

Appendix A: Lake Chelan Comprehensive Fishery Management Plan

LAKE CHELAN COMPREHENSIVE FISHERY MANAGEMENT PLAN

Draft Final

**LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637**

September 12, 2001



**Public Utility District No. 1 of Chelan County
Wenatchee, Washington**

TABLE OF CONTENTS

SECTION 1: INTRODUCTION..... 4

SECTION 2: Fish SPECIES in Lake Chelan..... 5

 2.1 Westslope cutthroat trout 5

 2.2 Rainbow trout 8

 2.3 Kokanee 8

 2.4 Landlocked chinook salmon 9

 2.5 Bull trout 10

 2.6 Lake trout 11

 2.7 Burbot 12

 2.8 Smallmouth bass 13

 2.9 Eastern brook trout 13

 2.10 Other native fish species 13

 2.11 Other non-native introductions 14

SECTION 3: Monitoring and Evaluation Program..... 14

SECTION 4: Issues to be resolved..... 15

SECTION 5: Literature Cited 18

LIST OF FIGURES

Figure 1: Comparison of Lake Chelan average elevations⁷

SECTION 1: INTRODUCTION

Lake Chelan Hydroelectric Project, FERC No. 637, relicensing stakeholders have stated that one goal of the relicensing process is to develop and periodically update a Comprehensive Fishery Management Plan (CFMP) for Lake Chelan.

The impetus for a such a comprehensive plan stems from the sometimes overlapping authorities and responsibilities of various resource managers and others currently involved in managing some portion of Lake Chelan waters and/or its tributaries, the biological resources therein, and surrounding lands.

The Washington Department of Fish and Wildlife (WDFW) has primary responsibility for fishery management in Lake Chelan under Revised Code of Washington (RCW)(**citation #**). However, other stakeholders have significant roles in managing the Lake Chelan fishery. These include:

- The U.S. Forest Service, as a manager of large tracts of land adjacent to Lake Chelan, and of tributaries to the Lake, has its own fishery management responsibilities in regard to habitat.
- The National Park Service has similar, but not identical, responsibilities.
- The U.S. Fish and Wildlife Service, particularly through the Endangered Species Act, does have an interest in the restoration of bull trout to the Lake Chelan watershed.
- Native American tribes, especially the Yakama Nation, are interested in exploring the feasibility of introducing sockeye salmon into Lake Chelan. The Lake Chelan Sportsman's Association seeks to protect and maintain a viable sport fishery on the lake. To support this effort they seek cooperative efforts with other stakeholders to educate sport fishers as well as contribute funds and volunteer labor for stocking and habitat improvement efforts.

A major objective of the CFMP is to coordinate the plans and actions of these and other stakeholders in developing and implementing fishery management measures in Lake Chelan.

An early draft of WDFW's "Lake Chelan and Chelan River Fishery Management Plan" (Viola and Foster, in press) served as the starting point for developing the CFMP. Representatives from various stakeholders, principally the WDFW, the U.S. Fish and Wildlife Service, the U.S. Forest Service (USFS), the National Park Service (NPS), the Lake Chelan Sportsman's Association (LCSA), the city of Chelan, and Chelan County Public Utility District (PUD), have worked cooperatively to develop the CFMP for use in the relicensing process and over the term of the license. The CFMP is to be included as a supporting document to fisheries Protection, Mitigation, and Enhancement (PM&E) measures in the new license for the Lake Chelan Project. The CFMP is designed to: 1) provide guidance for the management of the fishery resources in Lake Chelan; 2) maintain a healthy recreational sport fishery in Lake Chelan; 3) and develop a monitoring and evaluation (M&E) framework to assess the efficacy of management actions.

Described in the CFMP is a set of proposed management actions for each species currently inhabiting Lake Chelan, and a process for developing an M&E program, which will, ultimately, lead to developing specific species management goals and objectives. Also described is a

Appendix A

process for reviewing and updating the CFMP on a periodic basis to allow for the collaborative planning and implementation of adaptive management measures over the term of the license.

Relicensing studies were conducted in 1999 and 2000 to determine the current status of fishery resources in Lake Chelan. Studies investigated: (1) sport catch through conducting a creel survey; (2) incidence of barriers to upstream spawning migration in lake tributaries; (3) timing of fry emergence; (4) tributary spawning and rearing habitat availability; (5) tributary fish populations; (6) limnological conditions; (7) reference and/or synopsis of 2000/2001 Stehekin River fish study; and (8) role of large woody debris (LWD). Much of the relicensing work repeated studies conducted by Brown (1984) so that current conditions could be compared with conditions that existed in 1982 and 1983.

The primary management objectives of the CFMP for Lake Chelan are to:

1. Emphasize restoration/enhancement of native species, where feasible;
2. Support the recreational sport fishery;
3. Manage the lake elevation to enhance tributary production (see Section 2.1 and Figure 1);
4. Determine compatibility of management actions with potential future bull trout re-introduction;
5. Develop an M&E framework that includes an Adaptive Management component (see Section 3).

SECTION 2: Fish SPECIES in Lake Chelan

2.1 Westslope cutthroat trout

Few Westslope cutthroat trout were captured during relicensing studies, either in the creel survey or tributary investigations (DES 2000a). The few cutthroat trout caught in the creel survey gives an indication that the current juvenile cutthroat stocking effort, approximately 90,000 annually (1980 to 1999), is not contributing to the cutthroat trout population in the Chelan Basin. Tributary trout populations estimated during relicensing studies, particularly cutthroat trout, appear to be lower than those estimated by Brown (1984). Barriers to upstream spawning migration were identified in most tributary mouths investigated (DES 2000a). Barriers identified were in the form of depth, gradient, and/or velocity barriers. The Natural Sciences Working Group concluded that these barriers were created as a result of Project operations since 1981, the term of the second license, and are, most likely, contributing to trout population decline in the Lake Chelan tributaries. The fishery agencies have stated a strong desire to restore native species in the Chelan Basin, particularly Westslope cutthroat trout, as part of the relicensing process. Local community representatives have also stated a strong desire to maintain the existing recreational trout fishery.

Primary Issues

Phase out rainbow trout (RBT) stocking - WDFW, USFS, LCSA, NPS

Re-establish/supplement tributary populations where suitable – USFS, WDFW

Maintain present angling restrictions – USFS, NPS, WDFW

Restrictive harvest of WSCT until population rebuilds – USFS, NPS, WDFW

Manage water levels to optimize spawning, incubation and rearing – NPS, USFS, WDFW

Monitor levels of hybridization – NPS, WDFW

Appendix A

Minimize loss from entrainment/spills – NPS, LCSA

Support habitat enhancement - WDFW

Delay stocking until spill completed – LCSA

Develop monitoring and evaluation (M&E) program – WDFW, USFS, LCSA, NPS

Management Recommendations

1. Over a four-year period, with careful monitoring and evaluation, replace the current allotment of 100,000 rainbows with increasing proportions of Twin Lakes cutthroat until only cutthroat are stocked.
2. Eliminate, immediately, stocking of rainbow trout in high lakes and tributaries in the Chelan Basin, and in the Lucerne Basin of Lake Chelan.
3. Move toward stocking Westslope cutthroat trout (WSCT) of Twin Lakes origin. Accomplish through:
 - stocking catchable size Twin Lake WSCT
 - planting Twin Lake WSCT eyed eggs in tributaries
 - maintain recreational trout fishery with Twin Lake WSCT
 - fish management needs of Lake Chelan will take priority in the allocation of Twin Lake WSCT eyed eggs
 - locate an alternative source of Twin Lakes cutthroat or other stocks of cutthroat to be used in other waters throughout the state.
4. Manage lake water levels to provide tributary access for spawning, incubation and rearing (See Figure 1.).
5. Develop monitoring and evaluation (M&E) program to assess efficacy of management actions.
6. Delay opening fishing at mouths of lake tributaries to August 1 to protect spring spawning adult salmonids.
7. Delay stocking of catchable cutthroat trout until at least mid-September (enable carry-over to next year; after spill terminated).

Appendix ALAKE CHELAN ELEVATIONS
COMPARISON OF AVERAGES

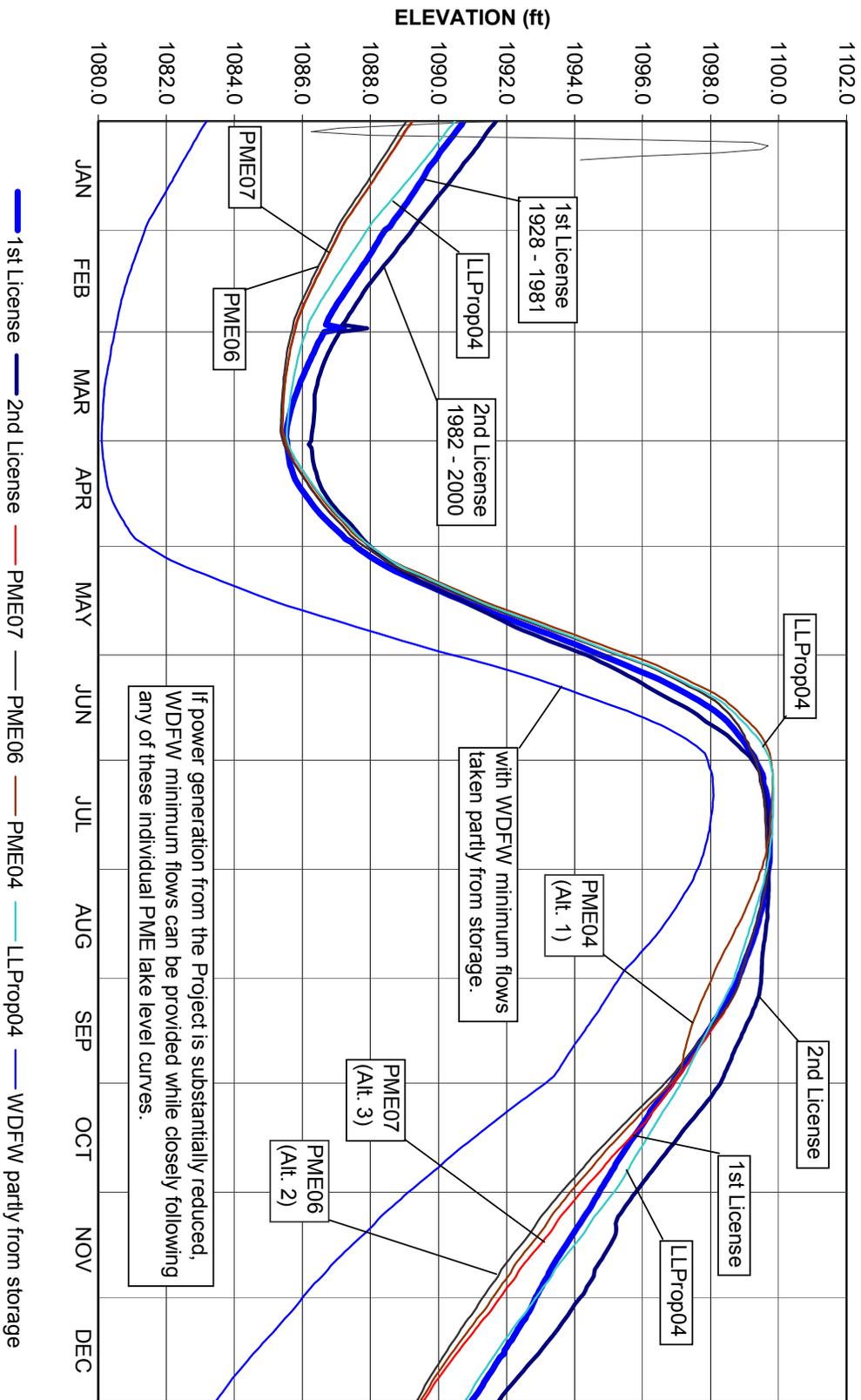


Figure 1: Comparison of Lake Chelan average elevations

Appendix A

2.2 Rainbow trout

Rainbow trout have been stocked in Lake Chelan since the early 1900's (DE&S 2000a). Recent stocking efforts, since 1990, have been conducted to make up for a shortfall in kokanee production, and to support a recreational fishery in the Wapato Basin of Lake Chelan. However, it has been well documented in other systems that introduction of rainbow trout has detrimental effects on Westslope cutthroat trout populations due to competition and hybridization. The Natural Sciences Working Group concluded that reducing, and eventually eliminating, rainbow trout stocking would be an important step in restoring Westslope cutthroat trout populations in the Chelan Basin.

Primary Issue

Phase out rainbow trout (RBT) stocking - WDFW, USFS, LCSA, NPS

Management Recommendations

1. Over a four-year period, with careful monitoring and evaluation, replace the current allotment of 100,000 rainbows with increasing proportions of Twin Lakes cutthroat until only cutthroat are stocked.
2. Eliminate, immediately, stocking of rainbow trout in high lakes and tributaries in the Chelan Basin, and in the Lucerne Basin of Lake Chelan.
3. Investigate feasibility of stocking triploid RBT to support recreational fishery if fish in addition to WSCT are needed.

2.3 Kokanee

Kokanee are the most popular recreational fish in Lake Chelan (DES 2000a). Recreational fishers have indicated a strong desire to maintain the size and number of fish at current levels. Spawning surveys conducted in recent years show that the Lake Chelan kokanee population is as high or higher than historical numbers (Fielder 2000). The Natural Sciences Working Group members recognize the need for balancing the populations of species inhabiting Lake Chelan, e.g., kokanee, landlocked chinook salmon and Lake trout. However, population objectives and methods for monitoring population size, species interactions, competition, etc. do not currently exist. A goal of the M&E program, discussed below, is to develop a methodology for establishing population objectives and evaluating management actions.

Primary Issues

Conduct annual spawning ground surveys – WDFW, NPS

Adjust stocking numbers - WDFW

Develop Lake Chelan strain of kokanee for planting – WDFW, USFS

Adjust stocking methods: scatter release from barge – WDFW, LCSA

Remove 25-Mile Creek barrier and rehab. spawning channel – WDFW, USFS, LCSA

Remove tributary mouth barriers – WDFW, USFS

Develop pop. mgt. objective compatible with recovery/protection of native species – NPS, USFS, WDFW

Supplement KOK if pop. objective is not met and only if stocking can be evaluated – NPS, USFS, WDFW

Improve tributary habitat - USFS

Rely on natural production – USFS

Appendix A

Manage as principal sport fish species - USFS

Delay stocking until spill completed – LCSA

Reduce predation loss: discontinue stocking of lake trout - NPS, WDFW

Balance chinook and kokanee abundance to provide an optimal number of kokanee of an acceptable size and as many salmon as needed for this balance -WDFW, USFS, LCSA

Minimize loss from entrainment/spills – NPS, LCSA

Develop monitoring and evaluation (M&E) program – WDFW, USFS, LCSA, NPS

Management Recommendations

1. Develop population size objectives compatible with recovery and protection of native fish species, and compatible with park management goals for the Stehekin River.
2. Monitor population:
 - stock if necessary when population size objective exhibits a declining trend
 - use naturalized Lake Chelan stock for supplementation instead of Kootenai or Whatcom stocks
 - Maintain recreational fishery
3. Develop M&E program to assess efficacy of management actions, particularly for assessing contribution of kokanee stocking program.
4. Stocked fish should be released after spill has stopped (September/October).

2.4 Landlocked chinook salmon

Landlocked chinook salmon are considered the trophy fish in Lake Chelan. Landlocked chinook supported a very strong recreational and commercial (guided) fishery in the late 1980's and early 1990's. The LCSA depends heavily on the annual Chinook Derby on Lake Chelan to raise funds for implementing fishery enhancement projects in the Lake Chelan basin. Additionally, the Chinook Derby is a significant economic event for the community of Chelan, as it is very well attended and draws participants from all parts of Washington and adjoining states. The LCSA, and Chelan community, has a very strong desire to rebuild the chinook fishery and maintain the annual Chinook Derby.

The population of this species has declined over the past several years as indicated by harvest statistics (DES 2000a). The Natural Sciences Working Group has examined many possible causes of decline, such as low survival of stocked fish, low natural reproduction, changes in race/deme of stocked fish, changes in rearing conditions of stocked fish, smolt emigration from the lake, excessive harvest, etc. As with other Lake Chelan species, an important part of the CFMP is developing an M&E program to assess species interactions and affects of management actions.

Primary Issues

Rear chinook 19-20 months prior to release – WDFW, LCSA

Release fish no earlier than mid to late September (after spill terminated) - LCSA

Stock identified spawning areas with eyed eggs – WDFW, LCSA

Reduce daily limit – WDFW, LCSA(?)

Experiment with different stock - WDFW

Coded wire tag (CWT), ventral clip - WDFW

Balance kokanee/chinook - WDFW

Reduce stocking 50% - USFS

Appendix A

Limit future stocking to triploid fish only – WDFW, NPS, USFS

Collect data on species interactions during M&E period (5 yrs?), results will be basis for future management – USFS, WDFW, NPS

Allow natural production to sustain fishery long-term – USFS

Significantly reduce stocking of chinook until evaluation of impacts to native species is completed - NPS

Monitor natural production and evaluate effects on native fish - NPS

Management Recommendations

1. Focus on landlocked chinook as apex predator species:
 - investigate feasibility of stocking triploid fish
 - set interim harvest restrictions to protect population size
 - support recreational fishery
2. Evaluate impacts of chinook on native fish species in Lake Chelan and investigate management actions that would limit potential impacts. Support recreational fisheries for chinook if impacts to native fish populations are minimal.
3. Discontinue Lake trout stocking:
 - discontinue stocking juveniles
 - reduce adult population
4. Develop M&E program to assess efficacy of management actions.

2.5 Bull trout

Bull trout have not been observed in the Chelan Basin, either in tributaries or the lake, since the early 1950's. Causes of decline, and apparent demise of the bull trout population, has been speculated to be a catastrophic epizootic (disease), unsuccessful spawning and loss of spawning habitat during floods in the late 1940's and early 1950's, excessive harvest, or a combination of the above (Brown 1984). There is interest from several relicensing stakeholders, primarily the US Fish and Wildlife Service (USFWS), in investigating the feasibility of restoring bull trout in the Chelan Basin. The USFWS is currently preparing a Bull Trout Recovery Plan, which may address Chelan Basin recovery efforts. However, Natural Sciences Working Group members have expressed serious concern about Chelan Basin perturbations i.e., non-native species introductions, remaining presence of pathogens, availability of bull trout donor stock, etc., that may preclude bull trout re-introduction. Due to these concerns, the Working Group has focused, initially, on conducting a bull trout restoration feasibility assessment before actually attempting to re-introduce the species into the basin.

The following paragraph describes the proposed methodology to be used for investigating reintroduction of bull trout into the Lake Chelan Basin. If feasible, the ultimate goal of the state and federal agencies is to attempt to reintroduce self-sustaining populations of bull trout in waters they historically inhabited in the tributaries that drain into the Stehekin River or directly into Lake Chelan. The first effort should be to conduct a survey designed to locate any bull trout population that might still exist in the system. If a fluvial bull trout population is found, then determine if habitat conditions exist which have limited their re-colonization of the system. The next step would be to eradicate the factor(s) that have been limiting bull trout or determine if enough fish exist to use as a brood stock, so we could avail them the survival advantage of the hatchery system. If no bull trout

Appendix A

population is found, then, if feasible, an appropriate stock of fluvial fish from another river may be chosen to use for reintroduction. Possibly bull trout from the Chiwawa River stock, which are adfluvial, could be used.

Primary Issues

Goal is to reintroduce fluvial bull trout – WDFW, USFWS

Conduct survey to locate remaining population - WDFW, USFWS

If feasible, attempt to reintroduce using identified stock – WDFW, USFWS, city of Chelan

Determine appropriate donor stock - WDFW, USFWS

Delay re-introduction until issues resolved: - USFS, NPS, USFWS

- interaction with brook/lake trout;
- fish pathogens present;
- stock source;
- potential angling restrictions;
- appropriate locations for re-introduction are identified.

Maintain recreational fishing opportunities for other species as a high priority (Lake Wenatchee mgt.) – USFS, NPS, LCSA, WDFW, city of Chelan

Do not attempt bull trout re-introduction – LCSA, PFLC

Phase out stocking of RBT and discontinue stocking of Lake Trout - NPS, WDFW

Manage KOK and Chi pop. at levels to minimize interference with potential bull trout recovery efforts – NPS, USFS, WDFW

Disease screening of hatchery fish - NPS, WDFW

Manage water levels for fish - NPS

Minimize loss from entrain./spills – NPS, LSCA

Develop monitoring and evaluation (M&E) program – WDFW, USFS, LCSA, NPS

Management Recommendations

1. Investigate feasibility of re-introducing fluvial and adfluvial bull trout
2. Maintain recreational fishing opportunities for other species as a high priority (Lake Wenatchee mgt.)
3. Develop M&E program to assess efficacy of management actions.

2.6 Lake trout

Lake trout have also contributed significantly to the trophy fish fishery in Lake Chelan. The Washington state record, a 31 lb. 2.5 oz. fish, was taken during May 2000. Another 30 + lb. fish was taken the same month. Popularity of the Lake trout fishery has increased in recent years as the landlocked chinook salmon fishery has declined. A primary concern of the Natural Sciences Working Group is restoration of native species. Management objectives are aimed at minimizing the impacts of non-native apex predators on native species and to provide additional sportfishing opportunity. Literature acquired from other systems that include Lake trout indicate strong potential for adverse species interactions between Lake trout, kokanee, landlocked chinook, WSCT, and bull trout. Due to the potential adverse effects on native species and landlocked chinook salmon, continued stocking of Lake trout is being questioned at this time. However, an important aspect of

Appendix A

the M&E program is to investigate these potential impacts and develop appropriate management actions for Lake trout.

Studies conducted in 1999 and 2000 for relicensing support indicate that Lake trout are reproducing naturally in Lake Chelan (DE&S 2000a). A Lake trout fry, approximately 32 mm in length, was observed off the mouth of First Creek during snorkel surveys conducted in July 2000. This fish was much smaller than the lake trout planted on June 15, 2000. The two biologists who observed the fry were confident that the fish did not key out as any of the *Oncorhynchus* species or as a bull trout. Upon further investigation they felt very confident that it was a lake trout fry. Additional evidence supporting Lake trout natural reproduction in Lake Chelan is observation of three Lake trout juveniles (75-100 mm) in a side channel in lower mainstem Stehekin River on September 12, 2000 during snorkel surveys.

Primary Issues

Discontinue stocking program – WDFW (Alt. 1), USFS, NPS

Continue stocking program – LCSA

Survey to determine number and origin of fish – WDFW, LCSA

Increase limit – WDFW

Explore the need for active removal programs - NPS

Assess kokanee population – WDFW, LCSA

Attempt to balance kokanee & lake trout populations – WDFW, LCSA

Attempt to balance kokanee & lake trout populations - LCSA

Develop monitoring and evaluation (M&E) program – WDFW, USFS, LCSA, NPS

Do not support any efforts to significantly reduce population of Lake trout – LCSA, city of Chelan

Management Recommendations

1. Discontinue Lake trout stocking program:
2. Develop M&E program to assess efficacy of management actions.

2.7 Burbot

Little is known of the burbot biology and population characteristics in Lake Chelan. The only data currently available are harvest data. The Natural Sciences Working Group has identified the need to investigate burbot population dynamics more thoroughly in order to develop better management actions.

Primary Issues

Assess burbot population trends via index sampling – WDFW, LCSA, NPS

Use otoliths for age structure - WDFW

Routine sample gonads – WDFW, USFS, LCSA

Angling restrictions if population continues to decline – USFS, NPS

Disease screening – NPS

Investigate life history requirements of burbot in the Chelan watershed - NPS

Assess hydro project related impacts - NPS

Management Recommendations

1. Develop M&E program to assess efficacy of management actions.

2.8 Smallmouth bass

Smallmouth bass were introduced into Lake Chelan some time around 1990. The smallmouth population has increased in the lake and supports an active sport fishery. The Natural Sciences Working Group believes that smallmouth are “here to stay” in Lake Chelan, but desire to confine the population to the Wapato Basin. This species will require some management to maintain control/confinement of the population. No enhancement measures for this species is recommended at this time.

Primary Issues

No change in angling regulations – WDFW

Monitor isolation to Wapato Basin – USFS, LCSA, NPS

Remove any developing populations in the Lucerne Basin – NPS

WDFW needs to develop position statement regarding where smallmouth bass fit into the overall fishery for Lake Chelan by **DATE?** Check with Art V.

Develop enforcement efforts necessary to ensure population is controlled and no further “illegal relocations” take place.

Management Recommendations

1. Develop M&E program to assess efficacy of management actions.
2. No enhancement measures for this species is recommended at this time.

2.9 Eastern brook trout

Eastern brook trout have become established in Twentyfive Mile Creek and the Stehekin River from historic stocking efforts. The Natural Sciences Working Group has a strong desire to remove brook trout from the Chelan Basin due to adverse impacts from this species through competition and disease on native salmonids. Any recovery efforts for Westslope cutthroat and bull trout populations would be hampered by the presence of brook trout in the Chelan Basin

Primary Issues

Eradicate, if possible, from 25-Mile Creek and Stehekin River – USFS, NPS

Angling regulations to encourage selective harvest will depend on status of bull trout restoration and possibility of incidental catch of bull trout attributed to misidentification – USFS, NPS

Management Recommendations

1. Eradicate, if possible, from Twentyfive Mile Creek and the Stehekin River.
2. Monitor success of eradication efforts.

2.10 Other native fish species

- Pygmy whitefish
- Threespine stickleback
- Peamouth chub

Appendix A

- Chiselmouth
- Northern pikeminnow

The Natural Sciences Working Group is unsure of the effects of non-native fish stocking on these native species. Pygmy whitefish, of particular concern, are listed as a Washington State species of concern. Additional data collection on Pygmy whitefish and other native species need to be included in CFMP M&E program in order to develop sound management actions.

Primary Issues

Periodic surveys to assess population trends and to evaluate status of populations – USFS, NPS

Avoid management actions that would push these species to extirpation – USFS

Management Recommendations

1. Develop M&E program to assess efficacy of management actions.

2.11 Other non-native introductions

Primary Issue

No new introductions of non-native species – USFS, NPS, WDFW, LCSA

Management Recommendations

1. No new introductions of non-native species.
2. No introductions of anadromous fish to the lake – USFS, NPS, WDFW, LCSA

SECTION 3: Monitoring and Evaluation Program

A sound monitoring and evaluation (M&E) program is an important component of any management plan. An M&E program is necessary to assess the efficacy of management actions, and to use for Adaptive Management alterations to the plan as future conditions and data analyses dictate. One proposal from the Natural Sciences Working Group is to enlist the services of Dr. Dave Beauchamp, University of Washington, to develop a bioenergetically-based food web model for Lake Chelan. The model can be used as a tool for evaluating the potential impacts of species interactions, production potential, and environmental conditions (i.e., inter-annual changes in temperature regimes) within a temporal, spatial, and size-structured framework. The model, ultimately, will be used to support development and evolution of the Comprehensive Fishery Management Plan for Lake Chelan. This approach will allow fishery managers to evaluate current and/or proposed fish stocking strategies and management regulations within the context of ecological feedback from the lake food web. The ultimate goal of the M&E program is to provide information to fishery managers with which to develop biological objectives and

Appendix A

make effective management decisions that will provide for sustainable fishery resources in Lake Chelan and its tributaries.

SECTION 4: Implementation

1. Responsibility for implementing the CFMP

The Washington Department of Fish and Wildlife (WDFW) has the primary responsibility for implementing the CFMP. However, a Fishery Advisory Committee (FAC), with membership as described below, will provide guidance and recommendations to WDFW regarding management of Lake Chelan fishery resources. Other stakeholders have significant roles in managing fishery resources in Lake Chelan, including the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), the Colville and Yakama Tribes, and the Lake Chelan Sportsman's Association (LCSA).

The initial core members of the FAC will be, but are not limited to, representatives from:

- WDFW
- USFS
- NPS
- LCSA
- Chelan PUD
- USFWS
- Tribes

Membership to the FAC will be accomplished via written request to the FAC. Entities petitioning for membership, once accepted, must make best efforts to attend meetings, review material to be discussed at FAC meetings prior to the meeting, come to meetings prepared to provide meaningful input, and complete tasks assigned by the FAC in a timely manner.

The FAC will make recommendations based on consensus of the members. Consensus is understood to mean that a majority of the participating members agree (do not object) to the decisions being made and that Chelan PUD and those agencies that have mandatory conditioning authority (for those decisions related to the agencies' mandatory conditioning authority) unanimously agree (do not object) to those decisions.

At least annually after license issuance, Chelan PUD shall convene the FAC to discuss issues pertinent to the CFMP.

2. Timing of implementing the CFMP

Low risk actions mutually agreeable to all interested parties e.g., converting stocked catchable trout from rainbow to Westslope cutthroat (WSCT), eliminating Lake trout stocking, adjusting stocked kokanee numbers, eyed-eggs plants of WSCT eggs in First Creek, are being implemented immediately. The Fishery Advisory Committee will compile

Appendix A

a list of additional low risk actions that could also be implemented early. Actions relying on results of the Monitoring and Evaluation Program will be reviewed by the FAC on an annual basis.

List of potential low risk actions

- Implement lake level operation proposal (PME07).
- Do not increase fish stocking (kokanee, landlocked chinook, Lake trout), with the exception of the rainbow trout phase-out program and other potential native fish restoration stocking actions
- Other?

3. Development of a Monitoring and Evaluation (M&E) Program

Development of the M&E Program is incumbent upon the interested parties participating in the relicensing process, such as those listed as Fishery Advisory Committee members. The food-web modeling proposed by Dr. Dave Beauchamp appears to be a good start toward developing an M&E program.

Objectives of the M&E program are to:

- 1) gather data for input into fishery management decisions to protect, conserve, and restore native fish populations, and to maintain quality recreational fishing opportunities;
- 2) evaluate whether measures implemented are providing desired results; and
- 3) maintain future options and prevent making any irreversible decisions.
- 4) Prepare annual report of M&E results and provide future recommendations.

4. Responsibility for funding the CFMP and associated M&E Program

WDFW

WDFW will continue funding the landlocked chinook salmon stocking program and a portion of the Chelan Falls Hatchery. Funding from the Lake trout stocking program, which is being discontinued at the present time, may be used for additional proposed stocking efforts and/or implementation of the M&E program. WDFW will also pursue partnerships with federal, state, and private entities and cost-sharing opportunities with other resource co-managers as the preferred funding mechanism.

USFS

The USFS will pursue partnerships with federal, state, and private entities and cost-sharing opportunities with other resource co-managers as the preferred funding mechanism. The USFS will continue to provide data as part of their ongoing M&E program on their lands. Grants will be sought to provide additional funding for CFMP implementation. The USFS will pursue development of a Large Woody Debris (LWD) Management Plan, and append the plan to the CFMP.

NPS

The NPS will pursue partnerships with federal, state, and private entities and cost-sharing opportunities with other resource co-managers as the preferred funding mechanism. The

Appendix A

NPS will continue to provide data as part of their ongoing M&E program on their lands, particularly in the lower Stehekin River. Grants will be sought to provide additional funding for CFMP implementation.

USFWS

The USFWS will pursue partnerships with federal, state, and private entities and cost-sharing opportunities with other resource co-managers as the preferred funding mechanism. The USFWS will provide data sharing and bull trout monitoring in the Stehekin drainage. Grants will be sought to provide additional funding for CFMP implementation.

Chelan PUD

Chelan PUD, upon receipt of a new license or signed agreement of all parties, will immediately provide funding for implementation of their responsibilities highlighted in the Comprehensive Fishery Management Plan (CFMP) submitted with the license application, more specifically items 1-4 below. The geographic scope of the CFMP is Lake Chelan, its bordering lands, and its tributaries. Funding provided by Chelan PUD will be for the following activities:

1. At least annually after license issuance, Chelan PUD shall convene the FAC to discuss issues pertinent to the CFMP. Chelan PUD will provide materials and meeting facilities to the FAC.
2. Within two years of license issuance, Chelan PUD shall provide funding of \$100,000 (2001 \$), to mechanically remove alluvium barriers in 3 to 5 tributaries to facilitate access to the tributaries for spawning.
3. Chelan PUD will provide \$30,000 (2001 \$) by January 31 of each year for fish stocking and/or tributary enhancement. Specific measures will be determined in coordination with the FAC. At the request of the FAC, funds may be allowed to accumulate for expenditure on projects in future years.

Chelan PUD will provide matching funds up to \$7,500 (2001 \$) by January 31 of each year for funding of the monitoring and evaluation program described in the CFMP. The Licensee will be responsible for matching the average amount of funding provided by the Washington Department of Fish and Wildlife (WDFW), the U.S. Forest Service (USFS) and the National Park Service (NPS) (up to the \$7,500 limit).

LSCA

The Lake Chelan Sportsman's association has provided funding for projects in the past such as First Creek culvert replacement, eyed WSCT egg plants, fish stocking programs, funding and labor to improve docks, an annual kids fishing program, and continued community efforts to raise awareness about the Lake Chelan fishery. The LCSA has stated continually during the relicensing process that they are willing to fund measures that provide enhancement to Lake Chelan fisheries. The LCSA has also been a strong proponent of developing a sound M&E program to determine effectiveness of management decisions, and could provide funding for a portion of the M&E program.

Appendix A

SECTION 5: Literature Cited

- Brown, L.G. 1984. Lake Chelan fishery investigations. Report to Chelan PUD and Washington Department of Game.
- Duke Engineering and Services (DES). 2000a. Lake Chelan fisheries investigation-final, Lake Chelan Hydroelectric Project No. 637. Prepared by Duke Engineering & Services, Inc., Bothell, Washington for Chelan PUD by Duke Engineering & Services, Inc., Bellingham, Washington. 95 pp. September 26, 2000.
- Felder, P.C. 1999. Lake Chelan spawning ground survey - 1999. Prepared for Chelan PUD, Wenatchee, Washington.
- A.E. Viola and J. ? Foster. In press. Lake Chelan Comprehensive Fishery Management Plan. Washington Department of Fish and Wildlife.

Appendix B: Chelan River Comprehensive Management Plan

CHELAN RIVER (BYPASSED REACH) COMPREHENSIVE MANAGEMENT PLAN

Third Draft

**LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637**

September 14, 2001



**Public Utility District No. 1 of Chelan County
Wenatchee, Washington**

TABLE OF CONTENTS

SECTION 1: INTRODUCTION.....	22
SECTION 2: BYPASSED REACH OF THE Chelan RIVER MEASURES.....	25
2.1 Minimum Flow.....	25
2.2 Reach 4 Modifications.....	28
2.3 Tailrace Modifications.....	29
2.4 Entrainment.....	29
2.5 Schedule.....	30
SECTION 3: Monitoring and Evaluation Program.....	33
3.1 Monitor Aquatic Macroinvertebrates.....	Error! Bookmark not defined.
3.2 Steelhead spawning surveys.....	Error! Bookmark not defined.
3.3 Steelhead Redd Characteristic Measurements.....	Error! Bookmark not defined.
3.4 Evaluate Steelhead Egg-Fry Success.....	Error! Bookmark not defined.
3.5 Steelhead Snorkel Surveys (Reach 4, tailrace).....	Error! Bookmark not defined.
3.6 Chinook Spawning Surveys.....	Error! Bookmark not defined.
3.7 Chinook Redd Characteristic Measurements (primarily tailrace).....	Error! Bookmark not defined.
3.8 Evaluate Chinook Egg-Fry Success.....	Error! Bookmark not defined.
3.9 Coho Spawning Surveys.....	Error! Bookmark not defined.
3.10 Snorkel Surveys: Reaches 1 and 2.....	Error! Bookmark not defined.
3.11 Temperature Monitoring.....	Error! Bookmark not defined.
3.12 Bull Trout Monitoring.....	Error! Bookmark not defined.
SECTION 4: Literature Cited.....	36

LIST OF TABLES

Table 1. Natural Sciences Working Group Chelan River Flow Proposal ³	26
Table 2. Natural Sciences Working Group Ramping Rate Proposal.....	27

LIST OF FIGURES

Figure 1. Lake Chelan Hydroelectric Project area, including Reaches 1 through 4 of the Chelan River (adapted from Chelan PUD, 2000d).....	24
Figure 2. Schematic diagram of the subreaches of Reach 4, including an example of the trapezoidal channel.....	31
Figure 3. Braid bar emphasizing spawning and rearing habitat in the modified tailrace.....	32

INTRODUCTION

Lake Chelan Hydroelectric Project, FERC No. 637, relicensing stakeholders have stated that one goal of the relicensing process is to develop and periodically update a Chelan River Comprehensive Management Plan (CRCMP).

The impetus for a such a comprehensive plan stems from the sometimes overlapping authorities and responsibilities of various resource managers and others currently involved in managing some portion of Lake Chelan waters and/or its tributaries, the biological resources therein, and surrounding lands.

Numerous stakeholders have significant roles in managing natural resources in the Chelan River and vicinity. These include:

- The National Marine Fisheries Service (NMFS), particularly through the Endangered Species Act, has interest in spring chinook salmon and summer steelhead stocks in the upper Columbia River.
- The Washington Department of Fish and Wildlife (WDFW), which has fishery management responsibility for resident and anadromous fish.
- The U.S. Fish and Wildlife Service (USFWS), particularly through the Endangered Species Act, has interest in the potential restoration of bull trout to the Lake Chelan watershed.
- The U.S. Forest Service (USFS), as a manager of large tracts of land adjacent to Lake Chelan, and of tributaries to the Lake, has its own fishery management responsibilities in regard to habitat.
- The National Park Service (NPS) has similar, but not identical, responsibilities.
- The Washington Department of Ecology (WDOE) has responsibility to maintain water quality and quantity.
- Native American tribes, especially the Colville Tribes (CCT) and Yakama Nation (YIN), are interested in exploring the feasibility of enhancing anadromous salmonid populations
- The Lake Chelan Sportsman's Association (LCSA) seeks to protect and maintain a viable sport fishery on the lake. To support this effort they seek cooperative efforts with other stakeholders to educate sport fishers as well as contribute funds and volunteer labor for stocking and habitat improvement efforts.

A major objective of the CRCMP is to coordinate the plans and actions of these and other stakeholders in developing and implementing fishery management measures in the Chelan River.

Representatives from various stakeholders, principally the NMFS, the WDFW, the USFWS, the USFS, the NPS, the WDOE, the LCSA, the city of Chelan, the People for Lake Chelan, and Chelan County Public Utility District (PUD), have worked cooperatively to develop the CRCMP for use in the relicensing process and over the term of the license. The CRCMP is to be included as a supporting document to fisheries Protection, Mitigation, and Enhancement (PM&E) measures in the new license for the Lake Chelan Project.

Appendix B

Described in the CRCMP is a set of proposed management actions that include: 1) minimum flows for the Chelan River; 2) habitat modifications for Reach 4 (Figure 2), 3) habitat modifications in the Project tailrace, and 4) a Monitoring and Evaluation (M&E) program. Also described is: 1) formation of a Fishery Advisory Committee (FAC) for providing resource management recommendations; 2) membership of the FAC; 3) roles and responsibilities of the FAC; and 4) a process for reviewing and updating the CRCMP on a periodic basis.

Relicensing studies were conducted in 1998, 1999 and 2000 to determine the current status of fishery resources in the Chelan River. Studies investigated: (1) fish stranding; (2) tailrace spawning surveys; (3) Instream Flow Incremental Methodology (IFIM) analysis; (4) Reach 3 barrier analysis; (5) Limiting Factor analysis; (6) fall chinook salmon spawning preference curve development; (7) water temperature; and (8) a comprehensive analysis of streambed stability and potential habitat modifications under different flow regimes.

The primary management objectives of the plan for the Chelan River are to:

1. establish a viable riverine ecosystem, with habitat attributes necessary to support fish populations consistent with natural limiting factors;
2. meet water quality standard for designated beneficial uses;
3. provide spawning and rearing habitat for summer chinook and steelhead in Reach 4;
4. provide spawning and rearing habitat for summer chinook and steelhead in the Project tailrace;
5. have WDFW provide a test of the passage of summer chinook salmon and steelhead through Reach 3; and
6. reduce the potential for entrainment of fish from Lake Chelan into the power intake via periodic monitoring of modified trashracks

Appendix B

Figure 2. Lake Chelan Hydroelectric Project area, including Reaches 1 through 4 of the Chelan River (adapted from Chelan PUD, 2000d)

BYPASSED REACH OF THE Chelan RIVER MEASURES

The Natural Sciences Working Group addressed a number of fish resource issues related to the operation of the Lake Chelan Hydroelectric Project, as well as general fisheries resource management concerns. The working group proposal consists of three main components. These are a set of biological objectives, a flow regime recommended to achieve those objectives, stream channel modifications to both the bypassed reach of the Chelan River and tailrace to improve habitat diversity necessary to support the biological objectives and a monitoring and evaluation program. A monitoring and evaluation program has been included because of biological uncertainty regarding the attainability of biological objectives and the exact flow regime necessary to support the objectives that are attainable.

Minimum Flow

Under present operations, the bypassed reach of the Chelan River provides no year-round fish habitat for resident or anadromous species, with the exception of groundwater-fed pools in a few locations above the gorge and in the gorge itself. The Natural Sciences Working Group has evaluated a number of options for minimum flows and flow regimes to accomplish biological objectives within the bypassed reach of the Chelan River and tailrace, while moderating the adverse affects to power generation and resources, both social and biological, in Lake Chelan. The working group used the results of several studies and empirical evidence to reach agreement on biological objectives and a flow regime for the bypassed reach of the Chelan River and tailrace. The studies included instream flow (IFIM) analysis, barrier analysis and temperature studies (R2 and IA, 2000; Anchor 2000), a comprehensive analysis of streambed stability and potential habitat enhancements under different flow regimes (Stillwater Sciences, 2001). Empirical evidence included field investigations of substrates and habitat utilization by spawning chinook salmon.

The biological objectives for the Chelan River and tailrace that were adopted by the working group are as follows:

- (1) Establish a naturally functioning aquatic ecosystem in the bypassed reach of the Chelan River;
- (2) Establish minimum flows adequate to support riparian vegetation, benthic food organisms, cutthroat trout and native cool-water species in Reaches 1, 2 and 3; and
- (3) Establish flows and habitat adequate to support spawning, incubation and early rearing of chinook salmon and steelhead trout in Reach 4 and the tailrace.

The working group's flow recommendation is shown in Table 1. Minimum flows will be variable based on the definition (dry/average/wet) of individual water years. Sources of flow include the minimum flows released from the dam, water pumped into Reach 4 and powerhouse flows in the tailrace. Physical modifications to the Reach 4 stream channel

Appendix B

and tailrace are also proposed to increase habitat diversity for spawning and rearing chinook and steelhead at the recommended flow levels. The outlet structure at the Chelan Dam will be modified to have the capability to: 1) deliver 100 percent of Reach 4 flows by gravity if pump failure occurs; and 2) provide up to 320 cfs at all lake elevations.

Table 1. Natural Sciences Working Group Chelan River Flow Proposal³

Reach	Dry year (cfs)	Average year (cfs)	Wet year (cfs)
1, 2 & 3 ¹	80 all months	80 July 16 – May 14	80 July 16 – May 14
		May 14 – ramp up as per schedule ⁴	May 14 – ramp up as per schedule ⁴
		200 May 15-July 15	320 May 15-July 15
		July 16 – ramp down as per schedule ⁴	July 16 – ramp down as per schedule ⁴
4 ² Spawning flow	80 + 240 pumped March 15 to May 15 and Oct. 15 to Nov. 30	320 by combination of spill & pumping March 15 to May 15 and Oct. 15 to Nov. 30 Incubation flow, as needed	320 by combination of spill & pumping March 15 to May 15 and Oct. 15 to Nov. 30 Incubation flow, as needed

¹ Flows measured at the dam by calibrated gate rating.

² Flows measured at the dam or through calibrated pump discharge curves.

³ See Sections 2.1.2 and 2.1.3

⁴ See Section 2.1.3

Definition of dry/average/wet water years

The year-round minimum flow level is 80 cfs with a spring/early summer flow increase to mimic the natural hydrograph. The spring/early summer flow increase is variable, depending on the level of winter snow deposition and runoff forecast. In dry years, when the runoff is predicted to be less than normal (within the 80% exceedance range of historical runoff volumes), then only the 80 cfs minimum flow would be released. In average water years, when the runoff is predicted to be normal (within the 21% - 79% exceedance range or 60% of the years based on historical records), then a 200 cfs minimum flow would be released in May through June. The exact timing of the flow increases could change depending on climatic conditions (spring temperatures or rain) and biological evaluations (see Section 2.1.2). In wet years, when runoff is predicted to be greater than normal (within the 20% exceedance level), then a 320 cfs minimum flow would be released in May through June. Minimum flows greater than 80 cfs would be subject to the ramping schedule specified in (Section 2.1.2). The actual flow into the Chelan River in years with higher than average snowpack would often exceed the minimum flow levels specified in section 2.1.2 and, during these high flow events, the ramping schedule would not apply (when inflows exceed the hydraulic capacity of the Project and the lake elevation is at 1,099 feet or higher).

Exceptions – Late runoff years

The April 1 runoff forecast and the lake level elevation are used to establish the level of releases for April and May. The volume of runoff needed to refill the lake is calculated from the lake elevation. The proportion of the April 1 runoff forecast expected to occur prior to July 1 is estimated and the volume in excess of the refill requirement is used for power generation. Three predictive curves, one each for early, average and late runoff

Appendix B

timing, are generated based on the forecast and these curves are used to manage generation. On average, approximately 80% of the runoff entering the lake occurs before July 1 (average runoff). In years with cold spring weather approximately 70% of the runoff occurs by July 1 (late runoff), whereas in warm years, as much as 95% occurs by July 1 (early runoff). The lake is currently managed assuming average to late runoff conditions. However, in most years the cold spring weather breaks by early June and the lake refills before July 1. The current management approach results in substantial levels of spill once the lake is full.

The proposed management approach would assume early to average runoff conditions and include provisions for minimum flow releases into the bypassed reach of the Chelan River. The results of the proposed lake level management approach, based on forecasting using the 1952 to 2000 period of record, would be that the lake would not fill to elevation 1098.0 feet (full) by July 1 on only 8 of the next 50 years. However, in all of the 8 years that the lake did not reach full by July 1, the lake would reach full by July 8. This level of flexibility will reduce spill levels that would provide: 1) reduced impacts on aquatic biota in the bypassed reach of the Chelan River from high peak spill level; 2) benefits to aquatic biota by providing conditions in the bypassed reach of the Chelan River that more closely mimic the natural hydrograph; 3) more flow in the tailrace in early spring (April and May) for steelhead egg incubation and fry emergence; and 4) reduce impacts on power generation.

2.1.3 Ramping Rate Schedule

In order to protect aquatic organisms from rapid fluctuations in water levels, ramping rates are generally established to allow fish to move into and out of shallow zones without being stranded when flows decrease. During the period when fry may be present, ramping rates in FERC licenses are usually set at 1 inch per hour (Yelm Hydroelectric Project No. 10703, Newhalem Creek Hydroelectric Project No. 2705-003, Nisqually Hydroelectric Project No. 186). The water elevations at various flows and locations were recorded during the instream flow studies in the bypassed reach of the Chelan River (Bypass Reach (Gorge) Flow Releases Study – R2 Resource Consultants and Ichthyological Associates, Inc., 2000). These measurements were taken to calibrate the flow model and include measurements at a number of transect locations in Reaches 1, 2 and 4 of the bypassed reach of the Chelan River. In Reaches 1 and 2, a flow increase of 179 cfs from the base minimum flow of 80 cfs changed the average water elevation in the channel by less than 1 inch. In Reach 4, a change in flow of 422 cfs raised the water elevation by slightly more than 1 inch. These water elevations were averaged from ten transects in the 2.23 mile-long Reach 1, five transects in the 0.75 mile-long Reach 2, and four transects in the 0.49 mile-long Reach 4. These data are summarized in Table 2.

Table 2. Natural Sciences Working Group Ramping Rate Proposal

Reach 1		Reach 2		Reach 4	
Discharge	Water Elevation	Discharge	Water Elevation	Discharge	Water Elevation
81 cfs	88.04 inches	81 cfs	91.12 inches	117 cfs	87.87 inches
260 cfs	88.73 inches	260 cfs	92.09 inches	539 cfs	88.93 inches
Difference	0.69 inches	Difference	0.98 inches	Difference	1.06 inches

Appendix B

The approximately 0.7 – 1.0 inch difference in average water elevation measured closely approximates the changes that will actually occur in the bypassed reach of the Chelan River with the proposed minimum flow increases.

The flow changes proposed for whitewater boating will be 370 cfs and 220 cfs increases over the 80 cfs base minimum flow. The whitewater flows would not be expected to increase river stage more than 2 inches, at most. Based on this information, a ramping period of 2 hours for flow changes associated with either the minimum flow operations or whitewater boating flows would be adequate to prevent water level elevations from exceeding 1 inch per hour.

Ramping flows up or down to minimum flow levels shall be done gradually over a two hour period, which will be adequate to prevent water elevations from increasing or decreasing by more than 1 inch per hour in the bypassed reach of the Chelan River. Ramping for whitewater boating flows will be conducted gradually over a two hour period during daylight hours.

Reach 4 Modifications

Enhanced stream channel

The existing river channel in Reach 4 and the tailrace both currently lack habitat diversity necessary to support rearing of juveniles and other functions of a natural aquatic ecosystem. The working group proposal includes recommended morphological modifications to the river channels in both Reach 4 and the tailrace. Reach 4 currently has little sinuosity and no large boulders or structure to create gravel catchments, scour pools and other habitat features. The working group proposes to use standard river habitat restoration techniques to accomplish the goals of providing and maintaining gravel areas for spawning, boulder placements for cover and pool formation, and increased sinuosity to moderate velocities and provide additional area and habitat diversity. Habitat modifications to Reach 4 are shown conceptually in Figure 2. Most of the modifications proposed in Reach 4 will be done by a bulldozer. The following are specific modifications proposed for Reach 4 sub-reaches identified in Figure 2:

Sub-reach 4.1

1. Create narrower/steeper channel
2. Use large boulder placement
3. Move channel away from road
4. Add/move gravel to channel

Sub-reach 4.2

1. Create wider (100' avg.)/flatter channel
2. Use large boulder placement
3. Add sinuosity of ~1.2
4. Move channel away from road
5. Add/move gravel to channel

Appendix B

Sub-reach 4.3

1. Continue 100' channel width
2. Use large boulder placement
3. Add sinuosity of ~1.2
4. Add/move gravel to channel

Sub-reach 4.4

5. Continue 100' channel width
6. Use large boulder placement
7. Add sinuosity of ~1.2
8. Add/move gravel to channel

Pumping

The working group proposal includes additional flow into Reach 4 during the spawning period for steelhead and summer chinook to provide greater depths and velocities that will improve habitat conditions for spawning by these species. The working group proposes to supply the additional flow by pumping from the tailrace, rather than providing this flow from lake storage. Releases from storage at the dam would reduce habitat availability for some species in Reaches 1 and 2 and would have adverse affects on lake levels and/or power generation. The additional pumped flow would be released into Reach 4 just upstream of the existing substation. The discharge location would be protected from damage during high flow periods. Spawning flows would provide optimal spawning potential in Reach 4. Depending on the location of redds that may be created by spawning salmon or steelhead in Reach 4, the pumps may also be used to prevent dewatering of redds during incubation. However, the working group anticipates that the 80 cfs minimum flow will be adequate for incubation in most cases and the pumps would only be used for redd protection on an as-needed bases. Should pump failure occur during spawning activity or when needed for protection of incubating redds, the water supply will be maintained by providing the needed flow from a backup pump or from lake storage until the pump system is returned to service. Downramping to 80 cfs from a higher incubation flow will be conducted per the ramping schedule in Section 2.1.3.

Tailrace Modifications

Braided Bar

In the tailrace, an area upstream from the confluence with the bypassed reach of the Chelan River will be partially filled with suitable sized substrate material to create a braided bar with low velocity rearing and spawning habitat. This proposed modification is shown conceptually in Figure 3. Maintenance of suitable spawning flows and adequate intra-gravel flow for incubation in the tailrace, if needed, will be maintained through operation of the powerhouse at minimum flow levels or through water pumped into the spawning gravel through perforated pipe laid into the tailrace streambed. The success of spawning and incubation through emergence will be addressed through the monitoring program.

Flow security for successful incubation (powerhouse off line)

1. Conduct on-site study to determine if powerhouse operations affect spawning success
2. Pumped water through under-gravel perforated pipes
3. Other?

Entrainment

Necessity of screening Project intake and, if so, screening criteria, to be discussed at the September 12, 2001 Natural Sciences Working Group meeting.

Appendix B

Schedule

Chelan PUD has made clear that early implementation of agreed upon PME's is possible as soon as a consensus agreement, as defined in the Communications Protocol: Consultation Guidelines and Procedures, is reached and signed by the Lake Chelan relicensing stakeholders.

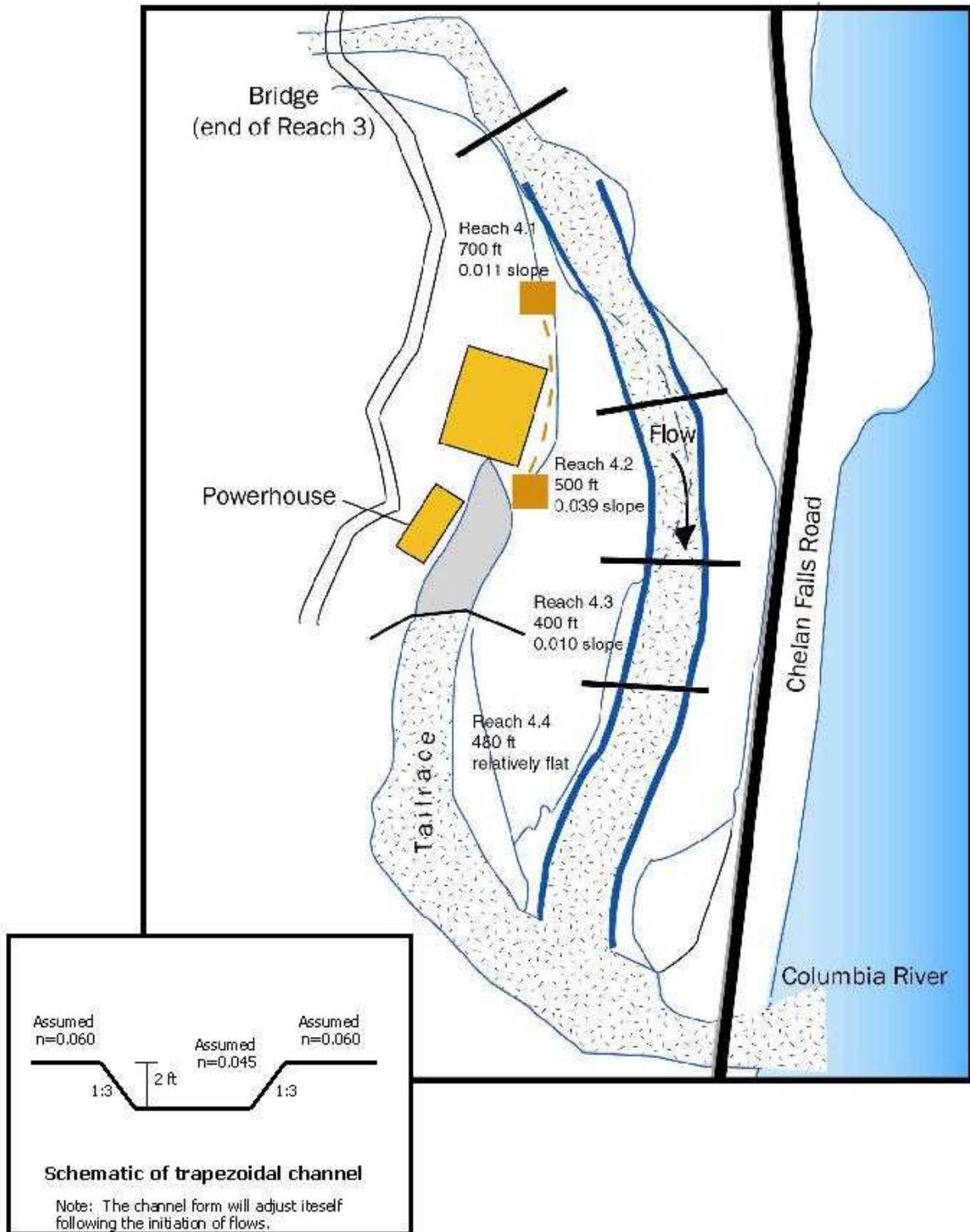


Figure 3. Schematic diagram of the subreaches of Reach 4, including an example of the trapezoidal channel

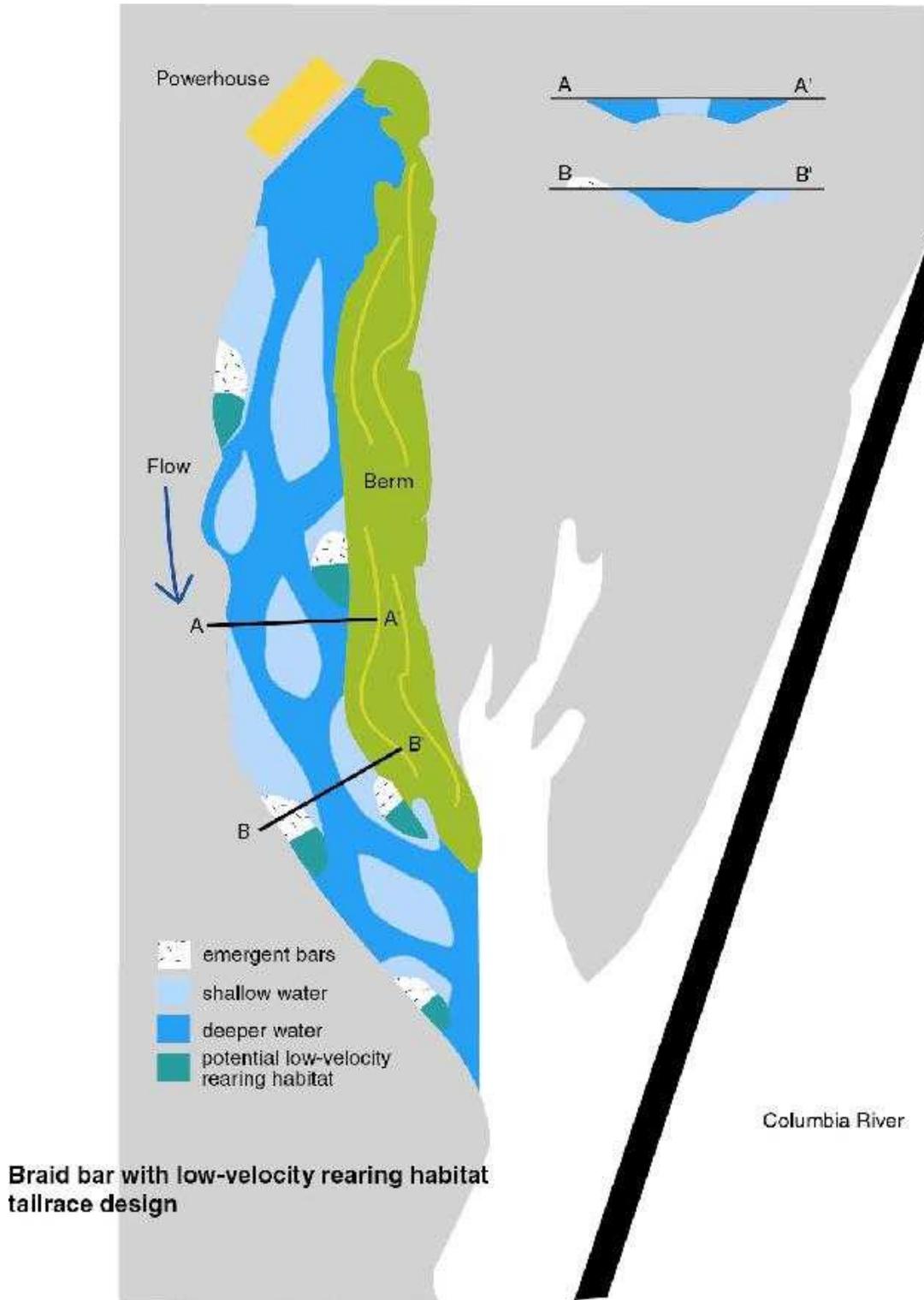


Figure 4. Braid bar emphasizing spawning and rearing habitat in the modified tailrace

Monitoring and Evaluation Program

The monitoring program would address the effectiveness of the working group flow and habitat proposal in meeting biological objectives. The monitoring and evaluation will be directed by a Fishery Advisory Committee (FAC) composed of stakeholders in the relicensing process. The FAC would include representation from Chelan PUD and appropriate federal and state agencies, tribes, local government and other interested parties. The FAC would be responsible for making recommendations, including flows necessary to protect redds during incubation, timing adjustments in spring flow levels through Reaches 1, 2, and 3, and setting monitoring objectives.

The initial core members of the FAC will be, but are not limited to, representatives from:

- WDFW
- USFS
- NPS
- USFWS
- Tribes
- WDOE
- Chelan PUD
- LCSA
- Port of Chelan

Membership to the FAC will be accomplished via written request to the FAC. Entities petitioning for membership, once accepted, must make best efforts to attend meetings, review materials to be discussed by the FAC prior to meetings, come to meetings prepared to provide meaningful input, and complete tasks assigned by the FAC in a timely manner.

The FAC will make recommendations based on consensus of the members. Consensus is understood to mean that a majority of the participating members agree (do not object) to the decisions being made and that Chelan PUD and those agencies that have mandatory conditioning authority (for those decisions related to the agencies' mandatory conditioning authority) unanimously agree (do not object) to those decisions.

At least annually after license issuance, Chelan PUD shall convene the FAC to discuss issues pertinent to the CRCMP.

Monitoring activities conducted for the FAC would include spawning surveys and spawning habitat utilization, surveys of aquatic invertebrates, incubation survival evaluations, snorkel surveys in Reaches 1 and 2, and juvenile salmon surveys in Reach 4 and the tailrace. The FAC would also conduct an experiment to introduce steelhead trout into Reach 4 and the tailrace to attempt establishing a naturally reproducing population. The FAC would have the responsibility of evaluating the information and, potentially, making recommendations to adjust flows and timing of flows as necessary. However, the minimum flows of 80 cfs from lake storage and the maximum spawning flow of 320 cfs (minimum flow or spillway flow plus pumping) would not be increased.

The monitoring and evaluation (M&E) program will continue to resolve uncertainties and provide information needs for future management decisions to meet biological objectives while reserving lake storage and generation resources. Should the monitoring program

Appendix B

determine that the biological objectives can be met with less adverse affects to lake storage or power generation, then the FAC will recommend changes in the pumped flow or changes to the timing of flow releases. Should the monitoring program determine that some of the biological objectives cannot be achieved due to factors beyond the control of the FAC, then the pumped flow into Reach 4 may be revised to conserve resources and the savings associated with pumping costs can be redirected to fish resource projects that are proven to be more effective.

The Natural Sciences Working Group anticipates M&E activities to be intensive for the first 10 years of the new license as proposed PME measures are implemented. M&E activities are expected to be implemented at a lower, more routine level of effort during the remainder of the license period. The FAC will modify implementation of the M&E program as deemed appropriate as information is collected and analyzed. The PME measures proposed in the following section are designed for implementation in the first period of the new license.

Proposed M&E measures are as follows:

Monitor Aquatic Macroinvertebrates

Implement Plotnikoff and Ehinger (1997); Plotnikoff and Wiseman (2001) methodology (see 8/24/01 JGO memo to NSWG)

D-samplers

Once per year

Index reach(es) (selected by FAC)

Sample between Aug.15 and Sept. 15

1 day preparation

1 day sampling

Two person crew

Conduct survey years 1, 3, 5 and 10

Steelhead spawning surveys

Weekly, March – May (13 surveys annually)

1/2 day per survey

One person crew

Conduct survey twice per month (April and May) years 1 and 2

Conduct weekly survey years 3 – 10

Steelhead Redd Characteristic Measurements

Twice during March – May (20% & 80% redd deposition)

Include shallowest redd

1 day preparation

1 day per survey

Two person crew

Conduct survey for incubation flow at end of May

Conduct survey, if redds observed, years 1 and 2

Conduct survey years 3 – 10

Annual monitoring, if habitat use in Reach 4 occurs, to set incubation flow

Evaluate Steelhead Egg-Fry Success

Hydraulic redd sampling (WDFW, Kris Petersen et al.)

Appendix B

Extract eggs and alevins periodically during incubation period (assess development)
Monitor water quality conditions (DO) within redds
Nighttime snorkel surveys during emergence period
Compare Chelan River with control site (Entiat River?)
Survey years 3, 5, and 8

Steelhead Snorkel Surveys (Reach 4, tailrace)

Survey monthly April – September [emergence], late November, and early March [over-winter] (eight surveys annually)
1 day preparation
1 day per survey
Two person crew
Conduct survey years 3 – 10

Chinook Spawning Surveys

Weekly, October 15 – November (seven surveys annually)
1 day per survey
One person crew
Conduct survey years 1 – 10

Chinook Redd Characteristic Measurements (primarily tailrace)

Twice during October 15 – November (20% & 80% redd deposition)
1 day preparation
1 day per survey
Three person crew (boat driver, 2 crew)
Conduct survey years 1 – 5
Annual monitoring, if habitat use in Reach 4 occurs, to set incubation flow

Evaluate Chinook Egg-Fry Success

Hydraulic redd sampling (WDFW, Kris Petersen et al.)
Extract eggs and alevins periodically during incubation period (assess development)
Monitor water quality conditions (DO) within redds
Nighttime snorkel surveys during emergence period
Compare Chelan River with control site (Entiat River?)
Conduct survey years 1 – 5

Coho Spawning Surveys

Twice monthly, November – December (4 surveys annually)
1/2 day per survey
One person crew
Conduct survey years 1 – 5

Snorkel Surveys: Reaches 1 and 2

Survey in April, August, and November (3 surveys annually)
1 day preparation
1 day per survey
Two person crew
Conduct survey years 1, 3, 5 and 10
Conduct one per month survey years 5 and 10

Temperature Monitoring

Continuous monitoring at several locations (dam and Reach 4)

Appendix B

Annual report of monitoring activities

Use temperature data to estimate time of emergence for summer chinook and steelhead

Bull Trout Monitoring

Snorkel surveys to address tailrace and Reach 4 use

Literature Cited

Anchor Environmental, L.L.C. (Anchor). 2000. 1999 Water quality monitoring report - final, Lake Chelan Hydroelectric Project No. 637., Seattle, Washington. 83 pp. Prepared for Chelan PUD. September 26, 2000.

Plotnikoff, R.W. and S.I. Ehinger. 1997. Using invertebrates to assess the quality of Washington streams and to describe biological expectations. Washington State Department of Ecology. Publ. No. 97-332

Plotnikoff, R.W. and C.W. Wiseman. 2001. Benthic macroinvertebrate biological monitoring protocols for rivers and streams (draft). Washington State Department of Ecology. Publ. No. 01-03-028.

R2 Resource Consultants and Ichthyological Associates, Inc. (R2 and IA). 2000. Bypass reach (gorge) flow releases study report - final, Lake Chelan Hydroelectric Project No. 637. Prepared by R2 Resource Consultants, Redmond, Washington, and Ichthyological Associates, Inc., Lansing, New York, for Chelan PUD. September 26, 2000.

Stillwater Sciences. 2001. Conceptual alternative for Chelan River restoration. Draft final report. Prepared by Stillwater Sciences, Berkeley, California, for Lake Chelan Caucus and Chelan PUD. June 20, 2001.