
Burbank	0	0.00
Clarkston	0	0.00
College Place	0	0.00
Dixie	0	0.00
Prescott	0	0.00
Touchet	8	3.38
Waitsburg	9	3.80
Walla Walla	63	26.58
Wallula	0	0.00
Walla Walla and Asotin County Totals	**80**	**33.76**
Other Cities in Washington State		
Arlington	0	0.00
Bellevue	0	0.00
Benton City	0	0.00
Chehalis	0	0.00
Cheney	0	0.0
Cle-Elum	0	0.00
Colfax	0	0.00
Connell	5	2.11
Ellensburg	0	0.00
Eltopia	0	0.00
Finley	0	0.00
Gig Harbor	0	0.00
Goldendale	0	0.00
Grandview	0	0.00
Hoquiam	0	0.00
Ione	0	0.00
Kahlotus	1	0.42
Lind	0	0.00
Mesa	0	0.00
Moses Lake	7	2.95
Olympia	0	0.00
Othello	6	2.53
Prosser	0	0.00
Pullman	0	0.00
Puyallup	0	0.00
Reardon	0	0.00
Redman	0	0.00
Ridgefield	0	0.00
Ritzville	0	0.00
Sammamish	0	0.00
Seattle	2	0.84
Silverdale	0	0.00
Snohomish	0	0.00
Soap Lake	2	0.84
Spokane	5	2.11
Sunnyside	0	0.00
Tri-Cities	83	35.02
Union Town	0	0.00
Vancouver	2	0.84
Washtucna	0	0.00
Wenatchee	0	0.00
Whidbey Island	0	0.00
Yakima	0	0.00
Zillah	0	0.00
Washington Totals	**113**	**47.68**
Oregon State Anglers		
Glide, OR	0	0.00
Hermiston, OR	0	0.00
Irrigon, OR	0	0.00
Medford, OR	0	0.00
Milton-Freewater, OR	0	0.00
Portland, OR	0	0.00
Salem, OR	0	0.00
Wallowa, OR	0	0.00
Oregon Totals	**0**	**0.00**
Idaho State Anglers		
Bothell, ID	0	0.00
Lewiston, ID	0	0.00
Peck, ID	0	0.00
Pocatello, ID	0	0.00
Whinchester, ID	0	0.00
Idaho Totals	**0**	**0.00**
Anglers from other U.S. Cities and States		
Alabama	0	0.00
Arizona	0	0.00
Mesa, AZ	0	0.00
California	0	0.00
Sacramento, CA	0	0.00
Florida	0	0.00
Michigan	0	0.00
Missouri	0	0.00
Nebraska	0	0.00
Las Vegas, NV	0	0.00
Carson City, NV	0	0.00
Texas	0	0.00
Salt Lake City, UT	0	0.00
Wisconsin	0	0.00
Other Totals	**0**	**0.00**

Summary and Conclusions

This study provided valuable information regarding the trout fisheries in the Tucannon Lakes in 2003. The angler effort on four of the Tucannon Lakes was estimated to be 38,116 angler-hours and 19,749 angler-days (with an average completed angler day of 1.93 hrs). This partial fishing season estimate of angler-days on only four of the Tucannon Lakes exceeded 29% of the LSRCP mitigation goal of 67,500 angler days for all of southeast Washington. An estimated 27,436 rainbow trout were harvested during the first 4.5 months of the fishing season (March 1 to mid-July). Approximately 58-78% of hatchery trout were removed from the lakes by anglers, excluding hooking mortalities for released fish. Jumbo trout were apparently harvested at a higher rate than catchable-sized trout. Most anglers (79-82%) used bait when fishing the Tucannon Lakes, even though catch rate was higher with artificial lures. Anglers were generally satisfied with the numbers and quality of trout they caught, but satisfaction levels decreased temporarily in April as the size of available hatchery trout decreased. Anglers in March were mostly from nearby areas of southeast Washington, but later in the season a portion of anglers were from very distant areas. The Tri-cities area was the source of the largest percentage (>50%) of anglers using the Tucannon Lakes, but some anglers from distant states also fished these lakes.

Estimated angling expenditures for fishing at these four lakes was $780,895 (derived from economic expenditures per-day in put-and-take trout lakes in nearby areas of northern Idaho). Cost to produce the trout in the four surveyed Tucannon Lakes was $88,088 in 2003. Therefore, the estimated economic return on investment ratio was 8.9/1.

Future Outlook

It is obvious from the information provided by this evaluation that the fisheries on the Tucannon Lakes fisheries provide valuable fishing opportunities to anglers from a wide area. Based on the estimated return on investment for put-and-take trout fisheries in the four Tucannon Lakes sampled, all eight Tucannon Lakes could provide more than $1 million annually in economic activity in the local area of southeast Washington. Unfortunately, the lake structure, habitat and fishing conditions in all eight of the Tucannon Lakes are deteriorating. These lakes need to be maintained by dredging (to increase depth and reduce aquatic vegetation) and the dams are in need of repair. Hatchery trout stocking rates have been reduced since 2003 in Rainbow, Spring and Deer lakes because of less lake volume, depth and fishing access, which equates to lower fishing success. The WDFW may be forced to close some of these lakes in the near future if they are not adequately maintained. Also, the Washington Department of Ecology (DOE) has notified WDFW that these lakes are in violation of DOE dam safety regulations and they must be brought into compliance, or dewatered. No mitigation funding is available to maintain these

lakes. The WDFW, the legislature, and the public should make maintenance of at least the larger of the Tucannon Lakes a priority and assist with securing funding for maintenance activities soon if angling opportunities are to continue. Preliminary estimates are available regarding repairs needed and estimated costs (Thomas, Dean and Hoskins, 2003). It has been estimated that some of these lakes will require $500,000 to over $1 million each for needed repairs, and costs will increase in the future. The WDFW should begin evaluation of the maintenance needs, the priorities for maintenance, and whether some of these lakes should be decommissioned. The public must be engaged during this evaluation and their input and assistance should be solicited.

The fishery monitoring results summarized in this report provide a valuable "snapshot" in time regarding the Tucannon Lakes fisheries and the level of achievement of WDFW fishery management goals for southeast Washington as well as LSRCP mitigation goals for replacing angler-days lost to the construction and operation of Snake River dams and reservoirs. Other southeast Washington resident trout fisheries should be monitored in the future to provide additional insight regarding their fisheries and the level of contribution to achieving LSRCP and WDFW fishery management goals. We recommend that Bennington Lake, the largest lake (reservoir) in southeast Washington stocked with hatchery trout, should be the next site for a detailed fishery survey in the near future.

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Appendix A. Creel Instructions/Questions and Creel Survey Form for the Tucannon Lakes, 2003.

Instructions

Count 1: starts at 06:00 and ends by 07:00
Interviews 1: starts at end of count 1 finished by10:00
Count 2: starts at 10:00 and ends by 11:00
Interviews 2: starts at end of count 2 finished by 13:00
Count 3: starts at 13:00 and ends by 14:00
Interviews 3: starts at end of count 3 finised by 16:00
Count 4: starts at 16:00 ends by 17:00

First count begins at Spring Lk., then Blue Lk., then Rainbow Lk. You have up to one hour to complete the count. At the end of the count write something in the comments section of the creel form about the weather (cold, warm, sunny, rainy, etc.). Once count is finished begin interviews (at least 10 groups per lake).

Questions

1. Number of people in party (adults/kids)?
2. What time did you start fishing? (Quit time is time interviewed)
3. Are you done fishing?
4. What are you using for bait? (Bait, Lure, Fly)
5a. How many trout have you caught?
5b. How many trout did you keep/how many did you release?
6a. Have you caught anything other than trout?
6b. Were the other species kept or released?
7a. Are you satisfied with the # of fish available?
7b. Are you satisfied with the quality of the fish you are catching? (take extra notes on any specific comments)
8. Take measurements on some or all of the fish (at least ½ of the groups surveyed)

Creel Survey Form

Tucannon Lakes Creel Form

														Effort Counts								
														Time	#	Time	#	Time	#	Time	#	
Lake:							Initials:			Date:												
Number		Time Fished								Other Species		Satisfied		Length in Centimeters								
Adults	Juveniles	Start	Quit	Completed Y/N	Angler Type	Gear Code	Target Species	Kept	Released	Caught	Kept or Released	# of Fish	Quality of Fish	#1	#2	#3	#4	#5	#6	#7	#8	Residence

Number		Time Fished								Other Species		Satisfied		Length in Centimeters								
Adults	Juveniles	Start	Quit	Completed Y/N	Angler Type	Gear Code	Target Species	Kept	Released	Caught	Kept or Released	# of Fish	Quality of Fish	#1	#2	#3	#4	#5	#6	#7	#8	Residence
Comments:																						

Appendix B. Angler Effort and Harvest for Spring, Blue, Rainbow and Deer Lakes, 2003.

Appendix B. Table 1. Spring Lake Angler Effort and Harvest, 2003.

			Angler Counts			Angler Interview Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
March 1-15 Weekday Totals				**23**	**2.88**	**38.53**	**54**	**0**	**0.714**	**0.000**	**330.63**	**463.38**	**0.00**
3	7	WD	7:00	0	1.00								
3	7	WD	10:00	0									
3	7	WD	13:00	2									
3	7	WD	16:00	2									
3	13	WD	8:00	4	4.75								
3	13	WD	11:00	3									
3	13	WD	14:00	5									
3	13	WD	17:00	7									
March 16-31 Weekday Totals				**30**	**3.75**	**42.10**	**27**	**22**	**1.559**	**1.914**	**515.63**	**330.68**	**269.45**
3	19	WD	7:00	2	4.50								
3	19	WD	10:00	7									
3	19	WD	13:00	4									
3	19	WD	16:00	5									
3	28	WD	7:00	0	3.00								
3	28	WD	10:30	6									
3	28	WD	14:00	6									
3	28	WD	17:30	0									
April 1-15 Weekday Totals				**59**	**5.90**	**77.64**	**15**	**6**	**5.176**	**12.940**	**854.73**	**165.13**	**66.05**
4	1	WD	7:00	5	2.25								
4	1	WD	10:30	2									
4	1	WD	14:00	2									
4	1	WD	17:30	0									
4	11	WD	7:00	2	8.33								
4	11	WD	9:30	9									
4	11	WD	12:00	6									
4	11	WD	14:30	17									
4	11	WD	17:00	14									
4	11	WD	19:30	2									
April 16-30 Weekday Totals				**17**	**0.94**	**24.09**	**17**	**3**	**1.417**	**8.030**	**145.44**	**102.64**	**18.11**
4	17	WD	6:30	1	2.00								
4	17	WD	9:00	1									
4	17	WD	11:30	5									
4	17	WD	14:30	3									
4	17	WD	17:00	0									
4	17	WD	19:00	2									
4	24	WD	6:30	0	0.50								
4	24	WD	9:00	0									
4	24	WD	11:30	0									
4	24	WD	14:00	3									
4	24	WD	16:30	0									
4	24	WD	19:00	0									
4	29	WD	7:00	0	0.33								
4	29	WD	9:30	0									
4	29	WD	12:00	0									
4	29	WD	14:30	2									
4	29	WD	17:00	0									
4	29	WD	19:30	0									
May 1-15 Weekday Totals				**0**	**1.75**	**N/A**	**N/A**	**N/A**	**1.251**	**11.680**	**282.40**	**225.67**	**24.18**

No weekday creel surveys conducted during this period, data was determined by averaging the number of anglers from 4/29 and 5/16 and by calculating a combined catch and release rate for 4/29 and 5/16.

Appendix B. Table 1. Spring Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow Trout Harvested**	**Rainibow Trout Released**
May 16-31 Weekday Totals				**43**	**1.43**	**65.71**	**58**	**36**	**1.133**	**1.825**	**241.70**	**213.35**	**132.42**
5	16	WD	7:30	5	3.17								
5	16	WD	10:00	1									
5	16	WD	12:30	6									
5	16	WD	15:00	4									
5	16	WD	17:30	3									
5	16	WD	20:00	0									
5	20	WD	7:30	2	0.83								
5	20	WD	10:00	2									
5	20	WD	12:30	0									
5	20	WD	15:00	1									
5	20	WD	17:30	0									
5	20	WD	20:00	0									
5	21	WD	7:30	1	2.33								
5	21	WD	10:00	0									
5	21	WD	12:30	2									
5	21	WD	15:00	1									
5	21	WD	17:30	4									
5	21	WD	20:00	6									
5	28	WD	7:00	0	0.00								
5	28	WD	9:30	0									
5	28	WD	12:00	0									
5	28	WD	14:30	0									
5	28	WD	17:00	0									
5	28	WD	19:30	0									
5	29	WD	7:30	0	0.83								
5	29	WD	10:00	0									
5	29	WD	12:30	1									
5	29	WD	15:00	2									
5	29	WD	17:30	0									
5	29	WD	20:00	2									
June 1-15 Weekday Totals				**20**	**1.67**	**16.67**	**17**	**16**	**0.981**	**1.042**	**261.17**	**266.33**	**250.66**
6	3	WD	7:30	0	1.33								
6	3	WD	10:00	4									
6	3	WD	12:30	0									
6	3	WD	15:00	2									
6	3	WD	17:30	2									
6	3	WD	20:00	0									
6	10	WD	7:00	0	2.00								
6	10	WD	9:30	2									
6	10	WD	12:00	4									
6	10	WD	14:30	0									
6	10	WD	17:00	0									
6	10	WD	19:30	6									
June 16-30 Weekday Totals				**52**	**2.17**	**78.72**	**69**	**7**	**1.141**	**11.246**	**342.98**	**300.63**	**30.50**
6	18	WD	7:30	0	2.33								
6	18	WD	10:00	0									
6	18	WD	12:30	6									
6	18	WD	15:00	4									
6	18	WD	17:30	4									
6	18	WD	20:00	0									
6	20	WD	7:00	0	2.00								
6	20	WD	9:30	2									
6	20	WD	12:00	4									
6	20	WD	14:30	4									
6	20	WD	17:00	2									
6	20	WD	19:30	0									

Appendix B. Table 1. Spring Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
June 16-30 Weekday Totals Continued													
6	25	WD	7:00	0	1.50								
6	25	WD	9:30	0									
6	25	WD	12:00	6									
6	25	WD	14:30	0									
6	25	WD	17:00	3									
6	25	WD	19:30	0									
6	26	WD	8:00	0	2.83								
6	26	WD	10:30	5									
6	26	WD	13:00	8									
6	26	WD	15:30	0									
6	26	WD	18:00	0									
6	26	WD	20:30	4									
July 1-15 Weekday Totals				**53**	**2.94**	**66.25**	**35**	**8**	**1.949**	**8.281**	**458.74**	**235.43**	**55.40**
7	1	WD	7:00	0	2.33								
7	1	WD	9:30	0									
7	1	WD	12:00	2									
7	1	WD	14:30	6									
7	1	WD	17:00	6									
7	1	WD	19:30	0									
7	3	WD	6:30	0	4.33								
7	3	WD	9:00	8									
7	3	WD	11:30	0									
7	3	WD	14:00	7									
7	3	WD	16:30	4									
7	3	WD	19:00	7									
7	8	WD	7:00	0	2.17								
7	8	WD	9:30	3									
7	8	WD	12:00	4									
7	8	WD	14:30	4									
7	8	WD	17:00	2									
7	8	WD	19:30	0									
Spring Lake Weekday Sub-totals				**297**		**409.71**	**291**	**98**			**3,433.42**	**2,303.24**	**846.77**
March 1-15 Weekend Totals				**152**	**19.00**	**201.57**	**84**	**3**	**2.400**	**67.190**	**1,092.50**	**455.28**	**16.26**
3	1	WE	7:00	22	32.00								
3	1	WE	10:00	39									
3	1	WE	13:00	36									
3	1	WE	16:00	31									
3	8	WE	7:00	0	6.00								
3	8	WE	10:00	14									
3	8	WE	13:00	3									
3	8	WE	16:00	7									
March16-31 Weekend Totals				**72**	**9.00**	**96.54**	**75**	**16**	**1.287**	**6.034**	**562.50**	**437.00**	**93.22**
3	16	WE	7:30	4	10.25								
3	16	WE	11:00	20									
3	16	WE	14:30	14									
3	16	WE	17:30	3									
3	30	WE	7:00	2	7.75								
3	30	WE	10:30	15									
3	30	WE	14:00	12									
3	30	WE	17:30	2									

Appendix B. Table 1. Spring Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
April 1-15 Weekend Totals				**107**	**10.70**	**162.00**	**54**	**19**	**3.000**	**8.526**	**563.68**	**187.89**	**66.11**
4	5	WE	7:00	8	13.50								
4	5	WE	10:30	18									
4	5	WE	14:30	10									
4	5	WE	17:30	18									
4	13	WE	7:00	3	8.83								
4	13	WE	9:30	14									
4	13	WE	11:30	17									
4	13	WE	14:30	15									
4	13	WE	17:00	4									
4	13	WE	19:30	0									
April 16-30 Weekend Totals				**106**	**8.83**	**135.54**	**42**	**32**	**3.227**	**4.236**	**494.67**	**153.29**	**116.79**
4	19	WE	7:00	0	11.17								
4	19	WE	9:00	11									
4	19	WE	11:30	16									
4	19	WE	14:30	18									
4	19	WE	16:30	22									
4	19	WE	19:00	0									
4	27	WE	7:00	4	6.50								
4	27	WE	9:30	17									
4	27	WE	12:00	6									
4	27	WE	14:00	7									
4	27	WE	17:00	5									
4	27	WE	19:30	0									
May 1-15 Weekend Totals				**88**	**7.33**	**92.59**	**27**	**21**	**3.429**	**4.409**	**430.32**	**125.48**	**97.60**
5	3	WE	7:00	1	8.83								
5	3	WE	9:30	5									
5	3	WE	12:00	18									
5	3	WE	14:30	7									
5	3	WE	17:00	17									
5	3	WE	19:30	5									
5	11	WE	6:30	0	5.83								
5	11	WE	9:30	2									
5	11	WE	12:30	18									
5	11	WE	14:30	0									
5	11	WE	17:00	8									
5	11	WE	19:00	7									
May 16-31 Weekend Totals				**89**	**7.42**	**99.53**	**87**	**32**	**1.144**	**3.110**	**568.49**	**496.93**	**182.78**
5	17	WE	7:00	0	3.00								
5	17	WE	10:00	7									
5	17	WE	12:30	7									
5	17	WE	15:00	1									
5	17	WE	17:30	3									
5	17	WE	20:00	0									
5	25	WE	7:00	3	11.83								
5	25	WE	10:00	21									
5	25	WE	12:30	12									
5	25	WE	15:00	20									
5	25	WE	17:30	12									
5	25	WE	20:00	3									
June 1-15 Weekend Totals				**40**	**3.33**	**83.07**	**59**	**11**	**1.408**	**7.552**	**261.17**	**185.49**	**34.58**
6	7	WE	6:30	2	2.17								
6	7	WE	9:00	0									
6	7	WE	12:00	3									
6	7	WE	14:00	2									
6	7	WE	16:30	0									
6	7	WE	19:00	6									

Appendix B. Table 1. Spring Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvsted**	**Rainbow trout Released**
June 1-15 Weekend Totals Continued													
6	15	WE	6:30	1	4.50								
6	15	WE	9:00	3									
6	15	WE	11:30	15									
6	15	WE	14:00	6									
6	15	WE	16:30	0									
6	15	WE	19:00	2									
June 16-30 Weekend Totals				**66**	**5.50**	**50.23**	**26**	**15**	**1.932**	**3.349**	**348.26**	**180.27**	**104.00**
6	21	WE	6:30	0	5.00								
6	21	WE	9:00	2									
6	21	WE	11:30	1									
6	21	WE	14:00	7									
6	21	WE	17:00	17									
6	21	WE	19:00	3									
6	29	WE	6:30	4	6.00								
6	29	WE	9:00	4									
6	29	WE	11:30	8									
6	29	WE	14:00	8									
6	29	WE	16:30	6									
6	29	WE	19:00	6									
July 1-15 Weekend Totals				**54**	**4.91**	**53.33**	**24**	**30**	**2.222**	**1.778**	**305.93**	**137.68**	**172.10**
7	6	WE	7:00	0	4.50								
7	6	WE	9:30	1									
7	6	WE	12:00	10									
7	6	WE	14:30	6									
7	6	WE	17:00	7									
7	6	WE	19:30	3									
7	12	WE	7:00	3	5.40								
7	12	WE	10:00	2									
7	12	WE	13:00	4									
7	12	WE	16:00	6									
7	12	WE	19:00	12									
Spring Lake Weekend Sub-total				**774**		**974.40**	**478**	**179**			**4,627.51**	**2,359.30**	**883.44**
Spring Lake Season Totals				**1,071**		**1,384.11**	**769**	**277**			**8,060.93**	**4,662.54**	**1,730.21**

Appendix B. Table 2. Blue Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
March 1-15 Weekday Totals				**36**	**4.50**	**48.10**	**46**	**18**	**1.046**	**0.408**	**517.50**	**494.88**	**1,269.63**
3	7	WD	7:00	0	2.75								
3	7	WD	10:00	7									
3	7	WD	13:00	4									
3	7	WD	16:00	0									
3	13	WD	8:00	2	6.25								
3	13	WD	11:00	7									
3	13	WD	14:00	8									
3	13	WD	17:00	8									
March 16-31 Weekday Totals				**70**	**8.75**	**97.59**	**123**	**74**	**0.793**	**1.319**	**1,203.13**	**1,516.42**	**912.29**
3	19	WD	7:00	4	6.50								
3	19	WD	10:00	12									
3	19	WD	13:00	4									
3	19	WD	16:00	6									
3	28	WD	7:00	2	11.00								
3	28	WD	10:30	19									
3	28	WD	14:00	16									
3	28	WD	17:30	7									
April 1-15 Weekday Totals				**181**	**18.10**	**189.11**	**132**	**32**	**1.433**	**5.910**	**2,622.15**	**1,830.21**	**443.70**
4	1	WD	7:00	2	4.75								
4	1	WD	10:30	8									
4	1	WD	14:00	7									
4	1	WD	17:30	2									
4	11	WD	7:00	14	27.00								
4	11	WD	9:30	29									
4	11	WD	12:00	31									
4	11	WD	14:30	34									
4	11	WD	17:00	38									
4	11	WD	19:30	16									
April 16-30 Weekday Totals				**27**	**1.50**	**25.02**	**33**	**18**	**0.758**	**1.390**	**231.00**	**304.67**	**166.19**
4	17	WD	6:30	0	1.33								
4	17	WD	9:00	0									
4	17	WD	11:30	3									
4	17	WD	14:30	2									
4	17	WD	17:00	0									
4	17	WD	19:00	3									
4	24	WD	6:30	0	0.83								
4	24	WD	9:00	3									
4	24	WD	11:30	0									
4	24	WD	14:00	2									
4	24	WD	16:30	0									
4	24	WD	19:00	0									
4	29	WD	7:00	2	2.33								
4	29	WD	9:30	2									
4	29	WD	12:00	4									
4	29	WD	14:30	6									
4	29	WD	17:00	0									
4	29	WD	19:30	0									
May 1-15 Weekday Totals				**0**	**2.58**	**N/A**	**N/A**	**N/A**	**1.059**	**1.959**	**416.87**	**393.68**	**212.80**

No weekday creel surveys conducted during this period, data was determined by averaging the number of anglers from 4/29 and 5/16 and by calculating a combined catch and release rate for 4/29 and 5/16.

Appendix B. Table 2. Blue Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
May 16-31 Weekday Totals				**57**	**1.90**	**66.94**	**84**	**56**	**0.797**	**1.195**	**320.40**	**402.05**	**268.02**
5	16	WD	7:30	0	2.83								
5	16	WD	10:00	2									
5	16	WD	12:30	2									
5	16	WD	15:00	7									
5	16	WD	17:30	2									
5	16	WD	20:00	4									
5	20	WD	7:30	0	2.50								
5	20	WD	10:00	3									
5	20	WD	12:30	2									
5	20	WD	15:00	2									
5	20	WD	17:30	4									
5	20	WD	20:00	4									
5	21	WD	7:30	0	2.00								
5	21	WD	10:00	0									
5	21	WD	12:30	2									
5	21	WD	15:00	5									
5	21	WD	17:30	5									
5	21	WD	20:00	0									
5	28	WD	7:00	0	0.00								
5	28	WD	9:30	0									
5	28	WD	12:00	0									
5	28	WD	14:30	0									
5	28	WD	17:00	0									
5	28	WD	19:30	0									
5	29	WD	7:30	0	21.7								
5	29	WD	10:00	4									
5	29	WD	12:30	4									
5	29	WD	15:00	5									
5	29	WD	17:30	0									
5	29	WD	20:00	0									
June 1-15 Weekday Totals				**17**	**1.42**	**26.60**	**14**	**37**	**1.900**	**0.719**	**221.99**	**116.84**	**308.79**
6	3	WD	7:30	4	2.33								
6	3	WD	10:00	0									
6	3	WD	12:30	3									
6	3	WD	15:00	4									
6	3	WD	17:30	2									
6	3	WD	20:00	1									
6	10	WD	7:00	0	0.50								
6	10	WD	9:30	1									
6	10	WD	12:00	2									
6	10	WD	14:30	0									
6	10	WD	17:00	0									
6	10	WD	19:30	0									
June 16-30 Weekday Totals				**65**	**2.71**	**54.13**	**32**	**25**	**1.692**	**2.165**	**428.73**	**253.45**	**198.01**
6	18	WD	7:30	0	2.00								
6	18	WD	10:00	3									
6	18	WD	12:30	9									
6	18	WD	15:00	0									
6	18	WD	17:30	0									
6	18	WD	20:00	0									
6	20	WD	7:00	14	4.17								
6	20	WD	9:30	2									
6	20	WD	12:00	8									
6	20	WD	14:30	0									
6	20	WD	17:00	0									
6	20	WD	19:30	1									

Appendix B. Table 2. Blue Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
June 16-30 Weekday Totals Continued													
6	25	WD	7:00	0	2.33								
6	25	WD	9:30	2									
6	25	WD	12:00	6									
6	25	WD	14:30	5									
6	25	WD	17:00	1									
6	25	WD	19:30	0									
6	26	WD	8:00	0	2.33								
6	26	WD	10:30	8									
6	26	WD	13:00	4									
6	26	WD	15:30	0									
6	26	WD	18:00	2									
6	26	WD	20:30	0									
July 1-15 Weekday Totals				**36**	**2.00**	**34.23**	**9**	**11**	**3.803**	**3.112**	**311.60**	**81.93**	**100.13**
7	1	WD	7:00	0	2.17								
7	1	WD	9:30	2									
7	1	WD	12:00	4									
7	1	WD	14:30	2									
7	1	WD	17:00	5									
7	1	WD	19:30	0									
7	3	WD	6:30	0	2.67								
7	3	WD	9:00	6									
7	3	WD	11:30	9									
7	3	WD	14:00	0									
7	3	WD	16:30	1									
7	3	WD	19:00	0									
7	8	WD	7:00	0	1.17								
7	8	WD	9:30	5									
7	8	WD	12:00	1									
7	8	WD	14:30	0									
7	8	WD	17:00	0									
7	8	WD	19:30	1									
Blue Lake Weekday Sub-totals				**489**		**541.72**	**473**	**271**			**6,273.36**	**5,394.13**	**3,879.57**
March 1-15 Weekend Totals				**288**	**36.00**	**246.16**	**195**	**28**	**1.262**	**8.791**	**2,070.00**	**1,639.73**	**235.46**
3	1	WE	7:00	42	59.00								
3	1	WE	10:00	78									
3	1	WE	13:00	80									
3	1	WE	16:00	36									
3	8	WE	7:00	4	13.00								
3	8	WE	10:00	21									
3	8	WE	13:00	13									
3	8	WE	16:00	14									
March16-31 Weekend Totals				**172**	**21.50**	**174.77**	**272**	**48**	**0.643**	**3.641**	**1,343.75**	**2,091.44**	**369.06**
3	16	WE	7:30	14	24.25								
3	16	WE	11:00	41									
3	16	WE	14:30	36									
3	16	WE	17:30	6									
3	30	WE	7:00	0	18.75								
3	30	WE	10:30	25									
3	30	WE	14:00	36									
3	30	WE	17:30	14									

Appendix B. Table 2. Blue Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
April 1-15 Weekend Totals				**149**	**14.90**	**147.90**	**70**	**16**	**2.113**	**9.244**	**784.93**	**371.50**	**84.91**
4	5	WE	7:00	2	17.00								
4	5	WE	10:30	24									
4	5	WE	14:30	27									
4	5	WE	17:30	15									
4	13	WE	7:00	2	13.50								
4	13	WE	9:30	24									
4	13	WE	11:30	18									
4	13	WE	14:30	21									
4	13	WE	17:00	11									
4	13	WE	19:30	5									
April 16-30 Weekend Totals				**173**	**14.42**	**177.11**	**95**	**35**	**1.864**	**5.060**	**807.33**	**433.05**	**159.54**
4	19	WE	7:00	6	18.67								
4	19	WE	9:00	11									
4	19	WE	11:30	44									
4	19	WE	14:30	25									
4	19	WE	16:30	11									
4	19	WE	19:00	15									
4	27	WE	7:00	0	10.17								
4	27	WE	9:30	14									
4	27	WE	12:00	23									
4	27	WE	14:00	11									
4	27	WE	17:00	10									
4	27	WE	19:30	3									
May 1-15 Weekend Totals				**68**	**5.67**	**76.13**	**62**	**11**	**1.228**	**6.921**	**332.52**	**270.80**	**48.05**
5	3	WE	7:00	0	6.50								
5	3	WE	9:30	8									
5	3	WE	12:00	13									
5	3	WE	14:30	2									
5	3	WE	17:00	12									
5	3	WE	19:30	4									
5	11	WE	6:30	0	4.83								
5	11	WE	9:30	5									
5	11	WE	12:30	11									
5	11	WE	14:30	4									
5	11	WE	17:00	6									
5	11	WE	19:00	3									
May 16-31 Weekend Totals				**183**	**15.25**	**211.16**	**193**	**71**	**1.094**	**2.974**	**1,168.91**	**1,068.38**	**393.03**
5	17	WE	7:00	0	8.17								
5	17	WE	10:00	8									
5	17	WE	12:30	13									
5	17	WE	15:00	6									
5	17	WE	17:30	20									
5	17	WE	20:00	2									
5	25	WE	7:00	7	22.33								
5	25	WE	10:00	40									
5	25	WE	12:30	18									
5	25	WE	15:00	24									
5	25	WE	17:30	23									
5	25	WE	20:00	22									
June 1-15 Weekend Totals				**89**	**7.42**	**101.64**	**88**	**59**	**1.155**	**1.723**	**581.10**	**503.11**	**337.32**
6	7	WE	6:30	0	4.50								
6	7	WE	9:00	3									
6	7	WE	12:00	5									
6	7	WE	14:00	8									
6	7	WE	16:30	5									
6	7	WE	19:00	6									

Appendix B. Table 2. Blue Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
June 1-15 Weekend Totals Continued													
6	15	WE	6:30	0	10.33								
6	15	WE	9:00	8									
6	15	WE	11:30	18									
6	15	WE	14:00	20									
6	15	WE	16:30	11									
6	15	WE	19:00	5									
June 16-30 Weekend Totals				**92**	**7.67**	**154.40**	**73**	**54**	**2.115**	**2.859**	**485.45**	**229.52**	**169.78**
6	21	WE	6:30	0	10.33								
6	21	WE	9:00	13									
6	21	WE	11:30	10									
6	21	WE	14:00	12									
6	21	WE	17:00	12									
6	21	WE	19:00	15									
6	29	WE	6:30	2	5.00								
6	29	WE	9:00	11									
6	29	WE	11:30	5									
6	29	WE	14:00	2									
6	29	WE	16:30	8									
6	29	WE	19:00	2									
July 1-15 Weekend Totals				**26**	**2.36**	**22.94**	**10**	**16**	**2.294**	**1.434**	**147.30**	**64.21**	**102.74**
7	6	WE	7:00	1	1.00								
7	6	WE	9:30	0									
7	6	WE	12:00	2									
7	6	WE	14:30	3									
7	6	WE	17:00	0									
7	6	WE	19:30	0									
7	12	WE	7:00	8	4.00								
7	12	WE	10:00	0									
7	12	WE	13:00	4									
7	12	WE	16:00	4									
7	12	WE	19:00	4									
Blue Lake Weekend Sub-total				**1,240**		**1,312.21**	**1,058**	**338**			**7,721.30**	**6,671.74**	**1,899.88**
Blue Lake Season Totals				**1,729**		**1,853.93**	**1,531**	**609**			**13,994.66**	**12,065.88**	**5,779.45**

Appendix B. Table 3. Rainbow Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
March 1-15 Weekday Totals				**33**	**4.13**	**41.47**	**28**	**16**	**1.481**	**2.592**	**474.38**	**320.29**	**183.02**
3	7	WD	7:00	0	4.75								
3	7	WD	10:00	13									
3	7	WD	13:00	5									
3	7	WD	16:00	1									
3	13	WD	8:00	0	3.50								
3	13	WD	11:00	7									
3	13	WD	14:00	6									
3	13	WD	17:00	1									
March 16-31 Weekday Totals				**59**	**7.38**	**75.39**	**114**	**68**	**0.661**	**1.109**	**1,014.06**	**1,533.44**	**914.64**
3	19	WD	7:00	2	6.25								
3	19	WD	10:00	12									
3	19	WD	13:00	4									
3	19	WD	16:00	7									
3	28	WD	7:00	0	8.50								
3	28	WD	10:30	18									
3	28	WD	14:00	9									
3	28	WD	17:30	7									
April 1-15 Weekday Totals				**148**	**14.80**	**140.87**	**60**	**29**	**2.348**	**4.858**	**2,144.08**	**913.23**	**441.39**
4	1	WD	7:00	0	4.00								
4	1	WD	10:30	7									
4	1	WD	14:00	2									
4	1	WD	17:30	7									
4	11	WD	7:00	0	22.00								
4	11	WD	9:30	34									
4	11	WD	12:00	40									
4	11	WD	14:30	28									
4	11	WD	17:00	18									
4	11	WD	19:30	12									
April 16-30 Weekday Totals				**60**	**3.33**	**48.81**	**24**	**8**	**2.034**	**6.101**	**513.33**	**252.40**	**84.14**
4	17	WD	6:30	0	4.83								
4	17	WD	9:00	8									
4	17	WD	11:30	7									
4	17	WD	14:30	3									
4	17	WD	17:00	2									
4	17	WD	19:00	9									
4	24	WD	6:30	0	1.67								
4	24	WD	9:00	3									
4	24	WD	11:30	7									
4	24	WD	14:00	0									
4	24	WD	16:30	0									
4	24	WD	19:00	0									
4	29	WD	7:00	2	3.50								
4	29	WD	9:30	4									
4	29	WD	12:00	8									
4	29	WD	14:30	4									
4	29	WD	17:00	1									
4	29	WD	19:30	2									
May 1-15 Weekday Totals				**0**	**2.83**	**N/A**	**N/A**	**N/A**	**1.744**	**1.642**	**457.22**	**262.10**	**278.48**

No weekday creel surveys conducted during this period, data was determined by averaging the number of anglers from 4/29 and 5/16 and by calculating a combined catch and release rate for 4/29 and 5/16.

Appendix B. Table 3. Rainbow Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
May 16-31 Weekday Totals				**81**	**2.70**	**96.04**	**88**	**61**	**1.091**	**1.574**	**455.30**	**417.17**	**289.19**
5	16	WD	7:30	0	2.17								
5	16	WD	10:00	4									
5	16	WD	12:30	3									
5	16	WD	15:00	4									
5	16	WD	17:30	2									
5	16	WD	20:00	0									
5	20	WD	7:30	0	3.00								
5	20	WD	10:00	0									
5	20	WD	12:30	8									
5	20	WD	15:00	9									
5	20	WD	17:30	1									
5	20	WD	20:00	0									
5	21	WD	7:30	2	2.50								
5	21	WD	10:00	8									
5	21	WD	12:30	0									
5	21	WD	15:00	1									
5	21	WD	17:30	4									
5	21	WD	20:00	0									
5	28	WD	7:00	1	3.67								
5	28	WD	9:30	4									
5	28	WD	12:00	1									
5	28	WD	14:30	5									
5	28	WD	17:00	11									
5	28	WD	19:30	0									
5	29	WD	7:30	1	2.17								
5	29	WD	10:00	0									
5	29	WD	12:30	4									
5	29	WD	15:00	5									
5	29	WD	17:30	3									
5	29	WD	20:00	0									
June 1-15 Weekday Totals				**40**	**3.33**	**71.46**	**78**	**28**	**0.916**	**2.552**	**522.33**	**570.11**	**204.67**
6	3	WD	7:30	0	3.50								
6	3	WD	10:00	5									
6	3	WD	12:30	8									
6	3	WD	15:00	2									
6	3	WD	17:30	5									
6	3	WD	20:00	1									
6	10	WD	7:00	0	3.17								
6	10	WD	9:30	6									
6	10	WD	12:00	3									
6	10	WD	14:30	0									
6	10	WD	17:00	2									
6	10	WD	19:30	8									
June 16-30 Weekday Totals				**90**	**3.75**	**87.59**	**58**	**17**	**1.510**	**5.152**	**593.63**	**393.08**	**115.21**
6	18	WD	7:30	0	3.50								
6	18	WD	10:00	5									
6	18	WD	12:30	2									
6	18	WD	15:00	7									
6	18	WD	17:30	7									
6	18	WD	20:00	0									
6	20	WD	7:00	0	4.33								
6	20	WD	9:30	2									
6	20	WD	12:00	5									
6	20	WD	14:30	11									
6	20	WD	17:00	5									
6	20	WD	19:30	3									

Appendix B. Table 3. Rainbow Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
June 16-30 Weekday Totals Continued													
6	25	WD	7:00	0	4.00								
6	25	WD	9:30	3									
6	25	WD	12:00	4									
6	25	WD	14:30	1									
6	25	WD	17:00	6									
6	25	WD	19:30	10									
6	26	WD	8:00	0	3.17								
6	26	WD	10:30	7									
6	26	WD	13:00	7									
6	26	WD	15:30	5									
6	26	WD	18:00	0									
6	26	WD	20:30	0									
July 1-15 Weekday Totals				**72**	**4.00**	**68.80**	**20**	**6**	**3.440**	**11.467**	**623.20**	**181.16**	**54.35**
7	1	WD	7:00	0	3.67								
7	1	WD	9:30	10									
7	1	WD	12:00	6									
7	1	WD	14:30	2									
7	1	WD	17:00	0									
7	1	WD	19:30	4									
7	3	WD	6:30	5	3.83								
7	3	WD	9:00	1									
7	3	WD	11:30	2									
7	3	WD	14:00	6									
7	3	WD	16:30	3									
7	3	WD	19:00	6									
7	8	WD	7:00	0	4.50								
7	8	WD	9:30	4									
7	8	WD	12:00	5									
7	8	WD	14:30	6									
7	8	WD	17:00	8									
7	8	WD	19:30	4									
Rainbow Lake Weekday Sub-totals				**583**		**630.43**	**470**	**233**			**6,797.52**	**4,842.98**	**2,565.09**
March 1-15 Weekend Totals				**179**	**22.38**	**200.81**	**181**	**30**	**1.109**	**6.694**	**1,286.56**	**1,159.69**	**192.20**
3	1	WE	7:00	16	31.50								
3	1	WE	10:00	50									
3	1	WE	13:00	30									
3	1	WE	16:00	30									
3	8	WE	7:00	9	13.25								
3	8	WE	10:00	9									
3	8	WE	13:00	23									
3	8	WE	16:00	12									
March16-31 Weekend Totals				**214**	**26.75**	**300.11**	**306**	**93**	**0.981**	**3.227**	**1,671.88**	**1,704.60**	**518.09**
3	16	WE	7:30	8	25.25								
3	16	WE	11:00	68									
3	16	WE	14:30	23									
3	16	WE	17:30	2									
3	30	WE	7:00	12	28.25								
3	30	WE	10:30	49									
3	30	WE	14:00	41									
3	30	WE	17:30	11									
April 1-15 Weekend Totals				**128**	**12.80**	**139.66**	**67**	**12**	**2.085**	**11.638**	**674.30**	**323.48**	**57.94**
4	5	WE	7:00	3	17.50								
4	5	WE	10:30	30									
4	5	WE	14:30	26									
4	5	WE	17:30	11									

Appendix B. Table 3. Rainbow Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					**Expanded Totals**		

Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
April 1-15 Weekend Totals Continued													
4	13	WE	7:00	3	9.67								
4	13	WE	9:30	16									
4	13	WE	11:30	28									
4	13	WE	14:30	2									
4	13	WE	17:00	5									
4	13	WE	19:30	4									
April 16-30 Weekend Totals				**178**	**14.83**	**210.45**	**68**	**30**	**3.095**	**7.015**	**830.67**	**268.40**	**118.41**
4	19	WE	7:00	8	21.00								
4	19	WE	9:00	21									
4	19	WE	11:30	33									
4	19	WE	14:30	33									
4	19	WE	16:30	15									
4	19	WE	19:00	16									
4	27	WE	7:00	3	8.67								
4	27	WE	9:30	16									
4	27	WE	12:00	17									
4	27	WE	14:00	11									
4	27	WE	17:00	4									
4	27	WE	19:30	1									
May 1-15 Weekend Totals				**144**	**12.00**	**204.80**	**138**	**60**	**1.484**	**3.413**	**704.16**	**474.47**	**206.30**
5	3	WE	7:00	8	17.00								
5	3	WE	9:30	14									
5	3	WE	12:00	25									
5	3	WE	14:30	7									
5	3	WE	17:00	27									
5	3	WE	19:30	21									
5	11	WE	6:30	2	7.00								
5	11	WE	9:30	11									
5	11	WE	12:30	6									
5	11	WE	14:30	7									
5	11	WE	17:00	11									
5	11	WE	19:00	5									
May 16-31 Weekend Totals				**220**	**18.33**	**299.12**	**151**	**55**	**1.981**	**5.439**	**1,405.25**	**709.40**	**258.39**
5	17	WE	7:00	2	9.17								
5	17	WE	10:00	18									
5	17	WE	12:30	17									
5	17	WE	15:00	8									
5	17	WE	17:30	6									
5	17	WE	20:00	4									
5	25	WE	7:00	8	27.50								
5	25	WE	10:00	44									
5	25	WE	12:30	21									
5	25	WE	15:00	38									
5	25	WE	17:30	30									
5	25	WE	20:00	24									
June 1-15 Weekend Totals				**138**	**11.50**	**255.82**	**85**	**48**	**3.010**	**5.330**	**901.03**	**299.38**	**169.06**
6	7	WE	6:30	0	11.67								
6	7	WE	9:00	9									
6	7	WE	12:00	13									
6	7	WE	14:00	10									
6	7	WE	16:30	12									
6	7	WE	19:00	26									

Appendix B. Table 3. Rainbow Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					**Expanded Totals**		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
June 1-15 Weekend Totals Continued													
6	15	WE	6:30	5	11.33								
6	15	WE	9:00	12									
6	15	WE	11:30	21									
6	15	WE	14:00	14									
6	15	WE	16:30	9									
6	15	WE	19:00	7									
June 16-30 Weekend Totals				**66**	**5.50**	**61.15**	**28**	**17**	**2.184**	**3.597**	**348.26**	**159.47**	**96.82**
6	21	WE	6:30	2	7.33								
6	21	WE	9:00	2									
6	21	WE	11:30	9									
6	21	WE	14:00	16									
6	21	WE	17:00	13									
6	21	WE	19:00	2									
6	29	WE	6:30	2	3.67								
6	29	WE	9:00	12									
6	29	WE	11:30	6									
6	29	WE	14:00	2									
6	29	WE	16:30	0									
6	29	WE	19:00	0									
July 1-15 Weekend Totals				**63**	**5.73**	**71.31**	**10**	**5**	**7.131**	**14.262**	**356.92**	**50.05**	**25.03**
7	6	WE	7:00	2	5.17								
7	6	WE	9:30	9									
7	6	WE	12:00	11									
7	6	WE	14:30	5									
7	6	WE	17:00	4									
7	6	WE	19:30	0									
7	12	WE	7:00	7	6.40								
7	12	WE	10:00	7									
7	12	WE	13:00	2									
7	12	WE	16:00	9									
7	12	WE	19:00	7									
Rainbow Lake Weekend Sub-total				**1,330**		**1,743.23**	**1,034**	**350**			**8,179.03**	**5,148.95**	**1,642.24**
Rainbow Lake Season Totals				**1,913**		**2,373.66**	**1,504**	**583**			**14,976.55**	**9,991.93**	**4,207.33**

Appendix B. Table 3. Deer Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
March 1-15 Weekday Totals				**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
No surveys done this lake was added to the ceel in late March													
March 16-31 Weekday Totals				**0**	**0.00**	**0.00**	**0**	**0**	**0.000**	**0.000**	**0.00**	**0.00**	**0.00**
3	28	WD	7:00	0	0.00								
3	28	WD	10:30	0									
3	28	WD	14:00	0									
3	28	WD	17:30	0									
April 1-15 Weekday Totals				**8**	**0.80**	**8.00**	**2**	**0**	**4.000**	**0.000**	**115.90**	**28.97**	**0.00**
4	1	WD	7:00	0	0.00								
4	1	WD	10:30	0									
4	1	WD	14:00	0									
4	1	WD	17:30	0									
4	11	WD	7:00	0	1.33								
4	11	WD	9:30	8									
4	11	WD	12:00	0									
4	11	WD	14:30	0									
4	11	WD	17:00	0									
4	11	WD	19:30	0									
April 16-30 Weekday Totals				**4**	**0.22**	**5.09**	**1**	**0**	**5.090**	**0.000**	**34.22**	**6.72**	**0.00**
4	17	WD	6:30	0	0.00								
4	17	WD	9:00	0									
4	17	WD	11:30	0									
4	17	WD	14:30	0									
4	17	WD	17:00	0									
4	17	WD	19:00	0									
4	24	WD	6:30	0	0.17								
4	24	WD	9:00	1									
4	24	WD	11:30	0									
4	24	WD	14:00	0									
4	24	WD	16:30	0									
4	24	WD	19:00	0									
4	29	WD	7:00	0	0.50								
4	29	WD	9:30	0									
4	29	WD	12:00	0									
4	29	WD	14:30	3									
4	29	WD	17:00	0									
4	29	WD	19:30	0									
May 1-15 Weekday Totals				**0**	**0.42**	**N/A**	**N/A**	**N/A**	**1.106**	**2.950**	**67.24**	**60.78**	**22.79**
No weekday creel surveys conducted during this period, data was determined by averaging the number of anglers from 4/29 and 5/16 and by calculating a combined catch and release rate for 4/29 and 5/16.													
May 16-31 Weekday Totals				**4**	**0.13**	**4.84**	**16**	**3**	**0.303**	**1.163**	**22.48**	**74.33**	**19.33**
5	16	WD	7:30	0	0.33								
5	16	WD	10:00	2									
5	16	WD	12:30	0									
5	16	WD	15:00	0									
5	16	WD	17:30	0									
5	16	WD	20:00	0									
5	20	WD	7:30	0	0.00								
5	20	WD	10:00	0									
5	20	WD	12:30	0									
5	20	WD	15:00	0									
5	20	WD	17:30	0									
5	20	WD	20:00	0									

Appendix B. Table 3. Deer Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
May 16-31 Weekday Totals Continued													
5	21	WD	7:30	0	0.00								
5	21	WD	10:00	0									
5	21	WD	12:30	0									
5	21	WD	15:00	0									
5	21	WD	17:30	0									
5	21	WD	20:00	0									
5	28	WD	7:00	0	0.33								
5	28	WD	9:30	2									
5	28	WD	12:00	0									
5	28	WD	14:30	0									
5	28	WD	17:00	0									
5	28	WD	19:30	0									
5	29	WD	7:30	0	0.00								
5	29	WD	10:00	0									
5	29	WD	12:30	0									
5	29	WD	15:00	0									
5	29	WD	17:30	0									
5	29	WD	20:00	0									
June 1-15 Weekday Totals				**6**	**0.50**	**5.16**	**4**	**3**	**1.290**	**1.720**	**78.35**	**60.74**	**45.55**
6	3	WD	7:30	0	0.67								
6	3	WD	10:00	2									
6	3	WD	12:30	0									
6	3	WD	15:00	0									
6	3	WD	17:30	2									
6	3	WD	20:00	0									
6	10	WD	7:00	0	0.33								
6	10	WD	9:30	0									
6	10	WD	12:00	0									
6	10	WD	14:30	0									
6	10	WD	17:00	2									
6	10	WD	19:30	0									
June 16-30 Weekday Totals				**1**	**0.04**	**0.34**	**0**	**0**	**0.000**	**0.000**	**6.60**	**0.00**	**0.00**
6	18	WD	7:30	0	0.17								
6	18	WD	10:00	1									
6	18	WD	12:30	0									
6	18	WD	15:00	0									
6	18	WD	17:30	0									
6	18	WD	20:00	0									
6	20	WD	7:00	0	0.00								
6	20	WD	9:30	0									
6	20	WD	12:00	0									
6	20	WD	14:30	0									
6	20	WD	17:00	0									
6	20	WD	19:30	0									
6	25	WD	7:00	0	0.00								
6	25	WD	9:30	0									
6	25	WD	12:00	0									
6	25	WD	14:30	0									
6	25	WD	17:00	0									
6	25	WD	19:30	0									
6	26	WD	8:00	0	0.00								
6	26	WD	10:30	0									
6	26	WD	13:00	0									
6	26	WD	15:30	0									
6	26	WD	18:00	0									
6	26	WD	20:30	0									

Appendix B. Table 3. Deer Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					Expanded Totals		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
July 1-15 Weekday Totals				**2**	**0.11**	**1.25**	**4**	**2**	**0.313**	**0.625**	**17.31**	**55.40**	**27.70**
7	1	WD	7:00	0	0.17								
7	1	WD	9:30	0									
7	1	WD	12:00	0									
7	1	WD	14:30	1									
7	1	WD	17:00	0									
7	1	WD	19:30	0									
7	3	WD	6:30	0	0.17								
7	3	WD	9:00	0									
7	3	WD	11:30	1									
7	3	WD	14:00	0									
7	3	WD	16:30	0									
7	3	WD	19:00	0									
7	8	WD	7:00	0	0.00								
7	8	WD	9:30	0									
7	8	WD	12:00	0									
7	8	WD	14:30	0									
7	8	WD	17:00	0									
7	8	WD	19:30	0									
Deer Lake Weekday Sub-totals				**25**		**24.68**	**27**	**8**			**342.10**	**286.93**	**115.37**
March 1-15 Weekend Totals				**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
No surveys done this lake was added to the creel in late March													
March16-31 Weekend Totals				**11**	**2.75**	**17.00**	**10**	**5**	**1.700**	**3.400**	**171.88**	**101.10**	**50.55**
3	30	WE	7:00	0	2.75								
3	30	WE	10:30	4									
3	30	WE	14:00	4									
3	30	WE	17:30	3									
April 1-15 Weekend Totals				**12**	**1.20**	**18.73**	**14**	**1**	**1.338**	**18.730**	**63.22**	**47.25**	**3.38**
4	5	WE	7:00	0	1.50								
4	5	WE	10:30	0									
4	5	WE	14:30	6									
4	5	WE	17:30	0									
4	13	WE	7:00	0	1.00								
4	13	WE	9:30	0									
4	13	WE	11:30	3									
4	13	WE	14:30	0									
4	13	WE	17:00	3									
4	13	WE	19:30	0									
April 16-30 Weekend Totals				**9**	**0.75**	**12.47**	**9**	**0**	**1.386**	**0.000**	**42.00**	**30.31**	**0.00**
4	19	WE	7:00	0	0.50								
4	19	WE	9:00	0									
4	19	WE	11:30	0									
4	19	WE	14:30	3									
4	19	WE	16:30	0									
4	19	WE	19:00	0									
4	27	WE	7:00	0	1.00								
4	27	WE	9:30	1									
4	27	WE	12:00	0									
4	27	WE	14:00	5									
4	27	WE	17:00	0									
4	27	WE	19:30	0									

Appendix B. Table 3. Deer Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					**Expanded Totals**		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
May 1-15 Weekend Totals				**13**	**1.08**	**12.85**	**4**	**1**	**3.213**	**12.850**	**63.57**	**19.79**	**4.95**
5	3	WE	7:00	0	2.17								
5	3	WE	9:30	8									
5	3	WE	12:00	5									
5	3	WE	14:30	0									
5	3	WE	17:00	0									
5	3	WE	19:30	0									
5	11	WE	6:30	0	0.00								
5	11	WE	9:30	0									
5	11	WE	12:30	0									
5	11	WE	14:30	0									
5	11	WE	17:00	0									
5	11	WE	19:00	0									
May 16-31 Weekend Totals				**38**	**3.17**	**55.86**	**42**	**8**	**1.330**	**6.983**	**242.73**	**182.50**	**34.76**
5	17	WE	7:00	0	1.00								
5	17	WE	10:00	0									
5	17	WE	12:30	0									
5	17	WE	15:00	6									
5	17	WE	17:30	0									
5	17	WE	20:00	0									
5	25	WE	7:00	4	5.33								
5	25	WE	10:00	7									
5	25	WE	12:30	2									
5	25	WE	15:00	4									
5	25	WE	17:30	9									
5	25	WE	20:00	6									
June 1-15 Weekend Totals				**7**	**0.58**	**0.64**	**0**	**0**	**0.000**	**0.000**	**45.70**	**0.00**	**0.00**
6	7	WE	6:30	0	0.00								
6	7	WE	9:00	0									
6	7	WE	12:00	0									
6	7	WE	14:00	0									
6	7	WE	16:30	0									
6	7	WE	19:00	0									
6	15	WE	6:30	0	1.17								
6	15	WE	9:00	5									
6	15	WE	11:30	2									
6	15	WE	14:00	0									
6	15	WE	16:30	0									
6	15	WE	19:00	0									
June 16-30 Weekend Totals				**15**	**1.25**	**4.00**	**1**	**0**	**4.000**	**0.000**	**79.15**	**19.79**	**0.00**
6	21	WE	6:30	0	1.83								
6	21	WE	9:00	0									
6	21	WE	11:30	0									
6	21	WE	14:00	3									
6	21	WE	17:00	4									
6	21	WE	19:00	4									
6	29	WE	6:30	0	0.67								
6	29	WE	9:00	4									
6	29	WE	11:30	0									
6	29	WE	14:00	0									
6	29	WE	16:30	0									
6	29	WE	19:00	0									

Appendix B. Table 3. Deer Lake Angler Effort and Harvest, 2003.

			Angler Counts			Creel Data					**Expanded Totals**		
Month	Day	WE/WD	Time	# of Anglers	Average # of Anglers	Total Hours	RBT Harvested	RBT Released	Average Catch Rate (hrs/fish harvested)	Average Release Rate (hrs/fish released)	**Angler Effort (hrs)**	**Rainbow trout Harvested**	**Rainbow trout Released**
July 1-15 Weekend Totals				**6**	**0.55**	**6.24**	**5**	**0**	**1.248**	**0.000**	**33.99**	**27.24**	**0.00**
7	6	WE	7:00	0	0.00								
7	6	WE	9:30	0									
7	6	WE	12:00	0									
7	6	WE	14:30	0									
7	6	WE	17:00	0									
7	6	WE	19:30	0									
7	12	WE	7:00	0	1.20								
7	12	WE	10:00	1									
7	12	WE	13:00	2									
7	12	WE	16:00	3									
7	12	WE	19:00	0									
Deer Lake Weekend Sub-total				**111**		**127.79**	**85**	**15**			**742.23**	**427.98**	**93.64**
Deer Lake Season Totals				**136**		**152.47**	**112**	**23**			**1,084.33**	**714.91**	**209.01**

Appendix C. Angler Residence Data from all Interviews Conducted During the Sampling Season for the Tucannon Lakes Creel Surveys, 2003.

Appendix C. Angler residence data from all interviews conducted during the sampling season for the Tucannon Lakes creel surveys, 2003.

Residence	Number of Anglers	% of Anglers
Washington State Anglers		
Columbia and Garfield County Anglers		
Blind Grade	4	0.11
Dayton	170	4.64
Lyons Ferry	5	0.14
Pomeroy	136	3.71
Starbuck	7	0.19
Tucannon	3	0.08
Columbia and Garfield County Totals	**325**	**8.87**
Walla Walla and Asotin County Anglers		
Asotin	2	0.05
Burbank	35	0.96
Clarkston	32	0.87
College Place	19	0.52
Dixie	12	0.33
Prescott	18	0.49
Touchet	38	1.04
Waitsburg	92	2.51
Walla Walla	537	14.66
Wallula	8	0.22
Walla Walla and Asotin County Totals	**793**	**21.65**
Other Cities in Washington State		
Arlington	1	0.03
Bellevue	1	0.03
Benton City	42	1.15
Chehalis	1	0.03
Cheney	5	0.14
Cle-Elum	2	0.05
Colfax	8	0.22
Connell	29	0.79
Ellensburg	6	0.16
Eltopia	4	0.11
Finley	5	0.14
Gig Harbor	13	0.35
Goldendale	3	0.08
Grandview	54	1.47
Hoquiam	1	0.03
Ione	2	0.05
Kahlotus	21	0.57
Lind	14	0.38
Mesa	6	0.16
Moses Lake	13	0.35
Olympia	1	0.03
Othello	27	0.74
Prosser	68	1.86
Pullman	23	0.63
Puyallup	5	0.14
Reardon	1	0.03
Redman	3	0.08
Ridgefield	4	0.11
Ritzville	1	0.03
Sammamish	1	0.03
Seattle	16	0.44
Silverdale	1	0.03
Snohomish	1	0.03
Soap Lake	2	0.05
Spokane	38	1.04
Sunnyside	3	0.08
Tri-Cities	1,928	52.63
Union Town	1	0.03
Vancouver	10	0.27
Washtucna	7	0.19
Wenatchee	1	0.03
Whidbey Island	4	0.11
Yakima	39	1.06
Zillah	2	0.05
Washington Totals	**3536**	**96.53**
Oregon State Anglers		
Glide, OR	2	0.05
Hermiston, OR	8	0.22
Irrigon, OR	11	0.30
Medford, OR	3	0.08
Milton-Freewater, OR	33	0.90
Portland, OR	3	0.08
Salem, OR	2	0.05
Wallowa, OR	1	0.03
Oregon Totals	**63**	**1.72**
Idaho State Anglers		
Bothell, ID	4	0.11
Lewiston, ID	9	0.25
Peck, ID	7	0.19
Pocatello, ID	3	0.08
Whinchester, ID	12	0.33
Idaho Totals	**35**	**0.96**
Anglers from other U.S. Cities and States		
Alabama	1	0.03
Arizona	3	0.08
Mesa, AZ	2	0.05
California	1	0.03
Sacramento, CA	2	0.05
Florida	1	0.03
Michigan	1	0.03
Missouri	1	0.03
Nebraska	5	0.14
Las Vegas, NV	6	0.16
Carson City, NV	1	0.03
Texas	1	0.03
Salt Lake City, UT	1	0.03
Wisconsin	3	0.08
Other Totals	**29**	**0.79**

This program receives Federal financial assistance from the U.S. Fish and Wildlife Service Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972. The U.S. Department of the Interior and its bureaus prohibit discrimination on the bases of race, color, national origin, age, disability and sex (in educational programs). If you believe that you have been discriminated against in any program, activity or facility, please write to:

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Civil Rights Coordinator for Public Access
4401 N. Fairfax Drive, Mail Stop: WSFR-4020
Arlington, VA 22203

Project Number: **30000481**
Project Title: **Wooten Wildlife Area Improve Flood Plain**

Description

Project Phase Title: Design and Permitting
Starting Fiscal Year: 2014
Project Class: Preservation
Agency Priority: 3

Project Summary

The Department will renovate the flood plain in the Wooten Wildlife Area to improve spawning and rearing habitat for ESA listed fish, protect private and public property, improve recreational fishing opportunities and increase revenue to the local economies.

Project Description

What is the proposed project?

An agency-wide, cross-program committee is currently engaged in writing the Wooten Floodplain Management Plan (FMP) for the 17 miles of Tucannon River that is located within the boundaries of the Wooten Wildlife Area. The Department has a unique opportunity to possibly obtain federal funding to help with implementation of this plan. The projects will improve spawning and rearing habitat for ESA listed fish in the Tucannon River, protects private and public property, improves recreational lake fishing opportunities, and extends the number of lake fishing days, increasing revenue to the local economies. The Department would like to phase this project out over three biennia to accommodate the possible funding from the BPA. The cost estimate associated with this project could change once the Department completes a predesign.

Phase 1 (2013-2015): Feasibility (Development, design and permitting of projects, outreach and early action projects)
Project Design and Permitting
Early Action Projects – Campground Relocation out of the floodplain
Habitat Enhancement (Spending Authority: BPA)
Additional Project Development under Initiatives

Phase 2 (2015-2017): Project Implementation Part 1
Rainbow Lake Enhancement
Deer Lake Enhancement
Tucannon Power line
Habitat Enhancement (Spending Authority: BPA)
Additional Projects Developed Under Phase 1

Phase 3 (2017-2019): Project Implementation Part 2
Beaver-Watson Lake Enhancement
Spring Lake Enhancement
Big Four Lake Decommissioning
Camp Wooten Reconfiguration/Relocation
Habitat Enhancement (Spending Authority: BPA)
Additional Projects Developed Under Phase 1

What opportunity or problem is driving this request?

The BPA may fund up to $1,300,000 a year until 2018 to support restoration projects in the Tucannon. Much of the work identified is on the Wooten Wildlife Area. The Department will need to compete for these funds and we are optimistic that we may receive funding if we can contribute funding to a portion of these projects.

The W.T. Wooten Wildlife Area covers approximately 16,000 acres in Columbia and Garfield counties and features eight lakes located along the Tucannon River. The Wooten Floodplain Management Plan has been driven by several factors, primary among which are the deteriorating condition of the Tucannon Lakes and associated infrastructure and the Bonneville Power Administration and the Snake River Salmon Recovery Board focus of spring Chinook recovery in the Tucannon River. The

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Report Number: CBS002
Date Run: 9/10/2012 11:25AM

Project Number: 30000481
Project Title: Wooten Wildlife Area Improve Flood Plain

Description

FMP team has identified lake rehabilitation as a priority, designed to improve and enhance recreation, reduce impacts to ESA listed species, and improve stream and floodplain function for the Tucannon River.

The current condition and configuration of most of the Tucannon Lakes is an ecological detriment to the Tucannon River floodplain function and drives constant maintenance needs. All but two lakes constrict the floodplain of the Tucannon River, causing the river to be channelized and incised. All of the lakes drain back into the river, leading to increased water temperatures. The dikes/levees of all eight lakes are in violation of the Department of Ecology's Dam Safety requirements. The lakes retain sediment and have to be periodically dredged out. Six of the lakes rely on surface diversions from the Tucannon River. The current diversions have had periodic failure issues in recent years impacting both the fishing availability of the lakes to the public and potentially endangering listed salmonids.

Bonneville Power Administration (BPA) has established funding through the Snake River Salmon Recovery Board to restore Spring Chinook habitat in the Tucannon River Basin. BPA will spend about 1.3 million dollars per year through 2018. Restoration strategies and recommendations were developed based on limiting factors identified in the Tucannon Sub basin Plan, Snake River Salmon Recovery Plan, and the Tucannon River Geomorphic Assessment and Habitat Restoration Study. Of a prioritized list of projects developed from this review, 75 percent of the top tiered projects are located on the Wooten Wildlife Area. This means that between six and nine million BPA dollars could be spent on habitat enhancement projects on the Wildlife Area between now and the end of the 2017-2019 Biennium.

How does the project support the agency and statewide results?
This project supports the agency's strategic plan by enhancing fish rearing habitat for ESA listed fish. This project also enhances fishing opportunities by increasing the number of fishing days in this area.

Goal 1: Conserve and protect native fish and wildlife
Objective C: Enhance and improve land and water stewardship to meet conservation goals
Strategies
Ensure department lands, fishways, screening structures, water intakes, dams and dikes are compliant with regulations

Goal 2: Provide sustainable fishing, hunting and other wildlife-related recreational experiences
Objective A: Increase the economic benefits and public participation derived from sustainable fish and wildlife opportunities
Strategies
Increase access to private lands to enhance hunting and wildlife viewing opportunities

This project supports the statewide results:

Improve the quality of Washington's natural resources
This project will protect the natural resources by protecting fish and wildlife, and their habitats. This project will also preserve, maintain and restore natural systems and landscapes.

Improve the economic vitality of businesses and individuals
Fish and wildlife activities bring in revenue to Washington communities. This project can help develop markets by promoting fishing and hunting opportunities. By improving and repairing infrastructure and restoring and acquiring natural habitats, this project will ensure healthy, diverse and sustainable fish and wildlife populations for the residents in Washington State for social and economic benefit.

Improve the safety of people and property
This project will reduce the potential of flooding and could protect private and public property. This project could also prevent human and wildlife conflict making highways safer and protecting Washington State's resources. By improving and repairing

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Description

infrastructures and structures, the Department will preserve and protect existing state property.

What are the specific benefits of this project?
This request if funded will enhance fishing, camping and other recreational uses on the Wooten Wildlife Area while improving habitat for fish and wildlife by reducing the impounded lakes' impact to the floodplain. The Wooten Floodplain Management Plan (FMP) team has identified lake rehabilitation as a priority, designed to improve and enhance recreation, reduce impacts to ESA listed species, and improve stream and floodplain function for the Tucannon River. This Capital Request will help to accomplish this goal by developing, designing and implementing projects under the six initiatives identified in the plan: 1) Lakes; 2) Campgrounds; 3) Roads/Water Crossings/infrastructure; 4) Camp Wooten; 5) Habitat Enhancement; and 6) Outreach.

How will clients be affected and services change if this project is funded?
This request if funded will enhance fishing, camping and other recreational uses on the Wooten.

How will other state programs or units of government be affected if this project is funded?
The dams currently are in violation can be removed from Department of Ecology's list.

What is the impact on the state operating budget?
The project will renovate and existing asset and is not expected to have any additional impacts to the operating budget.

Why is this the best option or alternative?
The Wooten Wildlife Area Floodplain Improvement Capital Request was developed to as a result of cross-program, agency-wide coordination on the Wooten Floodplain Management Plan (FMP). The goal of the FMP is to enhance fishing, camping and other recreational uses on the Wooten while improving habitat for fish and wildlife by reducing floodplain impacts.

What is the agency's proposed funding strategy for the project?
The Department requests State Building Construction Funds for this project. The Department has an opportunity to compete for federal funding and could receive up to $2.6 million per biennium until 2018.

How does this impact the economy?
This project is expected to extend the fishing seasons within the Tucannon and directly benefit the local economies. When feasible, the Department will use contract services for this project, thus helping to create jobs in the private sector.

Location
City: Dayton **County:** Columbia **Legislative District:** 016

Project Type
Infrastructure (Major Projects)

Growth Management impacts
This project is not expected to impact growth management.

Funding

Acct Code	Account Title	Estimated Total	Expenditures Prior Biennium	Current Biennium	2013-15 Fiscal Period Reapprops	New Approps
001-2	General Fund-Federal	6,500,000				2,600,000

477 - Department of Fish and Wildlife

Capital Project Request

2013-15 Biennium

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Report Number: CBS002
Date Run: 9/10/2012 11:25AM

Project Number: 30000481
Project Title: Wooten Wildlife Area Improve Flood Plain

Funding

Acct Code	Account Title	Estimated Total	Expenditures Prior Biennium	Current Biennium	2013-15 Fiscal Period Reapprops	2013-15 Fiscal Period New Approps
057-1	State Bldg Constr-State	16,097,000				1,800,000
	Total	**22,597,000**	**0**	**0**	**0**	**4,400,000**

		Future Fiscal Periods 2015-17	2017-19	2019-21	2021-23
001-2	General Fund-Federal	2,600,000	1,300,000		
057-1	State Bldg Constr-State	8,297,000	6,000,000		
	Total	**10,897,000**	**7,300,000**	**0**	**0**

Schedule and Statistics

	Start Date	End Date
Predesign	09/01/2013	06/01/2014
Design	7/1/2014	2/1/2018
Construction	3/1/2015	10/1/2019

	Total
Gross Square Feet:	3
Usable Square Feet:	0
Efficiency:	0.0%
Escalated MACC Cost per Sq. Ft.:	5,578,193
Construction Type:	Other Schedule A Projects
Is this a remodel?	No
A/E Fee Class:	A
A/E Fee Percentage:	Varies

Cost Summary

	Escalated Cost	% of Project
Acquisition Costs Total	**0**	**0.0%**
Consultant Services		
Pre-Schematic Design Services	184,730	0.8%
Construction Documents	1,106,260	4.9%
Extra Services	213,034	0.9%
Other Services	497,015	2.2%
Design Services Contingency	40,667	0.2%
Consultant Services Total	**2,041,706**	**9.0%**

Maximum Allowable Construction Cost(MACC) **16,734,580**

477 - Department of Fish and Wildlife
Capital Project Request
2013-15 Biennium

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Project Number: 30000481
Project Title: Wooten Wildlife Area Improve Flood Plain

Cost Summary

	Escalated Cost	% of Project
Construction Contracts		
Site work	0	0.0%
Related Project Costs	0	0.0%
Facility Construction	16,734,580	74.1%
GCCM Risk Contingency	0	0.0%
GCCM or Design Build Costs	0	0.0%
Construction Contingencies	1,673,458	7.4%
Non Taxable Items	0	0.0%
Sales Tax	1,435,828	6.4%
Construction Contracts Total	**19,843,866**	**87.8%**
Equipment		
Equipment	0	0.0%
Non Taxable Items	0	0.0%
Sales Tax	0	0.0%
Equipment Total	**0**	**0.0%**
Art Work Total	**0**	**0.0%**
Other Costs Total	**0**	**0.0%**
Project Management Total	**711,889**	**3.2%**
Grand Total Escalated Costs	**22,597,461**	
Rounded Grand Total Escalated Costs	**22,597,000**	

Operating Impacts

No Operating Impact

Tucannon Lakes Management

9/7/11

DOE Dam Safety Criteria – summary of applicability (see WAC 173-175-020)

- *Applies to dam which can impound a volume of 10 acre ft or more as measured at dam crest elevation which could be released by a dam failure (excluding the volume below natural ground level)*
- *For a dam of 6 ft high or less, which meets the conditions of subsection 1 of this section, DOE may elect to exempt the dam from these regulations.*
- *These regulations do not apply to dams that are owned by an agency of the federal government which has oversight on operation and maintenance and has its own dam safety program for inspection and repair of safety deficiencies of completed projects.*
- *These regulations do not apply to dikes and levees constructed along a water course for protection from flooding or for purposes of floodplain management.*

Issues

1. Dam Safety- in violation of DOE legal requirements for dams
2. Loss of depth and volume in lakes and consequential reduction of fish stocking and fishing access or success
3. Some lakes have river intakes to be maintained (Rainbow, Deer, Beaver/Watson, Big Four and Curl) and others have spring or ground water sources
4. Thermal inputs into the Tucannon River and ESA fish habitat issues
5. Too many lakes to manage and maintain?
6. Maintenance and Operation of facilities
    a. screens and intakes,
    b. dams and vegetation
    c. footbridge at Watson Lake - maintenance
    d. General repair/maintenance costs and man-power
7. Loss of Floodplain and constriction of the Tucannon River by lakes and dams
8. Resident trout angling and LSRCP mitigation goals (trout stocking to replace expected loss of angling days because of damming the Snake River)
9. Other resident Trout Fishing opportunities are limited (no natural lakes and only small ponds, streams no longer stocked, maintenance of the jumbo trout program)
10. Further restrictions to fishing in the Tucannon River to protect ESA listed fish likely in the near future

Opportunities

1. Repairs and restructuring could provide more fishing opportunity/recreation and more disabled angler access
2. Reexamine angling regulations and restrictions – could possibly relax some regulations and provide some use of float tubes, etc. in some locations
3. Could possibly enhance fish habitat for ESA listed fish and other wildlife
    a. Construct side channels and improve riparian vegetation
    b. Reduce river constriction and expand river access to floodplain
    c. Reduce thermal inputs from lakes
4. Reduce long term costs

5. The vegetation clearing by Screen Shop staff in January 2009 was for inspection purposes only and little money expected for statewide dam work by WDFW in new biennium ($150,000 total for 65 dams)
6. Capital Budget may receive $30 million of the $60 million requested, but includes design only for Rainbow and Spring Lakes, no construction funds available.

A. Spring Lake (built in 1955, 6.0 acres) – **High Priority for Repairs (repair and maintain dam, dredge to increase volume and depth)**

1. WDFW District Team identified this several years ago as a high priority for repair
2. Serious dam problems and this could have a catastrophic failure and severe impacts to habitat in the Tucannon River for ESA listed fish
3. very shallow and weedy now – lack of capacity
4. Angler access is limited because of weeds and overgrowth
5. Needs a bottom draw outlet and screen system to reduce thermal inputs into the river and to keep fish in the lake
6. has little constriction of the river
7. 2008 proposal to RCO for rehab. By WDFW??
8. stocking plans for 2009 were for 11,000 catchables and 300 jumbos
9. Outlet pipe replacement in 1997
10. 2003 estimated costs for repair: $544,000 for full repairs and $43,000 for decommissioning,
11. Over 8,000 angler hrs of use and 4,700 fish harvested in 2003

B. Blue Lake (built 1955, 5.0 acres) – **Needs Few Repairs**

1. Most dam safety issues already addressed, least cost for repairs
2. Already has a screened, bottom draw outlet
3. doesn't need to be dredged – was dredged about 8years ago
4. Has high angler use (nearly 14,000 angler hrs in 2003, and about 12,000 fish caught)
5. this lake does not draw from the river and has no constriction of the floodplain
6. this lake is classified as a fish passage barrier by the WDFW assessment of this spring fed tributary
7. stocking plans for 2009 were for 23,300 catchables and 400 jumbos
8. Rebuilt, dredged and new outlet in 1997
9. 2003 estimated costs for repair: $58,500 for dam repair

C. Rainbow Lake (built 1955, 10 acres) **– High Priority for Repair (major dam repairs, dredging to improve volume and depth – could fill or isolate the SW corner)**

1. Unique lake, as its intake is included with the intake for the hatchery (and the lake acts as a reservoir for the hatchery). The intake is owned by USFWS as part of LSRCP- it is part of the hatchery facility.
2. fills in with sediment quickly because it withdraws water year round

3. largest of the 8 lakes
4. the size of the lake could be reduced and the water circulation improved during dredging (e.g. fill the sw corner and breach or remove some of the spits)
5. the sediment trap section of the lake near the inflow could be expanded
6. docks could be added for better access and improved water flow patterns
7. another, separate issue is the constraining dike along the river downstream of the intake dam. This dike directs the river to the base of the hill and reduces floodplain and maintains channelization of the river
8. WDFW Region 1 staff compiled a proposal to RCO for funding lake rehab. In 2008
9. this lake used to be heavily stocked, but loss of capacity and volume has caused reduced stocking – the lake must be dredged to add depth/volume
10. Lake has high angler use (nearly 15,000 angler hrs in 2003, and about 10,000 fish caught)
11. stocking plans for 2009 were for 15,000 catchables and 300 jumbos
12. 2003 estimated costs for repair: $858,400 and $140,400 for decommissioning
13. Consultant's narrative in 2005 for proposed rehabilitation/reconstruction and drawings

D. Deer Lake (built 1955, 4.4 acres) **– could use alternative plans to decommission (e.g. breach dam and dismantle intake) and turn into a wetland, or reconfigure/relocate?**

1. no road access for anglers- secluded
2. small, shallow and weedy lake
3. low dam?
4. Tucannon River is close by
5. outlet does not have a functioning screen
6. intake structure controls the river location and is difficult to maintain or operate
7. the dam leaks
8. could decommission and leave the intake open but there may be risks to river damage to infrastructure such as the road and old dam.
9. could decommission and block the intake, and breach, or remove the dam
10. this lake could be used to replace loss of Big 4 as a fly fishing only lake
11. beaver problems in 2008
12. Has relatively low angler use (nearly 1,100 angler hrs in 2003, and about 700 fish caught – partial survey that missed first two weeks of the season)
13. stocking plans for 2009 were for 3,300 catchables and 25 jumbos
14. 2003 estimated costs for repair: $456,100 and $35,400 for decommissioning

E. **Watson Lake** (built 1954, 6.7 acres) – **repair/maintain dam, dredge and reconfigure/relocate to combine with Beaver Lk and open up floodplain**

1. This lake has lots of angler use (Easy access for the public and very popular)
2. This lake causes maintenance costs because or recent relocation and rebuilding of a separate access administrative road
3. This lake also requires a separate power line and maintenance costs
4. The river is channelized and has a sharp corner that is a risk to the footbridge, lake, road and parking lot, and reduces floodplain (Watson and Beaver lakes severely constricts the river and floodplain)
5. leaky dam that is covered with brush and trees
6. Parking lot is dangerous to exit
7. Bridge over river requires maintenance
8. Lake is not holding enough water to exit through the outflow screen now
9. stocking plans for 2009 were for 20,000 catchables and 300 jumbos
10. 2003 estimated costs for repair: $606,000 for repair and $43,900 for decommissioning

F. **Beaver Lake** (built 1953, 2.1 acres) **– decommission or combine with Watson**

1. This lake is very small, shallow, weedy and overgrown
2. little angler use and reduced stocking with hatchery fish
3. easy access
4. difficult to get water flow during the summer
5. could be used as a sediment trap for Watson Lake (terminated stocking in 2011)
6. stocking plans for 2009 were for 500 catchables and 0 jumbos
7. could consolidate with Watson with new lake configuration that would open up floodplain
8. 2003 estimated costs for repair: $246,800 for repair and $26,900 for decommissioning

G. **Big 4 Lake** (built 1954, 5.0 acres) **– Major issue – decommission or repair lake and protect it from the river – no access for stocking or repair except across river**

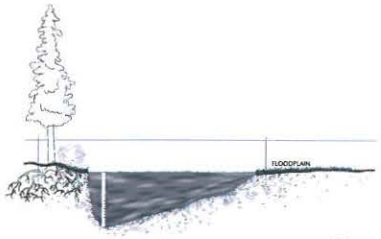
1. Unique fishing area because it is the **only <u>fly fishing only</u> area in SE WA**
2. it is secluded and access requires wading the river (can be difficult or dangerous in early spring during high flows)
3. dam is overgrown and leaks badly
4. this lake is difficult to stock because of no road access, and it is only stocked once per year
5. a beaver dam was blocking the outlet in 2008
6. the Tucannon River is threatening to erode the dam and capture the lake
7. the lake is shallow and needs to be dredged and it needs protection from the river
8. repairs will be expensive and difficult because there is no road access (all heavy equipment will have to cross the river)
9. stocking plans for 2009 were for 2,000 catchables and 300 jumbos

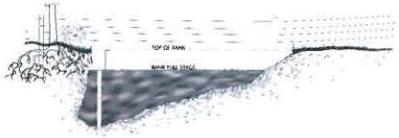
10. 2003 estimated costs for repair: $644,700 to repair and $123,100 for decommissioning

H. **Curl Lake** (built 1955, 2.5 acres) – **Few or NO repairs Needed – planned for dredging in 2011**

1. This lake is part of the USFWS ownership and part of the LSRCP hatchery program. It is used primarily as an acclimation pond for spring Chinook and later stocked with catchable trout for fishing.
2. The lake has very easy access
3. This lake opens for fishing the last Sat. in April, after use as an acclimation pond
4. Relatively few repairs are needed
5. Could likely get cost share from LSRCP, or possibly full costs paid by LSRCP
6. stocking plans for 2009 were for 12,000 catchables and 300 jumbos
7. 2003 estimated costs for repair: $214,600 for repairs and $42,900 to decommission. Could reduce volume to below DOE threshold for $30,000.
8. this lake is constricting the river channel and reducing floodplain
9. the intake was repaired to provide adequate fish passage in 2008, but it has been repaired several times in the past 10-12 yrs.
10. Installed a clay core in dam to reduce seepage in 2005, so this dam should be compliant with DOE regulations now, or nearly so

W.T. Wooten Wildlife Area
Tucannon River
Geomorphic Assessment





In Cooperation with the Washington Department of Fish and Wildlife

Prepared by
USDA, Natural Resources Conservation Service

August, 2004

W. T. Wooten Wildlife Area Tucannon River Geomorphic Assessment

Introduction

In December 2003, the Washington Department of Fish and Wildlife (WDFW) requested assistance from the USDA Natural Resources Conservation Service (NRCS) to conduct a stream and riparian-geomorphic assessment of the Tucannon River and floodplain within the Wooten Wildlife Area (WWA), located in the Blue Mountains of Columbia and Garfield Counties.

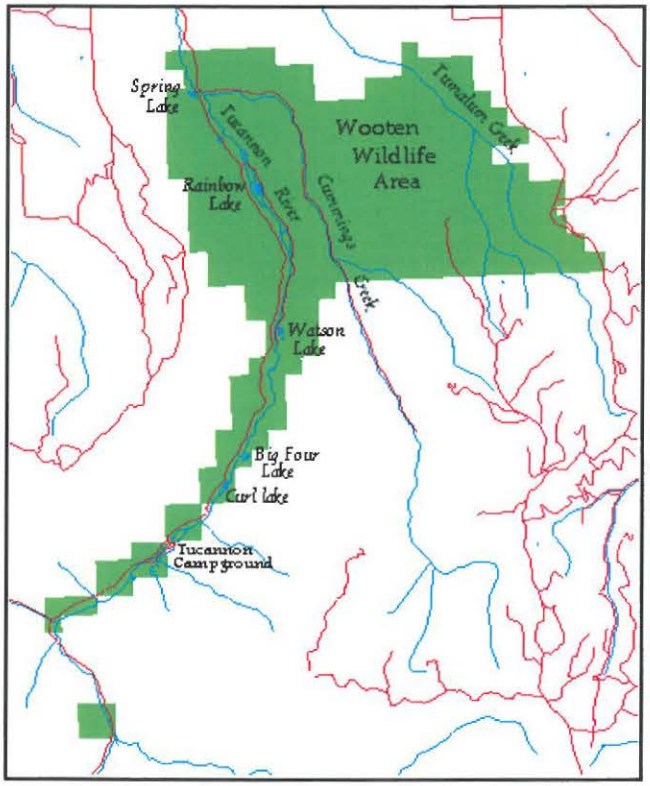


Figure 1. Wooten Wildlife Area and Hartsock Unit

The Wooten Wildlife Area encompasses 16,000 acres and includes approximately nine miles of the Tucannon River (**Figure 1**). The Hartsock Unit, which includes an additional 2,000 acres and 1.0 mile of the river, is located 1.3 miles downstream from the WWA.

The WWA includes eight artificial lakes located along the river; six are kept full by diverting water from the river, two are spring-fed. They are stocked annually with over 110,000 trout for recreational angling. The Tucannon River is "designated critical habitat" for three Snake River salmonid species listed under the federal Endangered Species Act.

Field work for this assessment occurred during April 19-23. Assessment recommendations pertain only to land within the floodplain of the river.

The assessment was made by an interdisciplinary team (IDT) that included the following:

W. Barry Southerland, Fluvial Geomorphologist, NRCS
Tim Dring, Biologist, NRCS
Gary Stendal, Wooten Wildlife Area Manager, WDFW
Shanna Kozusko, Wildlife Biologist, WDFW
Tom Schirm, Fish and Wildlife Biologist, Habitat Program, WDFW

Consultation and/or on-site visits also included:

Don Larsen, Agricultural Liaison, Lands Division, WDFW
Mark Schuller, Fish Biologist, WDFW/NRCS
Glen Mendel, Fish and Wildlife Biologist, WDFW
Mark Schuck, Fish and Wildlife Biologist, WDFW

Objectives of the Study

The WWA Tucannon River geomorphic assessment was developed to address the following:

1. Completion of a general characterization of geomorphic conditions;
2. Assessment of current fluvial geomorphic conditions;
3. Development of recommendations and opportunities for riparian vegetation enhancement and stream habitat improvements;
4. Identification of geomorphic opportunities to develop better riparian habitat and more successful plant establishment;
5. Identification of geomorphic opportunities to develop better salmonid habitat.

Resource Problems

The following issues had previously been identified as potential resource concerns:

1. Elevated water temperature relative to salmonid habitat;
2. Paucity of quality pools and instream cover for salmonids;
3. Sparse riparian/floodplain vegetative conditions;
4. Availability of appropriate floodprone areas for natural river migration and flooding processes.

Methods and Materials

Preparatory to field work, the most recent aerial photos were used to aid in locating sites of concern (mostly, by lack of riparian vegetation) and habitat opportunities along the river. Once these sites were located, the IDT drove or walked to each one, recorded the coordinates with a Global Positioning System (GPS) unit and assessed the condition of the streambank and its adjacent floodplain. The entire Hartsock Unit was assessed in the field without the aid of photos. The IDT field-assessed an estimated 2.2 miles of stream corridor, including 1.0 mile in the Hartsock Unit, where riparian vegetation was deficient.

The IDT generated a list of native plant species at each site and assessed some previously planted areas. Physical stream features that impact the potential for planting and habitat restoration success were also characterized and categorized at each site. The following information was assessed and estimated at each planting and habitat improvement site:

1. Bank Height Ratio (BHR) – streambank height divided by maximum bankfull depth – a measure of the degree of incision. A low BHR indicates stable banks and good floodplain connectivity, while a high BHR indicates major bank instability and disconnection from the floodplain.
2. Width-to-Depth Ratio (WDR) – bankfull width divided by mean bankfull depth - a measure of how wide and shallow or how narrow and deep the stream is at the site. Stream segments with a high WDR generally direct more energy and shear stress at the banks than do deep and narrow stream morphologies within the same stream type. Stable streams that are deep and narrow are more capable of transporting bedload and maintaining a local depositional and scour pattern in a pool-riffle morphology.

3. Water table availability – the need for temporary irrigation to assist establishment of native vegetative plantings.

Stream Geomorphology Characterization and Analysis:

Over twenty-five streamside locations were reconnoitered and characterized onsite for geomorphic condition and trend using WDR and BHR as critical indicators. Two cross-sections were made with a laser level and particle-size distributions were completed to validate bankfull dimensions to aid in the morphometric measurements of WDR and BHR.

The findings are consistent with the NRCS Tucannon River stream inventory completed in 1996. Typical ranges for stable C4 (Rosgen classification) geomorphic stream types in this area in eastern Washington are: WDR - 12 to 20 and BHR - 1.05 to 1.15. Most of the Tucannon River within the WWA has high WDR values (>30). These stream segments are wide and shallow (**Figure2**), which causes the water to heat up faster than segments with low WDR values. Despite intermittent sections of aggradation, BHR values are moderate to high (>1.2) and root cohesion in the banks is low because the water table is below the rootline of the existing woody vegetation growing on top of the bank.

Figure 2. High WDR, low vegetative root matrix near Deer Lake

The following observed conditions impose severe limitations and negative impacts to streambank stability, salmonid fish and other aquatic life. Under present conditions of persistent drought, they will not change, but with normal high flows, these conditions will likely worsen.

1. Wide and shallow streams are more exposed to the sun. Water temperature is a critical limiting factor for salmonids during the warmest months of summer and early fall.
2. Wide and shallow streams have velocity distributions that exert more shear against banks at high flow stages (75% of bankfull discharge, and higher).
3. High BHR values impose greater critical shear stress within the channel and less stability in the streambank toe.
4. Lack of root systems of live woody vegetation in stream banks means lack of resistance to lateral shear, allowing for higher WDR values to develop during high flows. Although large woody debris is a vital habitat component, reintroducing it without consideration of root matrices and the HBR will cause lateral instability.
5. Streams with high WDR values and low sinuosity (steeper channel slope) are not capable of supporting a profile with critical components needed for salmonids and other aquatic organisms. The Tucannon River was, and still is, a predominately C4 morphology. As such, most of the river's length should have a wide variety of pools, riffles, glides and runs (**Figure 3**). However, the vast majority of the stream profile for the Tucannon River is nearly featureless, being deficient in pools and glides (**Figure 2**). Consequently, resting, rearing and hiding places for fish are uncommon in the WWA.

Figure 3. Low WDR, high vegetative root matrix near Deer Lake

Riparian Vegetation and Planting Recommendations

With some exceptions, given the current geomorphic limitations of the river channel, the riparian community along the Tucannon River is in good condition, with adequate plant diversity among the young plants that have become established. These exceptions include banks with high BHR values; roads; campgrounds within the floodplain; access areas between the river and non-adjacent campgrounds; artificial fishing ponds; and buildings and associated grounds. Most of the ponds, as well as the Tucannon Hatchery, are within the floodplain. As such, they have various levels of flood protection (primarily earthen/rock berms) where trees are not allowed.

The 1995-96 flooding caused numerous channel avulsions; aggradation and widening of the historic channel; and loss of mature riparian trees and shrubs, along with much of the soil in which they grew. The local region has also been under drought conditions during the last decade. However, many riparian areas that have not been mechanically disturbed since the flooding and that are above the bankfull elevation appear to be recovering. These areas contain a diversity of young volunteer trees and shrubs that have become established since the flood. Introducing more plants to these areas would only cause disturbance to the existing plants and may not noticeably improve the sites or speed up the vegetative recovery.

Much of the channel length consists of straight, shallow, wide sections of exposed cobble and gravel where there is no soil. Some attempts have been made in recent years to stabilize these cobble outwash areas using various plant species; mostly with little success for plant establishment.

Figure 4. Willows, cottonwoods growing along wetted edge of cobble bar

These planting sites are all below the bankfull elevation, based on the current condition of the river. Specifically, willows (and a small percentage of cottonwoods) are the only woody vegetation that has survived in these locations. Furthermore, they are surviving only along the edge of the water at the low-flow elevation (**Figure 4**).

The bankfull (ordinary high water) elevation is normally delineated by the presence of rooted woody vegetation above it and exposed streambed or herbaceous plants below it. In the past, NRCS has discouraged planting trees and shrubs below this elevation because most woody vegetation, other than a few willow species, cannot become established due to inundation and scouring by normal high flows. The problem is compounded in the Tucannon River by the lack of soil in the interstices of the rocks in the cobble outwash areas. Numerous attempts have been made to establish cottonwoods by planting these areas, but these efforts have had low success. We noted, however, several locations where high flows have washed across wide expanses of cobble and deposited fines and cottonwood seeds in the interstices, resulting in excellent cottonwood growth (**Figure 5** at WP6, **Appendix C**). Left on their own, we believe that most of these cobble outwash areas will become reestablished after a series of high flow events.

Figure 5. Volunteer cottonwood establishment on cobble outwash area (WP 6)

Willow establishment, either from plantings or natural reseeding, in these low-flow areas will probably collect other woody debris and fine sediments during higher flows. This soil retention may encourage growth of more willows and eventually cottonwoods which could help shade the stream and add some stability to the bank. However, these same aggrading areas can also become so stable that high flows are forced around both sides, forming islands that eventually cause the single-thread channel to split into multiple channels. Either way, willows will probably play only a minor role in directly reducing the temperature of the river. If, however, WDFW feels that these willow clumps are providing desirable habitat, only *coyote willow* should be planted because it naturally grows below the bankfull line. For this report, however, the planting recommendations in **Appendix B** concern only the establishment of woody vegetation in the floodplain, above the bankfull elevation.

Riparian planting, by itself, will not solve the temperature problem for the Tucannon River in the Wooten Wildlife Area. The channel may need physical alteration, using heavy equipment, to make it more geomorphically stable with a more acceptable WDR. One possible technique

might be to excavate blind, shallow channels through the large cobble outwash areas. Each channel would be aligned perpendicular to the river flow and would only contain water during and immediately after high flows. These depressions would collect silt and debris, as well as cottonwood seeds (hopefully). The silt deposition creates a good base for future plant growth. These wooded areas would extend from the low-flow line to the top of the bar. They would act as "stream barbs" that force the majority of the flow around the lower end, scouring a deeper, narrower channel. This method has proven successful on a similar Tucannon River site (Janet Howard property).

Refer to **Appendix B** for specific planting recommendations. All recommendations for plantings are based on the presence of the species near where the actual planting is to take place. The plant community along the Tucannon River changes slightly when moving upstream or downstream. Certain species of trees or shrubs "phase out" with changes in elevation and new species appear. The most important guidelines to follow when planting the riparian area are species diversity, site preparation, altitude, and moisture management. A wide variety of species should be established to ensure the best functions and values of the riparian area.

Since most of the proposed planting sites are currently camping facilities, attention to site preparation will be important. Compaction by foot and vehicular traffic has degraded these sites for establishing woody vegetation, so some type of mechanical fracturing of the soil prior to planting is recommended. Lastly, some locations may lack the moisture or water necessary to ensure a high likelihood of success after planting. Developing a plan to water the young plant material will improve the establishment process and reduce the cost of future replacement materials should dry climatic conditions persist.

Campground Recommendations

WWA campgrounds were assessed (**Appendix B**). These campgrounds have vault-toilet systems that have their contents periodically removed. The toilets in all but one of these campgrounds are located outside the floodprone area.[1] The floodstage intervals constrained within the floodprone area vary relative to the hydrophysiographic area. Field measurements relative to bankfull depths may be used to delineate floodprone areas. In the campgrounds, the high terrace adjacent to the floodprone area is a readily observable feature.

Camp sites and vaulted toilet systems appropriately located on the higher elevation of the terrace should not negatively affect floodplain geomorphology and riparian areas. In the campgrounds we assessed, most of the high terraces are located up to several hundred feet from the Tucannon River. We recommend that campsites presently located within the floodprone area be moved to new sites on the high terrace. In most instances, existing toilets will be within reasonable distances to the newly relocated campsites. Abandoned campsites will need sufficient treatment (i.e. plowing and bed preparation) to address soil compaction and to allow for riparian vegetative establishment. Where feasible, native plant material should be transplanted from newly-developed campsites to the abandoned campsites.

[1] zone within the valley commonly associated with the active floodplain; generally, with a 35-50 year recurrence.

The yellow line in **Figure 6** shows where boulders could be placed along the higher ground at the edge of the floodprone area to provide "natural" barriers to vehicles attempting to access closed campsites located in floodprone areas. The proposed campsite relocations from the floodprone to the high terrace allows for over 200 feet of riparian buffer between the streambank and the open campsites at this campground. Toilets should all be located on the terrace **(Diagram 1, Appendix A).**

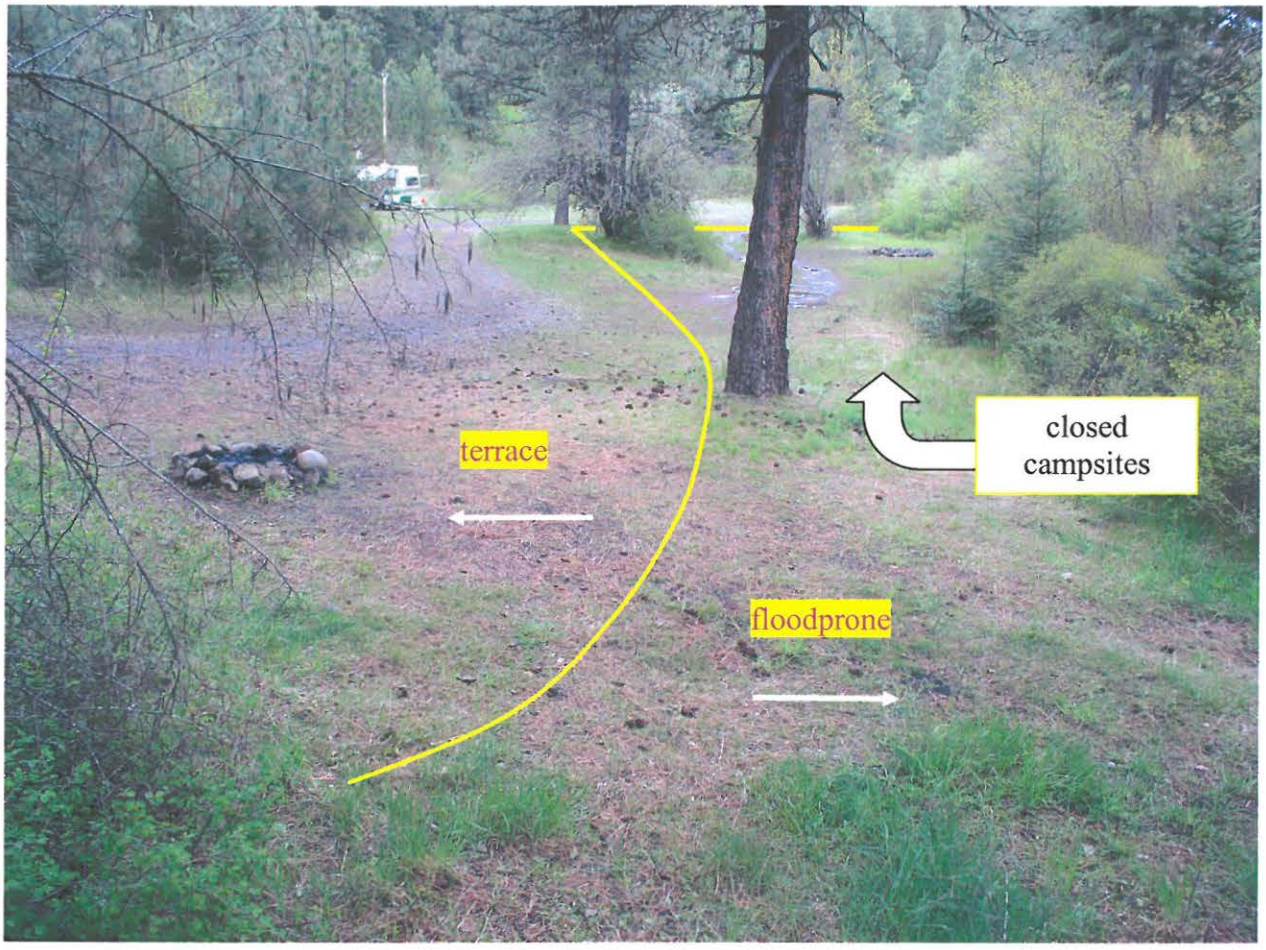


Figure 6. Campground #7, showing potential relocation and planting of existing campsites

There are signs at each campground that direct campers to use only down wood for their campfires, yet WDFW employees have remarked that some campers still cut down trees in the vicinity of the campgrounds. Down wood is an important component of the natural riparian and floodplain ecosystems and should also be left in place for the various wildlife species that use them. Perhaps it would be best to install a large sign near the entrance to the WWA, saying something like: "No Firewood Cutting or Gathering, Please Bring Your Own." Maybe it would be possible to designate a certain area for firewood gathering. This area could be chosen and managed for wildlife benefit and moved from one location to another, depending on its usage.

Fish Habitat Recommendations

Off-channel resting and rearing areas are lacking in the WWA portion of the Tucannon River. There are a number of locations that have opportunities to improve this habitat component. These are all sites where channel avulsions have occurred, isolating side channels or oxbows from the main river. They may be completely or partially dry throughout the year, but they have an obvious upstream or downstream connection with the river (**Figures 7** and **8**). Channels can be excavated into the water table, where cool water will be found. These excavations will create narrow, deep pools which can be enhanced with LWD and plantings.

There are two options for providing fish access to an off-channel site. One very effective way is to excavate a narrow outlet channel which carries the groundwater to the river – there is no surface inflow from the river (**Appendix A, Diagram 2**). Juvenile salmon and trout seek out these cool refuge areas during the summer and late fall; adult fish may find them useful for cover during flood flows.

Each off-channel design includes numerous rootwads and logs for cover habitat. During all but flood flows, this type of blind channel habitat does not suffer from the same problems found in the river (turbidity, warm water, scouring, etc.).

Figure 7. Inlet filled in – surface water at outlet at WP8

The second option (**Appendix A, Diagrams 3** and **4**) is to dig an inlet channel to the excavated rearing pool so that it becomes an active side channel, rather than a blind off-channel pool. All excavated inlet and outlet channels should be designed as narrow, meandering E4 (Rosgen) stream-types.

Typical side channels often do not have deep, wide pools, but have a constant flow and gravel bottom that provide good spawning. LWD and

Figure 8. Outlet filled in – no surface water at WP11

overhanging vegetation offers cover and can actually lower the water temperature slightly below the main channel temperature. It is, however, difficult to maintain a year-round flow through them. It may be necessary to install an instream structure in the main channel to force water into the side channel.

Conclusions

The recommendations (**Appendix B**) were generated to address the stated resource problems and objectives. Numerous sites within the WWA could use additional instream geomorphic practices to address the following conditions: wide and shallow channels; lack of pool/riffle morphology; unstable stream banks susceptible to excessive lateral shear during high flows; and moderately high bank-height ratios. Meander reconstruction to restore natural channel conditions would require substantial economic investment. However, since pools are a limiting characteristic for salmonid resting and rearing habitat, some relatively inexpensive off-channel habitat is recommended. The Hartsock Unit and Deer Lake reaches have areas identified for off-channel ponds and side-channels.

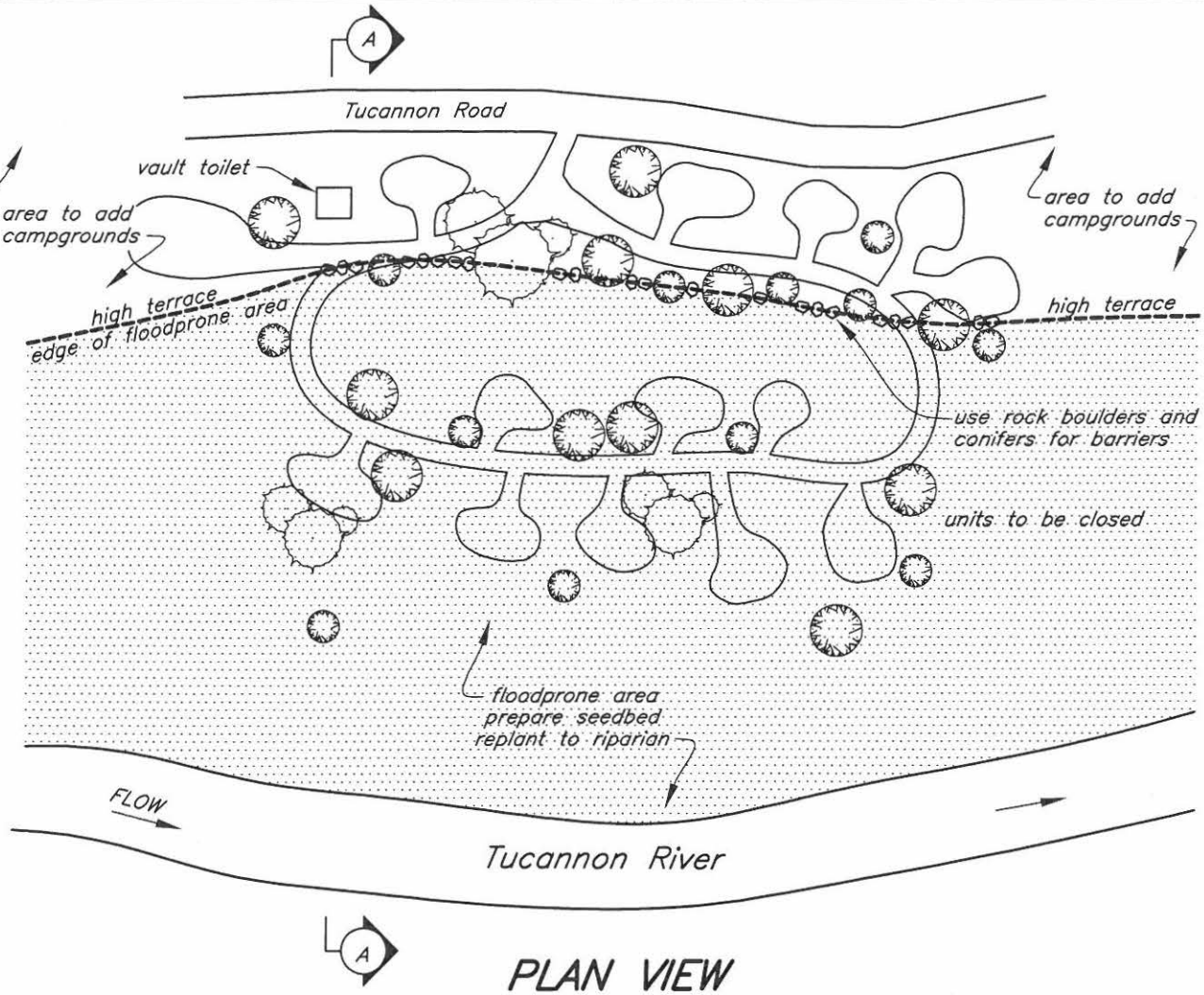
Deep and narrow, well-shaded, floodplain ponds and channels would have a net positive effect on water temperature due to improved groundwater exposure and interface with deeper soil profiles. It is preferable, considering valley hydraulics and solar valley-relief, that constructed ponds be located at an angle perpendicular to the solar azimuthal path during the months of June through September to allow for maximum shade cover during the warmest period of the season.

Treatment units in **Appendix B** total more than 24.5 acres located within the floodplain of the Tucannon River on the WWA that have not been previously planted. Additional, unmeasured acreage for planting is also identified in the appendix. The majority of these treatment units are good candidates for riparian planting and restoration through state and federal USDA programs. We recommend that previously planted areas only be replanted above the bankfull line and that they are irrigated for the first two or three years.

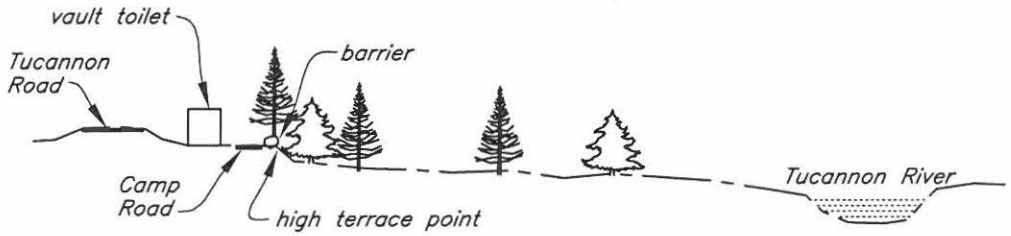
The treatment units included in this report are not all-inclusive. WDFW (property owner) requested an IDT program-neutral assessment and recommendation report. It is recommended that the existing databases of resource information such as seasonal thermographs, hydraulics, fish inventories and so forth be used to aid in planning, design, and implementation. Action taken to implement treatment units identified in this report would positively affect salmonids and water quality in the Tucannon River.

Appendix A

Conceptual Diagrams for Campground and Fish Habitat Recommendations



PLAN VIEW



SECTION (A)

DISTANCES ARE APPROXIMATE – CONCEPTUAL DRAWING ONLY

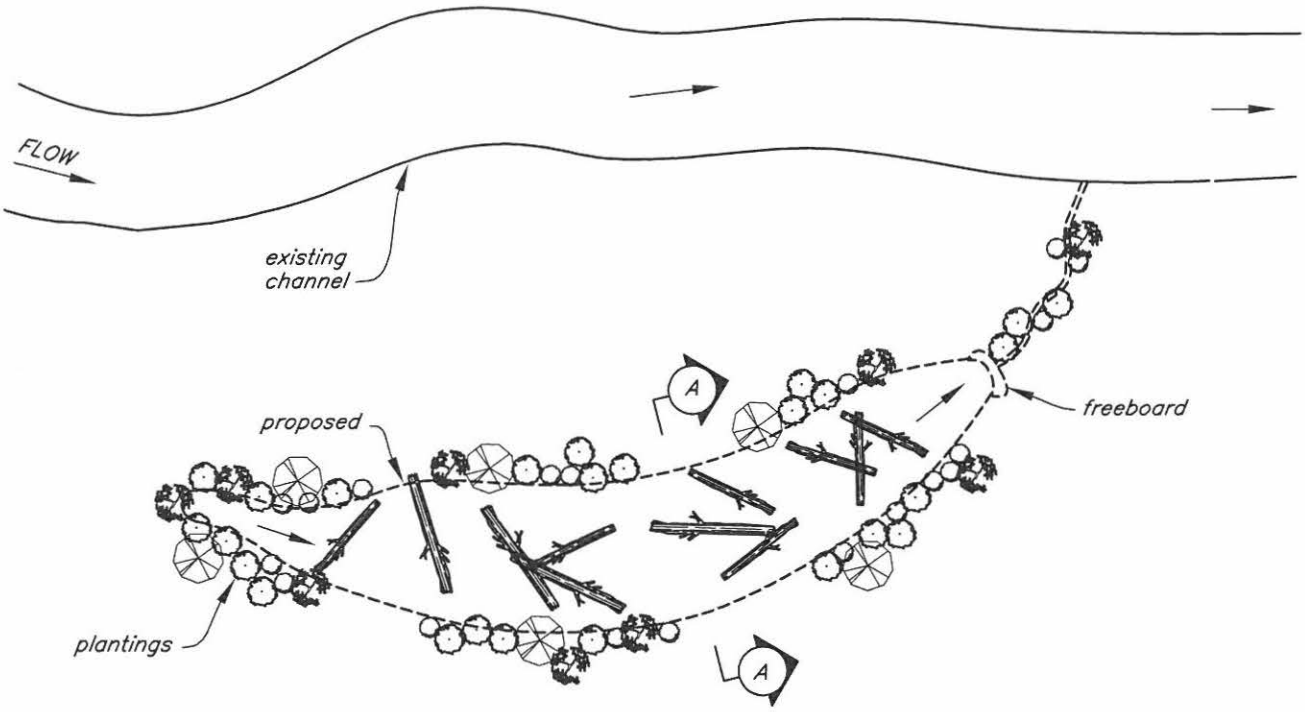
DIAGRAM 1

CONCEPTUAL CAMPSITE PLACEMENT IN CAMPGROUND

CAD FILE NO.	*pond_recommend*
DRAWING NO.	
SHEET	*1* OF *4*

U.S.D.A. NATURAL RESOURCES CONSERVATION SERVICE

	Date
Designed	
Drawn	
Checked	
Approved	



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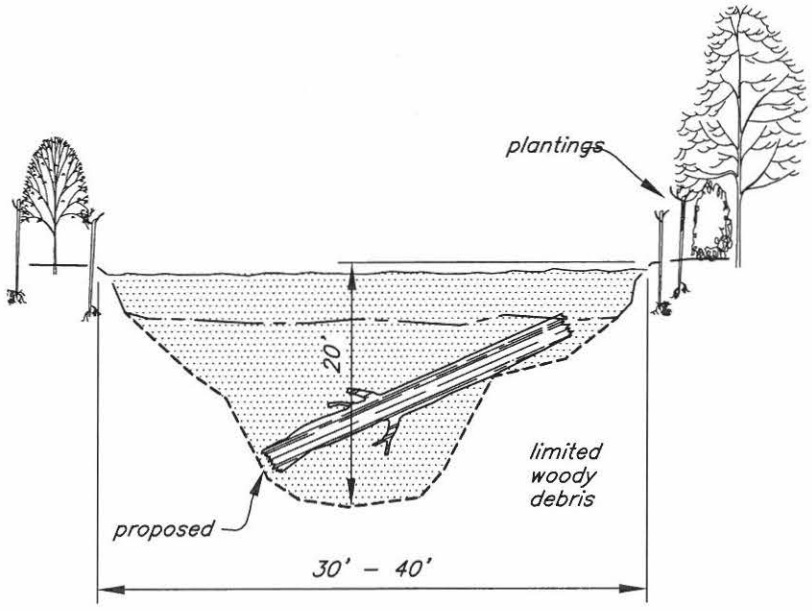

SECTION (A)

DISTANCES ARE APPROXIMATE – CONCEPTUAL DRAWING ONLY

DIAGRAM 2

CONCEPTUAL OFF-CHANNEL REARING POND

CAD FILE NO.	pond_recommend
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U.S.D.A. NATURAL RESOURCES CONSERVATION SERVICE

	Date
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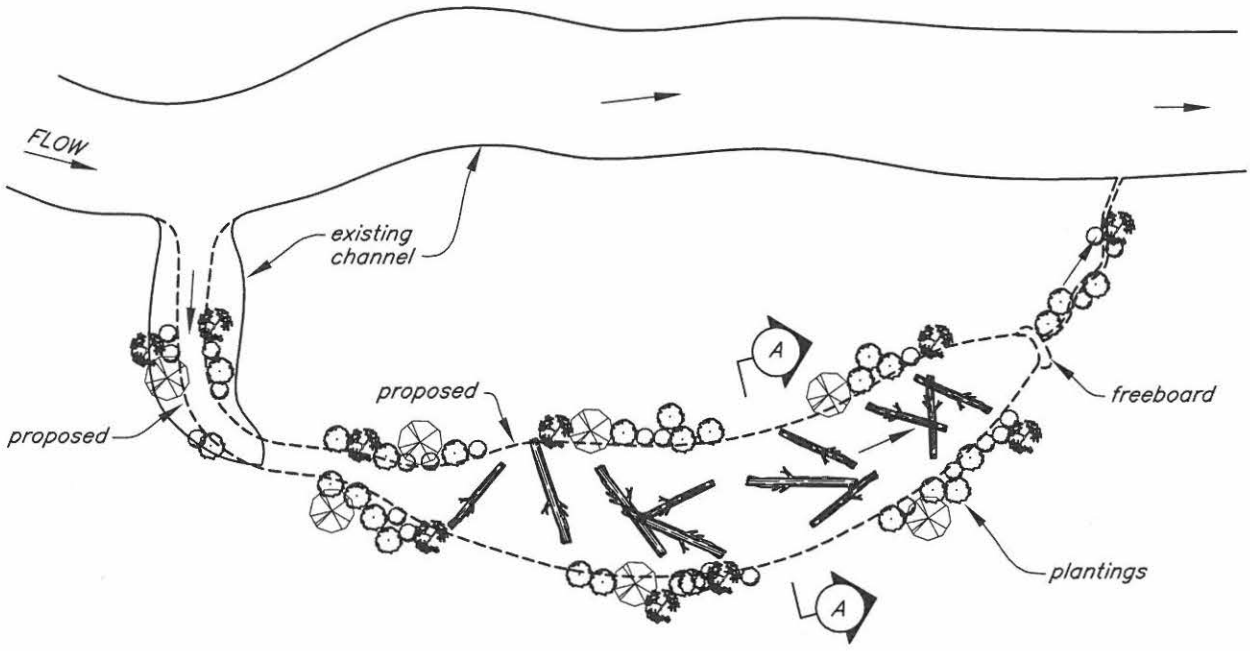

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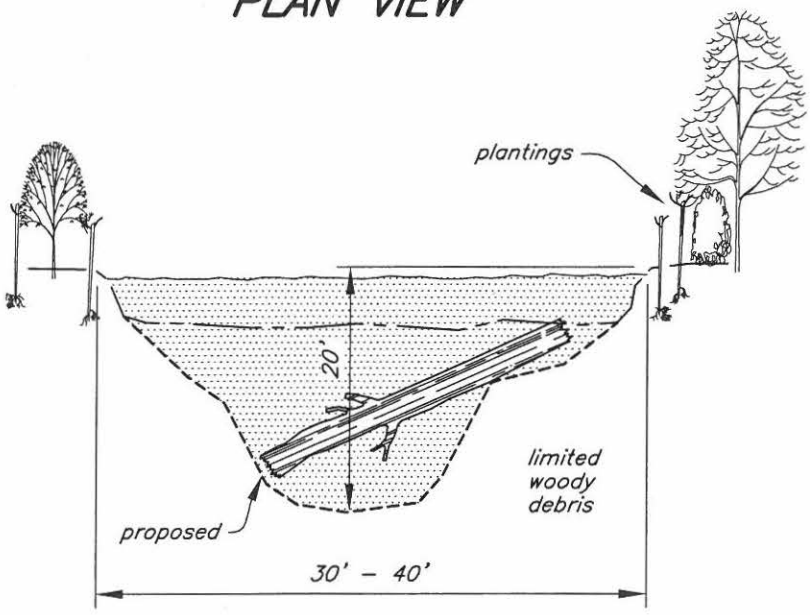

SECTION (A)

DISTANCES ARE APPROXIMATE – CONCEPTUAL DRAWING ONLY

DIAGRAM 3

CONCEPTUAL SIDE CHANNEL WITH POND

CAD FILE NO.	pond_recommend
DRAWING NO.	
SHEET	3 OF 4

U.S.D.A. NATURAL RESOURCES CONSERVATION SERVICE

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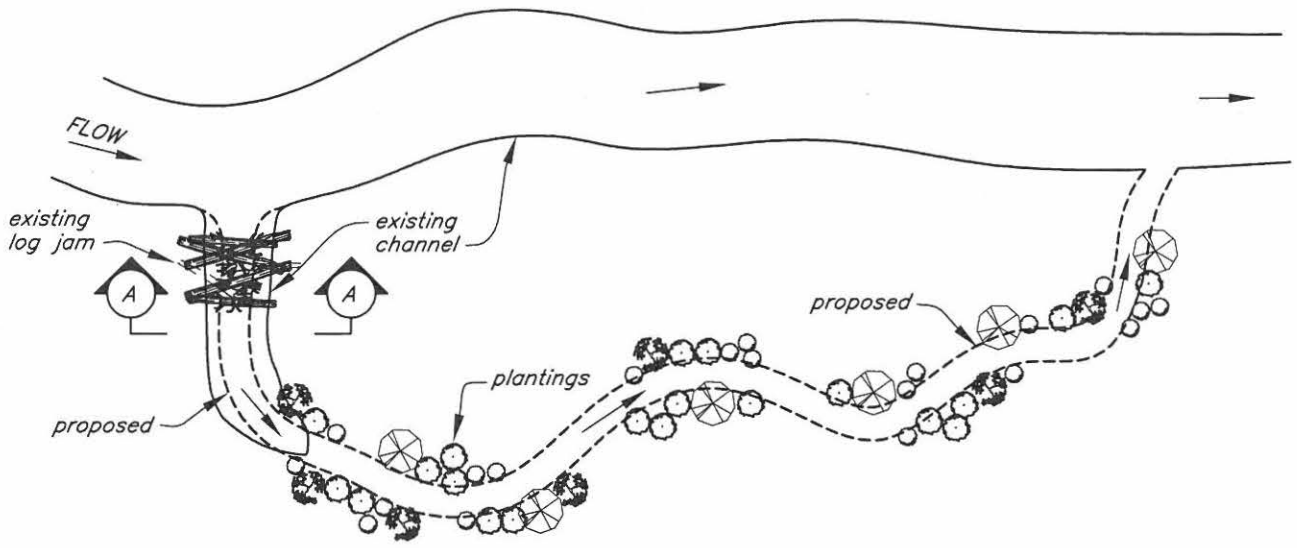

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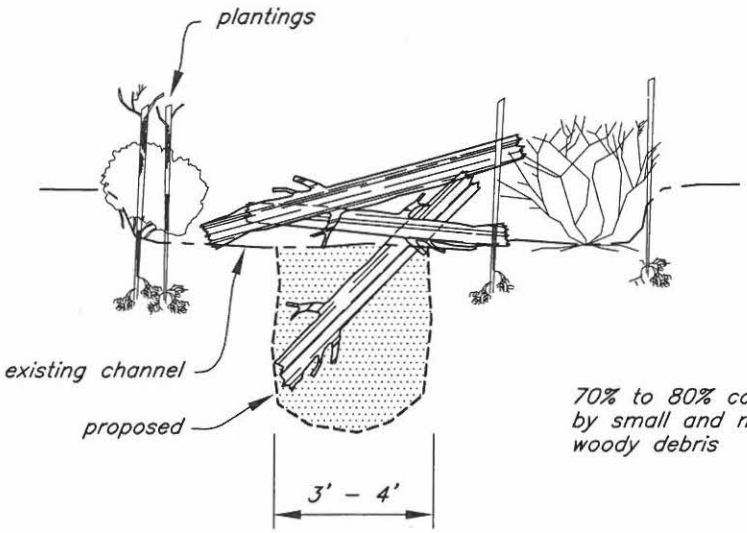


SECTION (A)

DISTANCES ARE APPROXIMATE – CONCEPTUAL DRAWING ONLY

DIAGRAM 4 CONCEPTUAL E4 SIDE CHANNEL	CAD FILE NO. pond_recommend DRAWING NO. SHEET 4 OF 4	Date Designed Drawn Checked Approved
U.S.D.A. NATURAL RESOURCES CONSERVATION SERVICE		

Appendix B

Proposed Tucannon River Treatment Units: Descriptions and Recommendations

APPENDIX B. PROPOSED TUCANNON RIVER TREATMENT UNITS

UNIT PHOTO[1]	LOCATION[2]	DESCRIPTION AND PLANTING SUGGESTIONS	IRRIGATION	PLANTING AREA (length x width) ft
WP1[3] 1	N 46° 23.416' W 117°41.956'	Geom: degraded C4; HWDR; MBHR Plants: PW, BC, ROD, BE; CC and PP on higher ground Notes: 2-3 small areas connect to stream; black polyethylene for RCG?	yes - during first 2 years for PP	570 x 215 [180-250][4] 122,550 ft^2
WP2 1	N 46°23.317' W 117°41.943'	Geom: degraded C4; multiple centerbars; VHWDR; MBHR Plants: PP, DH, CC, ROD, BE Notes: interplant between existing pines	no	660 x 215 [180-250] 141,900 ft^2
WP3 1	N 46°23.151 W 117°41.882'	continuation of WP2 unit		
WP4 1	N 46°23.074' W 117°41.866'	Geom: degraded C4; multiple centerbars; HWDR; BHR >1.6 Plants: DH, ROD around edge of wetland; some PP in driest areas	yes - during first 2 years for PP	NFM
WP5 1	N 46° 23.029' W 117°41.877'	Geom: degraded C4, short sections of D4; VHWDR; MBHR Plants: around meandering pond BC, ROD, WR, BE, SB, PP Notes: multiple centerbars	yes	675 x 180 121,500 ft^2
WP6 1	N 46°.23.072' W 117°41.735'	successful natural regeneration of BC (**Figure 5**)	no	NA
WP7 1	N 46° 22.996' W 117°41.785'	Geom: degraded C4, short sections D4; VHWDR Plants: SB, CC in shallow soil areas; PP, MO, BE in rest of unit Notes: 2 old pastures - gravelly soils; irrigation risers already in place	yes - during first 2 years for PP	500 x 390 195,000 ft^2 **and**: 400 x 180 72,000 ft^2
WP8 1	N 46° 22.996' W 117°41.687'	FishH: potential off-channel rearing site – excavation, LWD, planting Plants: PW Notes: channel is backwater; surface connection to main channel	no	NFM
WP9 1	N 46°22.893' W 117°41.712'	Geom: degraded C4; HWDR Plants: MO, BE, WSB, DH, SB, WR. Notes: on floodplain, higher ground areas should be low planting priority	yes	486 x 180 87,480 ft^2
WP10 1	N 46°22.781' W 117°41.688'	Plants: MO, BE, SB, DH, WR Notes: between Quonset hut and river	yes	528 x 180 95,040 ft^2
WP11 1	N 46°22.787' W 117°41.639'	FishH: excavate a narrow, meandering off-channel pond, add LWD Plants: CW, PW Notes: at site of ELJ (engineered log jam), upstream of Quonset hut	optional	NFM
WP12 1	N 46°22.744' W 117°41.646'	comment: this ELJ has heavy pieces of riprap holding some logs in place	NA	NA
WP13 2	N. 46° 20.135' W 117°40.636'	CpGd: Campground #1 – north end Plants: MO, OS, ROD, WR, SB Notes: compacted ground needs to be plowed before planting; WP18 is the south end of this campground	yes – at least for first year	NFM

APPENDIX B (continued)

UNIT PHOTO	LOCATION	DESCRIPTION AND PLANTING SUGGESTIONS	IRRIGATION	PLANTING AREA (length x width) ft
WP14	missing data	missing data	missing data	missing data
WP15 2	N. 46° 20'162' W 117 °40.714'	Geom: MBHR and HWDR Plants: none Notes: Area near campground -good natural recruitment	NA	NA
WP16 2	N. 46° 20.179' W 117 °40.807'	Plants: upland species in pastures near headquarters Notes: optional to plant behind headquarters	yes	NFM
WP17 2	N. 46° 20.226' W 117 °40.824'	FishH: Excavate existing backwater channel to lower the WDR; add LWD to channel for cover Plants: PW, CW, BC Notes: put most of plantings along the excavated channel	no	NFM
WP18 2		CpGd: Campground #1 Plants: MO, OS, ROD, WR, SB Notes: compacted soils need to be plowed before planting; WP13 is the north end of this campground	yes	NFM
WP19 3	N. 46° 19.287' W 117 °39.960'	CpGd: Campground #3 Plants: DF, PP MO SB, WR; Notes: Close camp units in floodprone area. keep toilets on higher terrace; keep new camp areas above the road that runs along the terrace edge; if new areas opened, transplant native material from these areas to abandoned areas in floodplain.	no	2 acres 87,100 ft^2
WP20 3	N. 46° 19.177' W 117 °39.872'	Plants: add PP, MO, DH to existing planted stock Notes: across from hatchery; successfully planted in 1998	no	NFM
WP21 2	N. 46° 19.838' W 117 °40.460'	Geom: HWDR Plants: MO, DH; plant in clumps; CC currently grows along the bank	optional	NFM
WP22 4	N. 46° 17.698' W 117 °39.110'	Geom: HWDR Plants: area was planted previously, but has very high mortality – try again	yes	NFM
WP23 9	N. 46° 12.395' W 117 °42.480'	CpGd: Campground #10 Geom: HWDR; HBHR Plants: DF, PP, MO, DM, SB, NB Notes: Move fence over to upper terrace, next to the gravel road; vault location is good. Plant area between main camp access road and the Tucannon Road.	yes	408' x 105' 42,840 ft^2
WP24 9	N. 46° 12.550' W 117 °42.495'	CpGd: Campground #9 Geom: degraded C4; HWDR MBHR; a former multi-threaded channel; Plants: NB, SB, OS, WR, SB; use front-end loader to transplant SB from local areas; compacted soils must be plowed before planting Notes: right bank; at mouth of Panjab Creek	optional	558, x 135' 79,000 ft^2

APPENDIX B (continued)

UNIT PHOTO	LOCATION	DESCRIPTION AND PLANTING SUGGESTIONS	IRRIGATION	PLANTING AREA (length x width) ft
WP25 8	N. 46° 13.884' W 117°42.927'	FishH: Riparian planting is okay here, but there is a noticeable lack of LWD in the river at this point and both upstream and downstream.	NA	NA
WP26 8	N. 46° 13.782' W 117° 43.041'	CpGd: Campground #8 Geom: steeper channel - B3c, B4c; HWDR, MBHR Plants: WR, MO, SB, OS, NB, but use ROD, PW and CW along stream banks; plant access areas to stream. Notes: Close access to high terrace and replant lower elevation areas	optional	55,000 ft^2
WP27 5 & 6	TBD	CpGd: Campground #7 Geom: B4c; MBHR, HWDR Plants: MO, OS, SB, CC, NB; compacted soils - good site to compare plowing without planting and with planting. Notes: off-channel rearing potential in two areas.	optional	840 x 165 129,000 ft^2
WP28 4	TBD	FishH: potential for off-channel habitat with excavation.	no	NFM
WP29 4	TBD	comment: Replant areas where former plantings have died, but irrigate.	yes	NFM

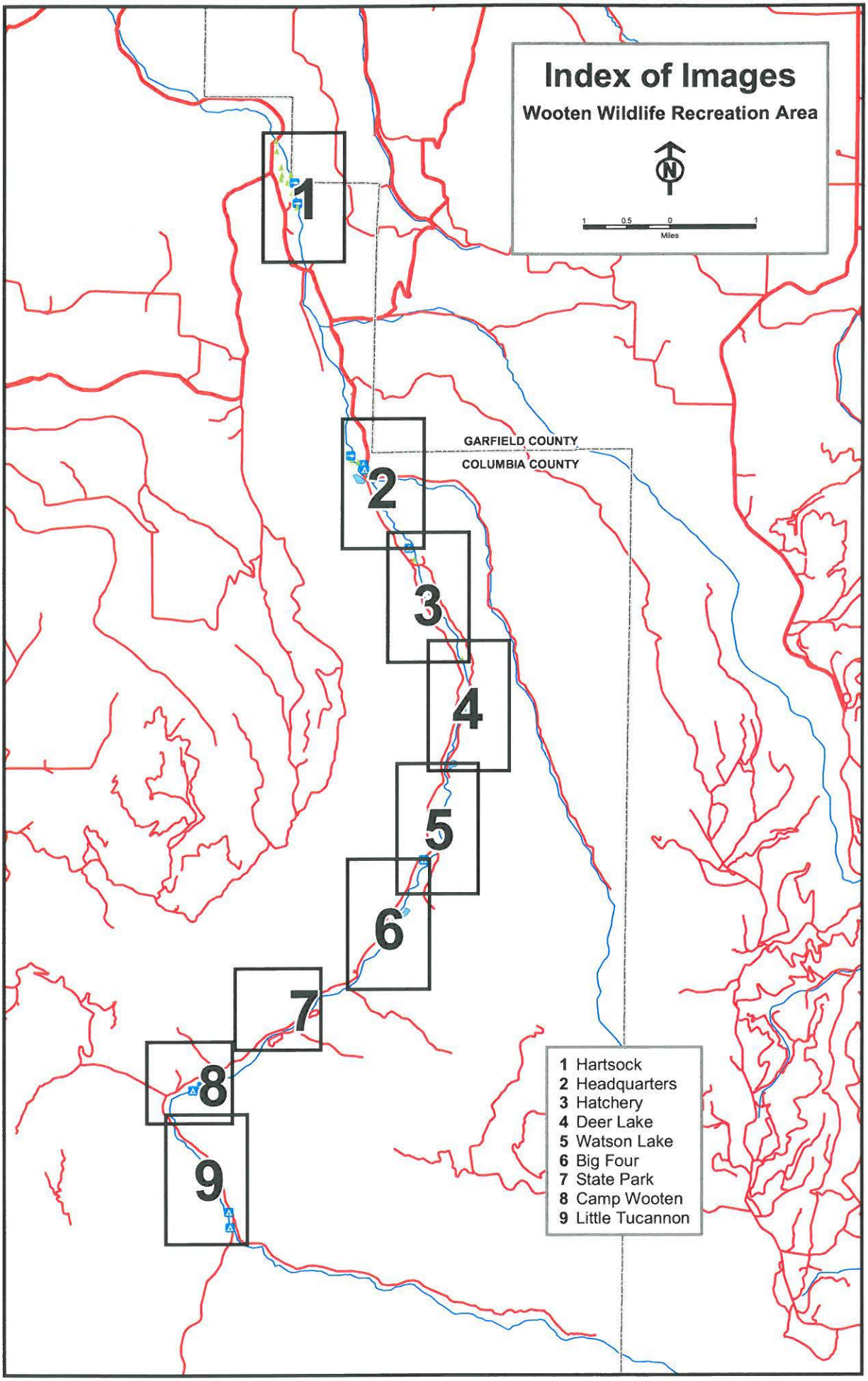
Abbreviations used in table:

BC - Black Cottonwood	OS - Ocean Spray	HBHR - high bank height ratio (>1.6)	LWD – large woody debris
BE - Blue Elderberry	PP - Ponderosa Pine	MBHR - moderate BHR (>1.2)	NA – not applicable
CC - Choke Cherry	PW - Pacific Willow		NFM – needs field measurement (not
CW - Coyote Willow	ROD - Red Osier Dogwood	HWDR - high width to depth ratio (>20)	enough time during assessment)
DF - Douglas Fir	SB - Snowberry	VHWDR - very high WDR (>30)	
DH - Douglas Hawthorne	WR - Wood Rose		B3c, B4c, C4 – Rosgen stream
MO - Mock Orange	WSB - West. Service Berry	FishH - potential fish habitat improvement	classification
NB - Nine Bark		Geom – geomorphology of stream	

[1] Appendix C
[2] latitude and longitude; all units, except WP13 and WP24, are located on left bank of river, looking downstream
[3] WP – waypoint number denoting a latitude and longitude stored in a GPS unit
[4] [range of widths] – area is computed using average width; widths labeled as 180 feet may actually be wider

Appendix C

Wooten Wildlife Area - Aerial Photos and Treatment Unit Locations


Index of Images
Wooten Wildlife Recreation Area
N
1 0.5 0 1
Miles
GARFIELD COUNTY
COLUMBIA COUNTY
1
2
3
4
5
6
7
8
9
1 Hartsock
2 Headquarters
3 Hatchery
4 Deer Lake
5 Watson Lake
6 Big Four
7 State Park
8 Camp Wooten
9 Little Tucannon


1 - Hartsock
Image Date: June, 2003
N
WP1
WP2
WP3
WP4
WP6
WP5
WP7
WP8
WP9
WP10
WP11
WP12

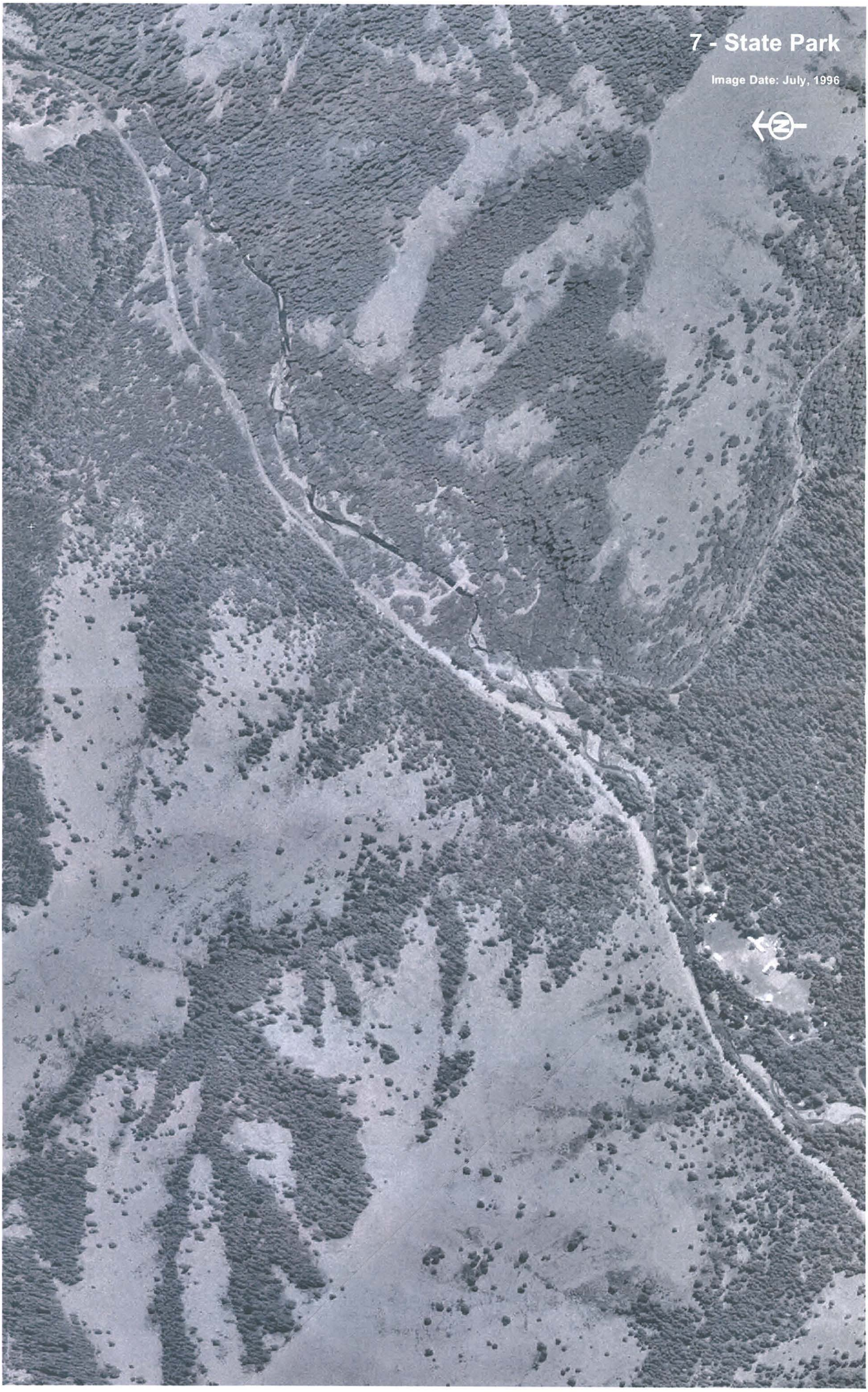

2 - Headquarters
Image Date: June, 2003
N
WP17
WP16
WP15
WP13
WP18
Spring Lake
WP21


3 - Hatchery
Image Date: June, 2003
N
WP19
WP20
Tucannon
Hatchery
Rainbow
Lake
WP29

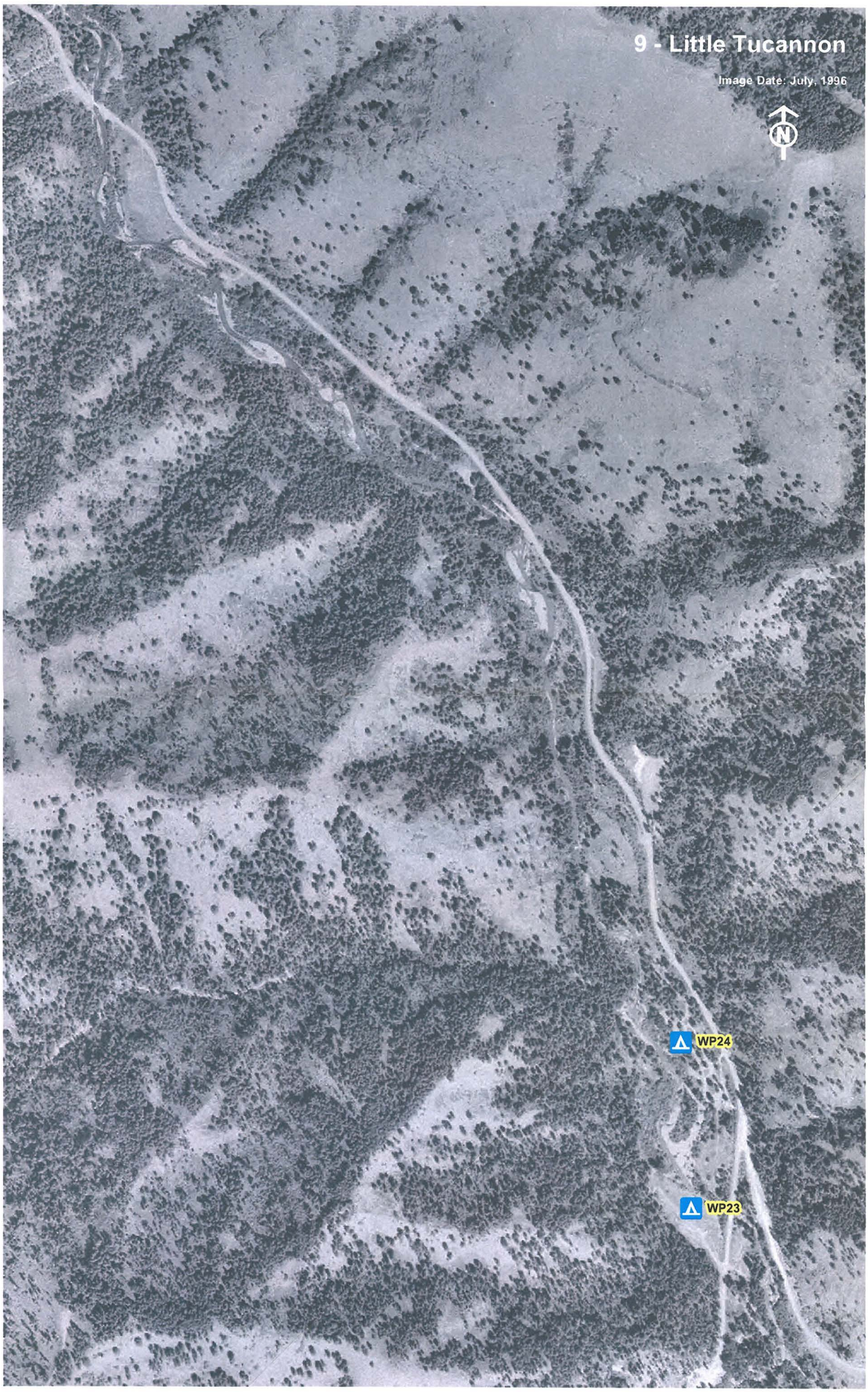

4 - Deer Lake
Image Date: June, 2003
N
WP29
WP22
WP28


5 - Watson Lake
Image Date: June, 2003
N
WP27


WP27
6 - Big Four
Image Date: June, 2003
N


7 - State Park
Image Date: July, 1996


8 - Camp Wooten
Image Date: July, 1996
N
WP25
WP26


9 - Little Tucannon
Image Date: July, 1996
N
WP24
WP23