

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail /One on One Meeting Log

Contact Name: Grant Lake Stakeholder Group (see below)

Agency/Organization: Grant Lake Stakeholder Group (see below)

Phone No./E-mail Address: Grant Lake Stakeholder Group (see below)

Date: 9/5/13

Time: 9am – 3pm (6 hours)

Grant Lake Licensing Team Contact: Cory Warnock

Summary of Conversation and/or E-mail Exchange:

Attendance List:

David Griffin (ADNR)
Cassie Thomas (NPS)
Patti Berkhahn (ADF&G)
Eric Rothwell (NMFS)
Robert Stovall (USFS)
Lesli Schick (ADNR)
Pam Russell (ADNR)
Audrey Alstrom (AEA)
Monte Miller (ADF&G)
Jason Mouw (ADF&G)
John Lang (USFS)
Mike Salzetti (KHL)
John Stevenson (BioAnalysts)
Cory Warnock (McMillen)

Mike Salzetti, John Stevenson and Cory Warnock met the attendees at the Moose Pass boat dock and transported them to the mouth of Grant Creek. Upon arriving on site, John Stevenson led the tour of the creek and associated project study infrastructure. Primary infrastructural areas focused on included:

- Fish weir
- Radio tagging area
- Radio telemetry data collection areas
- Man camp
- Incline plane traps (upper and lower)
- Stream gauge
- Thermologger locations
- Proposed powerhouse location

Sockeye could be seen actively passing the weir as well as staging immediately above and below it. A good amount of time was spent monitoring activities at the weir including fish collection for tagging and measurement of specific variables. During the tour, Mr. Stevenson stopped several times while moving upstream to point out a variety of relevant natural aquatic features including:

- Main channel spawning locations
- Side channel spawning and rearing locations
- Areas of quality habitat located in primary side channels (multiple life stages)
- Areas of radio telemetry detection for specific species
- Reach breaks
- The lower portion of the “canyon” (Reach 5)

During the tour, a variety of questions were asked. Given the grouping during the tour and the inclination for folks to spread out and explore areas of personal primary importance, not all questions could be heard and/or documented in this write-up. Areas of primary inquiry included:

- Flows down Grant Creek during the study season.
 - Cory Warnock pointed out that a low flow of 18cfs was measured and a high of over 900cfs was recorded during peak run-off.
- Flows at which primary side channels became wetted to an extent to provide suitable habitat.
 - Mr. Stevenson explained that the instream flow study will document this, analysis is currently underway and it will be discussed during the 2013 study report meetings.
- Numbers of anadromous and resident fish to pass the weir to date.
 - Mr. Stevenson stated that more fish are passing daily but Over 400 sockeye, 30 Chinook and 20 rainbow trout had been enumerated at the weir.
- Thermologger locations.
 - Mr. Stevenson and Mr. Warnock pointed out locations of existing thermologgers in Grant Creek. Mr. Warnock further explained that a portion of the thermologgers in the creek and the lake from the 2009/2010 study were retrieved and contain a good amount of quality data to supplement the 2013 effort.

- Numbers of fish documented (via tagging) in Reach 5.
 - Mr. Stevenson pointed out that the number was quite low relative to the overall counts at the weir but a few (approximately 10) sockeye had been recorded entering Reach 5. Many of those fish then moved back downstream within 24 hours indicating that they likely did not spawn there. Additionally, two rainbow trout had been tracked into Reach 5.
- Apparent value of primary side channels on Grant Creek.
 - Mr. Stevenson pointed out that while wetted, the primary side channels appear to possess significant value for spawning and rearing for both resident and anadromous fish in Grant Creek.
- Radio tag distribution for resident fish (Dolly Varden and rainbow trout).
 - Mr. Stevenson explained that the initial intent for the study year was to tag 30 rainbow trout and 10 Dolly Varden. Due to a variety of circumstances including high flows during primary rainbow migration timing and juvenile collection indicating that Grant Creek is a Dolly Varden dominated system, a decision and permit amendment was made to allow for the tagging of equal numbers of both rainbow and Dolly Varden (20 of each).
- It was pointed out by Patti Berkhahn (ADNR) that there were some erosion and armoring issues along with a few fuel receptacles that were not appropriately contained.
 - Ms. Berkhahn followed-up with suggestions for rectifying those areas and KHL is currently taking steps to remedy the issues as soon as possible.

Once the tour was finished and folks returned to the lower area, everyone ate lunch at the man camp and informally conversed. Once finished, Mr. Warnock and Mr. Stevenson transported two separate groups of stakeholders back to their vehicles and the site visit concluded at approximately 3pm.

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Consultation Record

Phone/E-mail/One-on-One Meeting Log

Contact Name: John Eavis

Agency/Organization: USFS Seward Ranger District

Phone No./E-mail Address: 907 288 2003

Date: September 5, 2013

Time: 10:50am

Grant Lake Licensing Team Contact: Dwayne Adams

Summary of Conversation and/or E-mail Exchange:

John said that he would be the contact for INHT matters relative to the INHT. Alison Rein wouldn't be involved. We discussed a possible meeting on 1 or 3 November to discuss a possible reroute of the INHT through the project area.

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail/One-on-One Meeting Log

Contact Name: John Eavis

Agency/Organization: USFS Seward Ranger District

Phone No./E-mail Address: 907 224 3374

Date: September 23, 2013

Time: 4:58pm

Grant Lake Licensing Team Contact: Dwayne Adams

Summary of Conversation and/or E-mail Exchange:

I left a message on John's cell phone asking if he could make an upcoming meeting to discuss the INHT.

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail/One-on-One Meeting Log

Contact Name: John Eavis

Agency/Organization: USFS Seward Ranger District

Phone No./E-mail Address: 907 288 2003

Date: September 26, 2013

Time: 4:58pm

Grant Lake Licensing Team Contact: Dwayne Adams

Summary of Conversation and/or E-mail Exchange:

I left a message asking John about an upcoming meeting to discuss INHT with the key people.

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail/One-on-One Meeting Log

Contact Name: John Eavis

Agency/Organization: USFS Seward Ranger District

Phone No./E-mail Address: 907 288 2003x701

Date: October 21, 2013

Time: 2:25pm

Grant Lake Licensing Team Contact: Dwayne Adams

Summary of Conversation and/or E-mail Exchange:

I left a message asking if John could make a 1 November meeting to discuss INHT with the involved agencies.

From: Cory Warnock
Sent: Monday, September 09, 2013 1:04 PM
To: Miller, Monte D (DFG); Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)
Cc: Mike Salzetti; Emily Andersen
Subject: RE: Grant Lake Project Work Groups

Hi Monte,

Glad you found the site visit beneficial. Mike and I have already been in touch with the appropriate folks (internally and externally) and the fuel containment issue along with two issues pointed out by Patti Berkhahn are already in the process of being remedied.

Cory

From: Miller, Monte D (DFG) [mailto:monte.miller@alaska.gov]
Sent: Monday, September 09, 2013 12:04 PM
To: Cory Warnock; Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)
Cc: Mike Salzetti; Emily Andersen
Subject: RE: Grant Lake Project Work Groups

Cory,

Please include me in both groups.

I appreciated the opportunity to attend the site visit. It appears that the efforts on site to maintain the ability to collect data have been successful. This has occurred under challenging conditions and I hope that the effort will continue long enough to collect some coho data as well. The closer to cold weather, the more challenging it will become to stay at the site and collect data. It will be very interesting to review the data collected.

Others have probably mentioned concern regarding generator and fuel storage containment. There are probably some permit compliance issues there as well. Our concerns are with possible fuel spills into the watershed. Please comply with standard fuel containment practices. Someone stated that containment equipment was on site but had not been placed in use. If so, this is an easy correction. Thanks.

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS
333 Raspberry Road
Anchorage, Alaska, 99518-1565
(907) 267-2312

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]

Sent: Monday, September 09, 2013 10:31 AM

To: Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Miller, Monte D (DFG); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: Grant Lake Project Work Groups

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

Hi all,

I wanted to start by saying thank you to those who attended the Grant Creek site visit and I hope that you all found it beneficial. I thought it was a great turn-out and was very pleased that the weather decided to cooperate! As I mentioned, if anyone has any follow-up questions, please don't hesitate to let me know.

I wanted to let you all know about a process change that we will be implementing in the interest of increased efficiency and collaboration. As I eluded to during the site visit, HEA will be developing a separate "Aquatics Work Group" (AWG). This group will responsible for discussing all matters associated with aquatics issues (fisheries, aquatic habitat, aquatic nutrients, instream flow, etc.) related to the Grant Lake Project. Given the number of studies and level of interest in this specific discipline, having a separate work group to discuss this area, makes sense from an efficiency standpoint. As such, the AWG meeting related to the upcoming 2013 study reports/data review will be held separate from the other natural resource areas (Water Resources, Terrestrial, Recreation/Visual), which will have their meeting in a grouped fashion. For the purposes of consistency, we will begin calling this other group the "Natural Resource Work Group" (NRWG). These two meetings will be staggered by approximately one month (NRWG first) and both will take

place in the first two months of next year. One note.....I definitely see the potential need for our Water Resources lead to participate in some of the AWG proceedings. Our lead has been prepped and will be present at both sets of meetings if the need is there. I suspect it will be given the relationship between hydrology and fish presence/habitat quality.

The only thing that I'd ask of all of you at this point is to please write back and indicate which group you'd like to be a member of. I fully appreciate and understand that some of you are responsible for multiple natural resource areas for your agencies and may want to be a part of both groups and that is fine. That said, some of you do not have a vested responsibility in some areas and as such, the goal of the separate AWG is to create a more focused group of aquatic representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of.

To give you a tentative idea of our planned report distribution and meeting schedule, we are working toward the following:

- Draft 2013 Water Resources, Terrestrial and Rec/Vis Reports to Stakeholders – **mid to late December (2013)**
- Water Resources, Terrestrial and Rec/Vis Study Results Meeting – **mid January (2014)**
- Draft 2013 Fisheries, IFIM and Aquatic Nutrients Reports to Stakeholders – **mid to late January (2014)**
- Fisheries, IFIM and Aquatic Nutrients Study Results Meeting – **mid February (2014)**

* Cultural Resources will follow the standard path for these types of projects.

Obviously, additional detail will follow as we get closer, groups get established and schedules get refined. In the interim, please don't hesitate to shoot me an email or give me a call with any questions/concerns. Please get back to me related to the work group(s) you'd like to be a part of. Again, thank you for your attendance at the site visit and I look forward to continuing to establish a collaborative process going forward,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

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5771 Applegrove Ln.

Ferndale, Wa. 98248

O – 360-384-2662

C – 360-739-0187

F – 360-542-2264

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Version: 2013.0.3392 / Virus Database: 3222/6648 - Release Date: 09/08/13

From: Cory Warnock
Sent: Monday, September 09, 2013 10:03 AM
To: John Stevenson; 'Mark Miller (mark.miller@bioanalysts.net)'; Gary Fandrei; Nathan Weber; Lisa Ka'aihue (LisaK@ciaanet.org)
Cc: Mike Salzetti
Subject: FW: Grant Creek site visit
Attachments: Contractors list.pdf; Weir.doc

From: Berkhahn, Patti [<mailto:PBerkhahn@borough.kenai.ak.us>]
Sent: Monday, September 09, 2013 8:40 AM
To: Salzetti, Mikel
Cc: john.stevenson@bioanalyst.net; Berkhahn, Patti
Subject: Grant Creek site visit

Mike, John,

Thank you very much for the tour of your weir/research facility at Grant Creek this week. It was very informative for me and gives me perspective on your operation and the dynamics of the river reaches. We talked on site about bank erosion and bank hardening to access the incline trap and the weir. Please refer to stipulation #4 from Fish Habitat Permit 13-V-0112:

- Streambanks shall not be disturbed. If streambanks are inadvertently disturbed by activities attributable to this project, they shall be immediately stabilized to prevent erosion and the resultant sedimentation of streams which could occur both during and after operations.

In reference to your access to the lower incline trap, the rocks you moved to harden the bank need to be redistributed into the river when the field camp is demobilized. If the project continues next year, it is recommended that elevated, light-penetrating gratewalks and stairs to the river be installed at all access points to the river. Currently, your access points are a muddy mess which causes erosion and the release of silt and mud into Grant Creek.

In addition, ADFG, Habitat Division recommends that the sandbags at the far end of weir (to keep the weir fish tight during high water) are replaced with a Vexar panel (similar to the other side of the weir). This could be done this year as I noticed you have the materials on site.

Please send photos to me of your access point to the lower incline trap after you redistribute the rocks into the river at the conclusion of your research this year.

Per your request, I attached the list of local contractors which includes the businesses that sell gratewalk. I also attached signs you can print out on Rite in Rain paper to post below and above the weir to keep anglers from fishing within 300 feet of your weir. We post these signs at Department weir sites – feel free to use them. For your reference, the Sportfish regulation is on page 4 of the 2013 Southcentral Alaska Sport Fishing Regulation Summary.

If you have any questions or comments, please contact me.

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476
(State agency housed in Kenai Peninsula Borough Building)

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Version: 2013.0.3392 / Virus Database: 3222/6648 - Release Date: 09/08/13

KENAI RIVER - BANK PROTECTION CONTRACTORS

The following contractors have requested to be listed for your information.

This list does not constitute a recommendation from any agency.

WILLOW CUTTINGS

(For Sale)

DeRaeve's Lawn & Garden
Girdwood Forest Industries
Moore's Landscaping

BIOLOGS/COIR LOGS

(For Sale)

Moore's Landscaping
Polar Supply-Anchorage
Polar Supply-Kenai

BANK RESTORATION/BRUSH LAYERING **SPRUCE TREE REVETMENT AND ROOT WADS** **(construction and installation)**

D & D Equipment Services
DeRaeve's Lawn & Garden
Girdwood Forest Industries
K-F Construction Services
Lyle Johnson
Merkes Builders'
Moore's Landscaping
Northstar Paving & Construction
Peninsula Construction, Inc.
Peninsula Stone & Tile
Reilly Brothers
River City Construction
Rodger Kimbell Construction
Slash E. Construction
Specialty Excavating
Tuff Construction, LLC
Valley View Gravel
Watershed Environmental Technology

HAZARDOUS TREE REMOVAL

An Arboristic View
Clearing Company
Peninsula Stone & Tile
Syd Karnikis
Tuff Construction

FLOATING DOCK SYSTEMS

(For Sale)

ATEC Construction
Beaver Creek Docks
McGhan Construction
Mikes Welding
Rodger Kimbell Construction

GRATEWALK MATERIAL **(For Sale)**

Alaska Steel
ATEC Construction
Mikes Welding
Morgan Steel, Inc.
Spenard Builders

STAIRS/GRATWALKS/DECKS **FISH CLEANING TABLES/FLOATING DOCKS** **(construction and installation)**

Aleckson Fabrication
ATEC
Beaver Creek Docks
D & D Equipment Services
Fireweed Fence
Gray Hawk Enterprise, Inc.
Kenai Welding
K-F Construction Services
Lyle Johnson
Merkes Builders'
Metalworks
Mikes Welding
Nick's Ironworks
Peninsula Construction, Inc.
Reilly Brothers
River City Construction
Rodger Kimbell Construction
Slash E. Construction
Specialty Excavating
Valley View Gravel

KENAI RIVER-BANK PROTECTION CONTRACTORS

The following contractors have some knowledge of bank stabilization and/or Bioengineering Methods, Stairs, or Gratewalks.

An Arboristic View
Curtis Stigall
PO Box 837
Sterling, AK 99672
(907) 262-7659
anarboristicview@hotmail.com

ATEC Construction
Steve Attleson
38566 K. Beach Road
Kenai, AK 99611
(907) 283-2628 or (866) 367-2832
fax (907) 283-0604
www.atec-usa.com / email: atec@gci.net

Alaska Steel
205 Trading Bay
Kenai, AK 99611
(907) 283-3880 fax: (907) 283-3759
s.crawford@alaskasteel.com

Aleckson Fabrication
Darrell Aleckson
38735 S. Ruby Circle
Soldotna, AK 99669
(907) 262-9654 fax: (907) 262-9654
shirley@alaska.net

Beaver Creek Docks
3050 Kim-N-Ang Ct
Kenai, AK 99611
(907) 283-5102
FAX (907) 283-2702
volcanic@alaska.net

Bestor Contracting
Chad Bestor
PO Box 3230
Kenai, AK 99611
(907) 283-7171 or (907) 252-7788

Clearing Co./Jim Reed
PMB 155, 35555 Spur Hwy
Soldotna, AK 99669
(907) 262-8733

D&D Equipment Services
Don Johnson
Mile 1.5 Swanson River Road
Sterling, AK 99672
(907) 262-7149

DeRaeve's Lawn & Garden
Dan DeRaeve
PO Box 521
Soldotna, AK 99669
(907) 262-3980
(907) 398-6278

Don Hensley Enterprises
P.O. Box 601
Sterling, AK 99672
(907) 262-4626/(907) 398-4630

Fireweed Fence
Zack Hoosier
38566 K. Beach Road
Kenai, AK 99611
907-283-5465 fax 907-283-0604
fireweedfence@hotmail.com

Girdwood Forest Industries
Jay Larson
PO Box 305
Girdwood, AK 99587
(907) 783-2848

Gray Hawk Enterprise Inc.
19500 N. Mitkof Loop
Eagle River, AK 99577
(907) 862-0986
Fax (907) 696-0988

Lyle Johnson
37722 Gretchen St.
Soldotna, AK 99669
(907) 262-1955

K-F Construction Services
Keith Freeman
PO Box 663
Cooper Landing, AK 99572
fax: (907) 595-1275
Cell: (907) 598-1025

Syd Karnikis / Twin Rocks Ent
PO Box 1095
Kasilof, AK 99610
(907) 262-1690 / 252-6035
karnikis@alaska.net

Kenai Welding
703 Childs St.
Kenai, AK 99611
(907) 283-7380

McGhan Construction Co.
PO Box 520356
Big Lake, AK 99652
(907) 892-6446
www.mcghanalaska.com

Merkus Builders'
Dennis Merkes
PO Box 404
Soldotna, AK 99669
(907) 262-6031

Mikes Welding
Mike Kunz
PO Box 627
Sterling, AK 99672
(907) 262-1323 / 398-1894
Mike@MikesWelding.Biz
www.alaskabushsleeds.net

Metalworks
Tom Honer
PO Box 1921
Soldotna, AK 99669
(907) 262-5620
Cell: (907) 252-3612

Moore's Landscaping
Tom Moore
PO Box 944
Kenai, AK 99611
(907) 283-9168 / fax 283-1472
mooreslandscaping@kenai.net
mooreslandscaping.com

Morgan Steel, Inc.
6480 Kenai Spur Hwy
Kenai, AK 99611
(907) 283-7136 fax: 283-3225
morgansteelsales@alaska.net

Nick's Ironworks
Nick Miller
911 Ames Road
Kenai, AK 99611
(907) 283-7744 fax: 283-8184
nicksiron@alaska.net

Northstar Paving & Construction
Steve Foster
35743 Kenai Spur Hwy Suite A
Soldotna, AK 99669
(907) 262-9139
brandi.nspci@alaska.net
www.nspci.com

Peninsula Construction, Inc.
Marty Oberg
39981 Dodge Court
Kenai, AK 99611
(907) 283-4581
fax: (907) 283-6432
pencon@alaska.net

Peninsula Stone & Tile
34330 Bus. Park Frontage Rd.
Soldotna, AK 99669
(907) 260-8453
Fax (907) 260-8461
peninsulastoneandtile@alaska.net

Polar Supply
Jaquel Blasko
300 E. 54th Ave.
Anchorage, AK 99518
(907) 563-5000
Fax: (907) 561-8150
www.polarsupply.com

Polar Supply
Jim Wackler
13936 Kenai Spur Hwy
Kenai, AK 99611
(907) 335-2600 Fax: 335-2601
imaal@polarsupply.com
www.polarsupply.com

Rain for Rent
Tim Musgrove
PO Box 1931
Kenai, AK 99611
(907) 283-4487 or 398-6919
Fax: (907) 283-4528
www.rainforrent.com
rharris@rainforrent.com

Reilly Brothers
Michael Reilly
47700 Judy Lynn Lane
Soldotna, AK 99669
(907) 283-9222

River City Construction
Shawn Holly
PO Box 1952
Soldotna, AK 99669
(907) 260-7553

Rodger Kimbell Construction
PO Box 4077
Soldotna, AK 99669
(907) 394-3924
rodgerkimbell@gmail.com

Slash E Construction
Roy Bird
37020 Funny River Road
Soldotna, AK 99669
(907) 262-4708 (phone & fax)

Specialty Excavating
Jerry Holly
PO Box 365
Soldotna, AK 99669
(907) 262-5175 fax: 262-1004
www.specialtyexcavating.com
dirtduke@specialtyexcavating.com

Spenard Builders Supply
Rick Abbott/Branch Mgr
Kenai-(907) 283-7584
Soldotna-(907) 262-9143/fax: 262-1338
www.probuild.com
rick.abbott@probuild.com

Tuff Construction, LLC
Jack & Bud Meeks
37885 Alex Dr.
Soldotna, AK 99669
(907) 262-6696
Fax: (907) 262-6200
alelameeks@yahoo.com

Valley View Gravel
Dan Michel
PO Box 648
Sterling, AK 99672
(907) 262-2257
robbynimichel@gmail.com

Watershed Environmental
Technology
Eric Genty
(503) 367-9737

Welding Services
PO Box 7248
Nikiski, AK 99635
(907) 776-8279
Fax: (907) 776-3311
weldingservices@acsaalaska.net

**FISHING PROHIBITED
DOWNSTREAM OF THIS SIGN FOR
300 FEET**

**WATERS CLOSED TO SPORTFISHING WITHIN
300 FEET OF THE WEIR**

ALASKA DEPARTMENT OF FISH AND GAME

**FISHING PROHIBITED UPSTREAM
OF THIS SIGN FOR 300 FEET**

**WATERS CLOSED TO SPORTFISHING WITHIN
300 FEET OF THE WEIR**

ALASKA DEPARTMENT OF FISH AND GAME

From: Brenda Trefon [mailto:btrefon@kenaitze.org]
Sent: Monday, September 09, 2013 2:25 PM
To: Cory Warnock
Subject: RE: Grant Lake Project Work Groups

I would like to be in the NRWG...
Thanks,
Brenda

This message is intended solely for the use of the addressee and may contain information that is privileged, confidential and exempt from disclosure under applicable law. If you are not the addressee, you are hereby notified that any use, distribution or copying of this message is strictly prohibited. If you received this message in error, please notify us by reply e-mail or by telephone at (907) 335-7300 and immediately delete this message including all attachments. Chiqinik! (Thank You)

Brenda Trefon, M.A.
Environmental Coordinator
Kenaitze Indian Tribe
P.O. Box 988
Kenai, AK 99611

Cell (907) 398-7933

From: Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]
Sent: Monday, September 09, 2013 10:31 AM
To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Ginny Litchfield (ginny.litchfield@alaska.gov); Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Pamela Russell (pamela.russell@alaska.gov); Patricia Berkahn (patricia.berkhahn@alaska.gov); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford

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Cc: Mike Salzetti; Emily Andersen

Subject: Grant Lake Project Work Groups

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

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Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

5771 Applegrove Ln.

Ferndale, Wa. 98248

O – 360-384-2662

C – 360-739-0187

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Version: 2013.0.3392 / Virus Database: 3222/6648 - Release Date: 09/08/13

From: Thomas, Cassie [mailto:cassie_thomas@nps.gov]
Sent: Monday, September 09, 2013 12:57 PM
To: Cory Warnock
Subject: Re: Grant Lake Project Work Groups

Thanks for hosting the site visit last week and finding us the only day for weeks with no downpours, Cory! I'd like to be in the NRWG only. Thanks too for the timely schedule estimates, which are helpful as I complete my federal FY 2014 workplan. If you are able to stick to the planned report and meeting timeline, it will make life much easier for me, at least, with respect to my Watana workload starting in early February.

Cassie Thomas

Program Analyst
WASO Park Planning & Special Studies Division
AK Coordinator, NPS Hydropower Assistance Program

Cell 907 350-4139

$$\langle \text{diagram} \rangle = \langle ((^0) \cdot \dots) \rangle$$

On Mon, Sep 9, 2013 at 10:30 AM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

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Cory

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Sent: Monday, September 09, 2013 11:31 AM
To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Ginny Litchfield (ginny.litchfield@alaska.gov); Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Pamela Russell (pamela.russell@alaska.gov); Patricia Berkhahn (patricia.berkhahn@alaska.gov); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)
Cc: Mike Salzetti; Emily Andersen
Subject: Grant Lake Project Work Groups

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Cory

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Version: 2013.0.3392 / Virus Database: 3222/6648 - Release Date: 09/08/13

From: Berkhahn, Patti [mailto:PBerkhahn@borough.kenai.ak.us]

Sent: Tuesday, September 10, 2013 5:17 PM

To: Cory Warnock

Subject: RE: Grant Lake Project Work Groups

Aquatics work group for me.

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476

patricia.berkhahn@alaska.gov

(State agency housed in Kenai Peninsula Borough Building)

From: Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]

Sent: Monday, September 09, 2013 10:31 AM

To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Ginny; Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Russel, Pam - State Address; Berkhahn, Patti; Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

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From: Griffin, David W (DNR) [mailto:david.griffin@alaska.gov]

Sent: Tuesday, September 10, 2013 10:42 AM

To: Cory Warnock

Subject: RE: Grant Lake Project Work Groups

Thanks Cory,

It was a very informative site visit. In terms of the working groups my role in the project will be best represented in the Natural Resource Work Group.

David Griffin

Project Coordinator

(907) 269-8696

david.griffin@alaska.gov

Division of Parks and Outdoor Recreation

Department of Natural Resources

550 West 7th Ave., Suite 1380

Anchorage, AK 99501

From: Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]

Sent: Monday, September 09, 2013 10:31 AM

To: Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Miller, Monte D (DFG); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

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5771 Applegrove Ln.

Ferndale, Wa. 98248

From: Cory Warnock
Sent: Tuesday, September 10, 2013 8:42 PM
To: Russell, Pamela J (DNR)
Subject: RE: Grant Lake Project Work Groups

Hi Pam,

I'll get you on both lists. Additionally, the moment I got back into the office we began working on the fuel containment issue and if it isn't taken care of now, it will be by the end of the week. I'll have an update from the ground tomorrow.

Cory

From: Russell, Pamela J (DNR) [mailto:pamela.russell@alaska.gov]
Sent: Tuesday, September 10, 2013 4:19 PM
To: Cory Warnock
Subject: RE: Grant Lake Project Work Groups

Hi Cory,

I would like to be part of both groups if time allows. I believe that The Kenai Special Management Area has a great responsibility within this area.

I would also like to thank you for the site visit. I would also like to comment that I do hope the fuel storage has been address. Also, if the project does happen to occur next ear I will be giving some changes to the structure of the camp and the surround area.

Thanks

Pamela Russell
Div. of Parks and Outdoor Recreation
Natural Resource Specialist III
514 Donald E Gilman River Center
Soldotna, AK 99669
907-714-2471

From: Cory Warnock [cory.warnock@mcmillen-llc.net]
Sent: Monday, September 09, 2013 10:30 AM
To: Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Miller, Monte D (DFG); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen
Subject: Grant Lake Project Work Groups

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

Hi all,

I wanted to start by saying thank you to those who attended the Grant Creek site visit and I hope that you all found it beneficial. I thought it was a great turn-out and was very pleased that the weather decided to cooperate! As I mentioned, if anyone has any follow-up questions, please don't hesitate to let me know.

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The only thing that I'd ask of all of you at this point is to please write back and indicate which group you'd like to be a member of. I fully appreciate and understand that some of you are responsible for multiple natural resource areas for your agencies and may want to be a part of both groups and that is fine. That said, some of you do not have a vested responsibility in some areas and as such, the goal of the separate AWG is to create a more focused group of aquatic representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of.

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Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

From: Eric Rothwell - NOAA Federal [mailto:eric.rothwell@noaa.gov]
Sent: Tuesday, September 10, 2013 9:44 AM
To: Cory Warnock
Subject: Re: Grant Lake Project Work Groups

Hi Cory,

Thanks again for a good site visit. As we discussed in the field I plan on participating in both groups.

best regards,
Eric

On Mon, Sep 9, 2013 at 10:30 AM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

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Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

5771 Applegrove Ln.

Ferndale, Wa. 98248

O – [360-384-2662](tel:360-384-2662)

C – [360-739-0187](tel:360-739-0187)

F – [360-542-2264](tel:360-542-2264)

--

Eric Rothwell

Hydrologist

NOAA Fisheries

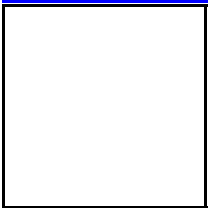
U.S. Department of Commerce

eric.rothwell@noaa.gov

907.271.1937

www.nmfs.noaa.gov

www.alaskafisheries.noaa.gov



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Version: 2013.0.3392 / Virus Database: 3222/6651 - Release Date: 09/09/13

From: Cory Warnock
Sent: Wednesday, September 11, 2013 5:07 PM
To: Grant Lake Mining
Cc: Mike Salzetti
Subject: RE: 3rd Progress Report (Grant Lake, P-13212)

Hi Paul,

We are in the process of finishing up field work and analyzing water quality data for 2013. Once we have the reports finalized for this year (early 2014), we will be providing the stakeholders (you included) with the reports that will have everything you are looking for. In advance of that, I'd be more than willing to discuss the results with you once we have everything synthesized (likely November). Would that work? Let me know and I'll get a tentative date on a calendar to touch base.

Thanks,

Cory

From: Grant Lake Mining [mailto:paul@grantlakemining.com]
Sent: Wednesday, September 11, 2013 2:33 PM
To: Cory Warnock
Subject: RE: 3rd Progress Report (Grant Lake, P-13212)

Cory,

Can you please forward copies of the water sampling results for Grant Lake mentioned in your study?

Very Best Regards,

Paul T. Torgerson
Grant Lake Mining
(865) 803-1416
Paul@GrantLakeMining.com

From: Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]
Sent: Tuesday, August 27, 2013 11:34 AM
To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Ginny Litchfield (ginny.litchfield@alaska.gov); Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Pamela Russell (pamela.russell@alaska.gov); Patricia Berkahn

(patricia.berkhahn@alaska.gov); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: 3rd Progress Report (Grant Lake, P-13212)

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

Hi all,

Here is a personal copy of the Progress Report just submitted to FERC for the Grant Lake Project.

Regards,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

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Version: 2013.0.3392 / Virus Database: 3222/6654 - Release Date: 09/10/13

From: Jan Konigsberg [<mailto:jan@hydroreform.org>]
Sent: Friday, September 13, 2013 1:58 PM
To: Cory Warnock
Subject: Re: Grant Lake Project Work Groups

Cory,

I won't be able to be active in any group, but want to continue to receive all study material sent to each group, Thanks.

Jan Konigsberg

On Mon, Sep 9, 2013 at 11:30 AM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

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Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

Attachments: BEboilerplateJan11.docx; _Certification_.htm

From: Charnon, Betty -FS [<mailto:bcharnon@fs.fed.us>]
Sent: Friday, September 13, 2013 3:27 PM
To: Kathryn Beck
Subject: RE: Grant Lake Pre-field Review

Betty Charnon
Kenai Peninsula Zone Ecologist
Phone: 907-754-2326
email: bcharnon@fs.fed.us

From: Kathryn Beck [<mailto:calypso@openaccess.org>]
Sent: Friday, September 13, 2013 2:12 PM
To: Charnon, Betty -FS
Subject: RE: Grant Lake Pre-field Review

Betty – I just left a message on your phone.
Is there a document similar to the “Guidance for Preparing a Botany Resource Report Tongass National Forest” (Karen Dillman) for the Chugach National Forest?
Otherwise, I will use the above named guidelines for my report.
I found very little in the way of weeds on USFS lands during my survey of the Grant Lake Project area; in fact I did not find any of the ones you have listed below.
Thanks, Katy

~~~~~  
Kathryn Beck  
Beck Botanical Services  
1708 McKenzie Ave.  
Bellingham, WA 98225  
360-671-6913 office  
360-305-0654 cell  
[calypso@openaccess.org](mailto:calypso@openaccess.org)

---

**From:** Charnon, Betty -FS [<mailto:bcharnon@fs.fed.us>]  
**Sent:** Thursday, June 27, 2013 12:32 PM  
**To:** Kathryn Beck  
**Subject:** RE: Grant Lake Pre-field Review

The most invasive species that could occur in the project area are:

|                                                     |
|-----------------------------------------------------|
| Canada Thistle ( <i>Cirsium arvense</i> )           |
| Orange Hawkweed ( <i>Hieracium auratiacum</i> )     |
| Butter and eggs ( <i>Linaria vulgaris</i> )         |
| Bird's foot trefoil ( <i>Lotus corniculatus</i> )   |
| White sweetclover ( <i>Melilotus alba</i> )         |
| Yellow sweetclover ( <i>Melilotus officinalis</i> ) |
| Reed canarygrass ( <i>Phalaris arundinacea</i> )    |
| Field sowthistle ( <i>Sonchus arvensis</i> )        |
| Bird vetch ( <i>Vicia cracca</i> )                  |

Also, attached are 2 spreadsheets. One is the raw data from the GIS layer you received. In the other file, I deleted records of the same species so you have just a list of species that occur in the GIS layer you received. The raw data file can be used to determine frequency of species.

I took a quick look at the pre-field review and the only comment I have is that *Ligusticum calderii* could also potentially occur in the project area. However, this species has not been found on the Chugach.

- Betty

Betty Charnon  
Kenai Peninsula Zone Ecologist  
Phone: 907-754-2326  
email: [bcharnon@fs.fed.us](mailto:bcharnon@fs.fed.us)

---

**From:** Kathryn Beck [<mailto:calypso@openaccess.org>]  
**Sent:** Wednesday, June 26, 2013 3:52 PM  
**To:** Charnon, Betty -FS  
**Cc:** Cory Warnock; Emily Andersen  
**Subject:** Grant Lake Pre-field Review

Betty – Nice to check in with you about Sensitive plants for the Grant Lake Project. Attached here is the Pre-field Review for the Sensitive plant survey there. I appreciate you getting me information about invasive plants in the area. Thanks, Katy

~~~~~  
Kathryn Beck
Beck Botanical Services
1708 McKenzie Ave.
Bellingham, WA 98225
360-671-6913 office
360-305-0654 cell
calypso@openaccess.org
~~~~~

This electronic message contains information generated by the USDA solely for the intended recipients. Any unauthorized interception of this message or the use or disclosure of the information it contains may violate the

@Revised January 2011

@Note! Remember to delete or modify all boldface or text preceded by the "@" symbol - these are directions to the writer of the BE and should not be left in the final draft.

@This BE format is based on the format developed and used in the Pacific Northwest Region and Rocky Mountain Region with modifications from the Pacific Southwest Region.

@Prior to using this form it is important that the project's proponent has completed a  
**PROJECT INITIATION FORM**

and you have completed a **PRE-FIELD REVIEW WORKSHEET**. In some cases the determinations page of a PRE-FIELD REVIEW WORKSHEET can serve as the BE documentation.

## BIOLOGICAL EVALUATION FOR PLANTS

Project Name

@xxx Ranger District

@xx National Forest

## SIGNATURES

Prepared by:\_\_\_\_\_

@NAME

Title

Date:\_\_\_\_\_

Reviewed by:\_\_\_\_\_

@NAME

Title

Date:\_\_\_\_\_

# BIOLOGICAL EVALUATION FOR PLANTS

@Project Name

@Xxx Ranger District

@Xxx National Forest

## INTRODUCTION

Forest Service policy requires that a review of programs and activities, through an effects analysis, be conducted to determine their potential effect on threatened and endangered species, species proposed for listing and Regional Forester designated sensitive species. The purpose of this document is to present the analysis and determination of effects of the alternatives on federally listed species (endangered, threatened, and proposed) and Forest Service sensitive species (FSM 2670.31-2670.32).

For threatened and endangered species and species proposed for listing, the analysis and document are referred to as a Biological Assessment, or BA. No plants federally listed or proposed by the U.S. Fish and Wildlife Service are known or suspected to occur in the Alaska Region, therefore there will be no further discussion of federally listed or proposed plants in this document.

For sensitive species the analysis and document are referred to as a Biological Evaluation or BE (FSM 2670.3). Preparation of a Biological Evaluation as part of the NEPA process ensures that sensitive species receive full consideration in the decision-making process.

## PROJECT DESCRIPTION

@ Describe the purpose and need for the action proposed and the alternatives (including the no action alternative) so the reader quickly understands the scope and nature of the project. Include enough information about the proposed action and alternatives so the Biological Evaluation can stand alone. Maps, photos and other illustrative materials are very helpful in building a clear understanding of the area and what actions are proposed.

Describe the project, including:

- What actions are being proposed;
- When the action will take place, including timeline or implementation schedules;
- How the action will be accomplished;
- Describe design standards and protections that will mitigate project effects on sensitive plants, for example;
  - Prior to construction, a person designated by the @xxxxxxxxxxxxx will mark the boundaries of all populations of sensitive plants within or near the construction area.
  - Populations not within the project footprint will be left undisturbed.
  - Existing drainage patterns will be maintained during and after construction.
  - Collecting plants or plant parts shall not be allowed except by permit issued by the Forest Supervisor for scientific or educational purposes.

- Close the area to off-road vehicles.
- No herbicide is to be applied within 100 feet of any known sensitive plant. Buffers will be clearly marked before treatment so applicators can easily see and avoid the sensitive plants.
- Plants native to the area and originating near the project area will be used for any revegetation or restoration work.

- Describe any connected actions.

Describe the project area (the project area is all areas to be affected directly or indirectly by the federal action, and not merely the immediate project area) include:

- Location and size;
- Current conditions, and relevant historical conditions (how have historical conditions affected sensitive plants or their habitat) for example:
  - Beaver activity and avalanches are evident by vegetation modification.
  - Recent geological changes, sea level changes, glacial advance or melting.
- Existing developments and human uses (how have developments and human uses affected sensitive plants or their habitat) for example;
  - Road construction, rockpits, debris, herbicide use, past seeding with non-native plants.
  - Past logging, minerals activities, associated roads and uses.
  - Campgrounds, recreational development, or use.
- Current management emphasis.

## SENSITIVE PLANTS

Seventeen vascular plants and one lichen are designated as sensitive in the Alaska Region (Appendix A). The following sensitive plants are known or suspected to occur on the @xxxxxxxxx Ranger District of the @xxxxxxxxx National Forest:

@List plants for your district here by deleting from the list of 18 below, then, indicate whether known or suspected (as shown in example below). Occurrence information can be extracted from the Alaska Region Sensitive Plants matrix and NRIS databases.

@Calder lovage (*Ligusticum calderi*)

suspected

@Pale poppy (*Papaver alboroseum*)

known

*Aphragmus eschscholtzianus*

Eschscholtz's little nightmare

*Botrychium spathulatum*

Spatulate moonwort

*Botrychium tunux*

Moosewort fern

*Botrychium yaaxudakeit*

Moonwort fern, no common name

*Cirsium edule* var. *macounii*

Edible thistle

*Cochlearia sessilifolia*

Sessileleaf scurvygrass

*Cypripedium guttatum*

Spotted lady's slipper

*Cypripedium montanum*

Mountain lady's slipper

*Cypripedium parviflorum* var. *pubescens*

Large yellow lady's slipper

*Ligusticum calderi*

Calder's loveage

|                                                     |                            |
|-----------------------------------------------------|----------------------------|
| <i>Lobaria amplissima</i>                           | Lichen, no common name     |
| <i>Papaver alboroseum</i>                           | Pale poppy                 |
| <i>Piperia unalaschensis</i>                        | Alaska rein orchid         |
| <i>Platanthera orbiculata</i>                       | Lesser round-leaved orchid |
| <i>Polystichum kruckebergii</i>                     | Kruckeberg's swordfern     |
| <i>Romanzoffia unalaschensis</i>                    | Unalaska mist-maid         |
| <i>Sidalcea hendersonii</i>                         | Henderson's checkermallow  |
| <i>Tanacetum bipinnatum</i> subsp. <i>huronense</i> | Dune tansy                 |

## PRE-FIELD REVIEW OF EXISTING INFORMATION

A pre-field review of existing information concerning the plants listed above was conducted for the project area. This review included (@ Adjust list for what you really did, delete the rest!) the Regional Forester's Sensitive Species List, Alaska Natural Heritage Program (AKNHP) data base records, ARCTOS database, herbarium sheets at @\_\_\_\_\_, and botanical literature (@ cite literature as needed and only list those references you used, some titles are listed in the references section of this document). Consultation with the Alaska Regional Botanist, other botanists, state, Native groups, other organizations and individuals (@List your contacts). Review of proposal details, maps, air photos, and previous management activities (@ what were they?).

PLANTS KNOWN. Previously documented sightings of sensitive plants in or near the project area were:

@Note: For location, do NOT be precise, since this is a public document. If there were no previous sightings change sentence above to: "There were no previously documented sightings of sensitive plants in or near the project area". And delete the line below.

| Species | Location |
|---------|----------|
|---------|----------|

PLANTS SUSPECTED. The following general habitats (or plant communities) occur in the project area: @ (you can choose from the following general list, and/or use your own wording) coniferous forest, deciduous forest, mixed conifer/deciduous forest, dwarf tree forest, forest edge, beach/ forest ecotone, tall shrublands, low shrublands, rocky areas, rock outcrops, ridgetops, cliffs, serpentine, calcareous areas, ultramafic substrate, gravel, scree, talus, boulder fields, seeps, wet areas, riparian areas (give channel type, if known), streambanks, waterfalls, lake margins, ponds, shallow freshwater, marshes, swamps, estuaries, sphagnum bogs, fens, heath, subalpine meadows, alpine, area dominated by moss or lichen, dry meadows, moist-wet meadows, upper beach meadows, grasslands, maritime beaches, sandy areas, human disturbance historic well drained.

The sensitive plants listed below are suspected to occur in the project area since the area contains appropriate habitat and is within the known or suspected range of the plants.

@ List plants, and describe their habitats, and possibly distribution. This information is available in Forest Service unpublished botanical guidance, botanical literature, and the most recent version of the Alaska Region sensitive plants matrix.

Here is a brief example for one plant:

*Sidalcea hendersonii* is known from upper beach meadows in Howard Bay, and is suspected to grow in that habitat throughout the Juneau Ranger District.

## FIELD SURVEY FOR SENSITIVE PLANTS

A @# type rare plant survey was conducted for the project (see Appendix B for definitions of plant survey types). A detailed map showing the exact route that the botanist(s) travelled on the ground is @attached to this Biological Evaluation OR on file at the @xxxxxxx Ranger District and will be incorporated into the NRIS survey layer by @date. Plant Survey Field Forms and R10 TES Plant Element Occurrence field forms (if sensitive plants were found) completed according to protocol for the Alaska Region, are in the planning file for this project.

@Note: specify here if different survey types were used in different portions of the project area. Also, if special survey methods were used (e.g. measured transects), make an Appendix page and refer to it here.

The following sensitive plants were located within areas likely to be affected by project activities: @list scientific names or put "none" here.

Date(s) of survey(s):@

Project surveyed by: @name(s) and position title(s).

@--if applicable, insert-- A field survey was recommended but not conducted for the sensitive plants listed above. The risk assessment was based solely on the information gained through the pre-field review. @Note - this is for cases where the survey was not conducted for non-biological reasons like lack of \$. Risk level should accordingly be higher to reflect this situation.

@--if applicable, insert-- Photographs of (names of species) were taken and are on file at: @(please be specific so these images can be found).

@--if applicable, insert-- The survey(s) took place at the appropriate time of year to identify sensitive plants with the exception of: (list species). Additional surveys for these species should take place in (Month/Year).

## DETERMINATION OF EFFECTS

@--if applicable, insert-- Since a thorough survey (Focused, Intuitive Controlled), documented above, was conducted by qualified botanists at the proper time of year and no sensitive plants were found, a risk assessment is not warranted (FSM 2672.43). The project, as described, is expected to have no impact on sensitive plants.(@ BE ends here!)

### Direct/Indirect Effects



Aspects of this project that may affect sensitive plants or their habitat are: @ (List effects by alternative, e.g., Alternative 1 would affect no individuals or populations of sensitive plants. List or describe possible threats e.g. project construction, activities associated with construction such as equipment storage, site access, trampling, earthmoving, mowing plants or changing hydrology. Be clear about effects, eg. roadbuilding would destroy individual plants. Explain why or why not the project may affect a plant. E.g., Since no sensitive plants are within the footprint of the project, there would be no direct loss from proposed activities.

Indirect effects are caused by the action and are later in time or farther removed in distance, but still reasonably foreseeable (50 CFR 1508.8).

@ Some examples of indirect effects:

Sensitive plants could be adversely affected by activities resulting in changes in hydrology.

Activities may indirectly effect sensitive plant populations and habitat through the introduction of exotic plants, which compete with native plants for preferred habitat.

Newly introduced off-road vehicles, increased recreational access, and other new activities may destroy sensitive plants and their habitat through trampling and changes in hydrology.

## **Cumulative Effects**

Under NEPA, "Cumulative impact" is defined as an impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (50 CFR 1508.7).

@ Past impacts in the project area have been described in the project description. The discussion should now focus on other projects that will contribute to any impacts that occur as a result of this action, and also look to any expected future actions.

Discuss the cumulative effects resulting from the proposal being analyzed in relation to the existing condition. Discuss how these other ongoing or proposed activities will magnify or otherwise contribute to any new impacts as a result of implementing the proposed action.

## **Risk Assessment for Sensitive Plants**

@ If a sensitive plant is known or suspected to be within the project area or within an area indirectly influenced by the project, and/or surveys were not completed at a type commensurate with the project size, then a risk assessment (analysis of impacts of the project on the species) is needed.

Determination of risks to populations of sensitive plants takes into account: size, density, vigor, habitat requirements, location of the population, and consequence of adverse effect on the species as a whole within its range and within the National Forest. A risk assessment considers two factors:

Factor 1) the consequence of adverse (or beneficial) effects on the population, and

Factor 2) the likelihood or probability that these effects will occur. Levels of consequence and levels of likelihood are described in the Appendices under the heading "Criteria for Risk Assessment"

The direct, indirect and cumulative effects of the proposed project are used to determine the level of consequence and level of likelihood.

After both of the factors have been determined, the preparer analyzes the degree of the effects of the proposed project on the sensitive plant. This process documents the rationale for arriving at the determination of effect.

This analysis should be done for each alternative, and for each sensitive plant found in the project area within each alternative. Group plants as needed.

The consequences of adverse impacts to Sensitive plants due to project activities are @(l/m/h) because @\_\_\_\_\_ (describe in plain language). The likelihood of adverse effects are @(n/l/m/h) because @\_\_\_\_\_. Therefore, the overall risk to this species due to project activities is @(describe in plain language).

The ratings for the risk assessment are defined in Appendix C.

## **Determination**

Based on the rationale described above, the alternative courses of action (design standards and protections that will mitigate project effects) will likely result in the following impacts on the sensitive plants. Determinations are listed by alternative and plant taxon.

@Select one determination below, delete those you don't use, also delete explanatory text below selected determination.

### **@ No Impact.**

A determination of "No Impact" for sensitive species occurs when a project or activity will have no environmental effects on habitat, individuals, a population or a species.

### **@ Beneficial Impact.**

Projects or activities that are designed to benefit, or that measurably benefit a sensitive species should receive this conclusion.

### **@ May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing.**

Activities or actions that have effects that are too small to measure, minor or are consistent with Conservation Strategies would receive this conclusion. For populations that are small - or vulnerable - each individual may be important for short and long term viability.

**@ Likely to result in a loss of viability in the Planning Area, or in a trend toward federal listing..**

Loss of individuals or habitat can be considered significant when the potential effect may be: 1. Contributing to a trend toward Federal listing; 2. Results in a significantly increased risk of loss of viability to a species; or, 3. Results in a significantly increased risk of loss of viability to a significant population (stock).

## **Additional Management Recommendations**

IF ANY PREVIOUSLY UNDISCOVERED SENSITIVE PLANTS ARE ENCOUNTERED AT ANY TIME PRIOR TO OR DURING IMPLEMENTATION OF THIS PROJECT, PROTECT THE POPULATION AND AVOID ANY DISTURBANCE IN THE AREA CONTAINING THE POPULATION (AND SIMILAR HABITATS IN THAT VICINITY). THE DISTRICT OR FOREST BOTANIST/ECOLOGIST SHOULD BE NOTIFIED IMMEDIATELY TO EVALUATE THE POPULATION AND RECOMMEND AVOIDANCE OR MITIGATION MEASURES.

@ If necessary, describe any additional management recommendations and how these would lower the risk level above if they were implemented. Discuss what the new risk level would be if your recommendations were implemented. Include additional work that should be completed in order to make an informed risk assessment, e.g. plant i.d. verification or botanical investigation, field survey conducted at a higher intensity level, survey needs to be at different time of year, etc. Other followup work may include clauses to be included in the permit or sale contract, KV projects, etc.

## **MONITORING**

@Describe plans for monitoring the local population. Remember to delete this whole section and title if there are no sensitive plants in the project area.

## REFERENCES

@Some titles, add or delete as needed.

- Charnon, B. 2007. Unpublished Report: Conservation assessment for the pale poppy (*Papaver alboroseum*). Unpublished administrative paper. USDA Forest Service, Glacier Ranger District, Chugach National Forest, Girdwood, Alaska.
- Calder, J. A. and R.L. Taylor. 1968. *Flora of the Queen Charlotte Islands, Part 1*. Canada Department of Agriculture, Research Branch, Monograph No. 4 Part 1. Ottawa.
- Cody, W.J. 1996. *Flora of the Yukon Territory*. National Research Council of Canada Press, Ottawa, Ontario.
- DeLapp, John. 1991. Unpublished Report: *Rare vascular plant species of the U.S. Forest Service Alaska Region*. Report for U.S. Forest Service, Alaska Region. Alaska Natural Heritage Program, The Nature Conservancy. Anchorage, Alaska.
- DeLapp, John. 1992. Unpublished Report: *1992 Supplement to the rare vascular plant species of the U.S. Forest Service Alaska Region*. Report for U.S. Forest Service, Alaska Region. Alaska Natural Heritage Program, The Nature Conservancy. Anchorage, Alaska.
- DeLapp, John. 1993. Unpublished Report: *1993 Supplement to the rare vascular plant species of the U.S. Forest Service Alaska Region. Report for U.S. Forest Service, Alaska Region*. Alaska Natural Heritage Program, The Nature Conservancy. Anchorage, Alaska.
- Dillman, K. 2004. *Epiphytic Lichens of the Forest-Marine Ecotone of Southeastern Alaska*. M.S. Thesis, Arizona State University, Tempe.
- Dillman, Karen L. 2008. Unpublished Report: Conservation Assessment of Large Round Leaved Orchid (*Platanthera orbiculata* (Pursh.) Lindl. on the Tongass National Forest, Alaska Region. USFS internal report. 25pp.
- Dillman, Karen L. 2010. Unpublished Report: Conservation Assessment of *Lobaria amplissima* (Scop.) Forss. Region 10 Sensitive Species. USFS internal report 18 pp.
- Douglas, G.W., G.B. Straley, D.V. Meidinger, & J. Pojar. 1998. *Illustrated Flora of British Columbia. Vol. 1: Gymnosperms and Dicotyledons (Aceraceae through Asteraceae)*. B.C. Ministry of Environment, Lands & Parks and B.C. Ministry of Forests. Victoria.
- Douglas, G.W., G. Straley, D. Meidinger, & J. Pojar. 1998. *Illustrated Flora of British Columbia. Vol. 2: Dicotyledons (Balsaminaceae through Cucurbitaceae)*. B.C. Ministry of Environment, Lands & Parks and B.C. Ministry of Forests. Victoria.
- Douglas, G.W., D. Meidinger, & J. Pojar. 1999. *Illustrated Flora of British Columbia. Vol. 3: Dicotyledons (Diapensiaceae through Onagraceae)*. B.C. Ministry of Environment, Lands & Parks and B.C. Ministry of Forests. Victoria..

- Douglas, G.W., D. Meidinger, & J. Pojar. 1999. *Illustrated Flora of British Columbia*. Vol. 4: *Dicotyledons (Orobanchaceae through Rubiaceae)*. B.C. Ministry of Environment, Lands & Parks and B.C. Ministry of Forests. Victoria..
- Douglas, G.W., D. Meidinger, & J. Pojar. 2000. *Illustrated Flora of British Columbia*. Vol. 5: *Dicotyledons (Salicaceae Through Zygophyllaceae) And Pteridophytes*. B.C. Ministry of Environment, Lands & Parks and B.C. Ministry of Forests. Victoria.
- Douglas, G.W., D. Meidinger and J. Pojar (eds.). 2001a. *The Illustrated Flora of British Columbia, Volume 6 - Monocotyledons (Acoraceae through Najadaceae)*. B.C. Minst. Environ., Lands and Parks and Minist. For., Victoria, B.C.
- Douglas, G.W., D. Meidinger and J. Pojar (eds.). 2001b. *The Illustrated Flora of British Columbia, Volume 7 - Monocotyledons (Orchidaceae through Zosteraceae)*. B.C. Minist. Sustainable Resour. Manage. and Minist. For., Victoria, B.C.
- Douglas, G.W., D. Meidinger and J. Pojar (eds.). 2002. *The Illustrated Flora of British Columbia, Volume 8 - General Summary, Maps and Keys*. B.C. Minist. Sustainable Resour. Manage. and Minist. For., Victoria, B.C.
- Douglas, G.W., D. Meidinger and J.L. Penny. 2002. *Rare Native Vascular Plants of British Columbia. 2nd edition*. Province of British Columbia, Victoria, B.C.
- Farrar, D. R. 2005. *Moonwort (Botrychium) Systematics*. Herbarium, Iowa State University. (Prepared for USDA Forest Service, Alaska Region).  
<http://www.public.iastate.edu/~herbarium/botrychium.html> (Accessed xxxxxxxxxx).
- Gisler, M. M. and R. M. Love. 2005. Henderson's checkermallow; the natural, botanical, and conservation history of a rare estuarine species. *Kalmiopsis* 12 1-8.
- Hitchcock, C.L. and A. Cronquist. 1974. *Flora of the Pacific Northwest An Illustrated Manual*. University of Washington Press. Seattle, Washington.
- Hitchcock, C.L. A. Cronquist, M. Ownbey, and J.W. Thompson. 1955, 1959, 1961, 1964, 1969. *Vascular Plants of the Pacific Northwest*. Parts 1-5. University of Washington Press, Seattle, Washington.
- Hulten, E. 1968. *Flora of Alaska and Neighboring Territories*. Stanford University Press, Stanford, California.
- Hulten, E. 1973. Supplement to flora of Alaska and neighboring territories: A study in the flora of Alaska and the transberingian connection. *Bot. Not.* 126:459-512.
- Keil, D. J. 2006. *Cirsium* Pp. 95-164 in Flora of North America Editorial Committee, eds. *Flora of North America, north of Mexico, Volume 19: Magnoliophyta: Asteridae, part 6: Asteraceae, part 1*.

Oxford University Press, New York.

- Kiger, R. W., D. F. Murray. 1997. *Papaver*. Pp 323-333 in Flora of North America Editorial Committee, eds. *Flora of North America, north of Mexico, Part 3: Magnoliophyta: Magnoliidae and Hamamelidae*. Oxford University Press, New York.
- Luer, Carlyle. 1975. *The Native Orchids of the United States and Canada Excluding Florida*. New York Botanical Garden, New York.
- Love, R. 2004. *Sidalcea* Summer: Our Petition Has Been Sent. *Bulletin of the Native Plant Society of Oregon*. 37(1): 1. Available: [http://www.npsoregon.org/arch/bull/04/NPSO\\_0401.PDF](http://www.npsoregon.org/arch/bull/04/NPSO_0401.PDF). Accessed: 2005.
- Lipkin, R. and D. Murray. 1997. *Alaska Rare Plant Field Guide*, U.S. Dept. Interior, Washington, D.C.
- Marshall, M., and F. R. Ganders. 2001. Sex-based seed predation and the maintenance of females in a gynodioecious plant. *American Journal of Botany* 88(8): 1437-1443.
- Mathias, M. E., L. Constance. 1959. New North American Umbelliferae -- III. *Bull. Torr. Bot. Club* 86:374-382.
- Rollins, R. C. 1993. *The Cruciferae of Continental North America, Systematics of the Mustard Family from the Arctic to Panama*. Stanford University Press, Stanford, California.
- Romero-Gonzalez, G. C. Fernandez-Concha, R. L. Dressler, L. K. Magrath, and G. W. Argus. 2002. *Orchidaceae*. Pp. 490-651 in Flora of North America Editorial Committee, eds. *Flora of North America, north of Mexico, Part 26: Magnoliophyta: Liliidae: Liliales and Orchidales*. Oxford University Press, New York.
- Sheviak, C. J. 2002. *Cypripedium* L. Pp 499-507 in Flora of North America Editorial Committee, eds. *Flora of North America, north of Mexico, Part 26: Magnoliophyta: Liliidae: Liliales and Orchidales*. Oxford University Press, New York.
- Stensvold, M. C. 2000. Southeastern Alaska's ultramafics and *Polystichum kruckebergii*, *Botanical Electronic News (BEN)* 246. Accessed at: <http://www.ou.edu/cas/botany-micro/ben/ben246.html>.
- Stensvold, M.C., D.R. Farrar and C.J. Groh. 2002. Two new species of moonworts (*Botrychium* subgenus *Botrychium*) from Alaska, *Amer. Fern J.* 92(2):150-160.
- Stensvold, M. C. and E. Anderson. 2005. Unpublished report. *Henderson's checkerbloom (Sidalcea hendersonii) Newly Discovered in Alaska*. USDA Forest Service, Alaska Region.
- Stensvold, M. C. and D. R. Farrar. 2008. Unpublished report. *Moonwort Fern Surveys in the Wrangell-St. Elias Mountains and Genetic Analysis with an Emphasis on Botrychium tunux & Botrychium lineare*. US Fish and Wildlife Service 1011 East Tudor Road Anchorage, Alaska 99503-6619.

- USDA Forest Service. 2002 Unpublished report. *Conservation Assessment for Lake Huron Tansy (Tanacetum huronense) Nutt.* U.S. Dept. of Agriculture, Eastern Region.
- Wagner, D.H. 1979. Systematics of *Polystichium* in western North America north of Mexico. *Pteridologia* 1:1-64.
- Wagner, D. H. 1993. *Polystichium*. Pp. 290-299 in Flora of North America Editorial Committee, eds. *Flora of North America, north of Mexico, Part 2: Pteridophytes and gymnosperms*. Oxford University Press, New York.
- Wagner, W. H. 1966. Two new species of ferns from the United States. *American Fern Journal* 56:3-17.
- Wagner, W. H. 1993. Ophioglossaceae C. Agardg: Adder's-tongue family. Pp. 85-106 in Flora of North America Editorial Committee, eds. *Flora of North America, north of Mexico, Part 2: Pteridophytes and gymnosperms*. Oxford University Press, New York.
- Wagner, W. H. Jr. and F.S. Wagner. 1990. Notes on the fan-leaflet group of moonworts in North America with descriptions of two new members. *American Fern Journal* 80:73-81.
- Wallace, L. E. & M. A. Case. 2002 contrasting allozyme diversity between northern and southern populations of *Cypripedium parviflorum* (Orchidaceae): implications for Pleistocene refugia and taxonomic boundaries. *Systematic Botany* 25(2) 281-296.
- Warwick, S. I., I. A. Al-Shehbaz, and C. A. Sauder. 2006. Phylogenetic position of *Arabis arenicola* and generic limits of *Aphragmus* and *Eutrema* (Brassicaceae) based on sequences of nuclear ribosomal DNA. *Can. J. Bot.* 84: 269–281.
- Watson, L. E. 2006. *Tanacetum*. Pp. 489-491 in Flora of North America Editorial Committee, eds. *Flora of North America, north of Mexico, Part 19: Magnoliophyta: Asteridae (in part): Asteraceae, part 1*. Oxford University Press, New York.
- Welsh, S.L. 1974. *Anderson's Flora of Alaska and adjacent parts of Canada*. Brigham Young University Press, Provo, Utah.

**Appendix A.** Alaska Region Sensitive Plants, February 2009

| Common Name                    | Scientific Name                                      | Occurrence |     |
|--------------------------------|------------------------------------------------------|------------|-----|
|                                |                                                      | CNF        | TNF |
| Vascular Plant                 |                                                      |            |     |
| Eschscholtz's little nightmare | <i>Aphragmus eschscholtzianus</i>                    | Y          | S   |
| Moosewort fern                 | <i>Botrychium tunux</i>                              | S          | Y   |
| Spatulate moonwort fern        | <i>Botrychium spathulatum</i>                        | S          | Y   |
| Moonwort, no common name       | <i>Botrychium yaaxudakeit</i>                        | S          | Y   |
| Edible thistle                 | <i>Cirsium edule</i> var. <i>macounii</i>            |            | Y   |
| Sessileleaf scurvygrass        | <i>Cochlearia sessilifolia</i>                       | S          |     |
| Spotted lady's slipper         | <i>Cypripedium guttatum</i>                          | Y          |     |
| Mountain lady's slipper        | <i>Cypripedium montanum</i>                          | S          | Y   |
| Large yellow lady's slipper    | <i>Cypripedium parviflorum</i> var. <i>pubescens</i> | S          | Y   |
| Calder's loveage               | <i>Ligusticum calderi</i>                            | S          | Y   |
| Pale poppy                     | <i>Papaver alboroseum</i>                            | Y          | S   |
| Alaska rein orchid             | <i>Piperia unalascensis</i>                          | S          | Y   |
| Lesser round-leaved orchid     | <i>Platanthera orbiculata</i>                        |            | Y   |
| Kruckeberg's swordfern         | <i>Polystichum kruckebergii</i>                      |            | Y   |
| Unalaska mist-maid             | <i>Romanzoffia unalaschcensis</i>                    | Y          | Y   |
| Henderson's checkermallow      | <i>Sidalcea hendersonii</i>                          |            | Y   |
| Dune tansy                     | <i>Tanacetum bipinnatum</i> subsp. <i>huronense</i>  | S          | Y   |
| Lichen                         |                                                      |            |     |
| Lichen, no common name         | <i>Lobaria amplissima</i>                            | S          | Y   |



## Appendix B. Survey Types.

| Survey type                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Field Check</b>                    | The survey area is given a quick “once over” but the surveyor does not walk completely through the project area. The entire area is not examined.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Cursory</b>                        | A Cursory survey is appropriately used to confirm the presence of species of interest identified in previous surveys or in the pre-field analysis. By its nature, the cursory survey is rapid, and does not provide in-depth environmental information. The entire area is traversed at least once. For example, stand condition as seen in aerial photography can be verified by a cursory survey. Also, a cursory survey can be used to determine if a plant population that had been previously documented at a site remains present or intact.                                                        |
| <b>General</b>                        | The survey area is given a closer review by walking through the area and its perimeter or by walking more than once through the area. Most of the area is examined                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Focused (Intuitive Controlled)</b> | The Focused, or Intuitive Controlled, survey is the most commonly used and most efficient method of surveying for TES plants. During pre-field analysis, potential suitable habitat is identified for each species of interest and the survey effort is focused in those areas. This method requires adequate knowledge of suitable habitat in order to accurately select the areas of focused searching. When conducting intuitive controlled surveys, an area somewhat larger than the identified suitable habitat should be searched to validate current suitable habitat definitions.                 |
| <b>Random</b>                         | Random surveys employ an undirected, typically non-linear, traverse through a project area. They are employed either when there is inadequate natural history information about a species to discern its suitable habitat and the surveyor is simply searching for occurrences, or when a target species is very abundant within a search area and the surveyor is attempting to make estimates of population parameters such as intra-patch variations in density or the occurrence of predation or herbivory. However, a stratified random survey may be more effective in these latter cases.          |
| <b>Stratified Random</b>              | This survey is most often used within known population areas of target species, or when an area to be surveyed is of unknown habitat suitability and is relatively large. Stratified random surveys employ a series of randomly selected plots of equal size within a project area that are each thoroughly searched for target species. When conducting a stratified random survey, it is important to sample an adequate number of plots that are of sufficient size if statistical inference regarding the survey area is desired (discussion of sample designs, see Elzinga, C., <i>et al.</i> 1998). |
| <b>Systematic</b>                     | Typically used in limited areas where the likelihood of occurrence of a target species may be evenly distributed throughout the survey area. Systematic surveys are often employed either within focused search areas (e.g., stratified random and intuitive controlled methods), or when a proposed project is likely to produce significant habitat alterations for species that are especially sensitive to the proposed activities.                                                                                                                                                                   |

## **Appendix C. Criteria for Risk Assessment.**

### **Factor 1. Consequence of Adverse Effect From a Particular Activity**

LOW: None, or questionable adverse effect on habitat or population.  
No cumulative effects expected.

MODERATE: Possible adverse effects to habitat or to population.  
Cumulative effects possible.

HIGH: Obvious adverse effects on habitat or population.  
Cumulative effects probable.

### **Factor 2. Likelihood of Adverse Effect From a Particular Activity**

NONE: Activity will not affect habitat or population.  
(no further risk assessment needed).

LOW: Activity controllable by seasonal or spatial restrictions.  
and not likely to affect habitat or populations.

MODERATE: Activity not completely controllable or intense administration of project needed  
to prevent adverse effects on habitat or population. Adverse effects may occur.

HIGH: Activity not controllable and adverse effects on habitat or populations likely  
to occur.

@NOTE! This process serves only to document the rationale for arriving at conclusions as per WO  
letter dated May 12, 1992.

---

**From:** kenailake@arctic.net  
**Sent:** Saturday, September 14, 2013 12:54 PM  
**To:** Cory Warnock  
**Subject:** Grant Lake Alaska P-13212 Work Groups

Mr. Warnock.

Regarding the Grant Lake Alaska hydro project, please add me to both the Aquatics and Natural Resource Work Groups..

Thanks,

Robert L. Baldwin, President  
Kenai River Watershed Foundation, Inc.  
P.O. Box 815  
Cooper Landing, AK 99572  
<[kenailake@arctic.net](mailto:kenailake@arctic.net)>

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**From:** Mike Cooney <mcooney@arctic.net>  
**Sent:** Saturday, September 14, 2013 6:30 PM  
**To:** Cory Warnock; 'Audrey Alstrom'; 'Barbara Stanley'; 'Brenda Trefon'; 'Brent Goodrum'; 'Cassie Thomas'; 'David Griffin'; 'David Schade'; 'Denise Koopman'; 'Doug Mutter'; 'Doug Ott'; 'Eric Rothwell'; 'Ginny Litchfield'; 'Jan Konigsberg'; 'Jason Mouw'; 'Jeffry Anderson'; 'Joe Klein'; 'Judith Bittner'; 'K.J. Muschovic'; 'Katherine McCafferty'; 'Ken Hogan'; 'Kevin Laves'; 'Kim Sager'; 'Lesli Schick'; 'Lynnda Kahn'; 'Michael Walton'; 'Monte Miller'; 'Pamela Russell'; 'Patricia Berkahn'; 'Paul Torgerson'; 'Phil Brna'; 'Ricky Gease'; 'Robert Stovall'; 'Robin Swinford'; 'Shina Duvall'; 'Sue Walker'; tomharkreader@gmail.com; 'Travis Moseley'  
**Cc:** 'Mike Salzetti'; Emily Andersen; kenailake@arctic.net; 'Mark Luttrell'  
**Subject:** RE: Grant Lake Project Work Groups  
**Attachments:** Cooney Early Scoping Comments Actual.docx

Mr. Warnock,  
Please add my name to the AWG and NRWG, as I'm interested in all facets of the proposal and all potential impacts of the project. Also, I'd like to recommend a separate Socio-Economic Working Group be formed to assess potential social and economic impacts of the project on local quality of life issues, local business, and the economy of local communities including Moose Pass and Cooper Landing (Please see Socio-Economic studies and ADDITIONAL STUDIES on page 2 of the attached document – my early scoping comments to the FERC).  
Thanks, and I look forward to participating in the working groups, Mike

Mike Cooney  
P.O. Box 169  
Moose Pass, Alaska 99631  
(907) 288 5022  
mcooney@arctic.net

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**From:** Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]  
**Sent:** Monday, September 09, 2013 10:31 AM  
**To:** Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie\_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas\_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Ginny Litchfield (ginny.litchfield@alaska.gov); Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry\_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda\_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Pamela Russell (pamela.russell@alaska.gov); Patricia Berkahn (patricia.berkahn@alaska.gov); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil\_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)  
**Cc:** Mike Salzetti; Emily Andersen  
**Subject:** Grant Lake Project Work Groups

**Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:**

Hi all,

I wanted to start by saying thank you to those who attended the Grant Creek site visit and I hope that you all found it beneficial. I thought it was a great turn-out and was very pleased that the weather decided to cooperate! As I mentioned, if anyone has any follow-up questions, please don't hesitate to let me know.

I wanted to let you all know about a process change that we will be implementing in the interest of increased efficiency and collaboration. As I eluded to during the site visit, HEA will be developing a separate "Aquatics Work Group" (AWG). This group will be responsible for discussing all matters associated with aquatic issues (fisheries, aquatic habitat, aquatic nutrients, instream flow, etc.) related to the Grant Lake Project. Given the number of studies and level of interest in this specific discipline, having a separate work group to discuss this area, makes sense from an efficiency standpoint. As such, the AWG meeting related to the upcoming 2013 study reports/data review will be held separate from the other natural resource areas (Water Resources, Terrestrial, Recreation/Visual), which will have their meeting in a grouped fashion. For the purposes of consistency, we will begin calling this other group the "Natural Resource Work Group" (NRWG). These two meetings will be staggered by approximately one month (NRWG first) and both will take place in the first two months of next year. One note.....I definitely see the potential need for our Water Resources lead to participate in some of the AWG proceedings. Our lead has been prepped and will be present at both sets of meetings if the need is there. I suspect it will be given the relationship between hydrology and fish presence/habitat quality.

The only thing that I'd ask of all of you at this point is to please write back and indicate which group you'd like to be a member of. I fully appreciate and understand that some of you are responsible for multiple natural resource areas for your agencies and may want to be a part of both groups and that is fine. That said, some of you do not have a vested responsibility in some areas and as such, the goal of the separate AWG is to create a more focused group of aquatic representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of.

To give you a tentative idea of our planned report distribution and meeting schedule, we are working toward the following:

- Draft 2013 Water Resources, Terrestrial and Rec/Vis Reports to Stakeholders – **mid to late December (2013)**
- Water Resources, Terrestrial and Rec/Vis Study Results Meeting – **mid January (2014)**
- Draft 2013 Fisheries, IFIM and Aquatic Nutrients Reports to Stakeholders – **mid to late January (2014)**
- Fisheries, IFIM and Aquatic Nutrients Study Results Meeting – **mid February (2014)**

\* Cultural Resources will follow the standard path for these types of projects.

Obviously, additional detail will follow as we get closer, groups get established and schedules get refined. In the interim, please don't hesitate to shoot me an email or give me a call with any questions/concerns. Please get back to me related to the work group(s) you'd like to be a part of. Again, thank you for your attendance at the site visit and I look forward to continuing to establish a collaborative process going forward,

Cory

**Cory Warnock**

*Senior Licensing and Regulatory Consultant*

McMillen, LLC

[www.mcmillen-llc.com](http://www.mcmillen-llc.com)

5771 Applegrove Ln.

Ferndale, Wa. 98248

O – 360-384-2662

## **M.D. Cooney Early Scoping Comments – June 2, 2010**

### **HEA's Grant Lake/Creek Hydroelectric Dam Proposal**

#### **FERC Dockets: P – 13212 and P - 13211**

#### **INTRODUCTION**

My name is Mike Cooney and I am a full time resident of Moose Pass. My mailing address is P.O. Box 169 Moose Pass, Alaska 99631. Since 1979, I have worked continuously in the fields of forestry and natural resource management in all regions of Alaska, and in both the public and private sectors.

My substantive comments are directed mainly to Federal Energy Regulatory Commission officials and to Homer Electric Association officials, but comments are also for agency representatives and HEA's consultants.

#### **ADDITIONAL RESOURCE, ENVIRONMENTAL and SOCIO-ECONOMIC ISSUES**

I request the FERC add the following fisheries and socio-economic issues to its future, revised Scoping Document 2, and that these problems be carefully considered and fully investigated in the NEPA process related to this project.

##### **Fisheries Issues**

1. Probable negative project impacts to Grant Creek's natural ability to annually produce and to annually supply wild fish, including any of all 5 species of Pacific Salmon and rainbow trout, to the greater Kenai River Basin ecosystem, including Kenai River reaches located downstream of Kenai Lake.
2. Probable negative project impacts to spawning gravel recruitment in Grant Creek necessary to maintaining viable populations of Grant Creek's existing wild fish stocks, including all 5 species of Pacific salmon, rainbow trout and other fish species documented in the Creek.
3. Probable negative project impacts that could cause the extinction of the relatively small but genetically significant runs of wild pink and chum salmon that are documented to exist in Grant Creek.
4. Probable negative project impacts to fish habitat as a result of constructing and maintaining an access road parallel to Grant Creek and below the main slope-break inside the canyon.

5. Probable negative project impacts to the Kenai River Basin ecosystem resulting from the potential use of hatchery raised fish that may be prescribed as mitigation for damage done to naturally sustainable wild fisheries.

#### Socio-Economic Issues

1. Probable negative project impacts to the local quality of life, small local businesses, and to the tourism, outdoor recreation, and sport fishing-dependent economies of Moose Pass and Cooper Landing, and other communities that depend in very large measure on the existing and relatively undeveloped nature of nearby public lands, waters and natural resources in the Kenai River Basin.

#### ADDITIONAL STUDIES

##### Socio-Economic Studies

Without going into the specifics of individual studies, but in recognition of significant probable negative project impacts to the local and unique quality of life, individual businesses, and local economies, Socio-economic issues related to this project should not be evaluated peripherally or as a by-product of other studies as currently proposed by HEA. I again request HEA immediately establish an independent Technical Working Group to comprehensively identify and to investigate these issues. The Socio-Economic TWG membership should be significantly comprised of residents from local project area communities, including local business owners. I look forward to working with that study group.

#### ENVIRONMENTAL DOCUMENT SHOULD BE AN EIS

Based on the controversial nature of the project, my experience in natural resource management and the NEPA process, my understanding of the project, my familiarity with local public lands, waters, resources and the local community dependence on these resources, and my knowledge of the tremendous negative impacts of similar hydro projects, including the one at Cooper Creek, I firmly believe that the reasonably foreseeable, probable, negative, direct, indirect and cumulative project impacts of the Grant Lake/Creek project rise to a level of significance under NEPA such that an Environmental Impact Statement is required.

I request the FERC rescind its plan to conduct and EA, and immediately commit to the process of preparing an EIS for this project. The Kenai River and its resource-dependent Communities deserve no less.

## COMPREHENSIVE PLANS

I request the FERC add the Kenai Area Plan to its list of Comprehensive Plans (Section 9.0) of its revised Scoping Document 2. I also request that the following passage from that Plan be incorporated and emphasized in the text of revised Scoping Document 2:

### **G. Impoundment structures**

The construction of new dams or diversions on the Kenai River or its fish-bearing tributaries that impede fish movements or reduce essential stream flows for spawning, rearing or migration will be prohibited. [4.5.5.2 page 82]

## REASONABLE ALTERNATIVES TO HEA'S PROPOSAL

A seemingly reasonable and potentially feasible alternative to this project, and one that deserves full consideration in this NEPA process, is the opportunity to develop a hydroelectric facility at Lowell Creek, near Seward. It would seem that retrofitting hydropower turbines in the existing man-made tunnel that diverts water from Lowell Creek, through Bear Mountain with outflow at tidewater on Resurrection Bay, could supply renewable electricity to the Rail-belt electrical grid without most or even any of the negative environmental or social impacts that will result from HEA's dam at Grant Lake/Creek.

## ENHANCEMENT AND MITIGATION

I request that agencies, HEA, and HEA's Consultants do not attempt to delude the public into believing that on balance, this project will actually enhance any existing natural resources in the project area, without first providing compelling scientific data, information, action plans and budgets to substantiate any such assertion.

Typically, mitigation and enhancement of hydropower projects results in costly, half-vast - that's V-A-S-T - Half-Vast and wholly deficient attempts to only partially remedy significant environmental problems that were intentionally created in the first place. The multi-million dollar plan to divert water from Stetson Creek into Cooper Creek, without any guarantee it will either produce the desired results or at least not create additional environmental problems is only one example.

In its Pre-Application Document, HEA concedes that the Kenai River is "*one of the most productive salmon rivers in the world*". I request that no aquaculture operations, including hatchery raised fish, be used to mitigate inevitable wild fisheries impacts resulting from this project.



To maintain the integrity of Kenai River and its fisheries, including maintenance of natural genetic diversity, the most effective mitigation will be to select the No Action Alternative and to deny an original hydropower license for this project.

## CONCLUSION

Just over 2 weeks ago I began circulating a citizen petition in opposition to this project. From May 15 to May 31, not less than **199** concerned citizens have added their names to the petition. People who signed the petition agree that the reasonably foreseeable, probable and extremely negative social and environmental impacts that will result from this project, compared with the relatively insignificant amount of electricity that may be produced, in no way justifies its licensing, construction or operation.

The citizen petition states:

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**From:** Develice, Rob -FS [mailto:rdevelice@fs.fed.us]

**Sent:** Monday, September 16, 2013 3:50 PM

**To:** Charnon, Betty -FS; Kathryn Beck

**Subject:** RE: Grant Lake Pre-field Review

Betty and Katy,

I'd suggest saying that **the data were extracted from the Forest Service's NRIS TESP-IS\* application**. TESP-IS support national data collection standards for combined TESP and invasive species surveys, TESP element-occurrences, and Invasive Species Inventories.

\*Natural Resource Information System Threatened, Endangered, and Sensitive Plants, and Invasive Species.

I regard to Lutz spruce, white spruce, and Sitka spruce on the Kenai Peninsula. The predominant spruce in the vicinity of Moose Pass is "Lutz" spruce (white x Sitka hybrid). White spruce is more characteristic of the Kenai Lowlands (at least in the northwestern part of the peninsula). Sitka spruce is more characteristic of the Seward and Girdwood areas with the intervening space featuring the hybrid (Lutz spruce).

---Rob

-----  
Robert L. DeVelice, Ph.D.

Vegetation Ecologist

USDA Forest Service, Chugach National Forest

161 East 1st Avenue, Door 8

Anchorage, AK 99501-1639

[rdevelice@fs.fed.us](mailto:rdevelice@fs.fed.us) 907-743-9437 743-9476 fax

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**From:** Charnon, Betty -FS

**Sent:** Monday, September 16, 2013 12:01 PM

**To:** Kathryn Beck

**Cc:** Develice, Rob -FS

**Subject:** RE: Grant Lake Pre-field Review

All the data is in our corporate database (NRIS). I'm not sure how to cite that? Rob, do you have any ideas?

- Betty

Betty Charnon

Kenai Peninsula Zone Ecologist

Phone: 907-754-2326

email: [bcharnon@fs.fed.us](mailto:bcharnon@fs.fed.us)

---

**From:** Kathryn Beck [<mailto:calypso@openaccess.org>]  
**Sent:** Monday, September 16, 2013 9:36 AM  
**To:** Charnon, Betty -FS  
**Subject:** RE: Grant Lake Pre-field Review

Betty – Just left another message on your phone.  
What is the citing for the weed information that was sent to me back in June?  
I will attach it here, in case you don't remember the specifics.  
Is there is a report associated with that data/map? It might be helpful to see it.

I'm curious about the overall distribution of Lutz spruce vs White spruce on the Kenai Peninsula.  
Would it typically be predominantly Lutz spruce, or are white spruce and Lutz spruce intermixed in an area like Moose Pass?

Thanks, Katy

---

**From:** Charnon, Betty -FS [<mailto:bcharnon@fs.fed.us>]  
**Sent:** Friday, September 13, 2013 3:27 PM  
**To:** Kathryn Beck  
**Subject:** RE: Grant Lake Pre-field Review

Betty Charnon  
Kenai Peninsula Zone Ecologist  
Phone: 907-754-2326  
email: [bcharnon@fs.fed.us](mailto:bcharnon@fs.fed.us)

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**From:** Kathryn Beck [<mailto:calypso@openaccess.org>]  
**Sent:** Friday, September 13, 2013 2:12 PM  
**To:** Charnon, Betty -FS  
**Subject:** RE: Grant Lake Pre-field Review

Betty – I just left a message on your phone.  
Is there a document similar to the "Guidance for Preparing a Botany Resource Report Tongass National Forest" (Karen Dillman) for the Chugach National Forest?  
Otherwise, I will use the above named guidelines for my report.  
I found very little in the way of weeds on USFS lands during my survey of the Grant Lake Project area; in fact I did not find any of the ones you have listed below.  
Thanks, Katy

~~~~~  
Kathryn Beck
Beck Botanical Services
1708 McKenzie Ave.
Bellingham, WA 98225
360-671-6913 office
360-305-0654 cell
calypso@openaccess.org

From: Charnon, Betty -FS [<mailto:bcharnon@fs.fed.us>]
Sent: Thursday, June 27, 2013 12:32 PM

To: Kathryn Beck
Subject: RE: Grant Lake Pre-field Review

The most invasive species that could occur in the project area are:

Canada Thistle (<i>Cirsium arvense</i>)
Orange Hawkweed (<i>Hieracium auratiacum</i>)
Butter and eggs (<i>Linaria vulgaris</i>)
Bird's foot trefoil (<i>Lotus corniculatus</i>)
White sweetclover (<i>Melilotus alba</i>)
Yellow sweetclover (<i>Melilotus officinalis</i>)
Reed canarygrass (<i>Phalaris arundinacea</i>)
Field sowthistle (<i>Sonchus arvensis</i>)
Bird vetch (<i>Vicia cracca</i>)

Also, attached are 2 spreadsheets. One is the raw data from the GIS layer you received. In the other file, I deleted records of the same species so you have just a list of species that occur in the GIS layer you received. The raw data file can be used to determine frequency of species.

I took a quick look at the pre-field review and the only comment I have is that *Ligusticum calderii* could also potentially occur in the project area. However, this species has not been found on the Chugach.

- Betty

Betty Charnon
Kenai Peninsula Zone Ecologist
Phone: 907-754-2326
email: bcharnon@fs.fed.us

From: Kathryn Beck [<mailto:calypso@openaccess.org>]
Sent: Wednesday, June 26, 2013 3:52 PM
To: Charnon, Betty -FS
Cc: Cory Warnock; Emily Andersen
Subject: Grant Lake Pre-field Review

Betty – Nice to check in with you about Sensitive plants for the Grant Lake Project.
Attached here is the Pre-field Review for the Sensitive plant survey there.
I appreciate you getting me information about invasive plants in the area.
Thanks, Katy

~~~~~  
Kathryn Beck  
Beck Botanical Services  
1708 McKenzie Ave.  
Bellingham, WA 98225  
360-671-6913 office  
360-305-0654 cell  
[calypso@openaccess.org](mailto:calypso@openaccess.org)  
~~~~~

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]

Sent: Tuesday, September 17, 2013 9:29 AM

To: Cory Warnock

Subject: FW: Grant Lake copper deposits

Cory,

Just a heads up to you. I returned the gentleman's phone call and left a message, but have not heard back from him. Do you have any input on copper deposits at Grant Lake? I did not want this to become a four alarm fire if there is no need, so I have not distributed this beyond the initial few people contacted. After a week of no return call from Grant Lake Mining, I have decided to send this on to you as an FYI.

Monte Miller

From: Berkhahn, Patti [<mailto:PBerkhahn@borough.kenai.ak.us>]

Sent: Monday, September 09, 2013 4:37 PM

To: Miller, Monte D (DFG)

Cc: Mouw, Jason E B (DFG); jeffry_anderson@fws.gov

Subject: RE: Grant Lake copper deposits

I don't know if it's anecdotal or real data. Just giving you a heads up on his potential call to you...

Patti Berkhahn

Habitat Biologist III

ADFG, Habitat Division

River Center

514 Funny River Road

Soldotna, AK 99669

907 714-2476

patricia.berkhahn@alaska.gov

(State agency housed in Kenai Peninsula Borough Building)

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]
Sent: Monday, September 09, 2013 4:33 PM
To: Berkhahn, Patti
Cc: Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: RE: Grant Lake copper deposits

And when I read your e-mail again , you stated that the miner had information on copper deposits at Grant Lake....was this right? Should we forward this e-mail string to Cory?
Monte

From: Berkhahn, Patti [<mailto:PBerkhahn@borough.kenai.ak.us>]
Sent: Monday, September 09, 2013 4:27 PM
To: Miller, Monte D (DFG)
Cc: Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: RE: Grant Lake copper deposits

All good questions you pose...

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476
patricia.berkhahn@alaska.gov
(State agency housed in Kenai Peninsula Borough Building)

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]
Sent: Monday, September 09, 2013 4:21 PM
To: Berkhahn, Patti; Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: RE: Grant Lake copper deposits

Patti,
I also had a call, which I missed, to inquire about fish resources. Thought it was Paul Torgeson, but may be Jorgenson....of Grant Lake Mining. I called him back and left a message but he has not called back. I am unaware of any WQ studies.

From the 2012 Draft Water Resources Study Plan identifying HDR efforts in 2009 and 2010:
"Water samples were collected at three sampling sites in Grant Creek and one site in Falls Creek in June and August, 2009 and in June, 2010 for laboratory analysis. Temperature data and other in-situ parameters including pH, dissolved oxygen, conductivity, and oxygen reduction potential were also collected."

Baseline water quality studies in Grant Lake

- Water quality samples will be collected at two sites in Grant Lake in late summer to complete the seasonal sampling initiated in 2010. Samples will be collected at two Grant Lake Project Kenai Hydro, LLC
FERC No. 13212 Page 7 November 2012
depths at the natural outlet site (GLOut) and at three depths at the proposed intake

location.

- In situ parameters will be collected using an YSI or Hydrolab multi-parameter meter at each site in a vertical transect at one meter increments.
- Water samples will be collected for laboratory analysis of the analytes listed in Table 1.
- A thermistor string identical to that used in 2009 will be re-established in late winter/early spring near the proposed intake (GLTS) and will log temperature at ten depths in a vertical transect, continuing the period of record from prior measurements. It should be noted that the thermistor string installed in 2009 may still exist and be functional. The prospective bidders should provide individual costs for the installation of a new thermistor string and the cost associated with restoring the potentially functional, existing string.

Table 1. Water Quality Analytes.

Parameter Units

Alkalinity (CaCO₃) mg/L
Total dissolved solids (TDS) mg/L
Total suspended sediment (TSS) mg/L
Kjeldahl Nitrogen mg/L
Nitrate/Nitrite mg/L
Orthophosphate mg/L
Total phosphorous mg/L
Lead µg/L
Hardness mg/L
Calcium mg/L
Magnesium mg/L
Sodium mg/L
Potassium mg/L
Low level mercury ng/L
Fluoride mg/L
Chloride
Sulfate mg/L
pH STD
Temperature °C
Dissolved oxygen (DO) mg/L, %
Specific and Relative Conductivity mS/cm, µS/cm
Oxygen Reduction Potential (ORP) mV
Turbidity NTU

There does not seem to be a heavy metal component to the proposed studies. A few questions? Will raising the Grant Lake surface level have an effect on copper concentrations if the shoreline is not exposed? Are there have been any geology reports done which indicate a concentration of copper? Will there be copper deposits bored through for penstock installation and will any portion of the penstock be unlined? Copper leaching into the penstock would seem to me to be of greater concern due to the constant rapid volume of flows passing any such exposed deposits. Other than what I have cited, I have no specific knowledge of mineral studies, however the DNR mining section may have additional information. If deposits of copper have been identified then perhaps some heavy metal studies also need to be undertaken. At some point Cory should also be asked. It would seem that they would now need to answer those questions.

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS

333 Raspberry Road
Anchorage, Alaska, 99518-1565
(907) 267-2312

From: Berkhahn, Patti [<mailto:PBerkhahn@borough.kenai.ak.us>]
Sent: Monday, September 09, 2013 3:04 PM
To: Miller, Monte D (DFG); Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: Grant Lake copper deposits

I received a phone call today from Paul Jorgenson 865 803-1416 paul@grantlakemining.com regarding concerns with existing copper deposits in Grant Lake. He is trying to contact you with information about these existing deposits. Do you know if anyone has done water quality studies in Grant Lake that documented excessive amounts of copper in Grant Lake? I'm curious.

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476
patricia.berkhahn@alaska.gov
(State agency housed in Kenai Peninsula Borough Building)

Attachments:

RE 2nd FERC Preliminary Permit Boundaries for the Proposed Grant Lake Hydro Electric Project; RE 3rd Progress Report (Grant Lake, P-13212)

From: Salzetti, Mikel [<mailto:MSalzetti@HomerElectric.com>]

Sent: Thursday, September 12, 2013 11:40 AM

To: Douglas Ott

Cc: Cory Warnock

Subject: RE: Grant Lake Hydro Project

Doug:

Thank you for the phone call this morning. Attached are a couple of emails in response to communications with the mining entity located in the Grant Lake area. The emails discussed power supply, project boundaries and a request for water quality data. I believe that our responses have adequately addressed all of the questions that we have received to date. As indicated in these emails we are committed to keeping them involved in the public process associated with our licensing efforts. If there are addition substantiated concerns regarding our proposed project we are willing to engage in discussions on how best to address those concerns.

Regards,

Mike Salzetti

Fuel Supply & Generation Engineering Manager

(907) 283-2375 *work*

(907) 398-5073 *Mobile*

From: Douglas Ott [<mailto:DOtt@aidea.org>]

Sent: Thursday, September 12, 2013 9:18 AM

To: Grant Lake Mining

Cc: Salzetti, Mikel; Audrey Alstrom; Shawn Calfa

Subject: RE: Grant Lake Hydro Project

Mr. Torgerson,

Thank you for your contact. During our phone conversation yesterday a number of unsubstantiated claims were made regarding the proposed Grant Lake Hydroelectric Project and its potential impacts on fish habitat and your mine.

AEA is a funder of the project, along with the developer, Kenai Hydro LLC and its parent utility, Homer Electric Association. I encourage you to be in contact with the developer's project manager to engage in an exchange of

information about your concerns. His name is Mikel (Mike) Salzetti and his phone number is (907) 283-2375. His email address is also shown above.

After our conversation, I did speak with Mike regarding your contact. He has been in active contact with White Rock Mining in the past and was unaware the mine was (apparently) under new ownership.

The Grant Lake project FERC Project # is P-13212. The FERC website address is <http://ferc.gov>. If you go through the elibrary section of their website you can view and download information specific to this project that has been filed with FERC.

I close by again stressing to you that the project is undergoing early phase pre-licensing studies as a part of a public licensing process conducted by FERC. These studies will gather information to be used to refine the project concepts to maximize the project's energy output while minimizing its impacts. If you have legitimate concerns about this project it is your responsibility to follow up with the proper officials and the developer.

Regards,
Douglas Ott, P.E.

From: Grant Lake Mining [<mailto:paul@grantlakemining.com>]
Sent: Wednesday, September 11, 2013 1:07 PM
To: Audrey Alstrom
Cc: Douglas Ott
Subject: Grant Lake Hydro Project

Audrey,

I would like to get some information on the Grant Lake Hydro Project. I and my partner own the Case Mine on the north shore of Grant Lake. Could you please give me a call at (865) 803-1416.

I look forward to speaking with you and/or Mr. Ott.

Very Best Regards,

Paul T. Torgerson
Grant Lake Mining
(865) 803-1416
Paul@GrantLakeMining.com

No virus found in this message.
Checked by AVG - www.avg.com
Version: 2013.0.3408 / Virus Database: 3222/6660 - Release Date: 09/12/13

No virus found in this message.
Checked by AVG - www.avg.com
Version: 2013.0.3408 / Virus Database: 3222/6672 - Release Date: 09/16/13

From: Cory Warnock
Sent: Friday, June 14, 2013 9:28 AM
To: Tom Harkreader
Cc: Mike Salzetti
Subject: RE: Grant Lake Project Boundary Clarification for BLM

Hi Tom,

My apologies for taking so long to get back to you. I just heard back from our contact at FERC. I explained the situation as it relates to Falls Creek and your interest in a mining claim in the area. He is currently checking with an associate on the current status at Falls Creek. Essentially what happens when an entity asks for and receives approval to explore hydro on a site is that FERC issues a "Section 24 Land Reserve" on the defined area which basically means that no other entity has priority on exploring the area for infrastructural reasons. As you know, HEA no longer has interest in this particular area and has surrendered their Falls Creek Preliminary Permit. If, through discussion with his associate, it turns out that Section 24 has already been lifted for Falls Creek, then the BLM should be ok to authorize your claim. If the reserve has not been lifted yet, BLM would need to send a letter to FERC "Seeking concurrence that the Section 24 status for Falls Creek be lifted due to the fact that the Preliminary Permit has been surrendered and there is a pending mining claim that the BLM would like to process". My suggestion to you (and the BLM) would be for you to relay this to the appropriate folks at the BLM and have them draft the letter and send it in. This would ensure that things were moving forward and likely do the most to expedite your process. If you or the BLM would like a little additional text citing the chronology of events as it relates to the Falls Creek Preliminary Permit, let me know and I can get you something.

The letter should be addressed to:

Secretary Kimberly D. Bose
Federal Energy Regulatory Commission Attn: DHAC, PJ-
12.2
888 First Street, NE
Washington, DC 20426

*Please Cc both Ken Hogan and Henry Woo (both at FERC)

Hopefully this helps and if you have any further questions or needs, don't hesitate to let me know.

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

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5771 Applegrove Ln.
Ferndale, Wa. 98248
O – 360-384-2662
C – 360-739-0187
F – 360-542-2264

From: Tom Harkreader [<mailto:tomharkreader@gmail.com>]
Sent: Wednesday, May 15, 2013 8:29 PM
To: Cory Warnock
Subject: Re: Grant Lake Project Boundary Clarification for BLM

Cory
Thankyou for looking into the matter for us any help would be great,
My mining partner Paul Torgerson maybe in contact with you down the line
as he is heading up our project and I will be out of State later this summer
Tom
White Rock Mining

On Tue, May 14, 2013 at 9:02 AM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Hi Tom,

My name is Cory Warnock. I'm the consulting project manager for the licensing and natural resources components of the proposed Grant Lake Hydro Project. Mike Salzetti and I have been talking about your concerns related to the changes in project boundary since 2010 and making sure (for your benefit) that the appropriate folks at the BLM were adequately informed. I wanted to let you know that I'm working on this and have a couple messages into our FERC representative. As soon as I hear from him and inform him a bit on the situation, I will get you the appropriate contact information for you to share with your contacts at the BLM.

In the meantime, if you have any questions or concerns, don't hesitate to let me know.

Thanks,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

From: Salzetti, Mikel <MSalzetti@HomerElectric.com>
Sent: Monday, June 17, 2013 11:02 AM
To: Grant Lake Mining
Cc: 'Tom Harkreader '; Cory Warnock
Subject: RE: 2nd FERC Preliminary Permit Boundaries for the Proposed Grant Lake Hydro Electric Project
Attachments: RE Grant Lake Project Boundary Clarification for BLM

Paul:

It was nice meeting you in person as well.

I want to make sure that you understand that the Grant Lake Hydro Electric project is still in the licensing process and that there is no guarantee that the project will be licensed and constructed. Additionally, Homer Electric Associations Certificate of Public Convenience and Need does not currently allow us to serve customers in this area. The Moose Pass Area has traditionally been served by either the City of Seward or Chugach Electric Association. If the location of your proposed mine falls within one of the currently established utility boundaries you will need to apply with that utility for service. If your proposed mine is outside of a current electric utility service territory and the Grant Lake Project is licensed and constructed within a timeframe that is commensurate with your construction schedule then we could discuss the possibilities of serving your facility. This will require an official request for service and the formal engineering that accompanies that process. If the Grant Lake Hydro Electric project is licensed and constructed, HEA would be interested in working cooperatively with White Rock Mining and any other electric utility involved to discuss solutions to best serve your proposed mining facilities.

Since Tom is outside, I have attached an email that was recently sent to Tom regarding Grant Lake Project boundary clarifications.

A copy of our second Preliminary Permit Application can be found on our web site at [kenaihydro.com](http://www.kenaihydro.com). Here is a direct link:

http://www.kenaihydro.com/documents/documents/GrantLake_P-13212_PreliminaryPermitApplicationNo2.pdf

I wish White Rock Mining success in developing their mining project,

Mike Salzetti

Fuel Supply & Generation Engineering Manager

(907) 283-2375 *work*

(907) 398-5073 *Mobile*

From: Grant Lake Mining [<mailto:paul@grantlakemining.com>]
Sent: Sunday, June 16, 2013 12:13 PM
To: Salzetti, Mikel
Cc: 'Tom Harkreader '

Subject: FW: 2nd FERC Preliminary Permit Boundaries for the Proposed Grant Lake Hydro Electric Project
Importance: High

Mike,

It was very nice speaking with you in person at Trail Lake last week. As you know I wear two hats in this venture; one as a partner in the White Rock claim group and a second as the President of the mining entity being formed to identify, extract, process and export the minerals from the property on a commercial basis.

It was very encouraging to hear that Homer Electric will be able to supply my mining company's proposed milling plant on Grant Lake with more power than just the 2.5 MW base load produced by the new Hydro on Grant Creek. Your comment gives me much greater flexibility in mill design. It also gives impetus to expanding my core drilling program and mining plan once the issue of staking additional claims above your 700' msl project boundary on Lark Mountain are resolved.

As you may know, my partner in the White Rock Claim Group on Grant Lake -- Tom Harkreader -- is going outside for the remainder of the year so I will be dealing with all issues involving our claim group including staking additional claims needed to complete our mining program. Please direct all comments to me with copy to Tom Harkreader as you deem appropriate.

As a deliverable, would you please send me a complete pdf copy of the Kenai Hydro, LLC, Preliminary Permit Application dated October 2011? Please feel free to contact me with any questions or comments. I look forward to your response and too working with Homer Electric over the coming years.

Very Best Regards,

Paul Torgerson
(865) 803-1416
paul@grantlakemining.com

From: Tom Harkreader [<mailto:tomharkreader@yahoo.com>]
Sent: Friday, June 14, 2013 11:24 PM
To: paul@wespeak.net
Subject: Fw: 2nd FERC Preliminary Permit Boundaries for the Proposed Grant Lake Hydro Electric Project

----- Forwarded Message -----

From: "Salzetti, Mikel" <MSalzetti@HomerElectric.com>
To: Tom Harkreader <tomharkreader@yahoo.com>
Cc: "Cory Warnock" (cory.warnock@mcmillen-llc.com)" <cory.warnock@mcmillen-llc.com>
Sent: Friday, January 25, 2013 9:25 AM
Subject: 2nd FERC Preliminary Permit Boundaries for the Proposed Grant Lake Hydro Electric Project

Tom:

Attached are the Grant Lake project boundaries as approved in the 2nd FERC Preliminary Permit for the proposed Grant Lake Hydro Electric Project.

Regards,

Mike Salzetti

Fuel Supply & Generation Engineering Manager

(907) 283-2375 *work*

(907) 398-5073 *Mobile*

From: Cory Warnock
Sent: Wednesday, September 11, 2013 5:07 PM
To: Grant Lake Mining
Cc: Mike Salzetti
Subject: RE: 3rd Progress Report (Grant Lake, P-13212)

Hi Paul,

We are in the process of finishing up field work and analyzing water quality data for 2013. Once we have the reports finalized for this year (early 2014), we will be providing the stakeholders (you included) with the reports that will have everything you are looking for. In advance of that, I'd be more than willing to discuss the results with you once we have everything synthesized (likely November). Would that work? Let me know and I'll get a tentative date on a calendar to touch base.

Thanks,

Cory

From: Grant Lake Mining [mailto:paul@grantlakemining.com]
Sent: Wednesday, September 11, 2013 2:33 PM
To: Cory Warnock
Subject: RE: 3rd Progress Report (Grant Lake, P-13212)

Cory,

Can you please forward copies of the water sampling results for Grant Lake mentioned in your study?

Very Best Regards,

Paul T. Torgerson
Grant Lake Mining
(865) 803-1416
Paul@GrantLakeMining.com

From: Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]
Sent: Tuesday, August 27, 2013 11:34 AM
To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Ginny Litchfield (ginny.litchfield@alaska.gov); Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Pamela Russell (pamela.russell@alaska.gov); Patricia Berkahn

(patricia.berkhahn@alaska.gov); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: 3rd Progress Report (Grant Lake, P-13212)

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

Hi all,

Here is a personal copy of the Progress Report just submitted to FERC for the Grant Lake Project.

Regards,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

5771 Applegrove Ln.

Ferndale, Wa. 98248

O – 360-384-2662

C – 360-739-0187

F – 360-542-2264

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Version: 2013.0.3392 / Virus Database: 3222/6654 - Release Date: 09/10/13

From: Cory Warnock
Sent: Tuesday, September 17, 2013 9:05 AM
To: Miller, Monte D (DFG); Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)
Cc: Mike Salzetti; Emily Andersen
Subject: RE: Grant Lake Project Work Groups
Attachments: 20130916_110111.jpg; 20130910_130136.jpg

All,

Just a couple photos to document that the fuel containment issue that was brought up during the site visit is being taken care of at all sites.

Thanks,

Cory

From: Cory Warnock
Sent: Monday, September 09, 2013 1:04 PM
To: 'Miller, Monte D (DFG)'; Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)
Cc: Mike Salzetti; Emily Andersen
Subject: RE: Grant Lake Project Work Groups

Hi Monte,

Glad you found the site visit beneficial. Mike and I have already been in touch with the appropriate folks (internally and externally) and the fuel containment issue along with two issues pointed out by Patti Berkahn are already in the process of being remedied.

Cory

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]

Sent: Monday, September 09, 2013 12:04 PM

To: Cory Warnock; Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Russell, Pamela J (DNR); Berkahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: RE: Grant Lake Project Work Groups

Cory,

Please include me in both groups.

I appreciated the opportunity to attend the site visit. It appears that the efforts on site to maintain the ability to collect data have been successful. This has occurred under challenging conditions and I hope that the effort will continue long enough to collect some coho data as well. The closer to cold weather, the more challenging it will become to stay at the site and collect data. It will be very interesting to review the data collected.

Others have probably mentioned concern regarding generator and fuel storage containment. There are probably some permit compliance issues there as well. Our concerns are with possible fuel spills into the watershed. Please comply with standard fuel containment practices. Someone stated that containment equipment was on site but had not been placed in use. If so, this is an easy correction. Thanks.

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS
333 Raspberry Road
Anchorage, Alaska, 99518-1565
(907) 267-2312

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]

Sent: Monday, September 09, 2013 10:31 AM

To: Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan

(kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Miller, Monte D (DFG); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: Grant Lake Project Work Groups

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

Hi all,

I wanted to start by saying thank you to those who attended the Grant Creek site visit and I hope that you all found it beneficial. I thought it was a great turn-out and was very pleased that the weather decided to cooperate! As I mentioned, if anyone has any follow-up questions, please don't hesitate to let me know.

I wanted to let you all know about a process change that we will be implementing in the interest of increased efficiency and collaboration. As I eluded to during the site visit, HEA will be developing a separate "Aquatics Work Group" (AWG). This group will responsible for discussing all matters associated with aquatics issues (fisheries, aquatic habitat, aquatic nutrients, instream flow, etc.) related to the Grant Lake Project. Given the number of studies and level of interest in this specific discipline, having a separate work group to discuss this area, makes sense from an efficiency standpoint. As such, the AWG meeting related to the upcoming 2013 study reports/data review will be held separate from the other natural resource areas (Water Resources, Terrestrial, Recreation/Visual), which will have their meeting in a grouped fashion. For the purposes of consistency, we will begin calling this other group the "Natural Resource Work Group" (NRWG). These two meetings will be staggered by approximately one month (NRWG first) and both will take place in the first two months of next year. One note.....I definitely see the potential need for our Water Resources lead to participate in some of the AWG proceedings. Our lead has been prepped and will be present at both sets of meetings if the need is there. I suspect it will be given the relationship between hydrology and fish presence/habitat quality.

The only thing that I'd ask of all of you at this point is to please write back and indicate which group you'd like to be a member of. I fully appreciate and understand that some of you are responsible for multiple natural resource areas for your agencies and may want to be a part of both groups and that is fine. That said, some of you do not have a vested responsibility in some areas and as such, the goal of the separate AWG is to create a more focused group of aquatic representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of.

To give you a tentative idea of our planned report distribution and meeting schedule, we are working toward the following:

- Draft 2013 Water Resources, Terrestrial and Rec/Vis Reports to Stakeholders – **mid to late December (2013)**
- Water Resources, Terrestrial and Rec/Vis Study Results Meeting – **mid January (2014)**
- Draft 2013 Fisheries, IFIM and Aquatic Nutrients Reports to Stakeholders – **mid to late January (2014)**
- Fisheries, IFIM and Aquatic Nutrients Study Results Meeting – **mid February (2014)**

* Cultural Resources will follow the standard path for these types of projects.

Obviously, additional detail will follow as we get closer, groups get established and schedules get refined. In the interim, please don't hesitate to shoot me an email or give me a call with any questions/concerns. Please get back to me related to the work group(s) you'd like to be a part of. Again, thank you for your attendance at the site visit and I look forward to continuing to establish a collaborative process going forward,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

5771 Applegrove Ln.

Ferndale, Wa. 98248

O – 360-384-2662

C – 360-739-0187

F – 360-542-2264

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Version: 2013.0.3408 / Virus Database: 3222/6672 - Release Date: 09/16/13





From: Grant Lake Mining [mailto:paul@grantlakemining.com]
Sent: Tuesday, September 17, 2013 5:38 PM
To: Cory Warnock
Cc: "Mike Salzetti ()"@exmf017-1.msoutlookonline.net
Subject: RE: Grant Lake Project Work Groups
Importance: High

Cory,

I would like to participate in the work groups. You have a pretty substantial case of NIMBY against this project. I've dealt with this many times before. Having been involved in ~3GW of power generation in North America, Australia, Vietnam, the Philippines', Kalimantan, Pakistan, Indonesia and a couple of other countries, I think you're going to need Pro-dam people like me. The biggest US dam I was associated with was the 560MW second powerhouse at Bonneville on the Columbia. I was a member of Groves-Kiewit-Granite's management team. My work was approved by USACE.

I am interested in this dam going forward because I need to buy the power from the dam to power my proposed milling plant at the Case Mine. Mike has quoted me \$140/MWh based on 2.5MW/hr. To accomplish my goals I need the closure to mineral entry lifted in the federal sections I need. It is actually a very simple matter to change your project boundaries to the perimeter of the lake. Both me and my consultants at Strategic Analysis (www.sainc.com) in Arlington, VA have spoken with FERC about lifting the closure. It will help Kenai Hydro's chances of permitting this project.

I think we should talk about my concerns with respect to the water quality in Grant Lake before your suggested November date. The water is poison to fish. There may be an easy solution.

Please consider my direct comments to you as confidential. I do have to answer Doug Ott's email which was copied to several people. I don't like the term "allegations" being used about my comments, especially when my comments are fact, so my response will be copied to everyone he copied. I would prefer not to respond to his email but that depends on the mineral closure issue.

Best Regards,

Paul Torgerson
Grant Lake Mining
The Case Mine
(865) 803-1416
paul@grantlakemining.com

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]

Sent: Monday, September 09, 2013 10:31 AM

To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Ginny Litchfield (ginny.litchfield@alaska.gov); Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Pamela Russell (pamela.russell@alaska.gov); Patricia Berkhahn (patricia.berkhahn@alaska.gov); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: Grant Lake Project Work Groups

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

Hi all,

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representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of.

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Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

5771 Applegrove Ln.

Ferndale, Wa. 98248

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C – 360-739-0187

F – 360-542-2264

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Version: 2014.0.4117 / Virus Database: 3604/6672 - Release Date: 09/16/13

From: Miller, Monte D (DFG) [mailto:monte.miller@alaska.gov]
Sent: Wednesday, September 18, 2013 5:15 PM
To: Cory Warnock
Cc: Berkhahn, Patricia G (DFG); Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: RE: Grant Lake copper deposits

Cory,

We have seen in the past, people who may want some studies done for their own benefit. I kind of wondered if that may have been the case here. This project has both a pro and an anti following which have used the media to push their beliefs. If there are issues here, I am confident that they will fall out before any project finalization occurs. Since this individual has previously approached HEA and AEA, he may not have received what he was hoping for. At least he is on the radar so the project/applicant will not be surprised and can plan accordingly. There will probably also be a geology component that will pair with the engineering assessments yet to be completed. As I stated in my e-mails, my concerns could run to boring through deposits and leaching from that action. At this point it is all speculation better saved for future discussions. Thanks for the return information.

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS
333 Raspberry Road
Anchorage, Alaska, 99518-1565
(907) 267-2312

From: Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]
Sent: Wednesday, September 18, 2013 3:28 PM
To: Miller, Monte D (DFG)
Subject: RE: Grant Lake copper deposits

Hi Monte,

Thank you for the email. I appreciate you keeping me in the loop and fully assessing validity prior to a mass distribution. To provide a bit of background, HEA and I have had some correspondence with Mr. Torgerson (Grant Lake Mining) over the course of the past 9 months or so. They made initial contact with HEA related to their interest in staking claim to some mining areas around Grant Lake that appear to be reserved with HEA's FERC preliminary permit. HEA provided Grant Lake Mining with the revised project description that shows most of the claims outside of the project boundary. Additionally, Grant Lake Mining approached Mike about the potential related to purchasing some of the power from the Grant Lake Project in the future. At that time, Mike and I updated him on project developments,

let him know where we were in the process and committed to keeping him informed as things progressed. More recently, Mr. Torgerson reached out to AEA (Doug Ott) regarding the same perceived issue that he brought up with you and Patti. AEA then contacted Mike and I regarding our prior discussions with Mr. Torgerson. Once we provided all of the historical documentation and back and forth, Mr. Ott let us know that , “At this point I am satisfied that we (you, Cory and I) have attempted to communicate to Mr. Torgerson several approaches for him to follow up if he is interested in pursuing this any further.” He also followed-up with Mr. Torgerson and re-stressed what we had told him previously, that the licensing process was a public one and he has avenues for involving himself in that process.

At this point, we have seen no data from Mr. Torgerson or discovered any reports that would suggest his copper deposit assumptions associated with Grant Lake are anything but unsubstantiated and/or anecdotal. Additionally, we feel that Mr. Torgerson’s understanding of the current project configuration may be a bit fuzzy. It is our understanding based upon our discussions with Mr. Torgerson, that his primary concern is related to drawdown and its potential to increase leaching of copper downstream into Grant Creek. As you know, our current operational plan calls for a “drawdown” of no more than 4 feet below current natural low lake conditions and an increase of only approximately 2 feet. This being the case, if any of his assertions related to copper deposits prove to have a factual component, any leaching of copper would be minimal, at worst. Additionally, the operations and engineering component of our studies still needs to be completed but it is quite possible that, given the flashy nature of the Grant Lake system, the managed draw down of water may lead to less exposure cycles than what naturally occurs.

At this point, we feel our current water quality effort is sufficient documentation of existing conditions and this along with our project approach lends itself to the belief that Mr. Torgerson’s concern is likely a non-issue. Obviously, if Mr. Torgerson has additional data to substantiate his assertions, we’d be more than willing to technically review it and make decisions (with the Stakeholders) regarding the appropriate approach for evaluation and acquiring additional metals data (if needed). Based upon my observations of recent events and communications, I think there might be some value in you, Mike and I having a quick phone call to discuss this issue and the individual making these claims. Having everyone on the same page in relation to this issue would benefit us all greatly, I believe. Let me know of a time that would work to chat over the next week or so and I’ll get it set up.

Thanks,

Cory

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]
Sent: Tuesday, September 17, 2013 9:29 AM
To: Cory Warnock
Subject: FW: Grant Lake copper deposits

Cory,
Just a heads up to you. I returned the gentleman’s phone call and left a message, but have not heard back from him. Do you have any input on copper deposits at Grant Lake? I did not want this to become a four alarm fire if there is no need, so I have not distributed this beyond the initial few people contacted. After a week of no return call from Grant Lake Mining, I have decided to send this on to you as an FYI.
Monte Miller

From: Berkhahn, Patti [<mailto:PBerkhahn@borough.kenai.ak.us>]
Sent: Monday, September 09, 2013 4:37 PM
To: Miller, Monte D (DFG)
Cc: Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: RE: Grant Lake copper deposits

I don’t know if it’s anecdotal or real data. Just giving you a heads up on his potential call to you...

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476
patricia.berkhahn@alaska.gov

(State agency housed in Kenai Peninsula Borough Building)

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]
Sent: Monday, September 09, 2013 4:33 PM
To: Berkhahn, Patti
Cc: Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: RE: Grant Lake copper deposits

And when I read your e-mail again , you stated that the miner had information on copper deposits at Grant Lake....was this right? Should we forward this e-mail string to Cory?
Monte

From: Berkhahn, Patti [<mailto:PBerkhahn@borough.kenai.ak.us>]
Sent: Monday, September 09, 2013 4:27 PM
To: Miller, Monte D (DFG)
Cc: Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: RE: Grant Lake copper deposits

All good questions you pose...

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476
patricia.berkhahn@alaska.gov
(State agency housed in Kenai Peninsula Borough Building)

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]
Sent: Monday, September 09, 2013 4:21 PM
To: Berkhahn, Patti; Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: RE: Grant Lake copper deposits

Patti,
I also had a call, which I missed, to inquire about fish resources. Thought it was Paul Torgeson, but may be Jorgenson...of Grant Lake Mining. I called him back and left a message but he has not called back. I am unaware of any WQ studies.

From the 2012 Draft Water Resources Study Plan identifying HDR efforts in 2009 and 2010:

“Water samples were collected at three sampling sites in Grant Creek and one site in Falls Creek in June and August, 2009 and in June, 2010 for laboratory analysis. Temperature data and other in-situ parameters including pH, dissolved oxygen, conductivity, and oxygen reduction potential were also collected.”

Baseline water quality studies in Grant Lake

- Water quality samples will be collected at two sites in Grant Lake in late summer to complete the seasonal sampling initiated in 2010. Samples will be collected at two Grant Lake Project Kenai Hydro, LLC
FERC No. 13212 Page 7 November 2012
depths at the natural outlet site (GLOut) and at three depths at the proposed intake location.
- In situ parameters will be collected using an YSI or Hydrolab multi-parameter meter at each site in a vertical transect at one meter increments.
- Water samples will be collected for laboratory analysis of the analytes listed in Table 1.
- A thermistor string identical to that used in 2009 will be re-established in late winter/early spring near the proposed intake (GLTS) and will log temperature at ten depths in a vertical transect, continuing the period of record from prior measurements. It should be noted that the thermistor string installed in 2009 may still exist and be functional. The prospective bidders should provide individual costs for the installation of a new thermistor string and the cost associated with restoring the potentially functional, existing string.

Table 1. Water Quality Analytes.

Parameter Units

Alkalinity (CaCO₃) mg/L
 Total dissolved solids (TDS) mg/L
 Total suspended sediment (TSS) mg/L
 Kjeldahl Nitrogen mg/L
 Nitrate/Nitrite mg/L
 Orthophosphate mg/L
 Total phosphorous mg/L
 Lead µg/L
 Hardness mg/L
 Calcium mg/L
 Magnesium mg/L
 Sodium mg/L
 Potassium mg/L
 Low level mercury ng/L
 Fluoride mg/L
 Chloride
 Sulfate mg/L
 pH STD
 Temperature °C
 Dissolved oxygen (DO) mg/L, %
 Specific and Relative Conductivity mS/cm, µS/cm
 Oxygen Reduction Potential (ORP) mV
 Turbidity NTU

There does not seem to be a heavy metal component to the proposed studies. A few questions? Will raising the Grant Lake surface level have an effect on copper concentrations if the shoreline is not exposed? Are there have been any geology reports done which indicate a concentration of copper? Will there be copper deposits bored through for penstock installation and will any portion of the penstock be unlined? Copper leaching into the penstock would seem to me to be of greater concern due to the constant rapid volume of flows passing any such exposed deposits. Other than what I have cited, I have no specific knowledge of mineral studies, however the DNR mining section may have additional information. If deposits of copper have been identified then

perhaps some heavy metal studies also need to be undertaken. At some point Cory should also be asked. It would seem that they would now need to answer those questions.

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS
333 Raspberry Road
Anchorage, Alaska, 99518-1565
(907) 267-2312

From: Berkhahn, Patti [<mailto:PBerkhahn@borough.kenai.ak.us>]
Sent: Monday, September 09, 2013 3:04 PM
To: Miller, Monte D (DFG); Mouw, Jason E B (DFG); jeffry_anderson@fws.gov
Subject: Grant Lake copper deposits

I received a phone call today from Paul Jorgenson 865 803-1416 paul@grantlakemining.com regarding concerns with existing copper deposits in Grant Lake. He is trying to contact you with information about these existing deposits. Do you know if anyone has done water quality studies in Grant Lake that documented excessive amounts of copper in Grant Lake? I'm curious.

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476
patricia.berkhahn@alaska.gov
(State agency housed in Kenai Peninsula Borough Building)

From: Cory Warnock
Sent: Thursday, September 19, 2013 1:18 PM
To: 'Grant Lake Mining'
Cc: Mike Salzetti
Subject: RE: Grant Lake Project Work Groups

Mr. Torgerson,

Thank you for your response to our email and interest in the project. I understand your motivation for being involved in the process and your associated desire for energy to power your proposed milling plant. I need to make it clear that Mike has never quoted you a price for power. As he pointed out in his email on June 17th, 2013 (below), the Grant Lake Hydro Project is still in the licensing process and there is no guarantee that the project will be licensed and constructed. Additionally, Homer Electric Association's Certificate of Public Convenience and Need does not currently allow them to serve customers in this area. The Moose Pass Area has traditionally been served by either the City of Seward or Chugach Electric Association. If the location of your proposed mine falls within one of the currently established utility boundaries, you will need to apply with that utility for service. If your proposed mine is outside of a current electric utility service territory and the Grant Lake Project is licensed and constructed within a timeframe that is commensurate with your construction schedule, HEA could discuss the possibility of serving your facility. This will require an official request for service and the formal engineering that accompanies that process. If the Grant Lake Hydro Project is licensed and constructed, HEA would be interested in working cooperatively with you and any other electric utility involved to discuss solutions to best serve your proposed mining facilities. As for power costs, those are clearly spelled out in the tariffs that are on file with the Regulatory Commission of Alaska for all three electric utilities mentioned above.

From a project boundary perspective, I can give you a general development pathway for a boundary on a new hydro project as it is a good example of the collaborative approach I discuss in the final paragraph of this email. Typically, a final boundary designation is heavily based upon two broad categories: 1) project infrastructure, 2) natural resource studies. All project infrastructure (powerhouse, tunnel, penstock, intake, primary transmission, etc.) is included in the project boundary area. In addition to this, impacts to the natural environment are taken into consideration when a final project boundary is developed. A few examples would include modified flows down a stream due to project operations, impacts to wildlife and botanical species in the area as a result of the project and modified lake level fluctuations as a result of project operations. These areas (and others) have the potential to change the area impacted by the project and as a result, the project boundary. The natural resource studies that are currently being conducted are directly addressing the potential for impacts to the natural environment. Once those studies are complete, the data is analyzed and reports are developed, HEA will meet with the stakeholders to go over the results and collaborate on a variety of issues including level of impact and mitigation options, operational regime options, etc. It is during these discussions that a refined project boundary is developed based upon the findings of the studies and the final project infrastructure development. In a perfect scenario, these discussions are completed and agreements with stakeholders are finalized (to a great extent) prior to or during development of the FERC license application. Once the final license application is submitted, FERC evaluates the document internally for completeness and makes the final determination as to whether a license will be issued. Even at this late phase, it is still possible that FERC will come back with additional information

requests to complete the application that could include more studies, engineering, boundary modifications, etc. So, while at a first glance, it may appear that a project boundary modification is a simple exercise, you can see that there is a process that can have many twists and turns. What HEA has proposed currently is their view of an all-encompassing and optimal boundary for their needs.

As it relates to the perceived water quality issue that you seem to think exists, I'm not sure that I can comment until you provide a bit more detail. I can tell you that part of our study program this year consists of a comprehensive water quality investigation that evaluates a series of biological, chemical and physical parameters on both Grant Lake and Grant Creek. While the results of these studies are not complete, our preliminary data does not indicate anything unexpected and the data seems to be consistent with historical study results. If you have study results indicating an issue, we would be interested in discussing this information with you and all of our stakeholders to address any concerns that you may have.

I'm certainly nowhere near as well versed in federal mining regulations and/or permitting as I am in hydro licensing, relicensing, amendments, permitting and process. From a Grant Lake Project perspective and in very general terms, we have made significant progress this year with our studies and efforts to collaborate with state and federal agencies as well as the public. We are in the process of refining our project infrastructure and operational regime. All of this is being done within the confines of the approved FERC licensing process and we are placing a heavy emphasis on communication and collaboration with our stakeholder group and FERC. I work very intensively with our stakeholders and FERC representative to maximize efficiency in the process and ensure expectations and commitments are being met. Obviously this is a public process where transparency is explicit but it has been my experience with many other projects that an approach emphasizing cooperation lends itself to success and a reasonable outcome for all parties involved. This approach is proving successful in this arena as well and my intent is to continue down this path.

If you have additional thoughts, please feel free to shoot me an email and/or give me a call and I'd be happy to discuss further. Again, thank you for your interest in the project and I will plan on keeping you informed via the comprehensive stakeholder group communications.

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

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From: Salzetti, Mikel [<mailto:MSalzetti@HomerElectric.com>]

Sent: Monday, June 17, 2013 11:02 AM

To: Grant Lake Mining

Cc: 'Tom Harkreader '; Cory Warnock

Subject: RE: 2nd FERC Preliminary Permit Boundaries for the Proposed Grant Lake Hydro Electric Project

Paul:

It was nice meeting you in person as well.

I want to make sure that you understand that the Grant Lake Hydro Electric project is still in the licensing process and that there is no guarantee that the project will be licensed and constructed. Additionally, Homer Electric Associations Certificate of Public Convenience and Need does not currently allow us to serve customers in this area. The Moose Pass Area has traditionally been served by either the City of Seward or Chugach Electric Association. If the location of your proposed mine falls within one of the currently established utility boundaries you will need to apply with that utility for service. If your proposed mine is outside of a current electric utility service territory and the Grant Lake Project is licensed and constructed within a timeframe that is commensurate with your construction schedule then we could discuss the possibilities of serving your facility. This will require an official request for service and the formal engineering that accompanies that process. If the Grant Lake Hydro Electric project is licensed and constructed, HEA would be interested in working cooperatively with White Rock Mining and any other electric utility involved to discuss solutions to best serve your proposed mining facilities.

Since Tom is outside, I have attached an email that was recently sent to Tom regarding Grant Lake Project boundary clarifications.

A copy of our second Preliminary Permit Application can be found on our web site at [kenaihydro.com](http://www.kenaihydro.com). Here is a direct link:

http://www.kenaihydro.com/documents/documents/GrantLake_P-13212_PreliminaryPermitApplicationNo2.pdf

I wish White Rock Mining success in developing their mining project,

Mike Salzetti

Fuel Supply & Generation Engineering Manager

(907) 283-2375 *work*

(907) 398-5073 *Mobile*

From: Grant Lake Mining [<mailto:paul@grantlakemining.com>]

Sent: Tuesday, September 17, 2013 5:38 PM

To: Cory Warnock

Cc: "Mike Salzetti ()" <exmf017-1.msoutlookonline.net>

Subject: RE: Grant Lake Project Work Groups

Importance: High

Cory,

I would like to participate in the work groups. You have a pretty substantial case of NIMBY against this project. I've dealt with this many times before. Having been involved in ~3GW of power generation in North America, Australia, Vietnam, the Philippines', Kalimantan, Pakistan, Indonesia and a couple of other countries, I think you're going to need Pro-dam people like me. The biggest US dam I was associated with was the 560MW second powerhouse at Bonneville on the Columbia. I was a member of Groves-Kiewit-Granite's management team. My work was approved by USACE.

I am interested in this dam going forward because I need to buy the power from the dam to power my proposed milling plant at the Case Mine. Mike has quoted me \$140/MWh based on 2.5MW/hr. To accomplish my goals I need the closure to mineral entry lifted in the federal sections I need. It is actually a very simple matter to change your project boundaries to the perimeter of the lake. Both me and my consultants at Strategic Analysis (www.sainc.com) in Arlington, VA have spoken with FERC about lifting the closure. It will help Kenai Hydro's chances of permitting this project.

I think we should talk about my concerns with respect to the water quality in Grant Lake before your suggested November date. The water is poison to fish. There may be an easy solution.

Please consider my direct comments to you as confidential. I do have to answer Doug Ott's email which was copied to several people. I don't like the term "allegations" being used about my comments, especially when my comments are fact, so my response will be copied to everyone he copied. I would prefer not to respond to his email but that depends on the mineral closure issue.

Best Regards,

Paul Torgerson
Grant Lake Mining
The Case Mine
(865) 803-1416
paul@grantlakemining.com

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From: Cory Warnock
Sent: Monday, September 23, 2013 4:13 PM
To: Douglas Ott
Cc: Mikel (Mike) Salzetti (msalzetti@homerelectric.com); Audrey Alstrom
Subject: RE: Grant Lake Project Work Groups

Thanks, Doug. I'll definitely continue to keep you (and your successor) informed.

Cory

From: Douglas Ott [<mailto:DOtt@aidea.org>]
Sent: Monday, September 23, 2013 4:08 PM
To: Cory Warnock
Cc: Mikel (Mike) Salzetti (msalzetti@homerelectric.com); Audrey Alstrom
Subject: RE: Grant Lake Project Work Groups

Cory,
Please continue to include me on your stakeholders list, though I won't be signing up as a work group member. I will soon be taking another position at AEA, but will presume my replacement will ultimately decide if he (or she) will want to join a work group and take over my involvement as a project stakeholder.

Thanks,
Doug

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, September 23, 2013 2:57 PM
To: Audrey Alstrom; Barbara Stanley (bstanley@fs.fed.us); Brent Goodrum (brent.goodrum@alaska.gov); David Schade (david.w.schade@alaska.gov); Douglas Ott; Ginny Litchfield (ginny.litchfield@alaska.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); susan walker
Cc: Mike Salzetti; Emily Andersen
Subject: RE: Grant Lake Project Work Groups

Hi all,

If I'm including you on this message it means I haven't heard back from you regarding the work group designation I discuss below. As you have time, it would be helpful to hear back from you related to what group(s) you'd like to be involved in. Additionally, if you don't have plans to participate in either and/or you'd like to be removed from future correspondence that will go to the Stakeholder list, please let me know.

Thanks,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

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O – 360-384-2662

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From: Cory Warnock

Sent: Monday, September 09, 2013 11:31 AM

To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Ginny Litchfield (ginny.litchfield@alaska.gov); Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Pamela Russell (pamela.russell@alaska.gov); Patricia Berkahn (patricia.berkhahn@alaska.gov); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: Grant Lake Project Work Groups

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

Hi all,

I wanted to start by saying thank you to those who attended the Grant Creek site visit and I hope that you all found it beneficial. I thought it was a great turn-out and was very pleased that the weather decided to cooperate! As I mentioned, if anyone has any follow-up questions, please don't hesitate to let me know.

I wanted to let you all know about a process change that we will be implementing in the interest of increased efficiency and collaboration. As I eluded to during the site visit, HEA will be developing a separate "Aquatics Work Group" (AWG). This group will responsible for discussing all matters associated with aquatics issues (fisheries, aquatic habitat, aquatic nutrients, instream flow, etc.) related to the Grant Lake Project. Given the number of studies and level of interest in this specific discipline, having a separate work group to discuss this area, makes sense from an efficiency standpoint. As such, the AWG meeting related to the upcoming 2013 study reports/data review will be held separate from the other natural resource areas (Water Resources, Terrestrial, Recreation/Visual), which will have their meeting in a grouped fashion. For the purposes of consistency, we will begin calling this other group the "Natural Resource Work Group" (NRWG). These two meetings will be staggered by approximately one month (NRWG first) and both will take place in the first two months of next year. One note.....I definitely see the potential need for our Water Resources lead

to participate in some of the AWG proceedings. Our lead has been prepped and will be present at both sets of meetings if the need is there. I suspect it will be given the relationship between hydrology and fish presence/habitat quality.

The only thing that I'd ask of all of you at this point is to please write back and indicate which group you'd like to be a member of. I fully appreciate and understand that some of you are responsible for multiple natural resource areas for your agencies and may want to be a part of both groups and that is fine. That said, some of you do not have a vested responsibility in some areas and as such, the goal of the separate AWG is to create a more focused group of aquatic representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of.

To give you a tentative idea of our planned report distribution and meeting schedule, we are working toward the following:

- Draft 2013 Water Resources, Terrestrial and Rec/Vis Reports to Stakeholders – **mid to late December (2013)**
- Water Resources, Terrestrial and Rec/Vis Study Results Meeting – **mid January (2014)**
- Draft 2013 Fisheries, IFIM and Aquatic Nutrients Reports to Stakeholders – **mid to late January (2014)**
- Fisheries, IFIM and Aquatic Nutrients Study Results Meeting – **mid February (2014)**

* Cultural Resources will follow the standard path for these types of projects.

Obviously, additional detail will follow as we get closer, groups get established and schedules get refined. In the interim, please don't hesitate to shoot me an email or give me a call with any questions/concerns. Please get back to me related to the work group(s) you'd like to be a part of. Again, thank you for your attendance at the site visit and I look forward to continuing to establish a collaborative process going forward,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

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From: Mushovic, Kathleen (KJ) [mailto:kjmushovic@blm.gov]
Sent: Monday, September 23, 2013 3:59 PM
To: Cory Warnock
Subject: Re: Grant Lake Project Work Groups

Cory, I don't work with withdrawals any more.

Best,
KJ Mushovic

On Mon, Sep 23, 2013 at 2:57 PM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Hi all,

If I'm including you on this message it means I haven't heard back from you regarding the work group designation I discuss below. As you have time, it would be helpful to hear back from you related to what group(s) you'd like to be involved in. Additionally, if you don't have plans to participate in either and/or you'd like to be removed from future correspondence that will go to the Stakeholder list, please let me know.

Thanks,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

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From: Cory Warnock

Sent: Monday, September 09, 2013 11:31 AM

To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Brent Goodrum (brent.goodrum@alaska.gov); Cassie Thomas (cassie_thomas@nps.gov); David Griffin (david.griffin@alaska.gov); David Schade (david.w.schade@alaska.gov); Denise Koopman (denise.koopman@usace.army.mil); Doug Mutter (douglas_mutter@ios.doi.gov); Doug Ott (dott@aidea.org); Eric Rothwell (eric.rothwell@noaa.gov); Ginny Litchfield (ginny.litchfield@alaska.gov); Jan Konigsberg (jan@hydroreform.org); Jason Mouw (jason.mouw@alaska.gov); Jeffry Anderson (Jeffry_Anderson@fws.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Mike Cooney (mcooney@arctic.net); Monte Miller (monte.miller@alaska.gov); Pamela Russell (pamela.russell@alaska.gov); Patricia Berkahn (patricia.berkhahn@alaska.gov); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: Grant Lake Project Work Groups

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

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Cory

Cory Warnock

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Ferndale, Wa. 98248

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C – 360-739-0187

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Checked by AVG - www.avg.com

Version: 2014.0.4117 / Virus Database: 3604/6691 - Release Date: 09/22/13

Begin forwarded message:

From: Dwayne Adams <dadams@uskh.com>
Date: September 23, 2013 at 6:02:42 PM PDT
To: "Eavis, John -FS" (jeavis@fs.fed.us)" <jeavis@fs.fed.us>
Cc: Cory Warnock <cory.warnock@mcmillen-llc.net>
Subject: RE: INHT Meeting

Hi John,

I understand you are out this week but would like to talk when you are back on Thursday about a date for an interagency meeting on a possible re-route of the Iditarod Trail Easement in the vicinity of Grant Lake. I left a message on your phone as well. Feel free to call if that would work better.

Thanks

From: Dwayne Adams
Sent: Tuesday, September 10, 2013 10:23 AM
To: 'Eavis, John -FS'
Subject: RE: INHT Meeting

John,

Would something the 3rd or 4th of October work for a meeting?

Dwayne

Dwayne Adams, FASLA
Principal
Landscape Architecture and Community Planning

USKH Inc.

Celebrating

40 years

2515 A Street
Anchorage, AK 99503
main: 907.276.4245
direct: 907.343.5248
cell: 907.441.4948
www.uskh.com
[Facebook](#) | [Twitter](#) | [LinkedIn](#)
paper = trees

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Sent: Monday, September 23, 2013 3:57 PM
To: Audrey Alstrom (aalstrom@aidea.org); Barbara Stanley (bstanley@fs.fed.us); Brent Goodrum (brent.goodrum@alaska.gov); David Schade (david.w.schade@alaska.gov); Doug Ott (dott@aidea.org); Ginny Litchfield (ginny.litchfield@alaska.gov); Joe Klein (joe.klein@alaska.gov); Judith Bittner (judy.bittner@alaska.gov); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Kim Sager (kimberly.sager@alaska.gov); Lesli Schick (lesli.schick@alaska.gov); Lynnda Kahn (Lynnda_Kahn@fws.gov); Michael Walton (michael.walton@alaska.gov); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Robin Swinford (robin.swinford@alaska.gov); Shina Duvall (shina.duvall@alaska.gov); Sue Walker (susan.walker@noaa.gov)
Cc: Mike Salzetti; Emily Andersen
Subject: RE: Grant Lake Project Work Groups

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Version: 2014.0.4117 / Virus Database: 3604/6691 - Release Date: 09/22/13

From: Cory Warnock
Sent: Wednesday, September 25, 2013 8:23 PM
To: Klein, Joseph P (DFG)
Cc: Miller, Monte D (DFG)
Subject: RE: Grant Lake Project Work Groups

Thanks, Joe. I'll keep you notified.

Cory

From: Klein, Joseph P (DFG) [mailto:joe.klein@alaska.gov]
Sent: Wednesday, September 25, 2013 4:40 PM
To: Cory Warnock
Cc: Miller, Monte D (DFG)
Subject: RE: Grant Lake Project Work Groups

Cory- Although I will likely not be an active participant, I would like to remain on the AWG listserve. Thanks, Joe

Joe Klein, P.E.
Aquatic Resources Unit Supervisor
Alaska Department of Fish and Game
333 Raspberry Rd
Anchorage, AK 99518
(907) 267-2148

From: Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]
Sent: Monday, September 23, 2013 2:57 PM
To: Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Goodrum, Brent W (DNR); Schade, David W (DNR); Ott, Douglas C (AIDEA); Litchfield, Virginia P (DFG); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov)
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-----Original Message-----

From: Cory Warnock
Sent: Wednesday, September 25, 2013 1:28 PM
To: 'McCafferty, Katherine A POA'
Subject: RE: Grant Lake Project Work Groups (UNCLASSIFIED)

Thanks for the response Katie.

Cory

-----Original Message-----

From: McCafferty, Katherine A POA [mailto:Katherine.A.McCafferty2@usace.army.mil]
Sent: Wednesday, September 25, 2013 1:25 PM
To: Cory Warnock
Subject: RE: Grant Lake Project Work Groups (UNCLASSIFIED)

Classification: UNCLASSIFIED

Caveats: NONE

Cory,
I believe that I will need to be in both working groups.

Katie McCafferty
Project Manager
Regulatory Division, Kenai Field Office
U.S. Army Corps of Engineers
phone: 907-283-3562
fax: 907-283-3981

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Cc: Mike Salzetti; Emily Andersen
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I wanted to let you all know about a process change that we will be implementing in the interest of increased efficiency and collaboration. As I eluded to during the site visit, HEA will be developing a separate "Aquatics Work Group" (AWG). This group will responsible for discussing all matters associated with aquatics issues (fisheries, aquatic habitat, aquatic nutrients, instream flow, etc.) related to the Grant Lake Project. Given the number of studies and level of interest in this specific discipline, having a separate work group to discuss this area, makes sense from an efficiency standpoint. As such, the AWG meeting related to the upcoming 2013 study reports/data review will be held separate from the other natural resource areas (Water Resources, Terrestrial, Recreation/Visual), which will have their meeting in a grouped fashion. For the purposes of consistency, we will begin calling this other group the "Natural Resource Work Group" (NRWG). These two meetings will be staggered by approximately one month (NRWG first) and both will take place in the first two months of next year. One note.....I definitely see the potential need for our Water Resources lead to participate in some of the AWG proceedings. Our lead has been prepped and will be present at both sets of meetings if the need is there. I suspect it will be given the relationship between hydrology and fish presence/habitat quality.

The only thing that I'd ask of all of you at this point is to please write back and indicate which group you'd like to be a member of. I fully appreciate and understand that some of you are responsible for multiple natural resource areas for your agencies and may want to be a part of both groups and that is fine. That said, some of you do not have a vested responsibility in some areas and as such, the goal of the separate AWG is to create a more focused group of aquatic representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of.

To give you a tentative idea of our planned report distribution and meeting schedule, we are working toward the following:

- * Draft 2013 Water Resources, Terrestrial and Rec/Vis Reports to Stakeholders - mid to late December (2013)
- * Water Resources, Terrestrial and Rec/Vis Study Results Meeting - mid January (2014)
- * Draft 2013 Fisheries, IFIM and Aquatic Nutrients Reports to Stakeholders - mid to late January (2014)
- * Fisheries, IFIM and Aquatic Nutrients Study Results Meeting - mid February (2014)

* Cultural Resources will follow the standard path for these types of projects.

Obviously, additional detail will follow as we get closer, groups get established and schedules get refined. In the interim, please don't hesitate to shoot me an email or give me a call with any questions/concerns. Please get back to me related to the work group(s) you'd like to be a part of. Again, thank you for your attendance at the site visit and I look forward to continuing to establish a collaborative process going forward,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com <<http://www.mcmillen-llc.com/>>

From: Cory Warnock
Sent: Friday, September 27, 2013 1:54 PM
To: Russell, Pamela J (DNR); pberkhahn@borough.kenia.ak.us
Subject: RE: Grant Lake Project Work Groups
Attachments: 20130924_095801.jpg

Hi Pam and Patti,

My apologies for not getting you this picture earlier; crazy week!! Here is a photo of the containment we have in place for our generators.

Let me know if you have any questions,

Cory

From: Russell, Pamela J (DNR) [mailto:pamela.russell@alaska.gov]
Sent: Tuesday, September 17, 2013 10:02 AM
To: Cory Warnock; pberkhahn@borough.kenia.ak.us
Subject: RE: Grant Lake Project Work Groups

Hi Cory,

Thanks for the pictures. I just needed a little more clarification. Does that mean that all fuel containers and generators are in containers?

Pamela Russell
Div. of Parks and Outdoor Recreation
Natural Resource Specialist III
514 Donald E Gilman River Center
Soldotna, AK 99669
907-714-2471

From: Cory Warnock [cory.warnock@mcmillen-llc.net]
Sent: Tuesday, September 17, 2013 8:05 AM
To: Miller, Monte D (DFG); Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Russell, Pamela J (DNR); Berkahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)
Cc: Mike Salzetti; Emily Andersen
Subject: RE: Grant Lake Project Work Groups

All,

Just a couple photos to document that the fuel containment issue that was brought up during the site visit is being taken care of at all sites.

Thanks,

Cory

From: Cory Warnock

Sent: Monday, September 09, 2013 1:04 PM

To: 'Miller, Monte D (DFG)'; Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: RE: Grant Lake Project Work Groups

Hi Monte,

Glad you found the site visit beneficial. Mike and I have already been in touch with the appropriate folks (internally and externally) and the fuel containment issue along with two issues pointed out by Patti Berkhahn are already in the process of being remedied.

Cory

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]

Sent: Monday, September 09, 2013 12:04 PM

To: Cory Warnock; Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: RE: Grant Lake Project Work Groups

Cory,

Please include me in both groups.

I appreciated the opportunity to attend the site visit. It appears that the efforts on site to maintain the ability to collect data have been successful. This has occurred under challenging conditions and I hope that the effort will

continue long enough to collect some coho data as well. The closer to cold weather, the more challenging it will become to stay at the site and collect data. It will be very interesting to review the data collected.

Others have probably mentioned concern regarding generator and fuel storage containment. There are probably some permit compliance issues there as well. Our concerns are with possible fuel spills into the watershed. Please comply with standard fuel containment practices. Someone stated that containment equipment was on site but had not been placed in use. If so, this is an easy correction. Thanks.

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS
333 Raspberry Road
Anchorage, Alaska, 99518-1565
(907) 267-2312

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]

Sent: Monday, September 09, 2013 10:31 AM

To: Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Miller, Monte D (DFG); Russell, Pamela J (DNR); Berkhahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

Cc: Mike Salzetti; Emily Andersen

Subject: Grant Lake Project Work Groups

Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group:

Hi all,

I wanted to start by saying thank you to those who attended the Grant Creek site visit and I hope that you all found it beneficial. I thought it was a great turn-out and was very pleased that the weather decided to cooperate! As I mentioned, if anyone has any follow-up questions, please don't hesitate to let me know.

I wanted to let you all know about a process change that we will be implementing in the interest of increased efficiency and collaboration. As I eluded to during the site visit, HEA will be developing a separate "Aquatics Work Group" (AWG). This group will responsible for discussing all matters associated with aquatics issues (fisheries, aquatic habitat, aquatic nutrients, instream flow, etc.) related to the Grant Lake Project. Given the number of studies and level of interest in this specific discipline, having a separate work group to discuss this area, makes sense from an efficiency standpoint. As such, the AWG meeting related to the upcoming 2013 study reports/data review will be held separate from the other natural resource areas (Water Resources, Terrestrial, Recreation/Visual), which will have their meeting in a grouped fashion. For the purposes of consistency, we will begin calling this other group the "Natural Resource Work Group" (NRWG). These two meetings will be staggered by approximately one month (NRWG first) and both will take place in the first two months of next year. One note.....I definitely see the potential need for our Water Resources lead to participate in some of the AWG proceedings. Our lead has been prepped and will be present at both sets of meetings if the need is there. I suspect it will be given the relationship between hydrology and fish presence/habitat quality.

The only thing that I'd ask of all of you at this point is to please write back and indicate which group you'd like to be a member of. I fully appreciate and understand that some of you are responsible for multiple natural resource areas for your agencies and may want to be a part of both groups and that is fine. That said, some of you do not have a vested responsibility in some areas and as such, the goal of the separate AWG is to create a more focused group of aquatic representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of.

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* Cultural Resources will follow the standard path for these types of projects.

Obviously, additional detail will follow as we get closer, groups get established and schedules get refined. In the interim, please don't hesitate to shoot me an email or give me a call with any questions/concerns. Please get back to me related to the work group(s) you'd like to be a part of. Again, thank you for your attendance at the site visit and I look forward to continuing to establish a collaborative process going forward,

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

McMillen, LLC
www.mcmillen-llc.com
5771 Applegrove Ln.
Ferndale, Wa. 98248
O – 360-384-2662
C – 360-739-0187
F – 360-542-2264



From: Cory Warnock
Sent: Monday, September 30, 2013 11:41 AM
To: Ayers, Scott D (DFG)
Cc: Mike Salzetti; John Stevenson; Begich, Robert N (DFG); Pawluk, Jason A (DFG); Lewis, Bert A (DFG); Oxman, Dion S (DFG); Litchfield, Virginia P (DFG); Daigneault, Michael J (DFG); Miller, Monte D (DFG)
Subject: RE: AMENDMENT 5: Fish Resource Permit SF2013-105 (Salzetti/Homer Electric-grant creek/trail lake narrows-local species)

Scott,

Thank you for the quick response. I really appreciate it.

Cory

From: Ayers, Scott D (DFG) [<mailto:scott.ayers@alaska.gov>]
Sent: Monday, September 30, 2013 11:38 AM
To: Cory Warnock
Cc: Mike Salzetti; John Stevenson; Begich, Robert N (DFG); Pawluk, Jason A (DFG); Lewis, Bert A (DFG); Oxman, Dion S (DFG); Litchfield, Virginia P (DFG); Daigneault, Michael J (DFG); Miller, Monte D (DFG)
Subject: AMENDMENT 5: Fish Resource Permit SF2013-105 (Salzetti/Homer Electric-grant creek/trail lake narrows-local species)

Hi Cory,

Please see the attached Amendment 5 to the Fish Resource Permit SF2013-105, which increases the number of coho salmon that may be tagged with esophageal radio-tags. All other conditions specified in the original permit and prior amendments remain in effect. A copy of this amendment must be signed and attached to a signed copy of the original permit at all collection, handling, and tagging locations. A paper copy of this amendment will only be mailed upon request.

Best wishes,
-Scott

Scott D Ayers
Fish Resource Permit Program Coordinator
Alaska Department of Fish and Game
Division of Sport Fish
333 Raspberry Road
Anchorage, AK 99518
(907) 267-2517 – phone (907) 267-2464 – fax
scott.ayers@alaska.gov

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, September 30, 2013 8:55 AM

To: Ayers, Scott D (DFG)
Cc: Mike Salzetti; John Stevenson
Subject: Permit#SF2013-105 (Grant Creek)

Hi Scott,

I'm writing to request an amendment to our existing Fish Resource Permit for Grant Creek. Given the low number of Chinook we saw this year in Grant Creek, we have a number of supplemental tags in our possession. As such and given the fact that we are seeing more coho than we anticipated, we'd like to amend the permit to allow for the tagging of additional coho (if possible). We have seen enough already that we have no reason to believe we couldn't tag an additional 30 if that was permissible so that is what I'll request.

Let me know if this will work for you and if so, I'd really appreciate an amendment. Thanks, Scott and as always, if you have any questions/concerns, let me know.

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

McMillen, LLC
www.mcmillen-llc.com
5771 Applegrove Ln.
Ferndale, Wa. 98248
O – 360-384-2662
C – 360-739-0187
F – 360-542-2264

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STATE OF ALASKA
DEPARTMENT OF FISH AND GAME-SPORT FISH
P.O. BOX 115525
JUNEAU, ALASKA 99811-5525

FISH RESOURCE PERMIT AMENDMENT #5

Permit No. SF2013-105

Permit Issued To: **Mike Salzetti** (signature required below for permit validation)

This amendment of Fish Resource Permit SF2013-105:

- 1) under **Final Disposition:** *increases the allowable number of coho salmon for radio-tagging:*

From: **≤20 coho salmon adults**

To: **≤50 coho salmon adults**

All other conditions specified in Fish Resource Permit SF2013-105 remain in effect.

This amendment must be attached to the original permit.



Division of Sport Fish

9-30-2013
Date

PERMIT AMENDMENT VALIDATION requires permittee's signature agreeing to abide by conditions of this permit amendment:



Signature of Permittee 9/30/2013

cc: Robert Begich, Division of Sport Fish, Soldotna
Jason Pawluk, Division of Sport Fish, Soldotna
Bert Lewis, Division of Commercial Fisheries, Anchorage
Dion Oxman, M-T-A Lab, Juneau
Ginny Litchfield, Division of Habitat, Soldotna
Mike Daigneault, Division of Habitat, Anchorage
Fish and Wildlife Protection, Soldotna

From: Cory Warnock
Sent: Monday, October 07, 2013 10:47 AM
To: Patricia Berkhahn (patricia.berkhahn@alaska.gov); Litchfield, Ginny (VLitchfield@borough.kenai.ak.us)
Cc: John Stevenson
Subject: FW: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Hi Patti,

Just wanted to let you know that I just spoke to John Stevenson on site and he is hoping that he can get the box trap in soon as flows are continuing to drop as are capture rates for juveniles. Again, not sure if we even need an amendment but if you could review and let us know, it would be appreciated. I'm sure this isn't the only thing on your plate but to the extent you could expedite the process, it would be much appreciated.

Thanks!

Cory

From: Cory Warnock
Sent: Monday, October 07, 2013 9:41 AM
To: 'Litchfield, Ginny'
Subject: RE: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Me too!! ☺

Thanks.

From: Litchfield, Ginny [<mailto:VLitchfield@borough.kenai.ak.us>]
Sent: Monday, October 07, 2013 9:40 AM
To: Cory Warnock
Subject: RE: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

I just forwarded your request to Patti to work on.

Ginny Litchfield

*(907) 714-2477
Kenai Peninsula Area Manager
ADF&G - Division of Habitat
(State agency housed in Kenai Peninsula Borough Building)*

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, October 07, 2013 8:38 AM
To: Ayers, Scott D (DFG)
Cc: Litchfield, Ginny
Subject: RE: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Thanks, Scott. That's what I needed. Patti is working on the Grant Lake project as well. Just wasn't exactly sure of the hierarchy and associated responsibilities.

Thanks!

From: Ayers, Scott D (DFG) [<mailto:scott.ayers@alaska.gov>]
Sent: Monday, October 07, 2013 9:37 AM
To: Cory Warnock
Cc: Litchfield, Virginia P (DFG)
Subject: RE: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Hi Cory,

You can also try Patti Berkhahn, who works under Ginny in the Soldotna office. Her contact information is as follows:

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476
patricia.berkhahn@alaska.gov
(State agency housed in Kenai Peninsula Borough Building)

Cheers,
-Scott

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, October 07, 2013 8:20 AM
To: Ayers, Scott D (DFG)
Subject: FW: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Hi Scott,

I sent this to Ginny last week and haven't heard anything in response. I realize that this particular permit might be out of your area but I'm wondering if you could provide any insight on alternate contacts.

Thanks,

Cory

From: Cory Warnock
Sent: Wednesday, October 02, 2013 7:36 PM
To: 'Ginny Litchfield (ginny.litchfield@alaska.gov)'
Cc: Mike Salzetti; John Stevenson
Subject: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Hi Ginny,

As you know, we are progressing through our field season on Grant Lake/Creek. Our fisheries team has secured a box trap that they feel may efficiently capture juvenile salmonids on certain sections of Grant Creek during the lower flow

period we are starting to experience. As such and given that our current permit (attached) only specifies the use of incline plan and rotary screw traps, I'm writing to check with you to see if an amendment is needed to utilize a box trap and if so, I'd like to request that amendment. Again, it may not be necessary but in that case, we'd obviously want confirmation and your verbal approval prior to proceeding. If in fact it is necessary and you need any additional information to process the amendment, please let me know what that would be and I'll get it to you right away.

Thanks Ginny and I'll look forward to hearing from you,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

5771 Applegrove Ln.

Ferndale, Wa. 98248

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C – 360-739-0187

F – 360-542-2264

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Version: 2014.0.4142 / Virus Database: 3604/6726 - Release Date: 10/05/13

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From: Cory Warnock
Sent: Monday, October 07, 2013 10:50 AM
To: Berkhahn, Patti
Cc: Litchfield, Ginny; John Stevenson; Emily Andersen
Subject: RE: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Thank you very much, Patti.

From: Berkhahn, Patti [<mailto:PBerkhahn@borough.kenai.ak.us>]
Sent: Monday, October 07, 2013 10:49 AM
To: Cory Warnock
Cc: Litchfield, Ginny; Berkhahn, Patti
Subject: RE: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Cory,

This email serves as your authorization to utilize a box trap instead of an incline plane or rotary screw trap for your research on Grant Creek. Please keep this email with your permit on location. A copy will be saved to your file at the River Center.

Patti Berkhahn
Habitat Biologist III
ADFG, Habitat Division
River Center
514 Funny River Road
Soldotna, AK 99669
907 714-2476
patricia.berkhahn@alaska.gov

(State agency housed in Kenai Peninsula Borough Building)

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, October 07, 2013 8:40 AM
To: Berkhahn, Patti
Subject: FW: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Hi Patti,

I tried last week to get in touch with Ginny (see below) regarding a potential amendment to our fish habitat permit. Given that I haven't heard back from her, I'm wondering if you could provide some input.

Thanks,

Cory

From: Cory Warnock
Sent: Wednesday, October 02, 2013 7:36 PM
To: 'Ginny Litchfield' (ginny.litchfield@alaska.gov)'

Cc: Mike Salzetti; John Stevenson

Subject: Fish Habitat Permit (Grant Lake) (FH 13-V-0012)

Hi Ginny,

As you know, we are progressing through our field season on Grant Lake/Creek. Our fisheries team has secured a box trap that they feel may efficiently capture juvenile salmonids on certain sections of Grant Creek during the lower flow period we are starting to experience. As such and given that our current permit (attached) only specifies the use of incline plan and rotary screw traps, I'm writing to check with you to see if an amendment is needed to utilize a box trap and if so, I'd like to request that amendment. Again, it may not be necessary but in that case, we'd obviously want confirmation and your verbal approval prior to proceeding. If in fact it is necessary and you need any additional information to process the amendment, please let me know what that would be and I'll get it to you right away.

Thanks Ginny and I'll look forward to hearing from you,

Cory

Cory Warnock

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Checked by AVG - www.avg.com

Version: 2013.0.3408 / Virus Database: 3222/6729 - Release Date: 10/07/13

From: Dwayne Adams
Sent: Monday, October 21, 2013 2:28 PM
To: Eavis, John -FS (jeavis@fs.fed.us)
Subject: INHT-Moose Pass

John,

I'd like to go about trying to schedule the discussion of the INHT easement re-alignment in the vicinity of Moose Pass. I suggest the first week in November as a possible window. Would that work for you?

Thanks

Dwayne Adams, FASLA
Principal
Landscape Architecture and Community Planning

USKH Inc.
Celebrating
40 years

2515 A Street
Anchorage, AK 99503
main: 907.276.4245
direct: 907.343.5248
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[Facebook](#) | [Twitter](#) | [LinkedIn](#)
paper = trees

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From: Eric Rothwell - NOAA Federal [mailto:eric.rothwell@noaa.gov]
Sent: Wednesday, October 23, 2013 10:48 AM
To: Cory Warnock
Subject: Re: Grant Creek aerial or project map?

Hi Cory,

Thanks that figure is great. Although it will probably be cut out of my write up (too much detail - nobody really reads these things they just want pretty pictures :)

The week of 1/13 looks mostly open, I have a place holder for Susitna ISR meetings 2/19-21. I believe the ISRs come out 2/3.

I watched part of the Iowa game - was rooting for them and they were hanging in there for a while. We lost our senior quarterback in his first play and looked pretty bad - but had a good second half.

Thanks again for the info and figure.
cheers.
Eric

On Wed, Oct 23, 2013 at 8:51 AM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Hi Eric,

I'm attaching an aerial image that you may or may not have seen before displaying Grant Creek/Lake as well as the Project infrastructure as it is currently proposed. It states this on the image (and I know you know this), but please keep in mind that the infrastructure documented on the aerial is preliminary and dependent both on the results of our natural resource and engineering feasibility work and our discussions with you and the other stakeholders. All that said, please let me know if this type of image is what you need. If not, we have a variety of other images/maps that may suit your needs better.

As for scheduling of meetings.....We have begun the process of internal review on our draft study reports and have a coordinated (albeit somewhat flexible) schedule for having both the Natural Resources Work Group (Water Resources, Terrestrial and Rec/Vis) and the Aquatics Work Group (Aquatics/Instream Flow) meetings. As it stands now, we have our internal schedule showing a NRWG meeting during the week of January 13th and the AWG meeting during the week of February 17th. Given our current progress, I'm pretty confident that we will be able to complete all drafts and get them

to you for a solid review period in advance of those dates. That said, I'm a little hesitant to send out invites to the entire group until we get a little further down the road. In the interest of you getting something on a calendar however, I'm more than happy to share those dates as I understand there are likely whole lot of "Susitna" days currently on your slate! In fact, I can use you as a bit of a yardstick to determine whether the weeks I mention above have potential to work out for our meetings. If you could let me know, that would be great.

Let me know if you need anything else and hopefully you can put work aside to watch Boise St. and BYU on Friday. Gotta love it when your team gets on national TV!! I was fortunate enough to watch mine get dismantled by Ohio St. last weekend. 😊

Talk to you soon,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

5771 Applegrove Ln.

Ferndale, Wa. 98248

O – [360-384-2662](tel:360-384-2662)

C – [360-739-0187](tel:360-739-0187)

F – [360-542-2264](tel:360-542-2264)

From: Eric Rothwell - NOAA Federal [mailto:eric.rothwell@noaa.gov]

Sent: Tuesday, October 22, 2013 5:33 PM

To: Cory Warnock

Subject: Grant Creek aerial or project map?

Hi Cory,

I'm putting together a short summary of some projects to represent what Sue and I work on (hydro) - between the recent field trip and past work I have plenty of the Grant Creek but could use a project figure or aerial photo. Would be for an internal doc and would recognize/reference where the figure came from - if there is one available.

hope all is well - I'm sure you know Susitna is scheduling meeting into the spring now :) so if you are starting to throw around dates for Grant Creek let me know and I'll put place holders on my calendar.

cheers.

--

Eric Rothwell

Hydrologist

NOAA Fisheries

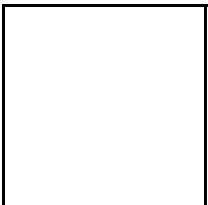
U.S. Department of Commerce

eric.rothwell@noaa.gov

[907.271.1937](tel:907.271.1937)

www.nmfs.noaa.gov

www.alaskafisheries.noaa.gov



No virus found in this message.

Checked by AVG - www.avg.com

Version: 2014.0.4158 / Virus Database: 3614/6768 - Release Date: 10/21/13

From: Dwayne Adams <dadams@uskh.com>
Sent: Wednesday, October 23, 2013 2:48 PM
To: Eavis, John -FS; Mike Anderson (andengr@gci.net)
Subject: RE: INHT-Moose Pass

Thanks much John. Let me know. We can always do it here but it would be good to make it convenient for the most people.

-----Original Message-----

From: Eavis, John -FS [<mailto:jeavis@fs.fed.us>]
Sent: Wednesday, October 23, 2013 1:45 PM
To: Dwayne Adams
Subject: RE: INHT-Moose Pass

That is a good list. I'll check with Glacier. If not we can do it here at Moose Pass since it looks like three of the parties will be coming from this side of the peninsula.

John

-----Original Message-----

From: Dwayne Adams [<mailto:dadams@uskh.com>]
Sent: Wednesday, October 23, 2013 1:41 PM
To: Eavis, John -FS
Subject: RE: INHT-Moose Pass

State of Alaska Parks (KRSMA), Lesli Schick, Judith Bittner, and the Borough. Are there others you'd recommend?

-----Original Message-----

From: Eavis, John -FS [<mailto:jeavis@fs.fed.us>]
Sent: Wednesday, October 23, 2013 1:38 PM
To: Dwayne Adams
Subject: RE: INHT-Moose Pass

That date/time sounds good. Who else will you be involving?

John

-----Original Message-----

From: Dwayne Adams [<mailto:dadams@uskh.com>]
Sent: Wednesday, October 23, 2013 8:34 AM
To: Eavis, John -FS
Subject: RE: INHT-Moose Pass

How about afternoon of Wednesday the 13th, say 1-3pm? Can we schedule it for the USFS Glacier District headquarters building in Girdwood? Can you coordinate that or should I deal with them directly?

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail/One-on-One Meeting Log

Contact Name: Pam Russell

Agency/Organization: Alaska State DNR (KRSMA)

Phone No./E-mail Address: 907 714 2471

Date: October 24, 2013

Time: 10:20am

Grant Lake Licensing Team Contact: Dwayne Adams

Summary of Conversation and/or E-mail Exchange:

Pam said that she could attend the upcoming November meeting on INHT.

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail/One-on-One Meeting Log

Contact Name: Pam Russell

Agency/Organization: Alaska DNR (KRSMA)

Phone No./E-mail Address: 907 714 2471

Date: August 12, 2013

Time: 1:11pm

Grant Lake Licensing Team Contact: Dwayne Adams

Summary of Conversation and/or E-mail Exchange:

I left a message for Pam to call me.

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail/One-on-One Meeting Log

Contact Name: Pam Russell

Agency/Organization: Alaska DNR (KRSMA)

Phone No./E-mail Address: 907 714 2471

Date: August 16, 2013

Time: 12:54pm

Grant Lake Licensing Team Contact: Dwayne Adams

Summary of Conversation and/or E-mail Exchange:

I left a message for Pam to call me. She had a voice mail that said she'd be back on the 27th.

From: Dwayne Adams <dadams@uskh.com>
Sent: Monday, October 28, 2013 4:47 PM
To: lesli.schick@alaska.gov; pamela.russell@alaska.gov; judy.bittner@alaska.gov; Duvall, Shina A (DNR) (shina.duvall@alaska.gov); gwilliams@borough.kenai.ak.us; Eavis, John - FS (jeavis@fs.fed.us); Mike Salzetti (msalzetti@HomerElectric.com); Cory Warnock; Emily Andersen
Subject: RE: INHT-Moose Pass

The INHT meeting will be held at Glacier District Headquarters in Girdwood. Thanks John for coordinating that.

Dwayne Adams

-----Original Appointment-----

From: Dwayne Adams
Sent: Friday, October 25, 2013 2:23 PM
To: Dwayne Adams; lesli.schick@alaska.gov; pamela.russell@alaska.gov; jbittner@aedcweb.com; Duvall, Shina A (DNR) (shina.duvall@alaska.gov); gwilliams@borough.kenai.ak.us; Eavis, John -FS (jeavis@fs.fed.us); Mike Salzetti (msalzetti@HomerElectric.com); Cory Warnock (cory.warnock@mcmillen-llc.net); Emily Andersen (emily.andersen@mcmillen-llc.net)
Subject: INHT-Moose Pass
When: Wednesday, November 13, 2013 1:00 PM-3:00 PM (UTC-09:00) Alaska.
Where: TBD

Thanks for agreeing to meet with Kenai Hydro LLC (KLH)/USKH to discuss the INHT near Moose Pass and agreeing to discuss a possible relocation of the trail and easement in light of a proposed KHL hydroelectric facility. I know many of you are somewhat familiar with the proposed project.

I will send out some documents next week to provide some background for the project and the proposed relocation.

John Eavis is looking at a location either at USFS Chugach NFS Glacier District headquarters in Girdwood or possibly the Kenai Lake Work Center near Moose Pass. I'll let you know how that sorts out.

Again, thanks

Dwayne Adams
USKH

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From: Amal Ajmi <amal.ajmi@erm.com>
Sent: Friday, November 01, 2013 10:36 AM
To: Emily Andersen
Cc: Jeannette Blank
Subject: FW: Winter moose flights
Attachments: sf-299.rtf

Morning Emily, I would like to submit this email conversation as part of the conversation Jeanette sent yesterday. Thanks.

Amal Ajmi
Senior Wildlife Scientist

ERM Alaska, Inc.
748 Gaffney Rd., Suite 102
Fairbanks, AK 99701

907-458-8273 (Direct)

amal.ajmi@erm.com
www.erm.com

From: Van Massenhove, Katherine B -FS [mailto:kvanmassenhove@fs.fed.us]
Sent: Friday, November 01, 2013 9:29 AM
To: Amal Ajmi
Cc: Jeannette Blank; Mike Salzetti (msalzetti@HomerElectric.com)
Subject: RE: Winter moose flights

Hi Amal,

At this point there is not a permit for ERM Alaska, Inc. or Kenai Hydro, LLC. to conduct field work next summer 2014. This type of use on National Forest System (NFS) lands requires a special use permit. An application will need to be submitted by ERM Alaska, LLC for a special use permit, or Kenai Hydro, LLC will need to submit a permit renewal request. Attached is the appropriate form for submitting a proposal. I highly suggest that you coordinate with Kenai Hydro on their plans for meeting the permitting requirements, or it may impact your abilities to conduct your studies next summer. Keep in mind, there are fees for processing the permit dependent on the scope of your request, as well as land use fees for use of NFS lands.

Thanks,

Kathy Van Massenhove
Special Uses Team Leader
Chugach National Forest
(907) 743-9542
kvanmassenhove@fs.fed.us

From: Amal Ajmi [<mailto:amal.ajmi@erm.com>]
Sent: Thursday, October 31, 2013 9:07 AM
To: Van Massenhove, Katherine B -FS
Cc: Jeannette Blank
Subject: RE: Winter moose flights

Hello Kathy, ERM Alaska, Inc has been contracted to do this work for Kenai Hydro, LLC. We will also be conducting field work next summer 2014.
Thank you for your attention.

Amal Ajmi
Senior Wildlife Scientist

ERM Alaska, Inc.
748 Gaffney Rd., Suite 102
Fairbanks, AK 99701

907-458-8273 (Direct)

amal.ajmi@erm.com
www.erm.com

From: Van Massenhove, Katherine B -FS [<mailto:kvanmassenhove@fs.fed.us>]
Sent: Thursday, October 31, 2013 8:59 AM
To: Amal Ajmi
Cc: Mike Salzetti (msalzetti@HomerElectric.com)
Subject: RE: Winter moose flights

Amal,

The permit is issued to Kenai Hydro, LLC. I'm not sure the relationship between Kenai Hydro, LLC and ERM Alaska, Inc., however I need to be clear that you do not have authorization to be conducting surveys under this permit, therefore you cannot request for the ability to work under this authorization. It's possible that you could be hired by Kenai Hydro, LLC to conduct surveys under their permit, however I need to have my communications regarding use of the permit and requests to renew the permit with the permit holder. At this point, Kenai Hydro, LLC permit expires on 12/31/2013. Therefore, there will be no authorization in place to allow for the studies beyond that, unless Kenai Hydro were to request to have their permit renewed. I am cc'ing Mike Salzetti to this email, he has been the permit contact in the past. Mike will need to submit a request asking to have the permit renewed, with a detail description of the proposed use for the new term. This can be submitted via an email.

Thanks,
Kathy Van Massenhove
Special Uses Team Leader
Chugach National Forest
(907) 743-9542
kvanmassenhove@fs.fed.us

From: Paquet, Teresa -FS
Sent: Wednesday, October 30, 2013 3:12 PM

To: Van Massenhove, Katherine B -FS
Cc: Paquet, Teresa -FS
Subject: FW: Winter moose flights

Kathy, Looks like they want to extend the expiration date on SEW457. See Amal's second paragraph.

From: Amal Ajmi [<mailto:amal.ajmi@erm.com>]
Sent: Wednesday, October 30, 2013 1:35 PM
To: Benoit, Mary A -FS
Cc: Paquet, Teresa -FS
Subject: RE: Winter moose flights

Hi Mary, thanks much for the clarification. We are not planning to land on USFS lands (barring any aircraft emergency issue). So that is great, we will not need a permit for that. The moose surveys will only be conducted over "delineated" moose habitat that will not include sheep or goat habitat. However, I am aware that goats will sometimes utilize forested habitat in the winter, in which case I will make a concerted effort to keep an eye out for them and comply with regs if we spot them in non-delineated areas. It is hard to tell from the image, so just want to clarify, the no-fly zones are the darker shades yes? The legend is more pinkish.

Also, I have this permit (see attached) may I continue to use it for the winter waterbird surveys in Nov/Dec 2013 and Feb/Mar 2014? We will be snow machining to and from the road to the outlet of Grant Lake (Grant Creek) to conduct 2 winter waterbird surveys at the "open water" area.
Thank you very much for your clarification and guidance.
Regards,

Amal Ajmi
Senior Wildlife Scientist

ERM Alaska, Inc.
748 Gaffney Rd., Suite 102
Fairbanks, AK 99701

907-458-8273 (Direct)

amal.ajmi@erm.com
www.erm.com

From: Benoit, Mary A -FS [<mailto:mbenoit@fs.fed.us>]
Sent: Wednesday, October 30, 2013 1:18 PM
To: Amal Ajmi
Cc: Paquet, Teresa -FS
Subject: RE: Winter moose flights

Hi Amal, if you think you will be landing on Forest Service lands, you will need to get a special use permit from us. You may contact Teresa Paquet, who I cc'd on this message for that.

We do have similar requirements for fixed wing aircraft as we do for helicopters to minimize impacts to wildlife such as Dall sheep and mountain goats. That area has habitat for both on the mountains surrounding the lake. We have no-fly zones for these areas. It is our belief that these no-fly zones will mitigate most potential impacts to mountain goat and Dall sheep populations within the area. No-fly zones are based on known goat locations from flight surveys and contiguous blocks of potential winter habitat. Each zone places 1500 ft buffers around core concentrations of goats and their habitat during the winter months. Our Chugach Forest Plan requires that helicopters and fixed wing aircraft

maintain a 1500 foot separation distance from observed goats. However when goat habitat is covered with snow it is often difficult for pilots to detect these animals before approaching them at less than 1500 ft. Thus, we feel that no-fly zones established based on this standard offer the best option to mitigate potential disturbance during winter months (November – May). I have attached a map that shows where the no-fly zones are surrounding Grant Lake for your use. If you need to fly over these areas, please stay above 1500'AGL. Thanks☺

Mary Ann Benoit
Wildlife Biologist
Seward Ranger District
Chugach National Forest
mbenoit@fs.fed.us
907-288-7747

334 Fourth Ave
Seward Alaska 99664

From: Amal Ajmi [<mailto:amal.ajmi@erm.com>]
Sent: Tuesday, October 29, 2013 7:25 AM
To: Benoit, Mary A -FS
Cc: Laves, Kevin -FS
Subject: RE: Winter moose flights

Hello Ms. Benoit. I am contacting you with regards to the 2 winter aerial surveys for moose in the Grant Lake area. I have spoken with Jeff Selinger at ADF&G and have a pilot out of Palmer who has flown the Kenai for various ADF&G projects. I have looked through all the documentation I have to find flight level restrictions for fixed wing. All I can find are for rotary aircraft. I will be coordinating the flight efforts with ADF&G to make sure to reduce aerial activity in the area during our survey. I plan on flying the first survey in Nov-Dec, weather and snow conditions depending and the second in Feb-Mar. Please let me know if there are USFS restrictions for fixed wing aircraft and if there are any other issues you would like to discuss.

Basically, I plan on using standard ADF&G protocol for moose surveys in the area.
Thanks for any help. Regards,

Amal Ajmi
Senior Wildlife Scientist

ERM, Alaska Inc.
748 Gaffney Rd., Suite 102
Fairbanks, AK 99701
907-458-8273
amal.ajmi@erm.com
www.erm.com

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Please visit ERM's web site: <http://www.erm.com>

STANDARD FORM 299 (1/2006)
 Prescribed by DOI/USDA/DOT
 P.L. 96-487 and Federal
 Register Notice 5-22-95

**APPLICATION FOR TRANSPORTATION AND
 UTILITY SYSTEMS AND FACILITIES
 ON FEDERAL LANDS**

FORM APPROVED
 OMB NO. 0596-0082

FOR AGENCY USE ONLY

NOTE: Before completing and filing the application, the applicant should completely review this package and schedule a preapplication meeting with representatives of the agency responsible for processing the application. Each agency may have specific and unique requirements to be met in preparing and processing the application. Many times, with the help of the agency representative, the application can be completed at the preapplication meeting.

Application Number

Date Filed

1. Name and address of applicant (*include zip code*)

Name, title, and address of authorized agent if different from item 1 (*include zip code*)

3. Telephone (area code)

Applicant

Authorized Agent

4. As applicant are you? (*check one*)

- a. ☐ Individual
- b. ☐ Corporation*
- c. ☐ Partnership/Association*
- d. ☐ State Government/State Agency
- e. ☐ Local Government
- f. ☐ Federal Agency

5. Specify what application is for: (*check one*)

- a. ☐ New authorization
- b. ☐ Renewing existing authorization No.
- c. ☐ Amend existing authorization No.
- d. ☐ Assign existing authorization No.
- e. ☐ Existing use for which no authorization has been received *
- f. ☐ Other*

* If checked, complete supplemental page

* If checked, provide details under item 7

6. If an individual, or partnership are you a citizen(s) of the United States? ☐ Yes ☐ No

7. Project description (describe in detail): (a) Type of system or facility, (*e.g., canal, pipeline, road*); (b) related structures and facilities; (c) physical specifications (*Length, width, grading, etc.*); (d) term of years needed; (e) time of year of use or operation; (f) Volume or amount of product to be transported; (g) duration and timing of construction; and (h) temporary work areas needed for construction (*Attach additional sheets, if additional space is needed.*)

8. Attach a map covering area and show location of project proposal

9. State or Local government approval: ☐ Attached ☐ Applied for ☐ Not Required

10. Nonreturnable application fee: ☐ Attached ☐ Not required

11. Does project cross international boundary or affect international waterways? ☐ Yes ☐ No (*if "yes," indicate on map*)

12. Give statement of your technical and financial capability to construct, operate, maintain, and terminate system for which authorization is being requested.

13a. Describe other reasonable alternative routes and modes considered.

b. Why were these alternatives not selected?

c. Give explanation as to why it is necessary to cross Federal Lands.

14. List authorizations and pending applications filed for similar projects which may provide information to the authorizing agency. (*Specify number, date, code, or name*)

15. Provide statement of need for project, including the economic feasibility and items such as: (a) cost of proposal (construction, operation, and maintenance); (b) estimated cost of next best alternative; and (c) expected public benefits.

16. Describe probable effects on the population in the area, including the social and economic aspects, and the rural lifestyles.

17. Describe likely environmental effects that the proposed project will have on: (a) air quality; (b) visual impact; (c) surface and ground water quality and quantity; (d) the control or structural change on any stream or other body of water; (e) existing noise levels; and (f) the surface of the land, including vegetation, permafrost, soil, and soil stability.

18. Describe the probable effects that the proposed project will have on (a) populations of fish, plantlife, wildlife, and marine life, including threatened and endangered species; and (b) marine mammals, including hunting, capturing, collecting, or killing these animals.

19. State whether any hazardous material, as defined in this paragraph, will be used, produced, transported or stored on or within the right-of-way or any of the right-of-way facilities, or used in the construction, operation, maintenance or termination of the right-of-way or any of its facilities. "Hazardous material" means any substance, pollutant or contaminant that is listed as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq., and its regulations. The definition of hazardous substances under CERCLA includes any "hazardous waste" as defined in the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, 42 U.S.C. 6901 et seq., and its regulations. The term hazardous materials also includes any nuclear or byproduct material as defined by the Atomic Energy Act of 1954, as amended, 42 U.S.C. 2011 et seq. The term does not include petroleum, including crude oil or any fraction thereof that is not otherwise specifically listed or designated as a hazardous substance under CERCLA Section 101(14), 42 U.S.C. 9601(14), nor does the term include natural gas.

20. Name all the Department(s)/Agency(ies) where this application is being filed.

I HEREBY CERTIFY, That I am of legal age and authorized to do business in the State and that I have personally examined the information contained in the application and believe that the information submitted is correct to the best of my knowledge.

Signature of Applicant

Date

Title 18, U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

GENERAL INFORMATION
ALASKA NATIONAL INTEREST LANDS

This application will be used when applying for a right-of-way, permit, license, lease, or certificate for the use of Federal lands which lie within conservation system units and National Recreation or Conservation Areas as defined in the Alaska National Interest Lands Conservation Act. Conservation system units include the National Park System, National Wildlife Refuge System, National Wild and Scenic Rivers System, National Trails System, National Wilderness Preservation System, and National Forest Monuments.

Transportation and utility systems and facility uses for which the application may be used are:

1. Canals, ditches, flumes, laterals, pipes, pipelines, tunnels, and other systems for the transportation of water.
2. Pipelines and other systems for the transportation of liquids other than water, including oil, natural gas, synthetic liquid and gaseous fuels, and any refined product produced therefrom.
3. Pipelines, slurry and emulsion systems, and conveyor belts for transportation of solid materials.
4. Systems for the transmission and distribution of electric energy.
5. Systems for transmission or reception of radio, television, telephone, telegraph, and other electronic signals, and other means of communications.
6. Improved right-of-way for snow machines, air cushion vehicles, and all-terrain vehicles.
7. Roads, highways, railroads, tunnels, tramways, airports, landing strips, docks, and other systems of general transportation.

This application must be filed simultaneously with each Federal department or agency requiring authorization to establish and operate your proposal.

In Alaska, the following agencies will help the applicant file an application and identify the other agencies the applicant should contact and possibly file with:

Department of Agriculture
Regional Forester, Forest Service (USFS)
Federal Office Building,
P.O. Box 21628
Juneau, Alaska 99802-1628
Telephone: (907) 586-7847 (or a local Forest Service Office)

Department of the Interior
Bureau of Indian Affairs (BIA)
Juneau Area Office
Federal Building Annex
9109 Mendenhall Mall Road, Suite 2
Juneau, Alaska 99802
Telephone: (907) 586-7177

Department of the Interior
Bureau of Land Management
222 West 7th Avenue
P.O. Box 13
Anchorage, Alaska 99513-7599
Telephone: (907) 271-5477 (or a local BLM Office)

U.S. Fish & Wildlife Service (FWS) Office of the Regional Director 1011 East Tudor Road Anchorage, Alaska 99503 Telephone: (907) 786-3440	National Park Service (NPA) Alaska Regional Office, 2225 Gambell St., Rm. 107 Anchorage, Alaska 99502-2892 Telephone: (907) 786-3440
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Note - Filings with any Interior agency may be filed with any office noted above or with the Office of the Secretary of the Interior, Regional Environmental Office, P.O. Box 120, 1675 C Street, Anchorage, Alaska 99513.

Department of Transportation
Federal Aviation Administration
Alaska Region AAL-4, 222 West 7th Ave., Box 14
Anchorage, Alaska 99513-7587
Telephone: (907) 271-5285

NOTE - The Department of Transportation has established the above central filing point for agencies within that Department. Affected agencies are: Federal Aviation Administration (FAA), Coast Guard (USCG), Federal Highway Administration (FHWA), Federal Railroad Administration (FRA).

OTHER THAN ALASKA NATIONAL INTEREST LANDS

Use of this form is not limited to National Interest Conservation Lands of Alaska.

Individual department/agencies may authorize the use of this form by applicants for transportation and utility systems and facilities on other Federal lands outside those areas described above.

For proposals located outside of Alaska, applications will be filed at the local agency office or at a location specified by the responsible Federal agency.

SPECIFIC INSTRUCTIONS

(Items not listed are self-explanatory)

- 7 Attach preliminary site and facility construction plans. The responsible agency will provide instructions whenever specific plans are required.
- 8 Generally, the map must show the section(s), township(s), and range(s) within which the project is to be located. Show the proposed location of the project on the map as accurately as possible. Some agencies require detailed survey maps. The responsible agency will provide additional instructions.
- 9, 10, and 12 The responsible agency will provide additional instructions.
- 13 Providing information on alternate routes and modes in as much detail as possible, discussing why certain routes or modes were rejected and why it is necessary to cross Federal lands will assist the agency(ies) in processing your application and reaching a final decision. Include only reasonable alternate routes and modes as related to current technology and economics.
- 14 The responsible agency will provide instructions.
- 15 Generally, a simple statement of the purpose of the proposal will be sufficient. However, major proposals located in critical or sensitive areas may require a full analysis with additional specific information. The responsible agency will provide additional instructions.
- 16 through 19 Providing this information in as much detail as possible will assist the Federal agency(ies) in processing the application and reaching a decision. When completing these items, you should use a sound judgment in furnishing relevant information. For example, if the project is not near a stream or other body of water, do not address this subject. The responsible agency will provide additional instructions.

Application must be signed by the applicant or applicant's authorized representative.

EFFECT OF NOT PROVIDING INFORMATION: Disclosure of the information is voluntary. If all the information is not provided, the application may be rejected.

DATA COLLECTION STATEMENT

The Federal agencies collect this information from applicants requesting right-of-way, permit, license, lease, or certification for the use of Federal lands. The Federal agencies use this information to evaluate the applicant's proposal. The public is obligated to submit this form if they wish to obtain permission to use Federal lands.

SUPPLEMENTAL

NOTE: The responsible agency(ies) will provide instructions		CHECK APPROPRIATE BLOCK	
I - PRIVATE CORPORATIONS		ATTACHED	FILED*
a. Articles of Incorporation		☐	☐
b. Corporation Bylaws		☐	☐
c. A certification from the State showing the corporation is in good standing and is entitled to operate within the State		☐	☐
c. Copy of resolution authorizing filing		☐	☐
e. The name and address of each shareholder owning 3 percent or more of the shares, together with the number and percentage of any class of voting shares of the entity which such shareholder is authorized to vote and the name and address of each affiliate of the entity together with, in the case of an affiliate controlled by the entity, the number of shares and the percentage of any class of voting stock of that affiliate owned, directly or indirectly, by that entity, and in the case of an affiliate which controls that entity, the number of shares and the percentage of any class of voting stock of that entity owned, directly or indirectly, by the affiliate.		☐	☐
f. If application is for an oil or gas pipeline, describe any related right-of-way or temporary use permit applications, and identify previous applications.		☐	☐
g. If application is for an oil and gas pipeline, identify all Federal lands by agency impacted by proposal.		☐	☐
II - PUBLIC CORPORATIONS			
a. Copy of law forming corporation		☐	☐
b. Proof of organization		☐	☐
c. Copy of Bylaws		☐	☐
d. Copy of resolution authorizing filing		☐	☐
e. If application is for an oil or gas pipeline, provide information required by item "I-f" and "I-g" above.		☐	☐
III - PARTNERSHIP OR OTHER UNINCORPORATED ENTITY			
a. Articles of association, if any		☐	☐
b. If one partner is authorized to sign, resolution authorizing action is		☐	☐
c. Name and address of each participant, partner, association, or other		☐	☐
d. If application is for an oil or gas pipeline, provide information required by item "I-f" and "I-g" above.		☐	☐

* If the required information is already filed with the agency processing this application and is current, check block entitled "Filed." Provide the file identification information (e.g., number, date, code, name). If not on file or current, attach the requested information.

NOTICE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0082.

This information is needed by the Forest Service to evaluate the requests to use National Forest System lands and manage those lands to protect natural resources, administer the use, and ensure public health and safety. This information is required to obtain or retain a benefit. The authority for that requirement is provided by the Organic Act of 1897 and the Federal Land Policy and Management Act of 1976, which authorize the secretary of Agriculture to promulgate rules and regulations for authorizing and managing National Forest System lands. These statutes, along with the Term Permit Act, National Forest Ski Area Permit Act, Granger-Thye Act, Mineral Leasing Act, Alaska Term Permit Act, Act of September 3, 1954, Wilderness Act, National Forest Roads and Trails Act, Act of November 16, 1973, Archeological Resources Protection Act, and Alaska National Interest Lands Conservation Act, authorize the Secretary of Agriculture to issue authorizations or the use and occupancy of National Forest System lands. The Secretary of Agriculture's regulations at 36 CFR Part 251, Subpart B, establish procedures for issuing those authorizations.

The Privacy Act of 1974 (5 U.S.C. 552a) and the Freedom of Information Act (5 U.S.C. 552) govern the confidentiality to be provided for information received by the Forest Service.

Public reporting burden for this collection of information is estimated to average 8 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

From: Dwayne Adams <dadams@uskh.com>
Sent: Wednesday, November 06, 2013 11:25 AM
To: lesli.schick@alaska.gov; pamela.russell@alaska.gov; Duvall, Shina A (DNR) (shina.duvall@alaska.gov); gwilliams@borough.kenai.ak.us; Eavis, John -FS (jeavis@fs.fed.us); Mike Salzetti (msalzetti@HomerElectric.com); Cory Warnock; Emily Andersen; lesli.schick@alaska.gov; pamela.russell@alaska.gov; judy.bittner@alaska.gov; Duvall, Shina A (DNR) (shina.duvall@alaska.gov); gwilliams@borough.kenai.ak.us; Eavis, John -FS (jeavis@fs.fed.us); Mike Salzetti (msalzetti@HomerElectric.com); Cory Warnock; Emily Andersen
Cc: Kim Graham
Subject: INHT-Moose Pass
Attachments: AGENDA.docx; PROJECT DESCRIPTION.pdf; 2013-06-10_INHT Graphic Map.pdf

Attached are items relevant to our meeting scheduled for next week concerning proposed alternative routing for the INHT easement in proximity to Moose Pass. Included is an agenda, project description, and an overview graphic of the existing INHT easement/trail as well as alternatives considered by the Grant Lake Hydro project team.

Please let me know if you have questions.

Thanks
Dwayne Adams

This electronic communication (including all attachments) is intended only for the named addressee(s) and may contain confidential information. It has not passed through our standard review process. Design data and recommendations included herein are provided as a matter of convenience and should not be used for final design. RELY ONLY ON THE FINAL HARDCOPY MATERIALS BEARING THE CONSULTANT'S ORIGINAL SIGNATURE AND SEAL. If you are not the named addressee(s), any use, dissemination, distribution or copying of this communication is prohibited. If you have received this communication in error, please notify the sender immediately by return e-mail and delete the original communication from your system. This e-mail and all other electronic (including voice) communications from the sender's firm are not intended by the sender to constitute an electronic record, an electronic signature or any agreement to conduct a transaction by electronic means. Any such intention or agreement is hereby expressly disclaimed unless otherwise specifically indicated.

AGENDA—November 13, 2013, Glacier Ranger District Conference Room-Girdwood

Discussion of Possible INHT Relocation Grant Lake Hydroelectric Project

Meeting Start: 1:00pm

- Introductions
- Grant Lake Hydroelectric Project Overview
 - General project
 - INHT conflicts
 - Resolutions to date
- INHT Easement Alternatives
 - Review of mapped routes
 - Photo tour of possible solution
- Discussion of agency viewpoints
- Review of steps forward for resolution

PROJECT DESCRIPTION

Proposed Project Location

The proposed Grant Lake Hydroelectric Project would be located near the community of Moose Pass, Alaska (pop. 206), approximately 25 miles north of Seward, Alaska (pop. 3,016), just east of the Seward Highway (State Route 9); this highway connects Anchorage (pop. 279,671) to Seward. The Alaska Railroad parallels the route of the Seward Highway, and is also adjacent to the Project area. The community of Cooper Landing (pop. 369) is located 24 miles to the northwest and is accessible via the Sterling Highway (State Route 1) which connects to the Seward Highway approximately 10 miles northwest of Moose Pass. The proposed Project location is in the mountainous terrain of the Kenai Mountain Range.

Proposed Project Facilities

The proposed Project is comprised of a diversion dam at the outlet to Grant Lake (under consideration), an intake structure in Grant Lake, a tunnel, a surge tank, a penstock, a powerhouse, a tailrace detention pond, a switchyard with disconnect switch and step-up transformer, an overhead or underground transmission line, and a pole-mounted disconnect switch where the line intersects the existing City of Seward distribution line or Chugach Electric's transmission line depending on the selected access road. The powerhouse would contain two Francis turbine generating units with a combined rated capacity of 5.0 MW with a total design flow of 385 cfs.

Project Features

The proposed Project features have been developed based upon existing physical and environmental information and are conceptual in nature. As part of the pre-filing consultation process, additional information would be obtained through technical and environmental studies, research, and consultation with equipment manufacturers and resource agencies. As new information becomes available, the design features presented below will continue to be refined and/or modified to accommodate any changed conditions, including maintenance of instream flow requirements or other resource management needs. A final proposal will be presented in the license application to the Commission. Project features as currently envisioned are summarized in the following table.

Number of Generating Units	2
Turbine Type	Francis
Rated Generator Output	
Unit 1	1.0 MW
Unit 2	4.0 MW
Maximum Rated Turbine Discharge	
Unit 1	75 cfs
Unit 2	310 cfs
Turbine Centerline Elevation	521 ft msl

Normal Tailwater Elevation		
Minimum	512 ft msl	
Maximum	515 ft msl	
Average Annual Energy	19,700 MWh	
Normal Maximum Reservoir Elevation	698 ft msl	
Normal Minimum Reservoir Elevation	687 ft msl	
Gross Head	183 ft	
Net Head at Maximum Rated Discharge	171.6 ft	
Grant Lake		
Drainage Area	44 mi ²	
Surface Area	1,790 ac	
Active Storage Volume	15,900 ac-ft (Elevation 698 to 687 feet msl)	
Average Annual Natural Outflow	139,650 ac-ft	
Average Annual Natural Outflow	193 cfs	
Grant Creek Diversion		
Type (2 options under consideration)	None (natural lake outlet)	Concrete Gravity Dam
Maximum Height	NA	2 ft
Overall Width	NA	120 ft
Spillway Crest Length	NA	60 ft
Crest Elevation	698 ft msl	700 ft msl
Water Conveyance		
Intake	Tower	
Invert Elevation	655 ft msl	
<i>Lower Pressure Pipeline</i>		
Type	Welded steel	
Length	200 ft	
Diameter	48 in	
<i>Pressure Tunnel</i>		
Type	10-ft horseshoe	
Length	3,200 ft	
Velocity at Maximum Turbine Discharge	3.9 fps	
<i>Surge Tank</i>		
Diameter	96 in	
Base Elevation (preliminary)	650 ft msl	
Top Elevation (preliminary)	760 ft msl	
<i>Penstock</i>		
Type	Welded steel	
Length	360 ft	
Diameter	72 in	
Powerhouse		
Approximate Dimensions	45 ft x 60 ft x 30 ft high	
Finished Floor Elevation	526 ft msl	

Tailrace Detention Pond	
Approximate Acreage	5 ac
Approximate Capacity	15 ac-ft
Outlet Conveyance Length	300 ft
Tailrace	
Type	Open channel
Length	200 ft
Option 1	
Transmission Line	
Type	Overhead or underground
Length	Approximately 3.5 miles
Voltage	24.9 kV
Access Roads	
Type	Single lane gravel surfacing with turnouts
Length	Approximately 4.0 miles; including 3.0 miles to the powerhouse and 1.0 mile to the intake (portions will be new road)
Option 2	
Transmission Line	
Type	Overhead or underground
Length	Approximately 1.0 mile
Voltage	115 kV
Access Roads	
Type	Single lane gravel surfacing with turnouts
Length	Approximately 1.95 miles; including 1.0 mile to the powerhouse and 0.95 mile to the intake (this will be a new road)

Grant Creek Diversion

Two concepts are currently being evaluated for water control at the outlet of Grant Lake. The first option would consist of a natural lake outlet that would provide control of flows out of Grant Lake. A new low level outlet would be constructed on the south side of the natural outlet to release any required environmental flows when the lake is drawdown below the natural outlet level. The outlet works would consist of a 48-inch diameter pipe extending back into Grant Lake, a gate house, regulating gate, controls and associated monitoring equipment. The outlet would discharge into Grant Creek immediately below the natural lake outlet.

In the second option, a concrete gravity diversion structure would be constructed near the outlet of Grant Lake. The gravity diversion structure would raise the pool level by a maximum height of approximately 2 ft, and the structure would have an overall width of approximately 120 ft. The center 60 ft of the structure would have an uncontrolled spillway section with a crest elevation at approximately 700 ft mean sea level (msl). Similar to the first option, a low level outlet would be constructed on the south side of the natural outlet to release any required

environmental flows when the lake is drawn down below the natural outlet level. The outlet works would consist of a 48-in diameter pipe extending back into Grant Lake, a gate house a regulating gate, controls, and associated monitoring equipment. The outlet would discharge into Grant Creek immediately below the diversion structure.

Grant Lake Intake

The water intake would be a concrete tower structure located approximately 500 ft east of the natural outlet of Grant Lake and adjacent to the shore. The intake structure would have base dimensions of approximately 15 ft by 15 ft. A small house at the top of the intake would contain the gate hoist mechanism and controls.

The intake would allow for drawdown of Grant Lake to elevation 687 ft msl thereby creating approximately 15,900 ac-ft of active storage for the project between elevations 698 ft msl and 687 ft msl. The intake can be designed to allow the Project to draw water near the surface at various levels of storage, if deemed necessary. The invert of the intake would be at elevation 655 ft to provide for adequate submergence to the tunnel. The front of the intake would be protected by a steel trashrack. Downstream of the trashrack would be a shut-off gate.

Tunnel

An approximately 3,200-ft-long, 10-ft diameter horseshoe tunnel would convey water from the intake to directly above the powerhouse at about elevation 623 ft msl. It is expected that the tunnel would be supported with rock bolts and shotcrete. It may be partially lined depending upon the geotechnical conditions encountered during excavation.

Near the end of the tunnel an 8-ft diameter surge shaft would be constructed. The surge shaft would extend to the ground surface at approximately elevation 750 ft msl. At the ground surface the shaft would transition to a steel pipe section. The pipe section would have a top elevation of 760 ft msl.

Penstock

At the outlet to the tunnel, a section of penstock would convey water to the powerhouse. The penstock would be constructed of welded steel and would be approximately 360 ft long with an outside diameter of 72 in. The penstock would bifurcate at the bottom immediately upstream of the powerhouse.

Tailrace

The tailrace would be an open channel approximately 200 ft long and would convey water back to Grant Creek at an approximate elevation of 508 ft msl. The tailrace would be excavated from in-situ material and armored with riprap to prevent erosion. A control weir with an elevation of 512 ft msl would be constructed immediately downstream of the powerhouse at the beginning of the tailrace section.

Tailrace Detention Pond

An off-stream detention pond would be created to provide a storage reservoir for flows generated during the rare instance when the units being used for emergency spinning reserve are needed to provide full load. In this situation, the additional powerhouse flows would be diverted into the detention pond and then released slowly back into Grant Creek. The detention pond would be located immediately south of the powerhouse and would have a capacity of approximately 15 ac-ft and a surface area of approximately 5 ac. Water would be conveyed back to Grant Creek through a pipeline.

Powerhouse

The powerhouse would be located on the south bank of Grant Creek near the end of the canyon section. The powerhouse would be approximately 45 ft by 60 ft by 30 ft high and would have a finished floor elevation of 526 ft msl. The powerhouse would be a pre-engineered metal building on a concrete foundation.

The powerhouse would contain two horizontal Francis type turbine/ generator units with a rated total capacity of 5,000 kW, guard valves, and associated switchgear and controls. Unit 1 would have a design flow of 75 cfs and a rated capacity of 1,000 kW. Unit 2 would have a design flow of 310 cfs and a rated capacity of 4,000 kW. The size of each unit would be optimized once all flow conditions are known. Centerline of the turbine and generator units would be approximately 521 ft msl. The turbines could operate over a range of flows from the maximum of 385 cfs to a minimum of around 22 cfs depending on conditions. The tailwater elevation at the powerhouse would range from approximately elevation 512 to 515 ft msl depending upon the output level. The powerhouse would also contain a bypass valve to release flows during power generation outages.

Transmission Line/Switchyard

Both underground and overhead transmission lines to deliver energy from the Project to the grid are being evaluated. In addition to any overhead transmission structures, the facilities would include a switchyard at the powerhouse consisting of a pad-mounted disconnect switch and a pad-mounted step-up transformer. The transmission line would run from the powerhouse parallel to the access road where it would intersect the City of Seward distribution line or Chugach Electric's transmission line depending on the selected access road. The interconnection would have a pole mounted disconnect switch.

If used, the poles would be designed as tangent line structures on about 250-ft centers. Design of the line would also incorporate the latest raptor protection guidelines. Collision avoidance devices would be installed on the line at appropriate locations to protect migratory birds.

Access Roads

The Grant Lake Project would require an access road to both the powerhouse located near the base of the Grant Creek canyon and to the intake at Grant Lake. This access road would be

primarily used during project construction but afterwards, the powerhouse would be visited approximately once a week and the intake visited approximately once a month beginning just after the ice melts and continuing until just before freeze up. The powerhouse access road would be maintained year around. The intake access road would not be maintained in winter.

Two access road routes to the powerhouse are being evaluated. The first option would be approximately three miles long beginning at the south end of Lower Trail Lake and crossing the Alaska Railroad tracks at an existing crossing located at approximately MP 25.2 of the Seward Highway. The first mile of this road would follow the existing Falls Creek mining road. At a point approximately one mile up the Falls Creek road the access road would continue northward to the powerhouse staying between Lower Trail Lake and Vagt Lake. As currently proposed, portions of the road come near, or intersect with the commemorative Iditarod National Historic Trail (INHT) that would be under construction soon. The location of the road or the trail may be adjusted to avoid or mitigate potential impacts of the access road on the trail.

The second option would leave the Seward Highway at approximately MP 26.9. This route would travel eastward to cross Trail Lakes at the downstream end of the narrows between Upper and Lower Trail Lakes and then continue eastward to the powerhouse. This route would be approximately 1 mile long. It would cross the Alaska Railroad (ARRC) tracks near an existing railroad crossing for a private driveway. The road would cross the narrow channel connecting Upper and Lower Trail Lakes with an approximately a 100-foot-long single lane bridge. This bridge is proposed as a clear span with the west abutment located on bedrock and the east abutment on fill. The proposed route would avoid cuts and travel along the base of some small hills on the south side of Grant Creek to the Power House. This proposed access road would have one 90-degree crossing of the INHT.

The intake access road would be approximately one mile long, beginning at the powerhouse. The road would ascend a 230-foot bluff to get to the top of the southern lip of the Grant Creek canyon. The road would then generally follow the southern edge of the canyon until it descends to Grant Lake.

The road would be gravel with a 14-foot top width. Maximum grade would be 16 percent. Periodic turnouts would be provided to allow construction traffic to pass. Fifty-foot radius curves would be used to more closely contour around the small steep hills of bedrock to limit the extent of the excavation and the height of the embankments.

Proposed Project Boundary

The proposed Project boundary for the Grant Lake Project is shown in Exhibit 4. The proposed Project Boundary would encompass each of the Project features described above, and the area around Grant Lake up to approximately contour elevation 700 ft msl. The corridors for the access roads/transmission line and penstock would be approximately 75 ft from each side of the centerline. The specific delineation of the proposed Project Boundary, in terms of survey coordinates, would be made after study work has been completed and would be included as part of the license application.

The legal description and ownership of lands (ADNR 2006) within the proposed Project boundary are provided in the table below. All land is referenced to the Seward Meridian.

Township	Range	Section	Ownership
5N	1E	28	USDA Forest Service
5N	1E	29	USDA Forest Service
5N	1E	31	State patented land
5N	1E	32	State patented land
5N	1E	33	USDA Forest Service
5N	1E	34	USDA Forest Service
5N	1E	35	USDA Forest Service
5N	1E	36	USDA Forest Service
4N	1E	1	USDA Forest Service
4N	1E	2	USDA Forest Service
4N	1E	5	USDA Forest Service
4N	1E	6	State patented land
4N	1E	7	State patented land
4N	1E	18	State patented land
4N	1W	1	State patented land
4N	1W	12	State patented land/Private
4N	1W	13	State patented land/Private

No portion of the potential Project area has been designated as a Wilderness Area, recommended for designation as a Wilderness Area, or designated as Wilderness Study Area. No portion of the potential Project area has been included in the Wild and Scenic River System.

Proposed Construction and Development Schedule

The Project will be constructed over a 30-36 month timeframe after the issuance of the Project license. Construction will begin in the April timeframe with the construction of access roads. Construction of the Grant Lake diversion structure (if necessary) and intake will be performed by first drawing down the lake elevation using a pair of diversion trenches cut through the outlet of the lake. This method will allow the lake to be drawn down to approximately elevation 680 ft msl over the winter, if necessary. Next, the intake will be constructed behind an in-situ rock cofferdam. Once the intake and tunnel are complete the in-situ cofferdam will be removed by blasting. The Grant Lake diversion structure, if needed, will be constructed at the same time. The precise construction schedule and methods will be described further in the license application.

Benefits of the Proposed Project

Power from the Project would be available to customers of Homer Electric Association and other areas served by the existing transmission grid. Power from the proposed Project would be important to the citizens of the Kenai Peninsula and would be environmentally beneficial and cost effective as an alternative source of energy to offset fossil fuel generation. The power from the proposed Project would reduce consumption of non-renewable carbon-based energy sources, thereby helping to improve air quality in Kenai Peninsula Borough. Kenai Hydro, LLC will be the sole owners of property rights as the "Applicant."

NOTE: Because of the potentially sensitive nature of the information regarding cultural resources, the proposed Iditarod National Historic Trail (INHT) map attached to the November 6, 2013 email is not being distributed to the general public. This document may be obtained by request to Homer Electric Association (HEA) or Federal Energy Regulatory Commission (FERC), subject to confidentiality provisions.

From: Cory Warnock
Sent: Thursday, November 07, 2013 10:02 AM
To: Van Massenhove, Katherine B -FS; Sagner, Helen -FS
Cc: Mike Salzetti
Subject: RE: Grant Lake Special Use Permit Renewal Request (SEW457)

Hi Kathy,

Thanks for the follow-up and I'll look forward to hearing from you.

Cory

From: Van Massenhove, Katherine B -FS [<mailto:kvanmassenhove@fs.fed.us>]
Sent: Thursday, November 07, 2013 10:02 AM
To: Cory Warnock; Sagner, Helen -FS
Cc: Mike Salzetti
Subject: RE: Grant Lake Special Use Permit Renewal Request (SEW457)

Thanks Cory, We will work on reissuing the permit as it is currently authorized. Helen Sagner will be assisting with that renewal. Our public comment runs through the beginning of December, we will be in touch.

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Thursday, November 07, 2013 8:57 AM
To: Van Massenhove, Katherine B -FS
Cc: Mike Salzetti
Subject: RE: Grant Lake Special Use Permit Renewal Request (SEW457)

Hi Kathy,

Just touching base to see if you've had time to evaluate my email below. I'll look forward to hearing from you as you have time.

Thanks,

Cory

From: Cory Warnock
Sent: Tuesday, November 05, 2013 2:05 PM
To: Van Massenhove, Katherine B -FS (kvanmassenhove@fs.fed.us)
Cc: Mike Salzetti
Subject: Grant Lake Special Use Permit Renewal Request (SEW457)

Hi Kathy,

I wanted to start off by apologizing for your receipt (second hand) of an inquiry for work we (HEA) would be conducting in 2014 consistent with our existing study planning. Without implicating anyone or anything, the proper channels were not followed (internally) prior to reaching out to the Forest Service and as such, you received an inquiry related to this matter prematurely. Given that you have received the inquiry however, I'll go ahead and begin the formal process of

requesting a renewal (always the plan). Feel free to treat this as the formal request if in fact, this is the level of detail that you need. I'm guessing you'll need more so I will pose the following question.....

- Based upon our existing study plans, we have a set of very specific studies (primarily terrestrial in nature) that are planned to be completed in 2014. Those studies are easily definable as I can just pull the appropriate language from our study plans. What is a little more ambiguous to define is the potential for any additional work that may need to be done in relation to discussions with stakeholders that will be occurring early next year (2014). As such, my preference would be to have the existing permit, associated language and amendments all be renewed as they are to avoid the potential need for amendments later and/or time sensitivity issues. Is this possible?

Thanks Kathy and as always, more than happy to jump on the phone and discuss further. Let me know your thoughts when you have a chance,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

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Version: 2014.0.4158 / Virus Database: 3629/6814 - Release Date: 11/06/13

From: Cory Warnock
Sent: Monday, November 11, 2013 3:32 PM
To: Barclay, Andy W (DFG) (andy.barclay@alaska.gov)
Cc: Mike Salzetti; John Stevenson
Subject: Genetic Samples (Grant Creek)

Hi Andy,

You may recall our conversations this spring related to the potential for genetic analysis on anadromous species captured at our weir this year. Our studies are completed and an employee from CIAA will be delivering them to you in Anchorage on November 17th. In advance of that I wanted to shoot you a quick message, let you know about the delivery and remind you of our agreed upon path forward. Per that agreement, we are supplying the samples to you but do not plan on analyzing them at this time. If the need arises (from HEA or ADFG), we can reconvene and discuss the arrangement (financial and data reporting) associated with the exercise. More than happy to discuss further so let's chat if you need to.

If you wouldn't mind letting me know that you've received the samples on the 17th, I'd appreciate and again, don't hesitate to let me know if you have any questions/concerns.

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

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From: Cory Warnock
Sent: Tuesday, November 12, 2013 11:35 AM
To: kenneth_gates@fws.gov
Cc: Mike Salzetti
Subject: Preliminary Grant Creek Weir Data
Attachments: Grant Creek Preliminary Data.pdf

Hi Ken,

Per our conversation this morning, I'm attaching the preliminary Grant Creek weir data through the end of September. This should meet your initial needs as it relates to Chinook specifically. While I'm very confident in the accuracy of the data, please do not treat this as final at this point. As I mentioned on our call, once our analysis is complete and our Aquatics Report is developed, I'll follow-up with you and get you the complete data set/report. In the interim, if you have any questions, don't hesitate to give me a call.

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

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F – 360-542-2264

Preliminary Data

Grant Lake

Adult

	Sockeye		Pink		Chum		King		Coho		Rainbow		Dolly Varden	
	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm
29-Jul	1	1	0	0	0	0	0	0	0	0	0	14	0	0
30-Jul	1	2	0	0	0	0	0	0	0	0	0	14	0	0
31-Jul	0	2	0	0	0	0	0	0	0	0	0	14	0	0
1-Aug	0	2	0	0	0	0	0	0	0	0	0	14	0	0
2-Aug	3	5	0	0	0	0	0	0	0	0	0	14	0	0
3-Aug	0	5	0	0	0	0	0	0	0	0	0	14	0	0
4-Aug	0	5	2	2	0	0	0	0	0	0	0	14	0	0
5-Aug	0	5	1	3	0	0	0	0	0	0	0	14	0	0
6-Aug	0	5	2	5	0	0	0	0	0	0	0	14	0	0
7-Aug	2	7	1	6	0	0	0	0	0	0	0	14	0	0
8-Aug	1	8	0	6	0	0	0	0	0	0	0	14	0	0
9-Aug	0	8	0	6	0	0	0	0	0	0	0	14	0	0
10-Aug	0	8	0	6	0	0	0	0	0	0	0	14	0	0
11-Aug	0	8	1	7	0	0	1	1	0	0	0	14	0	0
12-Aug	1	9	-1	6	0	0	1	2	0	0	0	14	0	0
13-Aug	-1	8	0	6	0	0	1	3	0	0	0	14	0	0
14-Aug	1	9	0	6	0	0	1	4	0	0	0	14	0	0
15-Aug	0	9	2	8	0	0	-1	3	0	0	0	14	0	0
16-Aug	6	15	0	8	0	0	5	8	0	0	0	14	0	0
17-Aug	9	24	0	8	0	0	3	11	0	0	0	14	0	0
18-Aug	14	38	0	8	0	0	2	13	0	0	0	14	0	0
19-Aug	15	53	0	8	0	0	1	14	0	0	0	14	0	0
20-Aug	23	76	0	8	0	0	-2	12	0	0	0	14	0	0
21-Aug	22	98	0	8	0	0	0	12	0	0	0	14	0	0
22-Aug	33	131	0	8	0	0	0	12	0	0	0	14	0	0
23-Aug	38	169	1	9	0	0	0	12	0	0	0	14	0	0
24-Aug	75	244	0	9	0	0	2	14	0	0	0	14	1	1
25-Aug	112	356	1	10	0	0	0	14	0	0	0	14	0	1
26-Aug	55	411	0	10	0	0	0	14	0	0	0	14	2	3
27-Aug	77	488	0	10	0	0	3	17	0	0	0	14	0	3
28-Aug	101	589	0	10	0	0	1	18	0	0	0	14	1	4
29-Aug	131	720	0	10	0	0	0	18	0	0	0	14	0	4
30-Aug	80	800	0	10	0	0	3	21	0	0	0	14	1	5
31-Aug	45	845	0	10	0	0	0	21	0	0	0	14	0	5
1-Sep	29	874	0	10	0	0	1	22	0	0	0	14	0	5
2-Sep	24	898	0	10	0	0	0	22	0	0	0	14	0	5
3-Sep	35	933	0	10	0	0	0	22	0	0	0	14	1	6
4-Sep	39	972	0	10	0	0	0	22	0	0	0	14	0	6

Preliminary Data

Grant Lake

Adult

	Sockeye		Pink		Chum		King		Coho		Rainbow		Dolly Varden	
	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm
5-Sep	27	999	0	10	0	0	1	23	0	0	0	14	3	9
6-Sep	22	1021	0	10	0	0	0	23	0	0	0	14	1	10
7-Sep	25	1046	0	10	0	0	0	23	0	0	0	14	1	11
8-Sep	15	1061	0	10	0	0	0	23	1	1	0	14	1	12
9-Sep	12	1073	0	10	0	0	0	23	0	1	0	14	0	12
10-Sep	13	1086	0	10	0	0	0	23	0	1	0	14	1	13
11-Sep	15	1101	0	10	0	0	0	23	7	8	-1	13	1	14
12-Sep	5	1106	0	10	0	0	0	23	4	12	0	13	0	14
13-Sep	3	1109	0	10	0	0	0	23	2	14	1	14	0	14
14-Sep	2	1111	0	10	0	0	0	23	2	16	0	14	0	14
15-Sep	0	1111	0	10	0	0	0	23	6	22	0	14	0	14
16-Sep	4	1115	0	10	0	0	0	23	0	22	0	14	0	14
17-Sep	0	1115	0	10	0	0	0	23	1	23	0	14	0	14
18-Sep	0	1115	0	10	0	0	0	23	0	23	0	14	0	14
19-Sep	0	1115	0	10	0	0	0	23	2	25	0	14	0	14
20-Sep	0	1115	0	10	0	0	0	23	2	27	0	14	0	14
21-Sep	0	1115	0	10	0	0	0	23	6	33	0	14	0	14
22-Sep	0	1115	0	10	0	0	0	23	0	33	0	14	0	14
23-Sep	0	1115	0	10	0	0	0	23	5	38	0	14	0	14
24-Sep	1	1116	0	10	0	0	0	23	6	44	0	14	0	14
25-Sep	0	1116	0	10	0	0	0	23	9	53	0	14	0	14
26-Sep	-1	1115	0	10	0	0	0	23	9	62	0	14	0	14
27-Sep	0	1115	0	10	0	0	0	23	11	73	0	14	0	14
28-Sep	0	1115	0	10	0	0	0	23	0	73	0	14	0	14
29-Sep	1	1116	0	10	0	0	0	23	18	91	0	14	0	14
30-Sep	0	1116	0	10	0	0	0	23	10	101	0	14	0	14

On Nov 13, 2013, at 5:06 PM, "Dwayne Adams" <dadams@uskh.com> wrote:

FYI—confirmation. Yes!

From: Schick, Lesli J (DNR) [<mailto:lesli.schick@alaska.gov>]
Sent: Wednesday, November 13, 2013 10:27 AM
To: Dwayne Adams
Subject: RE: INHT-Moose Pass

Hi Dwayne,
BLM isn't involved at the agreement and plat portion..#7 (that would be the state survey group, which should be involved starting at the "formalize the proposed action" so there isn't a delay in the survey instructions being sent out). The public process would start at #5, once there is a proposed location that the agencies have concurred on.
-lesli

Lesli Schick
Iditarod Trail Easements
Department of Natural Resources
550 W 7th Ave, Suite 900C
Anchorage, AK 99501
Phone: (907) 334-2679, Fax: (907) 269-8930
Email: lesli.schick@alaska.gov

From: Dwayne Adams [<mailto:dadams@uskh.com>]
Sent: Wednesday, November 06, 2013 11:24 AM
To: Schick, Lesli J (DNR)
Cc: Kim Graham
Subject: INHT-Moose Pass

Lesli,

I'd like to be able to summarize next steps forward for the suggested INHT easement re-route, assuming some level of support for consideration of an alternate location. You provided a summary when I met with you in June and I wanted to make sure that I had it correct. Could you let me know if this sounds right?

1. Meet with core group (next week's meeting)
2. Get USFS buyoff at consideration
3. Get KRSMA buyoff
4. Get Kenai Peninsula Borough buyoff
5. Formalize the proposed location
6. Meet with core group and BLM
7. Get BLM agreement to move forward and plat (party proposing realignment must pay costs for new plat)

I'm assuming there must be some public process as well. At what point do you suggest that take place and how do you suggest advertising and ensuring key parties are informed?

Thanks Lesli for any help you can provide.

Dwayne

This electronic communication (including all attachments) is intended only for the named addressee(s) and may contain confidential information. It has not passed through our standard review process. Design data and recommendations included herein are provided as a matter of convenience and should not be used for final design. RELY ONLY ON THE FINAL HARDCOPY MATERIALS BEARING THE CONSULTANT'S ORIGINAL SIGNATURE AND SEAL. If you are not the named addressee(s), any use, dissemination, distribution or copying of this communication is prohibited. If you have received this communication in error, please notify the sender immediately by return e-mail and delete the original communication from your system. This e-mail and all other electronic (including voice) communications from the sender's firm are not intended by the sender to constitute an electronic record, an electronic signature or any agreement to conduct a transaction by electronic means. Any such intention or agreement is hereby expressly disclaimed unless otherwise specifically indicated.

This electronic communication (including all attachments) is intended only for the named addressee(s) and may contain confidential information. It has not passed through our standard review process. Design data and recommendations included herein are provided as a matter of convenience and should not be used for final design. RELY ONLY ON THE FINAL HARDCOPY MATERIALS BEARING THE CONSULTANT'S ORIGINAL SIGNATURE AND SEAL. If you are not the named addressee(s), any use, dissemination, distribution or copying of this communication is prohibited. If you have received this communication in error, please notify the sender immediately by return e-mail and delete the original communication from your system. This e-mail and all other electronic (including voice) communications from the sender's firm are not intended by the sender to constitute an electronic record, an electronic signature or any agreement to conduct a transaction by electronic means. Any such intention or agreement is hereby expressly disclaimed unless otherwise specifically indicated.

Grant Lake Hydroelectric Project (FERC No. 13212)
Iditarod National Historic Trail Meeting
Girdwood Ranger District Conference Room Girdwood, AK
November 13, 2013, 1:00 pm to 3:00 pm

In Attendance

Robert Stovall, United States Forest Service (USFS)
Pam Russell, Alaska Department of Natural Resources (ADNR)
John Eavis, USFS
Kathy Van Massenhove, USFS
Lesli Schick, ADNR *[via phone]*
Shina duVall, ADNR *[via phone]*
Mike Salzetti, Kenai Hydro (KHL)
Dwayne Adams, USKH
Kim Graham, USKH
Cory Warnock, McMillen, LLC

Meeting Summary

Introductions and Agenda

Dwayne Adams (USKH) began the meeting with introductions and then reviewed the proposed meeting agenda:

- Project Overview and Update
- Licensing Status
- Iditarod National Historic Trail (INHT) Easement Alternatives
 - Review of mapped route
 - Photo tour of possible solution
- Discussion of Agency Viewpoints
- Review of steps forward for resolution
- Adjourn

Project Description

Mike Salzetti (KHL) presented an overview and history of the Grant Lake Hydroelectric Project (Project) (see PowerPoint included as [Attachment 1](#)). Mike S. gave a general description of the utility, Homer Electric Association (HEA), noting that Kenai Hydro, LLC (KHL), the applicant for the Project, is a wholly-owned subsidiary of HEA. Mike S. shared three primary reasons why HEA was pursuing the Project 1) to meet the Board of Director's and the state of Alaska's goals for an increase in its renewable energy assets; 2) that as its own power producer, HEA now has the generation portfolio and operational control to accommodate renewable energy projects, and 3) to create a long-term, stable energy source in light of higher gas prices and the potential of future gas shortages.

Mike S. briefly described the history of the proposed Project to date, explaining that feasibility studies were conducted for four potential sites (Grant Lake, Falls Creek, Ptarmigan Lake, and Crescent Lake); two of which (Grant Lake and Falls Creek) were carried forward and environmental baseline studies were conducted in 2009. Mike went on to describe why Grant Lake was selected as the preferred Project location. He described the upstream fish passage barrier at the outlet to Grant Lake (beginning of Grant Creek), the steep topography around Grant Lake and the fact that only stickleback and sculpin have ever been documented in the lake. Mike stated that aside from the obvious power potential that exists at the site, these natural resource characteristics make it an attractive site with the likelihood of minimal adverse impacts to the natural environment.

Mike went on to describe the current Project infrastructural proposal, associated operational parameters, etc. He noted that an engineering contractor has been retained and will be working with KHL to refine infrastructure and operations over the next year, in advance of the Draft License Application (DLA) being distributed for stakeholder review. The review of infrastructure included a map documenting not only specific Project operational components but the proposed access road/transmission corridor as well.

Mike then went on to describe the proposed access road and infrastructural issues associated with the INHT. He stated that the primary issues were:

- The access road and trail share a need for the same natural terrain
- Current INHT alignment is co-located with the proposed powerhouse location

Mike indicated that KHL has solved the access road issue by rerouting the proposed access road so that it has just a single 90° crossing of the INHT.

Mike finished his presentation by asking for any questions and stating that all documents related to the licensing that have developed thus far could be found on KHL's website at:

www.kenaihydro.com.

- *Comment:* Pam Russell (ADNR) asked if .pdf'd presentations could be sent to her.
Response: Cory Warnock (McMillen) stated that all meeting documents (agenda, presentations, minutes, etc.) would be posted to the KHL website.
- *Comment:* Pam Russell asked if water temperature changes as a result of turbine operation had been evaluated and if so and the temperatures were adversely impacted, would a change in turbine type be considered.
Response: Mike Salzetti stated that a combination of water quality results from 2013 work and engineering feasibility work would evaluate if any issues existed.
- *Comment:* Robert Stovall (USFS) asked who owned the land on the "Seward Highway" side of Trail Lakes Narrows.
Response: Mike Salzetti (KHL) stated that almost all of the proposed Project was located on State Land but that multiple entities within the State governed various sections of the land. He stated that the area Robert was referring to was governed by as a Kenai River Special Management Area (KRSMA). Pam Russell confirmed this. Mike went on to

state that the Kenai Peninsula Borough has selected land within the Trail Lakes area, including along the shoreline of the Trail Lakes. However, the land has not been conveyed at this point thus the land remains in State hands.

Licensing Overview

Cory Warnock (McMillen) gave a brief summary of the licensing process being utilized by KHL (Traditional Licensing Process). Cory then went on to describe KHL's current status within this process and the fact that 2013 was primarily devoted to conducting a suite of natural resource studies on Grant Creek, Grant Lake and the surrounding Project area. He stated that natural resource reports were currently being developed and next steps included internal completion of those reports and subsequent meetings with stakeholders to discuss results along with continuing engineering feasibility work. All of this is being collaboratively done in advance of the development of the DLA which is currently scheduled for draft distribution to the stakeholders for review in the first half of 2015.

INHT Easement Alternatives

Dwayne Adams (USKH) presented a description of the current INHT and Project layouts and went on to describe the issue and two proposed re-route options (see PowerPoint included as [Attachment 2](#)).

Dwayne began by displaying a map showing the current infrastructural positioning for the Project along with the proposed location for the INHT through the Project area. He went on to state that KHL evaluated the area for an INHT re-route alternative that would:

- Provide separation with Project infrastructure
- Avoid any drainage concerns
- Expose the user to a large variety of forest types
- Maximize views of surrounding lakes and mountains

Dwayne stated that KHL had previously conducted a mapping and on the ground exercise to identify a re-route option in the Project Area. He stated that as part of this recent effort, USKH also conducted an evaluation and he felt that the re-route option USKH has identified accomplishes all of the bullets listed above and, in addition and based upon professional opinion, creates a higher level of global user experience through the area.

Dwayne then displayed photos of the various segments of the preferred alternative (USKH) through the Project area. Emphasis was placed on locations showing what was assessed as improvements to the user experience based on variables such as view, terrain alteration, forest type variety, etc. Special attention was placed on certain areas that provided a unique experience.

Dwayne then went on to describe KHL's current understanding of the process for resolution with the various stakeholders. He acknowledged the somewhat unique nature of the process and opened the floor for discussion and collaboration related to refinement of the re-route process.

- *Comment:* Lesli Schick (ADNR) stated that from a process perspective, the Southcentral Regional Office would approve the re-route of the easement and the State Platting and Survey Department would issue the survey instructions and approve the plat required to issue the easement for re-route.
 - o USFS
 - o Kenai Peninsula Borough (KPB)
 - o KRSMA
 - o South Central Regional Office of ADNR

Lesli went on to say that once these four entities agreed, a public notice and agency review would take place that would involve other stakeholder agencies to some degree. She went on to say that from a KPB perspective, Marcus Mueller, KPB Land Management Officer, would be the first contact and then the habitat division would deal with any buffer issues.

A general process discussion then took place involving all parties. Once complete, Cory Warnock (McMillen) attempted to verbally outline the approach for resolution with the following steps:

1. The four principle agencies agree to the proposed reroute
2. A public notice and review period occurs
3. KHL develops a Memorandum of Understanding (MOU) to be reviewed and signed by pertinent parties
4. KHL discusses this approach with FERC to gain informal approval of process in advance of DLA submittal
5. The MOU and associated documentation is incorporated into the License Application for FERC review

The group agreed that in general, this approach was a good starting point but additional review of internal processes and discussion would be needed prior to formalizing the approach.

- *Comment:* John Eavis (USFS) stated that he appreciated Dwayne's presentation and the effort placed in identifying a re-route option that maximized the user experience. He went on to state that the "wilderness experience" associated with the trail was important and asked if the re-route would result in an audible change related to highway noise.
Response: Kim Graham (USKH) stated that during the survey, most of the noise at the site was associated with snow machines and float planes and that it was very intermittent and the noise climaxed quickly and subsided.
- *Comment:* Pam Russell (ANDR) asked if the proposed re-route would impact the money recently put into the "Vagt Lake pull-out".
Response: John Eavis (USFS) stated that it would not.

Dwayne asked if the stakeholders would like to have a site visit to review the proposed re-route location and if so, when. The group did agree that a site visit would be beneficial but the aforementioned process should progress over the winter and then the site visit could occur in late spring/early summer.

- *Comment:* John Eavis stated that there was nothing “magic” about the original route design other than the bridge location across Grant Creek which sought to minimize construction costs. There was no reason that other options couldn’t meet those same expectations with respect to user experience.
- *Comment:* Shina duVall (ADNR) asked about the Section 106 process for the Project and if the INHT trail was assessed during the 2013 Cultural work.
Response: Cory Warnock stated that the INHT was discussed to some extent and the draft Cultural Resources Report was currently in development and meeting planning would be taking place over the next month or so. Dwayne said that he had spoken to Mike Yarborough (Cultural Resource Consultants) and he stated that the proposed INHT was not cited in this area to respond to any historic location and he saw nothing from a historic perspective that would preclude a re-route.

A general process discussion then took place during which, Pam Russell (ADNR) stated that she’d need agreement from Shina’s department (State Historic Preservation Office, (SHPO)) prior to discussing the issue with KRSMA.

- *Comment:* Lesli Schick (ADNR) stated that even if it is determined that the proposed trail doesn’t invoke Section 106 measures, it will require some sort of trail agreement for what it has been designated to be as a commemorative route of the INHT.

Cory Warnock suggested that a portion of the aforementioned Cultural meeting be reserved for discussion related to the INHT. The group agreed.

A bit more global discussion related to a site visit took place and further agreement related to late spring/early summer was gained.

- *Comment:* John Eavis (USFS) stated that eventually, KHL would need to develop the MOU letter and submit to the 4 primary agencies mentioned above. He went on to ask how FERC’s NEPA process plays into things.
Response: Cory Warnock stated that KHL would begin development of the MOU letter after the Cultural (Section 106) meeting. He went on to say that once a process was fully developed with this group, he intended on calling the FERC representative for the Grant Lake Project, Ken Hogan and discussing the approach with him. Given the licensing process being used (TLP) Mr. Warnock stated that developing a collaborative approach prior to receiving FERC input would be the best approach. Mr. Warnock stated that he’d report back to the group once the FERC communication had taken place.
- *Comment:* Lesli Schick (ADNR) reiterated that KHL would also have to submit an application for an easement after the four primary parties concurred on the re-route.

Response: Cory Warnock stated that that was understood and reiterated KHL's intent to develop the MOU letter after the Cultural (Section 106) meeting.

- *Comment:* Mike Salzetti (KHL) asked what level of detail should be included in the MOU letter.

Response: John Eavis (USFS) stated that he'd do some research and get back to KHL with some specifics.

- *Comment:* Lesli Schick (ADNR) stated that she'd be the coordinator for MOU letter evaluation and that it was important to realize that this process will be reviewed as a State project separate of the Section 106 review. What eventually will be needed for formal approval, will be the four primary agencies discussed above to confirm with Lesli the re-route will not adversely impact the trail. She additionally stated that the \$100 application fee could be submitted at any time and would help in identifying it as a current project.

Response: Mike Salzetti (KHL) acknowledged that he understood and stated that KHL would be submitting the fee soon.

- *Comment:* Pam Russell (ADNR) asked if the recent State Supreme Court ruling related to the disposal of land impacted the Project.

Response: Mike Salzetti (KHL) suggested that we keep the court ruling and the INHT issue separate.

- *Comment:* John Eavis and Kathy Van Massenhove (USFS) stated that they would identify the appropriate individuals within the USFS to consult with. They stated that ultimately, the letter from a USFS perspective would be sent to Terry Marceron (Forest Supervisor).

Closing

Dwayne Adams thanked everyone for their participation, acknowledged the value of the meeting and adjourned the proceedings.

Attachments

Attachments are available on the Work Groups page at www.kenaihydro.com.

Attachment 1: KHL Project Presentation

Attachment 2: KHL Re-route Alternatives Presentation*

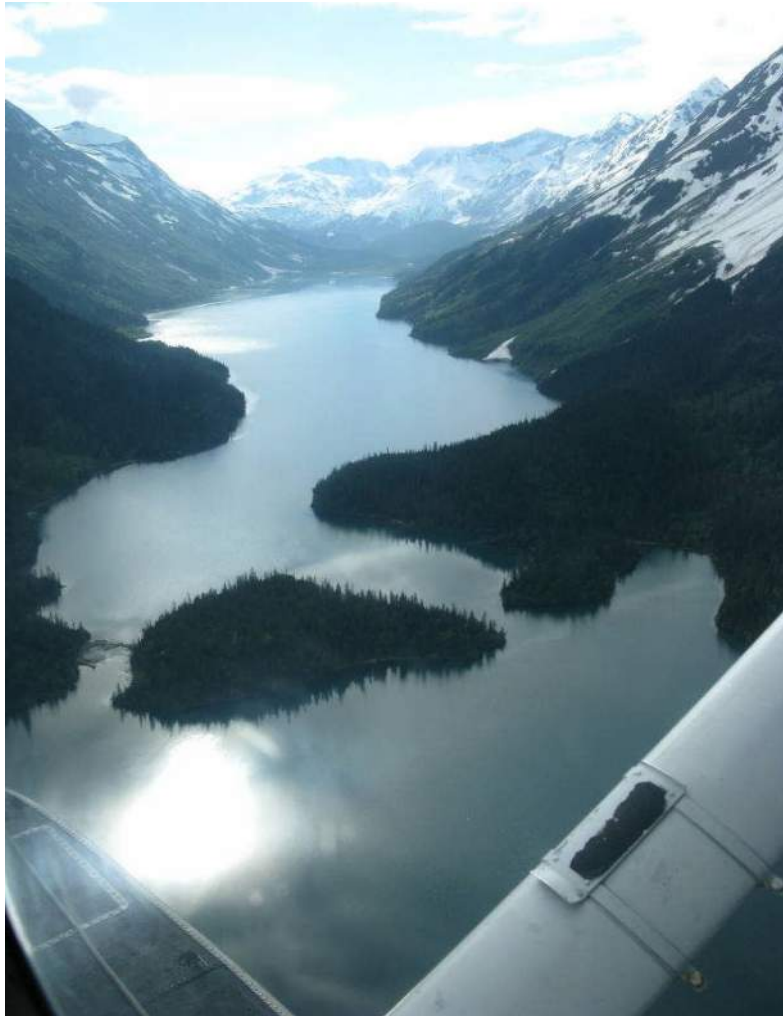
*Filed with FERC as privileged.

Attachment 1

Grant Lake Project History & Overview



GRANT LAKE PROJECT HISTORY & OVERVIEW



Kenai Hydro, LLC
Iditarod National Historic Trail
November 13, 2013
Mike Salzetti



PRESENTATION OVERVIEW



- Introduction to HEA
- Why we are doing this project?
- Project Selection
- Project Overview
- INHT Route Conflicts



Homer Electric
Association, Inc.
A Tractone Energy Cooperative



INTRODUCTION TO HEA



- 157 Employees
- Founded 1945
- Member-Owned Cooperative
- 32,853 Meters
- 2,392 Mile of Energized Line
- 3,166 Sq. Mile of Service Territory
- Sales of 475 GWh/year
- Governed by an Elected Board of Directors



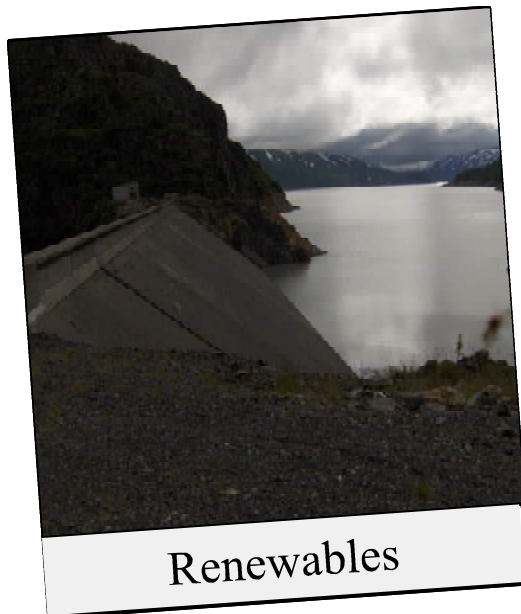
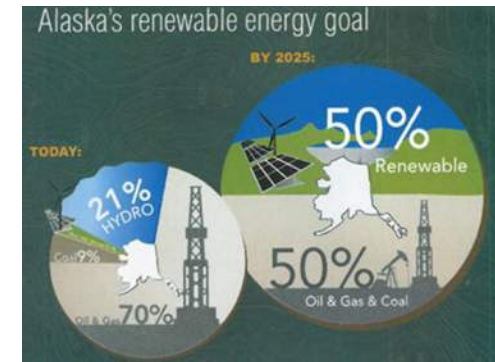
Homer Electric
Association, Inc.
A Traskline Energy Cooperative



WHY



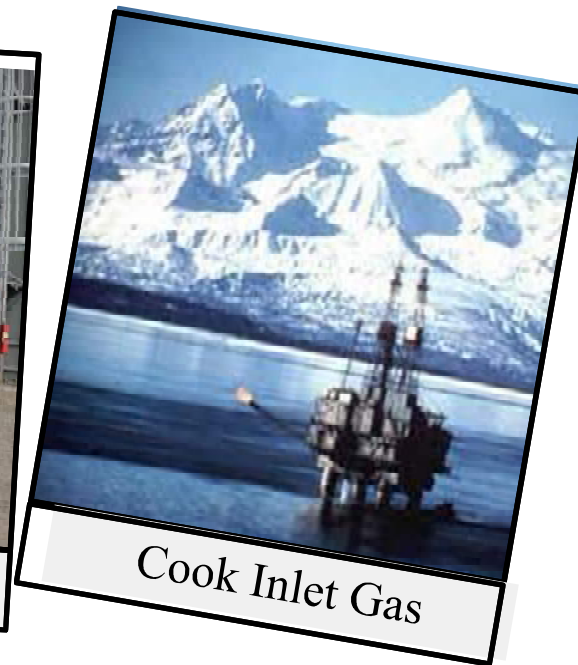
- Board of Directors Goal for Renewable Energy
- Independent Light
- Cook Inlet Gas Situation



Renewables



Independent Light



Cook Inlet Gas



Homer Electric
Association, Inc.
A Treadstone Energy Cooperative



RENEWABLE ENERGY



2011 HEA Demand 475,000 MWh

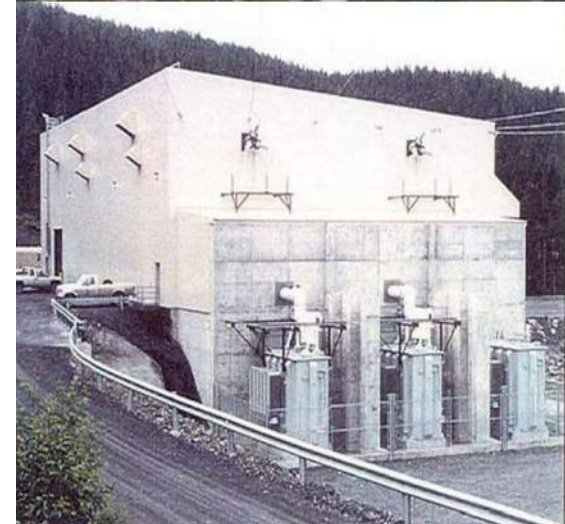
Grant Lake 19,700 MWh

$$\frac{19,700 \text{ MWh}}{475,000 \text{ MWh}} = 4.15\%$$

Bradley Lake

$$\frac{44,000 \text{ MWh}}{475,000 \text{ MWh}} = 9.26\%$$

Renewable Energy Increase 45



Homer Electric
Association, Inc.
A Traklone Energy Cooperative



PROJECT SELECTION



Feasibility Studies

- Grant Lake
- Falls Creek
- Ptarmigan Lake
- Crescent Lake



**Homer Electric
Association, Inc.**
A "Touchstone Energy" Cooperative



PROJECT SELECTION



Waterfall

There is a natural
anadromous barrier at the
outlet of Grant Lake.



Homer Electric
Association, Inc.
A Trask Energy Cooperative



PROJECT SELECTION



Steep Topology

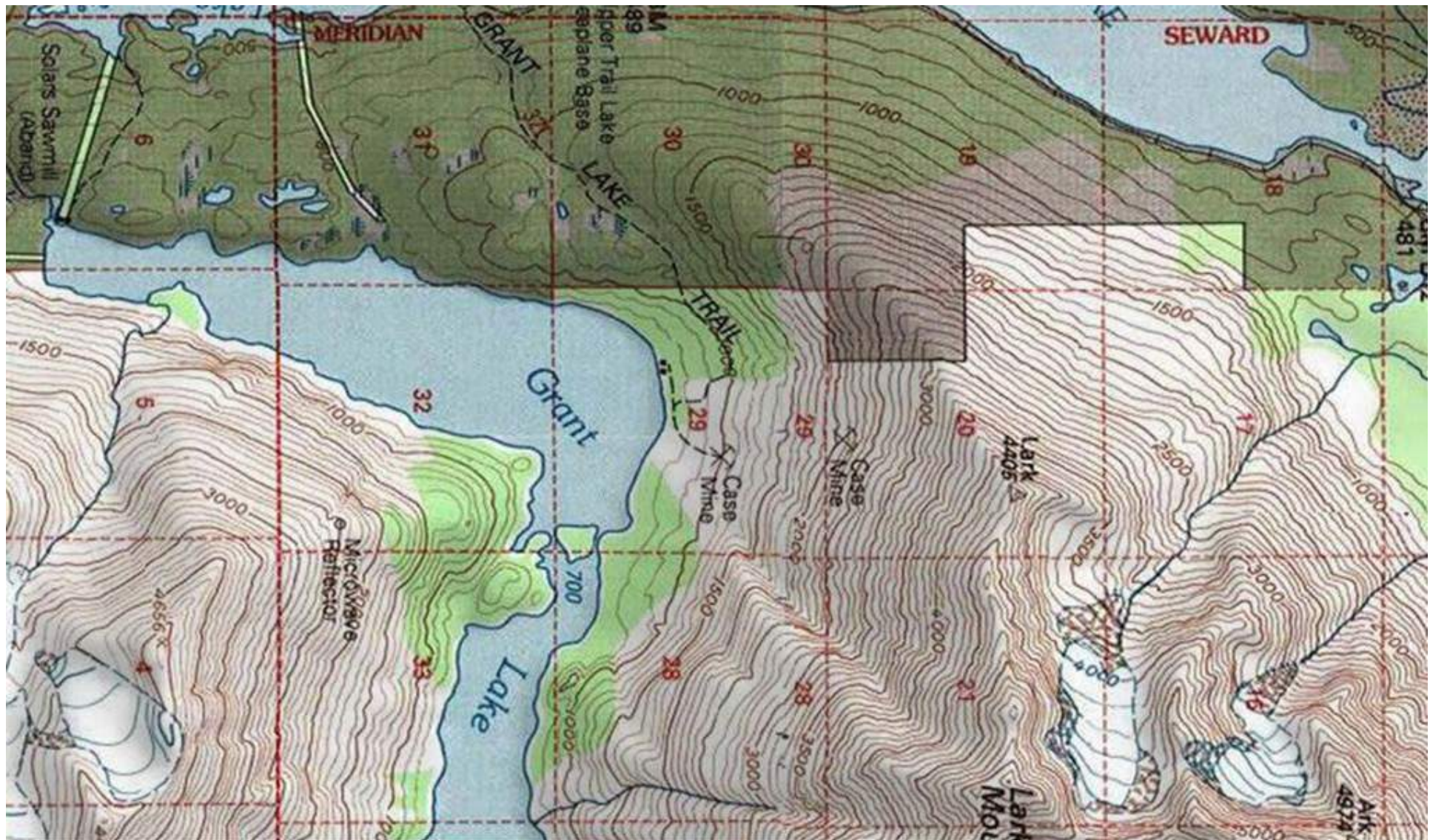
1. Very little inundation associated with lake level rise.
2. Vast majority of the potential energy occurs in the 1st 1/2 mile of stream.



Homer Electric
Association, Inc.
A Traklone Energy Cooperative

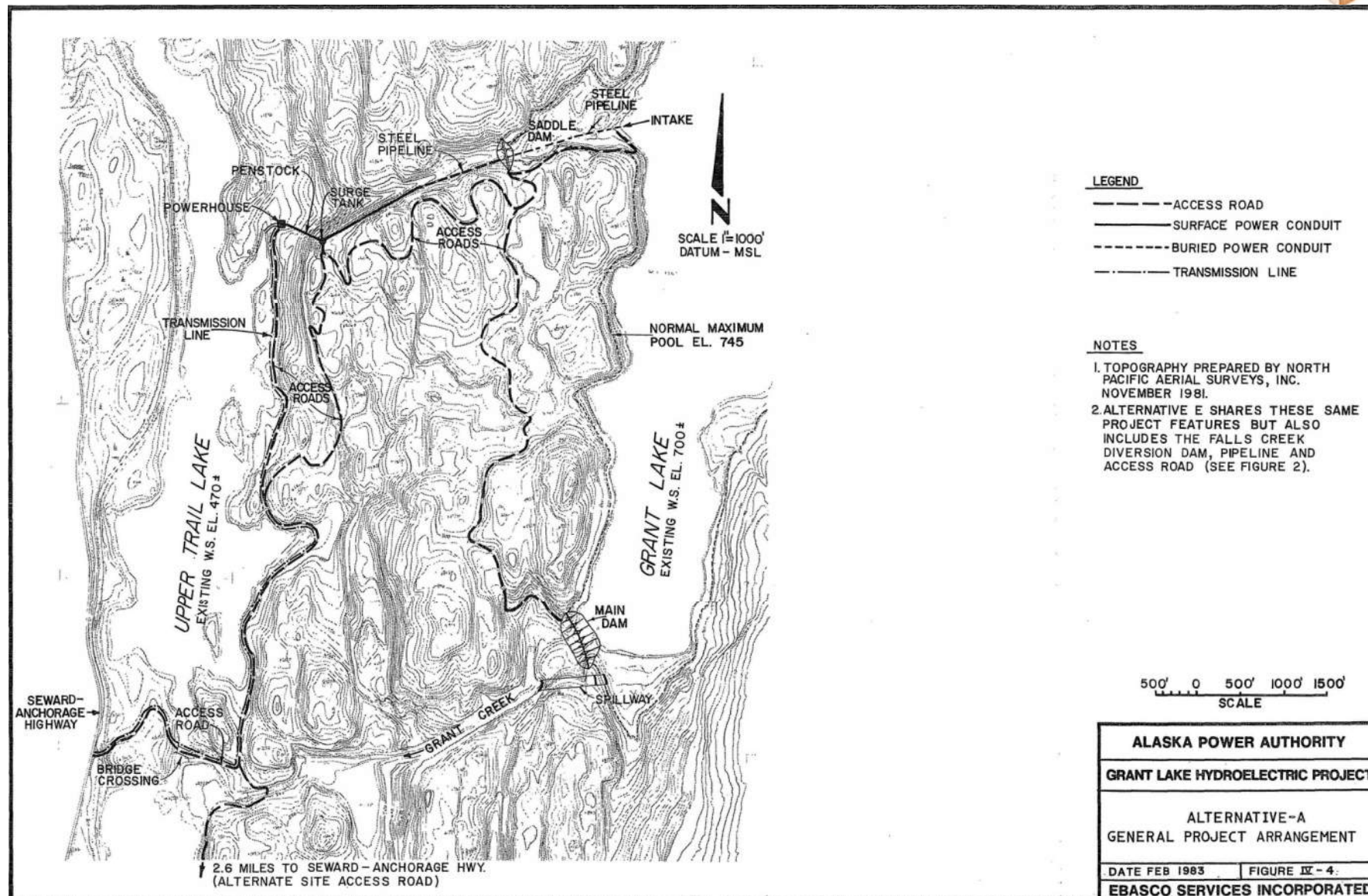


PROJECT SELECTION





PROJECT SELECTION





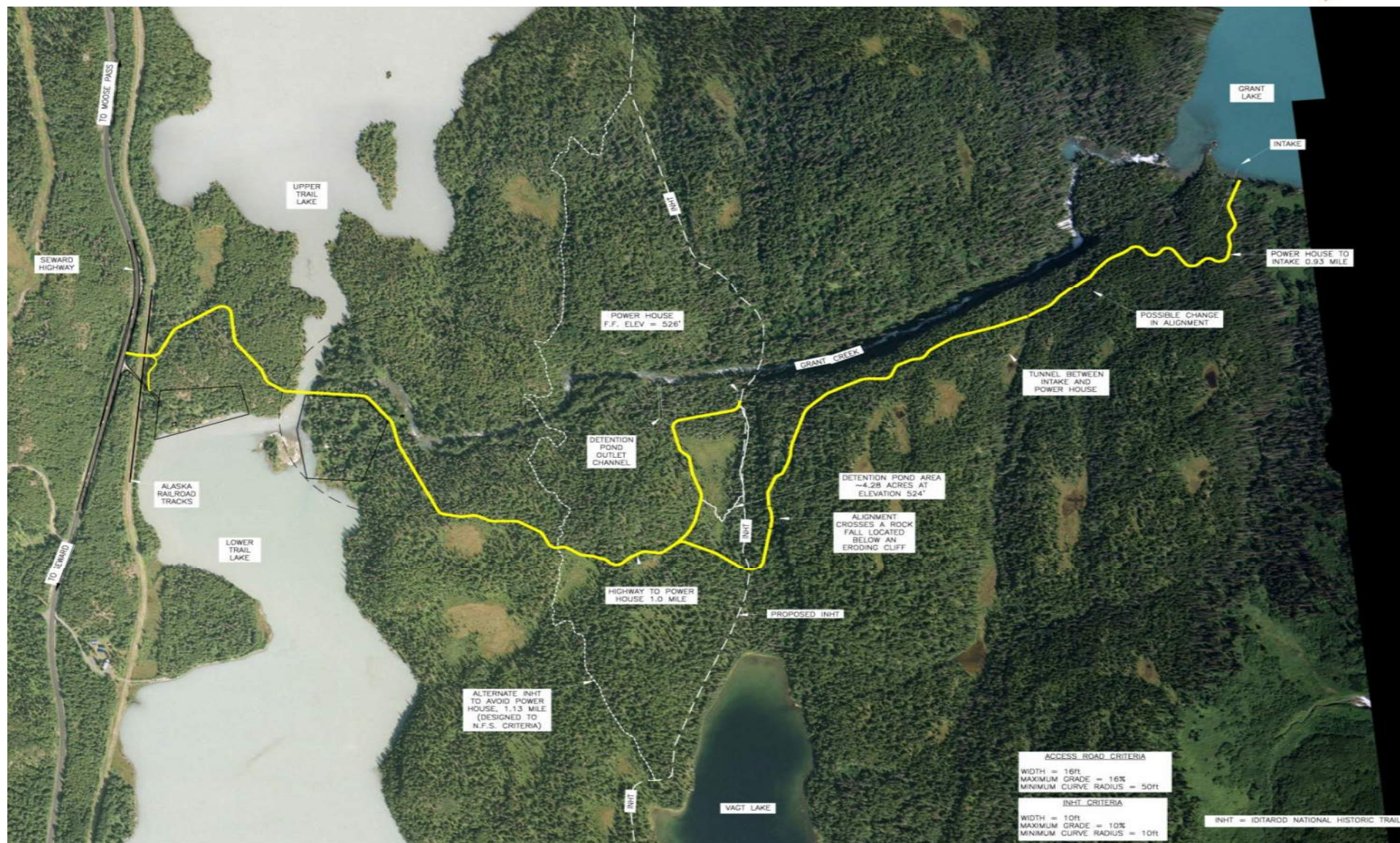
PROJECT OVERVIEW



Rated Generator Output Unit 1 – 1 MW Unit 2 – 4 MW	5 MW	
Average Annual Energy	19,700 MWh	20,500 MWh
Diversion	None	2 ft x 120 ft (H) (L)
Reservoir Max Elevation	698 fmsl* (natural)	700 fmsl*
Reservoir Min Elevation	687 (-11)	687 (-13)
Tunnel Length	3200 ft	
Access Road Length	4 miles	2 miles
Transmission Line	3.5 miles	1 mile
*fmsl – feet above mean sea level		



Homer Electric
Association, Inc.
A Trakstone Energy Cooperative

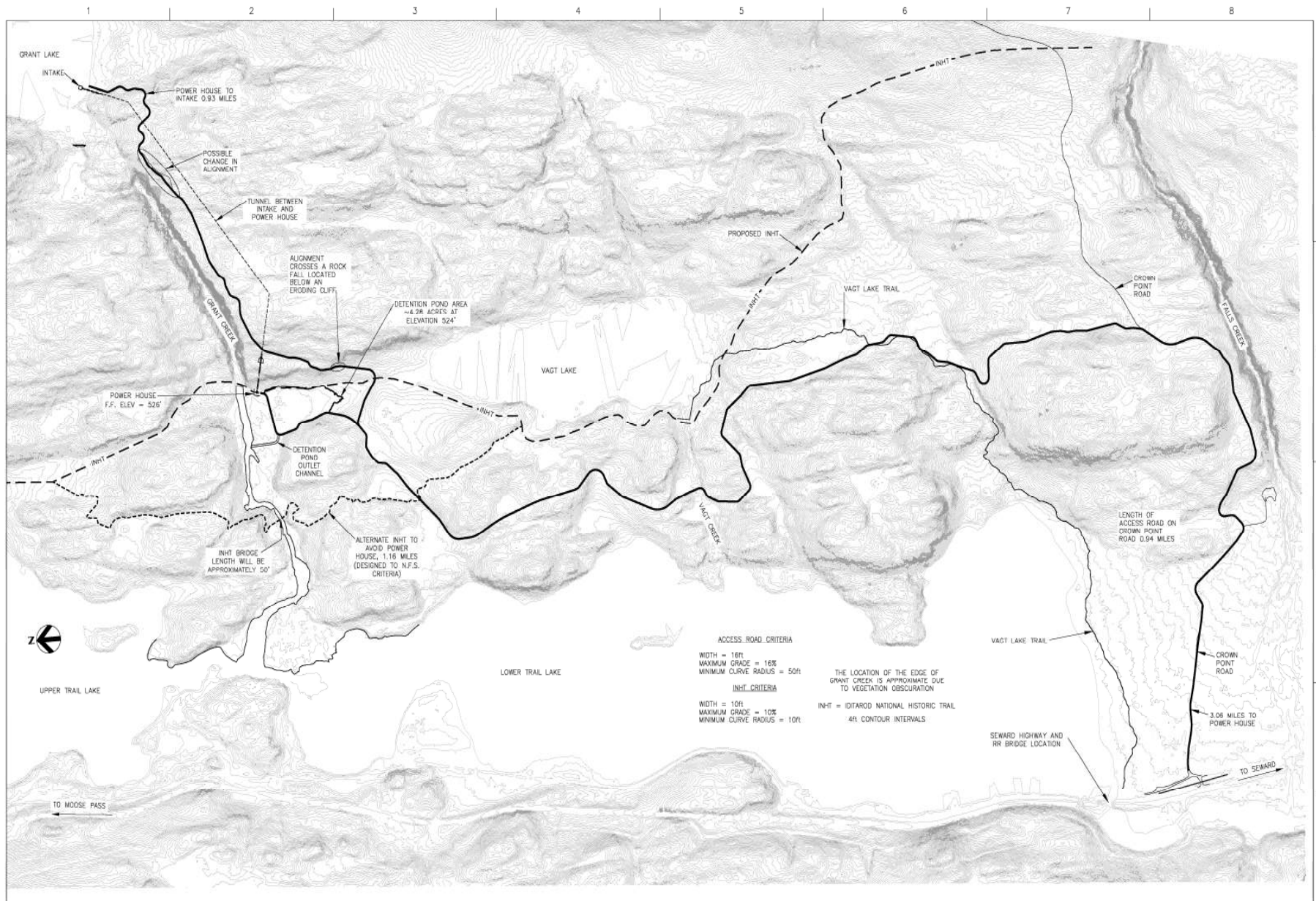




ACCESS ROAD & INHT ALIGNMENT ISSUES



- Road & Trail share a need for the same natural terrain
- Current INHT alignment co-located with the Power House



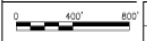
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER
DESIGNED BY
CHECKED BY
DRAWN BY
PROJECT NUMBER

**PRELIMINARY
NOT FOR
CONSTRUCTION
OR RECORDING**

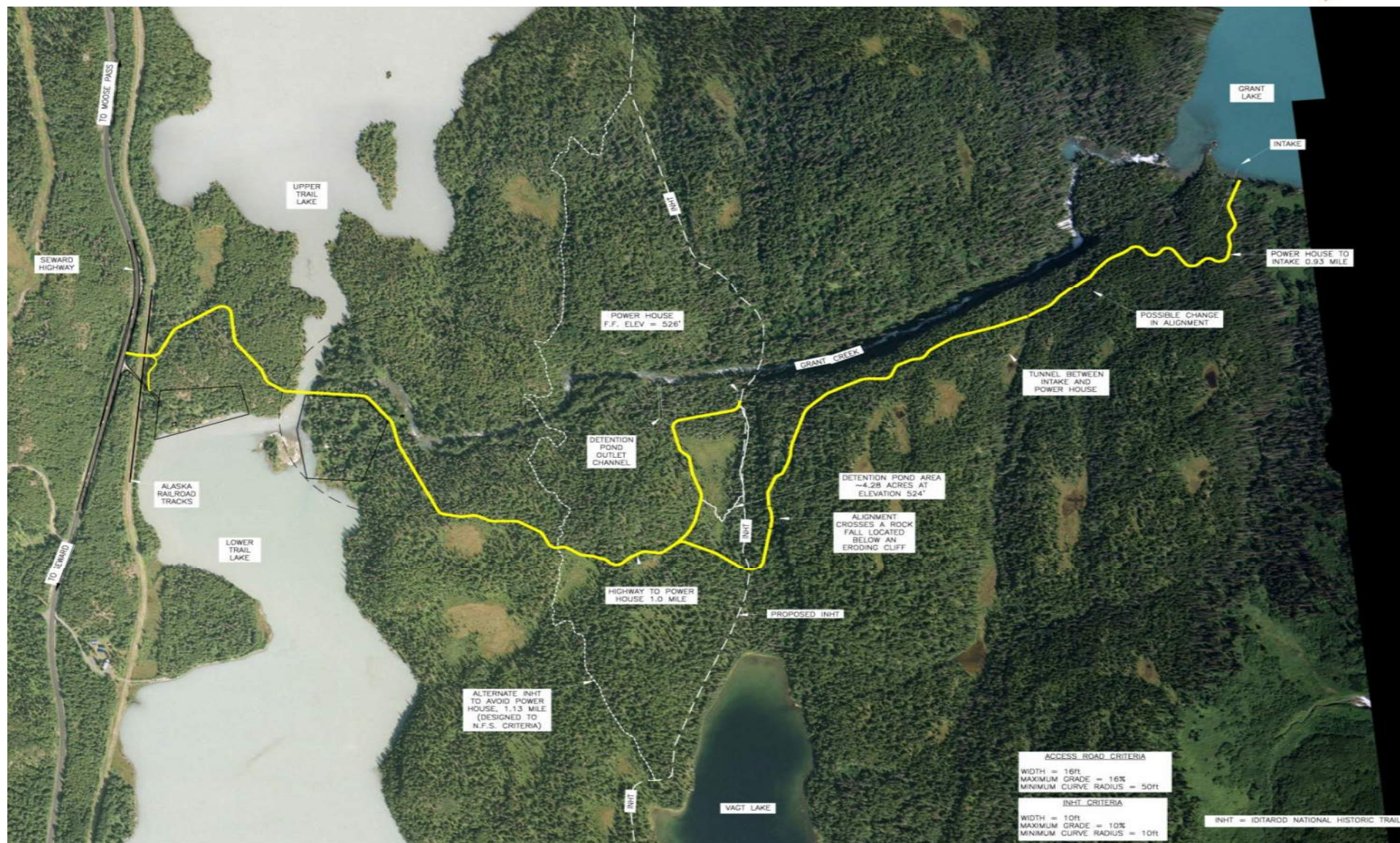
**KENAI HYDRO LLC
GRANT LAKE HYDROELECTRIC
PROJECT**

**GRANT LAKE HYDROELECTRIC
ACCESS ROAD
SOUTH ALTERNATIVE**



DATE	JULY 18, 2010
SCALE	1"=400'

SHEET





TRACKING PROJECT PROGRESS & COMMENTS



Kenai Hydro, LLC website
(www.kenaihydro.com)

FERC E-Subscription Service
(www.ferc.gov)



Sign-up for Email

Receive email alerts of meetings, site updates and important milestones.

► [Sign-up](#)

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What's New

September 15, 2009
[FERC approves KHL's request to use the TLP](#)

Grant Lake/Falls Creek Project Public Meeting

November 12, 2009 6:00 pm
- 9:00 pm

Thank you for visiting the Kenai Hydro Licensing Web site!

Kenai Hydro has developed this Web site to provide a central clearinghouse for information related KHL's activities under preliminary permits for potential hydroelectric projects on the Kenai Peninsula. This Web site will be used to provide regular updates on the project, announce upcoming meetings and events, and will act as repository for documents related to the licensing effort.

Kenai Hydro LLC is jointly owned by [Wind Energy Alaska LLC](#) and [Homer Electric Association \(HEA\)](#). Wind Energy Alaska is an Alaska company dedicated to developing and operating commercial-scale wind energy projects along the state's Railbelt-energy grid and in other areas of Alaska. It is a 50-50-owned subsidiary of [CIRI](#) and [enXco, Inc.](#)

As the project progresses, this site will grow. So please check back often for updates and upcoming meetings. If you would like to receive e-mail updates please fill out our [e-mail sign-up form](#).



**Homer Electric
Association, Inc.**

A Toolik Energy Cooperative

Attachment 2

Filed as Privileged by Kenai Hydro, LLC

Grant Lake Project (P-13212)

- **Attachment 2 of Final INHT Meeting Minutes_Grant Lake_P-13212.pdf**

NOTE: Because of the potentially sensitive nature of the information regarding Cultural Resources, the presentation attached to the minutes is not being distributed to the general public. This document may be obtained by request to Kenai Hydro or FERC, subject to confidentiality provisions.

Attachments: Instream Flow Guidelines Updated April 1 2013.pdf

Importance: High

FYI

From: John Blum [<mailto:john.blum@mcmillen-llc.com>]
Sent: Friday, November 15, 2013 4:00 PM
To: 'Eric Rothwell'; monte.miller@alaska.gov; jeffry.anderson@fws.gov
Cc: Cory Warnock
Subject: HSI curves for Grant Creek
Importance: High

Good afternoon:

We have finished conducting the instream flow study for Grant Creek, and I have just completed model calibration. The next task in hand to develop/select HSI curves for the Grant Creek fish species and life stages of interest.

We were able to obtain a pretty robust set of measurements for sockeye salmon spawning (99 individual spawning pairs), and an adequate sampling coho (43 spawning pairs); however, Chinook were few in Grant Creek and we were only able to obtain 3 sets of measurements of spawning Chinook. We have no measurements for spawning rainbow trout.

As a result, we will need to use literature curves for Chinook salmon and rainbow trout, augment the coho measurements with literature curves, and will need to rely on literature for rearing curves for the species in question. I am most familiar with the HSI curves developed in Washington State for these species; I've had a hand in some of the developed curves, and they are based on studies. Dr. Hal Beecher, WDFW, has done a good job of documenting the number of fish and studies used to develop these HSI curves. I have included a copy of the WDFW/WDOE Instream Flow Guidelines for your review.

Although these are available for use, I am hoping you can assist me in the use of the most appropriate curves for Grant Creek. I know that you are working on other hydropower projects in Alaska. Are there Alaskan curves that you are familiar with that would be more representative for these four species, in the spawning and rearing life history stages? If so, can you provide them to me, please?

Thanks for your help. I am not proposing the use of the WDFW HSI curves, unless there are no other curves that would prove to be more appropriate.

Thanks again, and have a good weekend!

John

John Blum
Sr. Fisheries Scientist

INSTREAM FLOW STUDY GUIDELINES:
Technical and Habitat Suitability Issues
including fish preference curves
UPDATED, April 1, 2013



04-11-007

INSTREAM FLOW STUDY GUIDELINES:

Technical and Habitat Suitability Issues

including fish preference curves

UPDATED, April 1, 2013



By Dr. Hal Beecher
Habitat Program
Department of Fish and Wildlife
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Water Resources
Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

Editing and Appendix Tables and Graphs by
Jim Pacheco
Water Resources
Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

Errata:

May 14 2013. Fixed small stream steelhead rearing curve to remove preference at zero depth and adjusted cutthroat juvenile velocity curve.

INTRODUCTION

The Washington Department of Ecology (Ecology) is charged both with administering state water rights laws and the federal Clean Water Act. Under Washington state law Chapters 90.54 and 90.22 RCW require Ecology to maintain instream flows sufficient to protect and preserve fish and other instream values and beneficial uses. The Department of Ecology (Ecology) is mandated by the Water Resources Act of 1971 (Chapter 90.54 RCW) to maintain base flows¹ “necessary to provide for preservation of wildlife, fish, scenic, aesthetic and other environmental values, and navigational values.” The word “preserve” means to keep from harm, damage, or danger.

Ecology must also meet the antidegradation requirements of Washington’s water quality standards (Chapter 173-201A WAC). This law says existing beneficial uses shall be maintained and protected and no further degradation shall be allowed. The minimum instream flow may not cause any further degradation of beneficial uses such as: fish; fish spawning, rearing and migration; wildlife; recreation; boating; sport fishing; and aesthetics.

Additionally, the minimum instream flow must protect fish, game, birds, and other wildlife, recreational and aesthetic values and water quality (Chapter 90.22 RCW).

The Department of Fish and Wildlife (WDFW) is mandated to “preserve, protect, perpetuate, and manage the wildlife and food fish, game fish ...” (Chapter 77.04.012 RCW); part of this mandate is to protect habitat, including streamflows.

For projects requiring a federal license or permit involving a discharge into navigable waters, a section 401 Water Quality Certification is required under the Clean Water Act. Ecology is required to condition certifications to ensure compliance with state water quality standards and other applicable state law such as Chapters 90.54 and 90.22. This authority under the Clean Water Act allows Ecology to mandate minimum instream flows on hydroelectric projects.

The Washington Department of Fish and Wildlife (WDFW) recommends instream flows as conditions on water rights and Clean Water Act Section 401 certifications on hydroelectric power project licenses or exemptions (issued by the Federal Energy Regulatory Commission - FERC). When a major water project is planned, WDFW and Ecology request that the project proponent conduct an instream flow study in consultation with the agencies to provide adequate information on which to base an instream flow recommendation or requirement. WDFW defines a major water project is a project as:

- a) diverting at least 1.0 cubic feet per second (cfs), and
- b) changing flow by at least 10% of the monthly 90% exceedence flow at any point along the stream channel.

¹ In statute, the term “base flow” is used synonymously with the terms “instream flow” and “minimum instream flow.” “Streamflow” refers to the amount of water flowing in a stream.

The purposes of WDFW's instream flow recommendation are:

1. to avoid reduction of habitat for fish and wildlife;
2. to ensure fish passage upstream and downstream; and
3. to maintain macrohabitat features of the stream channel.

To address fish habitat, WDFW and Ecology request use of an instream flow method which estimates the amount of habitat available at different flows that might occur with and without the proposed project. In most cases, this request is met by using the Physical Habitat Simulation (PHABSIM) program, part of the Instream Flow Incremental Methodology (IFIM), following quality control and model limitations consistent with the Instream Flow Study Guidelines.

A consultation documentation form is provided on the following page. Consultation with appropriate WDFW and Ecology personnel and adherence to the attached IFIM study guidelines during all phases of the instream study is crucial to completion of the study. We request documentation of each step of consultation by signature of a WDFW Habitat Program employee on the form on the following page.

Primary contacts:

WDFW:

Hal Beecher, Instream Flow Biologist	360-902-2421
Bob Vadas, Jr, Instream Flow Biologist	360-902-2594
Jonathan Kohr, Instream Flow Biologist	509-457-9306

Ecology:

Brad Caldwell, Instream Flow Biologist	360-407-6639
Jim Pacheco, Instream Flow Biologist	360-407-7458

Chris Maynard, Water Resources Program

Clean Water Act Section 401 certification and hydroelectric power project licenses	360-407-6641
---	--------------

PROJECT: _____
STREAM: _____
FERC#: _____

Documentation of consultation with WDFW on instream flow studies - all blanks must be signed by WDFW personnel for completion of consultation.

SCOPING

Study site(s) approved _____ date __/__/__
Transects approved _____ date __/__/__
Target measurement flows approved _____ date __/__/__

HYDRAULIC MODEL

Measured flows approved _____ date __/__/__
Hydraulic model approved for the following ranges: date __/__/__

HABITAT PREFERENCE CURVES

Preference curve study design approved (including species, lifestages) _____ date __/__/__
Preference curve study completed _____ date __/__/__
Preference curves approved (copy to be attached) _____ date __/__/__

INSTREAM FLOWS - LIST BY TIME PERIOD:

MONTH/DATE to MONTH/DATE MINIMUM FLOW (cfs)

____/____	to	____/____	_____
____/____	to	____/____	_____
____/____	to	____/____	_____
____/____	to	____/____	_____
____/____	to	____/____	_____
____/____	to	____/____	_____
____/____	to	____/____	_____

FLUSHING FLOW REQUIREMENT - >48 HRS/3 YRS _____ cfs

Approved by Department of Fish and Wildlife

_____ date __/__/__
Instream Flow Biologist

_____ date __/__/__
Regional Habitat Biologist

INSTREAM FLOW STUDY GUIDELINES:

Technical and Habitat Suitability Issues

including Fish Preference Curves

Updated as of April 1, 2013

PURPOSE OF AN INSTREAM FLOW STUDY

Existing or proposed projects often affect flow in a river or stream (i.e., hydropower, irrigation, or municipal/industrial diversions). Washington state resource agencies, including the Washington Department of Ecology (Ecology) and Washington Department of Fish and Wildlife (WDFW) may request studies to evaluate the impacts of altered flow on instream resources, including fish habitat and production, for the purpose of making decisions or recommendations on water use. This report offers guidelines on how to develop, conduct and analyze instream flow studies for determining impacts to fish and fish habitat.

Altered stream flows can impact fish by changing the magnitude, frequency, and/or timing of streamflow. Flow alterations change the availability and type of instream habitat and, in turn, change fish production and fish species composition. A widely used method called the Instream Flow Incremental Methodology (IFIM) (Bovee and Milhous 1978, Bovee 1982, Milhous, et al. 1984, Bovee, et al. 1998) is useful for estimating the streamflows needed to maintain the fish production potential of a stream.

This study provides information about the relationship between streamflow and fish habitat, which can be used in developing instream flow requirements for fish. Four key variables of fish habitat are examined:

- depth
- velocity
- substrate
- cover

IFIM uses several computer models, notably Physical HABitat SIMulation (PHABSIM) to determine how the quantity of fish habitat changes with streamflow.

Stream sites are chosen to represent a specific reach of each river. Field data are collected and entered into the computer model (PHABSIM) to simulate the distribution of water depths and velocities with respect to bottom substrate and overhead cover under a variety of flows. The simulated habitat parameters are then used to generate the quantity of available habitat at each modeled flow; this index is referred to as "weighted usable area" (WUA).

The habitat indexes (Weighted Usable Area or WUA) at each flow correspond to the biological requirements of the fish species and life history stage of interest. Results of an IFIM/PHABSIM

study predict how WUA for each species and lifestage change over a broad range of streamflows. With this fish habitat information and other information such as the hydrology, the resource agencies can recommend instream flows needed to maintain the fish and fish habitat in the stream.

An IFIM study cannot by itself determine the instream flow required by fish populations. The WUA graphs only show whether an increase or decrease in streamflow will increase or decrease the quantity of fish habitat. The study's fish habitat versus streamflow results have to be interpreted by knowledgeable biologists and others to arrive at an instream flow regime that satisfies applicable laws.

Sometimes the IFIM model will predict (for a certain fish species and lifestage) that the maximum amount of available habitat occurs at a flow that is higher than what typically is found during the late summer low flow period. This does not mean the model is incorrect. The model determines whether more or less flow makes more or less fish habitat based on the channel shape (its width and depth) – not on the hydrology (the quantity of flow which changes daily).

Whether an increase in fish habitat truly results in an increase in the fish population depends upon many different factors that affect fish survival. These include fish harvest, ocean survival, water quality, food supply, adult and juvenile fish passage survival, and predation.

A word of caution. IFIM is not a fixed sequence of procedures, but involves a number of important subjective decisions (e.g., transect selection, selection of computer models, and transect weighting). For this reason, the Washington state resource agencies require ongoing consultation during a study, including several meetings and field trips. Studies performed without adequate consultation may be partially or completely rejected, resulting in significant delays in project development.

Ramping Rates and Ramping Rate Studies

Interim ramping rates will be established according to Hunter (1992):

Season	Daylight Rates*	Night Rates
February 16 to June 15 (salmon fry)	No Ramping	2 inches/hour
June 16 to October 31 (steelhead and trout fry)	1 inch/hour	1 inch/hour
November 1 to February 15	2 inches/hour	2 inches/hour
*Daylight is defined as one hour before sunrise to one hour after sunset		

The rate of change of streamflow when diversion is started, stopped, or changed is referred to as the ramping rate. Ramping rates are a concern for fish protection because rapid decrease in flow can strand fish on gravel bars, as well as dewatering fish eggs.

The impacts of flow fluctuation are mitigated by specifying a rate of flow reduction, the ramping rate, and specifying times during the day and year at which ramping can occur. For most projects, a standard interim ramping rate and ramping schedule are provided early in consultation by the agencies. But if the standard ramping rates cannot be met or are determined by the developer to be difficult to meet, then site-specific ramping rate studies can be done. The agencies can assist with identifying transect locations and which critical flows should be measured.

KEY ELEMENTS OF INSTREAM FLOW STUDY

Consultation with the appropriate personnel in state agencies (Washington state Departments of Ecology (Ecology) and Fish and Wildlife (WDFW)) and other resource management agencies (including U.S. Fish and Wildlife Service and National Marine Fisheries Service) and affected Tribal Governments the responsibility of the project proponent at all stages of the study.

Stages of the study include:

- 1) planning or scoping - develop study plan and obtain approval from all parties;
- 2) fish habitat preference curve verification or use of default curves
- 3) field data collection;
- 4) hydraulic model calibration;
- 5) and habitat model runs.

Having approval of the study plan, model calibration, and preference curves and computer options selected by all interested agencies will prevent surprise delays at the end of the process.

PLANNING

Early in the planning phase, when the project is still flexible, the project proponent should schedule a meeting when representatives of all agencies and tribes can attend. At least 2 weeks notice is usually necessary. The purpose of the meeting is to discuss possible project designs and develop a study plan to assess the potential impacts on instream resources.

In preparation for the meeting, the project proponent should conduct a thorough reconnaissance of the stream reach to be affected by the project including downstream from the project to the next major confluence.

Documentation that would expedite agency review and planning include:

- 1) topographical maps with contour intervals no greater than 20 feet;
- 2) identification of areas along the stream that exhibit major morphological changes in the stream bed and/or stream banks;
- 3) graph of elevation plotted against the stream's longitudinal distance;
- 4) low altitude photo mosaic (preferred) or video tape of entire reach (low flow in winter is best if canopy closure is an issue);
- 5) on-the-ground photos or video tape of all habitat types and potential barriers to fish migration (with reference object for scale in pictures of potential barriers);

- 6) list of fish species known or expected in stream reach;
- 7) available hydrological data such as 10%, 50%, and 90% exceedence discharges by month; and information on the source of this data.

The proponent should conduct an instream flow study using PHABSIM or RHABSIM using the 3-flow (velocity regression) IFG4 program and the Dual SDR (Stage Discharge Rating) for the hydraulic model unless otherwise approved in advance by all agencies.

In preparation for the planning meeting or a follow-up site visit, the proponent should select and mark tentative transects to represent all habitats in the affected reach, including ramping rate transects both in the bypass reach and downstream of the powerhouse. A consultant or agency personnel with IFIM experience should select these tentative transects. A site visit should be done under suitable viewing conditions to allow agency representatives to view, modify as needed, and approve placement of transects.

The final product of the planning meeting is a study plan signed by all parties if possible agreeing to the plan. It should be as specific as possible and ensure that all parties understand what is expected from the study. This will allow scheduling and budgeting of the study. It should be amendable only by unanimous agreement of Ecology and WDFW and should seek the agreement of all other parties. The following elements should appear in the study plan:

- 1) hydraulic model(s) to be used (e.g., IFG4, WSP/ IFG2, MANSQ);
- 2) range of flows to be addressed and targeted flows to be measured as calibration flows;
- 3) available hydrographs to be used and any new hydrology to be collected;
- 4) locations of transects and study sites with maps and photos or videos as documentation;
- 5) habitat preference curve verification study plan (see below);
- 6) habitat models to be used (HABSIM or similar model, plunge pool, etc.);
- 7) any limiting factor analysis or time series analysis;
- 8) ramping rate study plan and sites.

FISH HABITAT PREFERENCE CURVE VERIFICATION

An instream flow study is incomplete if the project proponent has not made a reasonable effort to determine fish habitat preference at the study site or an approved substitute site. The study outlined here is a reasonable effort. If, after making a reasonable effort, the project proponent has not compiled enough data to verify or modify agencies' default generalized habitat preference curves, then default curves may be used with agency approval (see below and Appendix for discussion of default preference curves). Preference curve verification will be aimed at selected species and lifestages.

The preference curve verification study consists of three parts:

- 1) determine proportional habitat availability;
- 2) determine fish habitat utilization; and

- 3) analysis of fish preference by determining ratio of habitat utilization to habitat availability.

Useful references for habitat preference curve verification are Orth, Jones, and Maughan (1981), Bovee (1986, Instream Flow Information Paper No. 21), Slauson (1988), and Beecher, Johnson, and Carleton (1993).

Determining habitat availability. In PHABSIM the habitat variables are depth, velocity, substrate, and cover. The simplest way to determine the frequency of different ranges of habitat dimensions is to generate a table of depth and velocities frequencies from PHABSIM based on the streamflow occurring during field measurements. An alternative is to collect enough measurements of depth and velocity to map their distribution.

The frequency of a depth (or velocity or cover or substrate) range will be weighted by the weighting factor(s) for the transect(s) in which it is measured or simulated. If the preference curve verification study reach is smaller than the IFIM study reach, then different weighting factors may be required for determining mesohabitat availability than are used for the IFIM study.

Determining fish habitat utilization. These measurements should not be made during or immediately after habitat availability measurements in order to minimize fish disturbance.

Fish observations should be conducted by one or more snorkelers swimming slowly and cautiously upstream. Snorkelers should avoid disturbing fish. If more than one snorkeler is participating, they should coordinate positions to avoid disturbing fish or double-counting them. Before recording habitat data (depth, velocity, substrate, and cover) where a fish is observed, the snorkeler should determine that the fish is not disturbed. The observation is a good one if fish behavior includes (a) feeding, (b) territorial defense, or (c) returning to the observation point after measurement. (The snorkeler may determine that an observation is a good one even if these behaviors are not observed.) Snorkelers may either measure habitat data as they encounter fish, or they may mark fish positions with weighted flags and return to measure when all fish in the study site have been marked.

Analysis of fish habitat preference. The first stage in data analysis is to determine the final ranges (or bin size, Slauson, 1988) of each habitat dimension to be used. In many studies, small sample size of fish observations will limit how narrow those ranges will be.

Begin by using uniform initial ranges that are a reasonable size for the measurement equipment precision (e.g., 0.1 ft ranges for depth measurement with English unit wading rods). For each initial range, tabulate the proportion of preference curve verification study area that falls within that range. For example, we might find the following distribution of area in X Creek, listed with the observed number of fish (O) in each range:

Depth Interval	Frequency	Observations	Expected	Expected >5
0.00-0.09 ft	1.3%	O= 0	E= 1.13	
0.10-0.19 ft	1.4%	O= 0	E= 1.22	
0.20-0.29 ft	4.3%	O= 0	E= 3.74	E= 6.09
0.30-0.39 ft	4.8%	O= 0	E= 4.18	
0.40-0.49 ft	5.1%	O= 0	E= 4.44	E= 8.62
0.50-0.59 ft	7.8%	O= 1	E= 6.79	E= 6.79
0.60-0.69 ft	9.7%	O= 3	E= 8.44	E= 8.44
0.70-0.79 ft	14.7%	O=23	E=12.79	E=12.79
0.80-0.89 ft	18.2%	O=26	E=15.83	E=15.83
0.90-0.99 ft	15.0%	O=21	E=13.05	E=13.05
1.00-1.09 ft	11.5%	O= 7	E=10.01	E=10.01
1.10-1.19 ft	4.6%	O= 3	E= 4.00	
> 1.19 ft	1.6%	O= 3.	E= 1.39.	E= 5.39.

If the snorkeler had measured depth at 87 fish positions (N=87), the null hypothesis would be that fish were distributed independently of depth and should therefore be distributed at depths proportionally to the frequency with which those depths occur. The null expectation (E) of the number of fish in each depth range would be the product of N and the percent of total area in that depth range (D): $E=ND$. Depth ranges and corresponding values of E for X Creek are listed in the Expected column above.

Ranges will be combined using the criterion that E should be at least 5 in most if not all ranges (a standard derived from Chi-square tests, which may be used in preference curve development). Combining ranges are listed in the Expected >5 column above.

The ratio Observed/Expected (O/E) is calculated, then normalized (see Bovee, 1986) to create the preference factor so that the maximum value of P is 1.00:

Depth Interval with E>5	O/E Ratio	Preference
0.00-0.29 ft	0/6.09= 0.00	P=0.00
0.30-0.49 ft	0/8.62= 0.00	P=0.00
0.50-0.59 ft	1/6.79= 0.15	P=0.08
0.60-0.69 ft	3/8.44= 0.36	P=0.20
0.70-0.79 ft	23/12.79= 1.80	P=1.00
0.80-0.89 ft	26/15.83= 1.64	P=0.91
0.90-0.99 ft	21/13.05= 1.61	P=0.89
1.00-1.09 ft	7/10.01= 0.70	P=0.39
> 1.09 ft	6/5.39= 1.11	P=0.62.

These values of P could then be compared to agency fallback values and a mutually acceptable preference curve could be adopted for the “X” Creek IFIM study.

When sample sizes are small (e.g., $N<20$) a graph of use may appear jagged, but we expect a smooth relationship between depth or velocity and suitability. To better describe the suitability

we sample the distribution repeatedly and average the resulting values, then adjust the average to have a maximum value of 1.00.

Using the fish and depth distribution above as an example, but reducing the number of fish observed (N=19) as follows, we calculate Observed/Expected for each adjacent cluster of depth (or velocity) intervals until the Expected number of fish is at least 5 in the first column, 4 in the second column, 3 in the third column, 2 in the fourth column, and 1 in the fifth column.

Depth interval	Area	Fish	Expected	Observed/Group Expected				
				E>5	E>4	E>3	E>2	E>1
0.00-0.09 ft	1.3%	O=0	0.247	0.153	0	0	0	0
0.10-0.19 ft	1.4%	O=0	0.266	0.153	0	0	0	0
0.20-0.29 ft	4.3%	O=0	0.817	0.153	0	0	0	0
0.30-0.39 ft	4.8%	O=0	0.912	0.153	0	0	0	0
0.40-0.49 ft	5.1%	O=0	0.969	0.153	0	0	0	0
0.50-0.59 ft	7.8%	O=0	1.482	0.153	0	0.301	0	0
0.60-0.69 ft	9.7%	O=1	1.843	0.153	1.294	0.301	1.294	0.543
0.70-0.79 ft	14.7%	O=5	2.793	1.760	1.294	1.760	1.294	1.790
0.80-0.89 ft	18.2%	O=6	3.458	1.760	1.585	1.760	1.735	1.735
0.90-0.99 ft	15.0%	O=4	2.85	1.192	1.585	1.192	1.404	1.404
1.00-1.09 ft	11.5%	O=2	2.185	1.192	0.862	1.192	0.915	0.915
1.10-1.19 ft	4.6%	O= 0	0.874	0.562	0.892	0.849	0.849	0.849
> 1.19 ft	1.6%	O= 1	0.304	0.562	0.892	0.849	0.849	0.849

When we convert the Observed/Expected values to values that peak at 1.00 by dividing each value above by the maximum value in that column, we derive the following:

Depth interval	Area	Fish	Expected	Suitability ((Obs/Exp)/Exp _{max})					Ave.	Final
				E>5	E>4	E>3	E>2	E>1		
0.00-0.09 ft	1.3%	O= 0	0.247	0.087	0	0	0	0	0.017	0.017
0.10-0.19 ft	1.4%	O= 0	0.266	0.087	0	0	0	0	0.017	0.017
0.20-0.29 ft	4.3%	O= 0	0.817	0.087	0	0	0	0	0.017	0.017
0.30-0.39 ft	4.8%	O= 0	0.912	0.087	0	0	0	0	0.017	0.017
0.40-0.49 ft	5.1%	O= 0	0.969	0.087	0	0	0	0	0.017	0.017
0.50-0.59 ft	7.8%	O= 0	1.482	0.087	0	0.171	0	0	0.052	0.052
0.60-0.69 ft	9.7%	O= 1	1.843	0.087	0.816	0.171	0.746	0.303	0.425	0.427
0.70-0.79 ft	14.7%	O=5	2.793	1.000	0.816	1.000	0.746	1.000	0.912	0.918
0.80-0.89 ft	18.2%	O=6	3.458	1.000	1.000	1.000	1.000	0.969	0.994	1.000
0.90-0.99 ft	15.0%	O=4	2.85	0.677	1.000	0.677	0.809	0.784	0.789	0.794
1.00-1.09 ft	11.5%	O= 2	2.185	0.677	0.563	0.677	0.528	0.511	0.591	0.595
1.10-1.19 ft	4.6%	O= 0	0.874	0.319	0.563	0.482	0.489	0.474	0.466	0.468
> 1.19 ft	1.6%	O= 1	0.304	0.319	0.563	0.482	0.489	0.474	0.466	0.468

Fallback preference curves, including those for plunge pools, are listed in the Appendix or are available from the agencies.

Life-stage timing. Timing of spawning and emergence are often important determinants of what flows are required at different times. Temperature can be a critical factor in life-stage timing. Consequently, temperature should be monitored in affected reaches throughout the year. Surveys to determine timing of fry emergence should bracket the times when emergence is expected.

STREAM SIZE DEPENDENT PREFERENCE CURVE ANALYSIS

Recently we determined that habitat suitability or preference varies with stream size. Thus we present fallback habitat suitability criteria (HSCs) stratified by stream size, where stream size is measured as toe-of-bank width near hydraulic controls (see Swift 1976, 1979). Small streams are narrower than 35 ft. Future work on habitat suitability may further discriminate among medium and one or more larger stream size categories.

HYDRAULIC MODEL CALIBRATION

The agencies' first choice of hydraulic models is IFG4 using 3 sets of velocity measurements to establish regressions of velocity with flow and the Dual SDR option. Agencies expect to review a hydraulic model based on measured data (unmodified input). We will consider additional models with minor modifications to the input on a case by case basis. Recently, 2D and 3D hydraulic models have been developed (Leclerc et al. 1995, Hardy 1998) which involve different calibration approaches that have considerable promise over a wide range of flows.

If modifications improve extrapolation (i.e., more realistic velocities and better velocity adjustment factors at higher flows) of IFG4 without deterioration of interpolation, then minor or slight modifications will be accepted.

The agencies request the following material for each hydraulic model calibration run (always include a run with unmodified input):

- (1) field notes;
- (2) input file (bed and water surface elevations, velocities, substrate/cover, and calibration discharges for velocity regression models; bed and water surface elevations, roughness coefficients, substrate/cover, and calibration discharge for step-backwater models. Include both an unmodified and modified version of the input file along with a table of any data modifications.
- (3) tables for each transect of "calibration details" with simulated velocities paired with corresponding measured velocities for each calibration flow (thus, model needs to be run for calibration flow). If several 1-velocity models are being run, please provide tables of measured velocities with predicted velocities (e.g., measured high flow velocities with extrapolated high

flow velocities from medium and low flow models, and similar treatments of medium flow and low flow velocities);

(4) tables of pre and post calibration velocity adjustment factors (VAF) for each transect and each simulated flow over the proposed range of the model;

(5) tables of "computational details" for each simulated flow, including calibration flows;

(6) list of options used in the hydraulic model;

(7) map of site showing placement of numbered transects in relation to pools, riffles, chutes, large boulders, large woody debris, and other channel features; and

(8) table of stage differences between flows and between transects (for example:

	T1	diff	T2	diff	T3
400cfs:	91.20	0.10	91.30	0.15	91.45
diff:	.10		.09		.10
200cfs	91.10	0.11	91.21	0.14	91.35
diff:	.05		.07		.05
100cfs	91.05	0.09	91.14	0.16	91.30

We recommend limiting extrapolation to flows at which all VAFs are between 0.80 and 1.20, and at which no simulated velocities exceed 10.00 feet per second. If it is necessary to model higher or lower flows, additional field work to allow calibration of an additional or extended model will be required.

Where possible, have each transect in the study tied to a common benchmark. We review stages of zero flow in different transects and expect them to make a normal upstream progression. If transects are modeled separately, this test cannot be done and our model review is prolonged.

Other hydraulic models can be considered as needed if conditions preclude a 3-flow IFG4, but these should only be used with prior approval of the agencies.

HABITAT MODEL

A major product of an instream flow study is a set of tables and graphs showing the habitat to stream flow relationship. In PHABSIM and RHABSIM, this is produced by HABITAT or HABSIM program and uses weighted usable area (WUA) as a measure of fish habitat.

PHABSIM accepts 1 Substrate/Cover code in the input file. Separate runs of HABTAT should be run for spawning and rearing lifestages. For biological realism, use cover for rearing and substrate for spawning in those cells where both are recorded.

In contrast, RHABSIM accepts codes for two different attributes. This allows the HABSIM to use substrate for spawning lifestages and cover for rearing lifestages in a single run.

In studies with multiple sites, the tables discussed above should be provided for each site individually and for all sites combined. The combined or composite tables should have results at each site weighted according to the total stream area (including unsampled areas) that it represents.

The final report, in which these tables are presented, should also include:

- (1) the preference curves used with documentation of agency approval; and
- (2) a list of options used in the habitat model.

Plunge pool analysis. In some high-gradient, boulder- or bedrock-channel streams, the only fish habitat is in pools. This approach is based on the following assumptions about habitat quality in pools:

- (1) surface turbulence/bubble plume should cover about half the pool surface, and, as plume coverage increases beyond or decreases below half of pool area, habitat quality will decline rapidly;
- (2) pool area not covered by surface turbulence/bubble plume is valuable as habitat when depth equals or exceeds 0.5 ft or 10% of pool width, whichever is greater, but any depth over 3.0 ft should be considered usable, subject to preference verification;
- (3) spawning habitat response to changes in flow in pools is best assessed by using standard IFIM transects with depth, velocity, and substrate measurements near the tail of pools.

Pool habitat for juvenile and adult trout should be calculated as follows:

$$\text{Habitat} = \text{area of calm, deep water} \times \text{preference for ratio of plume area to calm, deep area (see Table 13).}$$

The field method for plunge pool analysis requires establishment of permanent transects and vertical depth measurement points ("verticals") along the transects. We recommend at least 3 transects. Record distances between transects. These transects should be visited at several different flows of interest. At each flow, depth should be measured at verticals up to 3.0 ft deep. Depths should be recorded with corresponding distances along the transect. The person conducting the field work should (a) identify the boundaries between plume and calm water and (b) record the distances along each transect where they occur. If velocity is substantially greater than 1 fps, that point might be considered to be in the plume if the boundary is not otherwise obvious.

Photographs from the same high vantage point should be taken at each measurement. Colored flags at reference points along each transect will facilitate interpretation of photographs.

Feeding Station Analysis. - The state agencies no longer consider this method to be a suitable alternative to calculation of WUA (see also Annear et al., 2004). Use of this method is no longer recommended because it has had less validation of assumptions than PHABSIM.

INTERPRETATION OF HABITAT MODELS AND DEVELOPMENT OF INSTREAM FLOW RECOMMENDATIONS

The agencies will recommend instream flows which will not reduce habitat for the most flow-sensitive species and relevant life stage in a given month. Flow recommendations based on model results (PHABSIM, RHABSIM, plunge pool, etc.) are subject to field verification or "ground-truthing".

This approach has been oversimplified to "recommending the peak of the WUA vs. flow curve." However, our recommendations are tempered by:

- 1) our knowledge of site hydrology and effects of hydrology on fish (e.g., scouring of redds and incubation flows),
- 2) agency management objectives and risk to species (e.g., greater emphasis on rainbow trout than on the more numerous mountain whitefish that typically occupy deeper, faster water), and
- 3) on modeled responses of coexisting species to flow.

For a more detailed discussion of agency considerations in interpretation of studies and development of recommendations, see Annear, et al. (2004).

Hydrology affects fish in several ways. High flows interact with geology and vegetation to form and maintain the channel, including depth, cover, and substrate quality. High flows also stimulate migrations upstream and downstream in migratory salmonids. The significance of high flows is discussed in more detail by Wald (2009). The Departments of Fish and Wildlife and Ecology recognize the following principles and standards based on Wald's recommendations.

Fish migration and spawning flows – High flow pulses to facilitate salmon spawning and migration should provide adequate water temperature, sufficient flow depth, appropriate seasonality and diurnal conditions, and sufficient flow duration for adult fish to migrate upstream to suitable spawning or holding areas and for juvenile fish to migrate downstream when necessary. Needed magnitude, frequency, and duration depend on fish stock and stream. Review of hydrological record and any fish count data available may be required to develop site-specific recommendations. Vadas (2000) has found that flows suitable for spawning are often conducive to upstream migration.

Flushing flows – Flushing flows to improve gravel quality for spawning and incubation habitat provide the greatest benefit when they occur at the beginning of spawning seasons. Flushing flows in the fall remove organic matter and fines that accumulate during the summer. Flushing flows in the spring provide migration flows while they reduce the amount of fines in spawning gravels. The departments of Fish and Wildlife and Ecology recommend preserving or providing

the mean annual discharge as a flushing flow for 6 to 12 hours duration during specified seasons and at intervals of at least 2 per year if not provided naturally. Release rates should be controlled according to specified ramping rates (Hunter 1992).

Channel maintenance flows - Channel maintenance flows for activating geomorphic processes are greater in magnitude and duration than flows necessary for initiation of bedload movement. The departments of Fish and Wildlife and Ecology recommend preserving or providing the 2-year frequency peak flow or 200% of mean annual discharge for at least 24 hours duration at specified seasons as a channel maintenance flow at intervals of 2 years if not provided naturally. The 2-year frequency peak flow should be based on natural hydrology, not hydrology modified by extensive increases in impervious surface nor other hydrologic modifications. Release rates should be controlled according to specified ramping rates (Hunter 1992).

Channel forming flows –The departments of Fish and Wildlife and Ecology recommend preserving or providing the 10-year frequency peak flow for at least 24 hours duration at specified seasons as a channel forming flow at intervals of 10 years if not provided naturally. The 10-year frequency peak flow should be based on natural hydrology, not hydrology modified by extensive increases in impervious surface nor other hydrologic modifications. Release rates should be controlled according to specified ramping rates (Hunter 1992).

Time-series analysis. Project proponents may wish to do time-series analysis (Milhous 1986). Evaluation of changes in habitat over time as well as changing habitat needs over time is an important consideration for rearing fish. The agencies neither request nor endorse the use of time-series models. However, if requested to consider results of such analysis, agencies will accept them only over the range of flows for which the hydraulic model is accepted by the agencies. In addition, any time-series of alternative flow regimes must incorporate a temperature-based metabolic factors, i.e., the habitat-temperature index (HTI), into the analysis, as follows:

If two different flow regimes, A and B, lead to two different amounts of WUA, WUA(A) and WUA(B), at a given time, we can compare WUA(A) and WUA(B) as they are affected by temperature. $HTI = 2^{(T/10)}$, where T is water temperature in degrees C at that season. The comparison of interest is WUA(A)/HTI vs WUA(B)/HTI. HTI need not be used for spawning or incubation.

RAMPING RATE STUDIES

Information needed for ramping rate determination includes: (1) identification of critical stranding sites, (2) determination of stage-discharge relationship at critical sites, (3) determination of travel time for a block of water traveling through a reach of interest, and (4) determination of attenuation of stage change over distance at different flows. Much of this information can be gathered conveniently and concurrently with PHABSIM studies. Critical sites are sites where juvenile fish are most likely to be stranded if stage is reduced rapidly. This can happen where the stream is wide and the cross section has a relatively flat slope, typically at a gravel bar or sand bar.

The applicant should identify potential critical sites both within the bypass reach and downstream from the powerhouse site. Following tentative critical site selection, agency personnel should be shown sites so that they can make a final decision on sites and transects.

The applicant should conduct a series of stage-discharge measurements at each critical site transect. A 3-flow stage discharge model that covers the range of flows over which the ramping events are expected to occur would be adequate. A detailed cross-sectional profile should be determined by surveying elevations along each critical site transect. Stage-discharge measurements should identify critical flows, such as flows that coincide with inflection points on the cross-sectional profile. Stage-discharge relationships will provide a basis for ramping rates by showing what change in depth is produced by what change in flow.

Dye studies should be used to give a preliminary estimate of travel time for a block of water from a release point, either at the diversion structure or powerhouse, to each critical site. Dye studies should be conducted over a range of flows to evaluate the influence of discharge on travel time. These will provide a preliminary estimate of necessary duration of flow continuation at the powerhouse to prevent reaches from drying up in the event of an emergency shut-down.

Data developed in these studies will be the basis for interim ramping rate recommendations. Additional studies, including test ramps with measurements of depth change at critical site transects, will be required once the facility is constructed. They will be the basis for operational ramping rates.

MONITORING

Monitoring the effects of flow regime (e.g., fish population response, attainment of flows, and channel conditions including passage) will be required. The agencies may recommend changes in flow regime based on the monitoring results.

REFERENCES

- Annear, T., I. Chisholm, H. Beecher, A. Locke, and 12 other coauthors. 2004. Instream Flows for Riverine Resource Stewardship, revised edition. Published by the Instream Flow Council, Cheyenne, WY.
- Beecher, H.A., B.A. Caldwell, and S.B. DeMond. 2002. Evaluation of depth, velocity, substrate, and cover preferences of juvenile coho salmon (*Oncorhynchus kisutch*) in Washington streams. *North American Journal of Fisheries Management* 22 (3): 785-795.
- Beecher, H.A., B.A. Caldwell, S.B. DeMond, D. Seiler, and S.N. Boessow. 2010. An empirical assessment of PHABSIM using long-term monitoring of coho salmon smolt production in Bingham Creek, Washington. *North American Journal of Fisheries Management* 30 (6): 1529-1543.
- Beecher, H.A., T.H. Johnson, and J.P. Carleton. 1993. Predicting microdistributions of steelhead parr (*Oncorhynchus mykiss*) parr from depth and velocity preference criteria: test of an assumption of the Instream Flow Incremental Methodology. *Canadian Journal of Fisheries and Aquatic Sciences* 50 (11): 2380-2387.
- Bovee, K.D. 1982. A guide to stream habitat analysis using the instream flow incremental methodology. Instream Flow Information Paper 12. U.S. Fish and Wildlife Service FWS/OBS-82/26. 248 pp.
- Bovee, K.D. 1986. Development and evaluation of habitat suitability criteria for use in the Instream Flow Incremental Methodology. Instream Flow Information Paper 21. U.S. Fish and Wildlife Service Biological Report 86(7). 235 pp.
- Bovee, K.D., and R.T. Milhous. 1978. Hydraulic simulation in instream flow studies: theory and technique. Instream Flow Information Paper 5. U.S. Fish and Wildlife Service FWS/OBS-78/33. 130 pp.
- Bovee, K.D., B.L. Lamb, J.M. Bartholow, C.B. Stalnaker, J. Taylor, and J. Henriksen. 1998. Stream habitat analysis using the Instream Flow Incremental Methodology. U.S. Geological Survey, Biological Resources Division Information and Technology Report USGS/BRD-1998-0004. viii+131 pp.
- Caldwell, J, B Caldwell and K Bruya. 1987. Documentation and rationale for preference curves for IFIM studies. Unpublished. State of Washington Department of Fisheries and State of Washington Department of Ecology.
- Campbell, Ronald F. and Jeffery Neuner. 1985. Seasonal and Diurnal Shifts in Habitat Utilized by Resident Rainbow Trout (*Salmo gairdneri*) Observed in Western Washington Cascade Mountain Streams. Symposium on Small Hydropower and Fisheries, Denver, CO May 1-3, 1985
- Campbell, R. 2003. Personal Communication. R2 Resource Consultants.

- Hanrahan, T.P., D.D. Dauble, and D.R. Geist. 2004. An estimate of chinook salmon (*Oncorhynchus tshawytscha*) spawning habitat and redd capacity upstream of a migration barrier in the upper Columbia River. *Canadian Journal of Fisheries and Aquatic Sciences* 61 (1): 23-33.
- Hardy, T.B. 1998. The future of habitat modeling and instream flow assessment techniques. *Regulated Rivers: Research and Management* 14 (5): 405-420.
- Hunter, M.A. 1992. Hydropower flow fluctuations and salmonids: a review of the biological effects, mechanical causes, and options for mitigation. State of Washington Department of Fisheries Technical Report No. 119. Olympia. 46 pp.
- Jackson, W.L., B. Shelby, A. Martinez, and B.P. Van Haveren. 1989. An interdisciplinary process for protecting instream flows. *Journal of Soil and Water Conservation* 44 (2): 121-126.
- Leclerc, M., A. Boudreault, J.A. Bechard, and G. Corfa. 1995. Two-dimensional hydrodynamic modeling: a neglected tool in the instream flow incremental methodology. *Transactions of the American Fisheries Society* 124 (5): 645-662.
- Locke, A. 2002. Alberta Sustainable Resource Development. Preference curves developed through a Delphi process to facilitate ongoing evaluations of the South Saskatchewan River Basin in Alberta. Cochrane, AB.
- Milhous, R.T. 1986. Development of a habitat time series. *Journal of Water Resources Planning and Management* 112: 145-148.
- Milhous, R.T., D.L. Wegner, and T. Waddle. 1984. User's guide to the Physical Habitat Simulation System. Instream Flow Information Paper No. 11. U.S. Fish and Wildlife Service FWS/OBS-81/43.
- Orth, D.J., R.N. Jones, and O.E. Maughan. 1981. Considerations in the development of curves for habitat suitability criteria. Pp. 124-133 in: N.B. Armantrout (ed.), Acquisition and utilization of aquatic habitat inventory information. Western Division, American Fisheries Society.
- Slauson, W.L. 1988. Constructing suitability curves from data. Pp. 225-258 in: K. Bovee and J.R. Zuboy (eds.), Proceedings of a workshop on the development and evaluation of habitat suitability criteria. U.S. Fish and Wildlife Service Biological Report 88(11). 407 pp.
- Swift, C.H. III. 1976. Estimation of stream discharges preferred by steelhead trout for spawning and rearing in western Washington. U.S. Geological Survey Open-File Report 75(155): 50 pp.
- Swift, C.H. III. 1979. Preferred stream discharges for salmon spawning and rearing in Washington. U.S. Geological Survey Open-File Report 77(422): 51 pp.
- Vadas, R.L., Jr. 2000. Instream-flow needs for anadromous salmonids and lamprey on the Pacific coast, with special reference to the Pacific Southwest. *Environmental Monitoring and Assessment* 64: 331-358.

Wald, A.R. 2009. High flows for fish and wildlife in Washington. Washington Department of Fish and Wildlife, Report of Investigations in Instream Flow, Olympia. 30 pp.
http://wdfw.wa.gov/habitat/science_data.html

INSTREAM FLOW STUDY GUIDELINES

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Appendix Notes

Tables and figures in this appendix list the WDFW and Ecology recommended preference codes and values for instream flow modeling using PHABSIM or RHABSIM models. These values are based on habitat suitability studies, in which WDFW and/or Ecology staff (or individuals following WDFW-Ecology study guidelines) recorded the depth, velocity, and substrate used by fish in a study reach and compared these observed results to the measured percent availability of different depths, velocities, or substrates in that study reach.

Recommended Preferences do not always accurately reflect local conditions. Therefore these preference values should only be used after consultation with and written agreement of WDFW and/or Ecology instream flow biologists.

Cover/Substrate preference tables and coding

Table 1 lists codes 0.1 through 0.9, which are cover codes, and 1 through 9, which are components of the substrate code. Adjacent to each code are the recommended preference factors used to determine preference value.

Substrate codes use the format “ab.c” where “a” is the component code for dominant particle size (i.e. the type of substrate that covers greatest area of bottom surface in a particular cell, not necessarily the largest diameter particle; e.g., sand may be dominant over cobble), “b” is the component code for the subdominant particle size, and “c” is tenths of cell area covered by dominant (50% or greater) substrate type. For example, the code 46.8 indicates 80% medium gravel and 20% small cobble.

Cover codes use the format 0.c, where “c” defines the type of cover. For example, 0.1 is an undercut bank, 0.2 is overhanging vegetation, etc.

Since PHABSIM can only accept 1 Cover/Substrate code, separate data decks should be developed for spawning and rearing lifestages. For biological realism, use cover for rearing and substrate for spawning in those cells where both are recorded.

RHABSIM can accept codes for two different attributes. This allows the user to choose one attribute (e.g. substrate) for the spawning lifestages and the other attribute (e.g cover) for the rearing lifestages in a single data deck. But care must be taken to properly set up and assign the attributes in the HYDSIM program.

Recommended Preference (RP) in substrate tables 2 through 6 are calculated from generic preferences in **Table 1** according to the following equation:

$$RP = c * Pa + (1-c) * Pb$$

where RP is the preference factor, Pa is the preference factor for substrate component “a” in Table 1, and Pb is the preference factor for substrate component “b” in Table 1. Exceptions are noted by an asterisk.

Exceptions: There are many exceptions to the RP equation based on biological considerations. For example, if the dominant substrate was silt, clay, or organic (component code 1), or sand (component code 2), the substrate was assigned a RP of 0.00, regardless of the suitability of the subdominant component. Moreover, if the subdominant substrate was silt, clay, or organic, or sand made up 30% or more of the substrate, the RP was assigned a value of 0.00, regardless of the quality of the dominant substrate, due to the smothering effect of fine substrates.

For salmonid spawning, the presence of bedrock (code 9) always resulted in a RP of 0.00, and in most cases, the presence of boulders (code 8) and for rainbow trout, large cobble (code 7) also resulted in an RP of 0.00 due to the inability of the fish to dig through, or move the substrate.

For salmonid juvenile rearing, boulders (component code 8) were found to be extremely valuable. Any presence of boulder, whether dominant or subdominant, results in a RP of 1.00.

Every code combination is neither listed nor necessary. When there is a gap, PHABSIM and RHABSIM assume a straight line between entered codes. For example, Table 2 lists the codes 47.5 (RP 0.75) and 47.9 (RP 0.95). If a value for 47.7 were needed, PHABSIM or RHABSIM would derive a RP of 0.85.

Another case is with redundant codes. A redundant code occurs when 100% of the substrate is of one type. If the substrate is 100% small gravel, any code between 33.5 - 33.9 could be used. By convention, redundant codes use the format aa.9.

Depth and velocity preference curves

Figures 1a-21b show the various recommended preference curves along with the coordinates used to make the curves. When available, the calculated preference curve and coordinates are provided to show the observed/expected calculations (see pages 10-12 under the heading Analysis of fish habitat preference) along with sample size and study locations. In these cases, recommended preference curves represent smoothed versions of the calculated preference curves. Smoothing of preference coordinates is based on professional judgment and observations from studies of wild fish. Such smoothing removed stair-stepped patterns at the upper and lower ends of the hydraulic distributions, by setting zero depth to zero suitability and spreading the sum of raw suitabilities out over the more-proximal categories.

Some of the “Calculated depth preference curves” show habitat value in a depth interval that includes 0.00 ft. This is a consequence of grouped observations and weighted calculations. Recommended Preferences begin with calculated suitabilities that are then adjusted based on actual observations and professional judgment.

Depth and velocity preference curves are being revised continually as new data are obtained and analyzed. Please contact the Department of Ecology or WDFW for the most recent preference curves for salmon, trout, and other game fishes.

TABLE 1. Generic Cover/Substrate Codes and Preference Values¹

Code	type of cover Note: Cover Codes are not used for spawning	Rearing					
		fry	juvenile				
00.1	undercut bank	1.00	1.00				
00.2	overhanging vegetation near or touching water ²	1.00	1.00				
00.3	rootwad (including partly undercut)	1.00	1.00				
00.4	log jam/submerged brush pile	1.00	1.00				
00.5	log(s) parallel to bank	0.30	0.80				
00.6	aquatic vegetation	1.00	0.80				
00.7	short (<1') terrestrial grass	0.40	0.10				
00.8	tall (>3') dense grass ³	0.70	0.70				
00.9	vegetation > 3 vertical ft above SZF	0.20	0.20				
Code	type of substrate	Spawning				Rearing	
		salmon	steelhead ⁴	resident trout	native char ⁵	fry	juvenile
1	silt, clay, or organic	0.00	0.00	0.00	0.00	0.10	0.10
2	sand	0.00	0.00	0.00	0.00	0.10	0.10
3	sm gravel (.1-.5")	0.30	0.50	0.80	1.00	0.10	0.10
4	med gravel (.5-1.5")	1.00	1.00	1.00	1.00	1.00	0.30
5	lrg gravel (1.5-3")	1.00	1.00	0.80	1.00	1.00	0.30
6	sm cobble (3-6")	1.00	1.00	0.50	0.70	1.00	0.50
7	lrg cobble (6-12")	0.50	0.30	0.00	0.70	1.00	0.70
8	boulder (>12")	0.00	0.00	0.00	0.00	1.00	1.00
9	bedrock	0.00	0.00	0.00	0.00	0.10	0.30

¹ This table reflects average values for the listed species. Site specific preferences would supersede this table.

² This includes low tree branches (<3 vertical ft above water surface elevation at stage of zero flow (SZF)) and bushes overhanging the bank-full water's edge.

³ This category refers to stout, almost bushy type grasses such as reed canary grass up to the bank-full water's edge.

⁴ This category includes intermountain and coastal cutthroat (*Oncorhynchus clarki*).

⁵ This category includes Bull Trout (*Salvelinus confluentus*) and Dolly Varden (*S. malma*).

TABLE 2. Complete Salmon Spawning Substrate Preference¹ Table

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
00.0	Cover codes are not factors for spawning habitat		
00.1			
00.2			
00.3			
00.4			
00.5			
00.6			
00.7			
00.8			
00.9			
11.9 ²	0.00	0.00	0.00
13.9	0.00	0.30	0.00*
17.9	0.00	0.30	0.00*
18.5	0.00	0.00	0.00
21.5	0.00	0.00	0.00
23.9	0.00	0.30	0.00*
27.9	0.00	0.50	0.00*
28.5	0.00	0.00	0.00
29.9	0.00	0.00	0.00
31.5	0.30	0.00	0.00*
31.7	0.30	0.00	0.00*
31.8	0.30	0.00	0.24
31.9	0.30	0.00	0.27
32.5	0.30	0.00	0.00*
32.7	0.30	0.00	0.00*
32.8	0.30	0.00	0.24
32.9	0.30	0.00	0.27
33.9	0.30	0.30	0.30
34.5	0.30	1.00	0.65
34.9	0.30	1.00	0.37
35.5	0.30	1.00	0.65
35.9	0.30	1.00	0.37
36.5	0.30	1.00	0.65
36.9	0.30	1.00	0.37
37.5	0.30	0.50	0.40
37.9	0.30	0.50	0.32
38.5	0.30	0.00	0.15
38.9	0.30	0.00	0.27
39.5	0.30	0.00	0.00*
39.9	0.30	0.00	0.00*
41.5	1.00	0.00	0.00*
41.7	1.00	0.00	0.00*
41.8	1.00	0.00	0.80
41.9	1.00	0.00	0.90
42.5	1.00	0.00	0.00*
42.7	1.00	0.00	0.00*
42.8	1.00	0.00	0.80
42.9	1.00	0.00	0.90
43.5	1.00	0.30	0.65
43.9	1.00	0.30	0.93
44.9	1.00	1.00	1.00
46.9	1.00	1.00	1.00
47.5	1.00	0.50	0.75
47.9	1.00	0.50	0.95
48.5	1.00	0.00	0.5
48.9	1.00	0.00	0.9
49.5	1.00	0.00	0.00*
49.9	1.00	0.00	0.00*
51.5	1.00	0.00	0.00*
51.7	1.00	0.00	0.00*
51.8	1.00	0.00	0.80
51.9	1.00	0.00	0.90
52.5	1.00	0.00	0.00*
52.7	1.00	0.00	0.00*
52.8	1.00	0.00	0.80
52.9	1.00	0.00	0.90
53.5	1.00	0.30	0.65
53.9	1.00	0.30	0.93
54.5	1.00	1.00	1.00
56.9	1.00	1.00	1.00
57.5	1.00	0.50	0.75
57.9	1.00	0.50	0.95
58.5	1.00	0.00	0.5
58.9	1.00	0.00	0.9
59.5	1.00	0.00	0.00*
59.9	1.00	0.00	0.00*

¹ Assume straight line between codes. Values are derived from RP equation (see pg. 19).

² Substrate code section begins at 11.9. This is an example of a redundant code (see pg 20).

* Asterisk indicated deviation from the RP formula.

Table 2 Continued

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
61.5	1.00	0.00	0.00*
61.7	1.00	0.00	0.00*
61.8	1.00	0.00	0.80
61.9	1.00	0.00	0.90
62.5	1.00	0.00	0.00*
62.7	1.00	0.00	0.00*
62.8	1.00	0.00	0.80
62.9	1.00	0.00	0.90
63.5	1.00	0.30	0.65
63.9	1.00	0.30	0.93
64.5	1.00	1.00	1.00
66.9	1.00	1.00	1.00
67.5	1.00	0.50	0.75
67.9	1.00	0.50	0.95
68.5	1.00	0.00	0.50
68.9	1.00	0.00	0.90
71.7	0.50	0.00	0.00*
71.8	0.50	0.00	0.40
71.9	0.50	0.00	0.45
72.5	0.50	0.00	0.00*
72.7	0.50	0.00	0.00*
72.8	0.50	0.00	0.40
72.9	0.50	0.00	0.45
73.5	0.50	0.30	0.40
73.9	0.50	0.30	0.48
74.5	0.50	1.00	0.75
74.9	0.50	1.00	0.55
75.5	0.50	1.00	0.75
75.9	0.50	1.00	0.55
76.5	0.50	1.00	0.75
76.9	0.50	1.00	0.55
77.9	0.50	0.50	0.50
78.5	0.50	0.00	0.25
78.9	0.50	0.00	0.45
79.5	0.50	0.00	0.00*
79.9	0.50	0.00	0.00*
81.5	0.00	0.00	0.00
82.9	0.00	0.00	0.00
83.5	0.00	0.30	0.00*
87.9	0.00	0.50	0.00*
88.9	0.00	0.00	0.00
92.9	0.00	0.00	0.00
93.5	0.00	0.30	0.00*
97.9	0.00	0.50	0.00*

98.5	0.00	0.00	0.00
99.9	0.00	0.00	0.00

TABLE 3. Complete Juvenile Salmon and Trout Cover/Substrate Preference¹ Table

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
00.1	a & b values are not used to determine cover preference		1.00
00.2			1.00
00.3			1.00
00.4			1.00
00.5			0.80
00.6			0.80
00.7			0.10
00.8			0.70
00.9			0.20
11.9 ²	0.10	0.10	0.10
13.9	0.10	0.10	0.10
14.5	0.10	0.30	0.20
14.9	0.10	0.30	0.12
15.5	0.10	0.30	0.20
15.9	0.10	0.30	0.12
16.5	0.10	0.50	0.30
16.9	0.10	0.50	0.14
17.5	0.10	0.70	0.40
17.9	0.10	0.70	0.16
18.5	0.10	1.00	1.00*
18.9	0.10	1.00	1.00*
19.5	0.10	0.30	0.20
19.9	0.10	0.30	0.12
21.5	0.10	0.10	0.10
23.9	0.10	0.10	0.10
24.5	0.10	0.30	0.20
24.9	0.10	0.30	0.12
25.5	0.10	0.30	0.20
25.9	0.10	0.30	0.12
26.5	0.10	0.50	0.30
26.9	0.10	0.50	0.14
27.5	0.10	0.70	0.40
27.9	0.10	0.70	0.16
28.5	0.10	1.00	1.00*
28.9	0.10	1.00	1.00*
29.5	0.10	0.30	0.20

29.9	0.10	0.30	0.12
31.5	0.10	0.10	0.10
33.9	0.10	0.10	0.10
34.5	0.10	0.30	0.20
34.9	0.10	0.30	0.12
35.5	0.10	0.30	0.20
35.9	0.10	0.30	0.12
36.5	0.10	0.50	0.30
36.9	0.10	0.50	0.14
37.5	0.10	0.70	0.40
37.9	0.10	0.70	0.16
38.5	0.10	1.00	1.00*
38.9	0.10	1.00	1.00*
39.5	0.10	0.30	0.20
39.9	0.10	0.30	0.12
41.5	0.30	0.10	0.20
41.9	0.30	0.10	0.28
42.5	0.30	0.10	0.20
42.9	0.30	0.10	0.28
43.5	0.30	0.10	0.20
43.9	0.30	0.10	0.28
44.9	0.30	0.30	0.30
45.9	0.30	0.30	0.30
46.5	0.30	0.50	0.40
46.9	0.30	0.50	0.32
47.5	0.30	0.70	0.50
47.9	0.30	0.70	0.34
48.5	0.30	1.00	1.00*
48.9	0.30	1.00	1.00*
49.5	0.30	0.30	0.30
49.9	0.30	0.30	0.30
51.5	0.30	0.10	0.20
51.9	0.30	0.10	0.28
52.5	0.30	0.10	0.20
52.9	0.30	0.10	0.28
53.5	0.30	0.10	0.20
53.9	0.30	0.10	0.28
54.5	0.30	0.30	0.30
55.9	0.30	0.30	0.30
56.5	0.30	0.50	0.40
56.9	0.30	0.50	0.32
57.5	0.30	0.70	0.50
57.9	0.30	0.70	0.34

¹ Assume straight line between codes. Values are derived from RP equation (see pg 19).

² Substrate code section begins at 11.9. This is an example of a redundant code (see pg 20).

* Asterisk indicated deviation from the RP formula.

Table 3 Continued

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
58.5	0.30	1.00	1.00*
58.9	0.30	1.00	1.00*
59.5	0.30	0.30	0.30
59.9	0.30	0.30	0.30
61.5	0.50	0.10	0.30
61.9	0.50	0.10	0.46
62.5	0.50	0.10	0.30
62.9	0.50	0.10	0.46
63.5	0.50	0.10	0.30
63.9	0.50	0.10	0.46
64.5	0.50	0.30	0.40
64.9	0.50	0.30	0.48
65.5	0.50	0.30	0.40
65.9	0.50	0.30	0.48
66.9	0.50	0.50	0.50
67.5	0.50	0.70	0.60
67.9	0.50	0.70	0.52
68.5	0.50	1.00	1.00*
68.9	0.50	1.00	1.00*
69.5	0.50	0.30	0.40
69.9	0.50	0.30	0.48
71.5	0.70	0.10	0.40
71.9	0.70	0.10	0.64
72.5	0.70	0.10	0.40
72.9	0.70	0.10	0.64
73.5	0.70	0.10	0.40
73.9	0.70	0.10	0.64
74.5	0.70	0.30	0.50
74.9	0.70	0.30	0.66
75.5	0.70	0.30	0.50
75.9	0.70	0.30	0.66
76.5	0.70	0.50	0.60
76.9	0.70	0.50	0.68
77.9	0.70	0.70	0.70
78.5	0.70	1.00	1.00*
78.9	0.70	1.00	1.00*
79.5	0.70	0.30	0.50
79.9	0.70	0.30	0.66
81.5	1.00	0.10	1.00*
87.9	1.00	0.70	1.00*
88.9	1.00	1.00	1.00
89.5	1.00	0.30	1.00*
89.9	1.00	0.30	1.00*
91.5	0.30	0.10	0.20

91.9	0.30	0.10	0.28
92.5	0.30	0.10	0.20
92.9	0.30	0.10	0.28
93.5	0.30	0.10	0.20
93.9	0.30	0.10	0.28
94.5	0.30	0.30	0.30
95.9	0.30	0.30	0.30
96.5	0.30	0.50	0.40
96.9	0.30	0.50	0.32
97.5	0.30	0.70	0.50
97.9	0.30	0.70	0.34
98.5	0.30	1.00	1.00*
98.9	0.30	1.00	1.00*
99.9	0.30	0.30	0.30

**TABLE 4. Complete Steelhead
(Oncorhynchus mykiss) Spawning Substrate
Preference¹**

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
00.0	Cover codes are not factors for spawning habitat		
00.1			
00.2			
00.3			
00.4			
00.5			
00.6			
00.7			
00.8			
00.9			
11.9 ²	0.00	0.00	0.00
13.9	0.00	0.50	0.00*
14.5	0.00	1.00	0.00*
16.9	0.00	1.00	0.00*
17.5	0.00	0.30	0.00*
17.9	0.00	0.30	0.00*
18.5	0.00	0.00	0.00
21.5	0.00	0.00	0.00
23.9	0.00	0.50	0.00*
27.9	0.00	0.30	0.00*
28.5	0.00	0.00	0.00
29.9	0.00	0.00	0.00
31.5	0.50	0.00	0.00*
31.7	0.50	0.00	0.00*
31.8	0.50	0.00	0.40
31.9	0.50	0.00	0.45
32.5	0.50	0.00	0.00*
32.7	0.50	0.00	0.00*
32.8	0.50	0.00	0.40
32.9	0.50	0.00	0.45
33.9	0.50	0.50	0.50
34.5	0.50	1.00	0.75
34.9	0.50	1.00	0.55
35.5	0.50	1.00	0.75
35.9	0.50	1.00	0.55
36.5	0.50	1.00	0.75

36.9	0.50	1.00	0.55
37.5	0.50	0.30	0.40
37.9	0.50	0.30	0.48
38.5	0.50	0.00	0.00*
38.9	0.50	0.00	0.00*
39.5	0.50	0.00	0.00*
39.9	0.50	0.00	0.00*
41.5	1.00	0.00	0.00*
41.7	1.00	0.00	0.00*
41.8	1.00	0.00	0.80
41.9	1.00	0.00	0.90
42.5	1.00	0.00	0.00*
42.7	1.00	0.00	0.00*
42.8	1.00	0.00	0.80
42.9	1.00	0.00	0.90
43.5	1.00	0.50	0.75
43.9	1.00	0.50	0.95
44.5	1.00	1.00	1.00
44.9	1.00	1.00	1.00
46.9	1.00	1.00	1.00
47.5	1.00	0.30	0.65
47.9	1.00	0.30	0.93
48.5	1.00	0.00	0.00*
48.9	1.00	0.00	0.00*
49.5	1.00	0.00	0.00*
49.9	1.00	0.00	0.00*
51.5	1.00	0.00	0.00*
51.7	1.00	0.00	0.00*
51.8	1.00	0.00	0.80
51.9	1.00	0.00	0.90
52.5	1.00	0.00	0.00*
52.7	1.00	0.00	0.00*
52.8	1.00	0.00	0.80
52.9	1.00	0.00	0.90
53.5	1.00	0.50	0.75
53.9	1.00	0.50	0.95
54.5	1.00	1.00	1.00
56.9	1.00	1.00	1.00
57.5	1.00	0.30	0.65
57.9	1.00	0.30	0.93

¹ Assume straight line between codes. Values are derived from RP equation (see pg 19).

² Substrate code section begins at 11.9. This is an example of a redundant code (see pg 20).

* Asterisk indicated deviation from the RP formula.

Table 4 Continued

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
58.5	1.00	0.00	0.00*
58.9	1.00	0.00	0.00*
59.5	1.00	0.00	0.00*
59.9	1.00	0.00	0.00*
61.5	1.00	0.00	0.00*
61.7	1.00	0.00	0.00*
61.8	1.00	0.00	0.80
61.9	1.00	0.00	0.90
62.5	1.00	0.00	0.00*
62.7	1.00	0.00	0.00*
62.8	1.00	0.00	0.80
62.9	1.00	0.00	0.90
63.5	1.00	0.50	0.75
63.9	1.00	0.50	0.95
64.5	1.00	1.00	1.00
66.9	1.00	1.00	1.00
67.5	1.00	0.30	0.65
67.9	1.00	0.30	0.93
68.5	1.00	0.00	0.00*
68.9	1.00	0.00	0.00*
69.5	1.00	0.00	0.00*
69.9	1.00	0.00	0.00*
71.5	0.30	0.00	0.00*
71.7	0.30	0.00	0.00*
71.8	0.30	0.00	0.24
71.9	0.30	0.00	0.27
72.5	0.30	0.00	0.00*
72.7	0.30	0.00	0.00*
72.8	0.30	0.00	0.24
72.9	0.30	0.00	0.27
73.5	0.30	0.50	0.40
73.9	0.30	0.50	0.32
74.5	0.30	1.00	0.65
74.9	0.30	1.00	0.37
75.5	0.30	1.00	0.65
75.9	0.30	1.00	0.37
76.5	0.30	1.00	0.65
76.9	0.30	1.00	0.37
77.5	0.30	0.30	0.30
77.9	0.30	0.30	0.30
78.5	0.30	0.00	0.00*
78.9	0.30	0.00	0.00*
79.5	0.30	0.00	0.00*

79.9	0.30	0.00	0.00*
81.5	0.00	0.00	0.00*
82.9	0.00	0.00	0.00*
83.5	0.00	0.50	0.00*
83.9	0.00	0.50	0.00*
84.5	0.00	1.00	0.00*
86.9	0.00	1.00	0.00*
87.5	0.00	0.30	0.00*
87.9	0.00	0.30	0.00*
88.5	0.00	0.00	0.00
92.9	0.00	0.00	0.00
93.5	0.00	0.50	0.00*
93.9	0.00	0.50	0.00*
94.5	0.00	1.00	0.00*
96.9	0.00	1.00	0.00*
97.5	0.00	0.30	0.00*
97.9	0.00	0.30	0.00*
98.5	0.00	0.00	0.00
99.9	0.00	0.00	0.00

TABLE 5. Complete Generic Trout Spawning Substrate Preference¹

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
00.1	Cover codes are not factors for spawning habitat		
00.2			
00.3			
00.4			
00.5			
00.6			
00.7			
00.8			
00.9			
11.9 ²	0.00	0.00	0.00
13.9	0.00	0.80	0.00*
14.5	0.00	1.00	0.00*
14.9	0.00	1.00	0.00*
15.5	0.00	0.80	0.00*
15.9	0.00	0.80	0.00*
16.5	0.00	0.50	0.00*
16.9	0.00	0.50	0.00*
17.5	0.00	0.00	0.00
21.5	0.00	0.00	0.00
23.9	0.00	0.80	0.00*
24.5	0.00	1.00	0.00*
24.9	0.00	1.00	0.00*
25.5	0.00	0.80	0.00*
25.9	0.00	0.80	0.00*
26.5	0.00	0.50	0.00*
26.9	0.00	0.50	0.00*
27.5	0.00	0.00	0.00
29.9	0.00	0.00	0.00
31.5	0.80	0.00	0.00*
31.7	0.80	0.00	0.00*
31.8	0.80	0.00	0.64
31.9	0.80	0.00	0.72
32.5	0.80	0.00	0.00*
32.7	0.80	0.00	0.00*
32.8	0.80	0.00	0.64
32.9	0.80	0.00	0.72

¹ Assume straight line between codes. Values are derived from RP equation (see pg 19).

² Substrate code section begins at 11.9. This is an example of a redundant code (see pg 20).

* Asterisk indicated deviation from the RP formula.

33.9	0.80	0.80	0.80
34.5	0.80	1.00	0.90
34.9	0.80	1.00	0.82
35.5	0.80	0.80	0.80
35.9	0.80	0.80	0.80
36.5	0.80	0.50	0.65
36.9	0.80	0.50	0.77
37.5	0.80	0.00	0.00*
37.9	0.80	0.00	0.00*
38.5	0.80	0.00	0.00*
38.9	0.80	0.00	0.00*
39.5	0.80	0.00	0.00*
39.9	0.80	0.00	0.00*
41.5	1.00	0.00	0.00*
41.7	1.00	0.00	0.00*
41.8	1.00	0.00	0.80
41.9	1.00	0.00	0.90
42.5	1.00	0.00	0.00*
42.7	1.00	0.00	0.00*
42.8	1.00	0.00	0.80
42.9	1.00	0.00	0.90
43.5	1.00	0.80	0.90
43.9	1.00	0.80	0.98
44.9	1.00	1.00	1.00
45.5	1.00	0.80	0.90
45.9	1.00	0.80	0.98
46.5	1.00	0.50	0.75
46.9	1.00	0.50	0.95
47.5	1.00	0.00	0.00*
47.9	1.00	0.00	0.00*
48.5	1.00	0.00	0.00*
48.9	1.00	0.00	0.00*
49.5	1.00	0.00	0.00*
49.9	1.00	0.00	0.00*
51.5	0.80	0.00	0.00*
51.7	0.80	0.00	0.00*
51.8	0.80	0.00	0.64
51.9	0.80	0.00	0.72
52.5	0.80	0.00	0.00*
52.7	0.80	0.00	0.00*
52.8	0.80	0.00	0.64
52.9	0.80	0.00	0.72
53.5	0.80	0.80	0.80
53.9	0.80	0.80	0.80

TABLE 5 Continued

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
54.5	0.80	1.00	0.90
54.9	0.80	1.00	0.82
55.9	0.80	0.80	0.80
56.5	0.80	0.50	0.65
56.9	0.80	0.50	0.77
57.5	0.80	0.00	0.00*
57.9	0.80	0.00	0.00*
58.5	0.80	0.00	0.00*
58.9	0.80	0.00	0.00*
59.5	0.80	0.00	0.00*
59.9	0.80	0.00	0.00*
61.5	0.50	0.00	0.00*
61.7	0.50	0.00	0.00*
61.8	0.50	0.00	0.40
61.9	0.50	0.00	0.45
62.5	0.50	0.00	0.00*
62.7	0.50	0.00	0.00*
62.8	0.50	0.00	0.40
62.9	0.50	0.00	0.45
63.5	0.50	0.80	0.65
63.9	0.50	0.80	0.53
64.5	0.50	1.00	0.75
64.9	0.50	1.00	0.55
65.5	0.50	0.80	0.65
65.9	0.50	0.80	0.53
66.9	0.50	0.50	0.50
67.5	0.50	0.00	0.00*
67.9	0.50	0.00	0.00*
68.5	0.50	0.00	0.00*
68.9	0.50	0.00	0.00*
69.5	0.50	0.00	0.00*
69.9	0.50	0.00	0.00*
71.5	0.00	0.00	0.00
72.9	0.00	0.00	0.00
73.5	0.00	0.80	0.00*
73.9	0.00	0.80	0.00*
74.5	0.00	1.00	0.00*
74.9	0.00	1.00	0.00*
75.5	0.00	0.80	0.00*
75.9	0.00	0.80	0.00*
76.5	0.00	0.50	0.00*
76.9	0.00	0.50	0.00*
77.9	0.00	0.00	0.00

82.9	0.00	0.00	0.00
83.5	0.00	0.80	0.00*
83.9	0.00	0.80	0.00*
84.5	0.00	1.00	0.00*
84.9	0.00	1.00	0.00*
85.5	0.00	0.80	0.00*
85.9	0.00	0.80	0.00*
86.5	0.00	0.50	0.00*
86.9	0.00	0.50	0.00*
87.5	0.00	0.00	0.00
92.9	0.00	0.00	0.00
93.5	0.00	0.80	0.00*
93.9	0.00	0.80	0.00*
94.5	0.00	1.00	0.00*
94.9	0.00	1.00	0.00*
95.5	0.00	0.80	0.00*
95.9	0.00	0.80	0.00*
96.5	0.00	0.50	0.00*
96.9	0.00	0.50	0.00*
97.5	0.00	0.00	0.00
99.9	0.00	0.00	0.00

TABLE 6. Complete Bull Trout (*Salvelinus confluentus*) and Dolly Varden (*S. malma*) Spawning Substrate Preference¹

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
00.1	Cover codes are not factors for spawning habitat		
00.2			
00.3			
00.4			
00.5			
00.6			
00.7			
00.8			
00.9			
11.9 ²	0.00	0.00	0.00
31.7	1.00	0.00	0.00*
31.8	1.00	0.00	0.80
31.9	1.00	0.00	0.90
32.5	1.00	0.00	0.00*
32.7	1.00	0.00	0.00*
32.8	1.00	0.00	0.80
32.9	1.00	0.00	0.90
33.9	1.00	1.00	1.00
35.9	1.00	1.00	1.00
36.5	1.00	0.70	0.85
36.9	1.00	0.70	0.97
37.5	1.00	0.70	0.85
37.9	1.00	0.70	0.97
38.5	1.00	0.00	0.50
38.9	1.00	0.00	0.90
39.5	1.00	0.00	0.00*
39.9	1.00	0.00	0.00*
41.5	1.00	0.00	0.00*
41.7	1.00	0.00	0.00*
41.8	1.00	0.00	0.80
41.9	1.00	0.00	0.90
42.5	1.00	0.00	0.00*
42.7	1.00	0.00	0.00*
42.8	1.00	0.00	0.80
42.9	1.00	0.00	0.90
43.5	1.00	1.00	1.00
45.9	1.00	1.00	1.00
46.5	1.00	0.70	0.85
46.9	1.00	0.70	0.97
47.5	1.00	0.70	0.85
47.9	1.00	0.70	0.97
48.5	1.00	0.00	0.50
48.9	1.00	0.00	0.90
49.5	1.00	0.00	0.00*
49.9	1.00	0.00	0.00*
51.5	1.00	0.00	0.00*
51.7	1.00	0.00	0.00*
51.8	1.00	0.00	0.80
51.9	1.00	0.00	0.90
52.5	1.00	0.00	0.00*
52.7	1.00	0.00	0.00*
52.8	1.00	0.00	0.80
52.9	1.00	0.00	0.90
53.5	1.00	1.00	1.00
55.9	1.00	1.00	1.00
56.5	1.00	0.70	0.85
56.9	1.00	0.70	0.97
57.5	1.00	0.70	0.85
57.9	1.00	0.70	0.97
58.5	1.00	0.70	0.85
58.9	1.00	0.70	0.97
59.5	1.00	0.00	0.00*
59.9	1.00	0.00	0.00*
61.5	0.70	0.00	0.00*
61.7	0.70	0.00	0.00*
61.8	0.70	0.00	0.56
61.9	0.70	0.00	0.63
62.5	0.70	0.00	0.00*
62.7	0.70	0.00	0.00*
62.8	0.70	0.00	0.56
62.9	0.70	0.00	0.63
63.5	0.70	1.00	0.85
63.9	0.70	1.00	0.73
64.5	0.70	1.00	0.85
64.9	0.70	1.00	0.73
65.5	0.70	1.00	0.85
65.9	0.70	1.00	0.73
66.9	0.70	0.70	0.70

¹ Assume straight line between codes. Values are derived from RP equation (see pg 19).

² Substrate code section begins at 11.9. This is an example of a redundant code (see pg 20).

* Asterisk indicated deviation from the RP formula.

Table 6 Continued

Code (ab.c)	Preference value a	Preference value b	Recommended Preference
67.9	0.70	0.70	0.70
68.5	0.70	0.00	0.35
68.9	0.70	0.00	0.63
69.5	0.70	0.00	0.00*
71.5	0.70	0.70	0.00*
71.7	0.70	0.00	0.00*
71.8	0.70	0.00	0.56
71.9	0.70	0.00	0.63
72.5	0.70	0.00	0.00*
72.7	0.70	0.00	0.00*
72.8	0.70	0.00	0.56
72.9	0.70	0.00	0.63
73.5	0.70	1.00	0.85
73.9	0.70	1.00	0.73
74.5	0.70	1.00	0.85
74.9	0.70	1.00	0.73
75.5	0.70	1.00	0.85
75.9	0.70	1.00	0.73
76.5	0.70	0.70	0.70
76.9	0.70	0.70	0.70
77.9	0.70	0.70	0.70
78.5	0.70	0.00	0.35
78.9	0.70	0.00	0.63
79.5	0.70	0.00	0.00*
79.9	0.70	0.00	0.00*
81.5	0.00	0.00	0.00*
82.9	0.00	0.00	0.00*
83.5	0.00	1.00	0.50
83.9	0.00	1.00	0.10
84.5	0.00	1.00	0.50
84.9	0.00	1.00	0.10
85.5	0.00	1.00	0.50
85.9	0.00	1.00	0.10
86.5	0.00	0.70	0.35
86.9	0.00	0.70	0.07
87.5	0.00	0.70	0.35
87.9	0.00	0.70	0.07
88.9	0.00	0.00	0.00
92.9	0.00	0.00	0.00
93.5	0.00	1.00	0.00*
99.9	0.00	0.00	0.00

TABLE 7. Chum Salmon (*O. keta*) Spawning Substrate Preference Data

Kennedy Creek, Duckabush and Dosewallips rivers (8 studies, 138 redds). For the full table of 3 digit codes, use Table 2.

Dominant substrate	Calculated preference	Recommended Preference
1 silt	0.08-0.18	0.00
2 sand	0.08-0.49	0.00
3 small gravel	0.49-0.76	0.30
4 medium gravel	0.76-1.00	1.00
5 large gravel	0.72-1.00	1.00
6 small cobble	0.62-0.90	1.00
7 large cobble	0.24-0.62	0.50
8 boulder	0.00-0.35	0.00
9 bedrock	no data	0.00

TABLE 8. Coho Salmon (*O. kisutch*) Spawning Substrate Preference Data

Dewatto River and Fletcher Canyon Creek (2 studies, 30 redds). For the full table of 3 digit codes, use Table 2.

Dominant substrate	Calculated preference	Recommended Preference
1 silt	0.00	0.00
2 sand	0.06	0.00
3 small gravel	0.06-1.00	0.30
4 medium gravel	0.25-0.61	1.00
5 large gravel	0.61-0.93	1.00
6 small cobble	0.93	1.00
7 large cobble	0.18-0.93	0.50
8 boulder	0.18	0.00
9 bedrock	0.18	0.00

TABLE 9. Pink Salmon (*O. gorbuscha*) Spawning Substrate Preference Data

Squire Creek, N. Fork Stillaguamish, Dosewallips, and Duckabush rivers (3 studies, 46 redds).

For the full table of 3 digit codes, use Table 2.

Dominant substrate	Calculated preference	Recommended Preference
1 silt	0.00	0.00
2 sand	0.00-0.60	0.00
3 small gravel	0.60-0.74	0.30
4 medium gravel	0.74-1.00	1.00
5 large gravel	0.77-1.00	1.00
6 small cobble	0.28-0.93	1.00
7 large cobble	0.00-0.28	0.50
8 boulder	0.00	0.00
9 bedrock	no data	0.00

TABLE 10. Sockeye Salmon (*O. nerka*) Spawning Substrate Preference Data.

Cedar River & Big Creek (Quinault Basin) (4 studies, 1053 redds). For the full table of 3 digit codes, use Table 2.

Dominant substrate	Calculated preference	Recommended Preference
1-silt	0.00	0.00
2-sand	0.00	0.00
3-small gravel	0.20-0.30	0.30
4-medium gravel	0.60-1.00	1.00
5-large gravel	1.00	1.00
6-small cobble	0.20-1.00	1.00
7-large cobble	0.00-0.20	0.50
8-boulder	no data	0.00
9-bedrock	no data	0.00

TABLE 11. Bull Trout (*S. confluentus*) and Dolly Varden (*S. malma*) Spawning Substrate Preference Data.

Based on 4 streams, 34 redds. For the full table of 3 digit codes, use Table 7.

Dominant substrate	Calculated preference	Recommended Preference
1-silt	NA	0.00
2-sand	0.00-1.00	0.00
3-small gravel	0.20-1.00	1.00
4-medium gravel	0.60-1.00	1.00
5-large gravel	1.00	1.00
6-small cobble	1.00	0.70
7-large cobble	0.45	0.70
8-boulder	0.00	0.00
9-bedrock	0.00	0.00

TABLE 12. Cutthroat Trout (*O. clarki*) Spawning Substrate Preference. Not yet finalized**TABLE 13. Preference Factors for Ratios of Turbulence**

Plume to Calm, Deep Area in Plunge Pool Method (from page 15)

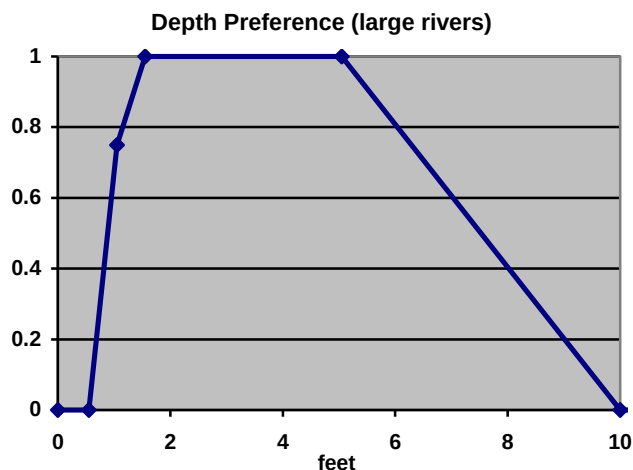
Ratio (plume to calm, deep)	Preference Factor
0.0	0.10
0.25	0.40
0.5	0.80
1.0	1.00
2.0	0.50
4.0	0.25
8.0	0.125
16.0	0.06
32.0	0.03

FIGURE 1a. Chinook Salmon (*Oncorhynchus tshawytscha*) Large River Spawning Depth Preference

For all stocks: Use Large rivers when mean annual flow (MAF) >3,000 cfs (Analysis based on Caldwell et al 1987. Use Columbia – Snake when MAF > 100,000 cfs (Hanrahan et al. 2004).

Preference has changed from the 2004 edition.

Plotted depth (feet)	Recommended depth preference	
	large rivers	Columbia – Snake
0.00	0.0	0.0
0.55	0.0	-
1.05	0.75	-
1.55	1.0	0.0
5.05	1.0	0.4
8.15		1.0
10	0.0	-
30	0.0	1.0
35	0.0	0.0



For Chinook Salmon Spawning Substrate Preference, use Table 2.

HSC notes: Large river examples include the Skagit and Snohomish rivers. If your stream is close to the 3000 cfs break point, please contact Ecology or WDFW biologists for help in selecting the proper curve.

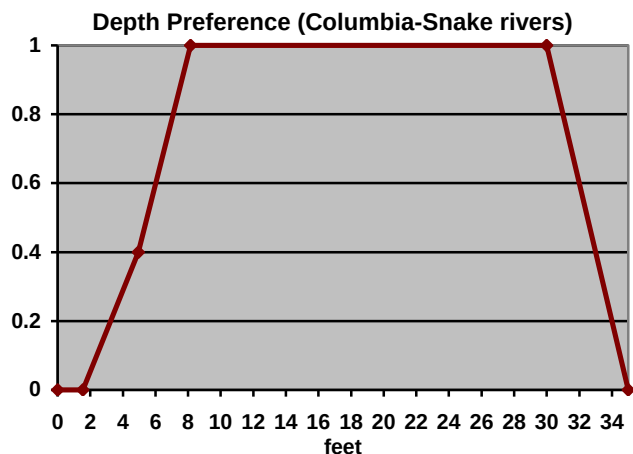


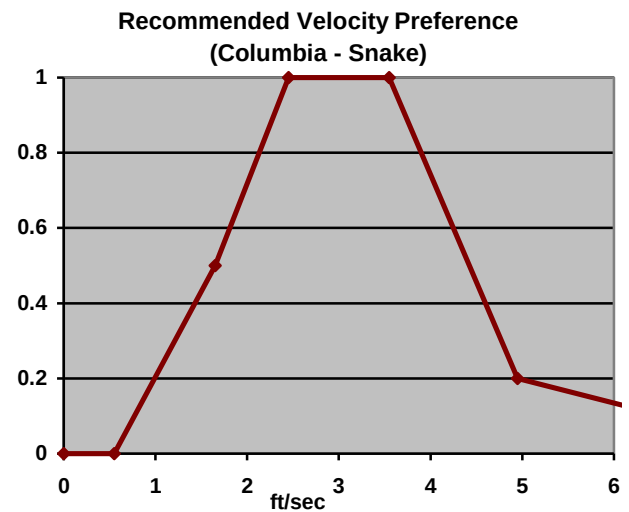
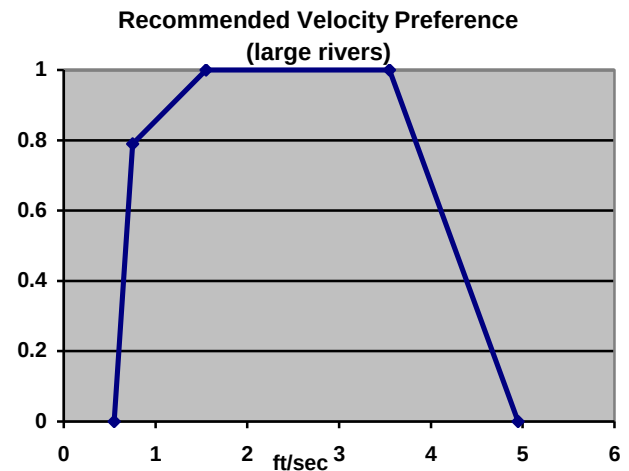
FIGURE 1b. Chinook Salmon Large River Spawning Velocity Preference

For all stocks: Use large rivers when MAF > 3,000 cfs (Analysis based on Caldwell et al 1987).

Use Columbia – Snake when MAF > 100,000 cfs (Hanrahan, Dauble and Geist 2004).

Preference has changed from 2004.

Plotted velocity (ft/sec)	Recommended velocity suitability	
	large rivers	Columbia – Snake
0.00	0.0	0.0
0.35	-	0.0
0.55	0.0	-
0.75	0.79	-
1.55	1.0	
1.65		0.50
2.45	-	1.0
3.55	1.0	1.0
4.95	0.0	0.2
6.55	0.0	0.1
7.0+	0.0	0



HSC notes: Large river examples include the Skagit and Snohomish rivers. If your stream is close to the 3000 cfs break point, please contact Ecology or WDFW biologists for help in selecting the proper curve.

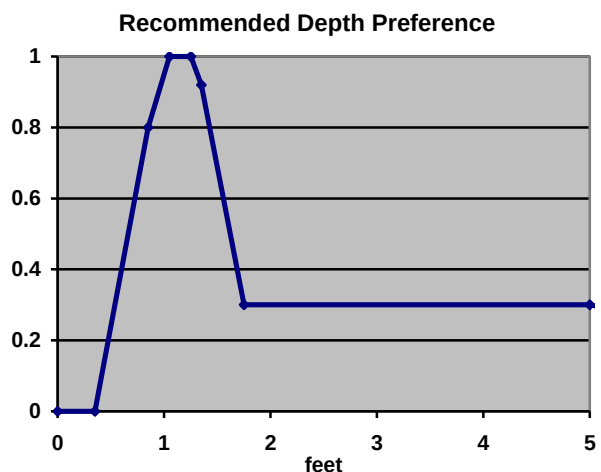
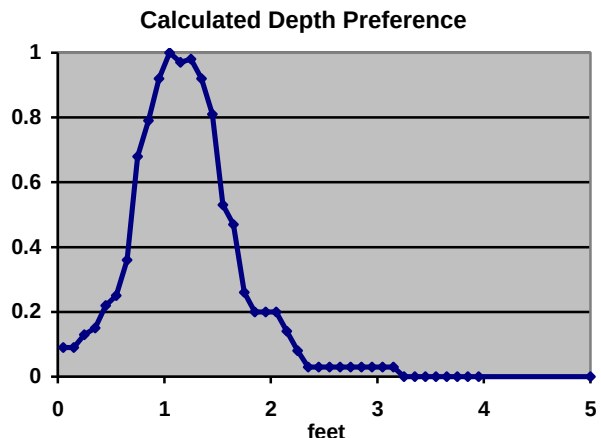
For Chinook Salmon Spawning Substrate Preference, use Table 2.

FIGURE 2a. Chinook Salmon Stream and River Spawning Depth Preference

For all stocks: Streams and rivers have a MAF <3,000 cfs. Analysis based on 5 studies and 165 redds (West Fork Humptulips, American, Yakima, Little Naches and upper Chehalis rivers).

Preference has changed from the 2004 edition.

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.19	0.09	0.00	0.00
0.20-0.29	0.13	0.35	0.00
0.30-0.39	0.15	0.85	0.80
0.40-0.49	0.22	1.05	1.0
0.50-0.59	0.25	1.25	1.0
0.60-0.69	0.36	1.35	0.92
0.70-0.79	0.68	1.75	0.3
0.80-0.89	0.79	5.0	0.3
0.90-0.99	0.92	10+	0
1.00-1.09	1.0		
1.10-1.19	0.97		
1.20-1.29	0.98		
1.30-1.39	0.92		
1.40-1.49	0.81		
1.50-1.59	0.53		
1.60-1.69	0.47		
1.70-1.79	0.26		
1.80-2.09	0.20		
2.10-2.19	0.14		
2.20-2.29	0.08		
2.30-3.19	0.03		
3.35-5.0+	0.0		



HSC notes: The calculated preference from 0.0 to 0.39 ft was based on averages from the binning process, not observations. We decided use a 0.0 preference from 0.0 to 0.35 ft. to reflect a physical minimum depth needed for spawning fish. The calculated preference decrease reduction after 1.7 ft comes from studies with high preference dropping to 0.0 due to a lack of habitat availability. We chose to maintain a 0.30 preference out to 5' then reduced it to 0.0 at 10'.

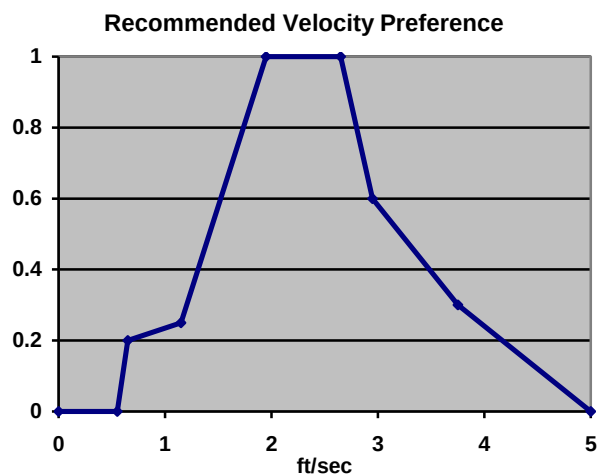
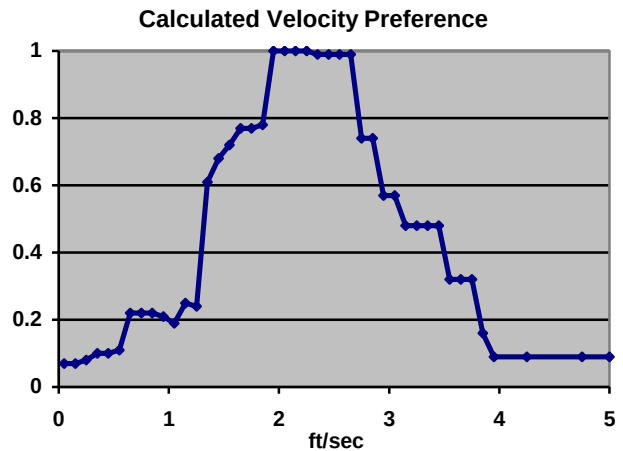
For Chinook Salmon Spawning Substrate Preference, use Table 2.

FIGURE 2b. Chinook Salmon Stream and River Spawning Velocity Preference

For all stocks: Streams and rivers have a MAF <3,000 cfs. Analysis based on 5 studies and 164 redds (West Fork Humptulips, American, Yakima, Little Naches and upper Chehalis rivers).

Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.19	0.07	0.00	0.00
0.20-0.29	0.08	0.55	0.00
0.30-0.49	0.10	0.65	0.2
0.50-0.59	0.11	1.15	0.25
0.60-0.89	0.22	1.95	1.0
0.90-0.99	0.21	2.65	1.0
1.00-1.09	0.19	2.95	0.60
1.10-1.19	0.25	3.75	0.30
1.20-1.29	0.24	5.0	0
1.30-1.39	0.61		
1.40-1.49	0.68		
1.50-1.59	0.72		
1.60-1.79	0.77		
1.80-1.89	0.78		
1.90-2.29	1.0		
2.30-2.69	0.99		
2.70-2.89	0.74		
2.90-3.09	0.57		
3.10-3.49	0.48		
3.50-3.79	0.32		
3.80-3.89	0.16		
3.90-5.0	0.09		



HSC notes: The calculated preference from 0.0 to 0.59 ft was based on statistics, not observations. We decided use a 0.0 preference from 0.0 to 0.55 ft.

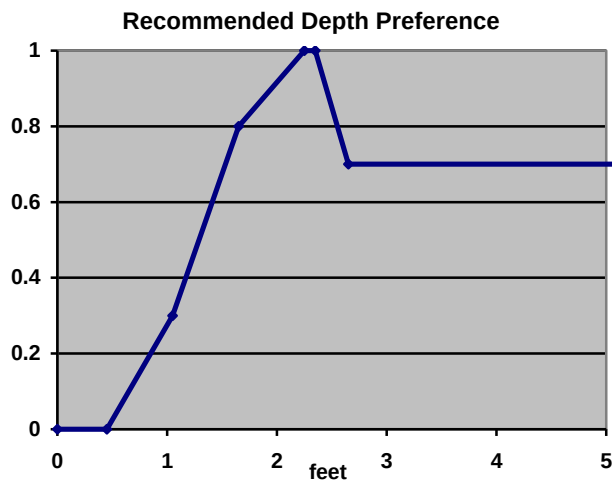
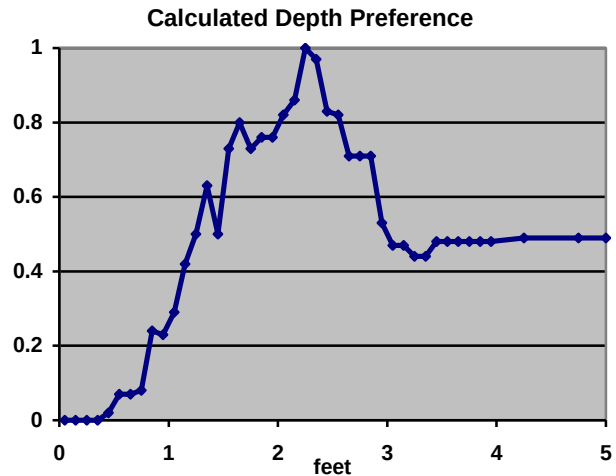
For Chinook Salmon Spawning Substrate Preference, use Table 2.

FIGURE 3a. Chinook Salmon Juvenile Rearing Depth Preference

Analysis based on 8 studies (Dungeness, Chiwawa, Mad & Similkameen, and Tucannon Rivers and Kendall Creek) and 5585 fish. Kendall Creek was a utilization study with 5055 observations.

Preference has changed from the 2004 edition.

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.39	0.00	0.00	0.00
0.40-0.49	0.02	0.45	0.00
0.50-0.69	0.07	1.05	0.30
0.70-0.79	0.08	1.65	0.80
0.80-0.89	0.24	2.25	1.00
0.90-0.99	0.23	2.35	1.00
1.00-1.09	0.29	2.65	0.70
1.10-1.19	0.42	10.0	0.70
1.20-1.29	0.50	30+	0.0
1.30-1.39	0.63		
1.40-1.49	0.50		
1.50-1.59	0.73		
1.60-1.69	0.80		
1.70-1.79	0.73		
1.80-1.99	0.76		
2.00-2.09	0.82		
2.10-2.19	0.86		
2.20-2.29	1.0		
2.30-2.39	0.97		
2.40-2.49	0.83		
2.50-2.59	0.82		
2.60-2.89	0.71		
2.90-2.99	0.53		
3.00-3.19	0.47		
3.20-3.39	0.44		
3.40-3.99	0.48		
4.00-5.0	0.49		



For Chinook Salmon Juvenile Rearing Cover/Substrate Preference, use Table 3.

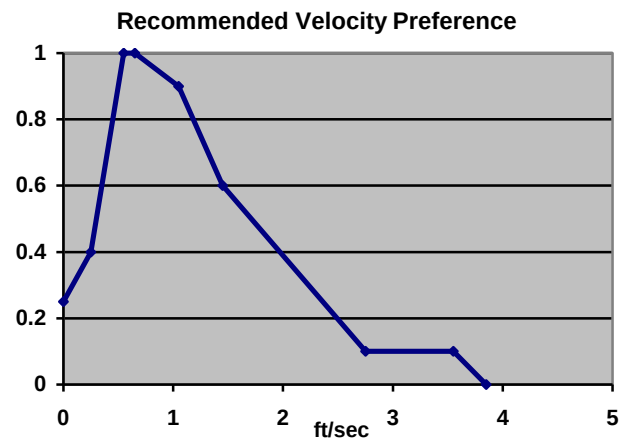
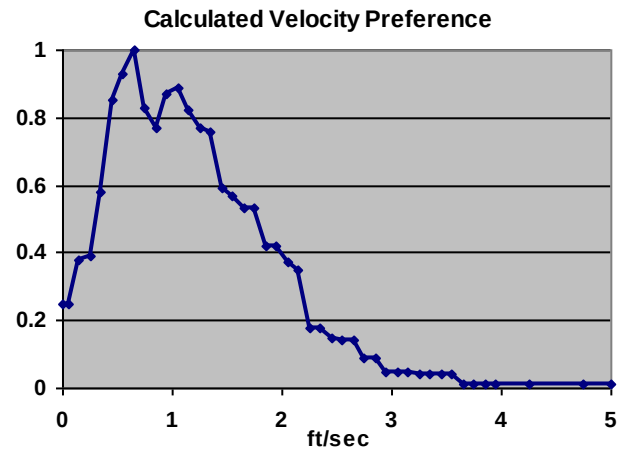
HSC Notes: The calculated preference decrease reduction after 2.8 ft comes from studies with high preference dropping out due to a lack of habitat availability. We chose to maintain a preference of 0.70 out to 10.0' then reduced it to 0.0 at 30'.

FIGURE 3b. Chinook Salmon Juvenile Rearing Velocity Preference

Analysis based on 8 studies (Dungeness, Chiwawa, Mad & Similkameen, & Tucannon Rivers and Kendal Creek) and 5556 fish. Kendal Creek was a utilization study with 5025 observations.

Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.25	0.00	0.25
0.10-0.19	0.38	0.25	0.40
0.20-0.29	0.39	0.55	1.0
0.30-0.39	0.58	0.65	1.0
0.40-0.49	0.85	1.05	0.90
0.50-0.59	0.93	1.45	0.60
0.60-0.69	1.0	2.75	0.10
0.70-0.79	0.83	3.55	0.10
0.80-0.89	0.77	3.85	0.0
0.90-0.99	0.87		
1.00-1.09	0.89		
1.10-1.19	0.82		
1.20-1.29	0.77		
1.30-1.59	0.76		
1.60-1.79	0.83		
1.80-1.99	0.42		
2.00-2.09	0.37		
2.10-2.19	0.35		
2.25-2.39	0.18		
2.40-2.49	0.15		
2.50-2.69	0.14		
2.70-2.89	0.09		
2.90-3.19	0.05		
3.20-3.59	0.04		
3.60-5.0	0.01		

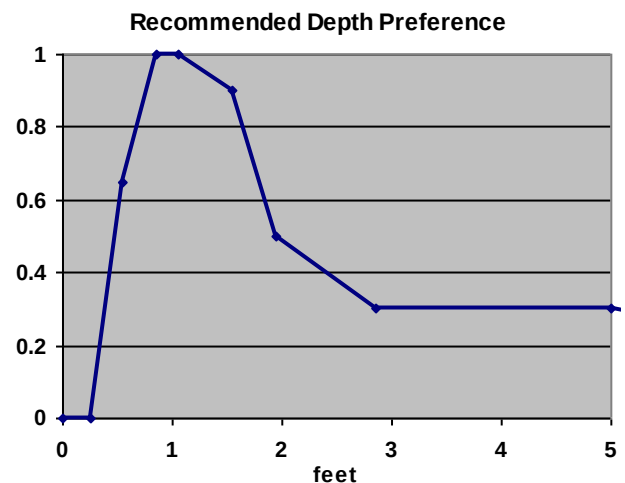
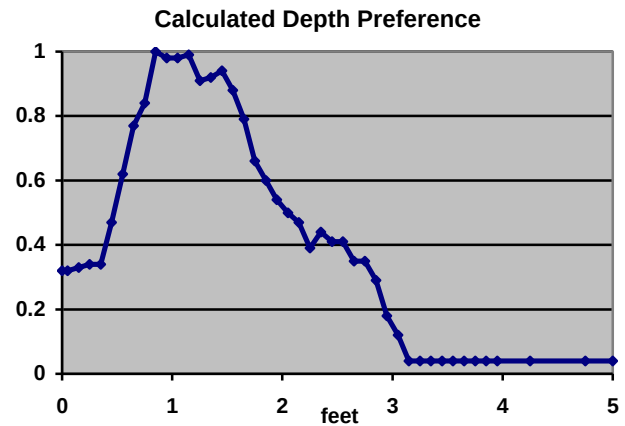


For Chinook Salmon Juvenile Rearing Cover/Substrate Preference, use Table 3.

FIGURE 4a. Coho Salmon (*O. kisutch*) Spawning Depth Preference

Analysis based on 5 studies and 66 redds (Fletcher Canyon and Irely creeks, and Humptulips and Dewatto rivers). **Preference has changed from the 2004 edition.**

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth Preference
0.00-0.09	0.32	0.00	0.0
0.10-0.19	0.35	0.25	0.0
0.20-0.39	0.34	0.55	0.65
0.40-0.49	0.47	0.85	1.0
0.50-0.59	0.62	1.05	1.0
0.60-0.69	0.77	1.55	0.90
0.70-0.79	0.84	1.95	0.50
0.80-0.89	1.0	2.85	0.30
0.90-1.09	0.98	5	0.30
1.10-1.19	0.99	10	0
1.20-1.29	0.91		
1.30-1.39	0.92		
1.40-1.49	0.94		
1.50-1.59	0.88		
1.60-1.69	0.79		
1.70-1.79	0.66		
1.80-1.89	0.60		
1.90-1.99	0.54		
2.00-2.09	0.50		
2.10-2.19	0.47		
2.20-2.29	0.39		
2.30-2.39	0.44		
2.40-2.59	0.41		
2.60-2.79	0.35		
2.80-2.89	0.29		
2.90-2.99	0.18		
3.00-3.09	0.12		
3.10-5.0	0.04		



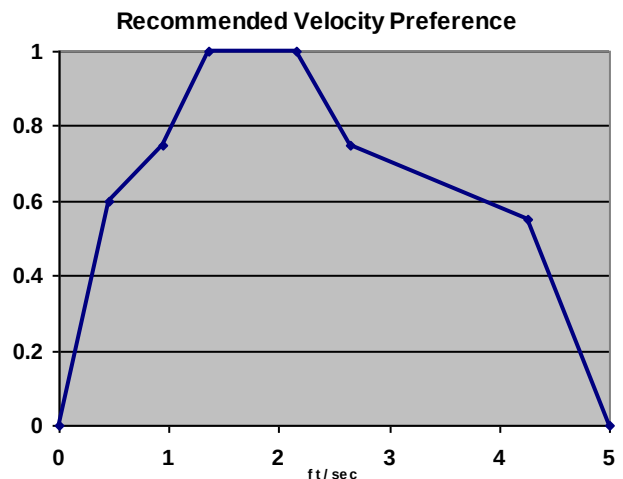
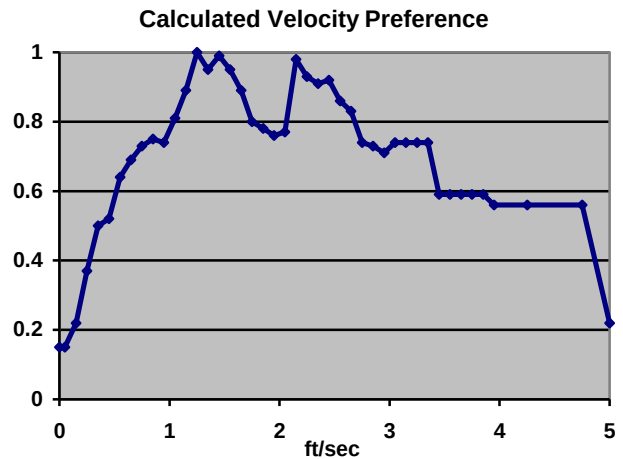
For Coho Salmon Spawning Substrate Preference, use Table 2. See Table 8 for calculated preference information

HSC Notes: The calculated preference decrease reduction after 2.85 ft comes from a study with 1.0 preference dropping to 0.0 due to a lack of habitat availability. We chose to maintain 0.30 preference out to 5' and then reduced it to 0.0 at 10'.

FIGURE 4b. Coho Salmon Spawning Velocity Preference

Analysis based on 5 studies and 66 redds (Fletcher Canyon and Irely creeks, and Humptulips and Dewatto rivers). **Preference has changed from the 2004 edition.**

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Velocity interval (ft/sec)	Velocity preference
0.00-0.09	0.15	0.00	0.0
0.10-0.19	0.22	0.45	0.60
0.20-0.29	0.37	0.95	0.75
0.30-0.39	0.50	1.25	1.0
0.40-0.49	0.52	2.15	1.0
0.50-0.59	0.64	2.65	0.75
0.60-0.69	0.69	4.25	0.55
0.70-0.79	0.73	5.0	0.0
0.80-0.89	0.75	7.0	0.0
0.90-0.99	0.74		
1.00-1.09	0.81		
1.10-1.19	0.89		
1.20-1.29	1.0		
1.30-1.39	0.95		
1.40-1.49	0.99		
1.50-1.59	0.95		
1.60-1.69	0.89		
1.70-1.79	0.80		
1.80-1.89	0.78		
1.90-1.99	0.76		
2.00-2.09	0.77		
2.10-2.19	0.98		
2.20-2.29	0.93		
2.30-2.39	0.91		
2.40-2.49	0.82		
2.50-2.59	0.86		
2.60-2.69	0.83		
2.70-2.79	0.74		
2.80-2.89	0.73		
2.90-2.99	0.71		
3.00-3.39	0.74		
3.40-3.89	0.59		
3.90-4.95	0.56		
5.0	0.22		



For Coho Salmon Spawning Substrate Preference, use Table 2. See Table 8 for calculated preference information

HSC notes: The bimodal peaks come in part from small vs. large stream differences. Unfortunately there were not enough studies to test for statistical significance.

Coho Salmon Juvenile Depth Preference (No Longer Recommended)

Coho Salmon Juvenile Velocity Preference (No Longer Recommended)

Analysis based on 4 studies and 451 fish (Dungeness, Satsop Rivers and Kenedy Creek) and (Beecher, et al. 2010).

Previous versions of the Instream Flow Study Guidelines provided default coho juvenile depth and velocity curves based on Beecher et al 2002. Subsequent research has shown that despite validation of the habitat suitability criteria and hydraulic model, the stream flow relating to peak coho rearing habitat did not resemble the stream flow relating to increased coho salmon production (Beecher et al 2010).

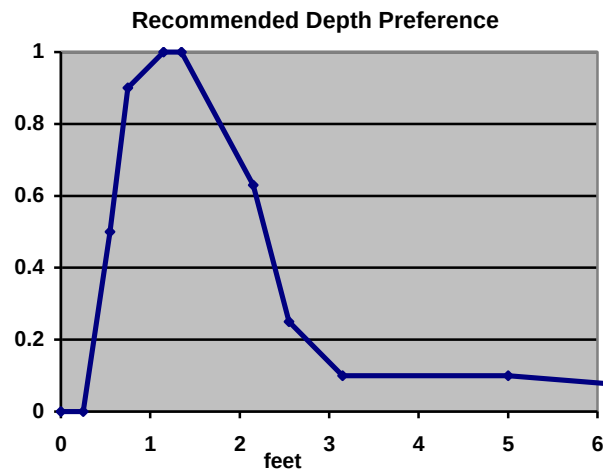
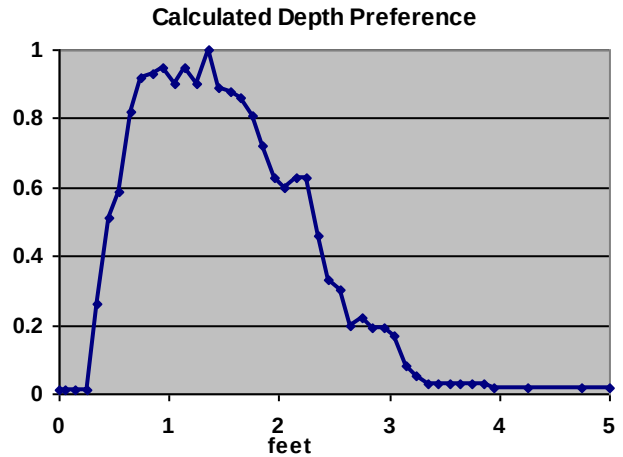
Based on this new research we have removed the coho rearing curves and do not recommend using coho rearing HSC curves when analyzing an instream flow study.

FIGURE 5a. Fall Chum salmon (*O. keta*) Spawning Depth Preference

Analysis based on 8 studies and 109 redds (Hill & Kennedy creeks and Duckabush River).

Preference has changed from the 2004 edition.

Fall chum: spawning from Nov-Jan			
Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted Depth (feet)	Depth preference
0.00-0.29	0.01	0.00	0.00
0.30-0.39	0.26	0.25	0.00
0.40-0.49	0.51	0.55	0.50
0.50-0.59	0.59	0.75	0.90
0.60-0.69	0.82	1.15	1.00
0.70-0.79	0.92	1.35	1.00
0.80-0.89	0.93	2.15	0.63
0.90-0.99	0.95	2.55	0.25
1.00-1.09	0.90	3.15	0.10
1.10-1.19	0.95	4.95	0.10
1.20-1.29	0.90	10.0	0.0
1.30-1.39	1.0		
1.40-1.49	0.89		
1.50-1.59	0.88		
1.60-1.69	0.86		
1.70-1.79	0.81		
1.80-1.89	0.72		
1.90-1.99	0.63		
2.00-2.09	0.60		
2.10-2.29	0.63		
2.30-2.39	0.46		
2.40-2.49	0.33		
2.50-2.59	0.30		
2.60-2.69	0.20		
2.70-2.79	0.22		
2.80-2.99	0.19		
3.00-3.09	0.17		
3.10-3.19	0.08		
3.20-3.29	0.05		
3.30-3.89	0.03		
3.90-5.0	0.02		



HSC Notes: We found some differences between small and large streams, but there were not enough small stream (<35' LBTW) studies to test for statistical significance. For depth preference after 3.15 ft we chose to maintain a 0.10 preference out to 5' then reduce it to 0.0 at 10'.

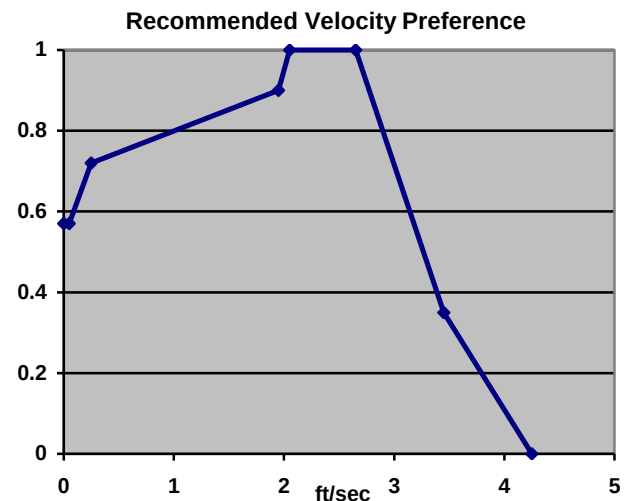
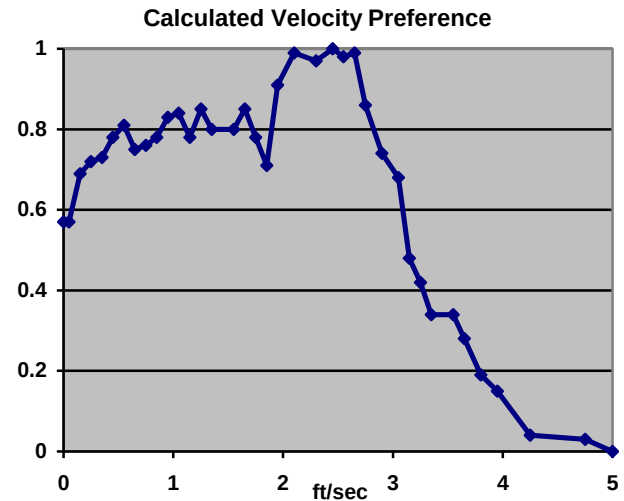
For Fall Chum Salmon Spawning Substrate Preference, use Table 2. See Table 7 for calculated preference information.

FIGURE 5b. Fall Chum Salmon Spawning Velocity Preference

Analysis based on 8 studies and 109 redds (Hill & Kennedy creeks and Duckabush River).

Preference has changed from the 2004 edition.

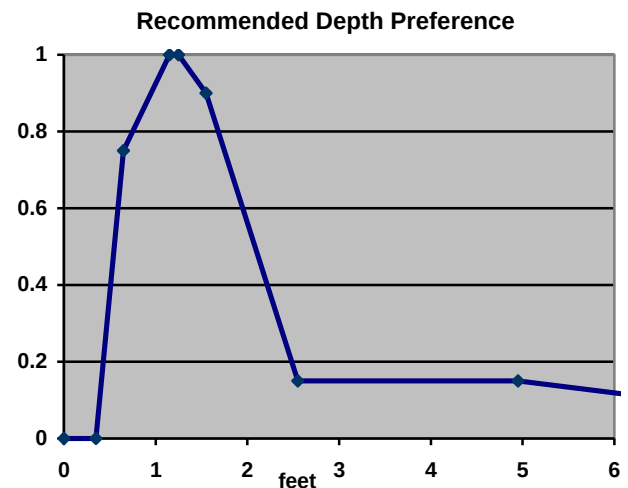
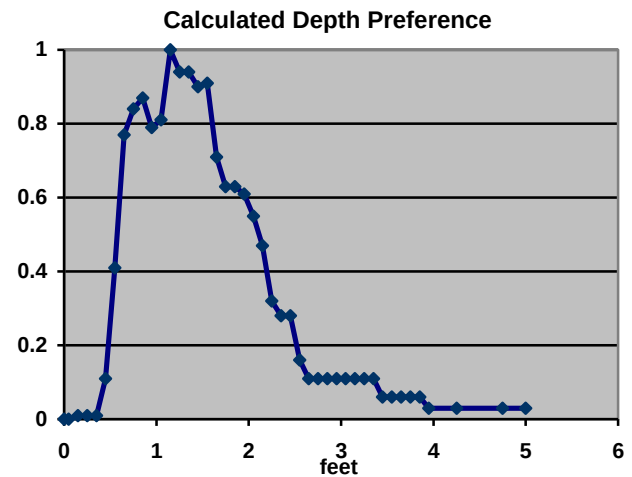
Fall chum: spawns from Nov to Jan			
Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted Velocity (ft/sec)	Velocity preference
0.00-0.09	0.57	0.00	0.57
0.10-0.19	0.69	0.05	0.57
0.20-0.29	0.72	0.25	0.72
0.30-0.39	0.73	1.95	0.90
0.4-0.49	0.78	2.05	1.0
0.5-0.59	0.81	2.65	1.0
0.6-0.69	0.75	3.45	0.35
0.7-0.79	0.76	4.25	0.00
0.8-0.89	0.78	10+	0.00
0.9-0.99	0.83		
1.0-1.09	0.84		
1.1-1.19	0.78		
1.2-1.29	0.85		
1.3-1.59	0.80		
1.6-1.69	0.85		
1.7-1.79	0.78		
1.8-1.89	0.71		
1.9-1.99	0.91		
2.0-2.19	0.99		
2.2-2.39	0.97		
2.4-2.49	1.00		
2.5-2.59	0.98		
2.6-2.69	0.99		
2.7-2.79	0.86		
2.8-2.99	0.74		
3.0-3.09	0.68		
3.1-3.19	0.48		
3.2-3.29	0.42		
3.3-3.59	0.34		
3.6-3.69	0.28		
3.7-3.89	0.19		
3.9-3.99	0.15		
4.0-4.49	0.04		
4.5-4.99	0.03		
5.0	0		



For Fall Chum Salmon Spawning Substrate Preference, use Table 2. See Table 7 for calculated preference information.

FIGURE 6a. Summer Chum Salmon Spawning Depth Preference
 Analysis based on 8 studies and 116 redds (Duckabush and Dosewallips rivers).
Preference has changed from the 2004 edition.

Summer chum: Spawns from Sept to early Oct			
Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.09	0.00	0.00	0.00
0.10-0.39	0.01	0.35	0.00
0.40-0.49	0.11	0.65	0.75
0.50-0.59	0.41	1.15	1.00
0.60-0.69	0.77	1.25	1.00
0.70-0.79	0.84	1.55	0.90
0.80-0.89	0.87	2.55	0.15
0.90-0.99	0.79	5.0	0.15
1.00-1.09	0.81	10.0+	0.00
1.10-1.19	1.0		
1.20-1.39	0.94		
1.40-1.49	0.90		
1.50-1.59	0.91		
1.60-1.69	0.71		
1.70-1.89	0.63		
1.90-1.99	0.61		
2.00-2.09	0.55		
2.10-2.19	0.47		
2.20-2.29	0.32		
2.30-2.49	0.28		
2.50-2.59	0.16		
2.60-3.39	0.11		
3.40-3.89	0.06		
3.90-5.0	0.03		

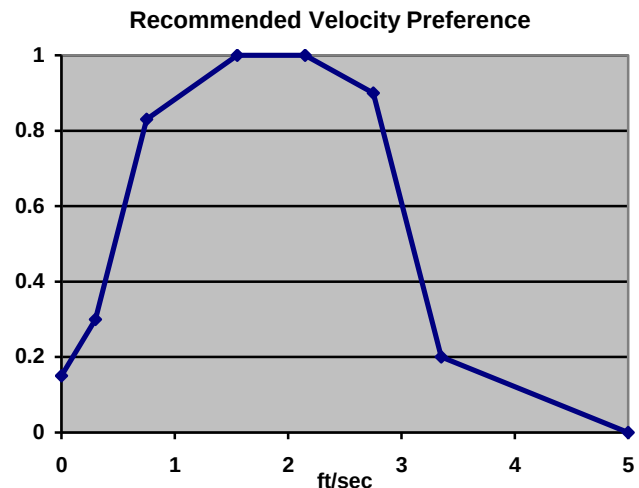
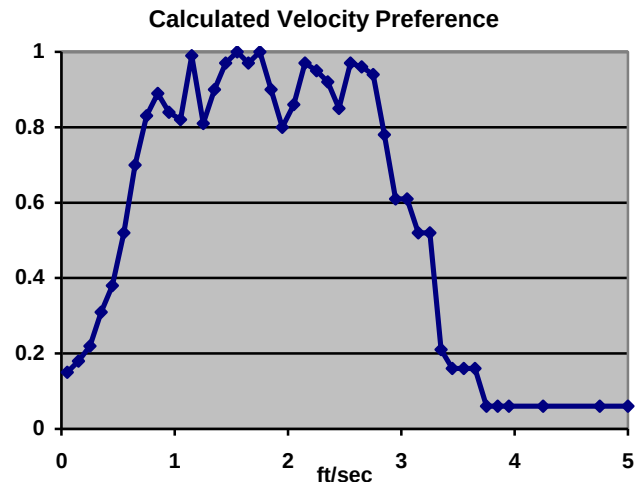


HSC Notes: There were no summer chum HSC studies conducted on small streams. For depth preference above 2.50 ft we chose to maintain a 0.15 preference out to 5' then reduced it to 0.0 at 10'.

For Summer Chum Salmon Spawning Substrate Preference, use Table 2. See Table 7 for calculated preference information.

FIGURE 6b. Summer Chum Salmon Spawning Velocity Preference
 Analysis based on 8 studies and 116 redds (Duckabush and Dosewallips rivers).
Preference has changed from the 2004 edition.

Summer chum: Spawning from Sept to early Oct			
Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted Velocity (ft/sec)	Velocity preference
0.00-0.09	0.15	0.00	0.15
0.10-0.19	0.18	0.35	0.30
0.20-0.29	0.22	0.75	0.83
0.30-0.39	0.31	1.55	1.0
0.40-0.49	0.38	2.15	1.0
0.50-0.59	0.52	2.75	0.90
0.60-0.69	0.70	3.35	0.20
0.70-0.79	0.83	5.0+	0.0
0.80-0.89	0.89		
0.90-0.99	0.84		
1.00-1.09	0.82		
1.10-1.19	0.99		
1.20-1.29	0.81		
1.30-1.39	0.90		
1.40-1.49	0.97		
1.50-1.59	1.0		
1.60-1.69	0.97		
1.70-1.79	1.0		
1.80-1.89	0.90		
1.90-1.99	0.80		
2.00-2.09	0.86		
2.10-2.19	0.97		
2.20-2.29	0.96		
2.30-2.39	0.92		
2.40-2.49	0.85		
2.50-2.59	0.97		
2.60-2.69	0.96		
2.70-2.79	0.94		
2.80-2.89	0.78		
2.90-3.09	0.61		
3.10-3.29	0.52		
3.30-3.39	0.21		
3.40-3.69	0.16		
3.70-5.0	0.06		



HSC Notes: All summer chum HSC studies conducted on large streams ($\geq 35'$ LBTW). We were unable to make a small vs. large stream comparison and cannot say if this curve represents preference in smaller streams

For Summer Chum Salmon Spawning Substrate Preference, use Table 2. See Table 7 for calculated preference information.

FIGURE 7a. Pink Salmon (*O. gorbuscha*) Spawning Depth Preference

Analysis based on 3 studies and 46 redds (Squire Creek, and North Fork Stillaguamish, Dosewallips, and Duckabush rivers). **Preferences are unchanged from the 2004 edition.**

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.49	0.77	0.00	0.00
0.50-0.69	1.00	0.55	1.00
0.70-0.99	0.89	0.65	1.00
1.00-1.19	0.68	1.15	0.68
1.20-1.29	0.43	1.45	0.20
1.30-2.09	0.09	2.15	0.05
2.10 +	0.00	5.00+	0.00

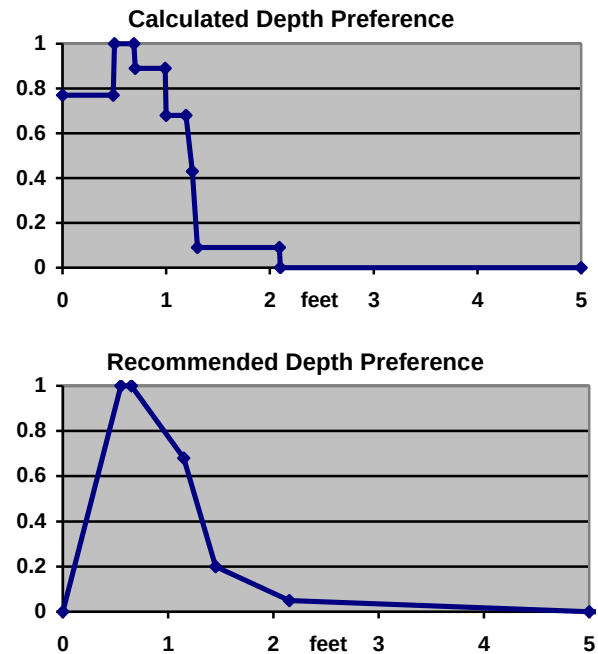
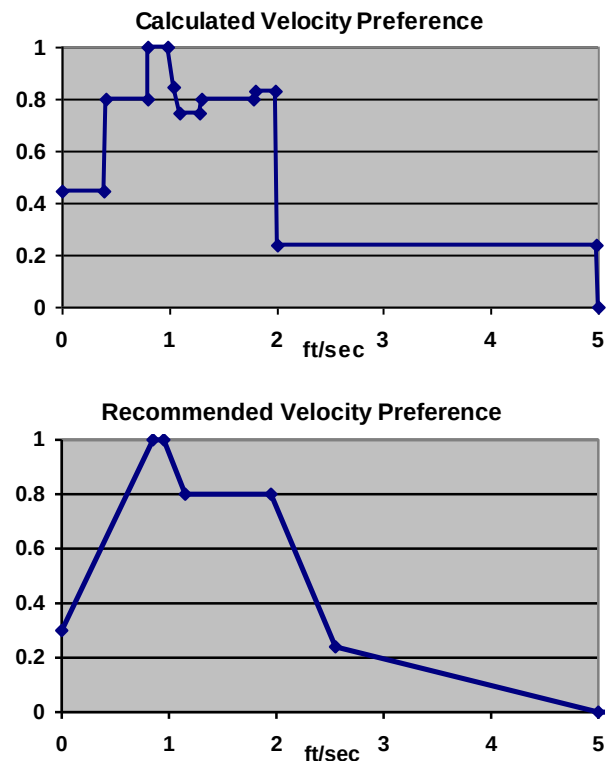


FIGURE 7b. Pink Salmon Spawning Velocity Preference

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.39	0.45	0.00	0.30
0.40-0.79	0.80	0.85	1.00
0.80-0.99	1.00	0.95	1.00
1.00-1.09	0.85	1.15	0.80
1.10-1.29	0.75	1.95	0.80
1.30-1.79	0.80	2.55	0.24
1.80-1.99	0.83	5.00	0.00
2.00-4.99	0.24	99	0.00
5.00 +	No data		



HSC Notes: All streams were large, i.e. were over 35' in LBTW.

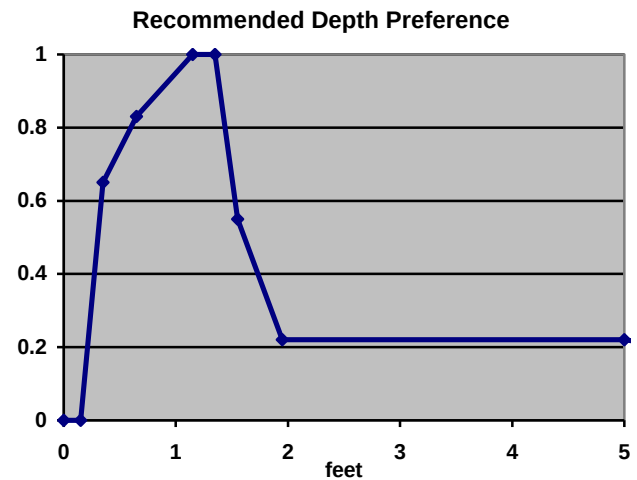
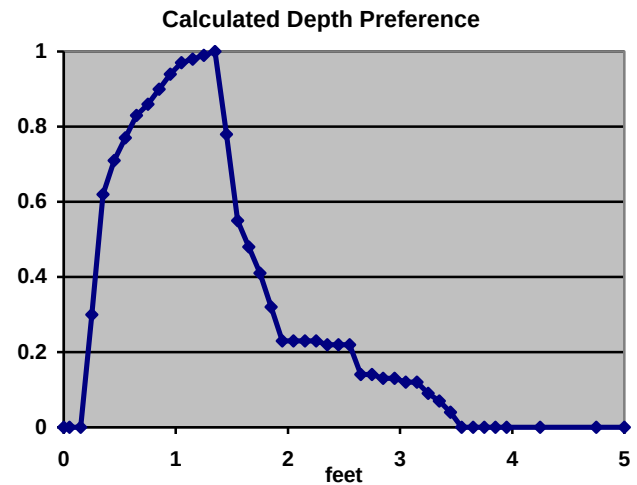
For Pink Salmon Spawning Substrate Preference, use Table 2. See Table 9 for calculated preference information.

FIGURE 8a. Sockeye Salmon (*O. nerka*) Spawning Depth Preference

Analysis based on 4 studies and 1,053 redds (Cedar River and Big Creek (Quinault basin)).

Preference has changed from the 2004 edition.

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.0-0.19	0.00	0.00	0.00
0.20-0.29	0.30	0.15	0.00
0.30-0.39	0.62	0.35	0.60
0.40-0.49	0.71	0.65	0.83
0.50-0.59	0.77	1.15	1.0
0.60-0.69	0.83	1.35	1.0
0.70-0.79	0.86	1.55	0.55
0.80-0.89	0.90	1.95	0.22
0.90-0.99	0.94	5.0	0.22
1.00-1.09	0.97	10	0
1.10-1.19	0.98		
1.20-1.29	0.99		
1.30-1.39	1.00		
1.40-1.49	0.78		
1.50-1.59	0.55		
1.60-1.69	0.48		
1.70-1.79	0.41		
1.80-1.89	0.32		
1.90-2.29	0.23		
2.30-2.59	0.22		
2.60-2.79	0.14		
2.80-2.99	0.13		
3.00-3.19	0.12		
3.20-3.29	0.09		
3.30-3.39	0.07		
3.40-3.49	0.04		
3.5+	0.00		



For Sockeye Salmon Spawning Substrate Preference, use Table 2. See Table 10 for calculated substrate preference information.

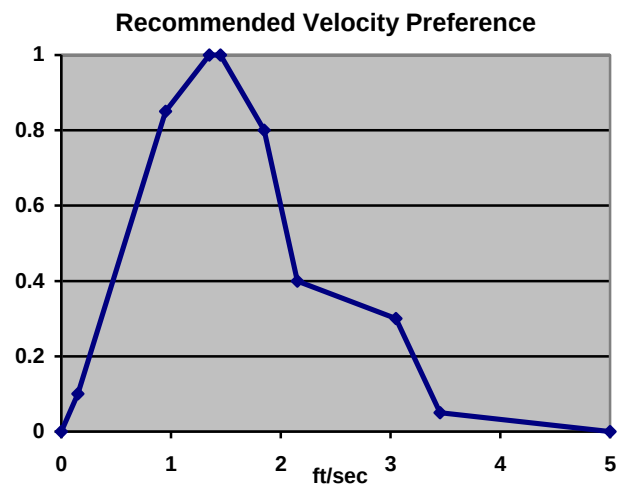
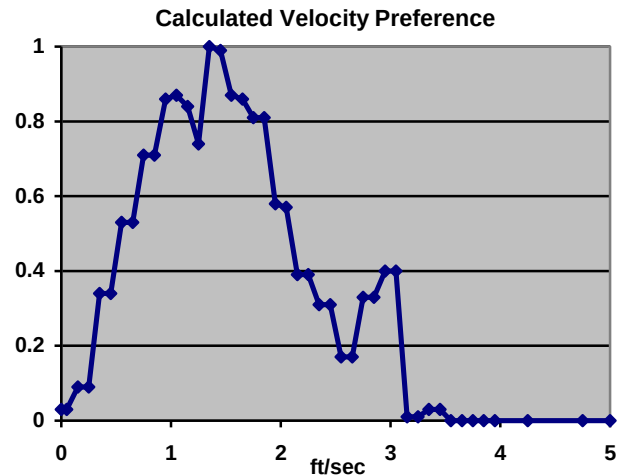
HSC Notes: For depth preference after 1.90 ft. we chose to maintain a 0.22 preference out to 5' then reduce it to 0.0 at 10'.

FIGURE 8b. Sockeye Salmon Spawning Velocity Preference

Analysis based on 4 studies and 1,053 redds (Cedar River & Big Creek (Quinault basin)).

Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.0-0.09	0.03	0.00	0.00
0.10-0.29	0.09	0.15	0.10
0.30-0.49	0.34	0.95	0.85
0.50-0.69	0.53	1.35	1.0
0.70-0.89	0.71	1.45	1.0
0.90-0.99	0.86	1.85	0.80
1.00-1.09	0.87	2.15	0.40
1.10-1.19	0.84	3.05	0.30
1.20-1.29	0.74	3.45	0.05
1.30-1.39	1.0	5	0
1.40-1.49	0.99		
1.50-1.59	0.87		
1.60-1.69	0.86		
1.70-1.89	0.81		
1.90-1.99	0.58		
2.00-2.09	0.57		
2.10-2.29	0.39		
2.30-2.49	0.31		
2.50-2.69	0.17		
2.70-2.89	0.33		
2.90-3.09	0.40		
3.10-3.29	0.01		
3.30-3.49	0.03		
3.5+	0.0		



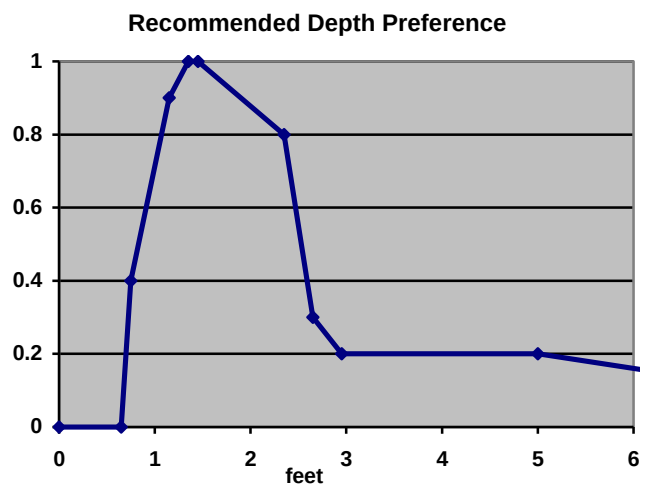
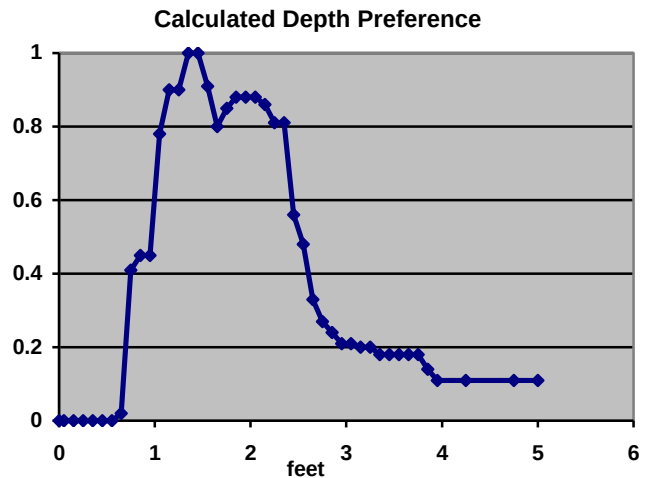
For Sockeye Salmon Spawning Substrate Preference, use Table 2. See Table 10 for calculated substrate preference information.

FIGURE 9a. Steelhead (*O. mykiss*) Spawning Depth Preference

Analysis based on 4 studies, 85 redds (Cedar and Sultan rivers and Chelan Fish Channel).

Preference has changed from the 2004 edition.

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.59	0.00	0.00	0.00
0.60-0.69	0.02	0.65	0.00
0.70-0.79	0.41	0.75	0.40
0.80-0.99	0.45	1.15	0.90
1.00-1.29	0.95	1.35	1.00
1.30-1.49	1.00	1.45	1.00
1.50-1.59	0.91	2.35	0.80
1.60-1.69	0.80	2.65	0.30
1.70-1.79	0.85	2.95	0.20
1.80-2.09	0.88	5.0	0.20
2.10-2.19	0.86	10.0	0.0
2.20-2.39	0.81		
2.40-2.49	0.56		
2.50-2.59	0.48		
2.60-2.69	0.33		
2.50-2.59	0.48		
2.60-2.69	0.33		
2.70-2.79	0.27		
2.80-2.89	0.24		
2.90-3.09	0.21		
3.10-3.29	0.20		
3.30-3.79	0.18		
3.80-3.89	0.14		
3.90-5.0+	0.11		



For Steelhead Spawning Substrate Preference, use Table 4.

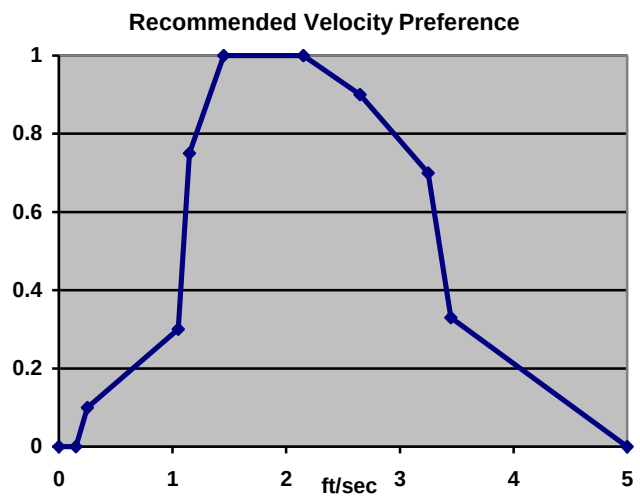
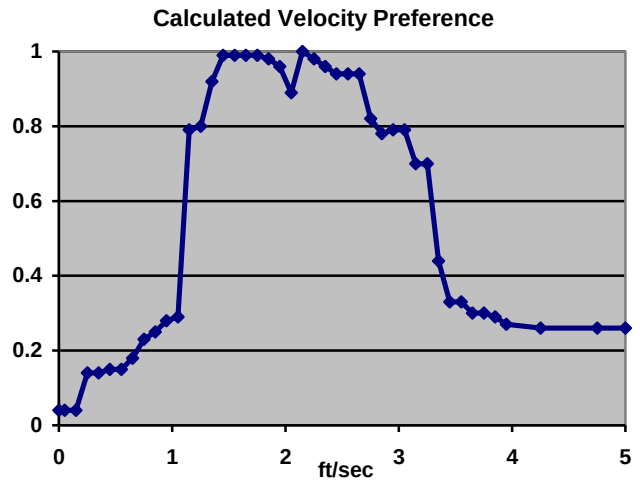
HSC Notes: All study streams were over 50' LBTW. We were unable to make a small vs. large stream comparison.
For depth preference after 2.90 ft. we chose to maintain a 0.20 preference out to 5' then reduced it to 0.0 at 10'.

FIGURE 9b. Steelhead Spawning Velocity Preference

Analysis based on 4 studies, 85 redds (Cedar and Sultan rivers and Chelan Fish Channel).

Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.19	0.04	0.00	0.0
0.20-0.39	0.14	0.15	0.0
0.40-0.59	0.15	0.25	0.10
0.60-0.69	0.18	1.05	0.30
0.70-0.79	0.23	1.15	0.75
0.80-0.89	0.25	1.45	1.0
0.90-0.99	0.28	2.15	1.0
1.00-1.09	0.29	2.65	0.90
1.10-1.19	0.79	3.25	0.70
1.20-1.29	0.8	3.45	0.33
1.30-1.39	0.92	5.0	0.0
1.40-1.79	0.99		
1.80-1.89	0.98		
1.90-1.99	0.96		
2.00-2.09	0.89		
2.10-2.19	1.0		
2.20-2.29	0.98		
2.30-2.39	0.96		
2.40-2.69	0.94		
2.70-2.79	0.82		
2.80-2.89	0.78		
2.90-3.09	0.79		
3.10-3.29	0.70		
3.30-3.39	0.44		
3.40-3.59	0.33		
3.60-3.79	0.30		
3.80-3.89	0.29		
3.90-3.99	0.27		
4.00-5.0	0.26		



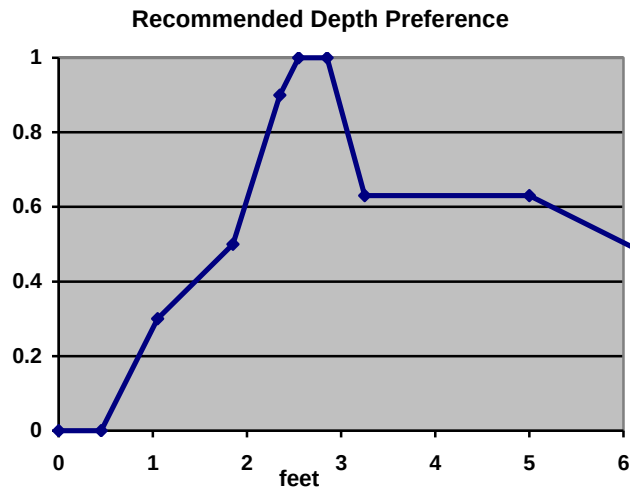
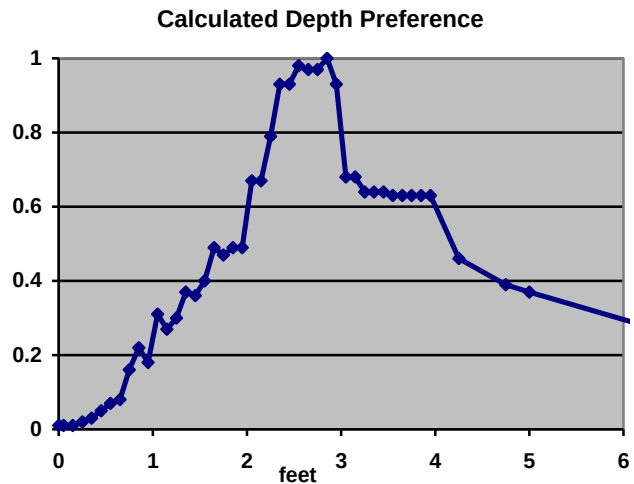
For Steelhead Spawning Substrate Preference, use Table 4.

HSC Notes: All study streams were over 50' in LBTW. We were unable to make a small vs. large stream comparison.

FIGURE 10a. O. mykiss Juvenile Depth Preference in Large Streams

Use on streams with $\geq 35'$ Low Bank Toe-Width (LBTW)¹. Analysis based on 13 studies and 1003 fish (Mill, Martin, and Morse creeks, and Tucannon (2), Wishkah, Sultan, Dungeness (2), Cedar, Chewuch, Chiwawa, and Similkameen rivers). **Preference has changed from the 2004 edition.**

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.19	0.01	0.00	0.00
0.20-0.29	0.02	0.45	0.00
0.30-0.39	0.03	1.05	0.30
0.40-0.49	0.05	1.85	0.50
0.50-0.59	0.07	2.35	0.90
0.60-0.69	0.08	2.55	1.0
0.70-0.79	0.16	2.85	1.0
0.80-0.89	0.22	3.25	0.63
0.90-0.99	0.18	5	0.63
1.00-1.09	0.31	10	0.0
1.10-1.19	0.27		
1.20-1.29	0.30		
1.30-1.19	0.37		
1.40-1.49	0.36		
1.50-1.59	0.40		
1.60-1.69	0.49		
1.70-1.79	0.47		
1.80-1.99	0.49		
2.00-2.19	0.67		
2.20-2.29	0.79		
2.30-2.49	0.93		
2.50-2.59	0.98		
2.60-2.79	0.97		
2.80-2.89	1.0		
2.90-2.99	0.93		
3.00-3.19	0.68		
3.20-3.49	0.64		
3.50-3.99	0.63		
4.00-4.49	0.46		
4.50-4.99	0.39		
5.0	0.37		



For Steelhead Juvenile Cover/Substrate Preference, use Table 3.

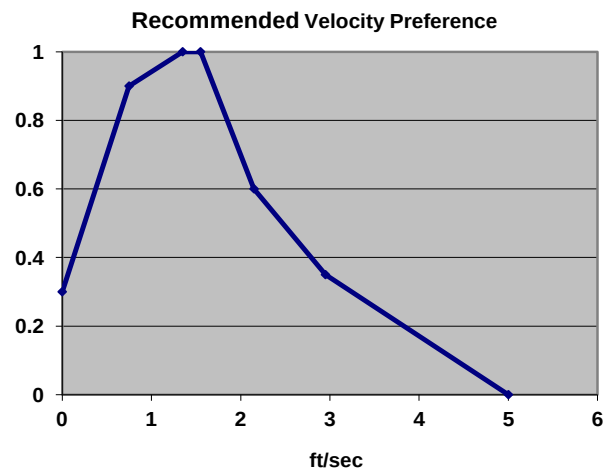
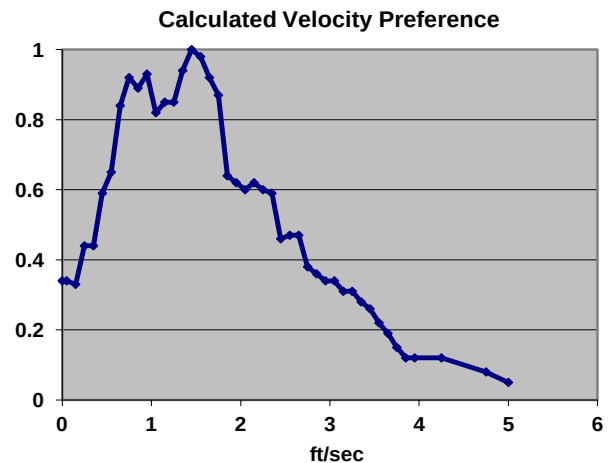
HSC Notes: The calculated preference reduction after 4.0 ft comes from studies with 1.0 preference dropping to 0.0 due to a lack of habitat availability. We chose to maintain a 0.63 preference out to 5' then reduced it to 0.0 at 10'.

¹ The median depth HSC peak in groups Small ($<35'$) and Large ($\geq 35'$) LBTW were 1.3 and 2.25 ft respectively. The distributions of the groups differed significantly (Wilcoxon rank sum test $U_1=22$, $U_2=131$, $n_1=6$, $n_2=11$, $P<.005$ two tailed).

FIGURE 10b. O. mykiss Juvenile Velocity Preference in Large Streams

Use on streams with $\geq 35'$ LBTW¹. Analysis based on 13 studies and 1000 fish (Mill, Martin, and Morse creek, and Tucannon (2), Wishkah, Sultan, Dungeness (2), Cedar, Chewuch, Chiwawa, and Similkameen rivers). **Preference has changed from the 2004 edition.**

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.34	0.00	0.30
0.10-0.19	0.33	0.75	0.90
0.20-0.39	0.44	1.35	1.0
0.40-0.49	0.59	1.55	1.0
0.50-0.59	0.65	2.15	0.60
0.60-0.69	0.84	2.95	0.35
0.70-0.79	0.92	5	0.0
0.80-0.89	0.89		
0.90-0.99	0.93		
1.00-1.09	0.82		
1.10-1.29	0.85		
1.30-1.39	0.94		
1.40-1.49	1.0		
1.50-1.59	0.98		
1.60-1.69	0.92		
1.70-1.79	0.87		
1.80-1.99	0.64		
2.00-2.09	0.60		
2.10-2.19	0.62		
2.20-2.29	0.60		
2.30-2.39	0.59		
2.40-2.49	0.46		
2.50-2.69	0.47		
2.70-2.79	0.38		
2.80-2.89	0.36		
2.90-3.09	0.34		
3.10-3.29	0.31		
3.30-3.39	0.28		
3.40-3.49	0.26		
3.50-3.59	0.22		
3.60-3.69	0.19		
3.70-3.79	0.15		
3.80-4.49	0.12		
4.50-4.95	0.08		
5.0	0.05		



For Steelhead Juvenile Cover/Substrate Preference, use Table 3.

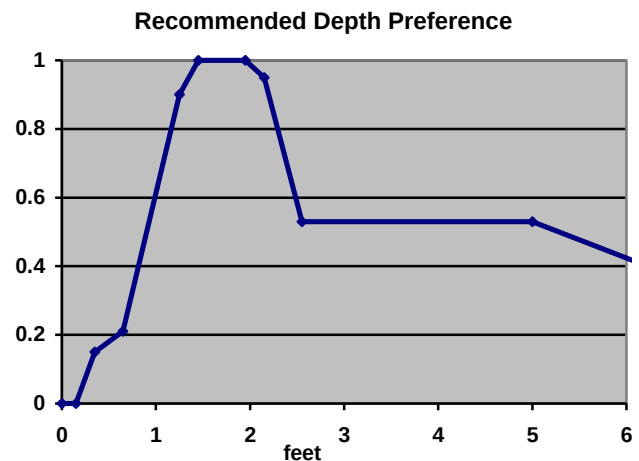
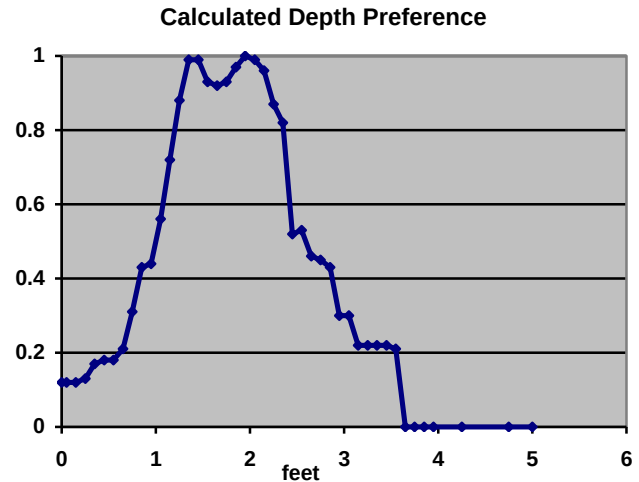
¹The median velocity HSC peak in groups Small ($<35'$) and Large ($\geq 35'$) LBTW were 0.4 and 0.85 ft/sec respectively. The distributions of the groups differed significantly (Wilcoxon rank sum test $U_1=33.5$, $U_2=119.5$, $n_1=6$, $n_2=11$, $P<0.05$ two tailed).

FIGURE 11a. O. mykiss Juvenile Depth Preference in Small Streams.

Use for Steelhead and Rainbow Trout juveniles on streams with < 35' LBTW¹. Analysis based on 6 studies and 234 fish (Olson, Jordan, Harlan, Hancock, and Calligan creeks and Mad River).

Preference has changed from the 2004 edition.

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.19	0.12	0.00	0.0
0.20-0.29	0.13	0.15	0.0
0.30-0.39	0.17	0.35	0.15
0.40-0.59	0.18	0.65	0.21
0.60-0.69	0.21	1.25	0.90
0.70-0.79	0.31	1.45	1.0
0.80-0.89	0.43	1.95	1.0
0.90-0.99	0.44	2.15	0.95
1.00-1.09	0.56	2.55	0.53
1.10-1.19	0.72	5.0	0.53
1.20-1.29	0.88	10.0	0.0
1.30-1.49	0.99		
1.50-1.59	0.93		
1.60-1.69	0.92		
1.70-1.79	0.93		
1.80-1.89	0.97		
1.90-1.99	1.0		
2.00-2.09	0.99		
2.10-2.19	0.96		
2.20-2.29	0.87		
2.30-2.39	0.82		
2.40-2.49	0.52		
2.50-2.59	0.53		
2.60-2.69	0.46		
2.70-2.79	0.45		
2.80-2.89	0.43		
2.90-3.09	0.30		
3.10-3.49	0.22		
3.50-3.59	0.21		
3.60-5.0+	0		



For Steelhead Juvenile Cover/Substrate Preference, use Table 3.

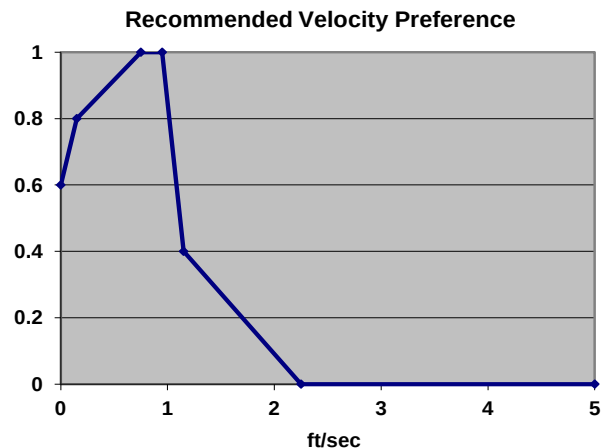
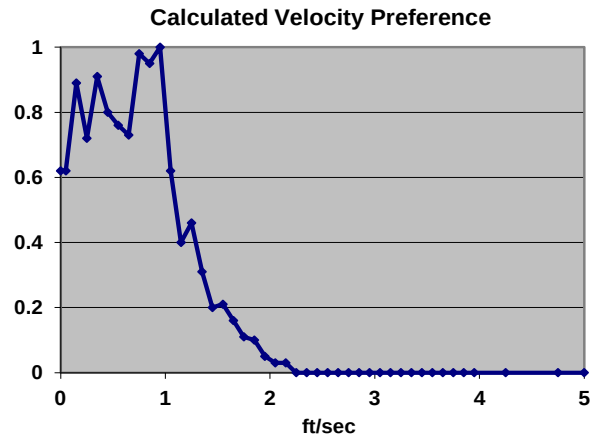
¹ The median depth HSC peak in groups Small (<35') and Large (≥35') LBTW were 1.3 and 2.25 ft. respectively. The distribution of the groups differed significantly (Wilcoxon rank sum test $U_1=22$, $U_2=131$, $n_1=6$, $n_2=11$, $P<.005$ two tailed).

FIGURE 11b. *O. mykiss* Juvenile Velocity Preference in Small Streams

Use for Steelhead and Rainbow Trout juveniles on streams with < 35' LBTW¹. Analysis based on 6 studies and 234 fish (Olson, Jordan, Harlan, Hancock, and Calligan creeks and Mad River).

Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.62	0.00	0.60
0.10-0.19	0.89	0.15	0.80
0.20-0.29	0.72	0.75	1.0
0.30-0.39	0.91	0.95	1.0
0.40-0.49	0.80	1.15	0.40
0.50-0.59	0.76	2.25	0.00
0.60-0.69	0.73	5.0+	0.00
0.70-0.79	0.98		
0.80-0.89	0.95		
0.90-0.99	1.0		
1.00-1.09	0.62		
1.10-1.19	0.40		
1.20-1.29	0.46		
1.30-1.39	0.31		
1.40-1.49	0.20		
1.50-1.59	0.21		
1.60-1.69	0.16		
1.70-1.79	0.11		
1.80-1.89	0.10		
1.90-1.99	0.05		
2.00-2.19	0.03		
2.20+	0.0		



For Steelhead Juvenile Cover/Substrate Preference, use Table 3.

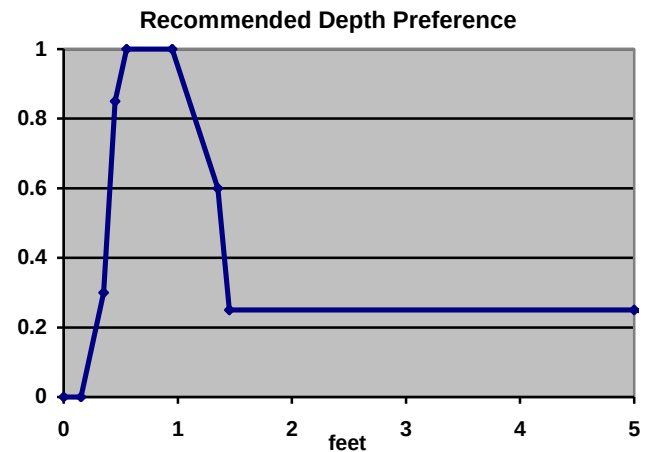
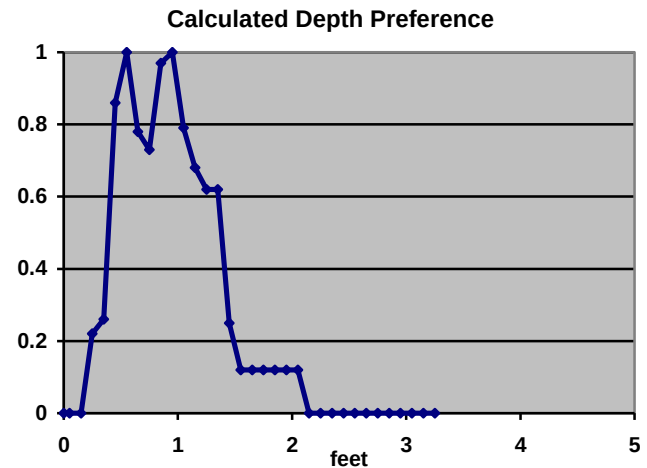
¹ The median velocity HSC peak in groups Small (<35') and Large (≥35') LBTW were 0.4 and 0.85 ft/sec respectively. The distributions of the groups differed significantly (Wilcoxon rank sum test $U_1=33.5$, $U_2=119.5$, $n_1=6$, $n_2=11$, $P<0.05$ two tailed).

FIGURE 12a. Resident Rainbow Trout (*O. mykiss*) Spawning Depth Preference
 Analysis based on 2 studies and 27 redds (upper Lake and Muller creeks).
Preference has changed from the 2004 edition.

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.19	0.0	0.00	0.00
0.20-0.29	0.22	0.15	0.00
0.30-0.39	0.26	0.35	0.30
0.40-0.49	0.86	0.45	0.85
0.50-0.59	1.0	0.55	1.0
0.60-0.69	0.78	0.95	1.0
0.70-0.79	0.73	1.35	0.60
0.80-0.89	0.97	1.45	0.25
0.90-0.99	1.0	5.0	0.25
1.00-1.09	0.79	10.0	0.0
1.10-1.19	0.68		
1.20-1.39	0.62		
1.40-1.49	0.25		
1.50-2.09	0.12		
2.1+	*No Data		

HSC Notes: Study sites were all small stream with shallow depths (< 2.5 ft.). We were unable to make a small vs. large stream comparison. We are unable to say if this curve represents preference in larger streams.

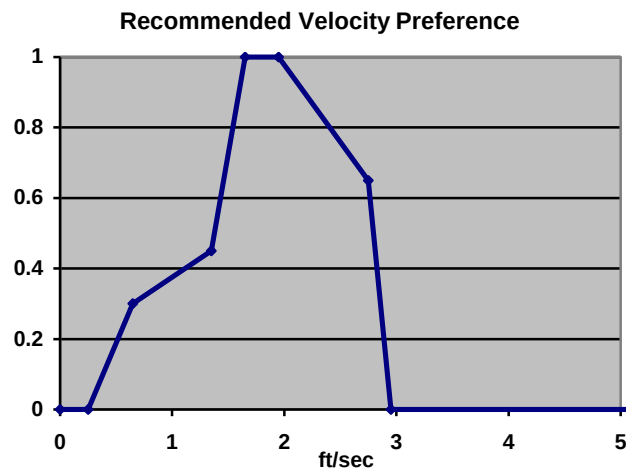
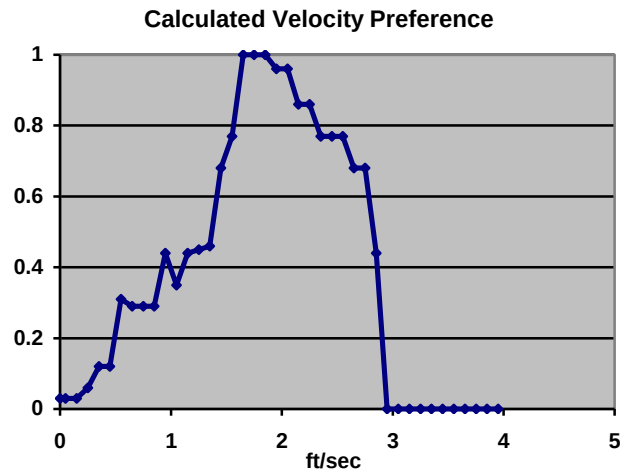
We chose to maintain a 0.25 preference out to 5' then reduced it to 0.0 at 10'.



For Resident Rainbow Trout Spawning Substrate Preference, use Table 5.

FIGURE 12b. Resident Rainbow Trout Spawning Velocity Preference
 Analysis based on 2 studies and 27 redds (upper Lake and Muller creeks).
Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.19	0.03	0.00	0.00
0.20-0.29	0.06	0.25	0.00
0.30-0.49	0.12	0.65	0.30
0.50-0.59	0.31	1.25	0.45
0.60-0.89	0.29	1.65	1.0
0.90-0.99	0.44	1.95	1.0
1.00-1.09	0.35	2.75	0.65
1.10-1.19	0.44	2.95+	0
1.20-1.29	0.45		
1.30-1.39	0.46		
1.40-1.49	0.68		
1.50-1.59	0.77		
1.60-1.89	1.0		
1.90-2.09	0.96		
2.10-2.29	0.86		
2.30-2.59	0.77		
1.60-1.79	0.68		
2.80-2.89	0.44		
2.95+	0.0		



For Resident Rainbow Trout Spawning Substrate Preference, use Table 5.

HSC Notes: Study sites were all small stream with shallow depths (< 2.5 ft.). We were unable to make a small vs. large stream comparison. We are unable to say if this curve represents preference in larger streams.

FIGURE 13a. Resident Rainbow Trout Winter Depth Preference
Campbell and Neuner (1985)¹. Preference is unchanged from 2004.

Plotted depth (feet)	Recommended depth preference
0.00	0.00
0.20	0.00
0.30	0.20
0.50	1.00
1.50	1.00
3.00	0.25
3.50	0.10
6.00	0.10
99	0.10

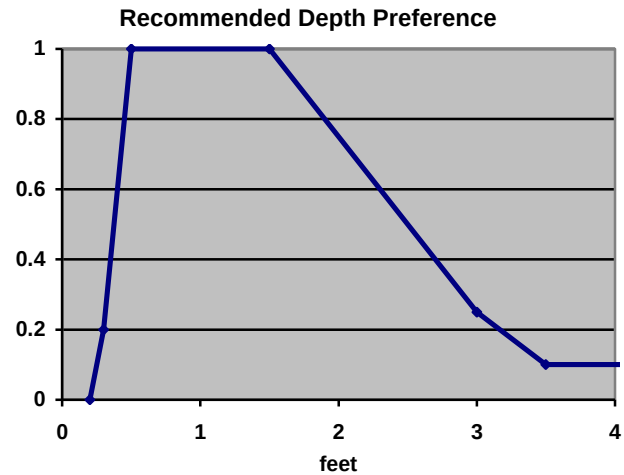
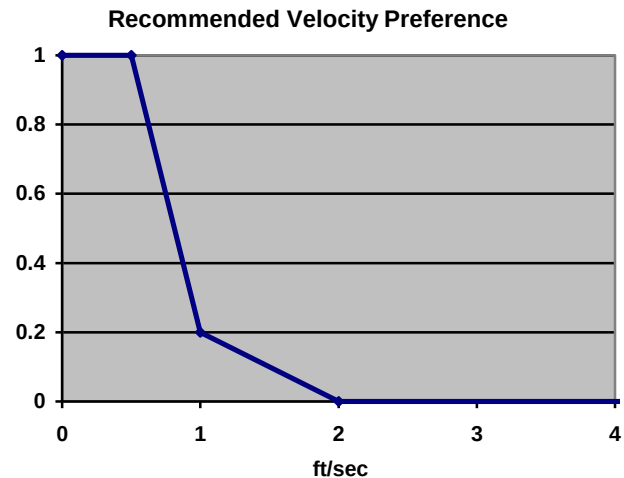


FIGURE 13b. Resident Rainbow Trout Winter Velocity Preference
Campbell and Neuner (1985). Preference is unchanged from 2004.

Plotted velocity (feet/sec)	Recommended velocity preference
0.00	1.00
0.50	1.00
1.00	0.20
2.00	0.00
99	0.00



For Winter Cover/Substrate Preference, use Table 3

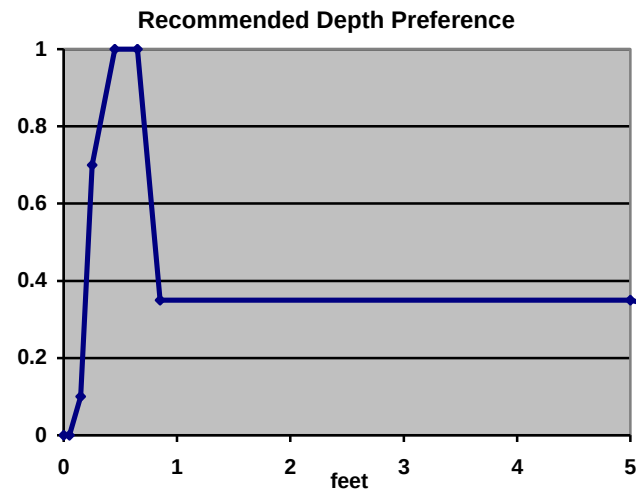
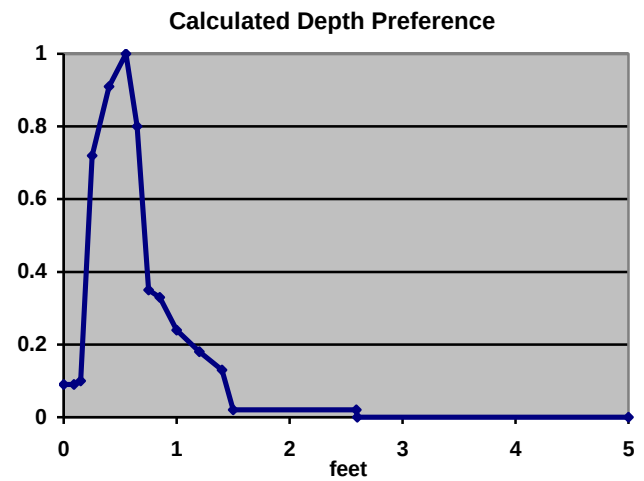
¹ Depth and velocity curves are estimates based on observations and professional judgment. Actual depth and velocities were not measured. Based on their observations during winter days, trout required deep pools or areas with a good level of interstitial spaces between the substrate (large gravel, cobbles, and boulders) for refuge. During the nighttime, the fish were always observed resting on the bottom in quiet areas with sandy to silty substrates (R. Campbell, R2 Resource Consultants, pers. comm., 2003).

FIGURE 14a. Cutthroat Trout (*O. clarki*) Spawning Depth Preference

Analysis based on 6 studies and 69 redds (Irely Creek).

Preference has changed from the 2004 edition.

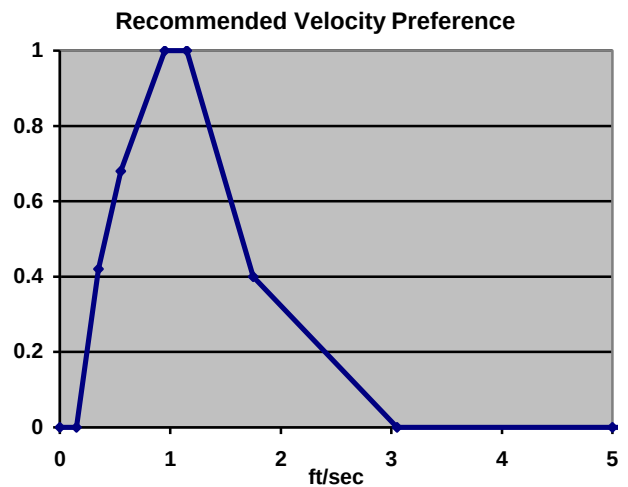
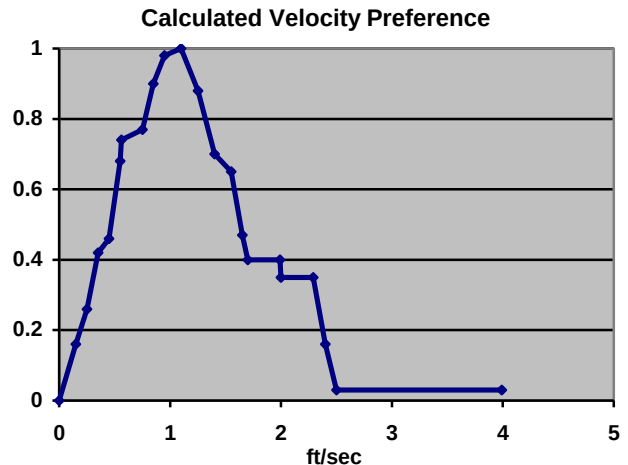
Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.09	0.09	0.00	0.00
0.10-0.19	0.10	0.05	0.00
0.20-0.29	0.72	0.15	0.10
0.30-0.49	0.91	0.25	0.70
0.40-0.49	0.94	0.45	1.0
0.50-0.59	1.0	0.65	1.0
0.60-0.69	0.88	0.85	0.35
0.70-0.79	0.35	5.00	0.35
0.80-0.89	0.33	10	0.0
0.90-1.09	0.24		
1.10-1.29	0.18		
1.30-1.49	0.13		
1.50-2.59	0.02		
2.60+	0.0		



HSC Notes: The study stream was small (<35' LBTW). We were unable to make a small vs. large stream comparison and cannot say if this curve represents preference in larger streams.

FIGURE 14b. Cutthroat Spawning Velocity Preference
 Analysis based on 6 studies and 69 redds (Irely Creek).
Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.05	0.00	0.00
0.10-0.19	0.16	0.15	0.00
0.20-0.29	0.26	0.35	0.42
0.30-0.39	0.42	0.55	0.68
0.40-0.49	0.46	0.95	1.00
0.50-0.59	0.68	1.15	1.00
0.60-0.69	0.74	1.75	0.40
0.70-0.79	0.77	3.05	0.0
0.80-0.89	0.90	5.00	0.0
0.90-0.99	0.98		
1.00-1.19	1.0		
1.20-1.29	0.88		
1.30-1.49	0.70		
1.50-1.59	0.65		
1.60-1.69	0.47		
1.70-1.99	0.40		
2.00-2.19	0.35		
2.30-2.49	0.16		
2.50-3.99	0.03		



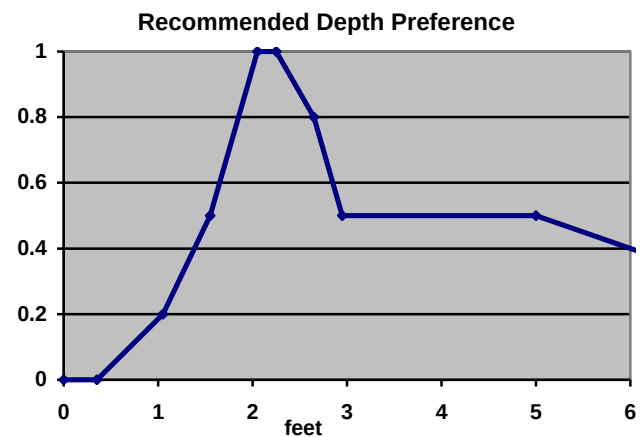
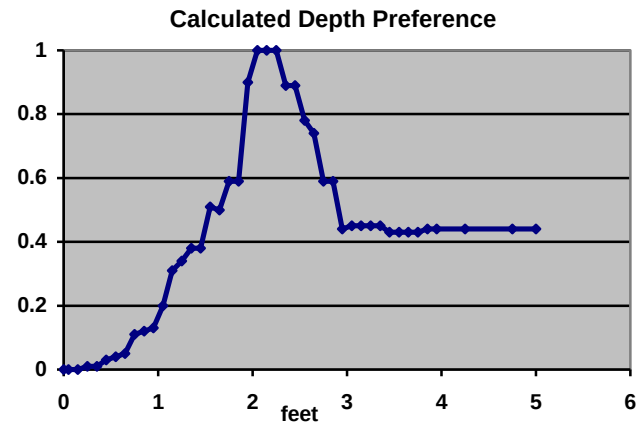
For Cutthroat Trout Spawning Substrate Preference, use Table 5

HSC Notes: The study stream was small (<35' LBTW). We were unable to make a small vs. large stream comparison and cannot say if this curve represents preference in larger streams.

FIGURE 15a. Cutthroat Trout Juvenile Depth Preference

Analysis based on 7 studies and 336 fish (Ohanapecosh River and Early Winters and Perry Creeks). **Preference has changed from 2004.**

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.19	0.00	0.00	0.00
0.20-0.39	0.01	0.35	0.00
0.40-0.49	0.03	1.05	0.20
0.50-0.59	0.04	1.55	0.50
0.60-0.69	0.05	2.05	1.00
0.70-0.79	0.11	2.25	1.00
0.80-0.89	0.12	2.65	0.80
0.90-0.99	0.13	2.95	0.50
1.00-1.09	0.20	5.0	0.50
1.10-1.19	0.31	10	0
1.20-1.29	0.34		
1.30-1.49	0.38		
1.50-1.59	0.51		
1.60-1.69	0.50		
1.70-1.89	0.59		
1.90-1.99	0.90		
2.00-2.29	1.00		
2.30-2.49	0.89		
2.50-2.59	0.78		
2.60-2.69	0.74		
2.70-2.89	0.59		
2.90-2.99	0.44		
3.00-3.39	0.45		
3.40-3.79	0.43		
3.80-4.99	0.44		
5.00+	0.44		



For Cutthroat Trout Winter Depth Preference, use Figure 13a

For Cutthroat Trout Winter Velocity Preference, use Figure 13b

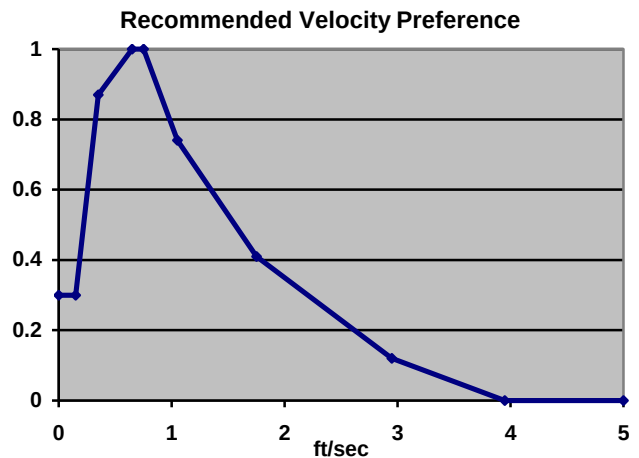
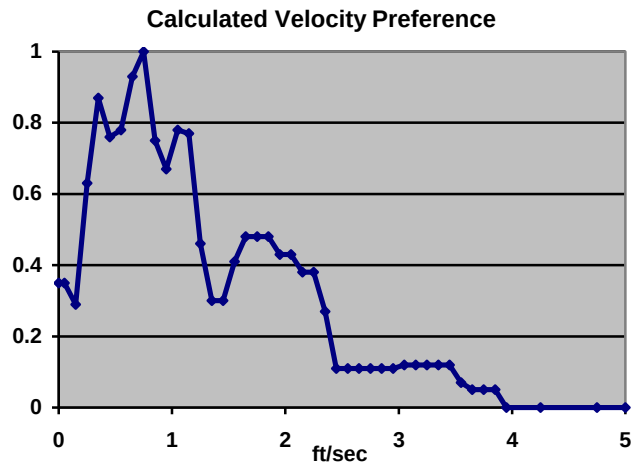
For Cutthroat Trout Winter Substrate Preference, use Table 3

HSC Notes: There were not enough studies to conduct a small vs. large stream comparison.

FIGURE 15b. Cutthroat Trout Juvenile Velocity Preference

Analysis based on 8 studies and 346 fish (Ohanapecosh River and Early Winters and Perry Creeks). **Preference has changed from the 2004 edition.**

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.35	0.00	0.30
0.10-0.19	0.29	0.15	0.30
0.20-0.29	0.63	0.35	0.87
0.30-0.39	0.87	0.65	1.00
0.40-0.49	0.76	0.75	1.00
0.50-0.59	0.78	1.05	0.74
0.60-0.69	0.93	1.75	0.41
0.70-0.79	1.00	2.95	0.12
0.80-0.89	0.75	3.95	0.00
0.90-0.99	0.67	5+	0.00
1.00-1.09	0.78		
1.10-1.19	0.77		
1.20-1.29	0.46		
1.30-1.49	0.30		
1.50-1.59	0.41		
1.60-1.89	0.48		
1.90-2.09	0.43		
2.10-2.29	0.38		
2.30-2.39	0.27		
2.40-2.99	0.11		
3.00-3.49	0.12		
3.50-3.59	0.06		
3.60-3.89	0.05		
3.90+	No data		



HSC Notes: There were not enough studies to conduct a small vs. large stream comparison.

For Cutthroat Trout Winter Depth Preference, use Figure 13a

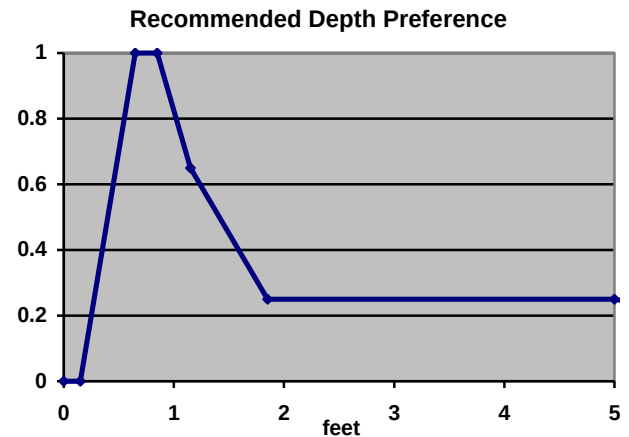
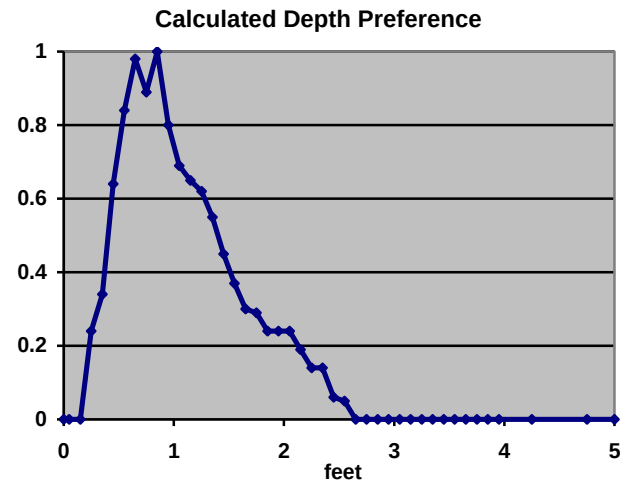
For Cutthroat Trout Winter Velocity Preference, use Figure 13b

For Cutthroat Trout Winter Substrate Preference, use Table 3

FIGURE 16a. Bull Trout and Dolly Varden Spawning Depth Preference

Analysis based on 8 studies and 122 redds (Rock, Phelps and Indian creeks, and Mad, North Fork Skykomish, and Chiwawa rivers). **Preference has changed from the 2004 edition.**

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.19	0.0	0.00	0.0
0.20-0.29	0.24	0.15	0.0
0.30-0.39	0.34	0.65	1.0
0.40-0.49	0.64	0.85	1.0
0.50-0.59	0.84	1.15	0.65
0.60-0.69	0.98	1.85	0.25
0.70-0.79	0.89	5.0	0.25
0.80-0.89	1.0	10	0.0
0.90-0.99	0.80		
1.00-1.09	0.69		
1.10-1.19	0.65		
1.20-1.29	0.62		
1.30-1.39	0.55		
1.40-1.49	0.45		
1.50-1.59	0.37		
1.60-1.69	0.30		
1.70-1.79	0.29		
1.80-2.09	0.24		
2.10-2.19	0.19		
2.20-2.39	0.14		
2.40-2.49	0.06		
2.50-2.59	0.05		
2.6+	0.0		



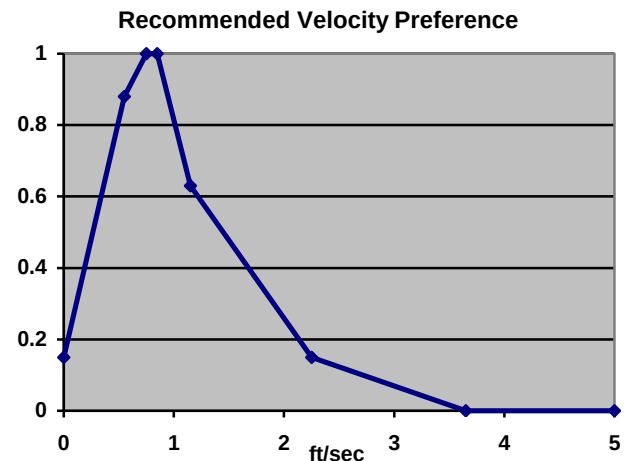
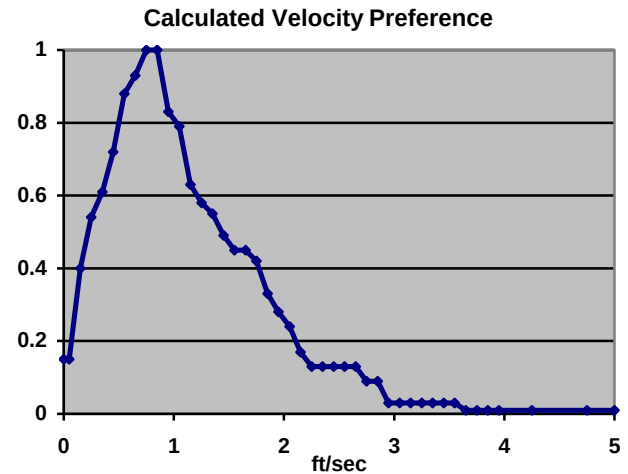
HSC Notes: We analyzed different sized streams and found no difference in Bull Trout depth preference.

For Bull Trout and Dolly Varden Juvenile Spawning Substrate Preference, use Table 6. See Table 11 for calculated substrate preference information.

FIGURE 16b. Bull Trout and Dolly Varden Spawning Velocity Preference

Analysis based on 8 studies and 122 redds (Rock, Phelps and Indian creeks, and Mad, North Fork Skykomish, and Chiwawa rivers). **Preference has changed from the 2004 edition.**

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.15	0.00	0.15
0.10-0.19	0.40	0.55	0.88
0.20-0.29	0.54	0.75	1.0
0.30-0.39	0.61	0.85	1.0
0.40-0.49	0.72	1.15	0.63
0.50-0.59	0.88	2.25	0.15
0.60-0.69	0.93	3.65+	0.0
0.70-0.89	1.0		
0.90-0.99	0.83		
1.00-1.09	0.79		
1.10-1.19	0.63		
1.20-1.29	0.58		
1.30-1.39	0.55		
1.40-1.49	0.49		
1.50-1.69	0.45		
1.70-1.79	0.42		
1.80-2.09	0.33		
2.10-2.19	0.28		
2.20-2.39	0.24		
2.10-2.19	0.17		
2.20-2.69	0.13		
2.70-2.89	0.09		
2.90-3.59	0.03		
3.60-5.0	0.01		

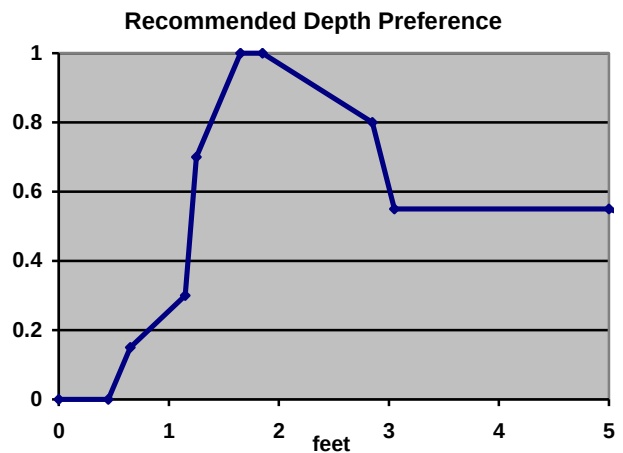
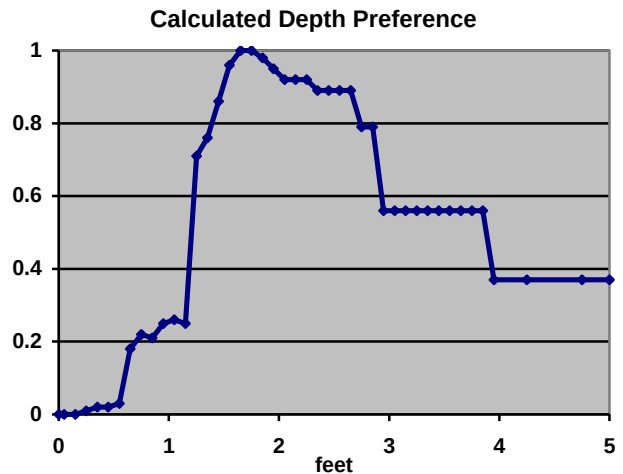


HSC Notes: We analyzed different sized streams and found no difference in Bull Trout velocity preference.

For Bull Trout and Dolly Varden Juvenile Spawning Substrate Preference, use Table 6. See Table 11 for calculated substrate preference information.

FIGURE 17a. Bull Trout and Dolly Varden Juvenile Depth Preference-Large Streams
 Use with Streams $\geq 35'$ LBTW¹. Analysis based on 5 studies and 80 fish (Troublesome Creek, and Chiwawa, Dungeness, and Tucannon rivers).
Preference has changed from the 2004 edition.

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.19	0.0	0.00	0.0
0.20-0.29	0.01	0.45	0.0
0.30-0.49	0.02	0.65	0.15
0.50-0.59	0.03	1.15	0.30
0.60-0.69	0.18	1.25	0.70
0.70-0.79	0.22	1.65	1.0
0.80-0.89	0.21	1.85	1.0
0.90-0.99	0.25	2.85	0.80
1.00-1.09	0.26	2.95	0.55
1.10-1.19	0.25	4.95	0.55
1.20-1.29	0.71	10	0
1.30-1.39	0.76		
1.40-1.49	0.86		
1.50-1.59	0.96		
1.60-1.79	1.0		
1.80-1.89	0.98		
1.90-1.99	0.95		
2.00-2.29	0.92		
2.30-2.69	0.86		
2.70-2.89	0.79		
2.90-3.89	0.56		
3.90-5.0	0.37		

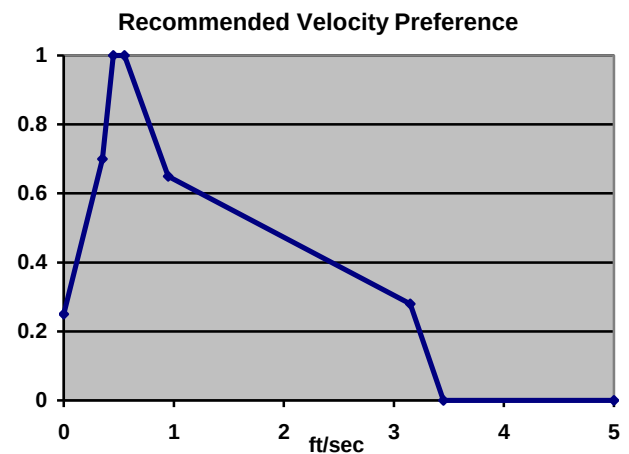
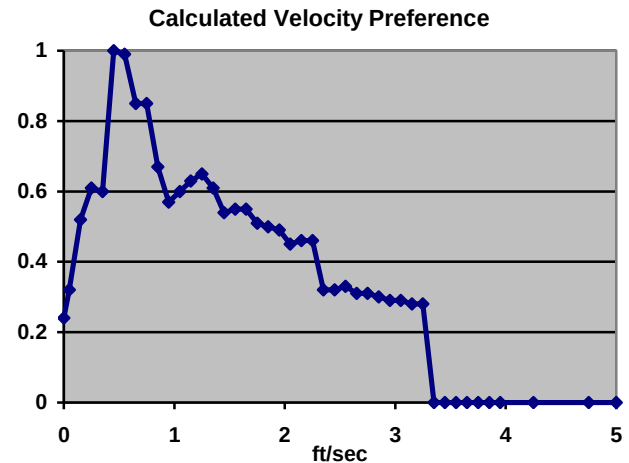


For Bull Trout and Dolly Varden Juvenile Cover/Substrate Preference, use Table 3.

¹ The median HSC peak in groups Small ($<35'$) and Large ($\geq 35'$) were 0.95 and 1.35 ft. The distributions of the groups differed significantly (Wilcoxon rank sum test $U_1=11$, $U_2=34$, $n_1=4$, $n_2=5$, $P<0.05$ two tailed).

FIGURE 17b. Bull Trout and Dolly Varden Juvenile Velocity Preference-Large Streams
 Use with Streams $\geq 35'$ LBTW¹. Analysis based on 5 studies and 80 fish (Troublesome Creek, and Chiwawa, Dungeness, and Tucannon rivers).
Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity suitability
0.00-0.09	0.24	0.00	0.25
0.10-0.19	0.52	0.35	0.70
0.20-0.29	0.61	0.45	1.0
0.30-0.39	0.60	0.55	1.0
0.40-0.49	1.0	0.95	0.65
0.50-0.59	0.99	3.15	0.28
0.60-0.79	0.85	3.45+	0.00
0.80-0.89	0.67		
0.90-0.99	0.57		
1.00-1.09	0.60		
1.10-1.19	0.63		
1.20-1.29	0.65		
1.30-1.39	0.61		
1.40-1.49	0.54		
1.50-1.69	0.55		
1.70-1.79	0.51		
1.80-1.89	0.50		
1.90-1.99	0.49		
2.00-2.09	0.45		
2.10-2.29	0.46		
2.30-3.49	0.32		
2.50-2.59	0.33		
2.60-2.79	0.31		
2.80-2.89	0.30		
2.90-3.09	0.29		
3.10-3.29	0.28		
3.30+	0.0		

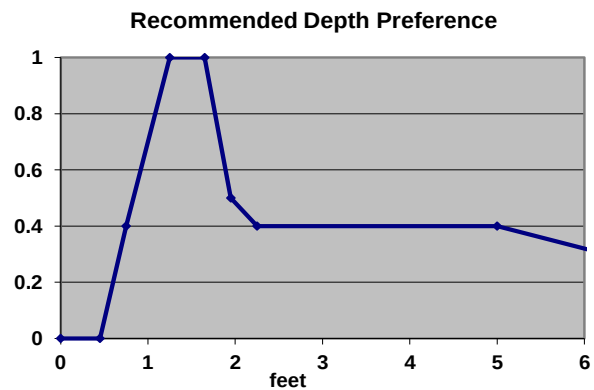
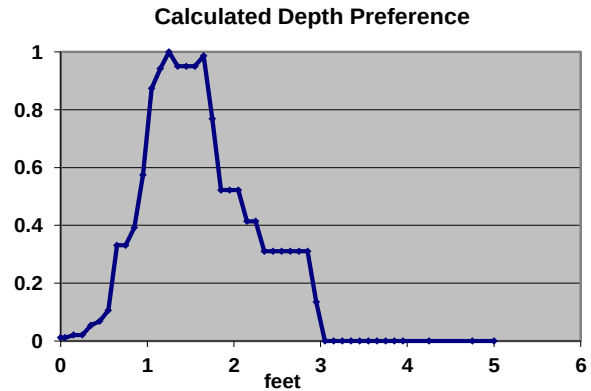


For Bull Trout and Dolly Varden Juvenile Cover/Substrate Preference, use Table 3.

¹ The median HSC peak in groups Small ($<35'$) and Large ($\geq 35'$) LBTW were 0.10 and 0.45 ft/sec respectively. The distributions of the groups differed significantly (Wilcoxon rank sum test $U_1=11$, $U_2=34$, $n_1=4$, $n_2=5$, $P<0.05$ two tailed).

FIGURE 18a. Bull Trout and Dolly Varden Juvenile Depth Preference in Small Streams
Use on Streams with < 35' LBTW¹. Analysis based on 4 studies and 28 fish (Rock, Early Winters, and Phelps creeks and Mad River). **Preference has changed from the 2004 edition.**

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.09	0.01	0.00	0.00
0.10-0.29	0.02	0.45	0.00
0.30-0.39	0.05	0.75	0.40
0.40-0.49	0.07	1.25	1.0
0.50-0.59	0.11	1.65	1.0
0.60-0.69	0.33	1.95	0.50
0.70-0.89	0.39	2.25	0.40
0.90-0.99	0.57	5.0	0.40
1.00-1.09	0.87	10.0+	0.00
1.10-1.19	0.94		
1.20-1.29	1.0		
1.30-1.59	0.95		
1.60-1.69	0.99		
1.70-1.79	0.77		
1.80-2.09	0.52		
2.10-2.29	0.41		
2.30-2.89	0.31		
2.90-2.99	0.13		
3.00+	No data		

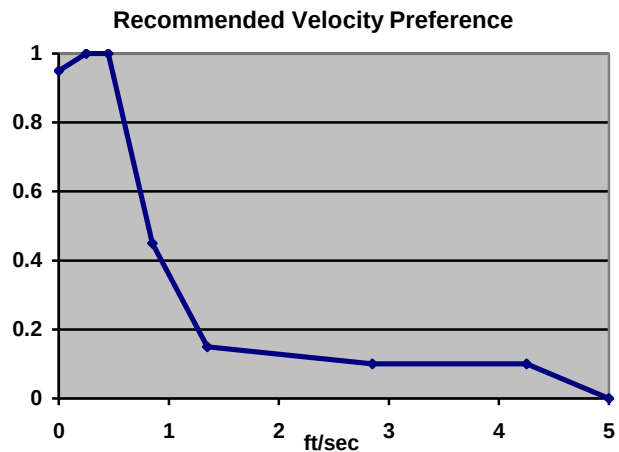
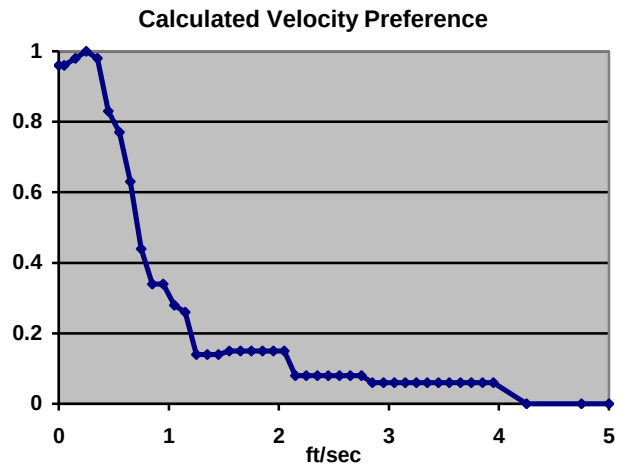


For Bull Trout and Dolly Varden Juvenile Cover/Substrate Preference, use Table 3.

¹ The median HSC peak in groups Small (<35') and Large (≥35') LBTW were 0.95 and 1.35 ft respectively. The distributions of the groups differed significantly (Wilcoxon rank sum test $U_1=11$, $U_2=34$, $n_1=4$, $n_2=5$, $P<0.05$ two tailed).

FIGURE 18b. Bull Trout and Dolly Varden Juvenile Velocity Preference-Small Streams
Use on Streams with < 35' LBTW¹. Analysis based on 4 studies and 28 fish (Rock, Early Winters, and Phelps creeks and Mad River). **Preference has changed from the 2004 edition.**

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity suitability
0.00-0.09	0.96	0.00	0.95
0.10-0.19	0.98	0.25	1.0
0.20-0.29	1.0	0.45	1.0
0.30-0.39	0.98	0.85	0.45
0.40-0.49	0.83	1.35	0.15
0.50-0.59	0.77	2.85	0.10
0.60-0.69	0.63	4.25	0.10
0.70-0.79	0.44	5.0	0
0.80-0.89	0.34		
0.90-1.09	0.28		
1.10-1.19	0.26		
1.20-1.49	0.14		
1.50-2.09	0.15		
2.10-2.79	0.08		
2.80-3.99	0.06		
4.00+	No data		



For Bull Trout and Dolly Varden Juvenile Cover/Substrate Preference, use Table 3.

¹ The median HSC peak in groups Small (<35') and Large (≥35') LBTW were 0.10 and 0.45 ft/sec respectively. The distributions of the groups differed significantly (Wilcoxon rank sum test $U_1=11$, $U_2=34$, $n_1=4$, $n_2=5$, $P<0.05$ two tailed).

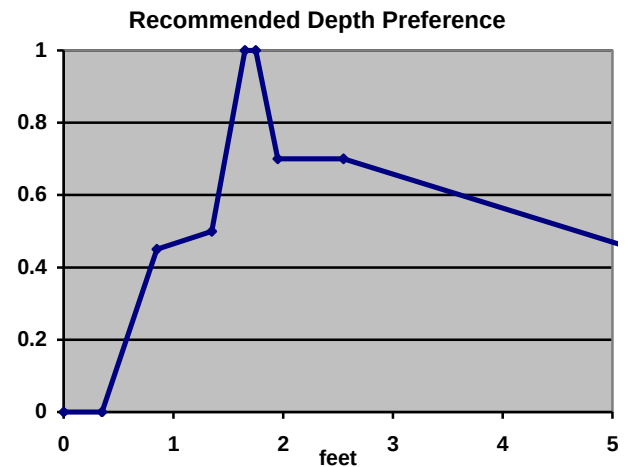
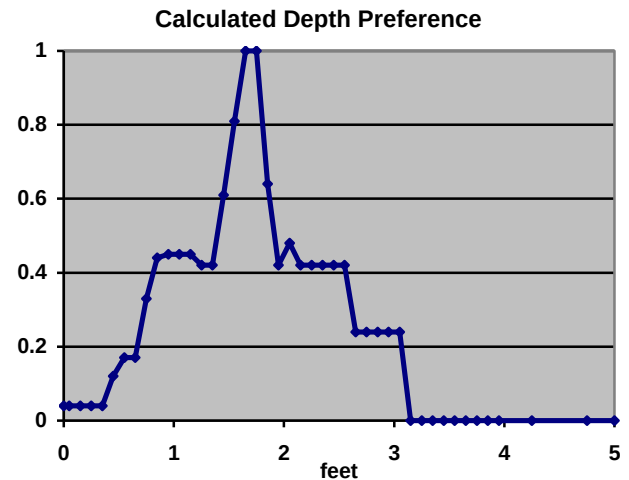
FIGURE 19a. Brook Trout Juvenile Rearing Depth Preference

Analysis based on 4 studies and 39 fish (Ohanapecosh River and Leech Creek).

Preference has changed from the 2004 edition.

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.39	0.04	0.00	0.00
0.40-0.49	0.12	0.35	0.00
0.50-0.69	0.17	0.85	0.45
0.70-0.79	0.33	1.35	0.50
0.80-0.89	0.44	1.65	1.0
0.90-1.19	0.45	1.75	1.0
1.20-1.39	0.42	1.95	0.70
1.40-1.49	0.61	2.55	0.70
1.50-1.59	0.81	10+	0
1.60-1.79	1.0		
1.80-1.89	0.64		
1.90-1.99	0.42		
2.00-2.09	0.48		
2.10-2.59	0.42		
2.60-3.09	0.24		
3.10+	No data		

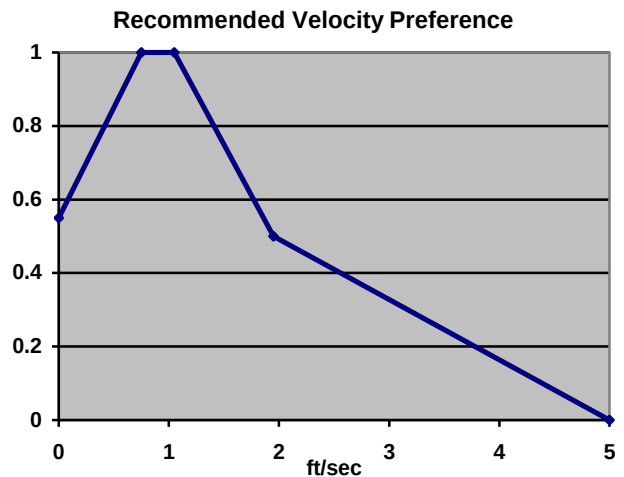
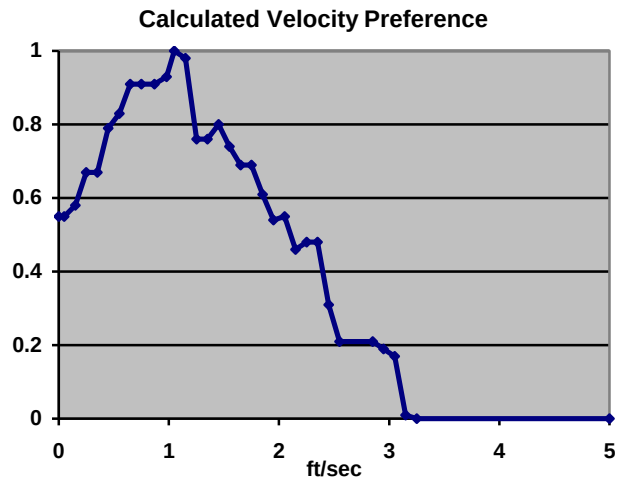
HSC Notes: The calculated preference reduction after 1.7 ft comes from studies with 1.0 preference dropping to 0.0 due to a lack of habitat availability. We chose to maintain a 0.70 preference out to 2.55 ft then reduced it to 0.0 at 10'



For Brook Trout Juvenile Rearing Cover/Substrate Preference, use Table 3.

FIGURE 19b. Brook Trout Juvenile and Adult Rearing Velocity Preference
 Analysis based on 4 studies and 39 fish (Ohanapecosh River and Leech Creek).
Preference has changed from the 2004 edition.

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.55	0.00	0.55
0.10-0.19	0.58	0.75	1.0
0.20-0.39	0.67	1.05	1.0
0.40-0.49	0.79	1.95	0.50
0.50-0.59	0.83	3.25+	0.00
0.60-0.89	0.91		
0.90-0.99	0.93		
1.00-1.09	1.0		
1.10-1.19	0.98		
1.20-1.39	0.76		
1.40-1.49	0.80		
1.50-1.59	0.74		
1.60-1.79	0.69		
1.80-1.89	0.61		
1.90-1.99	0.54		
2.00-2.09	0.55		
2.10-2.19	0.46		
2.20-2.39	0.48		
2.40-2.49	0.31		
2.50-2.89	0.21		
2.90-2.99	0.19		
3.00-3.09	0.17		
3.10-3.19	0.01		
3.20+	0.0		

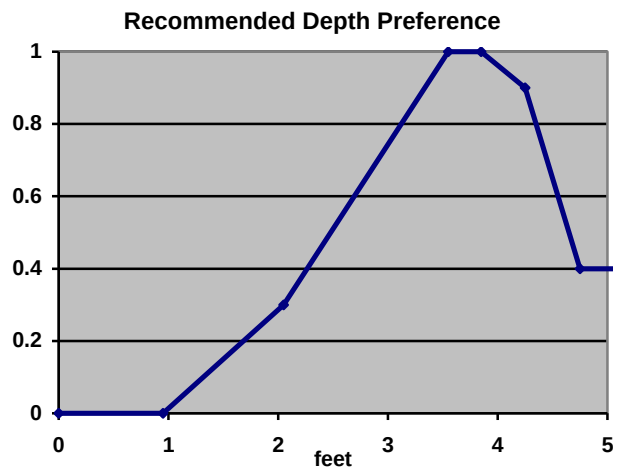
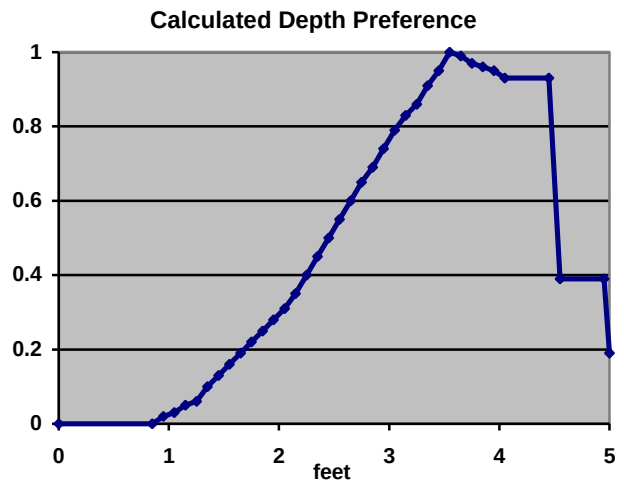


HSC Notes: There were not enough studies to analyse stream size differences

For Brook Trout Juvenile Rearing Cover/Substrate Preference, use Table 3.

FIGURE 20a. Mountain Whitefish Adult Spawning and Rearing Depth Preference
 Analysis based on a composite of 7 Canadian studies (Sheep, Bow, Kananaskis, Red Deer and
 Highwood rivers)*. **Preference has changed from the 2004 edition.**

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-1.09	0.00	0.00	0.00
1.10-1.29	0.01	1.35	0.20
1.30-1.49	0.02	1.95	0.30
1.50-1.59	0.04	2.95	1.0
1.60-1.69	0.08	3.35*	1.0
1.70-1.79	0.12	3.95*	0.73
1.80-1.89	0.17	5.0*	0.60
1.90-1.99	0.22	10.0*	0.00
2.00-2.09	0.29		
2.10-2.19	0.36		
2.20-2.29	0.42		
2.30-2.39	0.49		
2.40-2.49	0.60		
2.50-2.59	0.71		
2.60-2.69	0.81		
2.70-2.79	0.90		
2.80-2.89	0.95		
2.90-2.99	0.97		
3.00-3.09	0.99		
3.10-3.29	1.0		
3.30-3.39	0.96		
3.40-3.49	0.92		
3.50-3.59	0.89		
3.60-3.69	0.72		
3.70-3.79	0.81		
3.80-3.89	0.77		
3.90-3.99	0.73		
4.00-4.49	0.69		
4.50-4.99	0.65		
5.0+	0.49		



HSC Notes: *The studies analyzed have a mix of spawning and rearing fish. The recommended table is designed for spawning. If an adult rearing is needed, continue the 1.0 preference at 3.35 ft out to 99 feet.

FIGURE 20b. Mountain Whitefish Adult Spawning and Rearing Velocity Preference
Analysis based on a composite of 7 Canadian studies (Sheep, Bow, Kananaski, Red Deer and
Highwood rivers). **Preference has changed from the 2004 edition.**

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.02	0.00	0.00
0.10-0.19	0.04	1.25	0.45
0.20-0.29	0.06	1.55	1.0
0.30-0.39	0.08	1.95	1.0
0.40-0.49	0.12	3.75	0.75
0.50-0.59	0.16	4.25	0.60
0.60-0.69	0.21	5.0+	0.00
0.70-0.79	0.25		
0.80-0.89	0.32		
0.90-0.99	0.38		
1.00-1.09	0.48		
1.10-1.19	0.59		
1.20-1.29	0.69		
1.30-1.39	0.76		
1.40-1.49	0.90		
1.50-1.59	0.93		
1.60-1.79	0.96		
1.80-1.89	0.99		
1.90-1.99	1.0		
2.00-2.09	0.98		
2.10-2.19	0.96		
2.20-2.29	0.93		
2.30-2.39	0.91		
2.40-2.49	0.88		
2.50-2.59	0.85		
2.60-2.69	0.83		
2.70-2.79	0.80		
2.80-2.99	0.78		
3.00-3.19	0.74		
3.20-3.49	0.71		
3.50-3.59	0.68		
3.60-3.69	0.65		
3.70-3.79	0.56		
3.80-3.89	0.47		
3.90-3.99	0.37		
4.00-4.99	0.28		
4.50-4.99	0.18		
5.0	0.09		

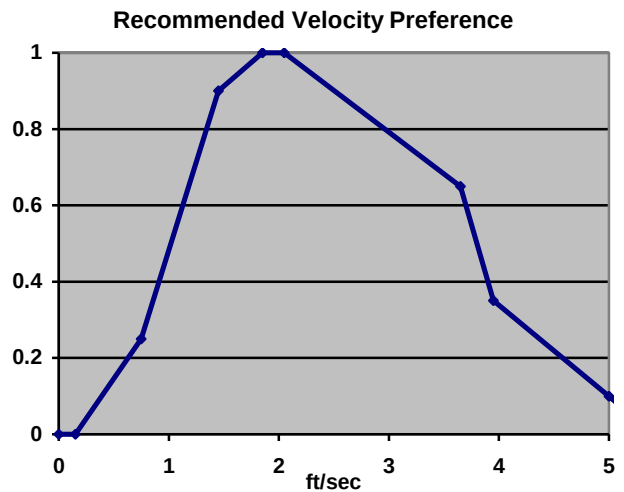
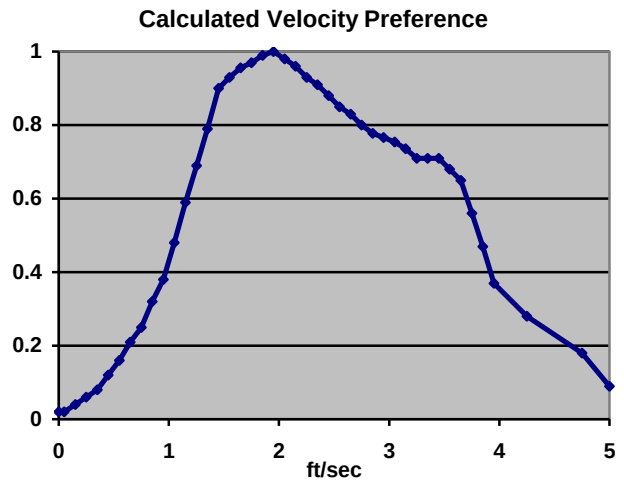


FIGURE 21a. Mountain Whitefish Juvenile Depth Preference

Analysis based on a composite of 4 Canadian studies (Sheep, Bow, Kananaskis, and Red Deer rivers). **Preference has changed from the 2004 edition.**

Calculated depth preference curve		Recommended depth preference curve	
Depth interval (feet)	Depth preference	Plotted depth (feet)	Depth preference
0.00-0.89	0.00	0.00	0.00
0.90-0.99	0.02	0.95	0.00
1.00-1.09	0.03	2.05	0.30
1.10-1.19	0.05	3.55	1.0
1.20-1.29	0.06	3.85	1.0
1.30-1.39	0.10	4.25	0.90
1.40-1.49	0.13	4.75	0.40
1.50-1.59	0.61	10.0	0.40
1.60-1.69	0.19	30.0+	0.00
1.70-1.79	0.22		
1.80-1.89	0.25		
1.90-1.99	0.28		
2.00-2.09	0.31		
2.10-2.19	0.35		
2.20-2.29	0.40		
2.30-2.39	0.45		
2.40-2.49	0.50		
2.50-2.59	0.55		
2.60-2.69	0.60		
2.70-2.79	0.65		
2.80-2.89	0.69		
2.90-2.99	0.74		
3.00-3.09	0.79		
3.10-3.19	0.83		
3.20-3.29	0.86		
3.30-3.39	0.91		
3.40-3.49	0.95		
3.50-3.59	1.0		
3.60-3.69	0.99		
3.70-3.79	0.97		
3.80-3.89	0.96		
3.90-3.99	0.95		
4.00-4.49	0.93		
4.50-4.99	0.39		
5.0+	0.19		

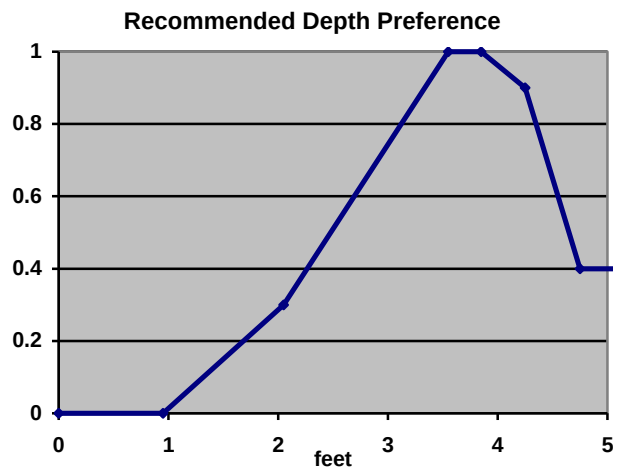
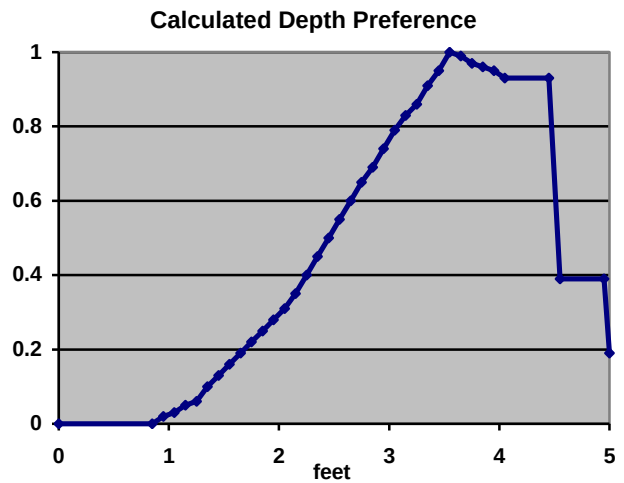
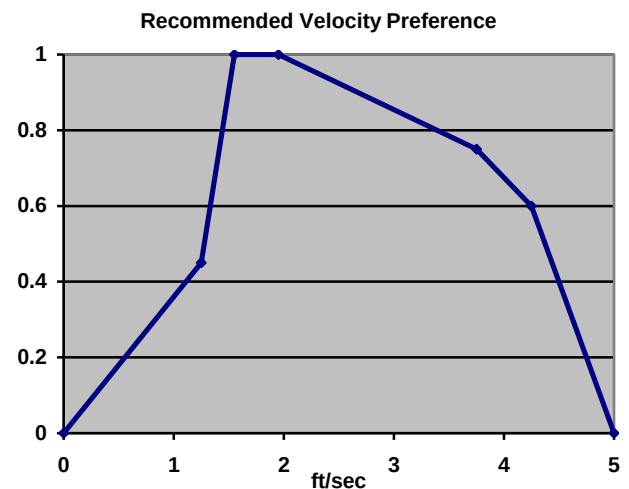
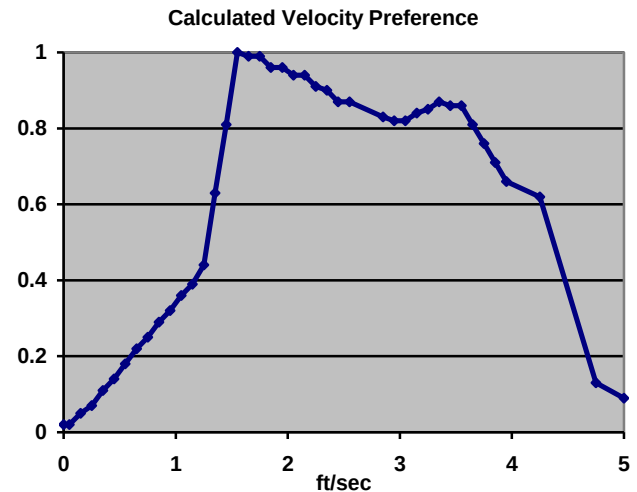


FIGURE 21b. Mountain Whitefish Juvenile Velocity Preference

Analysis based on a composite of 4 Canadian studies (Sheep, Bow, Kananaskis, and Red Deer rivers). **Preference has changed from the 2004 edition.**

Calculated velocity preference curve		Recommended velocity preference curve	
Velocity interval (ft/sec)	Velocity preference	Plotted velocity (ft/sec)	Velocity preference
0.00-0.09	0.02	0.00	0.00
0.10-0.19	0.05	1.25	0.45
0.20-0.29	0.07	1.55	1.0
0.30-0.39	0.11	1.95	1.0
0.40-0.49	0.14	3.75	0.75
0.50-0.59	0.18	4.25	0.60
0.60-0.69	0.22	5.0+	0.00
0.70-0.79	0.25		
0.80-0.89	0.29		
0.90-0.99	0.32		
1.00-1.09	0.36		
1.10-1.19	0.39		
1.20-1.29	0.44		
1.30-1.39	0.63		
1.40-1.49	0.81		
1.50-1.59	1.0		
1.60-1.79	0.99		
1.80-1.99	0.96		
2.00-2.19	0.94		
2.20-2.29	0.91		
2.30-2.39	0.90		
2.40-2.59	0.87		
2.60-2.79	0.85		
2.80-2.89	0.83		
2.90-3.09	0.82		
3.10-3.19	0.84		
3.20-3.29	0.85		
3.30-3.39	0.87		
3.40-3.59	0.86		
3.60-3.69	0.81		
3.70-3.79	0.76		
3.80-3.89	0.71		
3.90-3.99	0.66		
4.00-4.49	0.62		
4.50-4.99	0.13		
5.0+	0.09		



From: Cory Warnock
Sent: Monday, November 18, 2013 12:05 PM
To: Shina Duvall; Lesli Schick (lesli.schick@alaska.gov)
Cc: Michael Yarborough; Mike Salzetti; Dwayne Adams
Subject: INHT Follow-up (Grant Lake)

Hi Shina and Lesli,

Thanks for participating in our INHT meeting last week. I think it was very beneficial and assisted greatly in developing a process path for all of us to work with. To that end and based upon a couple of your questions during the meeting, I've been in contact with Mike Yarborough and think that a follow-up call with Mike involved would assist in refining the path discussed at the meeting and making sure we (KHL) are taking all of the necessary steps. I've briefed Mike on the discussion that took place in relation to your perceived trail assessment needs and we have some follow-up thoughts/questions. I'd really like to make sure that everyone is on the same page in regards to the path forward so that the right steps can be taken at the right time and needless hoops aren't jumped through.

I'd like to set-up a call relatively soon to discuss and get the ball rolling in the appropriate direction. If you could let me know a couple days/times that will work in the next week or so, I'll do all of the coordination.

Thanks,

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

McMillen, LLC
www.mcmillen-llc.com
5771 Applegrove Ln.
Ferndale, Wa. 98248
O – 360-384-2662
C – 360-739-0187
F – 360-542-2264

Attachments:

Cooper Creek Instream Flow Final Report.pdf; Appendix E - Chinook.pdf; Appendix E - Coho.pdf; Appendix E - DV.pdf; Appendix E - RBT.pdf

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]

Sent: Tuesday, November 19, 2013 4:12 PM

To: John Blum; 'Eric Rothwell - NOAA Federal'; Cory Warnock; Klein, Joseph P (DFG); jeffry_anderson@fws.gov

Subject: FW: Cooper Creek Instream Flow Final Report

Attached are the Cooper Creek Report and Appendix E provided by Joe.
Monte

From: Klein, Joseph P (DFG)

Sent: Tuesday, November 19, 2013 2:09 PM

To: Miller, Monte D (DFG)

Subject: Cooper Creek Instream Flow Final Report

Monte- Per your request, attached is a copy of the Cooper Creek Instream Flow Final Report and Appendix E with HSC data.

No virus found in this message.

Checked by AVG - www.avg.com

Version: 2014.0.4158 / Virus Database: 3629/6836 - Release Date: 11/14/13

From: Cory Warnock
Sent: Tuesday, November 19, 2013 10:05 AM
To: Miller, Monte D (DFG); Eric Rothwell (eric.rothwell@noaa.gov)
Cc: Klein, Joseph P (DFG); John Blum
Subject: RE: HSI curves for Grant Creek

Thanks for this Monte. I'll have John Blum (IFIM lead) look through this. I've Cc'd him here as well in case he has follow-up questions or further dialogue is needed.

Cory

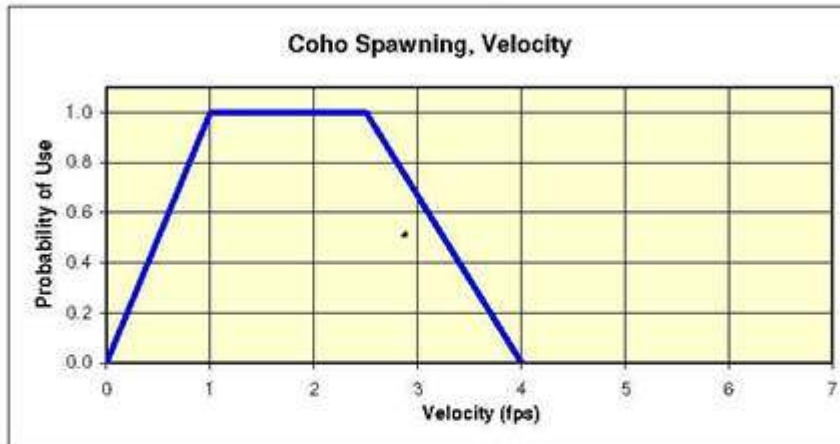
From: Miller, Monte D (DFG) [mailto:monte.miller@alaska.gov]
Sent: Tuesday, November 19, 2013 10:01 AM
To: Cory Warnock; Eric Rothwell (eric.rothwell@noaa.gov)
Cc: Klein, Joseph P (DFG)
Subject: RE: HSI curves for Grant Creek

To answer the HSC question posed by Eric, this is what I have from Cooper:

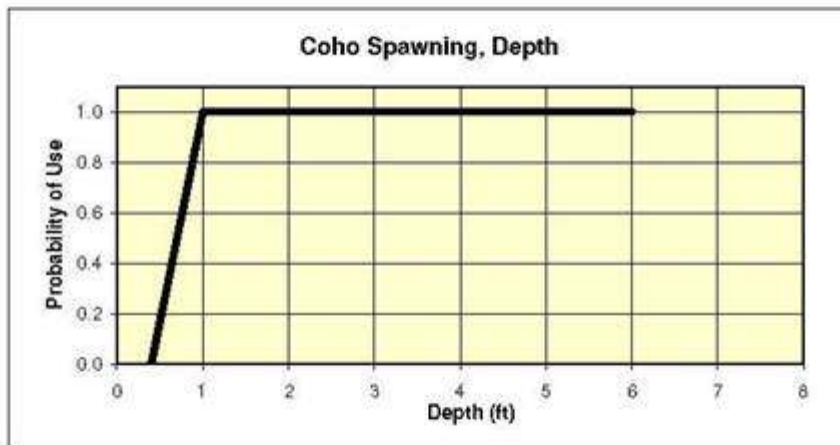
**Coho Salmon-Cooper Creek HSC
Final 7-29-2004**

SPAWNING

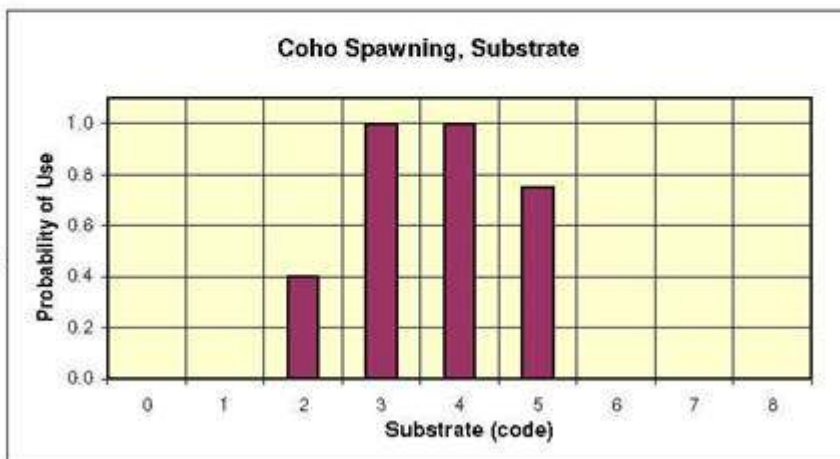
VELOCITY



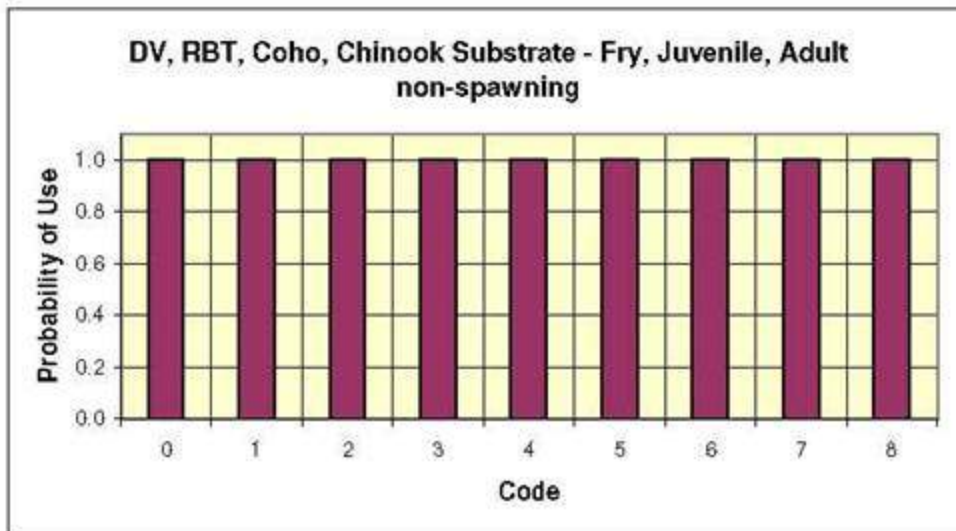
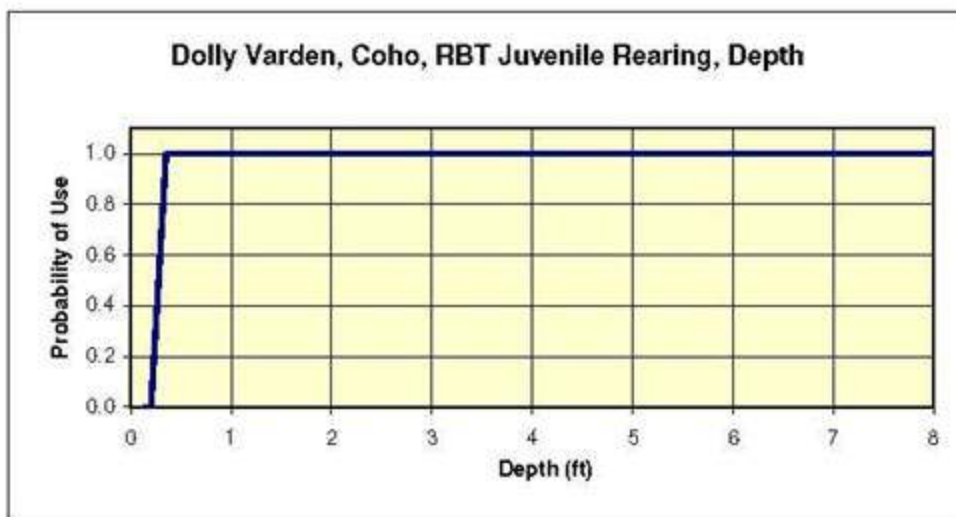
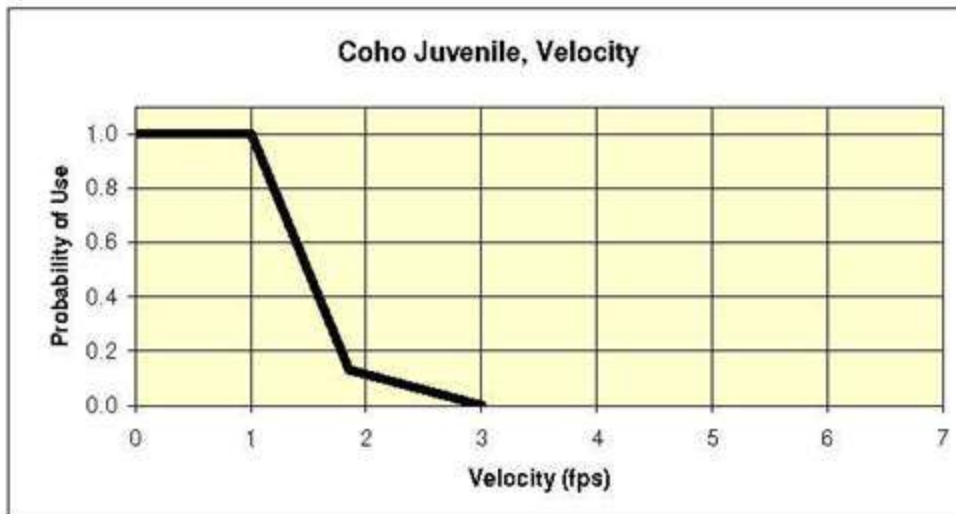
DEPTH



SUBSTRATE

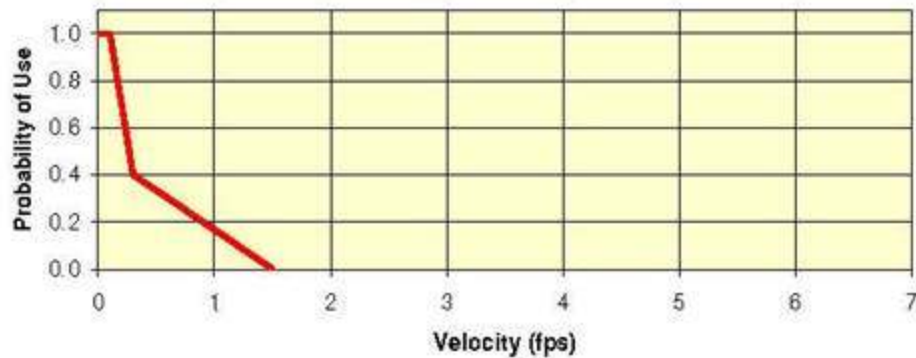


JUVENILE

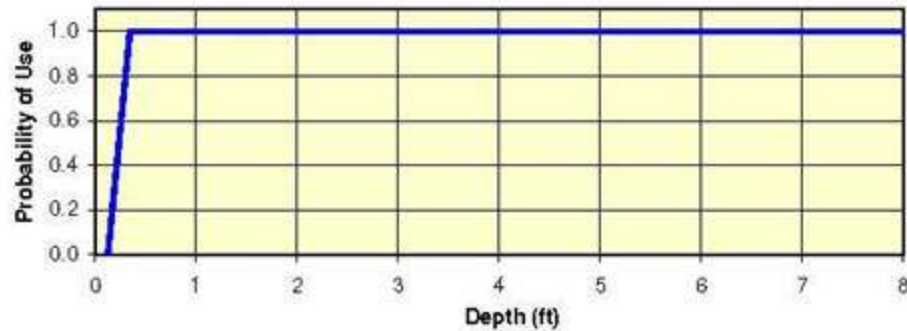


FRY

Dolly Varden, RBT, Coho Fry, Velocity



Dolly Varden, RBT, Coho, Chinook Fry Rearing, Depth



Cooper Creek Substrate Codes

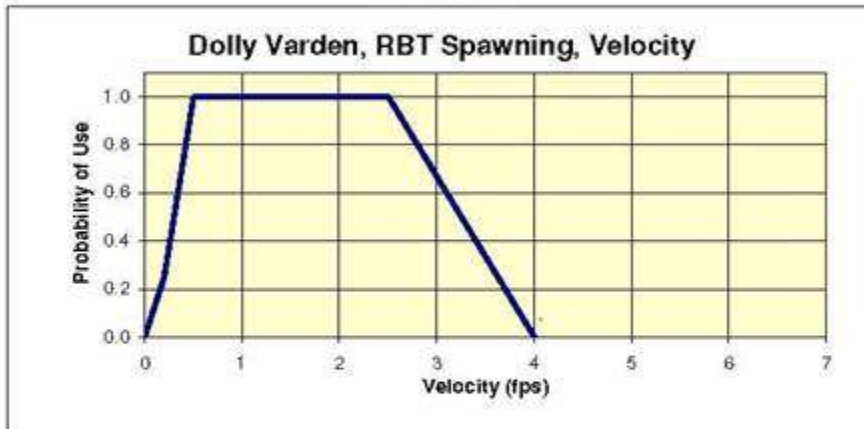
Code	Material	Size
0	Organic	Organic
1	Sand / Silt	< 2 mm
2	Small Gravel	2-8 mm
3	Med Gravel	8-32 mm
4	Large Gravel	32-64 mm
5	Small Cobble	64-128 mm
6	Large Cobble	128-256 mm
7	Boulder	> 266
8	Bedrock	Bedrock

Note: Codes are based on the Modified Wentworth Scale (used in the field) and the scales used in the draft habitat suitability curves.

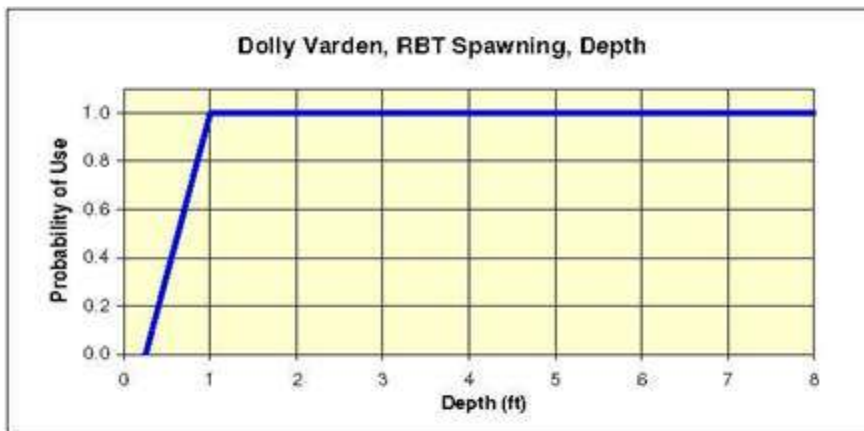
**Dolly Varden-Cooper Creek HSC
Final 7-29-2004**

SPAWNING

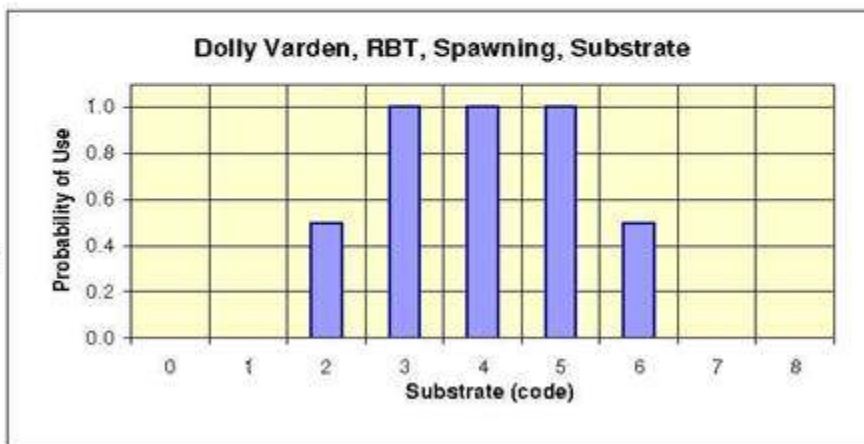
VELOCITY



DEPTH

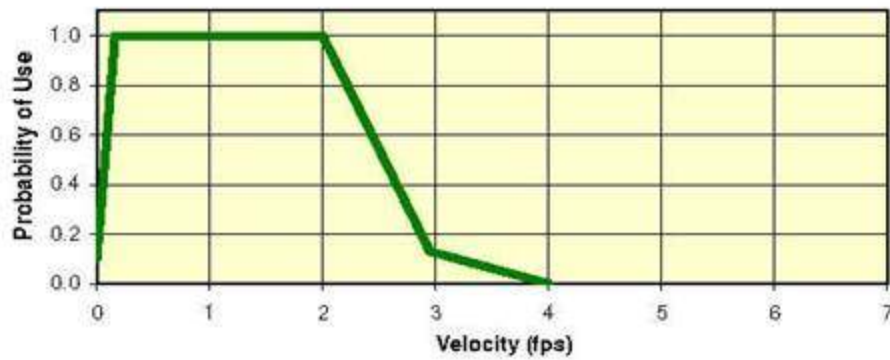


SUBSTRATE

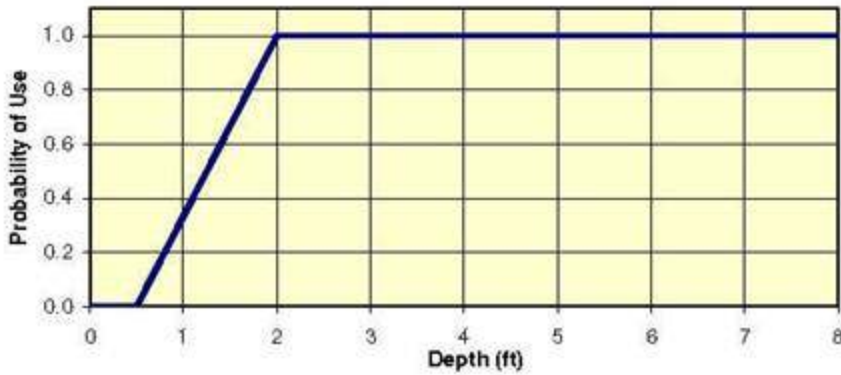


ADULT REARING

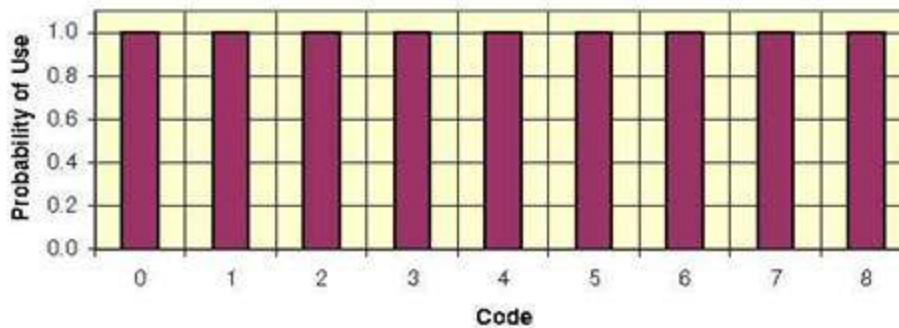
Dolly Varden, RBT Adult, Rearing, Velocity



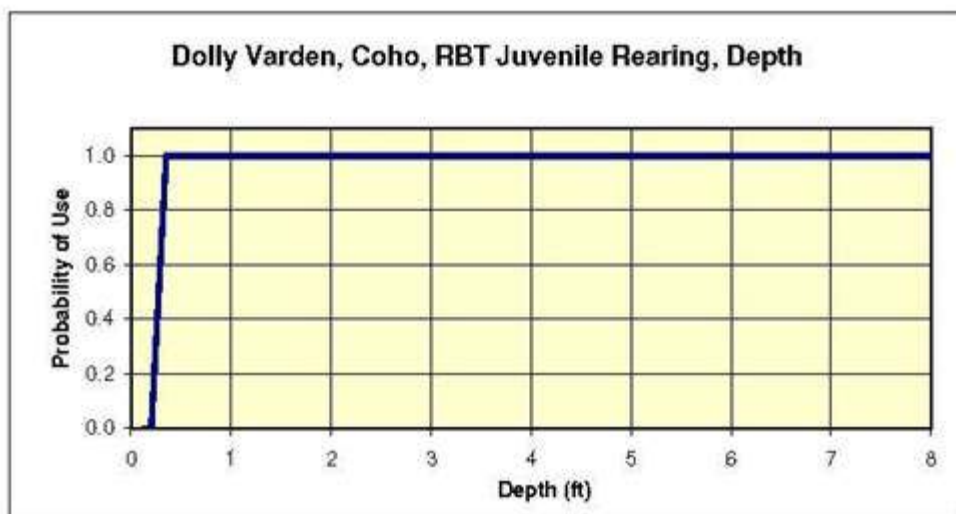
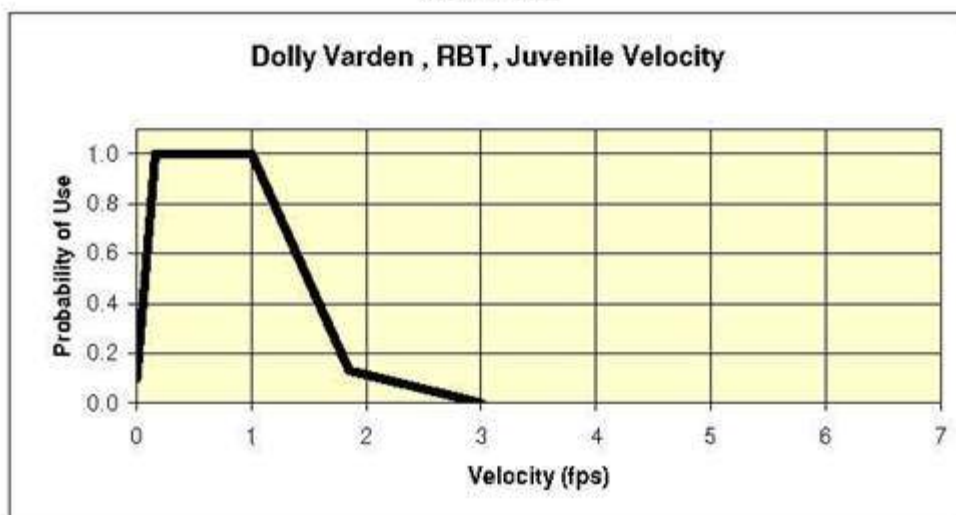
Dolly Varden, RBT Adult Rearing, Depth



DV, RBT, coho, chinook, Substrate - Fry, Juvenile, Adult non-rearing



JUVENILE

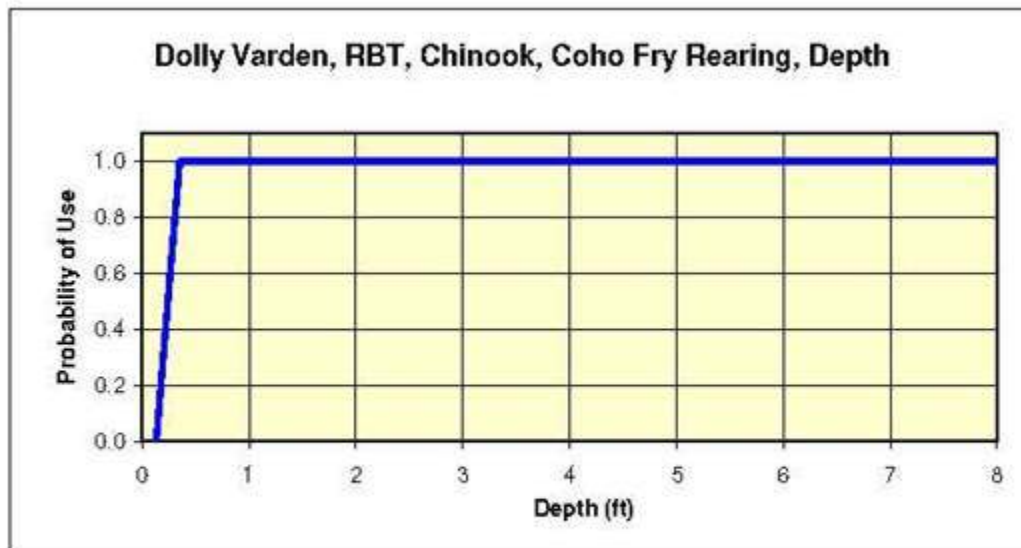
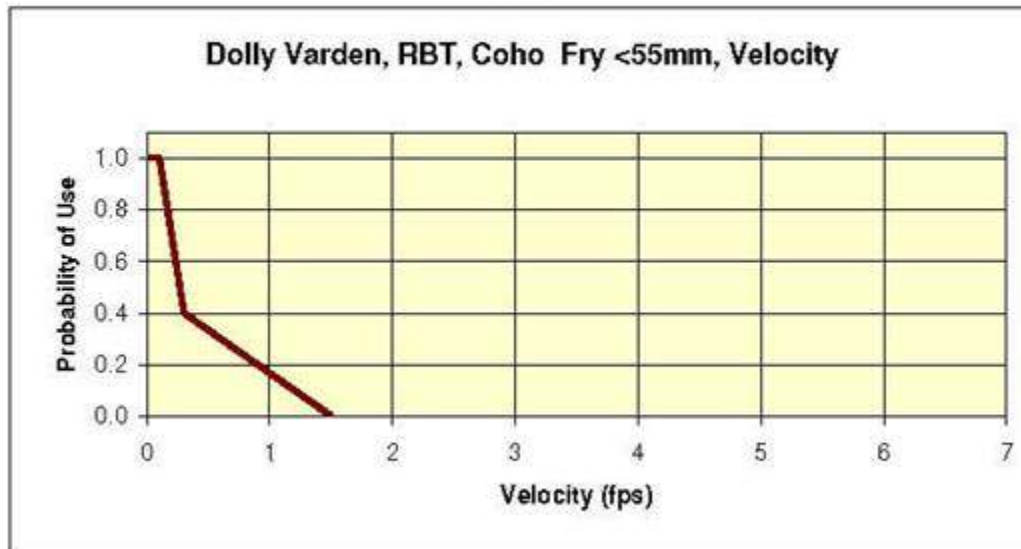


Cooper Creek Substrate Codes

Code	Material	Size
0	Organic	Organic
1	Sand / Silt	< 2 mm
2	Small Gravel	2-8 mm
3	Med Gravel	8-32 mm
4	Large Gravel	32-64 mm
5	Small Cobble	64-128 mm
6	Large Cobble	128-256 mm
7	Boulder	> 266
8	Bedrock	Bedrock

Note: Codes are based on the Modified Wentworth Scale (used in the field) and the scales used in the draft habitat suitability curves.

FRY



There is minimal chinook information presented. I agree that Washington stream data may not be very representative of Alaska conditions.

Monte Miller

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, November 18, 2013 8:40 PM
To: Eric Rothwell - NOAA Federal; John Blum
Cc: Miller, Monte D (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov)
Subject: RE: HSI curves for Grant Creek

Hi Eric,

I have a couple thoughts and/or questions related to this topic and in the global interest of being as collaborative as possible, I'll just throw them out here to our group and begin the first of what I intend to be many open forums during the development of our License Application. My thoughts/questions are as follows:

1. I have enough technical background in instream flow to be dangerous so I'll pose this question not only to our technical expert (John) but to the group as a whole with the understanding that you all have more technical modeling expertise than I do.....In reference to your concern about Washington curves not mimicking conditions in AK and more specifically Grant Creek, John, I presume the Washington curves for anadromous species are relatively robust. Is it possible to pull curves for the species/life stages that we are in need of from systems in WA that closely represent the conditions we are dealing with in AK? In other words, can we look at the global curve database and segregate based upon our needs? Eric, this may be the precursor to the more comprehensive question you ask below. The approach you describe sounds like a good one if possible. Seeing relatively similar shifts in habitat between sets would seem to suggest a decent match.
2. I will talk with Steve to see if I can get a bit more intel related to R2's initial findings on Juveniles for Susitna although I, like you am a pretty hesitant to put much stock in those curves from an applicability standpoint for Grant Creek. Similar to the concerns you mention for WA curves, I tend to think that the systems don't match all that well based on my understanding of that system. Admittedly, that understanding is somewhat limited relative to yours, Jeff's and Monte's so set me straight if my understanding is incorrect.
3. Mike and I had some preliminary conversations with Chris Holmquist-Johnson (USGS) out of Fort Collins last year and are intending on collaborating to the degree possible once our data analysis is completed and the appropriate licensing steps have been taken with you and the rest of the stakeholders. I'm not going to speak for Mike, but when the time is right, I tend to think that he would be ok with sharing data. Likewise, I'm quite certain that he would be receptive to discussing their data collection efforts in-depth to see if there is anything that would assist in our ongoing analysis.

With that, I'll look forward to hearing thoughts on the items Eric and I discuss above as well as letting Monte and Jeff weigh-in globally. All in all and as John pointed out, I'm very pleased with how the instream flow study went this year. Much like our natural resource study effort this year as a whole, we were very comprehensive in our efforts and I think that will lend itself to a solid product with which we intend to collaborate with you all on. Our aquatics analysis is ongoing and preliminary at this time but based upon the data that we collected during the field season, I'm confident that we were able to represent Grant Creek in a comprehensive fashion. I'll look forward to hearing everyone's thoughts on this issue and continuing to grow this type of collaborative atmosphere in general.

Thanks,

Cory

From: Eric Rothwell - NOAA Federal [<mailto:eric.rothwell@noaa.gov>]

Sent: Monday, November 18, 2013 5:51 PM

To: John Blum

Cc: Miller, Monte D (DFG); jeffry.anderson@fws.gov; Cory Warnock

Subject: Re: HSI curves for Grant Creek

Hi John,

I'm glad to hear how well the sampling and site specific curve development went for sockeye and potentially coho. That will be a nice contribution to the understanding of the range of conditions for sockeye (steep, coarse, fast stream) in AK.

I can't remember if the Cooper Creek curves include Chinook (Jeff? or Monte?). My concern with using curves from Washington is that they may not represent the conditions we find at Grant Creek (below a productive lake, thermal regime, steep/coarse stream, and relatively a lot of fish returning). I wonder if there is an approach that would allow a test of sensitivity of the curves, compare two (or more) sets of curves and see if under operating scenarios for Grant if we see large relative habitat changes. Or if we see shifts in habitat location.

Susitna curves are in development, I talked with R2 about some of their initial findings (for juveniles) but they may not be relevant anyway - way different system. Cory - you may have more luck talking to Steve P. to get an update on that. We requested that they collect a range of variables, beyond the typical d,v, substrate - and develop which criteria will be determined to be most influential into habitat functions.

When USGS-Fort came up and measured the bed and hydraulics for a 2D model they asked some of the same questions. I can't remember if they found anything satisfactory for Grant. I'll check in with them. Also, I'm sure they would be interested in using the curves you are developing in their model analysis. Cory and John, maybe we could talk and see if that would be favorable to the applicant.

Best regards,
Eric

On Fri, Nov 15, 2013 at 3:00 PM, John Blum <john.blum@mcmillen-llc.com> wrote:

Good afternoon:

We have finished conducting the instream flow study for Grant Creek, and I have just completed model calibration. The next task in hand to develop/select HSI curves for the Grant Creek fish species and life stages of interest.

We were able to obtain a pretty robust set of measurements for sockeye salmon spawning (99 individual spawning pairs), and an adequate sampling coho (43 spawning pairs); however, Chinook were few in Grant Creek and we were only able to obtain 3 sets of measurements of spawning Chinook. We have no measurements for spawning rainbow trout.

As a result, we will need to use literature curves for Chinook salmon and rainbow trout, augment the coho measurements with literature curves, and will need to rely on literature for rearing curves for the species in question. I am most familiar with the HSI curves developed in Washington State for these species; I've had a hand in some of the developed curves, and they are based on studies. Dr. Hal Beecher, WDFW, has done a good job of documenting the number of fish and studies used to develop these HSI curves. I have included a copy of the WDFW/WDOE Instream Flow Guidelines for your review.

Although these are available for use, I am hoping you can assist me in the use of the most appropriate curves for Grant Creek. I know that you are working on other hydropower projects in Alaska. Are there Alaskan curves that you are familiar with that would be more representative for these four species, in the spawning and rearing life history stages? If so, can you provide them to me, please?

Thanks for your help. I am not proposing the use of the WDFW HSI curves, unless there are no other curves that would prove to be more appropriate.

Thanks again, and have a good weekend!

John

John Blum
Sr. Fisheries Scientist

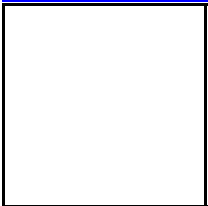
McMillen, LLC
1155 North State Street, Suite 700, Bellingham, WA 98225

direct [360.483.2807](tel:360.483.2807) | p [360.734.5915](tel:360.734.5915) x 281

f [360.734.5918](tel:360.734.5918) | c [360.220.0694](tel:360.220.0694)
john.blum@mcmillen-llc.com | www.mcmillen-llc.com

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Eric Rothwell
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Version: 2014.0.4158 / Virus Database: 3629/6836 - Release Date: 11/14/13

From: Cory Warnock
Sent: Wednesday, November 20, 2013 3:30 PM
To: Duvall, Shina A (DNR); Salzetti, Mikel
Cc: Michael Yarborough; Dwayne Adams; Schick, Lesli J (DNR)
Subject: RE: INHT/Section 106 Call (Grant Lake)(

I'm comfortable with either approach but I'd honestly prefer doing it this Friday morning (even though I can't participate) so that we can iron out remaining details from our meeting before they slip away. That said, if folks would prefer early the week of the 2nd, we can do that too. Could everyone on this email please let me know your preference and I'll send out the appropriate invite.

Thanks!

-----Original Message-----

From: Duvall, Shina A (DNR) [<mailto:shina.duvall@alaska.gov>]
Sent: Wednesday, November 20, 2013 3:28 PM
To: Salzetti, Mikel; Cory Warnock
Cc: Michael Yarborough; Dwayne Adams; Schick, Lesli J (DNR)
Subject: RE: INHT/Section 106 Call (Grant Lake)(

All,

I can do Friday morning, but not afternoon. Maybe we should look at the week of 12/2? It opens up considerably for me....

Shina

-----Original Message-----

From: Salzetti, Mikel [<mailto:MSalzetti@HomerElectric.com>]
Sent: Wednesday, November 20, 2013 2:26 PM
To: Cory Warnock
Cc: Duvall, Shina A (DNR); Michael Yarborough; Dwayne Adams; Schick, Lesli J (DNR)
Subject: RE: INHT/Section 106 Call (Grant Lake)(

Cory:

I'm also available on Friday afternoon and if that works for Mike Yarborough and Dwayne, I can help facilitate the meeting. If this is a go for everyone, will you please send out an appointment with the appropriate call-in information.

Thanks,

Mike

-----Original Message-----

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Wednesday, November 20, 2013 2:16 PM
To: Schick, Lesli J (DNR)
Cc: Duvall, Shina A (DNR); Salzetti, Mikel; Michael Yarborough; Dwayne Adams

Subject: RE: INHT/Section 106 Call (Grant Lake)(

Unfortunately, I'm no good Friday but, if Mike Yarborough and Dwayne are both available and willing to hold the meeting, I'd be more than happy to brief them in advance and let them lead the meeting. Dwayne and/or Mike, please let me know your thoughts.

-----Original Message-----

From: Schick, Lesli J (DNR) [<mailto:lesli.schick@alaska.gov>]

Sent: Wednesday, November 20, 2013 3:14 PM

To: Cory Warnock

Cc: Duvall, Shina A (DNR); Mike Salzetti; Michael Yarborough; Dwayne Adams

Subject: Re: INHT/Section 106 Call (Grant Lake)(

I am in meetings all day today and tomorrow and will not be available. I can do Friday.

-lesli

Lesli Schick

Iditarod Trail Easements

Department of Natural Resources

550 W 7th Ave, Suite 900C

Anchorage, AK 99501

Phone: (907) 334-2679, Fax: (907) 269-8930

Email: lesli.schick@alaska.gov

On Nov 20, 2013, at 1:28 PM, "Cory Warnock" <cory.warnock@mcmillen-llc.net> wrote:

> 1-800-882-3610

> PIN - 4158145

>

> <INHT_Section 106 Call (Grant Lake)>

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Version: 2014.0.4158 / Virus Database: 3629/6836 - Release Date: 11/14/13

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Version: 2014.0.4158 / Virus Database: 3629/6836 - Release Date: 11/14/13

From: Cory Warnock
Sent: Wednesday, November 20, 2013 2:50 PM
To: 'Eric Rothwell - NOAA Federal'
Cc: John Blum
Subject: RE: Cooper Creek Instream Flow Final Report

No sweat and I really appreciate the proactive approach. Along those lines, John and I were talking today and he is going to let me know in the next day or two when a call will work best but based on where he is analysis wise, I'm inclined to think that if we can work something out early next week, that would be optimal.

From: Eric Rothwell - NOAA Federal [<mailto:eric.rothwell@noaa.gov>]
Sent: Wednesday, November 20, 2013 2:47 PM
To: Cory Warnock
Cc: John Blum
Subject: Re: Cooper Creek Instream Flow Final Report

Sounds good. Thanks for the clarification - getting ahead of myself (and the data).

On Tue, Nov 19, 2013 at 3:37 PM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Hey there,

The 6 fps is correct but if memory serves (suspect sometimes) the species was sockeye, not Chinook. As an aside and a general comment just for clarity purposes, I'd have to check with John Stevenson to confirm the exact number but we had a relatively small number of adult Chinook come back to Grant Creek this year (less than 30 for sure). Well below numbers for either sockeye or coho.

As for the call, I think it's a good idea once John is far enough along with his analysis that we can have a substantive discussion on our options. John, thoughts?

From: Eric Rothwell - NOAA Federal [<mailto:eric.rothwell@noaa.gov>]
Sent: Tuesday, November 19, 2013 4:32 PM
To: Cory Warnock
Cc: John Blum
Subject: Re: Cooper Creek Instream Flow Final Report

Realizing it was not final data or anything but I seem to remember observations from Mark or John (while in the field) of Chinook spawning in waters exceeding 6 fps. Is that accurate? I email just the two of you to make sure I wasn't spreading rumors... prior to data coming out.

It is a tough situation - maybe we could use the data you collected to correct the Cooper curves. I know this is a TLP (and believe me I appreciate the open process that you have made it) but maybe we should have a brief call to discuss the options?

On Tue, Nov 19, 2013 at 3:13 PM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Thanks Monte

From: Miller, Monte D (DFG) [mailto:monte.miller@alaska.gov]
Sent: Tuesday, November 19, 2013 4:12 PM
To: John Blum; 'Eric Rothwell - NOAA Federal'; Cory Warnock; Klein, Joseph P (DFG); jeffry_anderson@fws.gov
Subject: FW: Cooper Creek Instream Flow Final Report

Attached are the Cooper Creek Report and Appendix E provided by Joe.

Monte

From: Klein, Joseph P (DFG)
Sent: Tuesday, November 19, 2013 2:09 PM
To: Miller, Monte D (DFG)
Subject: Cooper Creek Instream Flow Final Report

Monte- Per your request, attached is a copy of the Cooper Creek Instream Flow Final Report and Appendix E with HSC data.

No virus found in this message.

Checked by AVG - www.avg.com

Version: 2014.0.4158 / Virus Database: 3629/6836 - Release Date: 11/14/13

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail/One-on-One Meeting Log

Contact Name: Lesli Schick, Shina duVall, Mike Salzetti, Mike Yarborough, Kim Graham

Agency/Organization: Alaska Department of Natural Resources (ADNR), Alaska State Historic Preservation Office (SHPO), Kenai Hydro, LLC (KHL), Cultural Resource Consultants LLC, USKH

Phone No./E-mail Address: Lesli Schick (907) 334-2679 / lesli.schick@alaska.gov; Shina duVall (907) 269-8720 / shina.duvall@alaska.gov; Mikel Salzetti (907) 283-2375 MSalzetti@HomerElectric.com; Mike Yarborough (907) 349-3445 / salvagerecovery@gmail.com; Kim Graham (907) 276-4245 kgraham@uskh.com

Date: November 22, 2013

Time: 10:30-11:00am (AK time)

Grant Lake Licensing Team Contact: Kim Graham

Summary of Conversation and/or E-mail Exchange:

Subject: Iditarod National Historic Trail (INHT) Re-route

In response to the question if the re-route would have any cultural or historical impacts to the INHT, Mike Yarborough was able to state that the proposed re-route would not have any further impacts than the previously proposed trails for the INHT. The true historical trails still remain the abandoned sawmill trail and the Grant Lake Trail, but as shown, neither the KHL alignment nor the INHT re-route affect these. This was acknowledged by both Shina and Lesli; however, they both wanted to review Mr. Yarborough's report to review 1) the implications under Section 106, and 2) any effects under the state preservation act.

Although there are no known distinguishing cultural elements that would limit a re-route from Mr. Yarborough's research, it seems that both Shina and Lesli would prefer to review the report first-hand for confirmation that the re-route activity does not affect historic properties.

From here, Mr. Yarborough has offered to add some language in his Cultural Resources Study report in response to the INHT re-route. Shina and Lesli will then review what, if any, significant cultural resources are considered under Section 106 and State Preservation Act for the INHT, and then can offer

concurrence. That said, Shina indicated that neither one would preclude HEA from rerouting or realigning the trail. That both basically required that cultural and historical impacts should be evaluated and considered and that the cultural and historical impacts should be avoided, minimized and / or mitigated. Kim Graham pointed out that this can be done concurrently with other realignment efforts.

Lesli said that the Kenai Peninsula Borough Area Plan states that the trail cannot run parallel to the access road. If it did, it would require a change to the area plan. However, since HEA has changed the access road to avoid parallel runs no Area Plan modifications should be required.

It was directed that this review process can be done sequentially, or concurrently, with the license application and letter for approval from the (4) agencies.

From: Cory Warnock
Sent: Monday, November 25, 2013 10:39 AM
To: Miller, Monte D (DFG); Eric Rothwell; Jeffry Anderson (Jeffry_Anderson@fws.gov)
Cc: John Blum; Mike Salzetti
Subject: RE: Preference Curve Discussion (Grant Lake)

Great, thanks Monte. Now that I've heard from everyone, I'll get the invite out with the associated materials for review. As for involving pertinent habitat biologists and per my motivation for developing a separate Aquatics Work Group, if those folks that you'd like on the call have substantive technical expertise that will assist in the discussion, by all means, have them join.

Thanks to all.

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]
Sent: Monday, November 25, 2013 10:30 AM
To: Cory Warnock; Eric Rothwell; Jeffry Anderson (Jeffry_Anderson@fws.gov)
Cc: John Blum; Mike Salzetti
Subject: RE: Preference Curve Discussion (Grant Lake)

Cory,

I am available at 9:30 AM on Wednesday. Please send a call in number and the materials as soon as possible to allow for time to review and discuss internally. I would like to give the option of calling in, to our Habitat Biologists and SF and CF AMB's who have attended other Grant Lake meetings. Let me know.
Thanks

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS
333 Raspberry Road
Anchorage, Alaska, 99518-1565
(907) 267-2312

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, November 25, 2013 7:43 AM
To: Eric Rothwell; Jeffry Anderson (Jeffry_Anderson@fws.gov); Miller, Monte D (DFG)
Cc: John Blum; Mike Salzetti
Subject: Preference Curve Discussion (Grant Lake)

Hi all,

John has now crunched enough preference curve data from Grant Creek to have a call and hopefully reach consensus on the appropriate approach for analysis. Having the call sooner rather than later would be my preference so that we can keep on our current reporting schedule. With the understanding that it is a holiday week, if folks could let me know their availability this Wednesday (27th), I'd appreciate it. I'll go ahead and propose a time of 9:30 (AK time). Once I hear back from you all, I'll get you the appropriate discussion materials along with a call-in number. Please don't hesitate to let me know if you have any questions and I'll look forward to hearing back from you regarding the call.

From: Cory Warnock
Sent: Monday, November 25, 2013 9:59 AM
To: Anderson, Jeffry
Cc: Eric Rothwell; Monte Miller; John Blum; Mike Salzetti
Subject: RE: Preference Curve Discussion (Grant Lake)

Categories: Green Category

Thanks, Jeff. I haven't heard from Monte yet but with that exception, I think we are all good for Wednesday at 9:30. Once I hear from him (assuming he's available), I'll send out the invite.

From: Anderson, Jeffry [mailto:jeffry_anderson@fws.gov]
Sent: Monday, November 25, 2013 9:56 AM
To: Cory Warnock
Cc: Eric Rothwell; Monte Miller; John Blum; Mike Salzetti
Subject: Re: Preference Curve Discussion (Grant Lake)

Hi Cory. I am available Wednesday at 9:30. My schedule is also open Tuesday afternoon and Wednesday until 14:00.

-- Jeff

Jeffry Anderson
Field Supervisor
USFWS, Kenai Fish & Wildlife Field Office
43655 Kalifornsky Beach Road, Soldotna, AK 99669
Office: 907-260-0132
Cell: 907-252-4896

On Mon, Nov 25, 2013 at 7:43 AM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Hi all,

John has now crunched enough preference curve data from Grant Creek to have a call and hopefully reach consensus on the appropriate approach for analysis. Having the call sooner rather than later would be my preference so that we can keep on our current reporting schedule. With the understanding that it is a holiday week, if folks could let me know their availability this Wednesday (27th), I'd appreciate it. I'll go ahead and propose a time of 9:30 (AK time). Once I hear back from you all, I'll get you the appropriate discussion materials along with a call-in number. Please don't hesitate to let me know if you have any questions and I'll look forward to hearing back from you regarding the call.

Grant Lake Hydroelectric Project (FERC No. 13212) Licensing

Consultation Record

Phone/E-mail /One on One Meeting Log

Contact Names: Eric Rothwell, Monte Miller, Joe Klein, Jason Mouw, Jeffry Anderson, Mike Salzetti, John Blum

Agency/Organization: NOAA, ADF&G (3), USFWS, HEA, McMillen

Phone No./E-mail Address: Conference Call

Date: 11/27/13

Time: 10:30-11:30

Grant Lake Licensing Team Contact: Cory Warnock

Summary of Conversation and/or E-mail Exchange:

The primary intent of the conference call was to reach agreement on a set of species specific preference curves for use on the Grant Creek Instream Flow modeling effort.

Cory Warnock provided introductions and reiterated the specific intent of the call. He then turned it over to John Blum to lead the technical discussion.

John discussed the number of data points for each species that was collected during preference curve work on Grant Creek: sockeye (99), coho (47) and Chinook (3). No Dolly Varden or rainbow trout preference data was collected. John pointed out that the anadromous species numbers were in line with overall adult abundance numbers seen in 2013, ie., sockeye had the largest return followed by coho, followed by Chinook.

Monte Miller inquired about whether or not any tags were placed in Dolly Varden late in the year. Cory stated that none of a taggable size returned to the system.

From that point, John led a general discussion related to the types of surrogate curves that were evaluated. Curves from the Washington Department of Fish and Wildlife (WDFW), British Columbia and nearby Cooper Creek were evaluated for applicability to Grant Creek and presented internally to the group for review. John stated that his preference would be to use the closest regional option as a surrogate; Cooper Creek in this case.

Eric Rothwell stated that he was concerned with the use of the Cooper Creek curves due to the fact that the habitat present there may not adequately represent conditions on Grant Creek. He went on to say that the instream flow analysis in general and its associated results may not be of great interest to him if his understanding of the proposed operational scenario and the creek itself were correct. Eric stated that it appeared to him that spawning preference in Grant Creek was not based on hydraulics nearly as much as distribution of sediment. In other words, fish will utilize a variety of velocities if appropriate substrate was available in a respective area. Eric said that if his impressions were correct, a more fundamental analysis that would be more relevant to him would involve focusing on the wetted edges of the stream and what flows would allow for connectivity to side channels with high habitat value. Eric went on to say that it really comes down to the operational scenario. If the selected scenario is documented to sustain, improve and/or stabilize conditions in the wetted mainstem and off-channel areas compared to natural conditions, then the instream flow results don't matter much, in his opinion.

John confirmed Eric's belief that fish don't focus on velocities for spawning nearly as much as they do for substrate. Based upon his site specific measurements, he felt Eric's impression was correct.

Cory stated that engineering feasibility work was ongoing and that Eric's understanding of operational scenarios was consistent with HEA's intent of operating the project in a fashion that would sustain, improve and/or stabilize conditions in the wetted mainstem and off-channel areas compared to natural conditions.

Eric stated that normally he gets a little uneasy when project proponents state that the project will improve natural conditions but in this case he agreed that the potential was there for this project to improve/stabilize habitat in the system. He reiterated if that was the case and it was shown, the instream flow analysis isn't significant to him.

Monte Miller stated that he agreed with John that typically, the closest (regional) surrogate curves to the site were the preferable ones to use. He had two issues with any surrogate curves:

1. Are the curves similar hydraulically/water quality wise (glacial, range of flows, mean annual flow, etc.)?
2. Are the curves similar biologically (periodicity, correct group of fish, etc.)?

Monte went on to say that all life stages needed to be evaluated and perhaps establishing a matrix to determine priority would be a good step.

Eric stated that in his view, spawning was the priority life stage since not much rearing likely occurred in the mainstem.

John stated that a matrix wasn't needed. If priorities needed to be developed for life stages, utilization of the BioAnalysts fish data would be the appropriate way to do that.

Joe Klein stated that before the model was run, he'd like more info on the calibration flows that were collected.

John stated that all of that was coming shortly as part of the instream flow report. John went on to describe the field measurements that occurred and described them as more comprehensive than what is typically done. All 2010 HDR data was validated in the field and assessed for practical use. Where valid, it was incorporated. All told in 2013, 5 calibration flows were measured between 17 and 700 cfs.

John and Joe had a general discussion related to the contents of the report.

Eric reiterated his opinion that the results of this assessment would represent what habitat fish are using in Grant Creek. If operations are consistent with his understanding and partially developed with the intent to stabilize/improve habitat, this assessment won't mean much, from a results perspective.

Eric, Joe and Monte had a general discussion related to the validity of the analysis. Joe stated that ADF&G needed to see that the study was done appropriately in an effort to cover all the bases.

Monte stated that he needed to see the rest of the aquatics data.

Cory reminded the group of the reporting/meeting schedule and stated that everything was still planned similar to the schedule outlined during the site visit. He reiterated that the primary intent of this call was to reach agreement on preference curves for the instream flow study.

Monte asked if the data collected by ADF&G on Grant Creek would be used in this assessment.

John stated that he wasn't aware that this data existed and Jason Mouw confirmed that it had not been made public.

Cory asked Jeff Anderson if he had any thoughts. Jeff stated that he shared concerns with the utilization of Cooper Creek curves for Grant Creek.

Monte stated that he was ok with the sockeye and coho curves that are proposed for use. He said that there wasn't much curve data in Alaska for Chinook, Dolly Varden and rainbow trout.

Joe pointed out that John Morsell collected data for Cooper Creek and Liz Flore (sp?) collected data on Falls Creek.

John Blum will get in touch with John Morsell and Jason Mouw will get John Liz's data.

Joe requested that John send the specifics related to the WDFW and BC curves. John agreed.

Jeff asked if anyone had seen the partial curves for Chinook on the Kenai River (velocity and substrate only) from Berger 1983.

The general answer was no. Monte stated that his group would find them and send them to the group.

Eric reiterated that assuming that HEA's operational scenario was consistent with his current understanding, he wasn't going to have a problem with the curves that were selected. He stated that it was his observation of Grant Creek that if it was wet and the appropriate gravel was there, the fish would use it.

Mike Salzetti stated that it was in HEA's best interest to be as accurate and comprehensive as possible related to aquatic analysis to allow for some flexibility but the current operational regime is believed to have the potential to provide an improvement and stability to Grant Creek from a habitat perspective over what currently exists.

Cory addressed the planned reporting/meeting schedule, confirmed that sockeye and coho curves were acceptable, discussed action items, asked for final questions and reached agreement from the group that they would reconvene once the additional data sources had been reviewed and further analysis was done related to curves for Chinook, Dolly Varden and rainbow trout.

Meeting adjourned at 11:30

From: Cory Warnock
Sent: Monday, December 02, 2013 3:57 PM
To: Willette, Mark (DFG)
Cc: Mike Salzetti
Subject: RE: Grant Lake Chinook Scale Samples

Sounds good. I'll have Mike scan me the data forms once he picks them up.

Cory

From: Willette, Mark (DFG) [<mailto:mark.willette@alaska.gov>]
Sent: Monday, December 02, 2013 3:56 PM
To: Cory Warnock
Subject: RE: Grant Lake Chinook Scale Samples

Cory,

The ages were simply written on the hardcopy data forms, so I don't have an electronic file to send you.

Mark

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, December 02, 2013 2:02 PM
To: Willette, Mark (DFG)
Cc: Mike Salzetti
Subject: RE: Grant Lake Chinook Scale Samples

Great!! Mike Salzetti will be the one picking them up. I've Cc'd him here to get his input on a pick-up date/time. What form is the output data in? Can it be distributed electronically. If so, I'd be interested in having it emailed to me.

Thanks so much for your assistance. I appreciate your efforts very much. I'll look forward to hearing from you.

Cory

From: Willette, Mark (DFG) [<mailto:mark.willette@alaska.gov>]
Sent: Monday, December 02, 2013 1:46 PM
To: Cory Warnock
Subject: RE: Grant Lake Chinook Scale Samples

Cory,

We have your scales read so you can pick them up any time.

Mark

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Wednesday, November 20, 2013 1:52 PM
To: Willette, Mark (DFG)

Cc: Mike Salzetti; John Stevenson
Subject: RE: Grant Lake Chinook Scale Samples

Mark,

Thanks for the conversation and agreeing to analyze the samples. Per our call, if you can just look at the Chinook, coho and rainbow, that will meet our needs at this time.

Again, thanks and let me know if you have any questions/concerns,

Cory

From: Willette, Mark (DFG) [<mailto:mark.willette@alaska.gov>]
Sent: Wednesday, November 20, 2013 1:46 PM
To: Cory Warnock
Subject: RE: Grant Lake Chinook Scale Samples

We have an inventory now. You gave us 33 Chinook, 776 Sockeye, 233 coho, 21 rainbow and 17 pink scales. This is substantially more than you originally told me. We can probably still have them done by about Dec. 6th, but is there some way you can compensate us for our staff time (supply purchases, etc.) ?

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Wednesday, November 20, 2013 12:11 PM
To: Willette, Mark (DFG)
Subject: Re: Grant Lake Chinook Scale Samples

Would it be possible to do them all in the timeframe you outline (December 6th)? If so, that would be great.

Cory

On Nov 20, 2013, at 12:59 PM, "Willette, Mark (DFG)" <mark.willette@alaska.gov> wrote:

We should have these read for you by about Dec. 6th.

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Wednesday, November 20, 2013 9:21 AM
To: Willette, Mark (DFG)
Cc: Mike Salzetti
Subject: RE: Grant Lake Chinook Scale Samples

Not many, less than 100 fish.....

From: Willette, Mark (DFG) [<mailto:mark.willette@alaska.gov>]
Sent: Wednesday, November 20, 2013 10:16 AM
To: Cory Warnock
Subject: RE: Grant Lake Chinook Scale Samples

Cory,

You have the correct address except it is Soldotna, AK 99669. How many scales will you be sending ?

Mark

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Wednesday, November 20, 2013 8:55 AM
To: Willette, Mark (DFG)
Cc: Mike Salzetti; John Stevenson
Subject: Grant Lake Chinook Scale Samples

Hi Mark,

Per our previous discussions, Mike Salzetti (HEA) has the Chinook scale samples collected this year from Grant Creek and would like to deliver them to you for aging soon. I've Cc'd Mike here and I'll let you work out the delivery details. I have your address as:

43691 Kalifornsky Beach Rd.
Suite B
Soldatna

If you could confirm this and could give me a general idea of what your turn-around time might be for aging the scales, I'd appreciate it.

Thanks Mark and let me know if you have any questions,

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

McMillen, LLC
www.mcmillen-llc.com
5771 Applegrove Ln.
Ferndale, Wa. 98248
O – 360-384-2662
C – 360-739-0187
F – 360-542-2264

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Version: 2014.0.4259 / Virus Database: 3629/6885 - Release Date: 12/02/13

From: Cory Warnock
Sent: Monday, December 02, 2013 2:54 PM
To: Mark Luttrell
Cc: Mike Salzetti; Michael Yarborough
Subject: RE: Grant Lake Cultural Resources Group

Hi Mark,

As I stated below, we are currently working on the development of our natural resource study reports (Cultural Report included). Once deemed internally final, we will be distributing the draft report for review. Based upon your inquiry below, I will add you to the distribution list and make sure you get a copy. As for qualifications for the respective individuals working on the Cultural piece of the project, our subcontractor for that effort is Cultural Resource Consultants based in Anchorage and more specifically Mike Yarborough. I believe that I heard somewhere along the way that you two were familiar with one another but I could be mistaken. I've Cc'd Mike for confirmation. As you have questions going forward, don't hesitate to let Mike (or myself) know.

Thanks,

Cory

From: Mark Luttrell [<mailto:prufrock@arctic.net>]
Sent: Sunday, December 01, 2013 5:37 PM
To: Cory Warnock
Subject: Re: Grant Lake Cultural Resources Group

Hi Cory:

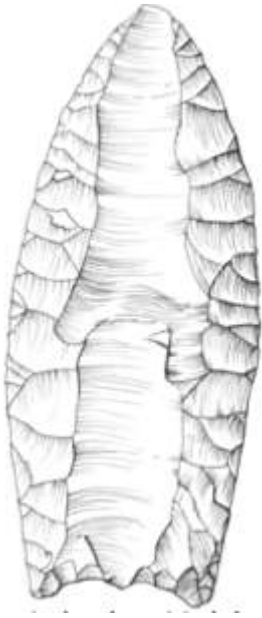
Thanks for keeping me in the loop. I'm interested in the process of evaluating the cultural resources in the Grant Lake area. Would you be willing to provide me any draft reports of those crafting the cultural analyses? Also, could you provide me a list and qualifications of each of the McMillen staff or contractors involved in that analysis?

Cheers

Mark

Mark Luttrell
Artifact Illustration
Box 511
Seward, Alaska 99664

907 224-5372
prufrock@arctic.net
artifactillustration.com



On Nov 18, 2013, at 10:56 AM, Cory Warnock <cory.warnock@mcmillen-llc.net> wrote:

Hi Mark,

My apologies for the delay in getting back to you. Grant Lake natural resource studies have been going at a pretty speedy clip and I've been pretty busy keeping things organized and coordinated. To that end, I wanted to let you know that we are currently working on the development of our natural resource study reports (Cultural Report included). Once deemed internally final, we will be distributing the draft report for review. Based upon your inquiry below, I will add you to the distribution list and make sure you get a copy. Before and after receipt, if you have any additional questions, please don't hesitate to let me know.

Thanks,

Cory

Cory Warnock

Senior Licensing and Regulatory Consultant

McMillen, LLC

www.mcmillen-llc.com

5771 Applegrove Ln.

Ferndale, Wa. 98248

O – 360-384-2662

C – 360-739-0187

F – 360-542-2264

From: Mark Luttrell [mailto:prufrock@arctic.net]

Sent: Friday, September 13, 2013 2:59 PM

To: Cory Warnock

Subject: Grant Lake Cultural Resources Group

Hi Cory:

My name is Mark Luttrell, a longtime resident of Seward and an archaeologist and illustrator. I'm interested in participating in the cultural resources discussions when they occur. I've been a part of discussions before when HDR was involved and I've followed HEA's efforts. Would it be possible to put me on your email contact list for both cultural and general announcements regarding the proposed dam at Grant Lake?

Thanks

Mark

Mark Luttrell
Artifact Illustration
Box 511
Seward, Alaska 99664

907 224-5372
prufrock@arctic.net
artifactillustration.com

<image001.png>

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Version: 2014.0.4259 / Virus Database: 3629/6885 - Release Date: 12/02/13

From: Cory Warnock
Sent: Monday, December 02, 2013 2:58 PM
To: waterlaw@uci.net
Cc: Mike Salzetti
Subject: RE: Grant lake email thread

Hello Mr. Shepherd,

Thanks for your interest in the project. I'll get your name added to our general distribution list. Additionally, the Kenai Hydro website (<http://www.kenaihydro.com/>) is kept up to date with proceedings and final documents for your review.

As you have questions, don't hesitate to let me know,

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

McMillen, LLC
www.mcmillen-llc.com
5771 Applegrove Ln.
Ferndale, Wa. 98248
O – 360-384-2662
C – 360-739-0187
F – 360-542-2264

From: H Shepherd CWA [mailto:waterlaw@uci.net]
Sent: Monday, December 02, 2013 11:47 AM
To: Cory Warnock; H Shepherd CWA
Subject: Re: Grant lake email thread

Mr. Warnock:

Please add me to the list-serve for the Work Group related to any information re: the Grant Lakes Hydropower project. Thank you.

Harold Shepherd, Director
Center for Water Advocacy
P.O. Box 2903
909 3rd Ave., Ste 7
Seward, AK 99664
(907)224-3887

>BODY { font-family:Arial, Helvetica, sans-serif;font-size:12px; }

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>On Tue 11/12/13 6:32 PM , Mark Luttrell wrote:

>

>

>

>

>

>On Sep 13, 2013, at 12:55 PM, Jan Konigsberg jan@hydroreform.org> wrote:

>

>----- Forwarded message -----

>From: Miller, Monte D (DFG)monte.miller@alaska.gov>

>Date: Mon, Sep 9, 2013 at 12:04 PM

>Subject: RE: Grant Lake Project Work Groups

>To: Cory Warnock cory.warnock@mcmillen-llc.net>, "Alstrom, Audrey D (AIDEA)" aalstrom@aidea.org>, "Barbara Stanley (bstanley@fs.fed.us)" bstanley@fs.fed.us>, "Brenda Trefon (btrefon@kenaitze.org)" btrefon@kenaitze.org>, "Goodrum, Brent W (DNR)" brent.goodrum@alaska.gov>, "Cassie Thomas (cassie_thomas@nps.gov)" cassie_thomas@nps.gov>, "Griffin, David W (DNR)" david.griffin@alaska.gov>, "Schade, David W (DNR)" david.w.schade@alaska.gov>, "Denise Koopman (denise.koopman@usace.army.mil)" denise.koopman@usace.army.mil>, "douglas_mutter@ios.doi.gov" douglas_mutter@ios.doi.gov>, "Ott, Douglas C (AIDEA)" dott@aidea.org>, "Eric Rothwell (eric.rothwell@noaa.gov)" eric.rothwell@noaa.gov>, "Litchfield, Virginia P (DFG)" ginny.litchfield@alaska.gov>, "Jan Konigsberg (jan@hydroreform.org)" jan@hydroreform.org>, "Mouw, Jason E B (DFG)" jason.mouw@alaska.gov>, "Jeffry Anderson (Jeffry_Anderson@fws.gov)" Jeffry_Anderson@fws.gov>, "Klein, Joseph P (DFG)" joe.klein@alaska.gov>, "Bittner, Judith E (DNR)" judy.bittner@alaska.gov>, "K.J. Muschovic (kjmushovic@blm.gov)" kjmushovic@blm.gov>, "Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil)" katherine.a.mccafferty2@usace.army.mil>, "Ken Hogan (kenneth.hogan@ferc.gov)" kenneth.hogan@ferc.gov>, "Kevin Laves (klaves@fs.fed.us)" klaves@fs.fed.us>, "Sager, Kimberly R (DNR)" kimberly.sager@alaska.gov>, "Schick, Lesli J (DNR)" lesli.schick@alaska.gov>, "lynnda_kahn@fws.gov" lynnda_kahn@fws.gov>, "Walton, Michael L (DNR)" michael.walton@alaska.gov>, "Mike Cooney (mcooney@arctic.net)" mcooney@arctic.net>, "Russell, Pamela J (DNR)" pamela.russell@alaska.gov>, "Berkhahn, Patricia G (DFG)" patricia.berkhahn@alaska.gov>, "Paul Torgerson (paul@grantlakemining.com)" paul@grantlakemining.com>, "Phil Brna (phil_brna@fws.gov)" phil_brna@fws.gov>, "Ricky Gease (ricky@kenairiversportfishing.com)" ricky@kenairiversportfishing.com>, "Robert Stovall (rstovall@fs.fed.us)" rstovall@fs.fed.us>, "Swinford, Robin E (DNR)" robin.swinford@alaska.gov>, "Duvall, Shina A (DNR)" shina.duvall@alaska.gov>, "Sue Walker (susan.walker@noaa.gov)" susan.walker@noaa.gov>, "tomharkreader@gmail.com" tomharkreader@gmail.com>, "Travis Moseley (tmoseley@fs.fed.us)" tmoseley@fs.fed.us>

>Cc: Mike Salzetti msalzetti@homerelectric.com>, Emily Andersen emily.andersen@mcmillen-llc.net>

>

>

>Cory, Please include me in both groups. I appreciated the opportunity to attend the site visit. It appears that the efforts on site to maintain the ability to collect data have been successful. This has occurred under challenging conditions and I hope that the effort will continue long enough to collect some coho data as well. The closer to cold weather, the more challenging it will become to stay at the site and collect data. It will be very interesting to review the data collected. Others have probably mentioned concern regarding generator and fuel storage containment. There are probably some permit compliance issues there as well. Our concerns are with possible fuel spills into the watershed. Please comply with standard fuel containment practices. Someone stated that containment equipment was on site but had not been placed in use. If so, this is an easy correction. Thanks.
Monte D. Miller

>Statewide FERC Hydropower Coordinator

>Alaska Department of Fish and Game

>Division of Sport Fish / RTS

>333 Raspberry Road

>Anchorage, Alaska, 99518-1565

>(907) 267-2312 From: Cory Warnock

>Sent: Monday, September 09, 2013 10:31 AM

>To: Alstrom, Audrey D (AIDEA); Barbara Stanley (bstanley@fs.fed.us); Brenda Trefon (btrefon@kenaitze.org); Goodrum, Brent W (DNR); Cassie Thomas (cassie_thomas@nps.gov); Griffin, David W (DNR); Schade, David W (DNR); Denise Koopman (denise.koopman@usace.army.mil); douglas_mutter@ios.doi.gov; Ott, Douglas C (AIDEA); Eric Rothwell (eric.rothwell@noaa.gov); Litchfield, Virginia P (DFG); Jan Konigsberg (jan@hydroreform.org); Mouw, Jason E B (DFG); Jeffry Anderson (Jeffry_Anderson@fws.gov); Klein, Joseph P (DFG); Bittner, Judith E (DNR); K.J. Muschovic (kjmushovic@blm.gov); Katherine McCafferty (katherine.a.mccafferty2@usace.army.mil); Ken Hogan (kenneth.hogan@ferc.gov); Kevin Laves (klaves@fs.fed.us); Sager, Kimberly R (DNR); Schick, Lesli J (DNR); lynnnda_kahn@fws.gov; Walton, Michael L (DNR); Mike Cooney (mcooney@arctic.net); Miller, Monte D (DFG); Russell, Pamela J (DNR); Berkahn, Patricia G (DFG); Paul Torgerson (paul@grantlakemining.com); Phil Brna (phil_brna@fws.gov); Ricky Gease (ricky@kenairiversportfishing.com); Robert Stovall (rstovall@fs.fed.us); Swinford, Robin E (DNR); Duvall, Shina A (DNR); Sue Walker (susan.walker@noaa.gov); tomharkreader@gmail.com; Travis Moseley (tmoseley@fs.fed.us)

>Cc: Mike Salzetti; Emily Andersen

>Subject: Grant Lake Project Work Groups Grant Lake Hydroelectric Project (FERC No. 13212) Natural Resources Study Stakeholder Group: Hi all, I wanted to start by saying thank you to those who attended the Grant Creek site visit and I hope that you all found it beneficial. I thought it was a great turn-out and was very pleased that the weather decided to cooperate! As I mentioned, if anyone has any follow-up questions, please don't hesitate to let me know. I wanted to let you all know about a process change that we will be implementing

in the interest of increased efficiency and collaboration. As I eluded to during the site visit, HEA will be developing a separate "Aquatics Work Group" (AWG). This group will responsible for discussing all matters associated with aquatics issues (fisheries, aquatic habitat, aquatic nutrients, instream flow, etc.) related to the Grant Lake Project. Given the number of studies and level of interest in this specific discipline, having a separate work group to discuss this area, makes sense from an efficiency standpoint. As such, the AWG meeting related to the upcoming 2013 study reports/data review will be held separate from the other natural resource areas (Water Resources, Terrestrial, Recreation/Visual), which will have their meeting in a grouped fashion. For the purposes of consistency, we will begin calling this other group the "Natural Resource Work Group" (NRWG). These two meetings will be staggered by approximately one month (NRWG first) and both will take place in the first two months of next year. One note...I definitely see the potential need for our Water Resources lead to participate in some of the AWG proceedings. Our lead has been prepped and will be present at both sets of meetings if the need is there. I suspect it will be given the relationship between hydrology and fish presence/habitat quality. The only thing that I'd ask of all of you at this point is to please write back and indicate which group you'd like to be a member of. I fully appreciate and understand that some of you are responsible for multiple natural resource areas for your agencies and may want to be a part of both groups and that is fine. That said, some of you do not have a vested responsibility in some areas and as such, the goal of the separate AWG is to create a more focused group of aquatic representatives to collaborate on the rather large suite of studies that are taking place in that area this year. So with that, please get back to me on the group(s) that you'd like to be a part of. To give you a tentative idea of our planned report distribution and meeting schedule, we are working toward the following:

- Draft 2013 Water Resources, Terrestrial and Rec/Vis Reports to Stakeholders - mid to late December (2013)

- >· Water Resources, Terrestrial and Rec/Vis Study Results Meeting - mid January (2014)

- >· Draft 2013 Fisheries, IFIM and Aquatic Nutrients Reports to Stakeholders - mid to late January (2014)

- >· Fisheries, IFIM and Aquatic Nutrients Study Results Meeting - mid February (2014)

- >

- >* Cultural Resources will follow the standard path for these types of projects.

>Obviously, additional detail will follow as we get closer, groups get established and schedules get refined. In the interim, please don't hesitate to shoot me an email or give me a call with any questions/concerns. Please get back to me related to the work group(s) you'd like to be a part of. Again, thank you for your attendance at the site visit and I look forward to continuing to establish a collaborative process going forward, Cory Cory Warnock Senior Licensing and Regulatory Consultant McMillen, LLC <http://www.mcmillen-llc.com5771> target="_blank">www.mcmillen-llc.com5771 Applegrove Ln. Ferndale, Wa. 98248O - 360-384-2662C - 360-739-0187F - 360-542-2264

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From: John Blum [<mailto:john.blum@mcmillen-llc.com>]

Sent: Thursday, December 05, 2013 8:39 AM

To: Eric Rothwell; Miller, Monte D (DFG); Klein, Joseph P (DFG); Mouw, Jason E B (DFG); jeffry_anderson@fws.gov; 'Cory Warnock'; 'Mike Salzetti'

Cc: 'John Blum'

Subject: Grant Lake HSC curves

Good Morning:

Per our discussions last week, I have finalized spawning HSC curves for Sockeye and Coho salmon for Grant Creek. The sockeye curve (n=99) is directly taken from Grant Creek observations. The depth curve remained at a value of 1.0 at depths >1.0 ft to account for fish that we could not reach and measure in the thalweg at high flows.

I'm recommending a slight change to the Coho salmon spawning curve for velocity. We obtained 47 measurements of spawning Coho, of which 44 were observed during flows ranging from 169 – 179 cfs. 4 measurements were taken at about 280; however, there were not a lot of measurements taken at higher flows. The reason for this was that the fish came in basically in one pulse, and we measured them from the time they came in until the run was over.

I'm mentioning this because I think the upper velocity is range is under-represented. What I would suggest doing is to: 1) use the Grant Creek curve from 0.0 – 1.49 fps. Then use the Cooper Creek velocity curve from 1.49 fps upwards until where it intersects the Grant Creek velocity curve.

I spoke with John Morsell re: the HSC curves used at Cooper Creek. He said that the only site-specific curves were for Dolly Varden, and that those were not used; the TWG wanted to use other literature-based curves from other projects.

I've made inquiries at WDFW re: the source of the streams, and in many instances, the composites curves come from a wide-range of waters, from major rivers to smaller streams. WDFW does have curves from smaller streams, which is what I used in my comparisons. The BC curves are all Delphi, and reflect a wide range of stream sizes. Given all that, I am surprised that some of the curves actually track pretty well.

Please get me the information from Falls Creek and the Kenai at your earliest convenience. Until then, I cannot run the models for the other species and species and life stages.

Thanks very much. I hope you all had a good Thanksgiving!

John

From: Cory Warnock
Sent: Monday, December 09, 2013 9:53 AM
To: Reimer, Adam M (DFG)
Subject: RE: Grant Lake Chinook Scale Samples

Hi Adam,

That is possible. It is also possible that they didn't include jacks in their weir count but did collect scales. I'll follow up with you once I see the draft report in about a week.

That work?

Thanks.

From: Reimer, Adam M (DFG) [<mailto:adam.reimer@alaska.gov>]
Sent: Monday, December 09, 2013 9:52 AM
To: Cory Warnock
Subject: RE: Grant Lake Chinook Scale Samples

Ok thank you. I understand that you are still writing things up.

I work in the same office that aged the scales for this project. I'm told that we aged 33 Chinook salmon scale samples, ostensibly from Grant Creek. Were some of those sampled below the weir or in other locations?

Adam

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Monday, December 09, 2013 8:07 AM
To: Reimer, Adam M (DFG)
Subject: RE: Grant Lake Chinook Scale Samples

Hi Adam,

I want to caveat the number I give you by saying that our fisheries subconsultant is currently analyzing all of the data collected and developing a comprehensive report for those efforts so the number I give you is preliminary but very likely accurate given the level of detail with which our studies were implemented. The report and associated data that is included/discussed therein, will be the final numbers for weir passage and that will be available on our website once completed and vetted with stakeholders (including ADF&G). All that said, and based upon our preliminary data, a total of 23 Chinook passed the weir on Grant Creek this year. Please keep in mind that this included some jacks.

Thanks and let me know if you have any questions,

Cory

From: Reimer, Adam M (DFG) [<mailto:adam.reimer@alaska.gov>]
Sent: Wednesday, December 04, 2013 4:30 PM
To: Cory Warnock
Subject: FW: Grant Lake Chinook Scale Samples

Hi Cory,

Is there any way we could find out how many Chinook salmon passed the Grant Creek weir this year?

Adam Reimer

++++++
Adam Reimer, Fisheries Biologist
43961 Kalifornsky Beach Road, Suite B
Soldotna, AK 99669
(w) 260-2961 (c) 252-3949
++++++

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From: Cory Warnock
Sent: Monday, December 09, 2013 9:22 AM
To: John Blum; 'Miller, Monte D (DFG)'; 'Eric Rothwell'; 'Klein, Joseph P (DFG)'; 'Mouw, Jason E B (DFG)'; jeffry_anderson@fws.gov; 'Mike Salzetti'
Subject: RE: Grant Lake HSC curves

Hi Monte,

Just bumping this up in your inbox as a reminder. John is getting very close to completing his Draft Instream Flow Report and the final curve info he requested below will help greatly. As you have time, a response would be appreciated.

Thanks very much,

Cory

From: John Blum [<mailto:john.blum@mcmillen-llc.com>]
Sent: Friday, December 06, 2013 2:44 PM
To: 'Miller, Monte D (DFG)'; 'Eric Rothwell'; 'Klein, Joseph P (DFG)'; 'Mouw, Jason E B (DFG)'; jeffry_anderson@fws.gov; Cory Warnock; 'Mike Salzetti'
Subject: RE: Grant Lake HSC curves

Thank you, Monte. I have looked at the different curves that were examined for Falls Creek, but I don't see where there was a proposed set of curves, as there was from the Sawmill Creek study. Do you happen to have the final curves that were used in the study? Thanks very much, and have a good weekend.

John

John Blum
Sr. Fisheries Scientist

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]
Sent: Thursday, December 05, 2013 11:18 AM
To: John Blum; Eric Rothwell; Klein, Joseph P (DFG); Mouw, Jason E B (DFG); jeffry_anderson@fws.gov; 'Cory Warnock'; 'Mike Salzetti'
Subject: RE: Grant Lake HSC curves

John,

Attached are the HSC's developed for Falls Creek. Also attached are the HSC's developed for Sawmill Creek (Sitka-Blue Lake outflow stream), as another set to ponder. These documents also cite many more references.

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS
333 Raspberry Road
Anchorage, Alaska, 99518-1565
[\(907\) 267-2312](tel:(907)267-2312)

From: John Blum [<mailto:john.blum@mcmillen-llc.com>]

Sent: Thursday, December 05, 2013 8:39 AM

To: Eric Rothwell; Miller, Monte D (DFG); Klein, Joseph P (DFG); Mouw, Jason E B (DFG); jeffry_anderson@fws.gov; 'Cory Warnock'; 'Mike Salzetti'

Cc: 'John Blum'

Subject: Grant Lake HSC curves

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I spoke with John Morsell re: the HSC curves used at Cooper Creek. He said that the only site-specific curves were for Dolly Varden, and that those were not used; the TWG wanted to use other literature-based curves from other projects.

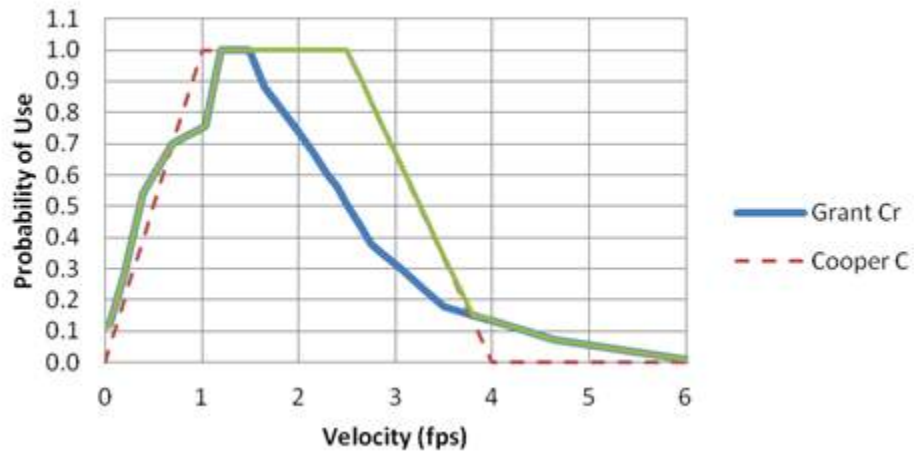
I've made inquiries at WDFW re: the source of the streams, and in many instances, the composites curves come from a wide-range of waters, from major rivers to smaller streams. WDFW does have curves from smaller streams, which is what I used in my comparisons. The BC curves are all Delphi, and reflect a wide range of stream sizes. Given all that, I am surprised that some of the curves actually track pretty well.

Please get me the information from Falls Creek and the Kenai at your earliest convenience. Until then, I cannot run the models for the other species and species and life stages.

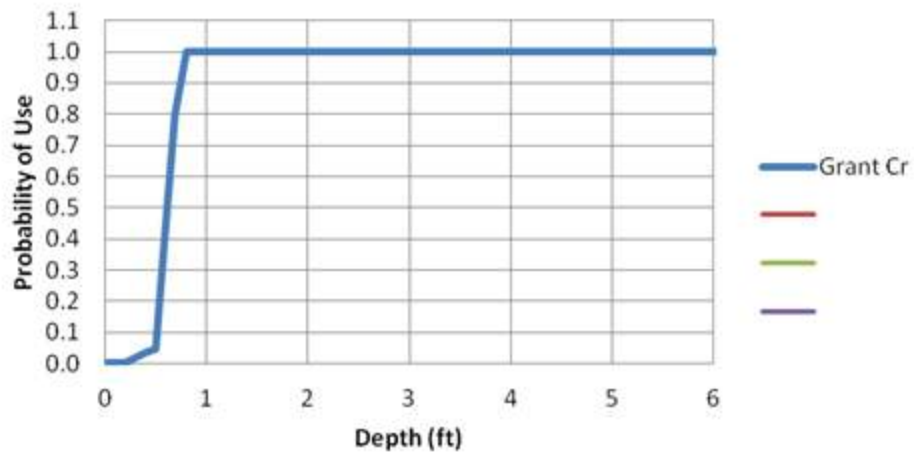
Thanks very much. I hope you all had a good Thanksgiving!

John

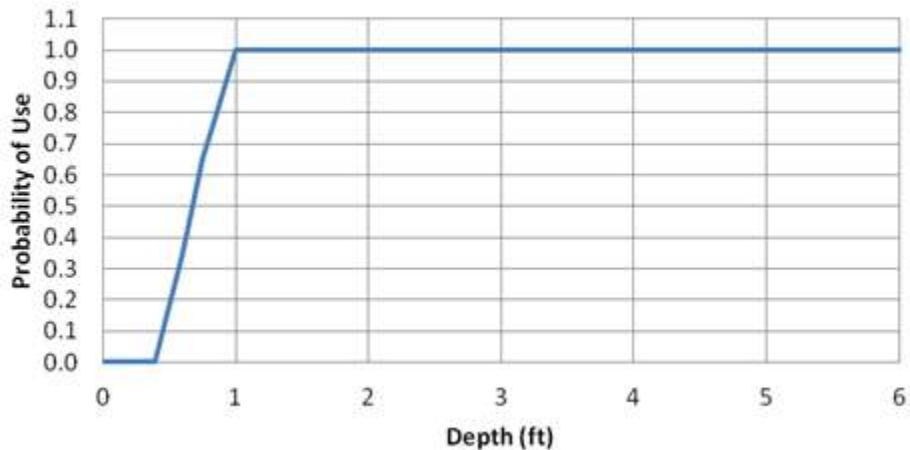
Grant Creek Coho Spawning, Velocity



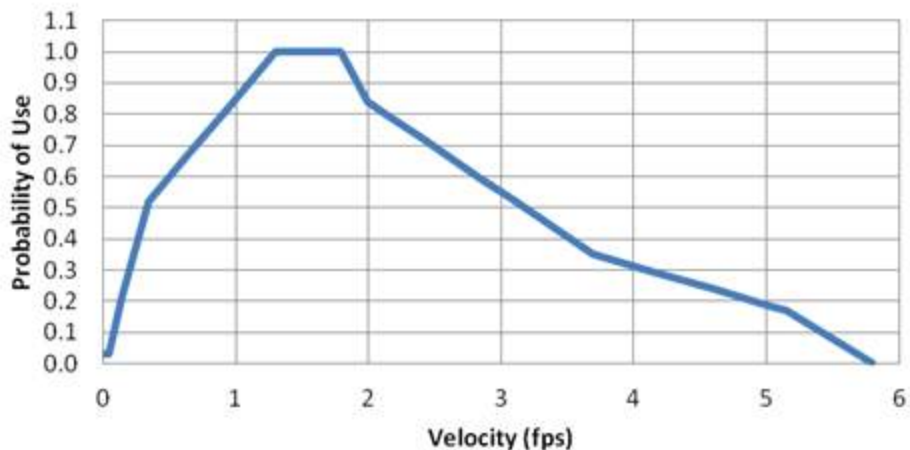
Coho Spawning, Depth



Sockeye Spawning, Depth



Sockeye Spawning, Velocity



John Blum

Sr. Fisheries Scientist

McMillen, LLC

1155 North State Street, Suite 700, Bellingham, WA 98225

direct 360.483.2807 | p 360.734.5915 x 281

f 360.734.5918 | c 360.220.0694

john.blum@mcmillen-llc.com | www.mcmillen-llc.com

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From: Ayers, Scott D (DFG) <scott.ayers@alaska.gov>
Sent: Monday, December 09, 2013 3:21 PM
To: John Stevenson
Cc: Cory Warnock; Mark Miller; Emily Andersen
Subject: RE: Data Submission Form
Attachments: FRP data submission form 5.3.xlsx

Hi John,

The data submission form is attached to this message. Let me know if you have any questions.

Cheers,
-Scott

Scott D Ayers
Fish Resource Permit Program Coordinator
Alaska Department of Fish and Game
Division of Sport Fish
333 Raspberry Road
Anchorage, AK 99518
(907) 267-2517 – phone (907) 267-2464 – fax
scott.ayers@alaska.gov

From: John Stevenson [<mailto:john.stevenson@bioanalysts.net>]
Sent: Monday, December 09, 2013 1:11 PM
To: Ayers, Scott D (DFG)
Cc: cory.warnock@mcmillen-llc.com; Mark Miller; Emily Andersen
Subject: Data Submission Form

Hi Scott,

I was wondering if you could send me a data submission form so that we can submit that for our Grant Creek work by the December 31 deadline. If that isn't something that you have, could you provide the contact information of who would have that?

Thanks, John

John R. Stevenson
Fisheries Biologist
BioAnalysts, Inc.
16541 Redmond Way, #339
Redmond, WA 98052
(425) 883-8295; (206) 390-7116 (cell)

ADF&G permit no. SF201X-XXX (FILL IN)																						
Summary report of fish collection activity.																						
The area biologist was contacted on: TIME/DATE																						
Location ID (optional)	Latitude	Longitude	Datum	Coordinate determination method	Name of water body	Date	Observer name (first name, middle initial, last name)	Fish collection method	Species	Life stage	Length (mm) No estimates/ranges	Length method	Weight (g)	Sex	Age	Age method	ADF&G GCL	Additional count (1)	Disposition (1)	Additional count (2)	Disposition (2)	Comments

From: Cory Warnock
Sent: Tuesday, December 10, 2013 2:37 PM
To: rstovall@fs.fed.us; pamela.russell@alaska.gov; jeavis@fs.fed.us; Van Massenhove, Katherine B -FS (kvanmassenhove@fs.fed.us); Lesli Schick (lesli.schick@alaska.gov); Shina Duvall
Cc: Mike Salzetti; Dwayne Adams; Emily Andersen
Subject: Draft INHT Meeting Minutes For Review
Attachments: Draft INHT Meeting Minutes_12_10_13.pdf

Hi all,

Attached are the draft INHT meeting minutes from our 11/13/13 meeting in Girdwood. If you all could please take a few moments to review over the next week or so (by 12/17/13), I'd appreciate it. Providing any comments via a word document and/or email will be fine. I'll plan on finalizing late next week. Thanks to all who attended for the valuable discussion and development of a process for resolution.

Thanks and I'll look forward to hearing from you,

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

McMillen, LLC
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5771 Applegrove Ln.
Ferndale, Wa. 98248
O – 360-384-2662
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F – 360-542-2264

Grant Lake Hydroelectric Project (FERC No. 13212)
Iditarod National Historic Trail Meeting
Girdwood Ranger District Conference Room Girdwood, AK
November 13, 2013, 1:00 pm to 3:00 pm

In Attendance

Robert Stovall, United States Forest Service (USFS)
Pam Russell, Alaska Department of Natural Resources (ADNR)
John Eavis, USFS
Kathy Van Massenhove, USFS
Lesli Schick, ADNR *[via phone]*
Shina duVall, ADNR *[via phone]*
Mike Salzetti, Kenai Hydro (KHL)
Dwayne Adams, USKH
Kim Graham, USKH
Cory Warnock, McMillen, LLC

Meeting Summary

Introductions and Agenda

Dwayne Adams (USKH) began the meeting with introductions and then reviewed the proposed meeting agenda (see [Attachment 1](#)):

- Project Overview and Update
- Licensing Status
- Iditarod National Historic Trail (INHT) Easement Alternatives
 - Review of mapped route
 - Photo tour of possible solution
- Discussion of Agency Viewpoints
- Review of steps forward for resolution
- Adjourn

Project Description

Mike Salzetti (KHL) presented an overview and history of the Grant Lake Hydroelectric Project (Project) (see PowerPoint included as [Attachment 2](#)). Mike S. gave a general description of the utility, Homer Electric Association (HEA), noting that Kenai Hydro, LLC (KHL), the applicant for the Project, is a wholly-owned subsidiary of HEA. Mike S. shared three primary reasons why HEA was pursuing the Project 1) to meet the Board of Director's and the state of Alaska's goals for an increase in its renewable energy assets; 2) that as its own power producer, HEA now has the generation portfolio and operational control to accommodate renewable energy projects, and 3) to create a long-term, stable energy source in light of higher gas prices and the potential of future gas shortages.

Mike S. briefly described the history of the proposed Project to date, explaining that feasibility studies were conducted for four potential sites (Grant Lake, Falls Creek, Ptarmigan Lake, and Crescent Lake); two of which (Grant Lake and Falls Creek) were carried forward and environmental baseline studies were conducted in 2009. Mike went on to describe why Grant Lake was selected as the preferred Project location. He described the upstream fish passage barrier at the outlet to Grant Lake (beginning of Grant Creek), the steep topography around Grant Lake and the fact that only stickleback and sculpin have ever been documented in the lake. Mike stated that aside from the obvious power potential that exists at the site, these natural resource characteristics make it an attractive site with the likelihood of minimal adverse impacts to the natural environment.

Mike went on to describe the current Project infrastructural proposal, associated operational parameters, etc. He noted that an engineering contractor has been retained and will be working with KHL to refine infrastructure and operations over the next year, in advance of the Draft License Application (DLA) being distributed for stakeholder review. The review of infrastructure included a map documenting not only specific Project operational components but the proposed access road/transmission corridor as well.

Mike then went on to describe the proposed access road and infrastructural issues associated with the INHT. He stated that the primary issues were:

- The access road and trail share a need for the same natural terrain
- Current INHT alignment is co-located with the proposed powerhouse location

Mike indicated that KHL has solved the access road issue by rerouting the proposed access road so that it has just a single 90° crossing of the INHT.

Mike finished his presentation by asking for any questions and stating that all documents related to the licensing that have developed thus far could be found on KHL's website at:

www.kenaihydro.com.

- *Comment:* Pam Russell (ADNR) asked if .pdf'd presentations could be sent to her.
Response: Cory Warnock (McMillen) stated that all meeting documents (agenda, presentations, minutes, etc.) would be posted to the KHL website.
- *Comment:* Pam Russell asked if water temperature changes as a result of turbine operation had been evaluated and if so and the temperatures were adversely impacted, would a change in turbine type be considered.
Response: Mike Salzetti stated that a combination of water quality results from 2013 work and engineering feasibility work would evaluate if any issues existed.
- *Comment:* Robert Stovall (USFS) asked who owned the land on the "Seward Highway" side of Trail Lakes Narrows.
Response: Mike Salzetti (KHL) stated that almost all of the proposed Project was located on State Land but that multiple entities within the State governed various sections of the land. He stated that the area Robert was referring to was governed by as a Kenai River Special Management Area (KRSMA). Pam Russell confirmed this. Mike went on to

state that the Kenai Peninsula Borough is considering selecting land within the Trail Lakes area, including along the shoreline of the Trail Lakes. However, the land has not been conveyed at this point thus the land remains in State hands...

Licensing Overview

Cory Warnock (McMillen) gave a brief summary of the licensing process being utilized by KHL (Traditional Licensing Process). Cory then went on to describe KHL's current status within this process and the fact that 2013 was primarily devoted to conducting a suite of natural resource studies on Grant Creek, Grant Lake and the surrounding Project area. He stated that natural resource reports were currently being developed and next steps included internal completion of those reports and subsequent meetings with stakeholders to discuss results along with continuing engineering feasibility work. All of this is being collaboratively done in advance of the development of the DLA which is currently scheduled for draft distribution to the stakeholders for review in the first half of 2015.

INHT Easement Alternatives

Dwayne Adams (USKH) presented a description of the current INHT and Project layouts and went on to describe the issue and two proposed re-route options (see PowerPoint included as [Attachment 3](#)).

Dwayne began by displaying a map showing the current infrastructural positioning for the Project along with the proposed location for the INHT through the Project area. He went on to state that KHL evaluated the area for an INHT re-route alternative that would:

- Provide separation with Project infrastructure
- Avoid any drainage concerns
- Expose the user to a large variety of forest types
- Maximize views of surrounding lakes and mountains

Dwayne stated that KHL had previously conducted a mapping and on the ground exercise to identify a re-route option in the Project Area. He stated that as part of this recent effort, USKH also conducted an evaluation and he felt that the re-route option USKH has identified accomplishes all of the bullets listed above and, in addition and based upon professional opinion, creates a higher level of global user experience through the area.

Dwayne then displayed photos of the various segments of the preferred alternative (USKH) through the Project area. Emphasis was placed on locations showing what was assessed as improvements to the user experience based on variables such as view, terrain alteration, forest type variety, etc. Special attention was placed on certain areas that provided a unique experience.

Dwayne then went on to describe KHL's current understanding of the process for resolution with the various stakeholders. He acknowledged the somewhat unique nature of the process and opened the floor for discussion and collaboration related to refinement of the re-route process.

- *Comment:* Lesli Schick (ADNR) stated that from a process perspective, the State Platting and Survey Department would issue an order for easement to approve the re-route and that the four entities that need to be involved in the initial review would be:
 - o USFS
 - o Kenai Peninsula Borough (KPB)
 - o KRSMA
 - o South Central Regional Office of ADNR

Lesli went on to say that once these four entities agreed, a public notice and agency review would take place that would involve other stakeholder agencies to some degree. She went on to say that from a KPB perspective, Marcus Mueller, KPB Land Management Officer, would be the first contact and then the habitat division would deal with any buffer issues.

A general process discussion then took place involving all parties. Once complete, Cory Warnock (McMillen) attempted to verbally outline the approach for resolution with the following steps:

1. The four principle agencies agree to the proposed reroute
2. A public notice and review period occurs
3. KHL develops a Memorandum of Understanding (MOU) to be reviewed and signed by pertinent parties
4. KHL discusses this approach with FERC to gain informal approval of process in advance of DLA submittal
5. The MOU and associated documentation is incorporated into the License Application for FERC review

The group agreed that in general, this approach was a good starting point but additional review of internal processes and discussion would be needed prior to formalizing the approach.

- *Comment:* John Eavis (USFS) stated that he appreciated Dwayne's presentation and the effort placed in identifying a re-route option that maximized the user experience. He went on to state that the "wilderness experience" associated with the trail was important and asked if the re-route would result in an audible change related to highway noise.
Response: Kim Graham (USKH) stated that during the survey, most of the noise at the site was associated with snow machines and float planes and that it was very intermittent and the noise climaxed quickly and subsided.
- *Comment:* Pam Russell (ANDR) asked if the proposed re-route would impact the money recently put into the "Vagt Lake pull-out".
Response: John Eavis (USFS) stated that it would not.

Dwayne asked if the stakeholders would like to have a site visit to review the proposed re-route location and if so, when. The group did agree that a site visit would be beneficial but the

aforementioned process should progress over the winter and then the site visit could occur in late spring/early summer.

- *Comment:* John Eavis stated that there was nothing “magic” about the original route design other than the bridge location across Grant Creek which sought to minimize construction costs. There was no reason that other options couldn’t meet those same expectations with respect to user experience.
- *Comment:* Shina duVall (ADNR) asked about the Section 106 process for the Project and if the INHT trail was assessed during the 2013 Cultural work.
Response: Cory Warnock stated that the INHT was discussed to some extent and the draft Cultural Resources Report was currently in development and meeting planning would be taking place over the next month or so. Dwayne said that he had spoken to Mike Yarborough (Cultural Resource Consultants) and he stated that the proposed INHT was not cited in this area to respond to any historic location and he saw nothing from a historic perspective that would preclude a re-route.

A general process discussion then took place during which, Pam Russell (ADNR) stated that she’d need agreement from Shina’s department (State Historic Preservation Office, (SHPO)) prior to discussing the issue with KRSMA.

- *Comment:* Lesli Schick (ADNR) stated that even if it is determined that the proposed trail doesn’t invoke Section 106 measures, it will require some sort of trail agreement for what it has been designated to be.

Cory Warnock suggested that a portion of the aforementioned Cultural meeting be reserved for discussion related to the INHT. The group agreed.

A bit more global discussion related to a site visit took place and further agreement related to late spring/early summer was gained.

- *Comment:* John Eavis (USFS) stated that eventually, KHL would need to develop the MOU letter and submit to the 4 primary agencies mentioned above. He went on to ask how FERC’s NEPA process plays into things.
Response: Cory Warnock stated that KHL would begin development of the MOU letter after the Cultural (Section 106) meeting. He went on to say that once a process was fully developed with this group, he intended on calling the FERC representative for the Grant Lake Project, Ken Hogan and discussing the approach with him. Given the licensing process being used (TLP) Mr. Warnock stated that developing a collaborative approach prior to receiving FERC input would be the best approach. Mr. Warnock stated that he’d report back to the group once the FERC communication had taken place.
- *Comment:* Lesli Schick (ADNR) reiterated that KHL would also have to submit an application for an easement after the four primary parties concurred on the re-route.
Response: Cory Warnock stated that that was understood and reiterated KHL’s intent to develop the MOU letter after the Cultural (Section 106) meeting.

- Comment:* Mike Salzetti (KHL) asked what level of detail should be included in the MOU letter.

Response: John Eavis (USFS) stated that he'd do some research and get back to KHL with some specifics.
- Comment:* Lesli Schick (ADNR) stated that she'd be the coordinator for MOU letter evaluation and that it was important to realize that this process will be reviewed as a State project separate of the Section 106 review. What eventually will be needed for formal approval, will be the four primary agencies discussed above to confirm with Lesli the re-route will not adversely impact the trail. She additionally stated that the \$100 application fee could be submitted at any time and would help in identifying it as a current project.

Response: Mike Salzetti (KHL) acknowledged that he understood and stated that KHL would be submitting the fee soon.
- Comment:* Pam Russell (ADNR) asked if the recent State Supreme Court ruling related to the disposal of land impacted the Project.

Response: Mike Salzetti (KHL) suggested that we keep the court ruling and the INHT issue separate.
- Comment:* John Eavis and Kathy Van Massenhove (USFS) stated that they would identify the appropriate individuals within the USFS to consult with. They stated that ultimately, the letter from a USFS perspective would be sent to Terry Marceron (Forest Supervisor).

Closing

Dwayne Adams thanked everyone for their participation, acknowledged the value of the meeting and adjourned the proceedings.

Attachments

Attachments are available on the Work Groups page at www.kenaihydro.com.

Attachment 1: Meeting Agenda

Attachment 2: KHL Project Presentation

Attachment 3: KHL Re-route Alternatives Presentation

Attachment 4: Map of Project Area and Proposed Re-route

From: Duvall, Shina A (DNR) [<mailto:shina.duvall@alaska.gov>]

Sent: Wednesday, December 11, 2013 11:09 AM

To: Cory Warnock

Subject: RE: Draft INHT Meeting Minutes For Review

Thanks Cory – I do not have any additional comments.

Best regards,
Shina

Shina duVall, RPA
Archaeologist, Review and Compliance Coordinator
Alaska State Historic Preservation Office / Office of History and Archaeology
550 W. 7th Ave., Suite 1310
907-269-8720 (phone) 907-269-8908 (fax)
shina.duvall@alaska.gov

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]

Sent: Tuesday, December 10, 2013 1:37 PM

To: rstovall@fs.fed.us; Russell, Pamela J (DNR); jeavis@fs.fed.us; Van Massenhove, Katherine B -FS (kvanmassenhove@fs.fed.us); Schick, Lesli J (DNR); Duvall, Shina A (DNR)

Cc: Mike Salzetti; Dwayne Adams; Emily Andersen

Subject: Draft INHT Meeting Minutes For Review

Hi all,

Attached are the draft INHT meeting minutes from our 11/13/13 meeting in Girdwood. If you all could please take a few moments to review over the next week or so (by 12/17/13), I'd appreciate it. Providing any comments via a word document and/or email will be fine. I'll plan on finalizing late next week. Thanks to all who attended for the valuable discussion and development of a process for resolution.

Thanks and I'll look forward to hearing from you,

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

McMillen, LLC

Attachments:

Master Library of habitat Suitablity Curves.pdf; _Certification_.htm

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]

Sent: Thursday, December 12, 2013 2:43 PM

To: John Blum

Subject: FW: Scanned Document

John,

I was able to locate the report and just got the scanned version back.

Hope this helps. I was in Juneau the past two days and only returned to the office today.

Monte Miller

From: Shelley, Jacqueline A (DFG)

Sent: Thursday, December 12, 2013 1:07 PM

To: Miller, Monte D (DFG)

Subject: Scanned Document

Done. The original is in your mailbox.

Thanks!

Jacque Shelley

Administrative Assistant II

Sport Fish RTS

333 Raspberry Rd

Anchorage, AK 99518

Work Number: 907-267-2294

Fax Number: 907-267-2422



✓ or C = O.K.

Master Library of Habitat Suitability Curves

**Falls Creek Hydroelectric Project
(FERC Project No. 11659)**

Prepared for:

Gustavus Electric Company
Gustavus, Alaska

Prepared by:

R2 Resource Consultants, Inc.
Redmond, Washington

January 2001

1. INTRODUCTION

This document contains an assemblage of all habitat suitability curve sets compiled and reviewed as part of the selection of suitability curves for use on the Falls Creek Instream Flow Project. The curves are presented by species and life history stage to allow a comparison of those sets selected/developed by the resource agencies (Appendix 1) with other curve sets that were available and reviewed during the selection process. For ease of comparison we are presenting all curves of a given species within the same section of the document. Likewise, we have grouped all curves pertaining to a given life stage together.

This document should be used during your final review and evaluation of the recommended curve sets. It is suggested that the curves recommended and presented in Appendix 1 for a given species and life stage be visually compared across species and life stages to determine the appropriateness of using the agency selected curve for the project.

For convenience, we have provided several tables that contain relevant information pertaining to suitability curve development and selection. These tables should prove useful to you in your final evaluation of the curve sets. The tables include the following:

- Table 1 – presents a cross species and life stage summary of suitability curve coordinates for the rising and falling limbs of the velocity, depth, and substrate suitability curves.
- Table 2 – presents a summary of suitability curve data that were compiled during the initial stages of the project. The table contains a listing of the references compiled for each species, an indication of life stage, the data source, stream information (location and size), and types of curves presented in the reference.
- Table 3 – presents a full citation for each of the reference documents presented in Table 2. A unique reference number that has been assigned to each document links the references presented in Tables 2 and 3.
- Table 4 – presents a summary of available background information for several of the prominent references presented in Tables 2 and 3.

A limited amount of site specific habitat utilization data was collected on Falls Creek during the summer and early fall of 2000 by Dr. Liz Flory. The raw data and the analysis used for generation of habitat utilization curves from Dr. Flory's data are presented in Appendix 2.

Table 1. Cross Species Comparison of Habitat Suitability Index (HSI) Curves for Falls Creek, AK.

Lifespan & Species	Velocity (fps)				Depth (ft.)				Substrate (size)			
	Rising limb		Falling limb		Rising limb		Falling limb		Rising limb		Falling limb	
	HSI min. (=0)	max (=1)	HSI min. (=0)	max (=1)	HSI min. (=0)	max (=1)	HSI min. (=0)	max (=1)	HSI min. (=0)	max (=1)	HSI min. (=0)	max (=1)
Spawning/Incubation												
Coho	0.25	1.50	2.50	5.0	0.30	1.0	non limiting	3.0	4.0	6.0	7.0	
Pink	0.25	0.75	2.25	5.0	0.30	1.0	non limiting	3.0	4.0	5.5	6.0	
Chum	0.25	1.0	2.50	5.0	0.30	1.0	non limiting	3.0	4.0	5.5	6.0	
Cutthroat trout	0.40	1.0	2.50	4.0	0.30	0.8	non limiting	2.0	3.0	4.5	5.5	
Resident char	0.00	0.20	2.0	3.0	0.30	0.6	non limiting	2.0	3.0	4.0	5.5	
Anadromous char	0.25	1.0	2.50	4.0	0.30	0.8	non limiting	2.0	3.0	4.5	5.5	
Adult Rearing												
Coho	999 ^t	0.40	2.50	4.0	0.75	2.0	non limiting					
Cutthroat trout	999 ^t	0.67	2.0	4.0	0.75	2.0	non limiting					
Resident char	999 ^t	0.16	1.5	2.5	0.33	1.5	non limiting					
Anadromous char	999 ^t	0.40	2.0	4.0	0.75	2.0	non limiting					
Juvenile Rearing												
Coho	999 ^z	0.67	2.6	4.0	0.33	1.0	non limiting					
Cutthroat trout	999 ^t	0.67	2.6	4.0	0.33	1.0	non limiting					
Resident char	999 ^t	0.16	1.0	3.0	0.33	1.0	non limiting					
Anadromous char	999 ^t	0.67	2.6	4.0	0.33	1.0	non limiting					
Fry Rearing												
Coho	999 ^z	0.00	0.36	2.5	0.0	0.2	non limiting					
Chum	999 ^z	0.00	0.36	2.5	0.0	0.2	non limiting					
Cutthroat trout	999 ^z	0.00	0.36	2.5	0.0	0.2	non limiting					
Resident char	999 ^z	0.00	0.36	2.5	0.0	0.2	non limiting					
Anadromous char	999 ^z	0.00	0.36	2.5	0.0	0.2	non limiting					

Code	Description	Diameter (inches)
1	Silt/Clay	
2	Sand	
3	Fine Gravel	0.1-0.5
4	Medium Gravel	0.5-1.5
5	Coarse Gravel	1.5-3.0
6	Small Cobble	3.0-6.0
7	Large Cobble	6.0-12.0
8	Boulder	> 12.0
9	Bedrock	

^tNote: Superscript (t) indicates HSI < 1 at velocity of 0 fps

^zNote: 999^z indicates HSI = 1 at velocity of 0 fps

Table 2 Summary of suitability curve data used in development of HSI curves for Falls Creek, AK.

Species	Life History Stage/Body Length	Docu- ment #	Reference	Cat. I/II	Data Source(s) if composite	Stream Location	Stream Name	Stream Type/Size	Type of Curves
PINK	Adult		Raleigh and Nelson 1985	I	Numerous sources	generic	not specific	various	depth, velocity
	Spawning	13			Wilson et al. 1981 (see Baldrige 1981), Nadeau 1984 (see Lyons and Nadeau 1985)	generic	not specific	various	depth, velocity, substrate
	Fry migration			I	Numerous sources	generic	not specific	various	depth, velocity, substrate
	Adult, spawning	1	Krueger 1981	I	Numerous sources	Alaska	not specific	various	passage, substrate, velocity
	Spawning	10	Lyons and Nadeau 1985	II	see additional descriptions	Alaska	Wilson River, Tunnel Creek	large stream, small river	depth, velocity, substrate
	Spawning	6	Estes et al. 1981	I	Adapted from Watsjold and Engel 1978 (AK)	Alaska	Willow Creek, Deception Creek	wet channel approx. 40-50 ft.	depth, velocity, substrate
	Spawning	3	Baldrige 1981	II	see additional descriptions	Kodiak, Alaska	Terror and Kizhuyak Rivers	approx. 50-100 ft. wetted channels	depth, velocity, substrate
	Spawning	7	Hosey 1986	I	Numerous sources	WA	White River	large river	depth, velocity
	Spawning	17	DES 1999	I	WDFW 1996 (depth, substrate), Kurko 1977 (velocity, upper Skagit)	WA	Skagit River	lower mainstem of large river	depth, velocity, substrate
	Spawning	24	Wampler 1980	I	Bruner 1951 (Columbia River salmon), Heiser 1971 (western WA)	WA	North and S. Fk. and mainstem Skokomish River	large river	depth, velocity, substrate
	Spawning	25	WDFW 1996	I	Dosewallips, Duckabush, N. Fk. Stillaguamish and Squire Creek	WA	Dosewallips, Duckabush, N. Fk. Stillaguamish and Squire Creek	large river	depth, velocity, substrate
	Spawning	31	Puget 1989 (based on WDW 1989)	I	WDF 1989	WA	N. Fork Nooksack River	small river	depth, velocity
	Spawning	35	Nadeau and Lyons 1987	II	see additional descriptions	Alaska	Indian River	average 80 ft. wide	depth, velocity, substrate
	Incubation	35	Nadeau and Lyons 1987	I	Delphi method	Alaska	Indian River	average 80 ft. wide	depth, velocity, substrate
CHUM	Spawning	10	Lyons and Nadeau 1985	I & II	Field data fit to AEIDC 1981 (Kodiak Is., AK)	SE Alaska	Wilson River, Tunnel Creek	large stream, small river	depth, velocity, substrate
	Spawning	3	Baldrige, 1981	II	see additional descriptions	Kodiak, Alaska	Terror and Kizhuyak rivers	approx. 50-100 ft. wetted channels	depth, velocity, substrate

Table 2 Summary of suitability curve data used in development of HSI curves for Falls Creek, AK.

Species	Life History Stage/Body Length	Docu- ment #	Reference	Cat. I/II	Data Source(s) if composite	Stream Location	Stream Name	Stream Type/Size	Type of Curves
CHUM (conti.)	Spawning, incubation	8	Hale et al. 1985	I	Kurko 1977 (Skagit River)	WA	Skagit River	mainstem	depth, velocity
	Fry	8	Hale et al. 1985	I	Professional judgement	generic	not specific	n/a	depth, velocity, substrate
	Spawning	7	Hosey 1986	I	Numerous sources	WA	White River	large river	depth, velocity
	Spawning	17	DES 1999	I	Kurko 1977 (Skagit River)	WA	Skagit River	lower mainstem of large river	depth, velocity, substrate, cover
	Spawning	24	Wampler 1980	I	Unknown source	WA	North and S. Fk. and mainstem Skokomish River	large river	depth, velocity, substrate
	Spawning	25	WDFW 1996	I	Kennedy Creek, Dosewallips and Duckabush R.	WA	Kennedy Creek, Dosewallips and Duckabush Rivers	large creek, small river	depth, velocity, substrate
	Spawning	35	Nadeau and Lyons 1987	I	Wilson et al. 1981 (see Baldrige 1981)	Alaska	Indian River	average 80 ft. wide	depth, velocity, substrate
	Incubation	35	Nadeau and Lyons 1987	II	Delphi method	Alaska	Indian River	average 80 ft. wide	depth, velocity, substrate
COHO	Spawning, juvenile, fry, incubation	10	Lyons and Nadeau 1985	I	AEIDC 1981 (Kodiak Island, AK)	SE Alaska	Wilson River, Tunnel Creek	large stream, small river	depth, velocity, substrate
	Fry, juvenile, spawning	3	Baldrige 1981	II	see additional descriptions	Kodiak, Alaska	Terror and Kizhuyak Rivers	approx. 50-100 ft. wetted channels	depth, velocity, substrate
	Juvenile	4	Bustard and Narver 1975	II	see additional descriptions	B.C., Vancouver Island	Carnation Creek	small coastal stream	depth, velocity
	Fry, juvenile, spawning	7	Hosey 1986	I	Numerous sources	WA	White River	large river	depth, velocity
	Spawning, fry	16	Bovee 1978	I	Numerous sources	Idaho/ Oregon	not specific	various	depth, velocity, substrate
	Rearing	17	DES 1999	I	WDFW 1996	WA	Skagit River	lower mainstem	depth, velocity, substrate, cover
	Spawning	15	Sams and Pearson 1963	II	see additional descriptions	Willamette Valley, OR	McKay, Beaver, Seine, and Burton Creeks	small rivers, large creeks	depth, velocity
	Spawning	24	Wampler 1980	I	Chambers et al. 1955	WA	North and S. Fk. and mainstem Skokomish River	large river	depth, velocity, substrate
	Spawning, juvenile, fry	28	R2 Resources 1998	I	Hampton 1988 (CA), Sams and Pearsons 1963, Bustard and Narver 1975	Oregon	Lostine River	large river	depth, velocity, substrate
	Juvenile	25	WDFW 1996	I	Unidentified, 4 studies, 451 fish	WA	not specific	various	depth, velocity

Table 2 Summary of suitability curve data used in development of HSI curves for Falls Creek, AK.

Species	Life History Stage/Body Length	Document #	Reference	Cat. I/II	Data Source(s) if composite	Stream Location	Stream Name	Stream Type/Size	Type of Curves
DOLLY VARDEN / BULL TROUT	Juvenile	35	Nadeau and Lyons 1987	I	Wilson 1981 (see Baldrige 1981)	Alaska	Indian River	average 80 ft. wide	depth, velocity, substrate
	Fry	35	Nadeau and Lyons 1987	II	see additional descriptions	Alaska	Indian River	average 80 ft. wide	depth, velocity, substrate
	Spawning, fry, juvenile	3	Baldrige 1981	II	see additional descriptions	Kodiak, Alaska	Terror and Kizhuyak Rivers	approx. 50-100 ft. wetted channels	depth, velocity, substrate
	Rearing	17	DES 1999	I	WDFW 1996	WA	Skagit River	lower mainstem	depth, velocity, substrate, cover
	Spawning, juvenile, fry	28	R2 Resources 1998	I	Pratt 1984 (MT), Bonneau 1994 (ID), Reiser et al. 1997 (Cedar R.)	Oregon	Lostine River	large river	depth, velocity, substrate
	Rearing (adult)	28	R2 Resources 1998	I	Adapted from R2 juvenile curve above, assumed higher velocities used	Oregon	Lostine River	large river	depth, velocity, substrate
	Spawning	25	WDFW 1996	I	Unidentified	WA, OR	Eastslope Cascade Mt. stream	stream	depth, velocity
	Juvenile, adult	25	WDFW 1996	I	Unidentified 4 studies, 39 fish	WA	not specific	various	depth, velocity
	Rearing (adult)	36	EA 1997	I	Bovee 1978 (OR, WA)	Oregon	Klamath River	large river	depth, velocity, substrate
	Spawning	36		I	Pruitt et al. 1978 (ID)	Oregon			depth, velocity, substrate
CUTTHROAT	Juvenile, fry	37	Bonneau 1994	I	Pratt 1984 (MT)	Idaho	Trestle, Rattle and Granite Creeks	streams	depth, velocity, substrate
	Juvenile			II	see additional descriptions	Alaska	Falls Creek	stream	depth, velocity
	Juvenile, adult		Flory 2000	II	site specific	Alaska			depth, velocity
	Rearing	17	DES 1999	I	WDFW 1996	WA	Skagit River	lower mainstem	depth, velocity, substrate, cover
	Rearing (>9cm)	26	Heggenes et al 1991	II	see additional descriptions	B.C.	Musqueam Creek	small coastal stream	depth, velocity, substrate, cover
	Fry, adult	25	WDFW 1996	I	Unidentified	generic	not specific	various	depth, velocity, substrate
	Adult	33	June 1981	II	see additional descriptions	Olympic Penn. WA	Bear Creek	headwater streams	depth, velocity, substrate
	Spawning, incubation, fry, juvenile, adult	16	Bovee 1978	I	Numerous sources	WA, BC, CA	not specific	various	depth, velocity, substrate, temperature
	Juvenile, adult		Flory 2000	II	site specific	Alaska	Falls Creek	stream	depth, velocity
	Adult, juvenile	29	Carlson and Campbell 1991 (based on Beak 1989)	I	Beak 1989	Mt. Baker system	Anderson Creek	small stream	depth, velocity

Table 3. Reference documents used for generation of HSI curves for Falls Creek, AK.	
Reference Number	Document Reference
1	Krueger, S. W. 1981. Freshwater habitat relationships pink salmon (<i>Oncorhynchus gorbuscha</i>). Alaska Dept. of Fish and Game, Anchorage.
2	Arctic Environ. Information and Data Center. 1981. An assessment of environmental effects of construction and operation of the proposed Terror Lake Hydroelectric Facility, Kodiak Alaska. Instream flow studies. Final report. Univ. of Alaska, Anchorage. 418 p. (same as #3)
3	Baldrige, J. E. 1981. Appendix 3, Development of habitat suitability criteria. Arctic Environ. Information and Data Center, Terror Lake project, Alaska. (see #2)
4	Bustard, D. R., and D. W. Narver. 1975. Aspects of the winter ecology of juvenile coho salmon and steelhead trout. Journal of the Fisheries Research Board of Canada 32:667-680.
5	Corning, R.V., and G. Elliott. 1987. An evaluation of IFIM curves developed for the Swanson River rainbow trout populations. Draft report for U.S. Fish and Wildlife Service, Alaska Invest. Field Office. Anchorage, Alaska. 24 p. (taken from #32)
6	Estes, C., K. Hepler, and A. Hoffman. 1981. Willow and Deception creeks instream flow demonstration study. Alaska Department of Fish and Game. Prepared for the USDA, Soil Conservation Service.
7	Hosey and Associates. 1986. Unpublished White River Criteria Curves.
8	Hale, S. S., T. E. McMahon, and P. C. Nelson. 1985. Habitat suitability index models and instream flow suitability curves: Chum salmon. U. S. Fish and Wildlife Service. Biol. Report 82(10.108).
9	Estes, C. and K. J. Kuntz. 1986. Kenai River habitat study. Volume 27, July 1, 1985 - June 30, 1986, Federal Aid in Fish Restoration and Anadromous Fish studies. Alaska Department of Fish and Game, Juneau, Alaska.
10	Lyons, S. M. and R. L. Nadeau. 1985. Instream flow investigations Wilson River and Tunnel Creek. U.S. Fish and Wildlife Service, Habitat Resources Program. Anchorage, Alaska.
11	McMahon, T. E. 1983. Habitat suitability index models: Coho salmon. U. S. Fish and Wildlife Service, FWS/OBS-82/10.49.
12	Raleigh, R. F., T. Hickman, R. C. Solomon, and P. C. Nelson. 1984. Habitat suitability information: Rainbow trout. U. S. Fish and Wildlife Service, FWS/OBS-82/10.60.
13	Raleigh, R. F. and P. C. Nelson. 1985. Habitat suitability index models and instream flow suitability curves: Pink salmon. U.S. Fish and Wildlife Service Biological Report 82(10.109).
14	Raleigh, R. F. and P. C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: Chinook salmon. U.S. Fish and Wildlife Service Biological Report 82(10.122).

Table 3. Reference documents used for generation of HSI curves for Falls Creek, AK.

Reference Number	Document Reference
15	Sams, R. E., and L. S. Pearson. 1963. The depth and velocity of water over redd sites selected by various salmonid species. Environmental Management section, Oregon Department of Fish and Wildlife, Portland.
16	Bovee, K. D. 1978. Probability-of-use criteria for the Family Salmonidae. Instream Flow Information Paper No. 4. FWS/OBS-78/07. 80 p.
17	Duke Engineering and Services, Inc. 1999. Final technical report lower Skagit River instream flow studies appendices. Prepared for Public Utility District No. 1 of Skagit County and City of Anacortes.
18	Campbell, R. F. and J. H. Neuner. 1985. Development of seasonal habitat preference criteria for rainbow trout (<i>Salmo gairdneri</i>) in western Washington Cascade mountain streams. Draft report prepared by Beak Consultants, Incorporated.
19	Beak Consultants Inc. 1991. Hydro energy development company instream flow study report for the Youngs Creek hydroelectric project. Prepared for Hydro West Group, Inc., Bellevue, Washington.
20	see 15
21	Wampler, P. L. 1985. Habitat preference curves for hatchery reared juvenile fall chinook salmon in a small western Washington stream. Trans. U.S. Fish and Wildlife Service, Olympia, WA.
22	Connor, E., D. Reiser, and P. DeVries. 1995. Site specific habitat suitability curves for the White River, Washington: 1993-1994 study results. Prepared by R2 Resource Consultants for Perkins Coie, Bellevue, Washington.
23	Campbell, R. F., J. H. Neuner, and B. R. Eddy. 1984. Verification of habitat utilization criteria for juvenile fall chinook salmon in the North Fork of the Lewis River, Washington. Prepared by Northwest Energy Services Company for Pacific Power and Light Company, Portland, Oregon.
24	Wampler, P. L. 1980. Instream flow requirements of the lower North Fork, South Fork, and mainstem Skokomish River. U.S. Fish and Wildlife Service, Olympia, Washington.
25	Washington State. 1996. Instream flow study guidelines. Washington Dept. of Fish and Wildlife.
26	Heggenes, J., T. G. Northcote and A. Peter. 1991. Seasonal habitat selection and preferences by cutthroat trout (<i>Oncorhynchus clarki</i>) in a small, coastal stream. Canadian Journal of Fisheries and Aquatic Sciences 48: 1364-1370.
27	Beak Consultants, Inc. 1985. Sandy River instream flow study for the City of Portland. Oregon.
28	R2 Resource Consultants, Inc. 1998. Lostine River instream flow study. Prepared for the Nez Perce Tribe and Oregon Dept. of Fish and

Table 3. Reference documents used for generation of HSI curves for Falls Creek, AK.	
Reference Number	Document Reference
	Wildlife.
29	Carlson and Campbell. 1991. Instream flow study report for the Anderson Creek hydro-electric project. FERC No. 10416. Prepared for Hydrowest Group, Inc. by Beak Consultants, Inc., Kirkland, Washington. (These curves are from other sources, i.e. WDW 1989)
30	Washington State. 1989. Instream flow study guidelines. Washington Dept. of Fisheries.
31	Puget Sound Power and Light Company. 1989. Instream flow study for the Nooksack Falls project, FERC project No. 3721. Bellevue, Washington. (Mostly from WDW 1989)
32	EA Engineering, Science, and Technology. 1990. Habitat suitability curve analysis Idaho instream flow studies. Prepared for: Bureau of Indian Affairs, Portland, Oregon.
33	June, J. A. 1981. Life history and habitat utilization of cutthroat trout (<i>Salmo clarki</i>) in headwater streams on the Olympic Peninsula, Washington. M.S. thesis. University of Washington, Seattle.
34	C. C. Estes and D. S. Vincent-Lang. 1984. Habitat suitability criteria for chinook, coho, and pink salmon spawning in tributaries of the middle Susitna River. Chapter 9 in Aquatic habitat and instream flow investigations, Susitna Hydro Aquatic Studies, Alaska Dept. of Fish and Game, Anchorage.
35	Nadeau, R. L. and S. M. Lyons. 1987. Instream flow investigation Indian River Sitka National Historical Park. Prepared by the USFWS Alaska Investigations for the National Park Service, Alaska Region.
36	EA Engineering, Science, and Technology. 1997. Habitat suitability curve development for the Upper Klamath River basin instream flow study. Draft Report to the USDI Bureau of Indian Affairs, Portland, Oregon.
37	Bonneau, J. L. 1994. Seasonal habitat use and changes in distribution of juvenile bull trout and cutthroat trout in small, high gradient streams. Masters thesis. University of Washington, Seattle.

Table 4 Brief summary of select reference sources.

Reference No.	Summary
#2 & #3	Arctic Environ. Information and Data Center. 1981. An assessment of environmental effects of construction and operation of the proposed Terror Lake Hydroelectric Facility, Kodiak Alaska. Instream flow studies. Final report. Univ. of Alaska, Anchorage. 418 p. (also referred to as Wilson et al. 1981 and Baldrige 1981) The study area is located on the northern end of Kodiak Island, Alaska. Fish species present in the Terror and Kizhuyak basins include pink, chum, and coho salmon, and Dolly Varden char. There is no mention of fish body size. The Terror River basin drains a 46.3 square mile area. It has an average annual flow of 224 cfs. The river valley is broad, U-shaped, and supports abundant vegetation. The Kizhuyak River basin drains approximately 54 square miles. Monthly flows in this basin average between 24 and 370 cfs. Study reaches were located in the lower and middle reaches of Kizhuyak River. Channel form consists of a broad, flat floodplain, leading into an intertidal deltaic system. Preliminary curves were formed from available literature for the Kodiak Island area. Field data collected from March through October of 1980 were used to refine the preliminary curve sets. Point measurements of depth, velocity, substrate, and temperature were made at each fish location. HSI curves for depth, velocity and substrate were produced for spawning pink, chum, coho and Dolly Varden. Insufficient field data was collected for development of site specific curves for coho and Dolly Varden spawning. A total of 815 observations were made for pink spawning, 121 for chum spawning, 752 for coho fry, 199 for coho juvenile, 460 for Dolly Varden fry and 344 for Dolly Varden juvenile.
#4	Bustard, D. R., and D. W. Narver. 1975. Aspects of the winter ecology of juvenile coho salmon and steelhead trout. J. Fish. Res. Board Can. 32:667-680. This study was conducted on Carnation Creek located on Vancouver Island, Canada. Some observations were also made in 750 Creek (a seasonal tributary to Carnation Creek). The Carnation Creek watershed is an unlogged watershed, encompassing approximately 10km² (3.86 mi²). Streamflow ranges from a minimum of 1 cfs to a maximum of 1000 cfs. However, all observations were made in sections of Carnation Creek with a streamflow less than 1.5 cfs. Carnation Creek supports populations of coho and chum salmon, steelhead and cutthroat trout. Observations were made from September through April of 1973. Depth and velocity measurements were recorded for over 1,500 juvenile coho and 289 juvenile steelhead.
#10	Lyons, S. M. and R. L. Nadeau. 1985. Instream flow investigations Wilson River and Tunnel Creek. U.S. Fish and Wildlife Service, Habitat Resources Program. Anchorage, Alaska. Tunnel River and Wilson Creek are located in the south-central part of the Misty Fjords National Monument, about 50 air miles east of Ketchikan, Alaska. Both streams have steep topography, high drainage density, shallow, porous and well-drained soils and large areas of exposed bedrock. These conditions result in a "flashy" basin hydrology. Field sampling was undertaken in August and October of 1984. Wilson River encompasses 116 square miles and the Tunnel Creek watershed is approximately 9.9 square miles in size. The average annual discharge of Wilson River is 1,390 cfs. The average annual flow in Tunnel Creek is 68 cfs. Pink and chum salmon are the most abundant fish species present; coho, chinook, sockeye, steelhead and Dolly Varden are also present. Habitat data were collected for pink and chum salmon. A large number of measurements were made for pink salmon spawning, but the report does not

Table 4 Brief summary of select reference sources.

Reference No.	Summary
#10	list the exact numbers. Depth and velocity measurements were made for 27 spawning chum salmon. Chinook and coho spawning, incubation, fry and juvenile curves were based solely on pre-existing depth and velocity curves.
#15	Sams, R. E., and L. S. Pearson. 1963. The depth and velocity of water over redd sites and selected by various salmonid species. Environmental Management Section, Oregon Dept. of Fish and Wildlife, Portland.
#17	Measurements were taken from 110 redds in the Willamette Valley, Oregon. The curves were smoothed using professional judgement. Depth and velocity curves were developed for spawning chinook and coho salmon and steelhead trout. Duke Engineering and Services, Inc. 1999. Final technical report lower Skagit River instream flow studies appendices. Prepared for Public Utility District No. 1 of Skagit County and City of Anacortes.
#22	Duke Engineering Services, Inc. conducted an instream flow study in the Skagit River, Washington, downstream of RM 24.3. Chinook, chum, pink, and coho salmon and steelhead cutthroat and bull trout were present in the study area. Both snorkeling and electrofishing were used to establish habitat criteria. Overall, depth and velocity measurements were made for 473 salmonids. In the cases where there was insufficient observations to generate site specific preference curves, other literature sources were used. Connor, E., D. Reiser, and P. DeVries. 1995. Site specific habitat suitability curves for the White River, Washington: 1993-1994 study results. Prepared by R2 Resource Consultants for Perkins Coie, Bellevue, Washington.
#26	This study was conducted in April and May of 1993 on the White River, Washington. The White River is highly turbid stream with significant channel instability, which are believed to contribute to the low fish production in the river. Juvenile chinook, steelhead, and coho were the target fish species. Overall, there were 115 juvenile chinook and 70 juvenile steelhead observations and measurements made during the surveying. The data were collected during nighttime snorkel surveys. Heggnes, J., T. G. Northcote and A. Peter. 1991. Seasonal habitat selection and preferences by cutthroat trout (<i>Oncorhynchus clarki</i>) in a small, coastal stream. Canadian Journal of Fisheries and Aquatic Sciences 48: 1364-1370.
#35	This study was undertaken in the Musqueam-Cutthroat Creek system of British Columbia. Musqueam Creek is a small, coastal creek with a watershed of approximately 730 hectares (2.82 square miles). During the winter, cutthroat trout are the dominant species, with juvenile coho also present. Base flow during the study was approximately 1.4 cfs. During this study, 754 observations of cutthroat rearing habitat use were made. The position of the fish (depth, velocity, substrate) was noted after visual observation. Only data for fish greater than 9 cm. in length were recorded. Observations were made during the winter, and a second set during the summer. Preference curves were put together for depth, velocity and substrate for rearing cutthroat (>9 cm.). Nadeau, R. L. and S. M. Lyons. 1987. Instream Flow Investigation Indian River Sitka National Historical Park. Prepared by USFWS, Branch of Water Resources Operations, for National Park Service, Alaska Region.
	The Indian River Instream Flow Investigation (1987) identifies the flow requirements for the Indian River which is located in Southeast

Table 4 Brief summary of select reference sources.

Reference No.	Summary
#35	Alaska, near the town of Sitka. The Indian River drainage encompasses 12.6 square miles and is generally characterized by very steep topography, high drainage density, and well-drained soils. The lower 0.4 miles of channel is quite straight, with an average gradient of 0.21 percent. Flows from 1980-85 average between 80 and 100 cfs year round except for September and October, which are between 170 and 180 cfs. Within the study area reach, the Indian River averages approximately 80 ft. wide. The instream flow study focused on pink, chum, and coho salmon. No descriptions of fish size or body lengths are given. Field observations were collected in July of 1984. The HSI curves were developed from measurements taken in front of 112 female pink salmon that were actively spawning and 7 spawning chum salmon (these were compared to existing data to form the chum curves). Point locations of 367 coho fry and 22 juvenile coho were also recorded. The Delphi method was used for pink and chum fry curve formation. All other data was taken from literature sources including Lyons and Nadeau 1985 and Wilson et al. 1981.
#37	Bonneau, J. L. 1994. Seasonal habitat use and changes in distribution of juvenile bull trout and cutthroat trout in small, high gradient streams. Masters thesis. University of Washington, Seattle. This study was conducted on Trestle, Granite, and Rattle Creeks in northern Idaho. These streams drain steep, forested watersheds. Fish species present include bull trout, westslope cutthroat trout, and rainbow trout. Data (depth and velocity) for approximately 80 bull trout were recorded by snorkel and bank observation. Winter fish counts were made during daytime surveys.
#39	Thurrow, R. F. 1997. Habitat utilization and diel behavior of juvenile bull trout (<i>Salvelinus confluentus</i>) at the onset of winter. Ecology of Freshwater Fish 6:1-7. Underwater observations of juvenile bull trout were made in Profile Creek, a second-order stream located in central Idaho. Other fish species present included steelhead and cutthroat trout. The study was undertaken at the onset of winter. Observations were made of 15 juvenile bull trout. All observed fish were less than 25 cm. in length. Thurrow noted that bull trout observed under cover during the day would move into the water column at night. This study measured the depth, velocity, and substrate of concealed (beneath "home stones") fish, not those in the water column. Because these values were not representative of the entire population, they are individual observations, and should not be considered a comprehensive range of suitable rearing conditions.
#41	Hunter, J.W. 1973. A discussion of game fish in the state of Washington as related to water requirements. Washington Dept. of Game. The curves presented in this report were developed from data collected on Kennedy Creek, a third order stream located in southwestern Washington State. Kennedy Creek was chosen for the abundance of spawning gravels available. Little other information is provided concerning the methods of data collection or specifics of the study site for this report. Fish species included in this report include: steelhead, eastern brook, brown, golden, resident and sea-run cutthroat, and rainbow trout; Dolly Varden, Kokanee and mountain whitefish.
#42	Fernet, D. A. and C. P. Bjornson. 1997. A Delphi analysis of bull trout habitat preference criteria with comparison to information collected from Smith-Dorrien Creek, Alberta. Pages 435-442 in Mackay, W. C., M. K. Brewin and M. Monita, editors. Friends of

Table 4 Brief summary of select reference sources.

Reference No.	Summary
#42	the Bull Trout Conference Proceedings. The study was conducted to identify habitat preferences of spawning and juvenile bull trout in Smith-Dorrien Creek, a tributary to the Kananaski River. The stream is located in the eastern slopes region of Alberta, Canada. The empirical results were compared to the results obtained in a prior Delphi analysis study. The Delphi analysis consisted of a survey of eight panelists on their expert opinion of bull trout habitat preferences. Smith-Dorrien Creek flows into Lower Kananaskis Lake and is utilized by an adfluvial population of bull trout. Habitat data were collected at 67 redd sites during the months of September and October. Habitat data were also collected for 164 juvenile fish while electroshocking during daytime surveys conducted in August. The juvenile fish ranged in size from 50 to 308 mm in length, with an average length of 108 mm.
#44	Baxter, J. S. 1997. Summer daytime microhabitat use and preference of bull trout fry and juveniles in the Chowade River, British Columbia. Fisheries Management Report No. 107. The study was conducted on the upper Chowade River a 2nd order stream located in northeastern British Columbia. It's headwaters originate from snowmelt and underground upwelling in the Rocky Mountain foothills at an elevation of approximately 1400m. Depth and velocities curves were developed for juvenile and fry bull trout from observations made during the summer of 1995. Microhabitat use estimates were based on 73 captures of bull trout fry, and 24 captures of juvenile bull trout using electrofishing techniques. Other fish species present within the system include rainbow trout, arctic grayling, mountain whitefish and sculpin. Longnose dace and longnose suckers are also thought to be present.

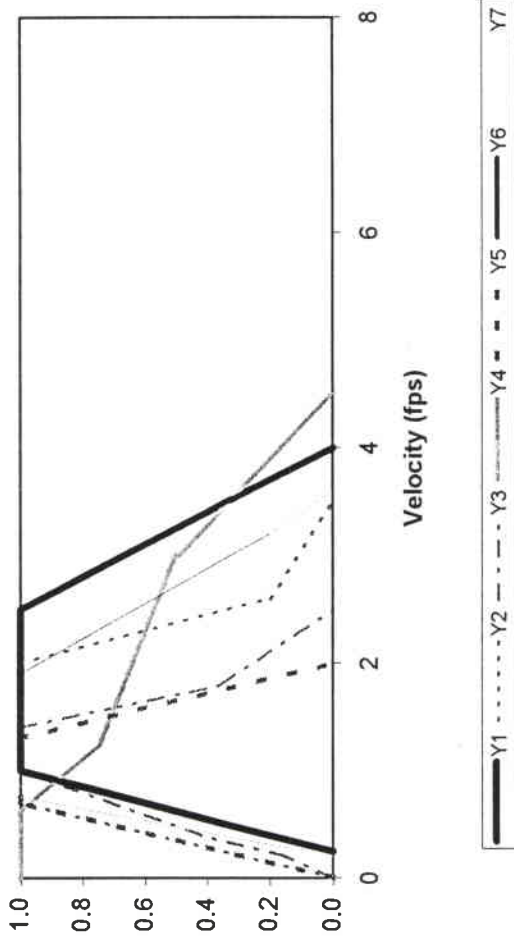
Appendix 1

Falls Creek Habitat Suitability Index Curves

FINAL
FALLS CREEK HSI CURVES
ANADROMOUS CHAR

Interim Final
Falls Creek HSI Curves -
Anadromous Char

Velocity							
X	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00		0.00	0.00	1.00	0.00		0.00
0.20			0.15				0.00
0.25	0.00					0.00	
0.40			0.42				
0.60				1.00			
0.70		1.00			1.00		
0.75						1.00	
1.00	1.00		1.00				1.00
1.25				0.75		1.00	
1.30			1.00		1.00		
1.40			0.35				
1.80							
1.90		1.00			0.00		
2.00	1.00	0.20		0.50		1.00	0.20
2.50							
2.60							
3.00							
3.20							
3.50							
3.60							
4.00	0.00			0.00		0.00	0.00
4.50							

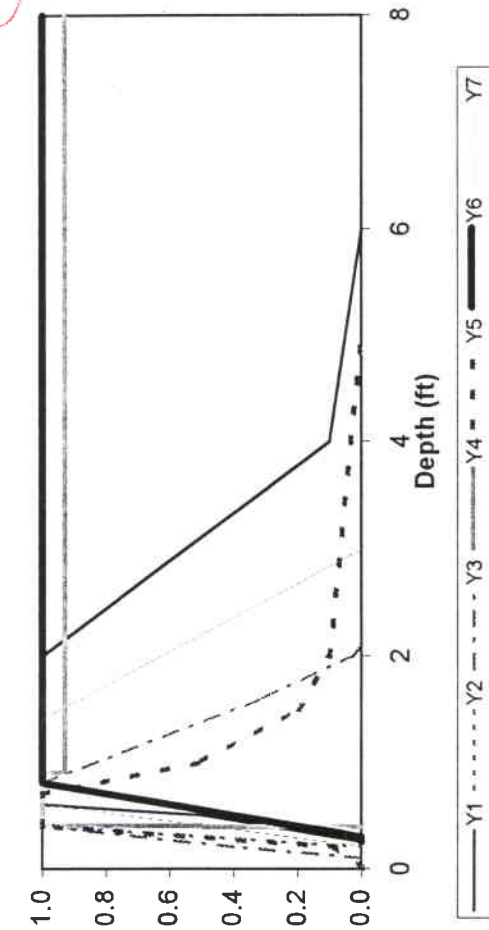


Source: Y1 - Baldrige 1981
Y2 - R2 Resource Consultants 1998
Y3 - R2 Resource Consultants
Y4 - WDFW 1996
Y5 - WDW 1989
Y6 - Recommended Y1
Y7 - EA 1997

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Lostine River, Oregon
Y3 - Cedar River, WA and tribs.
Y4 - Fallback, eastslope Cascade
Y5 - Fallback (Wells Creek)
Y6 -
Y7 - Upper Klamath Basin, Oregon
(ave. body length <12")

Figure 5S-1. Species: Char (anadromous)
Lifestage: Spawning/Incubation

Interim Final
Falls Creek HSI Curves -
Anadromous Char



X	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00					0.00		0.00
0.10			0.00				
0.20		0.00	0.40		0.08		0.00
0.25	0.00						
0.30						0.00	
0.39				0.00		0.00	
0.40		1.00	1.00	1.00	1.00		
0.50	0.50						
0.60	1.00						1.00
0.70			1.00		1.00		
0.80				1.00		1.00	
0.90				0.93			
0.91					0.50		
1.00					0.20		1.00
1.40							
1.50							
1.60			0.31				
2.00	1.00		0.03			1.00	
2.10			0.00		0.10		0.00
3.00							
4.00	0.10				0.00		
5.00							
6.00	0.00						
8.00		1.00		0.93		1.00	0.00

Figure 5S-2. Species: Char
Lifestage: Spawning/Incubation

Source: Y1 - Baldrige 1981
Y2 - R2 Resource Consultants 1998
Y3 - R2 Resource Consultants
Y4 - WDFW 1996
Y5 - WDFW 1989
Y6 - Recommended Mod. Y1
Y7 - EA 1997

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Lostine River, Oregon
Y3 - Cedar River, WA and tribs.
Y4 - Fallback, eastslope Cascade
Y5 - Fallback (Wells Creek)
Y6 -
Y7 - Upper Klamath Basin, Oregon
(ave. body length <12")

Interim Final
Falls Creek HSI Curves -
Anadromous Char

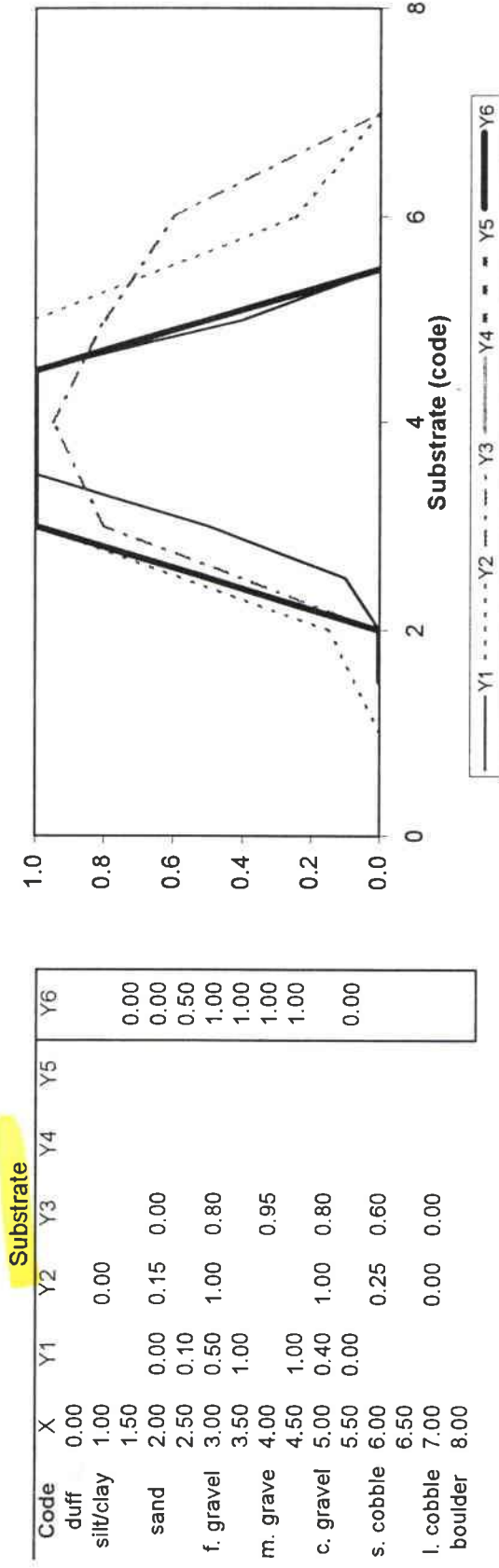


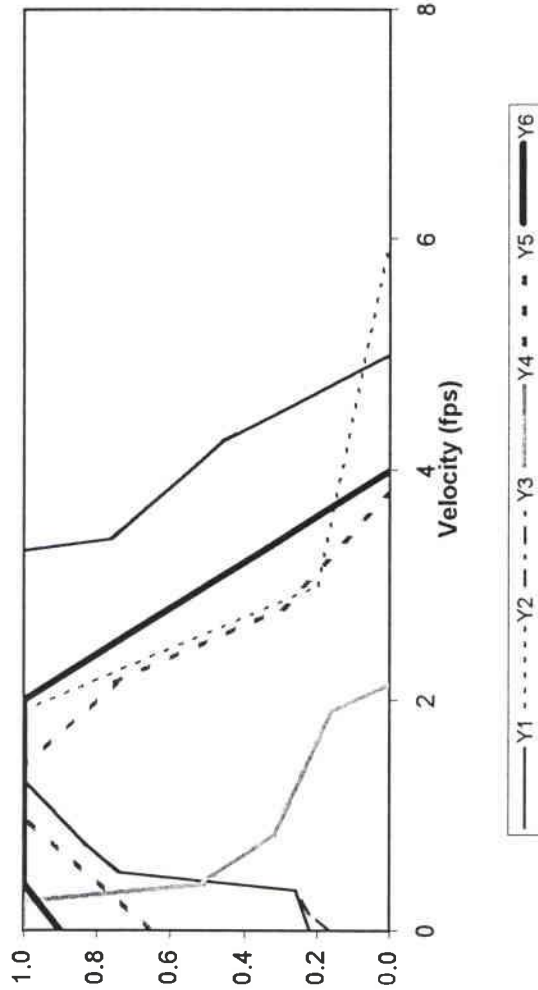
Figure 5S-3. Species: Char
Lifestage: Spawning substrate

Source: Y1 - Baldrige 1981
Y2 - R2 Resource Consultants 1998
Y3 - WDFW 1996 fallback curve
Y4 - ----
Y5 - ----
Y6 - Recommended Mod. Y1

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Lostine River, Oregon
Y3 - Composite for small fish (<20")
Y4 - ----
Y5 - ----
Y6 -

Interim Final
Falls Creek HSI Curves -
Anadromous Char

X	Velocity					
	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.22	0.90	0.17	1.00	0.66	0.90
0.15			0.22			
0.25				1.00		
0.35	0.26		0.26			
0.40		1.00		0.51		1.00
0.50	0.74		0.74			
0.75	0.83		0.83			
0.85				0.32		
1.00					1.00	
1.30	1.00		1.00			
1.40				0.16		
1.90		1.00				1.00
2.00					0.75	
2.15				0.00	0.30	
2.80						
3.00		0.20				
3.30	1.00		1.00			
3.40	0.76		0.76			
3.80					0.00	
4.00	0.46		0.46			0.00
4.25			0.00			
5.00	0.00					
6.00		0.00				



Source: Y1 - DES 1999 (unspecified lifestage)
Y2 - R2 Resource Consultants 1998
Y3 - WDFW 1996
Y4 - Flory 2000 (adult/juv. utilization data)
Y5 - WDFW 1996 (Brook trout, unsp. lifestage)
Y6 - Recommended Mod Y2 & Y4

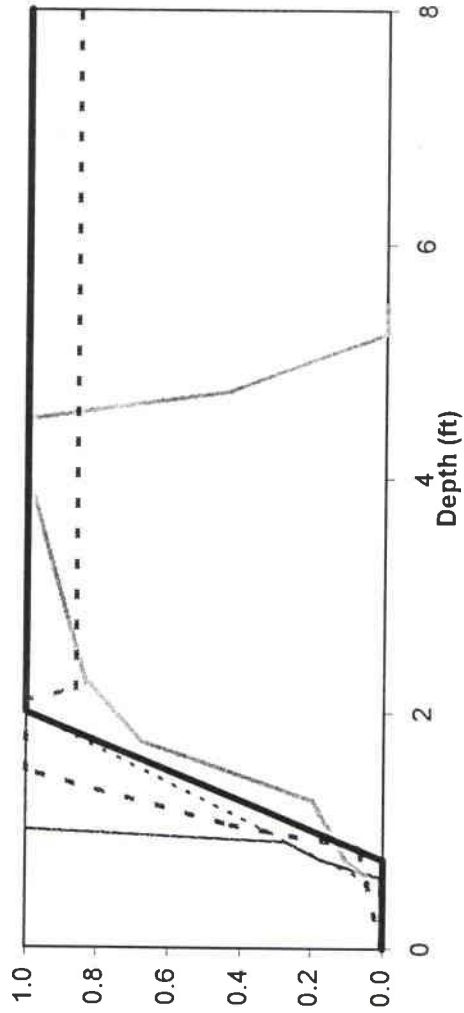
Location: Y1 - Skagit River, WA
Y2 - Lostine River, Oregon
Y3 - Fallback
Y4 - Falls Creek, AK
Y5 - Fallback, Cascade Mt. Streams
Y6 -

Figure 5A-1. Species: Char
Lifestage: Adult rearing

Interim Final
Falls Creek HSI Curves -
Anadromous Char

Depth						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.50	0.00	0.00	0.00	0.00	0.00	0.00
0.60	0.01		0.01			
0.75	0.17		0.17	0.10		0.00
0.85					0.07	
0.90	0.27		0.27			
1.00	1.00		1.00			
1.05						
1.25				0.20	0.45	
1.40	1.00					
1.50					1.00	
1.75				0.67		
2.00		1.00				1.00
2.10					1.00	
2.20					0.86	
2.25				0.83		
4.00				1.00		
4.50				1.00		
4.75				0.43		
5.25				0.00		
5.50				0.00		
8.00	1.00	1.00	1.00		0.86	1.00

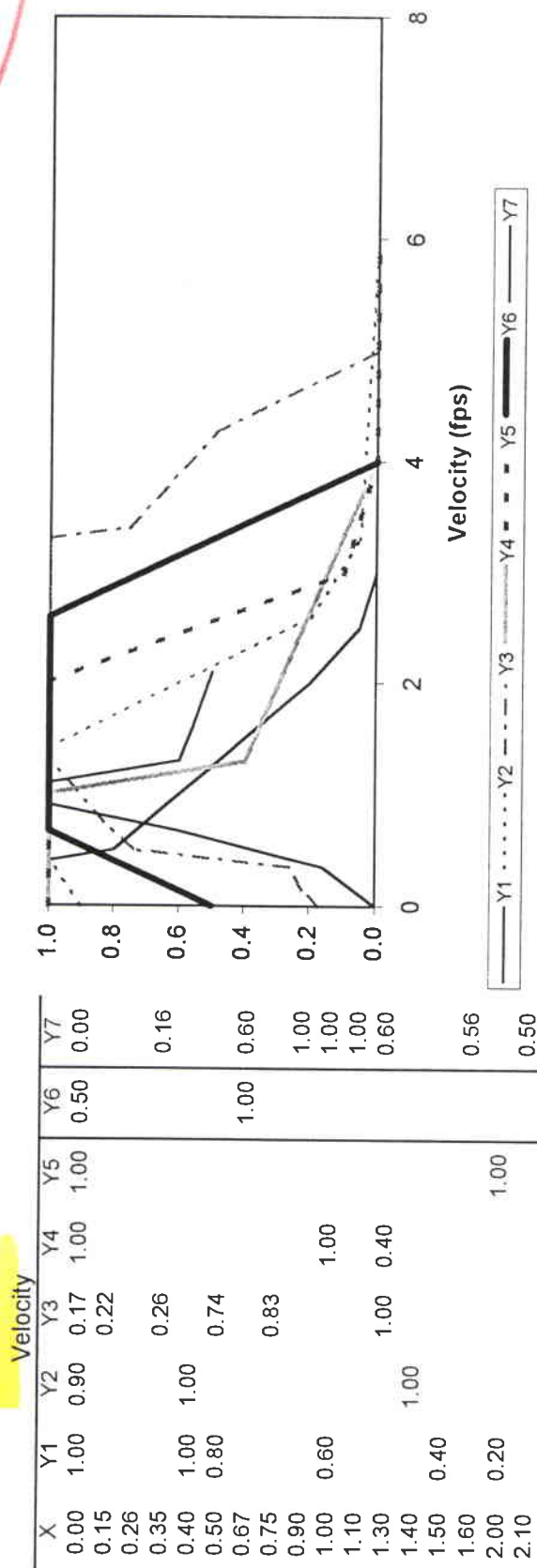
Figure 5A-2.
Species: Char
Lifestage: Adult rearing



Source: Y1 - DES 1999 (unspecified lifestage)
Y2 - R2 Resource Consultants 1998
Y3 - WDFW 1996
Y4 - Flory 2000 (adult/juv. utilization data)
Y5 - WDFW 1996 (Brook trout, unspec. lifestage)
Y6 - Recommended Y2

Location: Y1 - Skagit River, WA
Y2 - Lostine River, Oregon
Y3 - Fallback
Y4 - Falls Creek, AK
Y5 - Fallback, Cascade Mt. Streams
Y6 -

Interim Final
Falls Creek HSI Curves -
Anadromous Char

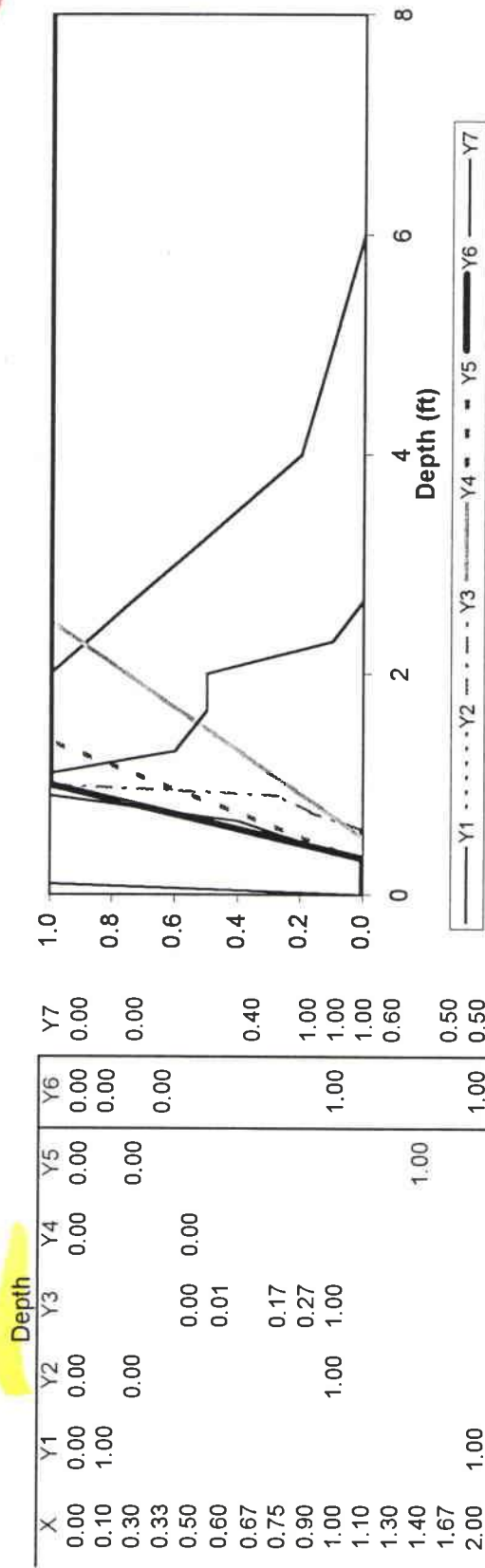


Source: Y1 - Baldridge 1981
Y2 - R2 Resource Consultants 1998
Y3 - WDFW 1996
Y4 - WDFW 1989
Y5 - EA 1997
Y6 - Recommended Mod. Y3 & Y5
Y7 - Bonneau 1994

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Lostine River, Oregon
Y3 - Fallback, composite
Y4 - Fallback
Y5 - Upper Klamath Basin, Oregon
Y6 -
Y7 - Trestle, Granite and Rattle Creeks, Idaho

Figure 5J-1. Species: Char
Lifestage: Juvenile rearing

Interim Final
Falls Creek HSI Curves -
Anadromous Char



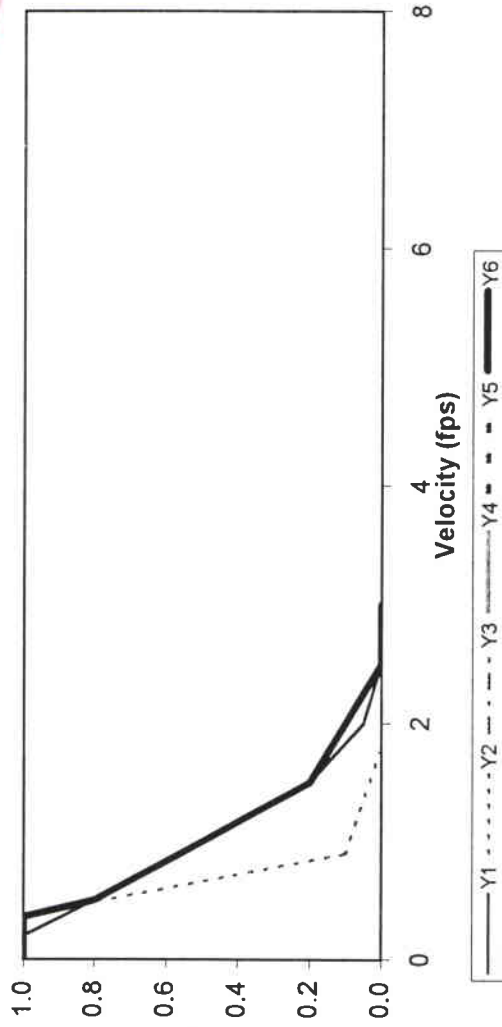
Source: Y1 - Baldrige 1981
Y2 - R2 Resource Consultants 1998
Y3 - WDFW 1996
Y4 - WDFW 1989
Y5 - EA 1997
Y6 - Recommended Mod. Y1 & Y3
Y7 - Bonneau 1994

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Lostine River, Oregon
Y3 - Fallback, composite
Y4 - Fallback
Y5 - Upper Klamath Basin, Oregon
Y6 -
Y7 - Trestle, Granite and Rattle
Creeks, Idaho

Figure 5J-2.
Species: Char
Lifestage: Juvenile rearing

Interim Final
Falls Creek HSI Curves -
Anadromous Char

Velocity						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	1.00	1.00				1.00
0.20	1.00					1.00
0.36		1.00				1.00
0.50	0.80					0.80
0.90		0.10				
1.50	0.20					0.20
1.80		0.00				
2.00	0.05					
2.50	0.00					0.00
3.00	0.00					0.00
4.50						
5.00						
5.50						
6.00						



Depth						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00		0.00				0.00
0.05	1.00					
0.20		0.00				1.00
0.50		1.00				1.00
1.00	1.00					1.00
1.50	0.80					
1.80		1.00				
2.00	0.60	0.20				
2.50	0.40					
2.80		0.00				
3.50	0.20					
4.00	0.10					
5.00	0.00					
8.00						1.00

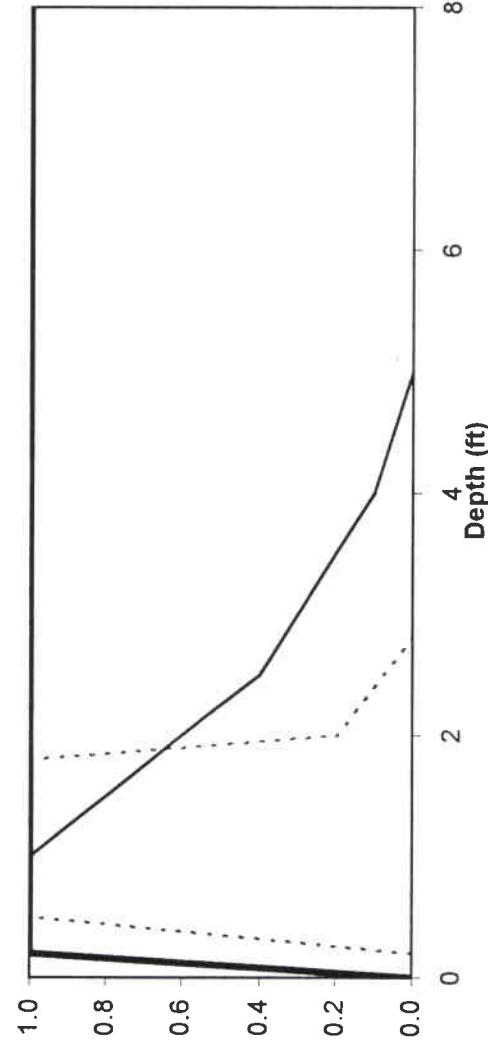


Figure 5F-1. Species: Char
Lifestage: Fry rearing

Source: Y1 - Baldrige 1981
Y2 - R2 Resource Consultants 1998
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - Recommended Mod. Y1 & Y2

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Lostine River, Oregon
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

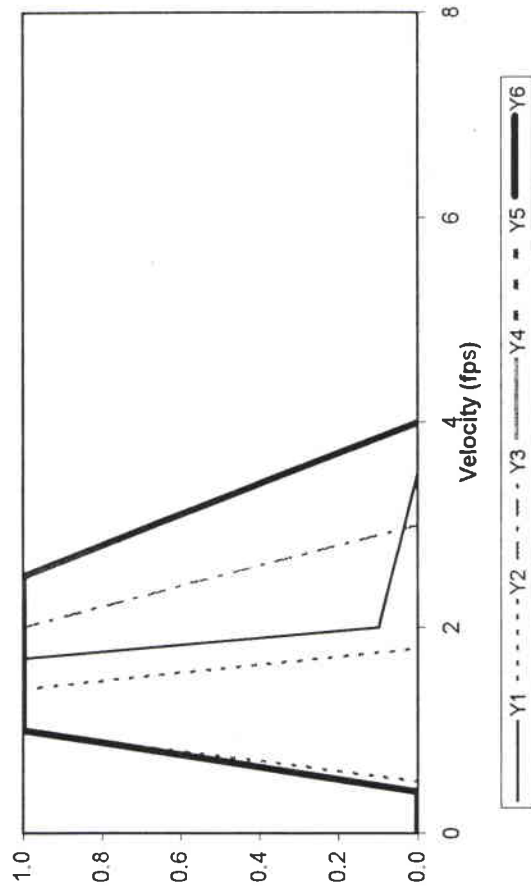
FINAL

FALLS CREEK HSI CURVES

SEA-RUN CUTTHROAT TROUT

Interim Final
Falls Creek HSI Curves -
Sea-run Cutthroat Trout

X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00					0.00
0.10						
0.40	0.00		0.00			0.00
0.50		0.00				
1.00	1.00	1.00	1.00			1.00
1.40		1.00				
1.70	1.00					1.00
1.80		0.00				
2.00	0.10		1.00			1.00
2.50						
3.00			0.00			
3.50	0.00					
4.00						0.00
5.00						
5.50						



X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00					0.00
0.15						
0.30	0.00					0.00
0.40		0.00				
0.50		1.00				
0.60		1.00				
0.80	1.00	0.75				1.00
1.30		0.00				
2.00						
3.00						
4.00						
4.50						
5.00						
8.00	1.00					1.00

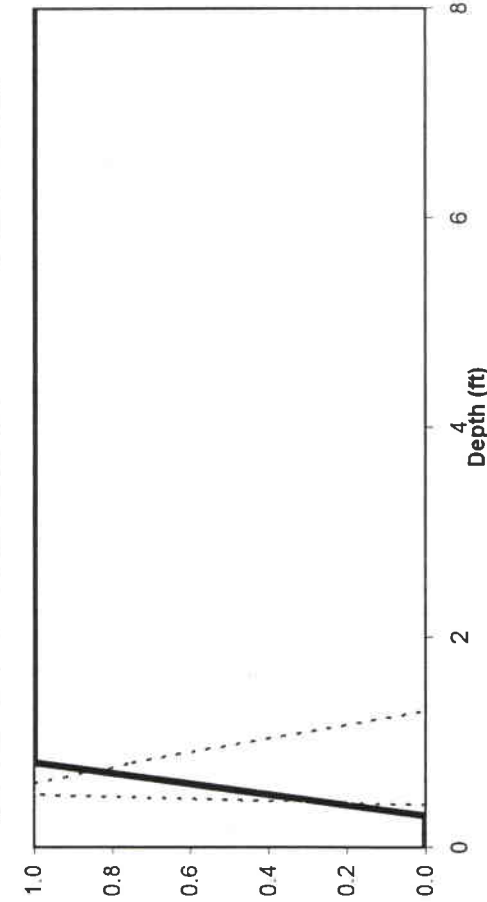


Figure 4S-1. Species: Cutthroat trout Source: Y1 Puget Power and Light 1989 Location: Y1 N. Fk. Nooksack River (sea-run)
Lifestage: Spawning/Incubation Y2 Hunter 1973 Y2 Kennedy Creek, Deschutes River, WA
Y3 Hickman 1982 Y3 Generic
Y4 Y4 Y5 Y5 Y6 Y6
Y6 Recommended Composite Y1 & Y3

Interim Final
Falls Creek HSI Curves -
Sea-run Cutthroat Trout

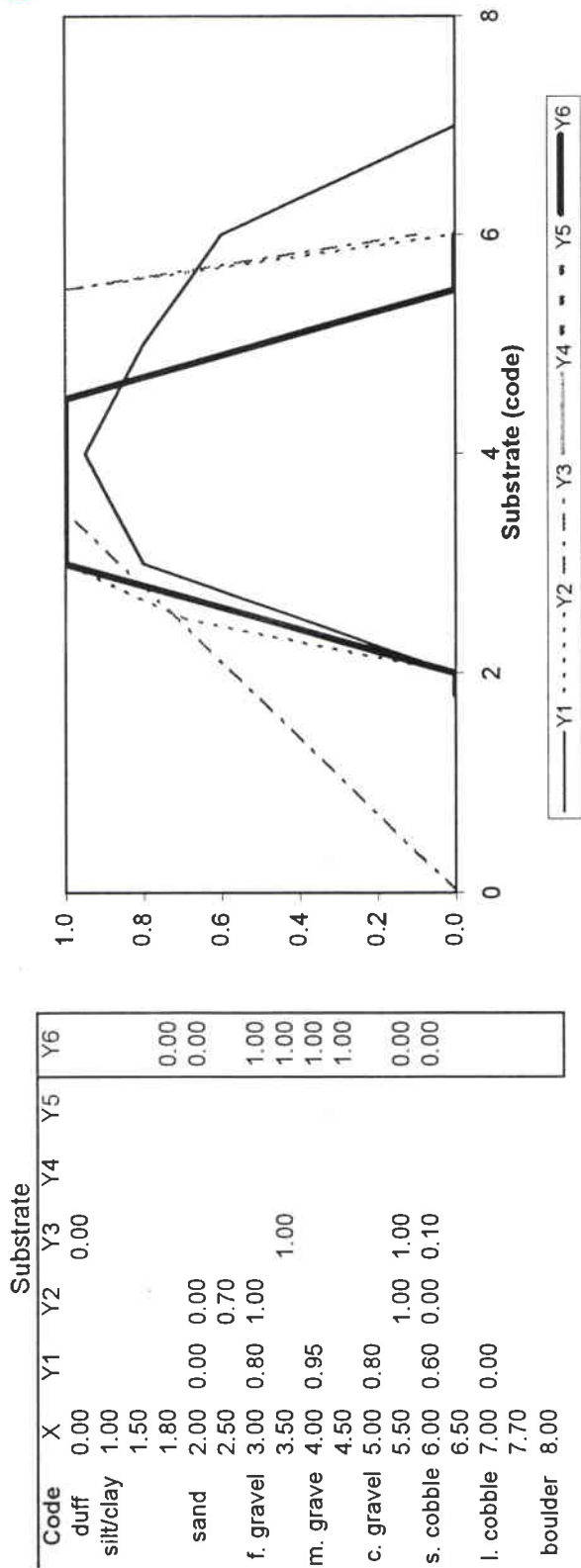
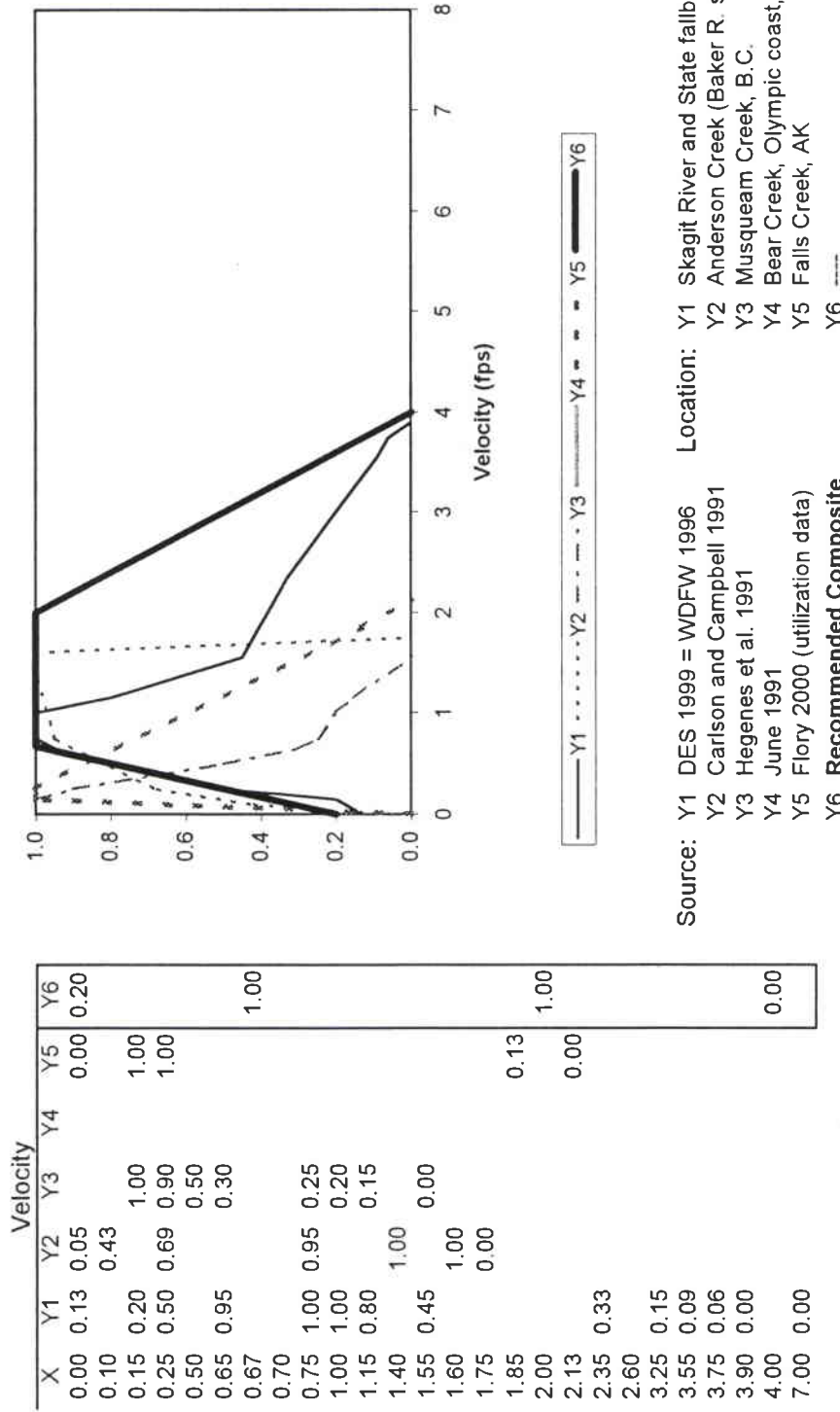


Figure 4S-2. Species: Cutthroat trout Source: Y1 WDFW 1996 fallback curve Location: Y1 Composite for small fish (<20")
Lifestage: Spawning substrate Y2 Bovee 1978 Y3 Hickman 1982 Y4 Generic Y5 Washington/BC/California Y6 Recommended Composite Y1 & Y2

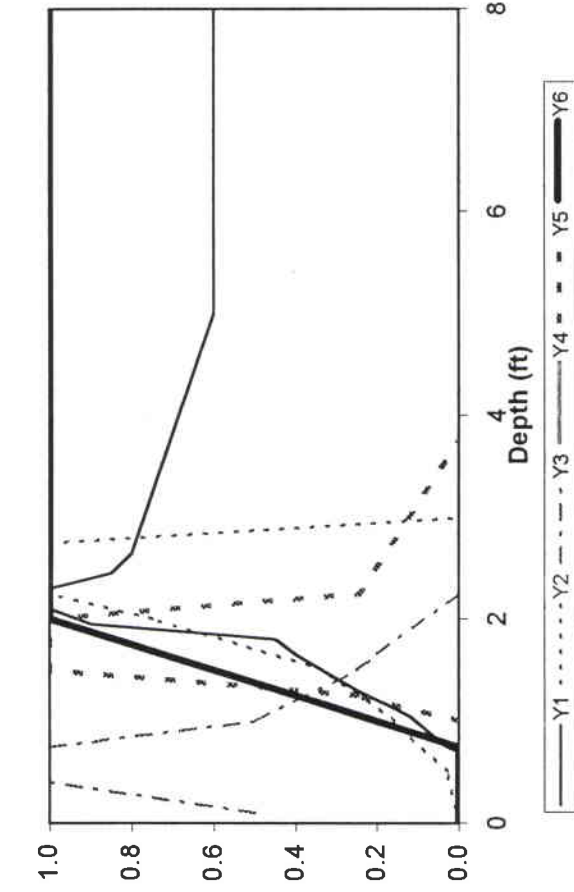
Interim Final
Falls Creek HSI Curves -
Sea-run Cutthroat Trout



Source: Y1 DES 1999 = WDFW 1996 Y2 Carlson and Campbell 1991 Y3 Hegenes et al. 1991 Y4 June 1991 Y5 Flory 2000 (utilization data) Y6 Recommended Composite

Location: Y1 Skagit River and State fallback Y2 Anderson Creek (Baker R. system) Y3 Musqueam Creek, B.C. Y4 Bear Creek, Olympic coast, WA Y5 Falls Creek, AK Y6

Interim Final
Falls Creek HSI Curves -
Sea-run Cutthroat Trout



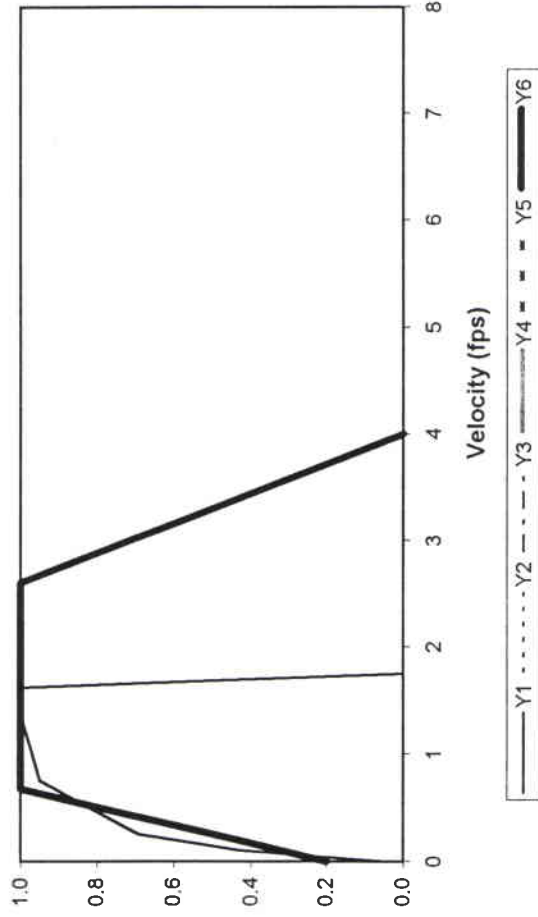
X	Depth					
	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00				0.00
0.10			0.50			
0.40			1.00			
0.50		0.03				
0.70	0.00					
0.75	0.03		1.00			0.00
1.00		0.16	0.50		0.00	
1.05	0.12					
1.25					0.25	
1.30	0.25					
1.50		0.33	0.25		1.00	
1.65	0.40		0.20			
1.75					1.00	
1.80	0.45					
1.95	0.90					
2.00		0.75			1.00	1.00
2.10	1.00					
2.25		1.00	0.00		0.25	
2.30	1.00					
2.45	0.85					
2.65	0.80					
2.75		1.00				
3.00		0.00			0.00	
3.75						
5.00	0.60					
8.00	0.60					1.00

Source: Y1 DES 1999 = WDFW 1996 Location: Y1 Skagit River and State fallback
Y2 Carlson and Campbell 1991 Y2 Anderson Creek (Baker R. system)
Y3 Heggenes et al. 1991 Y3 Musqueam Creek, B.C. (resident fish)
Y4 June 1981 Y4 Bear Creek, Olympic coast, WA
Y5 Flory 2000 (utilization data) Y5 Falls Creek, AK
Y6 Recommended Y1 smoothed Y6

Figure 4A-2. Species: Cutthroat trout
Lifestage: Adult rearing

Interim Final
Falls Creek HSI Curves -
Sea-run Cutthroat Trout

X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.05					0.20
0.10	0.43					
0.25	0.69					
0.67						1.00
0.75	0.95					
1.37	1.00					1.00
1.62	1.00					1.00
1.75	0.00					
2.00						1.00
2.60						
3.00						
4.00						0.00



X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00				0.00
0.33						0.00
0.50	0.03	0.10				
1.00	0.16	0.70				1.00
1.50	0.33	1.00				
2.00	0.75	1.00				1.00
2.25	1.00					
2.75	1.00					
3.00	0.00					
7.50						
8.00						1.00

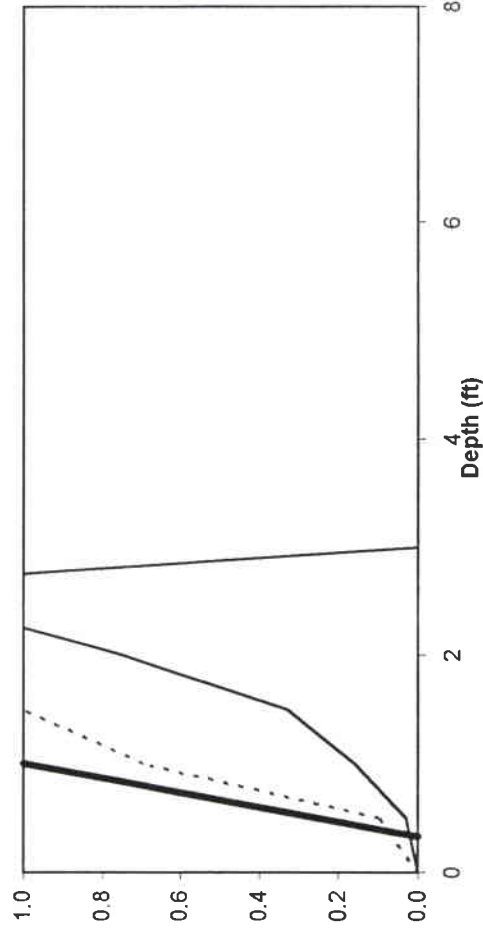
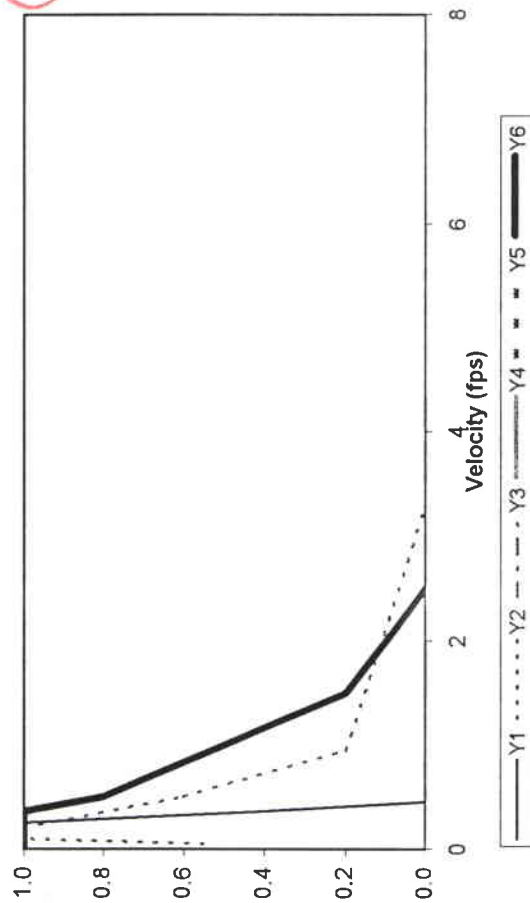


Figure 4J-1. Species: Cutthroat trout
Lifestage: Juvenile rearing

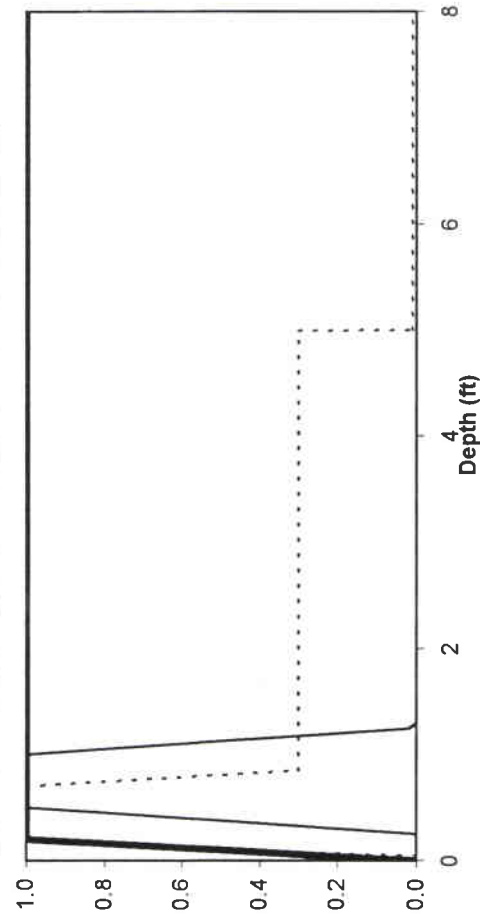
Source: Y1 Carlson and Campbell 1991 Y2 Hickman 1982 Y3 --- Y4 --- Y5 --- Y6 Recommended Y1 with modification
Location: Y1 Anderson Creek (Baker R. system) Y2 Generic Y3 --- Y4 --- Y5 --- Y6 ---

Interim Final
Falls Creek HSI Curves -
Sea-run Cutthroat Trout

Velocity						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	1.00					1.00
0.05		0.55				
0.10		1.00				
0.20		1.00				1.00
0.25	1.00					1.00
0.36	0.40					1.00
0.45	0.00					0.80
0.50		0.60				
0.95		0.20				
1.00						0.20
1.50						0.00
2.50						
3.30		0.00				
6.00						
8.00	0.00					



Depth						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00					0.00
0.05		0.00				
0.15		0.90				
0.20		1.00				1.00
0.25	0.00					
0.50	1.00					
0.70		1.00				
0.85		0.30				
1.00	1.00					
1.25	0.02					
1.30	0.00					
2.00						
5.00		0.30				1.00
5.01		0.01				
8.00		0.01				1.00



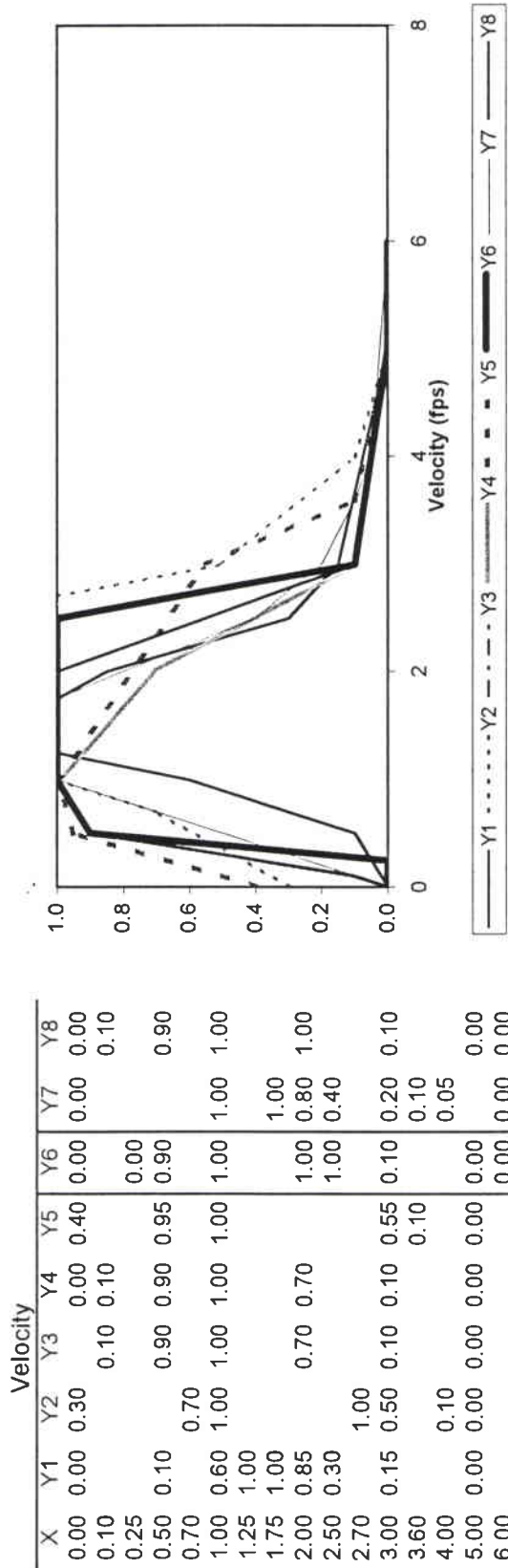
Source: Y1 Carlson and Campbell 1991
Y2 WDFW 1996
Y3 ---
Y4 ---
Y5 ---
Y6 Recommended Y2 modified

Location: Y1 Anderson Creek (Baker R. system)
Y2 Fallback curve, composite
Y3 ---
Y4 ---
Y5 ---
Y6 ---

Figure 4F-1. Species: Cutthroat trout
Lifestage: Fry rearing

FINAL
FALLS CREEK HSI CURVES
CHUM SALMON

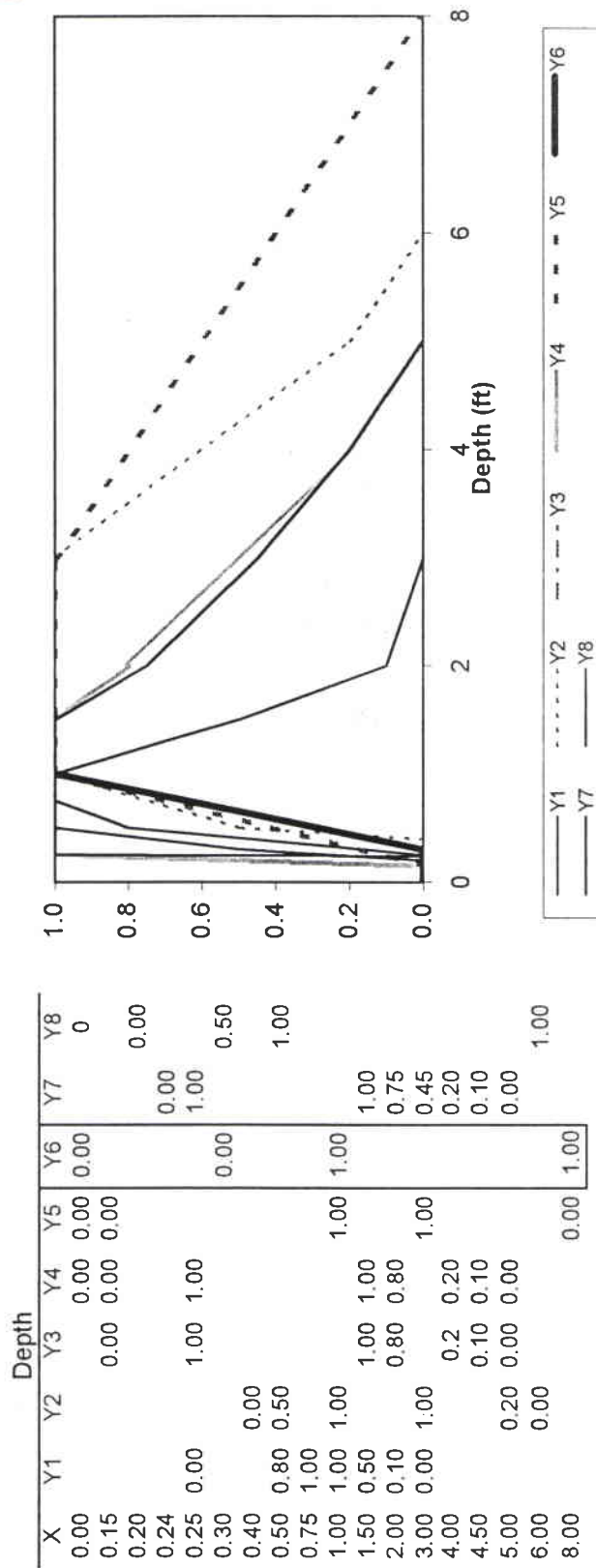
Interim Final
Falls Creek HSI Curves -
Chum Salmon



Source:	Y1	Wampler 1980	Location:	Y1	Skokomish R., WA and tribs.
	Y2	DES 1999		Y2	Skagit River, WA
	Y3	Baldrige 1981 (same #s as Y4)		Y3	Terror and Kizhuyak Rivers, AK
	Y4	Lyons and Nadeau 1985		Y4	Wilson River Tunnel Creek, AK
	Y5	Hale et al. 1985		Y5	Generic
	Y6	Recommended Y8 & Y4		Y6 -	
	Y7	Hosey 1987		Y7	White River, WA
	Y8	Nadeau and Lyons 1987		Y8	Indian River, AK

Figure 2S-1. Species: Chum salmon
Lifestage: Spawning/Incubation

Interim Final
Falls Creek HSI Curves -
Chum Salmon



Source: Y1 Wampler 1980 Location: Y1 Skokomish R., WA and tribs.
Y2 DES 1999 Y2 Skagit River, WA
Y3 Baldridge 1981 (same #s as Y4) Y3 Terror and Kizhuyak Rivers, AK
Y4 Lyons and Nadeau 1985 Y4 Wilson River Tunnel Creek, AK
Y5 Hale et al. 1985 Y5 Generic
Y6 Recommended Mod. Y4 & Y8 Y6 -
Y7 Hosey 1987 Y7 White River, WA
Y8 Nadeau and Lyons 1987 Y8 Indian River, AK

Figure 2S-2. Species: Chum salmon
Lifestage: Spawning/Incubation

Interim Final
Falls Creek HSI Curves -
Chum Salmon

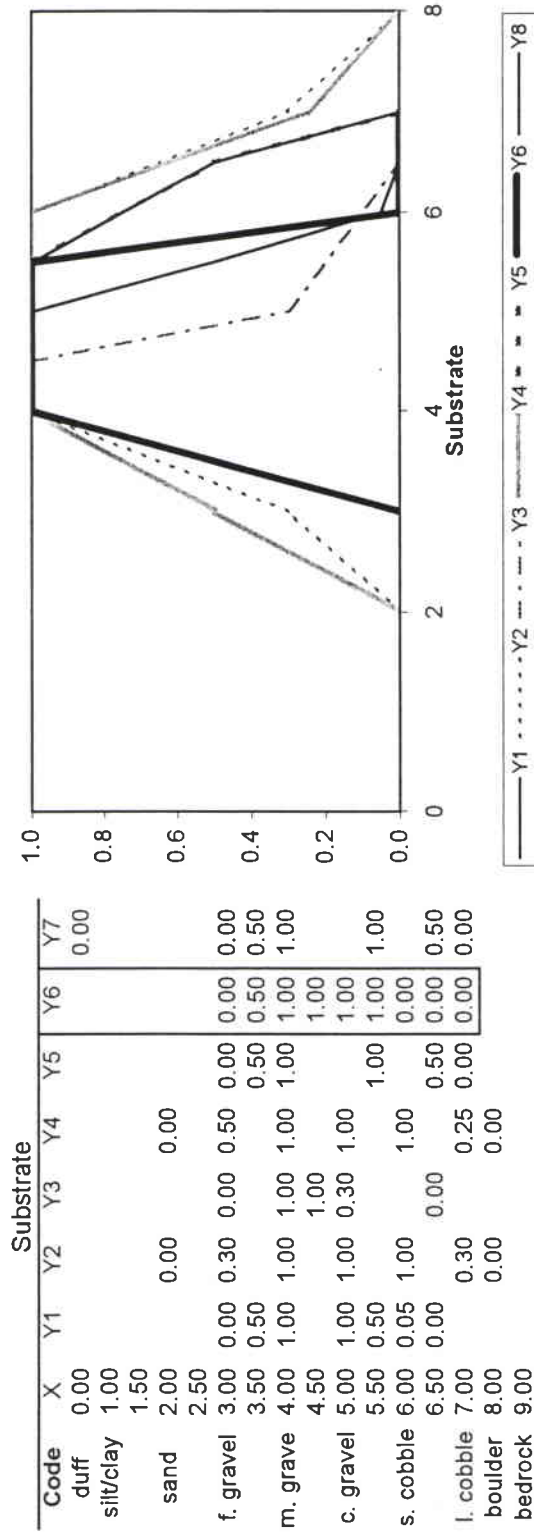


Figure 2S-3.

Species: Chum salmon Source: Y1 Baldrige 1981 Location: Y1 Terror and Kizhuyak Rivers, AK
 Lifesage: Spawning substrate Y2 DES 1999 Y2 Skagit River, Washington
 Y3 Wampler 1980 (assumed IFG coding) Y3 Skokomish River, WA
 Y4 WDFW 1996 Y4 Generic fallback curves
 Y5 Lyons and Nadeau 1985 Y5 Wilson River, Tunnel Creek, AK
 Y6 **Recommended Y5** Y6 ---
 Y7 Nadeau and Lyons 1987 Y7 Indian River, AK

Interim Final
Falls Creek HSI Curves -
Chum Salmon

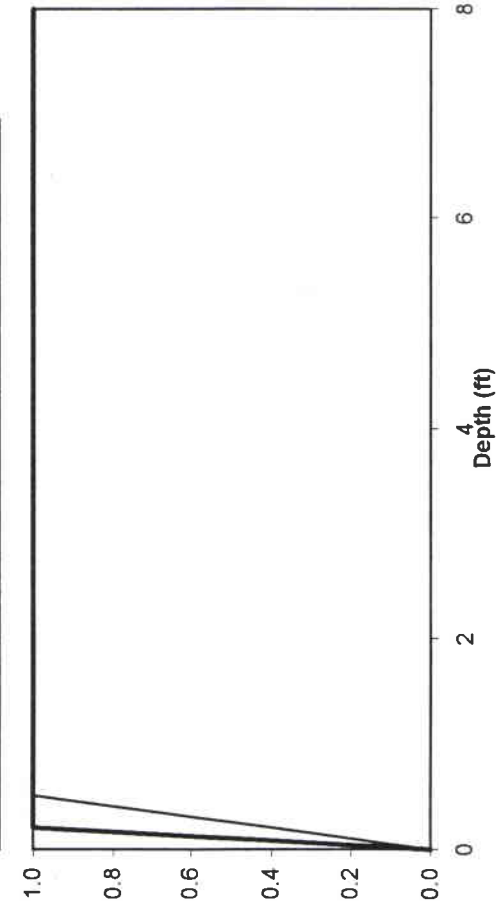
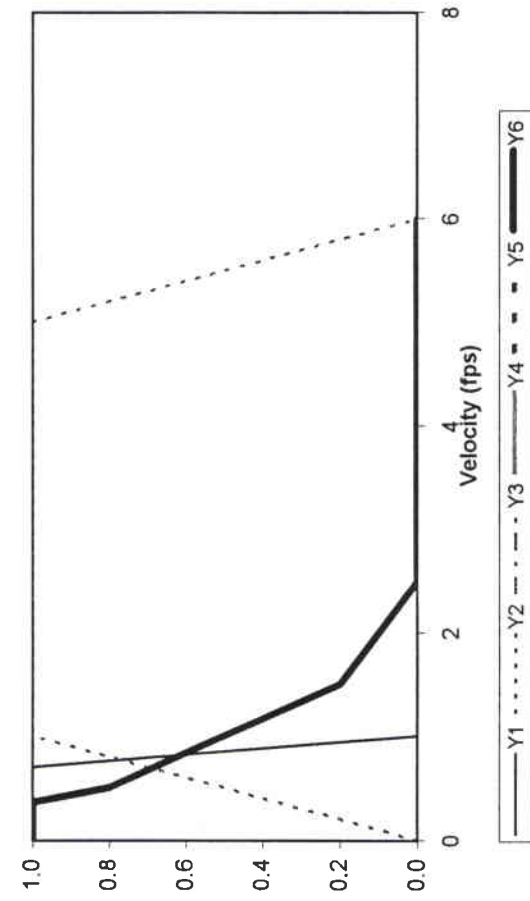


Figure 2F-1. Species: Chum Salmon
Lifestage: Fry rearing

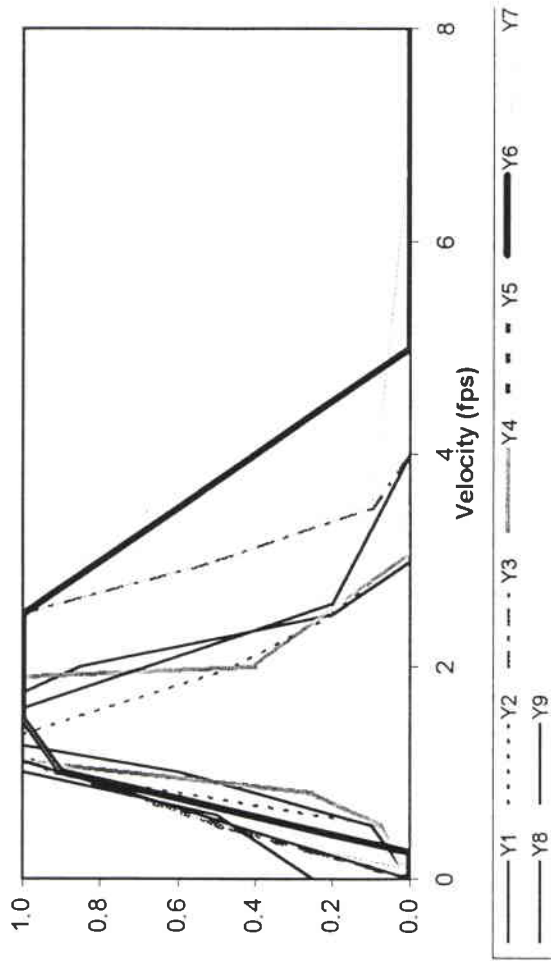
Source: Y1 Hale et al. 1985 (feeding) Y2 Hale et al. 1985 (emigration) Y3 --- Y4 --- Y5 --- Y6 Recommend Y1

Location: Y1 Generic Y2 Generic Y3 --- Y4 --- Y5 --- Y6 ---

FINAL
FALLS CREEK HSI CURVES
COHO SALMON

Interim Final
Falls Creek HSI Curves -
Coho Salmon

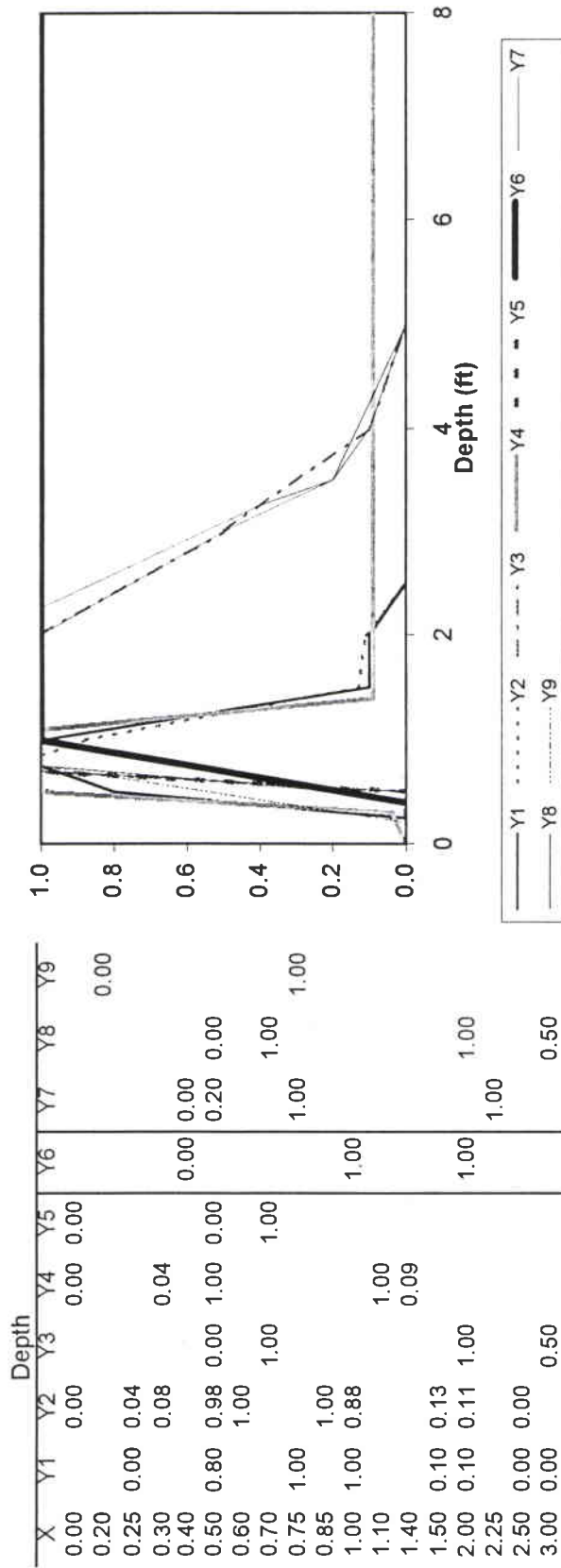
X	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
0.08							0.00		
0.10			0.10		0.10	0.00			
0.25						0.00			0.00
0.50	0.10	0.08	0.50	0.08	0.50		0.50		0.60
0.80				0.25					
1.00	0.60	0.94	0.90		0.90	0.90	0.90		1.00
1.10				1.00				1.00	
1.20		1.00							
1.25	1.00								
1.35		1.00							
1.50			1.00		1.00	1.00	1.00		1.00
1.60									
1.75	1.00			1.00					
1.90									
2.00	0.85	0.45							1.00
2.25									0.50
2.50	0.20	0.20	1.00		1.00	1.00	1.00		0.35
2.60								0.20	
3.00	0.00		0.50		0.50		0.50		0.20
3.10		0.00		0.00					
3.50			0.10	0.00	0.10		0.10		
4.00			0.00					0.00	0.05
4.50									0.00
5.00						0.00			
7.00					0.00	0.00	0.00		



Source: Y1 - Wampler 1980 Location: Y1 - Skokomish River, WA and tribs.
 Y2 - Bovee 1978 Y2 - Generic
 Y3 - Baldrige 1981 Y3 - Terror and Kizhuyak Rivers, AK
 Y4 - Sams and Pearson 1963 Y4 - Oregon
 Y5 - Lyons and Nadeau 1985 Y5 - Wilson R. & Tunnel Creek, AK
 Y6 - Recommended Mod. Y3 & Y5 Y6 -
 Y7 - Arctic Environmental 1981 Y7 - Terror Lake, AK
 Y8 - R2 Resource Consultants 1998 Y8 - Lostine River, OR
 Y9 - Hosey 1986 Y9 - White River, WA

Figure 3S-1. Species: Coho salmon
Lifestage: Spawning/Incubation

Interim Final
Falls Creek HSI Curves -
Coho Salmon



Source: Y1 - Wampler 1980 Location: Y1 - Skokomish River, WA and tribs.
 Y2 - Bovee 1978 Y2 - Generic
 Y3 - Baldrige 1981 Y3 - Terror and Kizhuyak Rivers, AK
 Y4 - Sams and Pearson 1963 Y4 - Willamette Valley, Oregon
 Y5 - Lyons and Nadeau 1985 Y5 - Wilson R. & Tunnel Creek, AK
 Y6 - Recommended Mod. Y7, Y3, Y8 Y6 -
 Y7 - Hosey 1987 Y7 - White River, WA
 Y8 - Arctic Environmental 1981 Y8 - Terror Lake, AK
 Y9 - R2 Resource Consultants 1998 Y9 - Lostine River, OR

Figure 3S-2. Species: Coho salmon
Lifestage: Spawning/Incubation

Interim Final
Falls Creek HSI Curves -
Coho Salmon

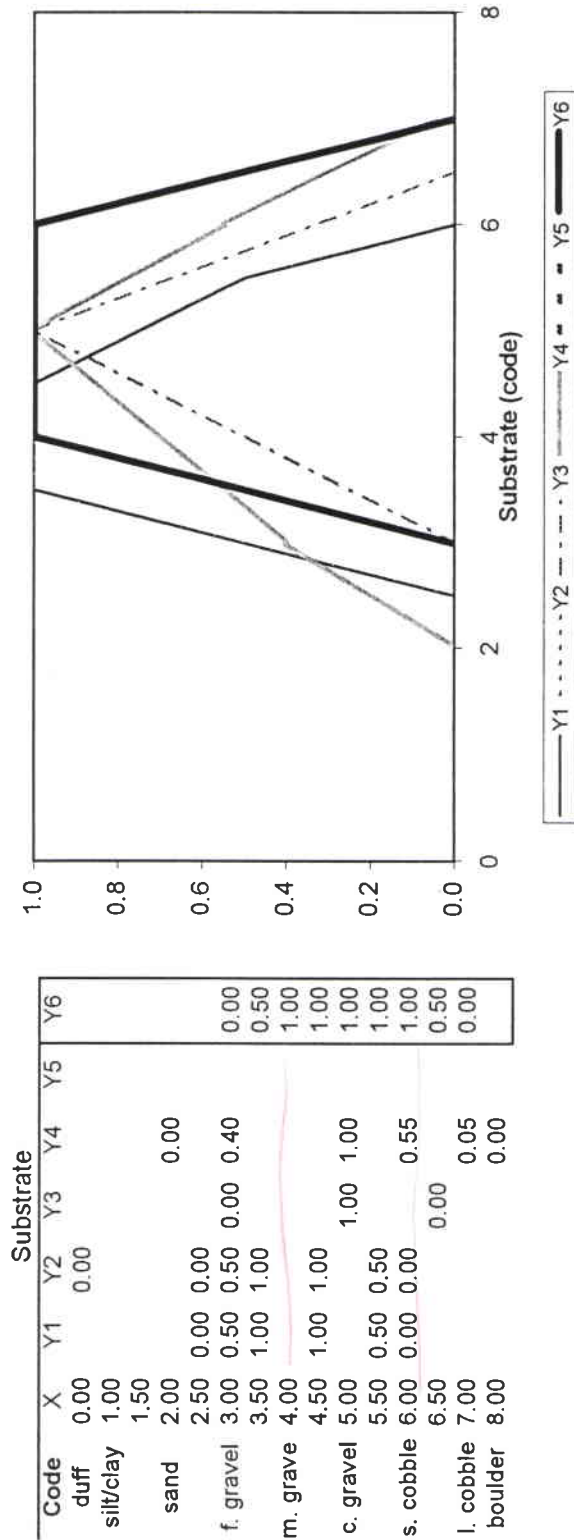


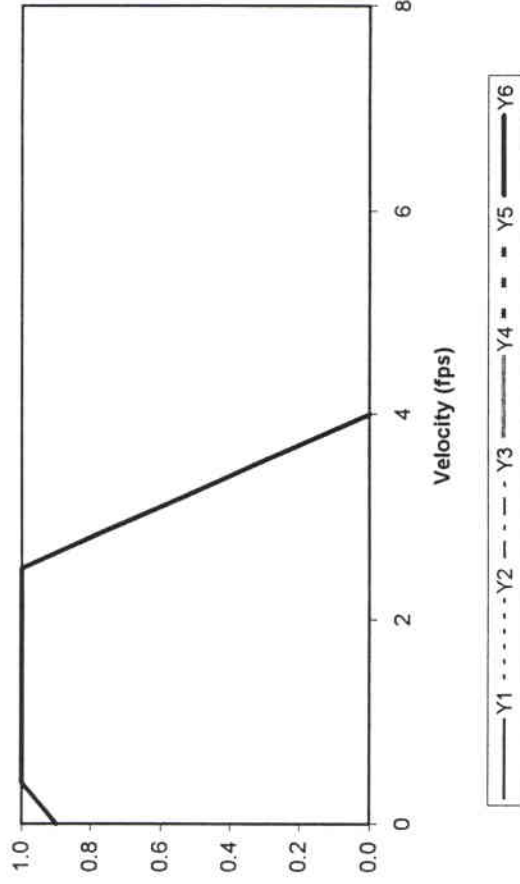
Figure 3S-3. Species: Coho salmon

Lifestage: Spawning substrate Source: Y1 Baldrige 1981 (Arctic Env. 1981) Location: Y1 Terror and Kizhuyak River
Y2 Lyons and Nadeau 1985 Y2 Wilson R. & Tunnel Creek,
Y3 Wampler 1980 (same as Bovee 1978) Y3 Skokomish River, WA
Y4 R2 Resource Consultants 1998 Y4 Lostine River, Oregon
Y5 - - - - -
Y6 Recommended Y1 Y6 -

Interim Final
Falls Creek HSI Curves -
Coho Salmon

No substrate
Coles

Velocity						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00						0.90
0.10						
0.40						1.00
0.50						1.00
1.00						
2.00						1.00
2.50						
3.50						0.00
4.00						
4.50						
5.00						
5.50						
6.00						



Depth						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00						0.00
0.50						
0.75						0.00
1.00						
2.00						1.00
3.00						
4.00						
5.00						
6.00						
8.00						1.00

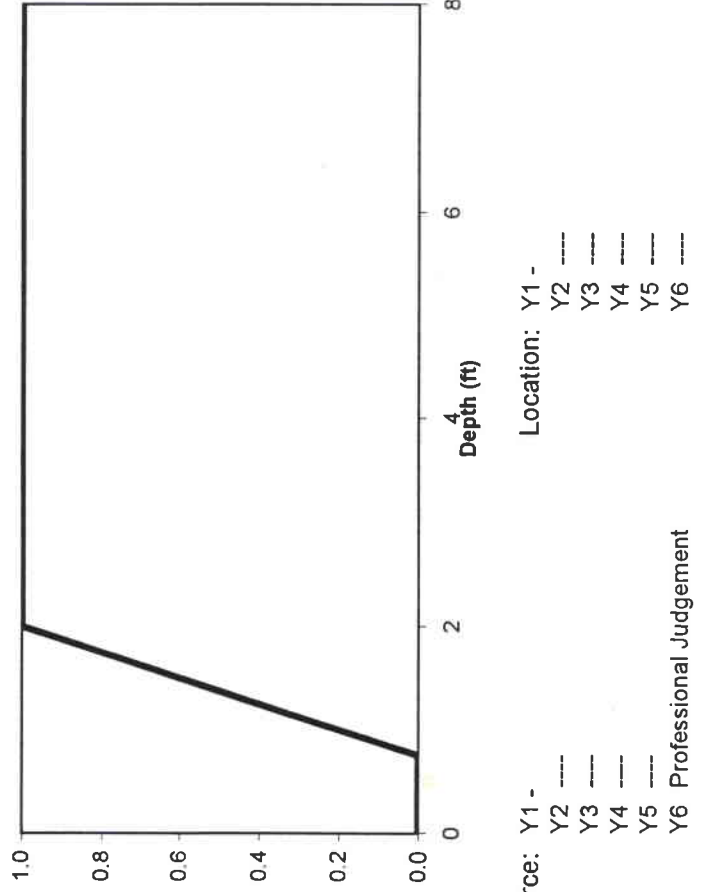


Figure 3A-1. Species: Coho salmon
Lifestage: Adult rearing

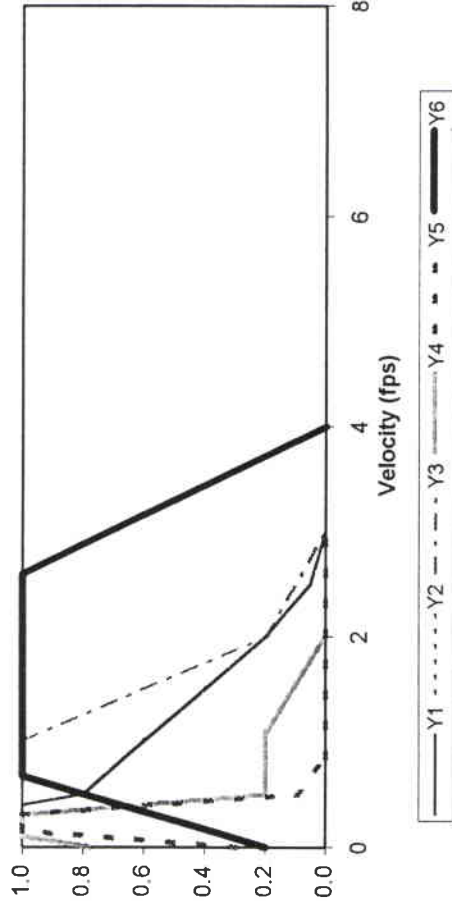
Source: Y1 -
Y2 -
Y3 -
Y4 -
Y5 -
Y6 Professional Judgement

Location: Y1 -
Y2 -
Y3 -
Y4 -
Y5 -
Y6 -

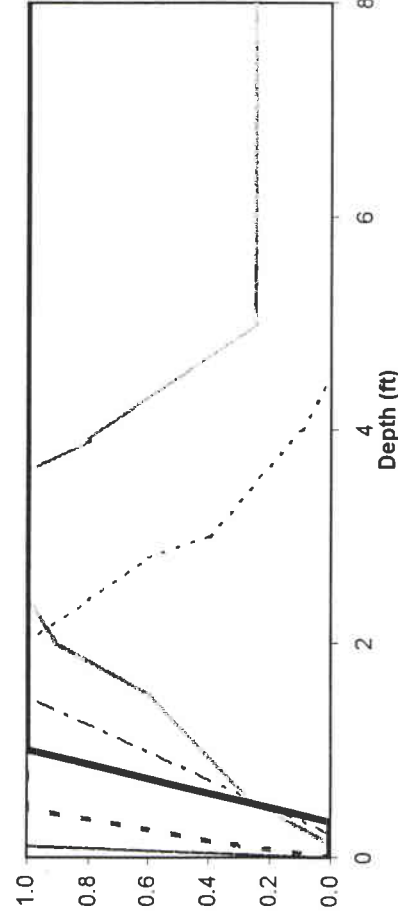
Interim Final
Falls Creek HSI Curves -
Coho Salmon

No sub-codes

Velocity						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	1.00	1.00	1.00	0.78	0.30	0.20
0.10				1.00		
0.15					1.00	
0.26						
0.30				1.00	1.00	
0.40	1.00	1.00				
0.50	0.80	0.80		0.20	0.10	
0.67						1.00
0.85					0.00	
1.00	0.60	0.60	1.00			
1.10				0.20		
1.50	0.40	0.40				
2.00	0.20	0.20	0.20	0.00		
2.60						1.00
2.50	0.05	0.05				
3.00	0.00	0.00	0.00		0.00	
4.00						0.00



Depth						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00		0.00	0.00	0.00
0.10	1.00	1.00		0.00		
0.15					0.40	
0.20			0.00			
0.33						
0.45				0.25	1.00	
0.50						
1.00						1.00
1.50			1.00	0.60		
2.00		1.00		0.90		
2.40		0.80		1.00		
2.80		0.60				
3.00		0.40				
3.60				1.00		
3.90				0.80		
4.00		0.10				
4.50		0.00				
5.00			1.00	0.25		
8.00	1.00			0.25	1.00	1.00



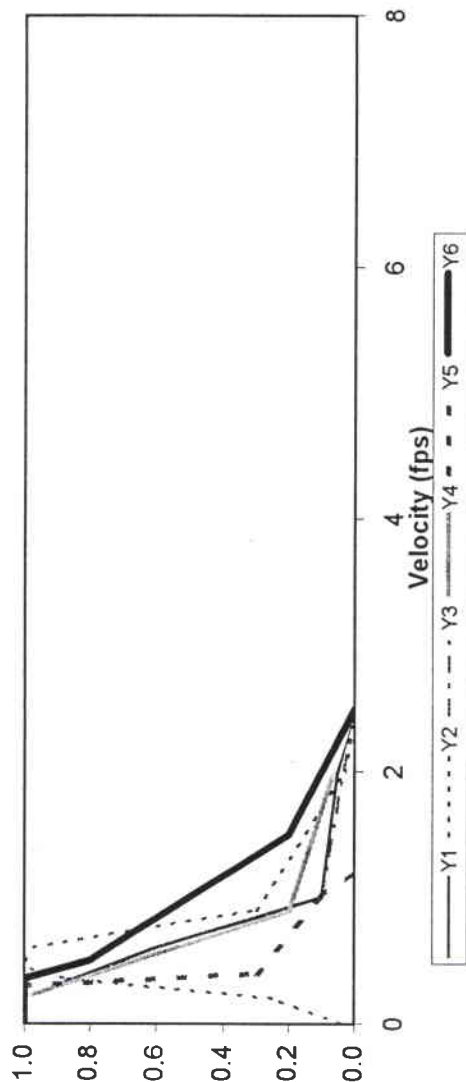
Source: Y1 Lyons and Nadeau 1985
Y2 Baldrige 1981 (Arctic Env. 1981)
Y3 R2 Resource Consultants 1998
Y4 DES 1999 (unspecified rearing)
Y5 Nadeau and Lyons 1987
Y6 Recommended Mod. Y1

Location: Y1 Wilson R. & Tunnel Creek, AK
Y2 Terror and Kizhuyak Rivers, AK
Y3 Lostine River, OR
Y4 Skagit River, WA
Y5 Indian River, AK
Y6 -

Figure 3J-1. Species: Coho salmon
Lifestage: Juvenile rearing

Interim Final
Falls Creek HSI Curves -
Coho Salmon

X	Velocity					
	Y1	Y2	Y3	Y4	Y5	Y6
0.00	1.00	0.04	1.00	1.00	1.00	1.00
0.20	1.00	0.25	1.00	1.00	1.00	1.00
0.30					1.00	
0.36		0.88				1.00
0.40					0.30	
0.45		1.00				
0.50		1.00				0.80
0.60	0.60	0.97	0.60			
0.90		0.30		0.20		
1.00	0.10		0.10		0.10	
1.20					0.00	0.20
1.50						
2.00	0.05	0.03				
2.40		0.00				
2.50	0.00		0.00	0.00		0.00
7.00			0.00			



X	Depth					
	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.05	1.00					
0.20					1.00	1.00
0.50	1.00		1.00			
0.60		0.06				
0.80	0.90			1.00		
1.00	0.80	0.25				
1.50	0.40			1.00		
1.60						
1.70		1.00				
2.00	0.10	1.00				
2.50	0.00					
2.70		0.75				
2.80				0.20		
4.00		0.28				
4.60		0.06				
4.80				0.00		
5.10	0.00	0.00	1.00		1.00	
8.00						1.00

Figure 3F-1. Species: Coho salmon
Lifestage: Fry rearing

Source: Y1 - Baldrige 1981 (Arctic Env. 1981) Location: Y1 Terror and Kizhuyak Rivers, AK
Y2 - Bovee 1978 Y2 Generic
Y3 - Lyons and Nadeau 1985 Y3 Wilson R. & Tunnel Creek, AK
Y4 - R2 Resource Consultants 1998 Y4 Lostine River, OR
Y5 - Nadeau and Lyons 1987 Y5 Indian River, AK
Y6 - Recommended Y6

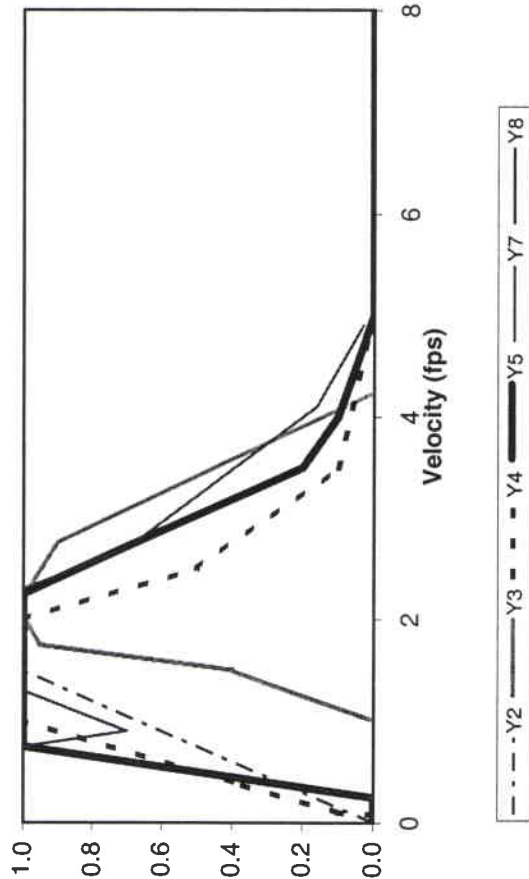
FINAL

FALLS CREEK HSI CURVES

PINK SALMON

Interim Final
Falls Creek HSI Curves -
Pink Salmon

X	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00	0.00	0.00			0.00	0.00	0.00
0.08			0.00				
0.10			0.10				
0.25					0.00	0.00	
0.40				0.40			
0.41							
0.50	0.00						
0.75					1.00	1.00	1.00
0.90						0.70	
1.00			0.00	1.00		1.00	
1.30							
1.50	1.00	1.00	0.40				
1.75			0.95				
2.00		1.00	1.00	1.00			
2.25		1.00	1.00		1.00		1.00
2.30	1.00					1.00	
2.50				0.50			
2.70						0.70	
2.75			0.90				
3.50		0.20		0.10	0.20		0.2
3.70	0.10						
4.00		0.10			0.10		0.1
4.10						0.16	
4.25			0.00				
4.90						0.03	
5.00	0.00	0.00		0.00	0.00		0
8.00		0.00			0.00		0.00



Source: Y1- Raleigh and Nelson 1985
Y2 - Lyons and Nadeau 1985
Y3 - Estes et al. 1981
Y4 - Baldrige 1981
Y5 - **Recommended Y8**
Y6 - WDF 1989
Y7 - Nadeau and Lyons 1987

Y2 - Generic
Y3 - Wilson River, Tunnel Creek, AK
Y4 - Willow and Deception Creeks, AK
Y5 - Terror and Kizhuyak Rivers, AK
Y6 - ----
Y7 - Generic streams
Y8 - Indian River, AK

Figure 1S-1. Species: Pink Salmon
Lifestage: Spawning

Interim Final
Falls Creek HSI Curves -
Pink Salmon

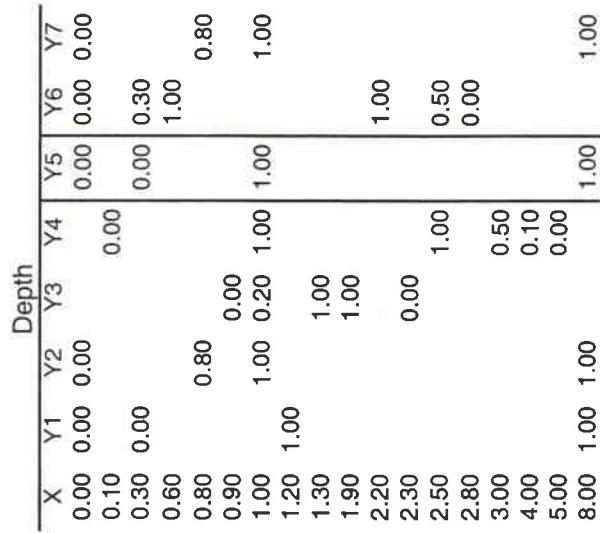
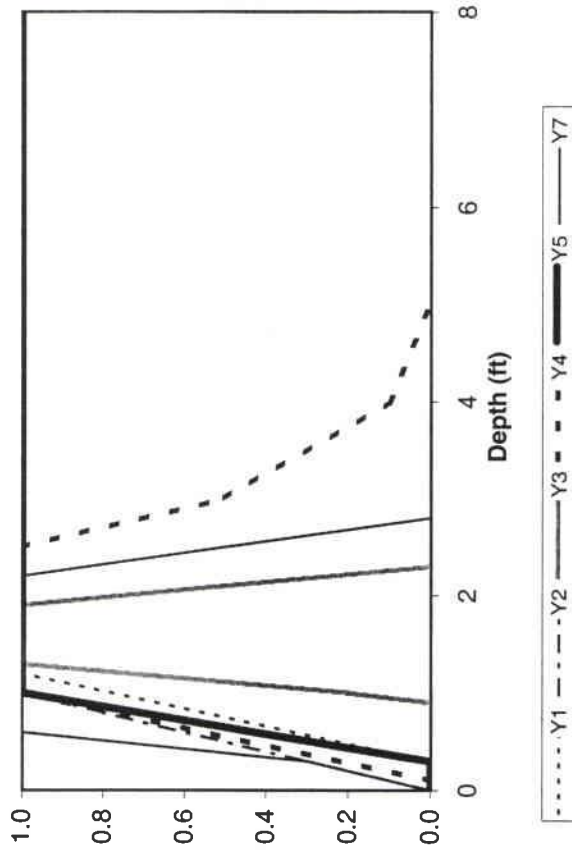


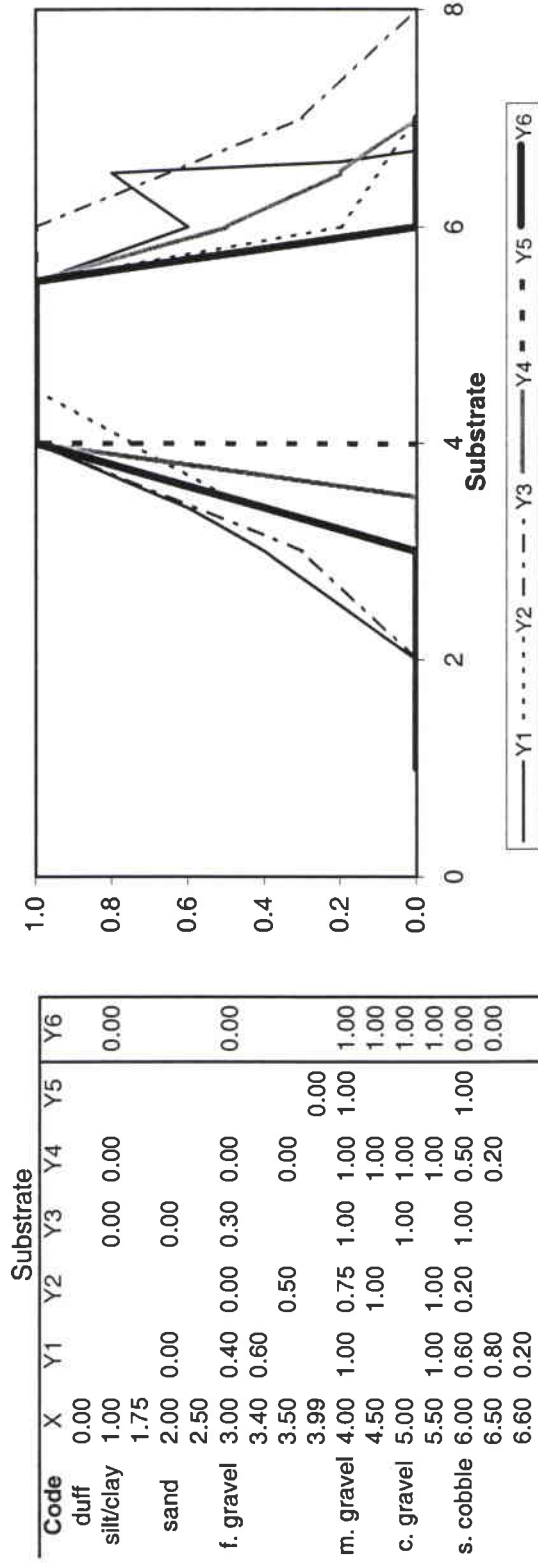
Figure 1S-2. Species: Pink Salmon
Lifestage: Spawning



Source: Y1 - Raleigh and Nelson 1985
Y2 - Lyons and Nadeau 1985
Y3 - Estes et al. 1981
Y4 - Baldrige 1981
Y5 - Recommended Mod. Y8
Y6 - WDF 1989
Y7 - Nadeau and Lyons 1987

Location: Y1 - Generic
Y2 - Wilson River, Tunnel Creek, AK
Y3 - Willow and Deception Creeks, AK
Y4 - Terror and Kizhuyak Rivers, AK
Y5 - Generic streams
Y6 - Indian River, AK
Y7 - Generic

Interim Final
Falls Creek HSI Curves -
Pink Salmon



Source: Y1 - Lyons and Nadeau 1985 Location: Y1 Wilson River, Tunnel Creek, AK
Y2 - Baldrige 1981 Y2 Terror and Kizhuyak Rivers, AK
Y3 - DES 1999 Y3 Skagit River, WA
Y4 - Nadeau and Lyons 1987 Y4 Indian River, AK
Y5 - Krueger 1981 Y5 Generic Alaska
Y6 - **Recommend Y4** Y6 -

Figure 1S-3. Species: Pink Salmon
Lifestage: Spawning substrate

FINAL
FALLS CREEK HSI CURVES
RESIDENT CHAR

Interim Final
Falls Creek HSI Curves -
Resident Char

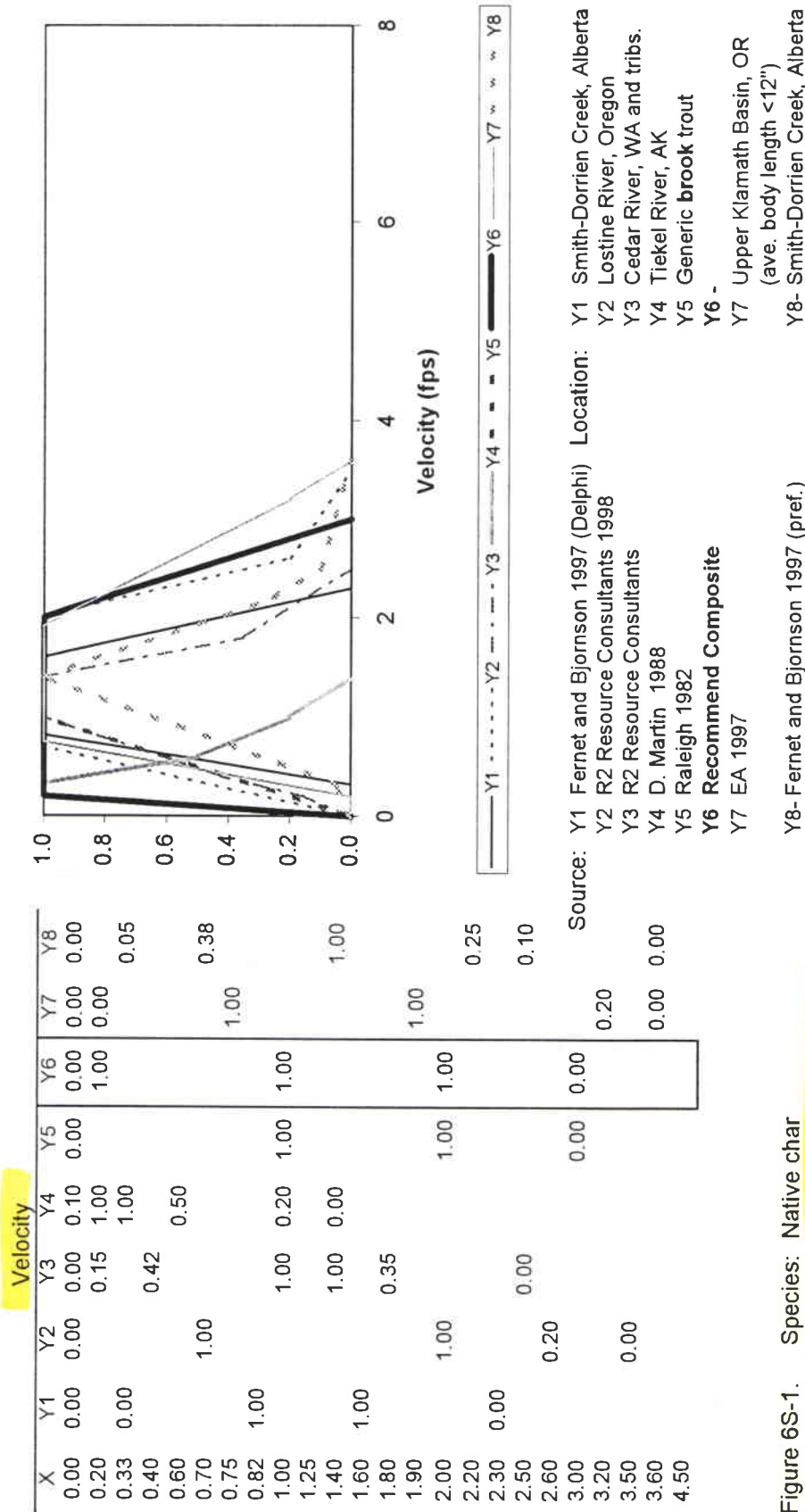
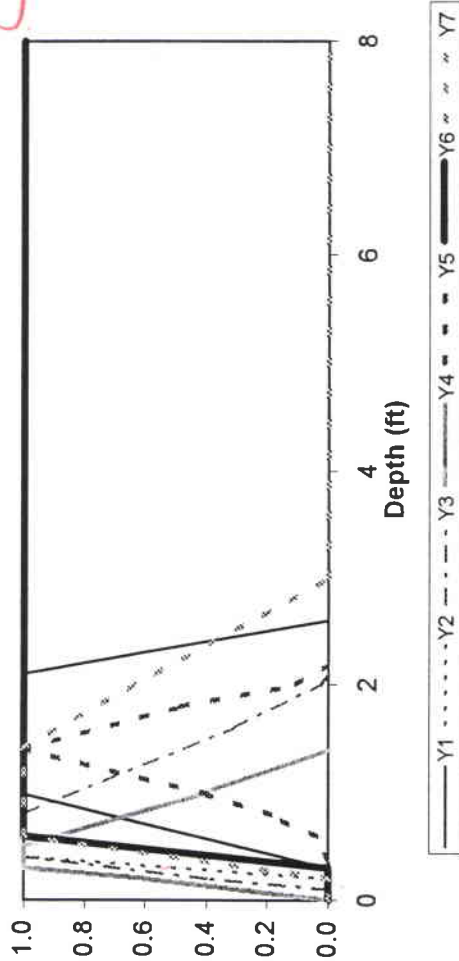


Figure 6S-1. Species: Native char
Lifestage: Spawning/Incubation

Interim Final
Falls Creek HSI Curves -
Resident Char

X	Depth						
	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00	0.00			0.00	0.00	0.00	0.00
0.10			0.00				
0.20		0.00	0.40	0.60			0.00
0.30	0.00			1.00		0.00	
0.39		1.00	1.00		0.00		
0.40							
0.60					0.04	1.00	1.00
0.50				1.00			
0.70							
0.80			1.00		0.19		
0.90							
0.91							
0.98	1.00				0.40		
1.00				0.40		1.00	1.00
1.40				0.00	1.00		
1.60			0.31				
1.80					0.48		
2.00			0.03		0.10		
2.10	1.00		0.00			1.00	
2.20					0.00		
2.60	0.00						0.00
3.00							
8.00		1.00				1.00	0.00



Source: Y1 Fernet and Bjornson 1997 (Delphi) Location: Y1 Smith-Dorrien Creek, Alberta
Y2 R2 Resource Consultants 1998 Y2 Lostine River, Oregon
Y3 R2 Resource Consultants Y3 Cedar River, WA and tribs.
Y4 D. Martin 1988 Y4 Tiekell River, AK
Y5 Fernet and Bjornson 1997 (pref.) Y5 Smith-Dorrien Creek, Alberta
Y6 **Recommend Composite** Y6 -
Y7 EA 1997 Y7 Upper Klamath Basin, OR
(ave. body length <12")

Figure 6S-2. Species: Native char
Lifestage: Spawning/Incubation

Interim Final
Falls Creek HSI Curves -
Resident Char

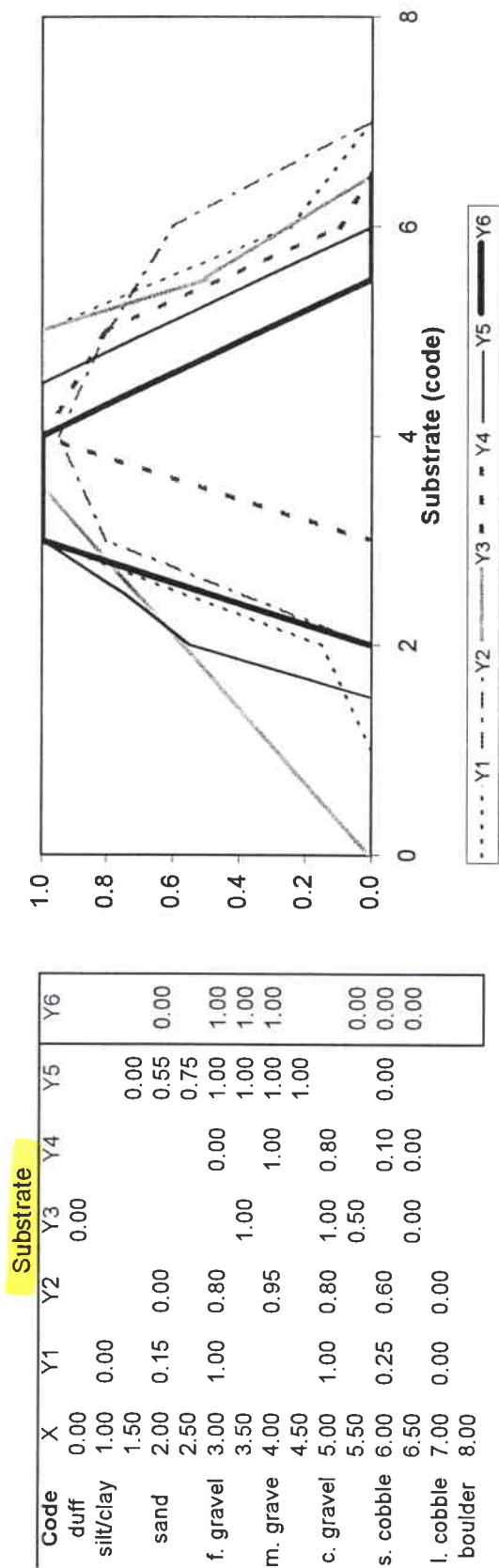
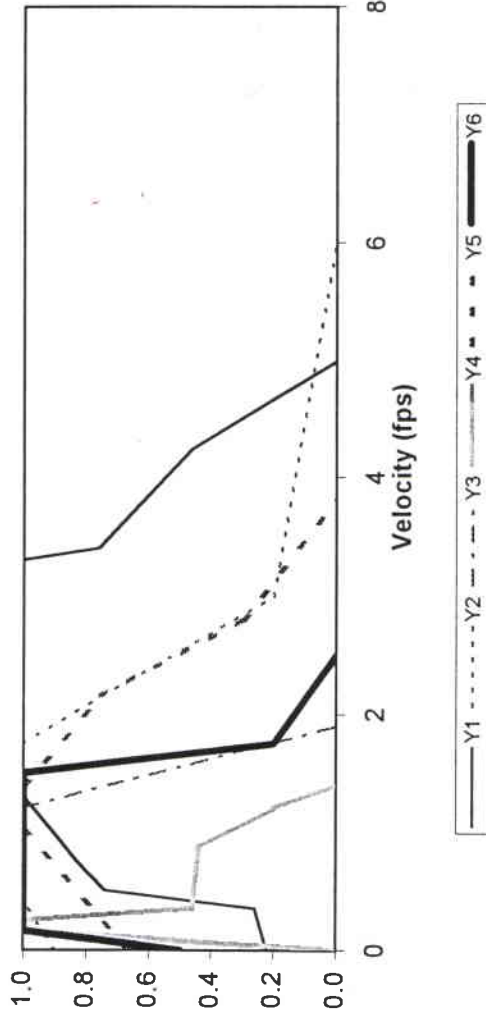


Figure 6S-3. Species: Char
Lifestage: Spawning substrate

Source: Y1 - R2 Resource Consultants 1998 Location: Y1 - Lostine River, Oregon
Y2 - WDFW 1996 fallback curve Y2 - Composite for small fish (<20")
Y3 - Fernet and Bjornson 1997 (Delphi) Y3 - Smith-Dorrien Creek, Alberta
Y4 - Fernet and Bjornson 1997 (pref.) Y4 - Smith-Dorrien Creek, Alberta
Y5 - D. Martin 1988 Y5 - Tielke River, AK
Y6 - Recommend Composite Y6 -

Interim Final
Falls Creek HSI Curves -
Resident Char

X	Velocity					
	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.22	0.90	0.00	0.00	0.66	0.50
0.16		1.00	1.00	1.00		1.00
0.25				1.00		
0.35	0.26			0.46		
0.40		1.00				
0.50	0.74					
0.75	0.83					
0.86				0.44		
1.00					1.00	
1.20			1.00	0.20		
1.30	1.00					
1.40				0.00	1.00	
1.50						1.00
1.75		1.00				0.20
1.90			0.00			
2.15					0.75	
2.50						0.00
2.80					0.30	
3.00		0.20				
3.30	1.00					
3.40	0.76					
3.80					0.00	
4.25	0.46					
5.00	0.00					
6.00		0.00				



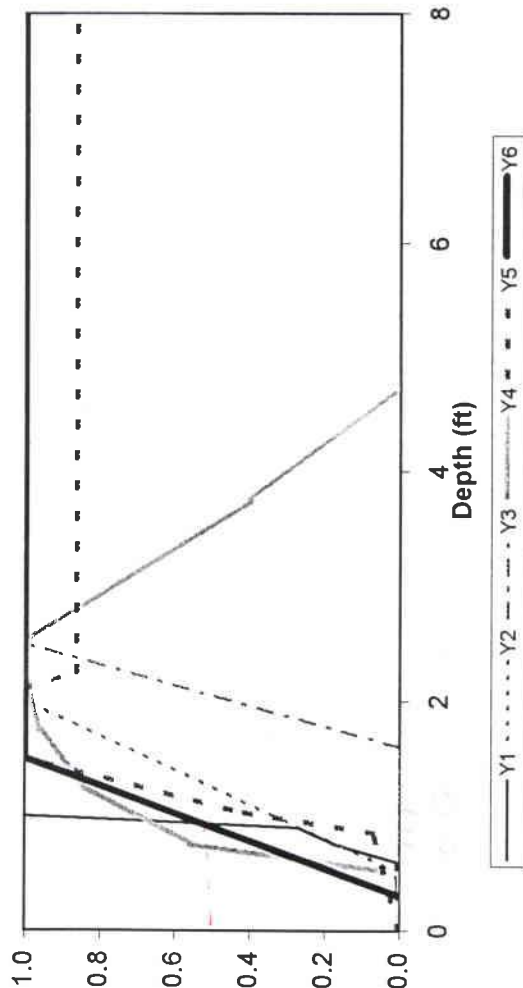
Source: Y1 - DES 1999 (unspecified lifestage) Location: Y1 - Skagit River, WA
 Y2 - R2 Resource Consultants 1998 Y2 - Lostine River, Oregon
 Y3 - Fernet and Bjornson 1997 (Delphi) Y3 - Smith-Dorrien Creek, Alberta
 Y4 - Flory 2000 (utilization data) Y4 - Falls Creek, AK
 Y5 - WDFW 1996 (Brook trout, unspec. lifestage) Y5 - Fallback, Cascade Mt. Streams
 Y6 - Recommended composite Y6 -

Figure 6A-1. Species: Native char
Lifestage: Adult rearing

Interim Final
Falls Creek HSI Curves -
Resident Char

X	Depth					
	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.30		0.00				
0.50				0.00		
0.60	0.01					
0.75	0.17			0.56		
0.85					0.07	
0.90	0.27					
1.00	1.00					
1.05					0.45	
1.25				0.84		
1.40	1.00					
1.50					1.00	1.00
1.60			0.00			
1.75				0.96		
2.00		1.00				
2.10					1.00	
2.25					0.86	
2.50			1.00	1.00		
3.75				0.40		
4.75				0.00		
8.00	1.00	1.00	1.00		0.86	1.00

Figure 6A-2. Species: Native char
Lifestage: Adult rearing

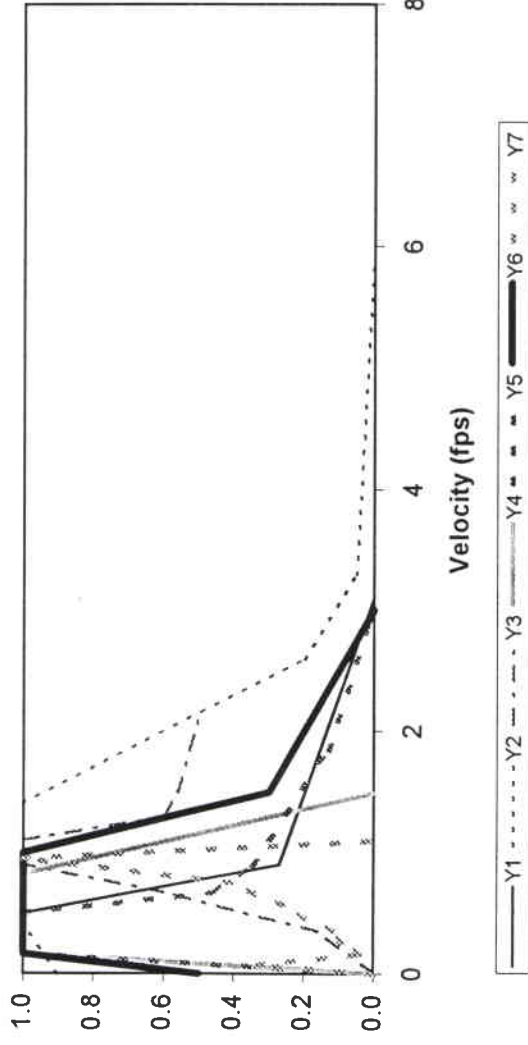


Source: Y1 - DES 1999 (unspecified lifestage)
Y2 - R2 Resource Consultants 1998
Y3 - Fernet and Bjornson 1997 (Delphi)
Y4 - Flory 2000 (utilization data)
Y5 - WDFW 1996 (Brook trout, unspec. lifestage)
Y6 - Recommended composite

Location: Y1 - Skagit River, WA
Y2 - Lostine River, Oregon
Y3 - Smith-Dorrien Creek, Alberta
Y4 - Falls Creek, AK
Y5 - Fallback, Cascade Mt. Streams
Y6 -

Interim Final
Falls Creek HSI Curves-
Resident Char

X	Velocity						
	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00	1.00	0.90	0.00	0.00	0.00	0.50	0.00
0.07							0.33
0.16				1.00	1.00	1.00	0.04
0.26						1.00	0.09
0.35			0.16				0.12
0.40		1.00				1.00	
0.50	1.00			1.00	1.00		
0.56							0.26
0.67			0.60		0.45		
0.75				1.00			0.41
0.82					0.35		
0.90	0.27		1.00				1.00
0.95						1.00	
1.00			1.00				0.00
1.10			1.00				
1.30			0.60				
1.40		1.00					
1.50		0.56	0.00			0.30	
1.85					0.13		
2.00							
2.10			0.50				
2.60		0.20					
3.00					0.00	0.00	
3.10	0.00						
3.30		0.05					
4.00							
6.00		0.00					

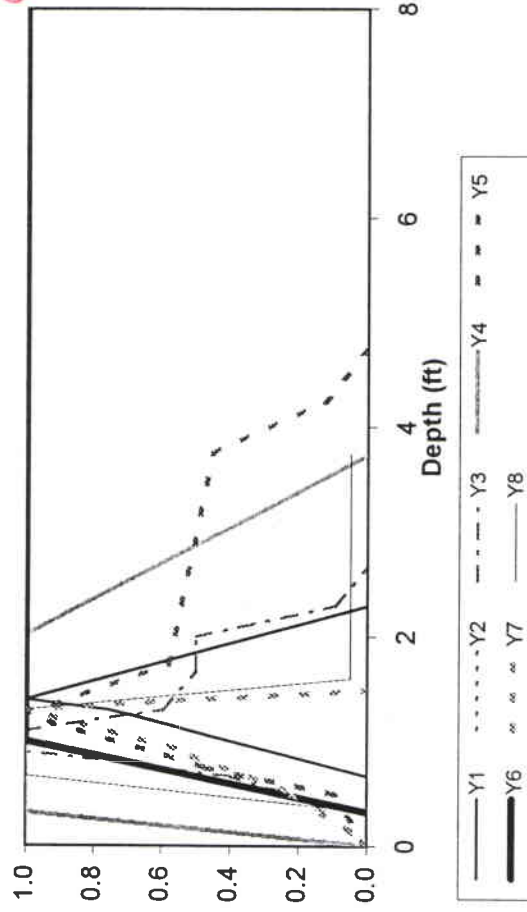


Source: Y1 Fernet and Bjornson 1997 (pref.) Location: Y1 Smith-Dorrien Creek, Alberta
Y2 R2 Resource Consultants 1998 Y2 Lostine River, Oregon
Y3 Bonneau 1994 Y3 Idaho
Y4 Fernet and Bjornson 1997 (Delphi) Y4 Smith-Dorrien Creek, Alberta
Y5 Flory 2000 (utilization data) Y5 Falls Creek, AK
Y6 Recommended Composite
Y7- Baxter 1997 (preference) Y7- Chowade River, British Columbia

Figure 6J-1. Species: Native char
Lifestage: Juvenile rearing

Interim Final
Falls Creek HSI Curves-
Resident Char

X	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.13							0.05	
0.30		0.00	0.00					
0.33				1.00		0.00	0.13	0.00
0.50					0.10			
0.53							0.24	
0.60								1.00
0.67	0.00		0.40					
0.75			1.00		0.48			
0.90								
0.92							0.56	
1.00		1.00	1.00			1.00		1.00
1.10			1.00					
1.25					1.00			
1.30	0.75		0.60					
1.40	1.00							
1.50								
1.60								0.05
1.67			0.50					
1.75					0.58			
2.00			0.50	1.00				
2.30	0.00		0.10					
2.50								
2.67			0.00					
3.75				0.00	0.45			0.05
4.00								
4.25					0.13			
4.75					0.00			
6.00								
8.00		1.00				1.00		



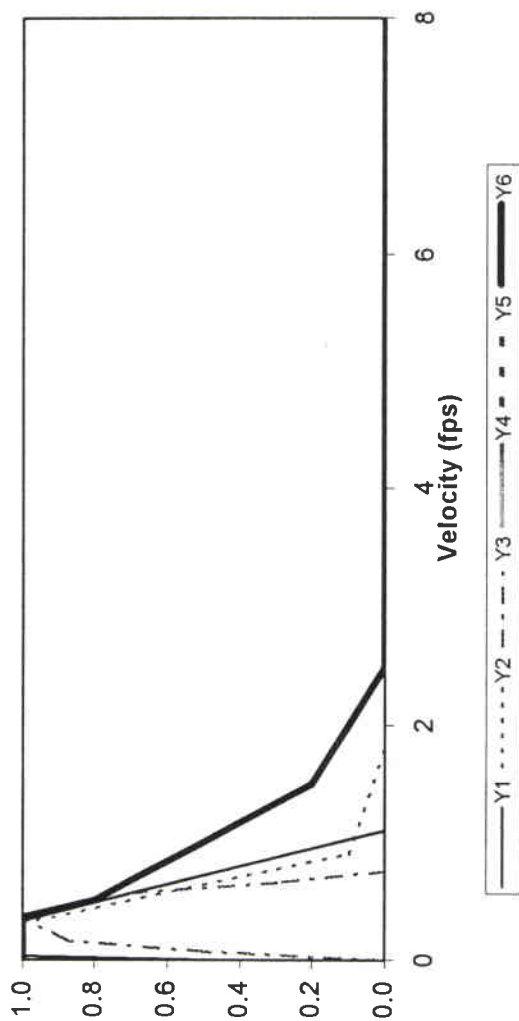
Source: Y1 Thurrow 1997 (Utilization values)
Y2 R2 Resource Consultants 1998
Y3 Bonneau 1994
Y4 Fernet and Bjornson 1997 (Delphi)
Y5 Flory 2000 (utilization data)
Y6 Recommended composite
Y7 Baxter 1997 (preference)
Y8- Fernet and Bjornson 1997 (pref.)

Location: Y1 Profile Creek, Idaho
Y2 Lostine River, Oregon
Y3 Trestle, Granite and Rattle Creeks,
Y4 Smith-Dorrien Creek, Alberta
Y5 Falls Creek, AK
Y6 -
Y7- Chowade River, British Columbia
Y8- Smith-Dorrien Creek, Alberta

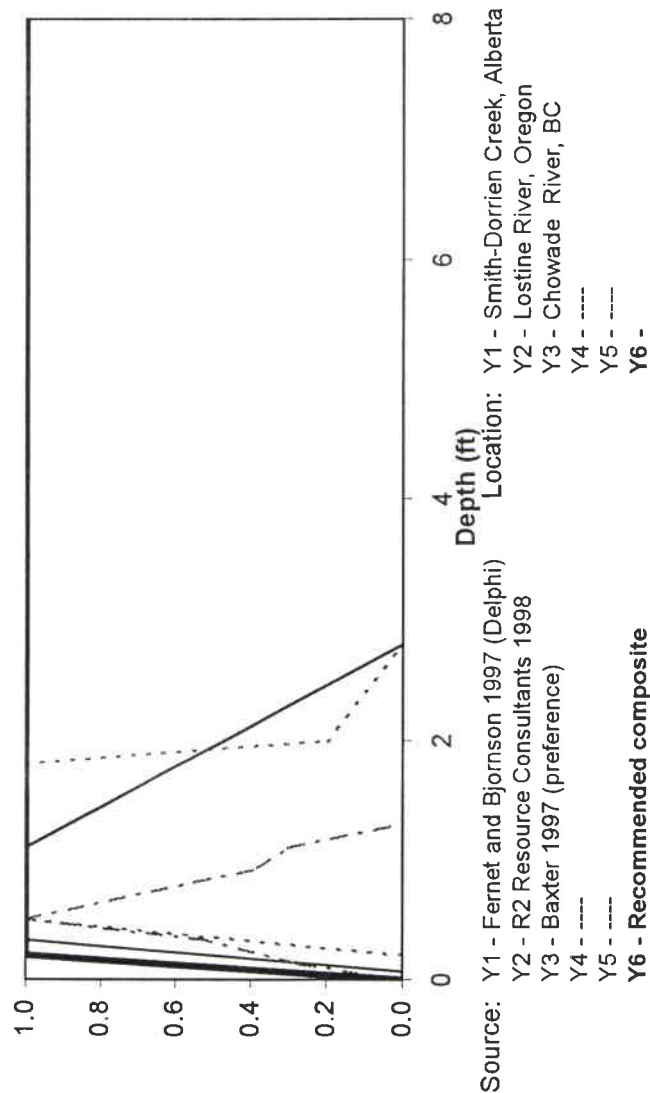
Figure 6J-2. Species: Native char
Lifestage: Juvenile rearing

Interim Final
Falls Creek HSI Curves-
Resident Char

Velocity	Y1	Y2	Y3	Y4	Y5	Y6
X						
0.00	0.50	1.00	0.00			1.00
0.03	1.00					
0.07			0.50			
0.16			0.88			
0.20						1.00
0.30		1.00				
0.33	1.00					
0.36			1.00			1.00
0.50						0.80
0.56			0.70			
0.66			0.28			
0.75			0.00			
0.90		0.10				
1.10	0.00					0.20
1.50		0.00				0.00
1.80						0.00
2.50						0.00
8.00						0.00



Depth	Y1	Y2	Y3	Y4	Y5	Y6
X						
0.00	0.00	0.00	0.00			0.00
0.07	0.00					
0.13			0.28			
0.20		0.00				1.00
0.33	1.00		0.52			1.00
0.50		1.00	1.00			1.00
0.92			0.38			
1.10	1.00		0.30			
1.30			0.00			
1.80		1.00				
2.00		0.20				
2.50						
2.80	0.00	0.00				
8.00						1.00



Source: Y1 - Fernet and Bjornson 1997 (Delphi)
 Y2 - R2 Resource Consultants 1998
 Y3 - Baxter 1997 (preference)
 Y4 - ----
 Y5 - ----
 Y6 - Recommended composite

Location: Y1 - Smith-Dorrien Creek, Alberta
 Y2 - Lostine River, Oregon
 Y3 - Chowade River, BC
 Y4 - ----
 Y5 - ----
 Y6 - ----

Figure 6F-1. Species: Native char
 Lifesage: Fry rearing

Appendix 2

Site Specific Habitat Utilization Data

Mid Flow (~40 cfs) Data Set for Resident Dolly Varden Habitat Utilization (Flory 2000)

Location	Record #	Number of Dollys	Total Length (inches)	Depth (feet)	Number of Revolutions	Velocity (feet/sec)	Habitat	Substrate
Aug. 30 Reach 4	1	1	4	1.35	2.5	0.124	pool	
	2	1	5	1.4	33	1.230	rifle	
	3	1	4	1.6	0	0.000	eddy in rifle	boulder
	4	1	6	1.5	24	0.805	gentle rifle	
	5	3	5	1.6	20	0.753	side pool	
	6	1	5	0.9	5	0.202	pool	
	7	1	3	1.6	18	0.679	gauge pool	
	8	1	5	0.85	3	0.128	gauge pool	boulder
	9	3	4	1.95	10	0.385	gauge pool	
	10	1	3	1.4	4.5	0.183	gauge pool	
ended at rifle transec Reach 2	11	3	4	1.1	6	0.238	gauge pool	
	12	1	4	2.9	27	1.010	rifle	
	13	1	3	0.6	18	0.679	gentle rifle	
	14	1	6	1.8	22	0.826	eddy in rifle	boulder
	15	1	4	0.65	11	0.422	eddy in rifle	boulder
	16	1	5	1.1	47	1.745	rifle	
	17	1	4	1.2	49	1.818	rifle	
	18	1	4	1.5	50	1.860	rifle	
	19	1	5	1.2	32	1.194	eddy in rifle	boulder
	20	1	3	0.6	25	0.936	eddy in rifle	
	21	1	6	1.2	5	0.202	pool	
	22	2	5	0.7	2	0.091	pool	
	23	1	2	2.4	8	0.312	glide	
	24	1	4	2.7	6.5	0.257	glide	
	25	1	4	1.95	61	2.259	top of pool	
	26	1	3	2.25	18	0.679	pool	
	27	1	4	0.7	21.5	0.808	top of pool	
	28	1	5	1.35	13	0.496	top of pool	
	29	1	5	0.9	31	1.157	eddy in rifle	
	30	1	4	2.35	28	1.047	pool tail	
	31	6	2	4	11	0.422	pool	
	32	1	5	4.4	8	0.312	pool	
	33	1	7	2.4	18	0.679		

Mid Flow (~40 cfs) Data Set for Resident Dolly Varden Habitat Utilization (Flory 2000)

Location	Record #	Number of Dollys	Total Length (inches)	Depth (feet)	Number of Revolutions	Velocity (feet/sec)	Habitat	Substrate
	34	1	5	2.4	18	0.679	top of pool	
	35	1	3	2.7	4	0.165	top of pool	
	36	1	5	3	8	0.312		
	37	1	6	3	8	0.312	top of pool	
	38	1	5	2.75	10	0.385	pool	
	39	1	6	1.8	18	0.679	pool	
	40	1	5	1.8	23	2.606	top of pool	
	41	1	3	0.85	15	0.569	top of pool	
	42	1	2	0.9	72	2.663	riffle	
	43	1	6	4.1	13.5	0.514	pool	
	44	1	4	4.1	13.5	0.514		
	45	1	5	2.45	15	0.569	pool	
	46	1	3	1.2	8	0.312	eddy in riffle	
	47	1	4	1.2	19	0.716	eddy in riffle	
	48	1	4	1.6	10.5	0.404	pool	bedrock
	49	1	3	1.4	53	1.965	pool	bedrock
	50	1	6	1.8	21	0.789	pool	bedrock
	51	1	8	2.7	4	0.165	pool	bedrock
	52	1	6	1.1	0	0.000	pool	bedrock
	53	1	6	2	8	0.312	pool	bedrock
	54	1	7	1.4	24	0.805	pool	bedrock
	55	1	5	1.9	10	0.385	pool	bedrock
	56	1	8	1.8	2	0.091	pool	bedrock
	57	1	4	1.8	2	0.091	pool	bedrock
	58	1	4	2.3	31	1.157	pool	bedrock
	59	1	5	2	31	1.157	pool	bedrock
	60	5	4	3.6	26.5	0.991	pool	bedrock
	61	2	4	4.1	35	1.304	pool	bedrock
	62	1	4	1.85	7	0.275	pool	bedrock
	63	1	4	4	20	0.753	pool	bedrock
	64	2	5	1.1	4	0.165	pool	bedrock
	65	1	8	4	17	0.642	pool	bedrock
	66	1	4	4	17	0.642	pool	bedrock

Reach 3

Mid Flow (~40 cfs) Data Set for Resident Dolly Varden Habitat Utilization (Flory 2000)

Location	Record #	Number of Dollys	Total Length (inches)	Depth (feet)	Number of Revolutions	Velocity (feet/sec)	Habitat	Substrate
	67	1	5	2.5	32	1.194	pool	bedrock
	68	1	4	1.6	18	0.679	pool	bedrock
	69	1	3	1.75	8.5	0.330	pool	bedrock
	70	1	4	1.75	7.5	0.293	pool	bedrock
	71	1	5	1.4	32	1.194	pool	bedrock
	72	2	2	2.2	22.5	0.845	pool	bedrock
	73	10	5	2.2	22.5	0.845	pool	bedrock
Total		101						

High Flow (80 - 90 cfs) Data Set for Resident Dolly Varden Habitat Utilization (Flory 2000)

Location	Record #	Number of Dollys	Total Length (inches)	Depth (feet)	Number of Revolutions	Flow (feet/sec)	Habitat	Substrate
24-Oct	5	1	3	1.35	4.0	0.16	gage pool	2" gravel
	13	1	3	0.80	3.0	0.13	rifle, under rock	6-10" cobble
	14	1	3	2.00	7.5	0.29	side of rifle	sandy with woody debris
	20	1	3	0.95	11.0	0.42	rifle	1/4" gravel with 4" cobble
	40	1	3	1.50	0.5	0.04	pool	bedrock
Right side channel	55	1	3	0.80	12.5	0.48	pool	2-3" cobble
	61	2	3	1.40	0.5	0.04	pool, behind rock	8" cobble, 1" gravel
	63	1	3	1.10	11.0	0.42	rifle	1/4" gravel, 6" cobble
	67	2	3	0.40	5.5	0.22	side pool	1/2-6" substrate
	69	1	3	0.40	19.5	0.73	side pool	1-4" gravel
channel	74	1	3	1.40	18.0	0.68	rifle	1/2" gravel
	12	1	3.5	2.60	57.0	2.11	rifle, behind rock	2-3" cobble
	39	1	3.5	1.05	8.5	0.33	pool	bedrock with 3-4" cobble
	46	1	3.5	2.15	13.0	0.50	pool	1" gravel
	47	2	3.5	1.40	9.0	0.35	pool	1" gravel
89.9 cfs	49	1	3.5	1.30	43.0	1.60	side pool	10" boulder
	75	1	3.5	2.40	51.0	1.89	rifle	1-1.5" gravel
	2	1	4	2.50	13.5	0.51	gage pool	1/2 - 1" gravel
	3	4	4	1.30	2.5	0.11	gage pool	1/4" gravel with leafy debris
	6	3	4	1.35	4.0	0.16	gage pool	2" gravel
8	8	1	4	3.00	39.0	1.45	rifle, under log	1/2" gravel
	9	1	4	0.60	27.5	1.03	rifle, behind rock	1" gravel
	10	1	4	0.95	20.5	0.77	rifle	1" gravel
	16	1	4	0.50	7.0	0.28	rifle	8" cobble with 1/2" gravel
	21	1	4	1.30	4.5	0.18	side pool	20" boulder
Reach 4	24	1	4	1.85	18.0	0.68	side pool	6-10" cobble
	25	1	4	1.70	15.0	0.57	side pool	1" gravel
	33	1	4	3.70	1.0	0.05	pool	1" gravel
	36	1	4	2.35	1.0	0.05	pool	1" gravel
	42	1	4	1.75	12.0	0.46	pool	bedrock with 1/4-2" gravel
79.8 cfs	44	2	4	1.85	5.5	0.22	pool	2-4" cobble
	51	1	4	1.00	0.0	0.02	side pool	8-10" cobble

High Flow (80 - 90 cfs) Data Set for Resident Dolly Varden Habitat Utilization (Flory 2000)

Location	Record #	Number of Dollys	Total Length (inches)	Depth (feet)	Number of Revolutions	Flow (feet/sec)	Habitat	Substrate
Main	60	1	4	0.85	18.0	0.68	rifle, under rock	10" boulder, 1/4" gravel
	62	1	4	1.40	0.5	0.04	pool, behind rock	8" cobble, 1" gravel
	64	1	4	1.05	3.0	0.13	side of riffle	1/2" gravel, 15" boulder
	71	1	4	0.85	1.0	0.05	side of riffle	1/4" gravel
	79	1	4	1.50	9.5	0.37	rifle	sand, 1/4" gravel, 1' boulder
	18	1	4.5	1.75	33.0	1.23	rifle	5" cobble
	22	1	4.5	1.10	6.0	0.24	rifle, behind rock	10" boulder
	4	2	5	2.05	12.5	0.48	gage pool	1/2 - 1" gravel
	11	2	5	1.15	7.0	0.28	rifle, behind rock	1" gravel
	17	1	5	1.60	33.0	1.23	rifle	1/4" gravel with 10" boulder
	19	1	5	2.05	2.5	0.11	side pool	1/4-1/2" gravel
	27	1	5	1.55	13.0	0.50	side of riffle	sand, 1/2-1" gravel, 2' boulder
	28	1	5	1.60	0.0	0.02	side pool	3/4-1.5" gravel
	31	4	5	3.70	1.5	0.07	pool	1/2-1" gravel
	35	2	5	3.70	1.0	0.05	pool	1" gravel
	37	2	5	2.35	1.0	0.05	pool	1" gravel
Left side	38	1	5	1.00	16.5	0.62	pool	bedrock
	41	1	5	1.50	0.5	0.04	pool	bedrock
	43	1	5	1.50	13.5	0.51	pool	10-15" boulder
	45	1	5	1.65	2.0	0.09	pool	1/4" gravel, 4" cobble
	48	1	5	0.90	0.0	0.02	side pool	10-18" boulder
	52	1	5	2.65	58.0	2.15	rifle, under rock	1/2" gravel with 8" cobble
	53	1	5	2.40	5.0	0.20	pool	sand, 2-6" cobble
	59	4	5	1.80	4.5	0.18	pool	1-2" gravel, 6-10" cobble
	66	1	5	1.00	9.0	0.35	side of riffle	1/2" gravel, 15" boulder
	70	1	5	0.85	1.0	0.05	side of riffle	1/4" gravel
25-Oct Reach 4	72	1	5	2.05	34.0	1.27	rifle	1/2" gravel, 4-8" cobble
	77	2	5	0.90	3.5	0.15	side pool	sand, 6-8" cobble
	23	1	5.5	2.50	10.0	0.39	rifle	2' boulder with 1/4-1/2" gravel
	1	1	6	1.40	1.0	0.05	gage pool	5" cobble with 1/4" gravel
	15	1	6	0.75	7.5	0.29	rifle	1" gravel/bedrock
	26	1	6	1.70	15.0	0.57	side pool	1" gravel
	30	1	6	2.35	2.0	0.09	pool	1/2" gravel
Pool below								

High Flow (80 - 90 cfs) Data Set for Resident Dolly Varden Habitat Utilization (Flory 2000)

Location	Record #	Number of Dollys	Total Length (inches)	Depth (feet)	Number of Revolutions	Flow (feet/sec)	Habitat	Substrate
Main 2nd island	32	2	6	3.70	1.5	0.07	pool	1/2-1" gravel
	34	1	6	3.70	1.0	0.05	pool	1" gravel
	50	1	6	1.25	2.5	0.11	side pool	1/2-3" gravel
	56	1	6	1.40	7.5	0.29	pool	1" gravel, 8" cobble
	58	1	6	1.75	2.0	0.09	pool	1-2" gravel
	76	1	6	2.20	45.0	1.67	riffle	1/4" gravel
	78	1	6	1.50	9.5	0.37	riffle	sand, 1/4" gravel, 1' boulder
	68	1	6.5	0.50	0.0	0.02	side pool	1-8" substrate
	73	1	6.5	1.50	9.0	0.35	pool, behind rock	1/2-1" gravel
	7	1	7	2.00	12.5	0.48	gage pool	1/2" gravel with 6" cobble
	54	1	7	2.40	5.0	0.20	pool	sand, 2-6" cobble
	65	1	7	1.00	9.0	0.35	side of riffle	1/2" gravel, 15" boulder
	29	1	8	1.60	20.0	0.75	riffle	20" boulder
	57	1	8	1.75	2.0	0.09	pool	1-2" gravel

Combined Mid & High Flow Habitat Utilization Data for Resident Dolly Varden (Flory 2000)

# of Dolys	Total Length (inches)	Depth (feet)	Flow (feet/sec)	Juvenile Life Stage (2 - 4 inches)										Velocity Bins				
				0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3			
1	2	2.4	0.31		1													
6	2	4	0.42		6													
1	2	0.9	2.66												1			
2	2	2.2	0.85				2											
1	3	1.35	0.16	1														
1	3	0.80	0.13	1														
1	3	2.00	0.29		1													
1	3	0.95	0.42		1													
1	3	1.50	0.04	1														
1	3	0.80	0.48		1													
2	3	1.40	0.04	2														
1	3	1.10	0.42		1													
2	3	0.40	0.22	2														
1	3	0.40	0.73			1												
1	3	1.40	0.68			1												
1	3	1.6	0.68			1												
1	3	1.4	0.18	1														
1	3	0.6	0.68			1												
1	3	0.6	0.94				1											
1	3	2.25	0.68			1												
1	3	2.7	0.17	1														
1	3	0.85	0.57			1												
1	3	1.2	0.31		1													
1	3	1.4	1.97										1					
1	3	1.75	0.33		1													
1	3.5	2.60	2.11												1			
1	3.5	1.05	0.33		1													
1	3.5	2.15	0.50		1													
2	3.5	1.40	0.35		2													
1	3.5	1.30	1.60												1			
1	3.5	2.40	1.89													1		
1	3.5	1.5	1.86													1		

# of Dolys	Total Length (inches)	Depth (feet)	Flow (feet/sec)	Velocity Bins											
				0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
1	4	2.50	0.51			1									
4	4	1.30	0.11	4											
3	4	1.35	0.16	3											
1	4	3.00	1.45						1						
1	4	0.60	1.03					1							
1	4	0.95	0.77				1								
1	4	0.50	0.28		1										
1	4	1.30	0.18	1											
1	4	1.85	0.68			1									
1	4	1.70	0.57			1									
1	4	3.70	0.05	1											
1	4	2.35	0.05	1											
1	4	1.75	0.46		1										
2	4	1.85	0.22	2											
1	4	1.00	0.02	1											
1	4	0.85	0.68			1									
1	4	1.40	0.04	1											
1	4	1.05	0.13	1											
1	4	0.85	0.05	1											
1	4	1.50	0.37		1										
1	4	1.35	0.12	1											
1	4	1.6	0.00	1											
3	4	1.95	0.39		3										
3	4	1.1	0.24	3											
1	4	2.9	1.01					1							
1	4	0.65	0.42		1										
1	4	1.2	1.82								1				
1	4	2.7	0.26		1										
1	4	1.95	2.26												
1	4	0.7	0.81				1							1	
1	4	2.35	1.05						1						
1	4	4.1	0.51			1									
1	4	1.2	0.72			1									
1	4	1.6	0.40		1										
1	4	1.8	0.09	1											

# of Dollys	Total Length (inches)	Depth (feet)	Flow (feet/sec)	Velocity Bins												
				0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3	
1	4	2.3	1.16					1								
5	4	3.6	0.99				5									
2	4	4.1	1.30						2							
1	4	1.85	0.28		1											
1	4	4	0.75				1									
1	4	4	0.64			1										
1	4	1.6	0.68			1										
1	4	1.75	0.29		1											
1	4	4.4	0.31		1											
100				31	29	14	11	4	3	1	4	1	1	1	0	100
				1.00	0.94	0.45	0.35	0.13	0.10	0.03	0.13	0.03	0.03	0.03	0.00	

# of Dolys	Total Length (inches)	Depth (feet)	Flow (feet/sec)	Velocity Bins											
				0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
Adult Life Stage (4.5 - 8 inches)															
1	4.5	1.75	1.23					1							
1	4.5	1.10	0.24	1											
2	5	2.05	0.48		2										
2	5	1.15	0.28		2										
1	5	1.60	1.23					1							
1	5	2.05	0.11	1											
1	5	1.55	0.50		1										
1	5	1.60	0.02	1											
4	5	3.70	0.07	4											
2	5	3.70	0.05	2											
2	5	2.35	0.05	2											
1	5	1.00	0.62			1									
1	5	1.50	0.04	1											
1	5	1.50	0.51			1									
1	5	1.65	0.09	1											
1	5	0.90	0.02	1											
1	5	2.65	2.15										1		
1	5	2.40	0.20	1											
3	5	1.80	0.18	3											
1	5	1.00	0.35		1										
1	5	0.85	0.05	1											
1	5	2.05	1.27						1						
2	5	0.90	0.15	2											
1	5	1.4	1.23												
3	5	1.6	0.75					1							
1	5	0.9	0.20	1				3							
1	5	0.85	0.13	1											
1	5	1.1	1.75										1		
1	5	1.2	1.19												
2	5	0.7	0.09	2											
1	5	1.35	0.50		1										
1	5	0.9	1.16												
1	5	2.4	0.68			1									
1	5	3	0.31		1										

# of Dolls	Total Length (inches)	Depth (feet)	Flow (feet/sec)	Velocity Bins												
				0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3	
1	5	2.75	0.39		1											
1	5	1.8	2.61												1	
1	5	2.45	0.57			1										
1	5	1.9	0.39		1											
1	5	2	1.16					1								
2	5	1.1	0.17	2												
1	5	2.5	1.19					1								
1	5	1.4	1.19					1								
10	5	2.2	0.85				10									
1	5.5	2.50	0.39		1											
1	6	1.40	0.05	1												
1	6	0.75	0.29		1											
1	6	1.70	0.57			1										
1	6	2.35	0.09	1												
2	6	3.70	0.07	2												
1	6	3.70	0.05	1												
1	6	1.25	0.11	1												
1	6	1.40	0.29		1											
1	6	1.75	0.09	1												
1	6	2.20	1.67							1						
1	6	1.50	0.37		1											
1	6	1.5	0.81						1							
1	6	1.8	0.83						1							
1	6	1.2	0.20	1												
1	6	3	0.31		1											
1	6	1.8	0.68			1										
1	6	4.1	0.51			1										
1	6	1.8	0.79						1							
1	6	1.1	0.00	1												
1	6	2	0.31		1											
1	6.5	0.50	0.02	1												
1	6.5	1.50	0.35		1											
1	7	2.00	0.48		1											
1	7	2.40	0.20	1												
1	7	1.00	0.35		1											

# of Dollies	Total Length (inches)	Depth (feet)	Velocity Bins														
			Flow (feet/sec)														
1	7	2.4	0.68			1											
1	7	1.4	0.81				1										
1	7.5	4	0.64			1											
1	8	1.60	0.75				1										
1	8	1.75	0.09	1													
1	8	2.7	0.17	1													
1	8	1.8	0.09	1													
100			41	19	9	18	8	1	2	0	1	0	1	0	1	0	
			1.00	0.46	0.22	0.44	0.20	0.02	0.05	0.00	0.02	0.00	0.02	0.00	0.02	0.00	
																	100

Combined High & Mid Flow Habitat Utilization Data for Resident Dolly Varden (Flory 2000)

No. of Fish	Fish Size (inches)	Depth (feet)	Velocity (ft/sec)	Depth Bins									
				0.5	1	1.5	2	2.5	3	3.5	4	4.5	
Juvenile Life Stage (2 - 4 inches)													
1	2	2.4	0.31					1					
6	2	4	0.42									6	
1	2	0.9	2.66	1									
2	2	2.2	0.85					2					
1	3	1.6	0.68				1						
1	3	1.4	0.18			1							
1	3	0.6	0.68	1									
1	3	0.6	0.94	1									
1	3	2.25	0.68					1					
1	3	2.7	0.17							1			
1	3	0.85	0.57	1									
1	3	1.2	0.31			1							
1	3	1.4	1.97			1							
1	3	1.75	0.33				1						
1	3	1.35	0.16			1							
1	3	0.80	0.13		1								
1	3	2.00	0.29				1						
1	3	0.95	0.42	1									
1	3	1.50	0.04			1							
1	3	0.80	0.48	1									
2	3	1.40	0.04			2							
1	3	1.10	0.42			1							
2	3	0.40	0.22	2									
1	3	0.40	0.73	1									
1	3	1.40	0.68			1							
1	3.5	1.5	1.86			1							
1	3.5	2.60	2.11							1			
1	3.5	1.05	0.33			1							
1	3.5	2.15	0.50						1				
2	3.5	1.40	0.35			2							
1	3.5	1.30	1.60			1							

No. of Fish	Fish Size (inches)	Depth (feet)	Velocity (ft/sec)	Depth Bins										
				0.5	1	1.5	2	2.5	3	3.5	4	4.5		
1	3.5	2.40	1.89					1						
1	4	1.35	0.12			1								
1	4	1.6	0.00				1							
3	4	1.95	0.39				3							
3	4	1.1	0.24			3								
1	4	2.9	1.01							1				
1	4	0.65	0.42	1										
1	4	1.2	1.82		1									
1	4	2.7	0.26						1					
1	4	1.95	2.26											
1	4	0.7	0.81	1										
1	4	2.35	1.05						1					
1	4	4.1	0.51										1	
1	4	1.2	0.72			1								
1	4	1.6	0.40				1							
1	4	1.8	0.09				1							
1	4	2.3	1.16						1					
5	4	3.6	0.99									5		2
2	4	4.1	1.30											
1	4	1.85	0.28				1							
1	4	4	0.75										1	
1	4	4	0.64										1	
1	4	1.6	0.68						1					
1	4	1.75	0.29						1					
1	4	4.4	0.31											1
1	4	2.50	0.51								1			
4	4	1.30	0.11			4								
3	4	1.35	0.16			3								
1	4	3.00	1.45								1			
1	4	0.60	1.03	1										
1	4	0.95	0.77	1										
1	4	0.55	0.28	1										
1	4	1.30	0.18			1								
1	4	1.85	0.68										1	
1	4	1.70	0.57										1	

No. of Fish	Fish Size (inches)	Depth (feet)	Velocity (ft/sec)	Depth Bins									
				0.5	1	1.5	2	2.5	3	3.5	4	4.5	
1	4	3.70	0.05								1		
1	4	2.35	0.05					1					
1	4	1.75	0.46				1						
2	4	1.85	0.22				2						
1	4	1.00	0.02		1								
1	4	0.85	0.68		1								
1	4	1.40	0.04			1							
1	4	1.05	0.13			1							
1	4	0.85	0.05		1								
1	4	1.50	0.37			1							
100				3	15	31	18	10	5	0	14	4	100
				0.10	0.48	1.00	0.58	0.32	0.16	0.00	0.45	0.13	

No. of Fish	Fish Size (inches)	Depth (feet)	Velocity (ft/sec)	Depth Bins						
				0.5	1	1.5	2	2.5	3	4
1	4.5	1.75	1.23				1			
1	4.5	1.10	0.24			1				
1	5	1.4	1.23			1				
3	5	1.6	0.75				3			
1	5	0.9	0.20		1					
1	5	0.85	0.13		1					
1	5	1.1	1.75			1				
1	5	1.2	1.19			1				
2	5	0.7	0.09		2					
1	5	1.35	0.50			1				
1	5	0.9	1.16		1					
1	5	2.4	0.68					1		
1	5	3	0.31						1	
1	5	2.75	0.39						1	
1	5	1.8	2.61							
1	5	2.45	0.57					1		
1	5	1.9	0.39							
1	5	2	1.16							
2	5	1.1	0.17							
1	5	2.5	1.19			2				
1	5	1.4	1.19			1				
10	5	2.2	0.85					10		
2	5	2.05	0.48					2		
2	5	1.15	0.28			2				
1	5	1.60	1.23							
1	5	2.05	0.11					1		
1	5	1.55	0.50							
1	5	1.60	0.02							
4	5	3.70	0.07							4
2	5	3.70	0.05							2
2	5	2.35	0.05					2		
1	5	1.00	0.62		1					

Adult Life Stage (4.5 - 8 inches)

No. of Fish	Fish Size (inches)	Depth (feet)	Velocity (ft/sec)	Depth Bins									
				0.5	1	1.5	2	2.5	3	3.5	4	4.5	
1	5	1.50	0.04			1							
1	5	1.50	0.51			1							
1	5	1.65	0.09				1						
1	5	0.90	0.02		1								
1	5	2.65	2.15						1				
1	5	2.40	0.20					1					
3	5	1.80	0.18				3						
1	5	1.00	0.35		1								
1	5	0.85	0.05		1								
1	5	2.05	1.27					1					
2	5	0.90	0.15		2								
1	5.5	2.50	0.39					1					
1	6	1.40	0.05			1							
1	6	0.75	0.29		1								
1	6	1.70	0.57				1						
1	6	2.35	0.09					1					
2	6	3.70	0.07								2		
1	6	3.70	0.05								1		
1	6	1.25	0.11			1							
1	6	1.40	0.29			1							
1	6	1.75	0.09				1						
1	6	2.20	1.67					1					
1	6	1.50	0.37			1							
1	6	1.5	0.81			1							
1	6	1.8	0.83				1						
1	6	1.2	0.20			1							
1	6	3	0.31						1				
1	6	1.8	0.68				1						
1	6	4.1	0.51									1	
1	6	1.8	0.79				1						
1	6	1.1	0.00			1							
1	6	2	0.31				1						
1	6.5	0.55	0.02		1								
1	6.5	1.50	0.35			1							
1	7	2.4	0.68									1	

No. of Fish	Fish Size (inches)	Depth (feet)	Velocity (ft/sec)	Depth Bins									
				0.5	1	1.5	2	2.5	3	3.5	4	4.5	
1	7	1.4	0.81			1							
1	7	2.00	0.48				1						
1	7	2.40	0.20					1					
1	7	1.00	0.35		1								
1	7.5	4	0.64								1		
1	8	2.7	0.17						1				
1	8	1.8	0.09				1						
1	8	1.60	0.75				1						
1	8	1.75	0.09				1						
100				0	14	21	24	25	5	0	10	1	100
				0	0.56	0.84	0.96	1	0.2	0	0.4	0.04	

From: Cory Warnock
Sent: Thursday, December 12, 2013 1:54 PM
To: Van Massenhove, Katherine B -FS
Cc: Sagner, Helen -FS; Mike Salzetti
Subject: RE: Grant Lake Special Use Permit Renewal Request (SEW457)

Good news, Kathy. Thanks for the update.

Cory

From: Van Massenhove, Katherine B -FS [<mailto:kvanmassenhove@fs.fed.us>]
Sent: Thursday, December 12, 2013 1:53 PM
To: Cory Warnock
Cc: Sagner, Helen -FS
Subject: RE: Grant Lake Special Use Permit Renewal Request (SEW457)

Hi Cory,

The renewal is underway. You've probably seen the bill in the mail. The old permit will stay in effect until the new one is issued, in the event of an overlap between the 12/31/2013 expiration and the reissue date. By billing the old number, and payment being received, it is what in effect makes the authorization still valid as confirmation that each party wishes to allow the use to continue. We hope to have the new permit to you for signature in January, I'm training a new temporary team member, Helen Sagner, and she will be working through the renewal with me this year.

Thanks for checking in with us,

Kathy Van Massenhove
Special Uses Team Leader
Chugach National Forest
(907) 743-9542
kvanmassenhove@fs.fed.us

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Thursday, December 12, 2013 12:41 PM
To: Van Massenhove, Katherine B -FS; Sagner, Helen -FS
Cc: Mike Salzetti
Subject: RE: Grant Lake Special Use Permit Renewal Request (SEW457)

Hi Kathy,

Just touching base to see where things were at with the Special Use Permit renewal process.

Thanks,

Cory

From: Van Massenhove, Katherine B -FS [<mailto:kvanmassenhove@fs.fed.us>]
Sent: Thursday, November 07, 2013 10:02 AM
To: Cory Warnock; Sagner, Helen -FS
Cc: Mike Salzetti
Subject: RE: Grant Lake Special Use Permit Renewal Request (SEW457)

Thanks Cory, We will work on reissuing the permit as it is currently authorized. Helen Sagner will be assisting with that renewal. Our public comment runs through the beginning of December, we will be in touch.

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Thursday, November 07, 2013 8:57 AM
To: Van Massenhove, Katherine B -FS
Cc: Mike Salzetti
Subject: RE: Grant Lake Special Use Permit Renewal Request (SEW457)

Hi Kathy,

Just touching base to see if you've had time to evaluate my email below. I'll look forward to hearing from you as you have time.

Thanks,

Cory

From: Cory Warnock
Sent: Tuesday, November 05, 2013 2:05 PM
To: Van Massenhove, Katherine B -FS (kvanmassenhove@fs.fed.us)
Cc: Mike Salzetti
Subject: Grant Lake Special Use Permit Renewal Request (SEW457)

Hi Kathy,

I wanted to start off by apologizing for your receipt (second hand) of an inquiry for work we (HEA) would be conducting in 2014 consistent with our existing study planning. Without implicating anyone or anything, the proper channels were not followed (internally) prior to reaching out to the Forest Service and as such, you received an inquiry related to this matter prematurely. Given that you have received the inquiry however, I'll go ahead and begin the formal process of requesting a renewal (always the plan). Feel free to treat this as the formal request if in fact, this is the level of detail that you need. I'm guessing you'll need more so I will pose the following question.....

- Based upon our existing study plans, we have a set of very specific studies (primarily terrestrial in nature) that are planned to be completed in 2014. Those studies are easily definable as I can just pull the appropriate language from our study plans. What is a little more ambiguous to define is the potential for any additional work that may need to be done in relation to discussions with stakeholders that will be occurring early next year (2014). As such, my preference would be to have the existing permit, associated language and amendments all be renewed as they are to avoid the potential need for amendments later and/or time sensitivity issues. Is this possible?

Thanks Kathy and as always, more than happy to jump on the phone and discuss further. Let me know your thoughts when you have a chance,

Cory

From: Stovall, Robert -FS <rstovall@fs.fed.us>
Sent: Friday, December 13, 2013 10:52 AM
To: Cory Warnock; pamela.russell@alaska.gov; Eavis, John -FS; Van Massenhove, Katherine B -FS; Lesli Schick (lesli.schick@alaska.gov); Shina Duvall
Cc: Mike Salzetti; Dwayne Adams; Emily Andersen; Malecek, Thomas -FS
Subject: RE: Draft INHT Meeting Minutes For Review

Cory:

I have reviewed the notes and they look good. I have no additions or corrections.

We (FS) are still working on determining our roles, responsibilities, activity related to the review of the Grant Lake Hydro FERC pre-licensing studies and who would be involved in these reviews. Thank you for the information on the studies size and time needed for review.

Robert

Deputy District Ranger
Chugach NF, Seward RD
Po Box 390, 334 Fourth Ave.
Seward, AK 99664
Seward office # 907 743-9474; KLWC # 288-7707
Gov. Cell # 907 399-3966

From: Cory Warnock [<mailto:cory.warnock@mcmillen-llc.net>]
Sent: Tuesday, December 10, 2013 1:37 PM
To: Stovall, Robert -FS; pamela.russell@alaska.gov; Eavis, John -FS; Van Massenhove, Katherine B -FS; Lesli Schick (lesli.schick@alaska.gov); Shina Duvall
Cc: Mike Salzetti; Dwayne Adams; Emily Andersen
Subject: Draft INHT Meeting Minutes For Review

Hi all,

Attached are the draft INHT meeting minutes from our 11/13/13 meeting in Girdwood. If you all could please take a few moments to review over the next week or so (by 12/17/13), I'd appreciate it. Providing any comments via a word document and/or email will be fine. I'll plan on finalizing late next week. Thanks to all who attended for the valuable discussion and development of a process for resolution.

Thanks and I'll look forward to hearing from you,

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

McMillen, LLC

From: Cory Warnock
Sent: Monday, December 16, 2013 12:47 PM
To: Emily Andersen
Subject: FW: Falls Creek Study Plan
Attachments: Final Study Plan-Falls Creek.pdf; _Certification_.htm

From: Miller, Monte D (DFG) [<mailto:monte.miller@alaska.gov>]
Sent: Monday, December 16, 2013 12:14 PM
To: John Blum
Subject: Falls Creek Study Plan

John,
I think that this may have some use in the identification of how curves were developed....or at least how they were supposed to be developed.
Monte Miller



Final Study Plan

Falls Creek
(FERC No. 11659)
Instream Flow Study
Gustavus Electric Company

Prepared for:

Gustavus Electric Company
PO Box 102
Gustavus, Alaska 99826

Prepared by:

R2 Resource Consultants
15250 NE 95th Street
Redmond, Washington 98052-2518

November 23, 1999

1207.01

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1. INTRODUCTION AND OBJECTIVES

On October 30th 1998 President Clinton signed legislation authorizing the Federal Energy Regulatory Commission (FERC) to accept a hydropower license application from Gustavus Electric Company (GEC) for the construction, operation, and maintenance of the proposed Kahtaheena River (Falls Creek) hydroelectric Project. Under Federal Energy Regulatory Commission's regulations, issuing an original license for this project first requires preparation of either an Environmental Assessment or Environmental Impact Statement, in accordance with the National Environmental Policy Act (NEPA) of 1969. Based on preliminary analysis of the issues, an Environmental Assessment will be prepared for the Falls Creek Project (FERC No. 11659) to decide whether issuing an original license would be a major federal action significantly affecting the quality of the human environment.

The proposed Falls Creek Project is a run-of-river hydroelectric facility located near the town of Gustavus, Alaska. The proposed project would consist of a siphon or diversion dam intake structure located at approximately 550 to 665-foot elevation diverting a maximum of 30 cfs into an approximately 6,600 foot-long penstock. The penstock would transport the diverted flow to a powerhouse structure located at approximately 30 feet above mean sea level and returning the flow to Falls Creek near the powerhouse structure through a pipe tailrace.

The construction, operation, and maintenance of the Falls Creek Project will affect flows in Falls Creek and subsequently the resources that depend on those flows including fish habitat. Altered stream flows have two types of impacts that affect fish: (1) flow alteration and (2) flow fluctuations. Flow alterations are defined as changes over substantial periods of time (i.e., weeks or longer). Flow alterations change the amount and type of instream habitat and, in turn, may potentially change fish production and fish species composition. Direct measurement of this potential impact in terms of lost fish production is difficult. However, a widely used method called the Instream Flow Incremental Methodology (IFIM) (Bovee 1982, Milhous, et al. 1984) is useful for evaluating incremental changes in habitat resulting from flow alterations, and thus provides an indirect means of assessing the flows needed to maintain the fish production potential of a stream or river.

The IFIM uses several computer models (e.g., Physical Habitat Simulation [PHABSIM]) to determine how habitat (termed Weighted Usable Area [WUA¹]) changes with flow. Results of an IFIM study provide estimates of WUA for each target species/life history stage over a range of flows. This information provides a means to evaluate habitat:flow tradeoffs, which is useful for deriving a recommended flow regime to protect fishery resources within the project area. To determine what level of flow is required to maintain or protect fish habitat in Falls Creek, GEC contracted with R2 Resource Consultants (R2) to conduct an instream flow study using the IFIM/PHABSIM.

This Final Study Plan has been produced to: 1) provide additional detail of proposed study activities described in the "Interim Final Study Plan" dated October 18, 1999; 2) incorporate site specific data collected since the Interim Final Study Plan was developed; and 3) to address resource agency comments made during the October 29, 1999, agency conference call and written comments received on October 29 and November 22, 1999 on the Interim Final Study Plan.

This report presents a detailed description of the proposed Falls Creek Instream Flow Study and is organized into three major sections including this section (Section 1 – **INTRODUCTION AND OBJECTIVES**). *No obj listed*

The remaining sections include:

Section 2 – **PROJECT SCOPE**, which describes the major project steps and specific methodologies for completion of the instream flow study, and;

Section 3 – **PROJECT SCHEDULE**, which outlines anticipated dates for proposed field and office activities.

2. PROJECT SCOPE

This section describes the proposed scope of work for completing the Falls Creek Instream Flow Study. In developing the approach, careful consideration has been given to the physical, operational, and logistical constraints pertinent to this project. Additionally, agency concerns

¹ Weighted Usable Area (WUA) is "weighted" by individual species and life stage preferences for certain habitat components including depth, velocity, and substrate.

and comments received since distribution of the Interim Final Study Plan and results of field activities completed during the week of November 1, 1999, have also been incorporated. The study will be completed using the U.S. Fish & Wildlife Service's IFIM and the associated PHABSIM computer program. Application of the IFIM/PHABSIM requires the collection of site specific data and the integration of biological information concerning fish species and life history stage utilization of various habitat components, including water depth, water velocity, and substrate. The instream flow study will be completed in a series of steps that include data collection and analysis, hydraulic modeling, habitat modeling, and development of habitat:flow relationships. Although activities associated with the instream flow study are generally conducted in a stepwise fashion, significant overlap of work performed during individual steps may occur. The anticipated work to be completed by R2 is presented below for each step.

STEP 1 – Selection of Target Fish Species and Life History Stages and Periodicity

Based on reviews of the Falls Creek Scoping Document, preliminary field data, and comments received from agency personnel (ADF&G 1999), five fish species and four life stages are recommended for analysis during the instream flow study (Table 1) (**Note: all tables and figures referenced in this document can be found in Appendix A**). An impassable falls located approximately 2400 feet upstream of the mouth of Falls Creek creates a natural barrier to the upstream migration and distribution of anadromous and resident fish stocks within Falls Creek (Figure 1).

Because fish species have different habitat requirements (defined by combinations of water depth, velocity, and substrate size) at different life history stages and the quantities of these habitats vary with flow, the development of monthly flow recommendations (using IFIM/PHABSIM) must include information on the periodicity or presence of each life stage during a given month. To facilitate the development of appropriate life stage periodicity for the Falls Creek basin, R2 compiled a set of candidate periodicities based on information reviewed in the literature and from discussions with fisheries biologist and on site observations (Figure 2). The "draft" periodicity chart in Figure 2 is presented as a starting point for review and discussion and it is anticipated that development of final periodicities will be completed through agency consultation.

STEP 2 – Habitat Mapping and Channel Typing

The habitat mapping of the Falls Creek bypass reach was completed by Dr. Liz Flory of Aquatic Science Inc. during three separate surveys conducted during the summer of 1999 (L. Flory

personal communication). It is our understanding that specific habitat-typing criteria used by Dr. Flory have been provided to the agencies, and therefore only the general survey method used is summarized here. In general, habitat typing was performed following guidelines described in Bisson et al. (1981) and included the delineation of individual habitat units (defined as a section or unit of the stream channel displaying unique habitat characteristics) and measurement of length and width for each identified habitat unit. The habitat mapping of Falls Creek resulted in the identification of four major habitat types including riffle, glide, cascade, and pool units. Individual habitat types/units were generally defined as:

Riffle – relatively shallow, steep section containing uneven water surface elevation, turbulent flows and swift velocities; "white water" may be present;

Glide – area of relatively deep, flowing water with relatively smooth (unbroken) water surface;

Pool – relatively deep area exhibiting relatively low velocities, smooth water surface; and

Cascade – steep areas with water surface gradients exceeding 3 percent, uneven water surface elevation, extremely turbulent with high velocities, many times containing exposed bedrock and boulder substrate.

Channel typing of Falls Creek was also completed by Dr. Liz Flory following guidelines presented in the USFS Channel Type Users Guide (1992) (Figure 1). Individual channel type classification units were defined by physical attributes, such as channel gradient, channel pattern, stream bank incision and containment, and riparian plant community composition. Channel types are a means of distinguishing the various parts of a stream system and provide key information on fish habitat utilization, fish habitat capability, and sensitivity to natural and human disturbance. A general description of the major physical attributes for the two dominate channel types found within the reviewed segment of Falls Creek is present in Table 2.

Based on the combined results of the habitat mapping and a review of the dominant channel features and fish use, Falls Creek was segmented into four (4) separate reaches (Figure 1). The reach delineation considered both the physical characteristics of the channel as well as the biological importance of the respective habitat types contained therein. Specific reach locations, reach length, and their biological significance are summarized as follows:

Reach 1 – Mouth of Falls Creek to lower most falls: (distance = 2387 ft) (Perceived biological significance – critical spawning and rearing area for anadromous fish species; observed high usage during escapement surveys; area comprised predominantly of riffle and pool habitat types)

Reach 2 – Lower most falls to start of canyon section: (distance = 2269 ft) (Perceived biological significance – critical spawning and rearing area for adult and juvenile Dolly Varden; unique large woody debris jam present; relatively high numbers of fish captured during daytime minnow trapping (Liz Flory, personal communication); comprised predominantly of riffle and cascade habitat types with a few well defined pool units present)

Reach 3 – Canyon section: (distance = 5579 ft) (Perceived biological significance – passage corridor for downstream movement of adult and juvenile Dolly Varden; high stream gradient; low habitat quality; comprised predominantly of cascade habitat with short sections of pool and riffle habitat)

Reach 4 – Canyon section to just upstream of proposed upper intake site: (distance = 3014 ft) (Perceived biological significance – low to moderate gradient reach with relatively moderate amount of spawning and rearing area for adult and juvenile Dolly Varden; island complex present; comprised predominantly of riffle and cascade habitat with short sections of pool and riffle habitat)

Using the habitat mapping data collected by Dr. Flory, the percent composition by length of each habitat type (e.g., pool) observed within the four designated reaches was then calculated. The length and percentage of total length of each of the habitat types as identified during the habitat mapping are depicted graphically for each reach in Figures 3, 4, 5, and 6 and listed in Table 3. Figure 7 depicts the total length and percentage of total length by habitat type for the combined reaches upstream of the lower falls (Reaches 2-4).

STEP 3 – Transect Selection

During September 28 – 30, 1999, a field reconnaissance of the bypass segment of Falls Creek (Reaches 1 through 4) was completed in order to select preliminary habitat units/transect locations from which physical and hydraulic data would be collected. Individual habitat units were selected based on the representative nature of the unit as compared to similar habitat units within the reach, and generally included those habitats which represent at least 10% (by length)

STEP 4 – Physical and Hydraulic Measurements

The collection of field data from each transect shall follow procedures as outlined in Trihey and Wegner (1984), Bovee (1982), and Bovee and Milhous (1978). Based on guidelines of the USGS River Systems Management Section, R2 is proposing to measure a range of flows, which will allow PHABSIM modeling of habitat conditions over the range of flows experienced in Falls Creek. Sampling will be coordinated with annual hydrograph variation. Based on a review of existing hydrology (HDR Draft Report, 1999), R2 has identified the following three target flows - low flow (20 cfs or lower), mid-flow (approximately 40 cfs), and high flow (75 cfs or higher). Depending on actual stream flows at the time of measurement and PHABSIM modeling results, a forth set of flow measurements may be necessary to increase model confidence.

The establishment of transects at each sampling location was completed as follows:

Locations of Transects – Transect locations will be recorded and mapped in a field book and on a topographic map. Survey flagging will be used to mark the position of each transect.

Establishment of Transect Benchmarks – Permanent surveying benchmarks (BM) will be established at each transect. All survey measurements within a site, including headpin and water surface elevations, will be referenced to the benchmark elevation. The benchmark (e.g., bedrock or boulder point, star-bolt anchors, rebar) will be placed above the floodplain of the creek, and marked with survey flagging.

Establishment of Working Pins – Working pins (e.g., wood stakes, tree stem or branch, star-bolt anchors) will be established on either bank of a transect. These working pins will be positioned in such a way that the line connecting these points would be perpendicular to the main flow of the river channel. A surveying tape will be stretched across the stream channel and connected to these points during the collection of instream flow data.

Survey of Headpin Elevations and Completion of Level Loop – Following the installation of the head pins, a level loop survey will be completed to establish head pin elevations. These elevation data will be obtained using an Automatic Level and stadia rod (0.01 ft accuracy). The level loop will be considered accurate if closed to within 0.02 ft of the BM elevation (adequate for the size of Falls Creek).

Transect depth, velocity, and substrate measurements will be made under mid and low-flow conditions. Water surface elevations will be measured at each transect under all three discharges. The following data will be recorded at each transect:

Reach and Transect Number;

Habitat Type – classified as run, riffle, or pool;

Sampling Date/Time/Investigators/Flow – information regarding when data were collected, who collected the data, and under what flow conditions the data were collected;

Water Surface Elevations (WSEs) – Measured to the nearest 0.01 ft at three locations in the channel: left bank, center of channel, and right bank; and

Photographs – each transect will be photographed under each of the three flow conditions.

Data will also be collected at set intervals across each transect. These intervals will be established so that the flow between any two intervals (cell) does not exceed 10 percent of the total flow in the channel or a minimum of twenty cells. The following data will be collected at measurement points (verticals) across each transect:

Bed Elevations (to nearest 0.01 ft) – measured during low flow conditions using an automatic level and stadia rod (note: bed elevations may be determined by subtracting depth measurements from the water surface elevation in pools);

Water Depth (to nearest 0.1 ft) – depths will be measured using either a 4-ft or 6-ft top setting rod, depending on water depth;

Mean Column Water Velocity (to nearest 0.1 ft/sec) – measured using a calibrated Swoffer Model 2100 velocity meter and/or a Price AA or Pygmy velocity meter (depending on stream depth); velocities will be measured at 6/10ths depth in the water column for depths less than 2.5 ft, and at 2/10ths and 8/10ths depth in the water column for depths greater than 2.5 ft;

Depending upon the hydraulic characteristics of a given transect, a stage:discharge relationships will be developed using one of three methods: a log-log regression method (rating curve developed using the program STGQS4), a channel geometry and roughness method (rating curve developed using the Manning's Equation based program MANSQ), or a step-backwater method (rating curve developed using the program WSP).

- 4) Velocities across each transect will be calibrated to provide a realistic distribution of mean column velocities across the river channel for the entire range of flows employed in habitat simulations.

Output from the hydraulic simulation modeling will be used in conjunction with final HSI criteria to simulate habitat conditions for each target species and life stage over a wide range of flows. Habitat simulations will be conducted using the HABTAV habitat simulation modeling program. HABTAV uses velocities obtained directly from the hydraulic model (IFG4) output files for habitat area calculations (Milhous et al. 1989). This differs from the HABTAT model (i.e., a program commonly used for simulation modeling), which averages velocity values between adjacent verticals for use in habitat area calculations. Because HABTAT averages adjacent velocities, it generally does not realistically portray the more highly variable velocity distributions that may be present.

Habitat simulations will be conducted using one of two possible methods: 1) the multiple velocity-set regression approach, which is a method often recommended by state agencies; or 2) the multiple "single-velocity set" approach (i.e., Mannings "n" method), which is the most commonly used method since the early 1990s. R2 will collect transect data, which can be employed by both approaches to ensure modeling flexibility.

Weighted usable area (WUA) habitat versus discharge curves will be calculated for each target fish species and life stage for all transects and sites. WUA is a habitat index that combines the quantity and quality of that habitat provided by alternative flows. WUA is expressed in units of square feet of habitat area per 1,000 linear ft of stream (sq-ft per 1,000 ft); (Bovee 1982, Milhous et al. 1989). The WUA versus habitat curves for each site will then be used to estimate total habitat areas (HAs) for each reach (see Bovee 1982). HA is used to express the total habitat area provided by a specified flow for a given river or reach, and is typically expressed in square feet, acres, or hectares. HA combines the amount of WUA provided among the different instream flow transects or reaches present in a river segment. The WUA values for each transect will be weighted according to the total length of habitat represented by the habitat type which the transect(s) represents. For example, if riffle represents 40 percent of the habitat within a reach,

then the WUA values from a single riffle transect in this reach will be weighted by 40 percent in determining total habitat area. Habitat weightings will be based upon the results of the habitat mapping surveys.

Contingent on the availability of flow data, habitat time series and habitat duration curves for each species and life stage will also be computed to identify differences in habitat duration between proposed and natural flow conditions. This will be useful for evaluating the temporal percentage increases/decreases in habitat availability that may result from different operating regimens. The extent of time series steps and duration curve development will be dependent on the period of record and availability of hydrologic data.

Additionally, physical data (water velocity) will be used with hydraulic simulation techniques to determine at which discharges frazil and anchor ice might form, given the generally known water velocities, which favor their development (FERC 1992). Results of simulation modeling will be combined with direct field observation to gain insight into the potential impact of project operation on ice formation.

STEP 7 – Analysis of Power Peaking/Load Following and Ramping Rates

The rate of change of streamflow when diversion is started, stopped, or changed is referred to as the ramping rate. Ramping rate is a concern for fish protection because rapid decreases in flow can strand fish on gravel bars, as well as dewater fish eggs. Drops in flow, even as little as one inch of water surface elevation per hour, can, depending on channel morphology, impact fish populations. Other effects, including depletion of aquatic invertebrates on which fish feed, and behavioral responses to changes in flow, may also reduce fish production but are not well understood.

To avoid or minimize the possible biological impacts of flow fluctuations or minimum flow levels, R2 proposes to conduct an evaluation of flows necessary to provide a critical flow to avoid fish stranding and/or redd dewatering. In conjunction with the agencies, R2 proposes to select 2 or 3 critical sites that are representative of areas within the bypass reach that would be sensitive to impacts associated with flow fluctuations (see Step 3).

Critical sites are sites where juvenile fish are most likely to be stranded if flow stage is reduced rapidly. This can happen where the stream is wide and the cross section has a relatively flat slope, typically at gravel bar or sand bar areas. R2 will identify potential critical flow sites both within the bypass reach and downstream from the powerhouse site (see Step 3).

At each of these sites, one or two transects will be established following procedures described in Step 4 above, and one discharge measurement and associated water surface elevations will be measured at each of the sampled flows. A detailed cross-sectional profile will be determined by surveying elevations along each critical site transect. Stage-discharge measurements will be used to identify critical flows, such as flows that coincide with inflection points on the cross-sectional profile. Stage-discharge relationships will provide a basis for evaluating ramping rates by showing what change in depth and wetted area is produced by what change in flow.

Interim ramping rate criteria, measured as rate of change, have been proposed by the agencies (ADF&G, October 5, 1999 comment letter) as follows:

February 16 to May 31	No ramping during daylight hours; 2 inches per hour maximum at night
June 1 to September 15	1 inch per hour maximum
September 16 to February 15	2 inches per hour maximum

R2 assumes that permanent ramping rate criteria can be established during consultation with agency biologists and that no separate data collection or analysis, other than those previously proposed, will be required.

STEP 8 – Environmental Assessment Preparation

R2 shall utilize the habitat:flow relationships, determination of critical flows, and ramping rate criteria to evaluate the effects of the proposed project operations on the fishery resources in Falls Creek. The results of this analysis shall be presented in a Preliminary Draft Report that shall be submitted to GEC for review and comment.

Pending receipt of comments from GEC, a Draft Report shall be prepared and submitted to the agencies for comment. A subsequent meeting with the agencies shall occur, during which time the overall results of the instream flow study shall be presented. The draft report shall generally contain the following major sections:

- 1) INTRODUCTION – describes context, background and objectives of the study

- 2) DESCRIPTION OF STUDY REACH – description of physical, climatic, topographic and hydrologic area generally, and specifically within the bypass reach. Includes location map of area and detailed map of bypass reach.
- 3) METHODS – discusses specific methods and study elements completed as part of the study
 - 3.1 Habitat Mapping
 - 3.2 PHABSIM Analysis
 - 3.2.1 Transect Selection
 - 3.2.2 Field Measurements
 - 3.2.3 Data Analysis
 - 3.2.4 Habitat Suitability Index Curves
 - 3.2.5 Habitat:flow Relationships
- 4) RESULTS – presents specific results of each study element
 - 4.1 Habitat Mapping
 - 4.2 PHABSIM Analysis – including GIS maps illustrating locations of transects etc.
 - 4.2.1 Transect Selection
 - 4.2.2 Field Measurements
 - 4.2.3 Data Analysis
 - 4.2.4 Habitat Suitability Index Curves – depict curves used; others in Appendix
 - 4.2.5 Habitat:flow Relationship – for target species
 - 4.2.5.1 Reach 1
 - 4.2.5.2 Reach 2
 - 4.2.5.3 Reach 3
 - 4.2.5.4 Reach 4
 - 4.2.5.5 Total Habitat
- 5) DISCUSSION – discusses implications of each of the study elements.
- 6) RECOMMENDATIONS – presents specific recommendation pertaining to: 1) additional study needs and analysis to further address agency concerns; 2) possible operational modifications to test certain hypothesis that may have developed from initial studies; 3) suggested instream flows for bypass reach.

APPENDIX A

Tables and Figures

Table 1. Fish species and life stages of concern for the Falls Creek Instream Flow Study

Species	Life Stage	Segment*
Dolly Varden char (<i>Salvelinus malma</i>)	Adult migration and rearing, spawning/incubation, juvenile, fry	Lower
Pink salmon (<i>Oncorhynchus gorbuscha</i>)	Adult migration and holding, spawning/incubation, fry migration	Lower
Chum salmon (<i>O. keta</i>)	Adult migration and holding, spawning/incubation, fry migration	Lower
Coho salmon (<i>O. kisutch</i>)	Adult migration and holding, spawning/incubation, juvenile, fry	Lower
Cutthroat trout (<i>O. clarki</i>)	Adult migration and rearing, spawning/incubation, juvenile, fry	Lower
Dolly Varden char (<i>Salvelinus malma</i>)	Adult rearing, juvenile, fry spawning/incubation	Upper

*Lower – downstream of the lower most impassable falls (Reach 1).

Upper – upstream of lower most impassable falls (Reaches 2, 3, and 4).

Table 2. Stream channel type characteristics for the two predominate channel types found within the Falls Creek Project area. (Adapted from Paustian et al. 1992)

Channel Type	Channel Characteristics
Large Contained (LC)	Low to moderate gradient (1-3%) channels that are moderately to deeply incised within low gradient landforms. High flows are generally contained within the active channel, and stream power is moderate to high, resulting in sporadic and discontinuous depositional features. Stream banks in large contained channels are relatively stable due to the high amounts of bedrock and boulder incorporated into them. Although LWD accumulation have limited influence on these channel, larger piece of debris incorporated into the stream bed can have an important function trapping gravel and cobble substrate used for spawning. Smaller or broken pieces of woody debris recruited into this channel type are generally distribute to downstream waters. Riparian management should emphasize protection of steep, unstable sideslopes to reduce potential of mass erosion. Large contained channels are frequently accessible to adult salmonids, however, partial or complete barriers can occur at bedrock knickpoints. These channels are frequently used by spawning pink, chum, and steelhead species, and occasionally by coho. These channels support some good rearing area, especially in reaches with stable large woody debris and boulder-pool habitats.
Moderate Gradient Contained (MC)	Moderate gradient (2-6%) transport dominated channels with moderate to high stream power. High flows are completely contained within the active channel. These channels are generally sediment transport systems due to high to moderate channel gradient and high flow containment. Stream bank erosion is variable due to high degree of bedrock control. Shallow sideslope mass wasting is the primary source of sediment recruitment. Large woody debris plays a minor role in channel development as coarse channel substrates provide most channel roughness elements. Moderate gradient contained channels are generally not accessible to anadromous salmonids due to migration barriers within these reaches. Available spawning areas are extremely restricted due to limited gravel storage. Some rearing areas are provided by large debris jams and boulder pools. Overwintering habitat is generally marginal with some use by Dolly Varden in deep scour pools.

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
Anadromous Reach	Old Log Bridge	1	Pool	2	6.6
		2	Pool	10	32.8
	Bend to right	3	Riffle	7	23.0
		4	Riffle	4	13.1
		5	Riffle	25	82.0
		6	Pool	15	49.2
	Stream Gauge	7	Pool	4	13.1
		8	Riffle	10	32.8
		9	Riffle	18	59.0
		10	Pool	6	19.7
	LWD Jam	11	Riffle	25	82.0
		12	Pool	8	26.2
	LWD Jam	13	Riffle	6	19.7
		14	Riffle	18	59.0
	Boulder	15	Glide	6	19.7
		16	Riffle	13	42.6
	Channel split/Island	17	Riffle	11	36.1
		18	Pool	2	6.6
	Right-hand channel	19	Riffle	7	23.0
		20	Pool	4	13.1
		21	Riffle	7	23.0
		22	Riffle	6	19.7
	Bend to left	23	Riffle	9	29.5
		24	Pool	2	6.6
	Overhead Log	25	Pool	13	42.6
		26	Cascade	1	3.3
	LWD Jam	27	Riffle	4	13.1
		28	Riffle	12	39.4
	Central Gravel Bar	29	Pool	8	26.2
		30	Riffle	11	36.1
	Center LWD	31	Pool	23	75.4
		32	Pool	4	13.1
	Gravel RB	33	Riffle	6	19.7
		34	Riffle	15	49.2
	Top island/LWD jam	35	Pool	2	6.6
		36	Cascade	4	13.1
	Diagonal log				

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
		37	Riffle	10	32.8
		38	Glide	9	29.5
		39	Pool	3	9.8
		40	Riffle	10	32.8
	Chute on bend to right	41	Riffle	4	13.1
		42	Pool	2	6.6
	LWD RB	43	Pool	15	49.2
		44	Riffle	16	52.5
		45	Riffle	18	59.0
		46	Pool	2	6.6
		47	Riffle	21	68.9
		48	Glide	10	32.8
	Central Gravel Bar	49	Riffle	23	75.4
	3 Logs	50	Riffle	12	39.4
		51	Glide	9	29.5
	Begin LWD jam	52	Pool	9	29.5
		53	Pools	10	32.8
		54	Riffle	10	32.8
		55	Riffle	5	16.4
		56	Pool	16	52.5
	End LWD jam	57	Pool	22	72.2
	Gravel Bank	58	Riffle	20	65.6
	LWD/Gravel	59	Pool	20	65.6
	Begin Gravel Bar	60	Riffle	17	55.8
	LWD Cross	61	Riffle	20	65.6
	End gravel bar	62	Pools	3	9.8
		63	Pool	20	65.6
		64	Riffle	5	16.4
		65	Pool	4	13.1
		66	Pool	3	9.8
		67	Cascade	4	13.1
		68	Pool	3	9.8
		69	Glide	4	13.1
		70	Riffle	4	13.1
		71	Pool	4	13.1
		72	Riffle	4	13.1
	End LWD cross	73	Riffle	5	16.4
	Coho Upper Limit	74	pool	26	85.3

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
	Begin Bedrock	75	Riffle	10	32.8
		76	Cascade	8	26.2
		77	pool	2	6.6
		78	pool	6	19.7
		79	Cascade	29	95.1
		80	Cascade	10	32.8
	Plunge Pool	81	Pool	12	39.4
END REACH #1					
Log Jam	Bottom of Log Jam	82	pool	50	164.0
		83	pool	10	32.8
Hab1		84	Riffle	15	49.2
	Top of Gravel Bar	85	Riffle	29	95.1
		86	Glide	29	95.1
		87	Riffle	5	16.4
		88	Glide	34	111.5
		89	Cascade	2	6.6
		90	Riffle	14	45.9
		91	Glide	3	9.8
		92	riffle	17	55.8
		93	Pool	2	6.6
		94	Glide	20	65.6
		95	Pool	4	13.1
		96	Cascade	9	29.5
		97	Glide	10	32.8
		98	Cascade	42	137.8
	Sharp Left Bend	99	Riffle	10	32.8
		100	Cascade	24	78.7
		101	Pool	3	9.8
		102	Cascade	6	19.7
		103	Cascade	21	68.9
		104	Pool	3	9.8
		105	Cascade	28	91.8
	Sharp Right Bend	106	Riffle	52	170.6
	0.75m Falls	107	Cascade	4	13.1
		108	Riffle	21	68.9
		109	riffle	2	6.6
		110	Riffle	32	105.0

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
	Sharp Left Bend	111	Riffle	24	78.7
		112	Glide	4	13.1
		113	Riffle	23	75.4
		114	Cascade	18	59.0
		115	Riffle	2	6.6
		116	Glide	9	29.5
		117	Riffle	5	16.4
		118	Cascade	5	16.4
		119	Glide	5	16.4
		120	Pool	13	42.6
END REACH #2					
	Overhead Log	121	Cascade	3	9.8
		122	Cascade	11	36.1
		123	Cascade	18	59.0
		124	pool	21	68.9
	Small Trib. RB	125	Cascade	8	26.2
		126	Cascade	9	29.5
		127	Cascade	37	121.4
		128	pool	3	9.8
	LWD/Bedrock	129	Riffle	10	32.8
		130	Pool	18	59.0
		131	Cascade	12	39.4
		132	riffle	30	98.4
		133	Cascade	3	9.8
	Small Trib. RB	134	pool	7	23.0
		135	riffle	20	65.6
		136	Cascade	20	65.6
		137	Cascade	8	26.2
		138	Cascade	25	82.0
	1.5m Falls	139	Cascade	16	52.5
		140	pool	25	82.0
		141	Cascade	25	82.0
		142	Cascade	17	55.8
	LWD	143	Riffle	8	26.2
	Gravel in Pool	144	pool	16	52.5
	LWD/Bedrock	145	Cascade	25	82.0
	LWD/Bedrock	146	pool	12	39.4

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
		147	Riffle	14	45.9
	Slide on LB	148	Riffle	10	32.8
		149	Cascade	5	16.4
		150	Riffle	4	13.1
		151	pool	13	42.6
		152	Riffle	5	16.4
		153	Cascade	7	23.0
		154	Cascade	9	29.5
	Gravel in Pool	155	pool	5	16.4
		156	Riffle	11	36.1
		157	Cascade	4	13.1
		158	Cascade	28	91.8
	LWD	159	Cascade	11	36.1
		160	Riffle	10	32.8
		161	Cascade	14	45.9
		162	pool	2	6.6
	3m Trib. RB	163	Cascade	11	36.1
		164	pool	2	6.6
		165	Cascade	4	13.1
		166	pool	2	6.6
		167	Cascade	23	75.4
		168	Riffle	11	36.1
		169	Riffle	6	19.7
	1.5m Falls	170	Cascade	16	52.5
		171	Riffle	11	36.1
		172	pool	6	19.7
		173	Cascade	7	23.0
		174	Riffle	21	68.9
		175	Glide	19	62.3
		176	Pool	8	26.2
		177	Cascade	15	49.2
	Overhead Log	178	Riffle	10	32.8
		179	Cascade	29	95.1
		180	pool	3	9.8
		181	Cascade	23	75.4
		182	pool	9	29.5
		183	Cascade	14	45.9
		184	Pool	9	29.5

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
	Bear Trail	185	Cascade	9	29.5
		186	Cascade	19	62.3
		187	Cascade	15	49.2
		188	Cascade	12	39.4
		189	Riffle	3	9.8
		190	Cascade	5	16.4
	Bear Trail	191	Cascade	13	42.6
		192	Cascade	13	42.6
		193	Pool	12	39.4
		194	Pool	5	16.4
		195	Cascade	4	13.1
		196	pool	17	55.8
		197	pool	20	65.6
	1.5m Falls	198	Cascade	35	114.8
		199	Riffle	10	32.8
		200	pool	3	9.8
		201	Riffle	15	49.2
		202	Cascade	12	39.4
		203	Riffle	3	9.8
	3m Falls	204	Cascade	2	6.6
		205	Cascade	8	26.2
		206	Cascade	16	52.5
		207	pool	7	23.0
		208	Riffle	10	32.8
		209	Cascade	9	29.5
		210	pool	3	9.8
		211	Cascade	5	16.4
		212	Cascade	7	23.0
		213	pool	2	6.6
		214	Cascade	3	9.8
		215	Cascade	13	42.6
		216	Riffle	8	26.2
		217	Cascade	9	29.5
		218	Riffle	16	52.5
		219	Cascade	5	16.4
		220	Cascade	11	36.1
		221	Riffle	3	9.8
		222	Pool	11	36.1

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
	LWD	223	Cascade	2	6.6
	3m Trib. RB	224	Cascade	6	19.7
		225	pool	2	6.6
		226	Cascade	4	13.1
		227	Cascade	2	6.6
		228	pool	2	6.6
		229	Cascade	20	65.6
		230	Cascade	16	52.5
		231	pool	3	9.8
		232	Riffle	8	26.2
		233	pool	2	6.6
		234	Riffle	20	65.6
		235	Cascade	8	26.2
		236	Riffle	23	75.4
		237	pool	2	6.6
		238	Cascade	7	23.0
		239	Riffle	5	16.4
		240	Pool	5	16.4
		241	Cascade	1	3.3
		242	Glide	15	49.2
		243	Pool	8	26.2
		244	Pool	5	16.4
		245	Cascade	16	52.5
		246	Riffle	6	19.7
		247	Pool	4	13.1
	Bear Trail at Notch	248	Riffle	22	72.2
		249	pool	4	13.1
		250	Riffle	8	26.2
		251	pool	7	23.0
		252	Pool	22	72.2
	Bedrock	253	Cascade	8	26.2
		254	pool	4	13.1
		255	Cascade	4	13.1
		256	pool	2	6.6
		257	pool	2	6.6
		258	Cascade	19	62.3
		259	pool	2	6.6
		260	Cascade	13	42.6

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
	Gravel RB	261	Riffle	13	42.6
		262	Cascade	7	23.0
	Boulder	263	Pool	2	6.6
		264	Cascade	15	49.2
	LWD/rocks	265	Cascade	14	45.9
		266	pool	2	6.6
		267	pool	2	6.6
		268	Cascade	12	39.4
		269	Cascade	7	23.0
		270	Pool	3	9.8
	0.75m Step	271	cascade	4	13.1
		272	pool	4	13.1
		273	cascade	5	16.4
	2m Step	274	cascade	22	72.2
	LWD	275	cascade	8	26.2
		276	cascade	6	19.7
		277	pool	5	16.4
	5.25m Falls	278	pool	10	32.8
	8.25m Falls	279	Cascade	40	131.2
	2m Step	280	pool	4	13.1
		281	pool	12	39.4
		282	Cascade	5	16.4
		283	Riffle	8	26.2
		284	Cascade	31	101.7
		285	pool	8	26.2
		286	cascade	12	39.4
		287	Riffle	30	98.4
		288	Pool	5	16.4
		289	Cascade	3	9.8
		290	Riffle	10	32.8
		291	Cascade	6	19.7
END REACH #3					
	LWD	292	Riffle	2	6.6
	Bend to right	293	riffle	33	108.2
	Boulder/Gravel Bar	294	Pool	2	6.6
	Minnow Trap Site	295	Riffle	50	164.0
	Tributary Above	296	Riffle	18	59.0

Table 3. Falls Creek habitat mapping data, Gustavus, Alaska.

Survey	Location	Unit #	Habitat Type	Length (m)	Length (ft)
	Horseshoe	297	pool	15	49.2
		298	Riffle	28	91.8
		299	pool	8	26.2
		300	Riffle	38	124.6
		301	Glide	19	62.3
		302	Cascade	20	65.6
		303	Riffle	10	32.8
		304	pool	8	26.2
		305	Riffle	17	55.8
		306	Cascade	5	16.4
		307	Riffle	22	72.2
		308	Riffle	117	383.8
		309	Cascade	12	39.4
	Small Trib. Left side	310	Riffle	36	118.1
		311	Glide	10	32.8
		312	Cascade	85	278.8
	Sharp Left Bend	313	pool	6	19.7
		314	Cascade	6	19.7
		315	pool	31	101.7
	Island - left channel	316	Glide	15	49.2
		317	Riffle	17	55.8
		318	glide	29	95.1
		319	Riffle	30	98.4
	Island - right channel	320	Glide	15	49.2
		321	Riffle	76	249.3
	Top of Island	322	Riffle	19	62.3
	Left Bend, Island	323	pool	4	13.1
		324	Riffle	40	131.2
	Top of Island	325	pool	9	29.5
		326	Riffle	72	236.2
		327	Cascade	35	114.8
		328	riffle	58	190.2
	Tributary from right	329	Riffle	26	85.3
END REACH #4					

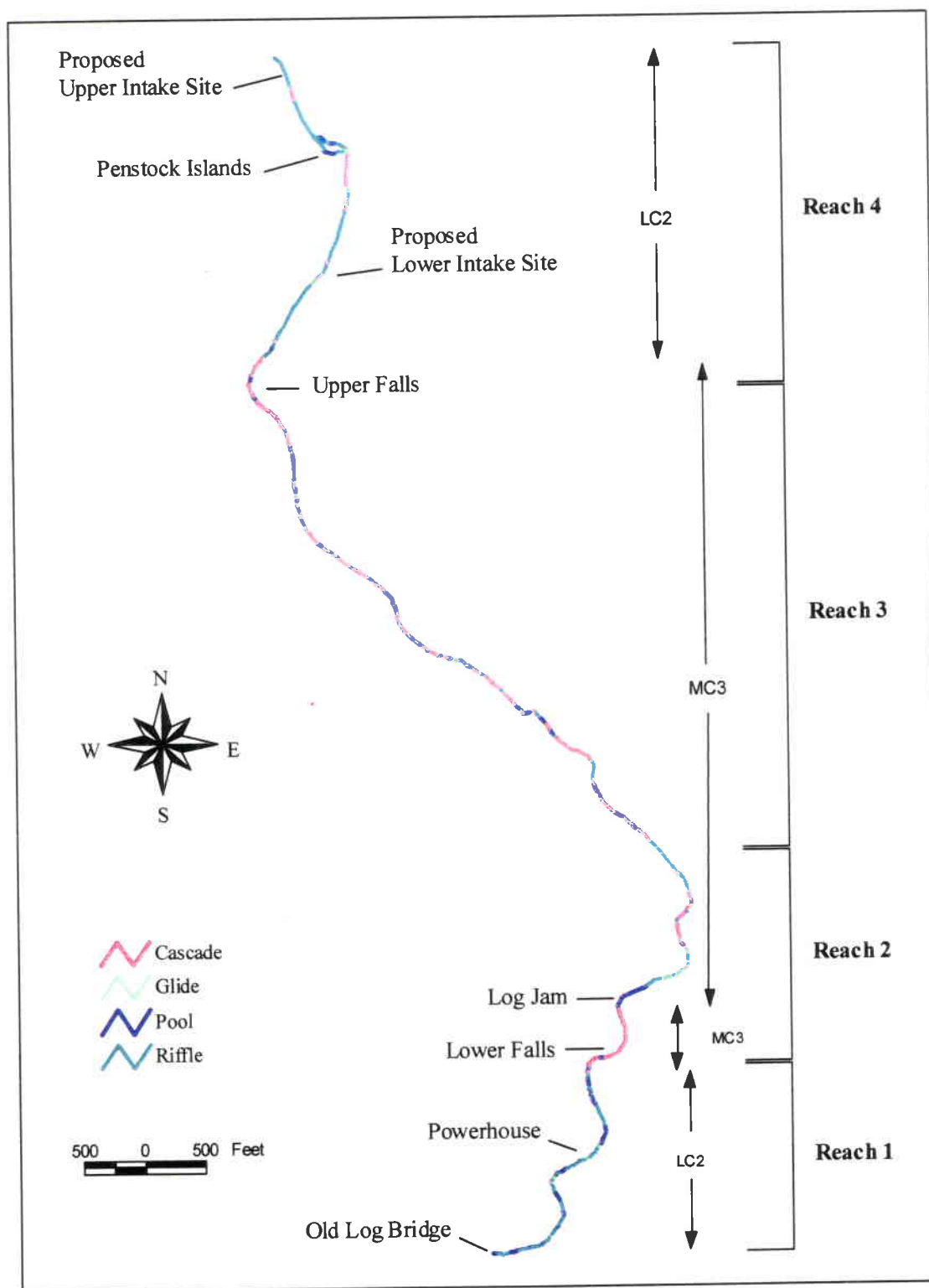
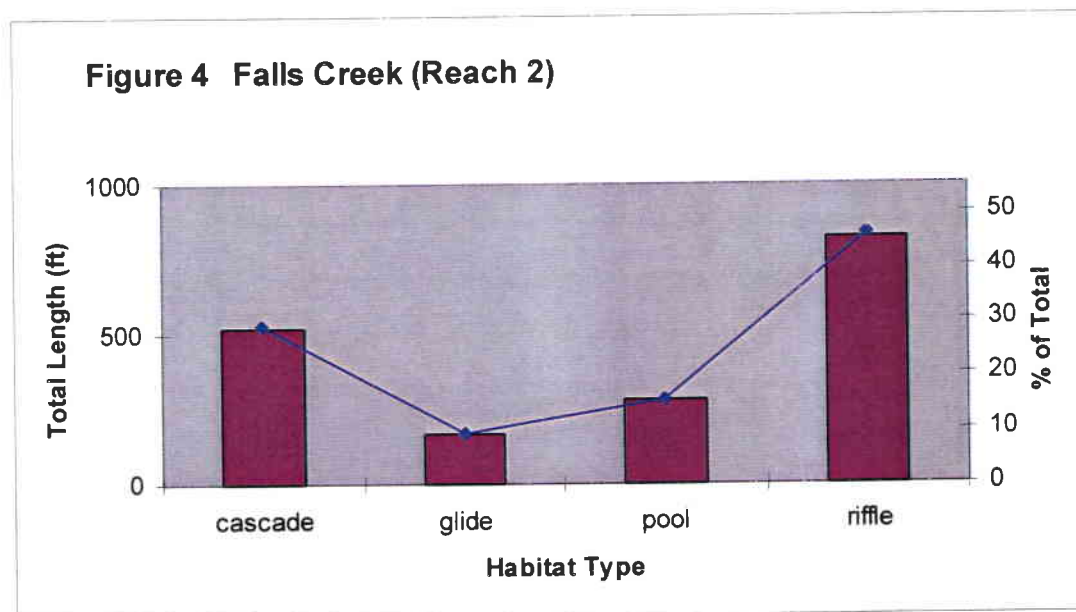
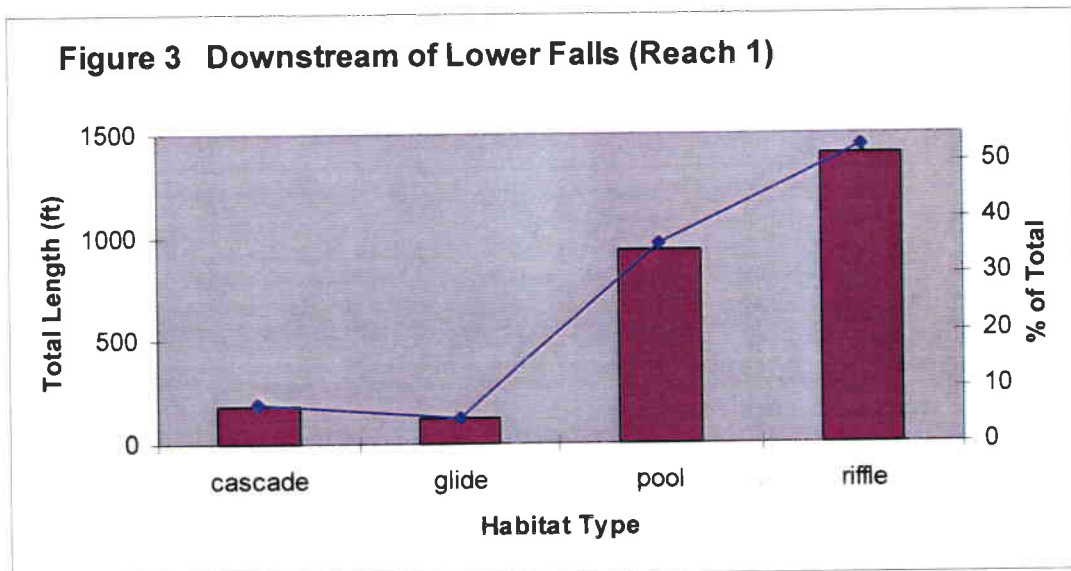


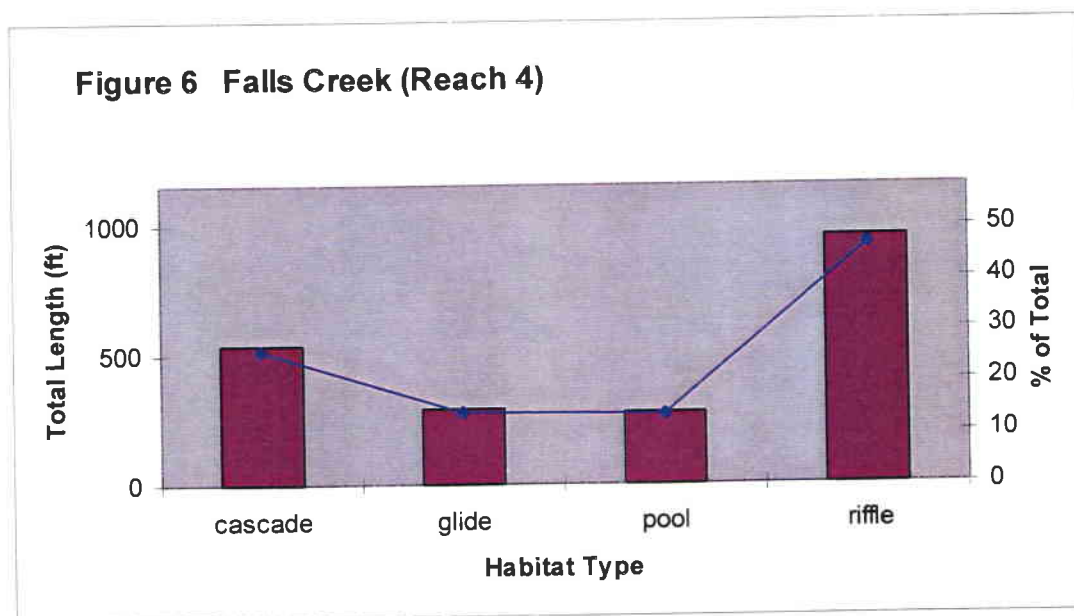
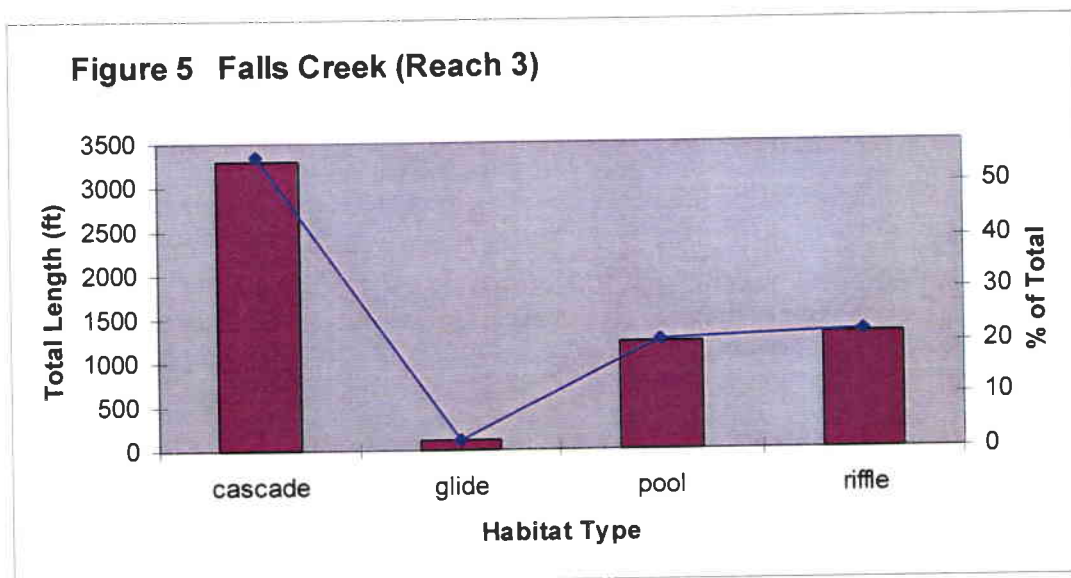
Figure 1. Location map of major habitat features and reach designations, Falls Creek. Gustavus, Alaska.

Species	Freshwater Life Phase	Jan 1-15 16-31	Feb 1-15 16-28	Mar 1-15 16-31	Apr 1-15 16-30	May 1-15 16-31	Jun 1-15 16-30	Jul 1-15 16-31	Aug 1-15 16-31	Sep 1-15 16-30	Oct 1-15 16-31	Nov 1-15 16-30	Dec 1-15 16-31
REACH 1													
Dolly Varden	Adult Rearing												
	Spawning												
	Incubation												
	Fry Emergence												
	Juvenile Rearing												
Cutthroat	Juvenile Outmigration			after 1 - 4 years in freshwater									
	Adult Rearing												
	Spawning			Migration									
	Incubation												
	Fry Emergence												
Coho	Juvenile Rearing												
	Juvenile Outmigration			after 1 - 4 years in freshwater									
	Adult Migration												
	Spawning												
	Incubation												
Pink	Fry Emergence												
	Juvenile Rearing												
	Juvenile Outmigration			after 0 - 3 years in freshwater									
	Adult Migration												
	Spawning												
Chum	Incubation												
	Fry Outmigration						age 0 only						
	Adult Migration												
	Spawning												
	Incubation												
REACH 2 - 4													
Dolly Varden	Fry Outmigration						age 0 only						
	Adult Rearing												
	Spawning												
	Incubation												
	Fry Rearing												
Dolly Varden	Juvenile Rearing												
	Adult Rearing												
	Spawning												
	Incubation												
	Fry Rearing												

Figure 2. Fish species and life stage periodicities for the Falls Creek Basin, Gustavus, Alaska.



Figures 3 and 4. Total length (ft) and percentage of total length of cascade, glide, pool, and riffle habitat types within Reach 1 (Figure 3) and Reach 2 (Figure 4) of Falls Creek, Alaska, as determined from habitat mapping.



Figures 5 and 6. Total length (ft) and percentage of total length of cascade, glide, pool, and riffle habitat types within Reach 3 (Figure 5) and Reach 4 (Figure 6) of Falls Creek, Alaska, as determined from habitat mapping.

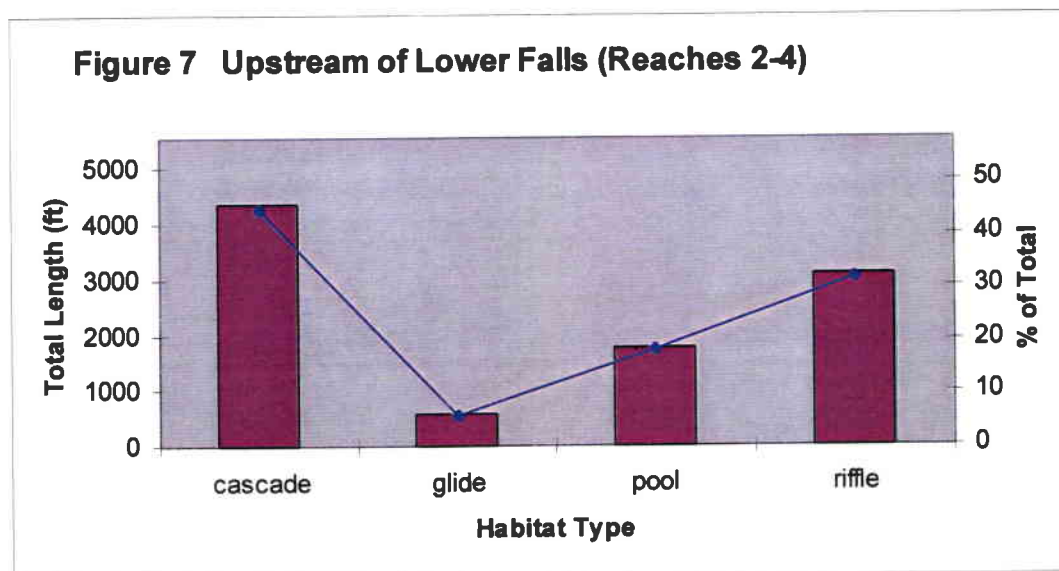


Figure 7. Total length (ft) and percentage of total length of cascade, glide, pool, and riffle habitat types within Reaches 2-4 (Figure 7) of Falls Creek, Alaska, as determined from habitat mapping.

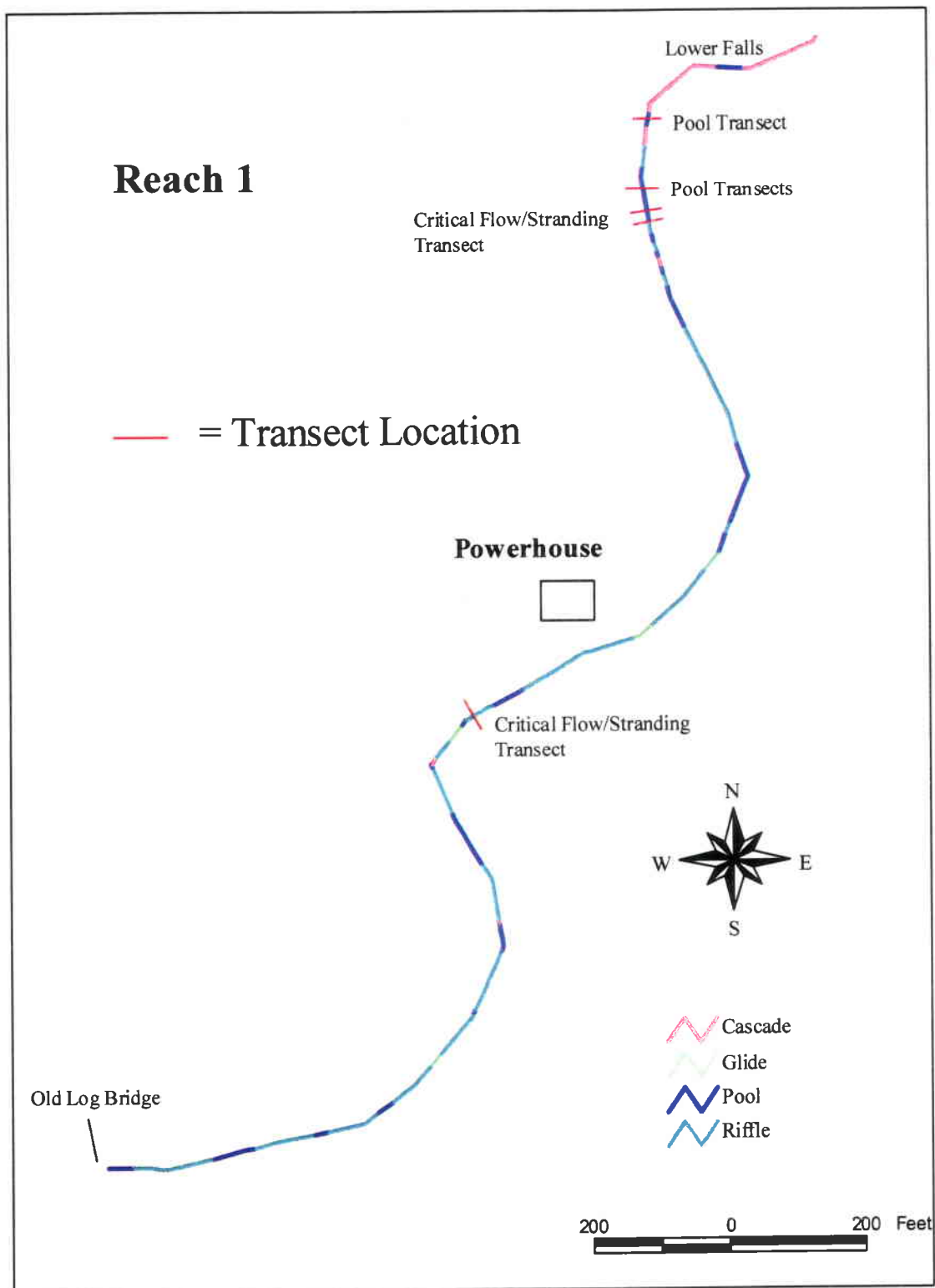
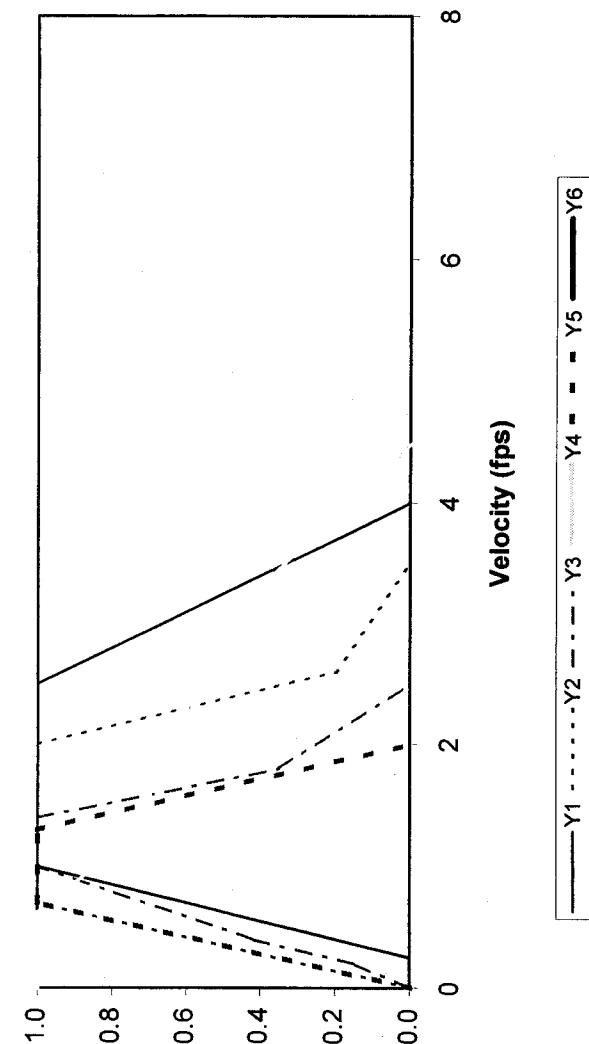


Figure 8. Reach 1 specific habitat type composition and transect placement.

HSI char



Source: Y1 - Baldrige 1981
 Y2 - R2 Resource Consultants 1998
 Y3 - R2 Resource Consultants
 Y4 - WDFW 1996
 Y5 - WDFW 1989
 Y6 - Recommended curve

Location: Y1 - Terror and Kizhuyak Rivers, AK
 Y2 - Lostine River, Oregon
 Y3 - Cedar River, WA and tribs.
 Y4 - Fallback, eastslope Cascade
 Y5 - Fallback (Wells Creek)
 Y6 - ----

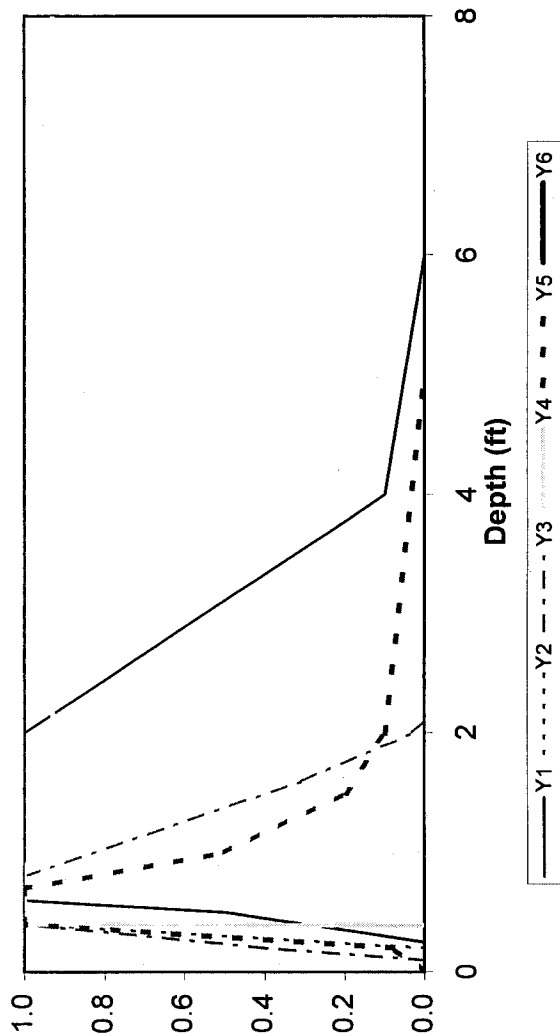
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00	0.00	1.00	0.00	
0.20			0.15			
0.25	0.00					
0.40			0.42			
0.60				1.00		
0.70		1.00			1.00	
1.00	1.00		1.00			
1.25				0.75		
1.30					1.00	
1.40			1.00			
1.80			0.35			
1.90						
2.00		1.00			0.00	
2.50	1.00		0.00			
2.60		0.20				
3.00				0.50		
3.50		0.00				
4.00	0.00					
4.50				0.00		

Figure XX. Species: Native char
 Lifstage: Spawning/Incubation

HSI char

X	Y1	Y2	Y3	Y4	Y5	Y6
0.00					0.00	
0.10			0.00			
0.20		0.00	0.40		0.08	
0.39				0.00		
0.25	0.00					
0.40		1.00	1.00	1.00	1.00	
0.50	0.50					
0.60	1.00					
0.70					1.00	
0.80			1.00			
0.90				1.00		
0.91				0.93		
1.00					0.50	
1.50					0.20	
1.60			0.31			
2.00	1.00		0.03		0.10	
2.10			0.00			
4.00	0.10					
5.00						0.00
6.00	0.00	1.00		0.93		
8.00						

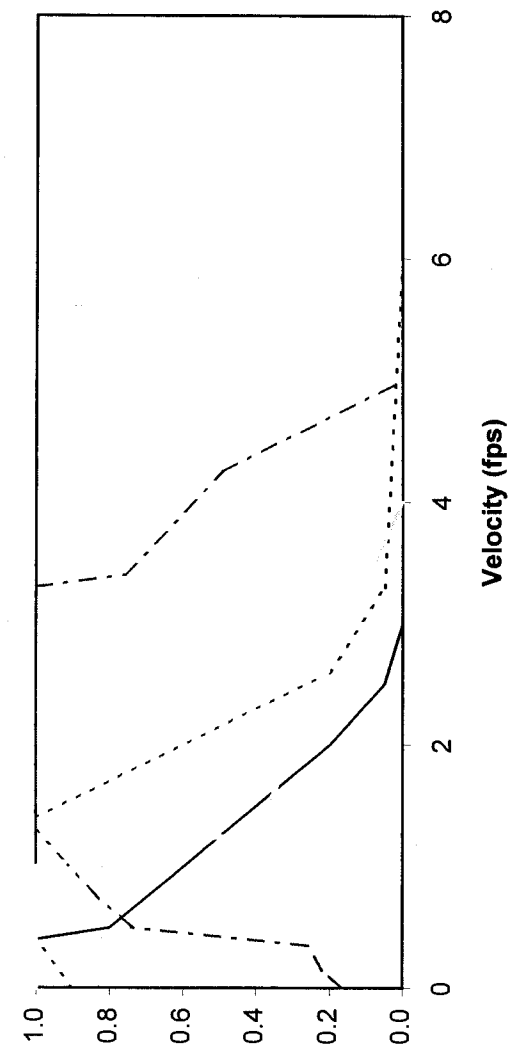
Figure XX. Species: Native char
Lifestage: Spawning/Incubation



Source: Y1 - Baldrige 1981
Y2 - R2 Resource Consultants 1998
Y3 - R2 Resource Consultants
Y4 - WDFW 1996
Y5 - WDFW 1989
Y6 - Recommended curve

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Lostine River, Oregon
Y3 - Cedar River, WA and tribs.
Y4 - Fallback, eastslope Cascade
Y5 - Fallback (Wells Creek)
Y6 - ----

HSI char



Source: Y1 - Baldridge 1981
 Y2 - R2 Resource Consultants 1998
 Y3 - WDFW 1996
 Y4 - WDW 1989
 Y5 - ----
 Y6 - Recommended curve

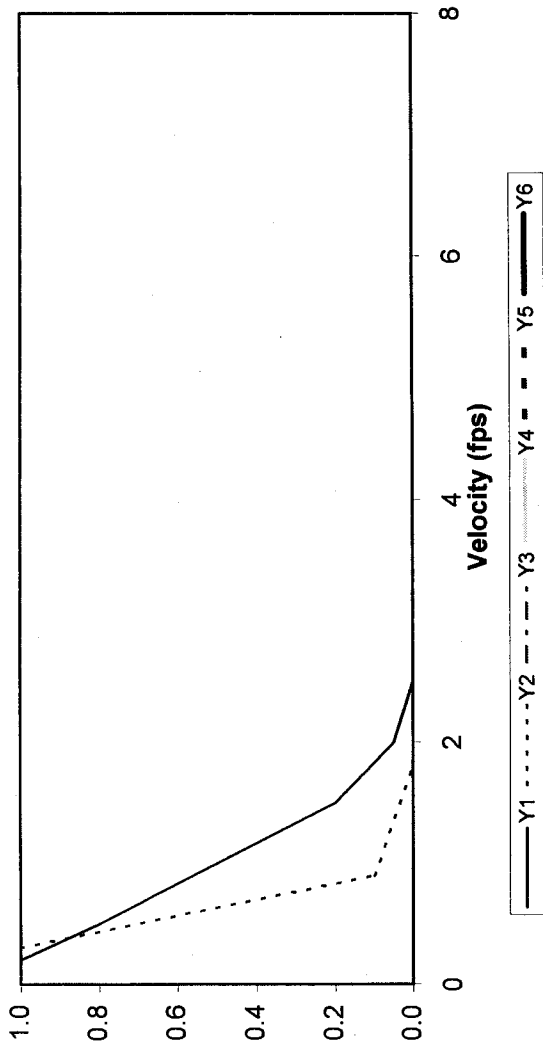
Location: Y1 - Terror and Kizhuyak Rivers, AK
 Y2 - Lostine River, Oregon
 Y3 - Fallback, composite
 Y4 - Fallback
 Y5 - ----
 Y6 - Final

X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	1.00	0.90	0.17	1.00		
0.15			0.22			
0.35			0.26			
0.40	1.00	1.00				
0.50	0.80		0.74			
0.75			0.83			
1.00	0.60			1.00		
1.30			1.00	0.40		
1.40		1.00				
1.50	0.40					
2.00	0.20					
2.50	0.05					
2.60		0.20				
3.00	0.00					
3.30		0.05	1.00			
3.40			0.76			
4.00				0.00		
4.25			0.49			
5.00			0.00			
6.00		0.00				

Figure XX. Species: Native char
 Lifes tage: Juvenile rearing

HSI char

Velocity					
X	Y1	Y2	Y3	Y4	Y5
0.00	1.00	1.00			
0.20	1.00				
0.30		1.00			
0.50	0.80				
0.90		0.10			
1.50	0.20				
1.80		0.00			
2.00	0.05				
2.50	0.00				
3.00	0.00				
4.50					
5.00					
5.50					
6.00					



Depth					
X	Y1	Y2	Y3	Y4	Y5
0.00		0.00			
0.05	1.00				
0.20		0.00			
0.50		1.00			
1.00	1.00				
1.50	0.80				
1.80		1.00			
2.00	0.60	0.20			
2.50	0.40				
2.80		0.00			
3.50	0.20				
4.00	0.10				
5.00	0.00				
8.00					

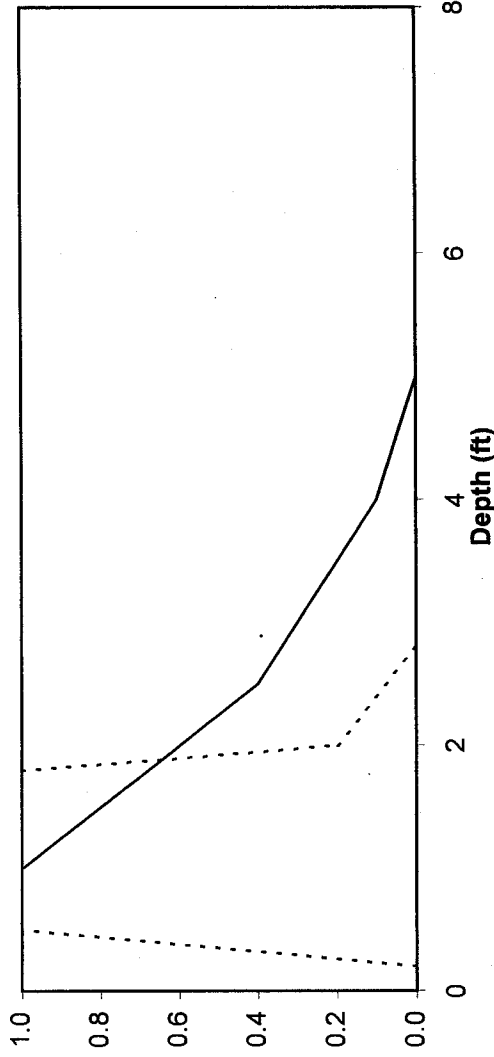


Figure XX. Species: Native char
Lifestage: Fry rearing

Source: Y1 - Baldrige 1981
Y2 - R2 Resource Consultants 1998
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Lostine River, Oregon
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

HSI pink

X	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00		0.00	0.00				0.00
0.08					0.00		
0.10					0.10		
0.30							0.00
0.40	0.00				0.40		
0.41	1.00						
0.50		0.00					
0.90							0.70
1.00				0.00	1.00		
1.30							1.00
1.50		1.00	1.00	0.40			
1.75				0.95			
2.00			1.00	1.00	1.00		
2.25		1.00	1.00	1.00			
2.30							1.00
2.50					0.50		
2.70							0.70
2.75				0.90			
3.50			0.20		0.10		
3.70		0.10					
4.00			0.10				
4.10							0.16
4.25				0.00			
4.90							0.03
5.00	0.00	0.00	0.00		0.00		
8.00			0.00				

Source: Y1 - ADF&G 1981
 Y2 - Raleigh and Nelson 1985
 Y3 - Lyons and Nadeau 1985
 Y4 - Estes et al. 1981
 Y5 - Baldrige 1981
 Y6 - Recommended curve
 Y7 - WDF 1989

Location: Y1 - Generic
 Y2 - Generic
 Y3 - Wilson River, Tunnel Creek, AK
 Y4 - Willow and Deception Creeks, AK
 Y5 - Terror and Kizhuyak Rivers, AK
 Y6 - ----
 Y7 - Generic streams

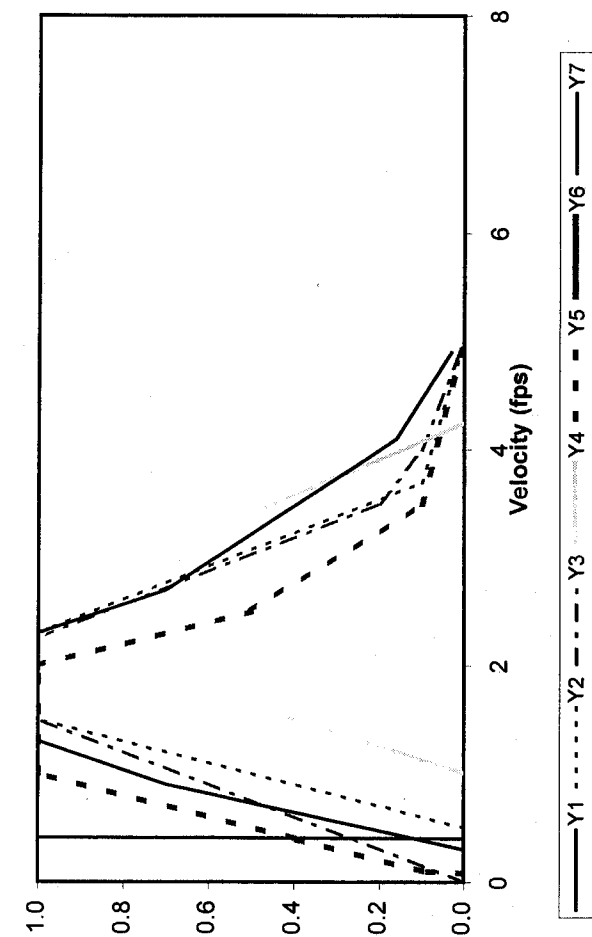


Figure XX. Species: Pink salmon
 Lifstage: Spawning

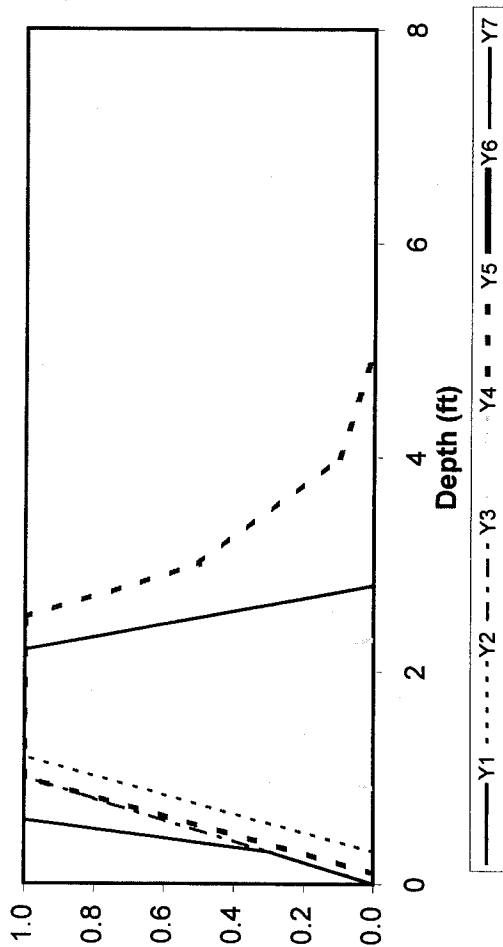
HSI pink

Depth							
X	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00		0.00	0.00				0.00
0.10							
0.30		0.00			0.00		0.30
0.60							1.00
0.80			0.80				
0.90				0.00			
1.00			1.00	0.20	1.00		
1.20		1.00					
1.30				1.00			
1.90				1.00			
2.20							1.00
2.30				0.00			
2.50					1.00		0.50
2.80						0.50	
3.00						0.10	
4.00					0.00		
5.00		1.00	1.00				
8.00							

Figure XX: Species: Pink salmon
Lifestage: Spawning

Source: Y1 - ADF&G 1981
Y2 - Raleigh and Nelson 1985
Y3 - Lyons and Nadeau 1985
Y4 - Estes et al. 1981
Y5 - Baldrige 1981
Y6 - Recommended curve
Y7 - WDF 1989

Location: Y1 - Generic
Y2 - Generic
Y3 - Wilson River, Tunnel Creek, AK
Y4 - Willow and Deception Creeks, AK
Y5 - Terror and Kizhuyak Rivers, AK
Y6 - ----
Y7 - Generic streams



HSI pink

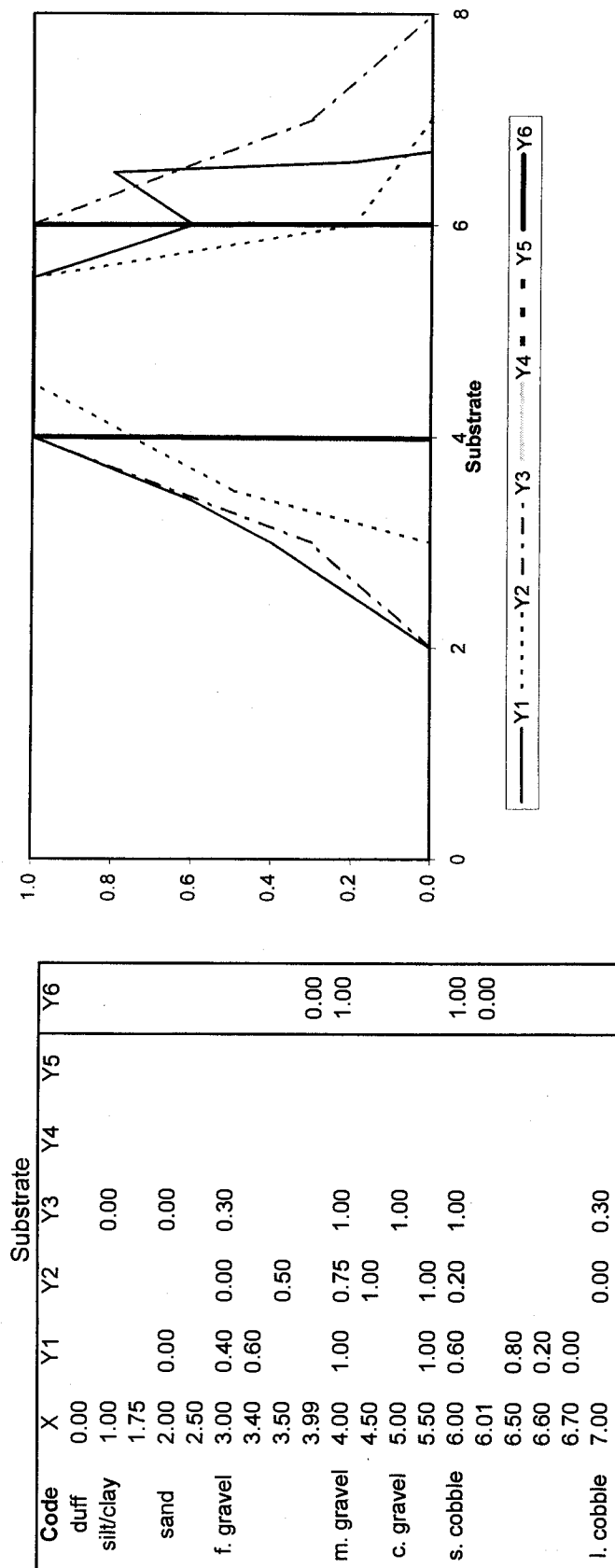


Figure XX. Species: Pink salmon

Lifestage: Spawning substrate

Source: Y1 - Lyons and Nadeau 1985

Y2 - Baldrige 1981

Y3 - DES 1999

Y4 -

Y5 -

Y6 - Krueger 1981

Y1 Wilson River, Tunnel Creek, AK

Y2 Terror and Kizhuyak Rivers, AK

Y3 Skagit River, WA

Y4 -

Y5 -

Y6 generic Alaska

HSI pink

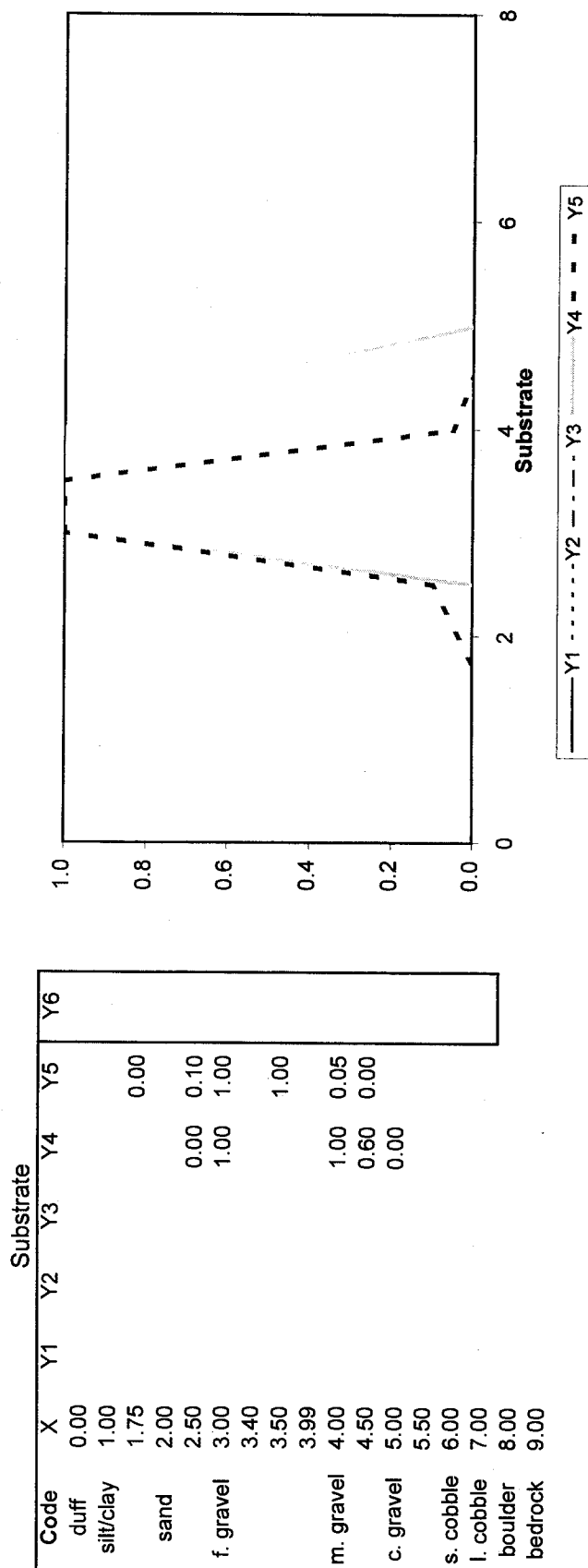


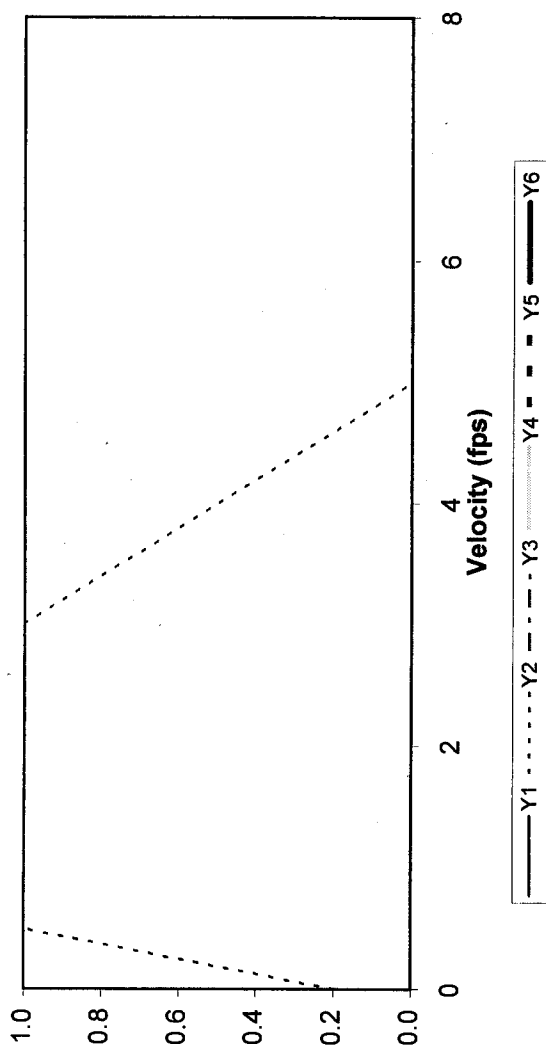
Figure XX. Species: Pink salmon
Lifestage: Spawning substrate

Source: Y1 - ---
Y2 - ---
Y3 - ---
Y4 - Wampler 1980 (assumed IFG coding)
Y5 - Estes et al. 1981
Y6 - Recommended curve

tion: Y1 ---
Y2 ---
Y3 ---
Y4 Skokomish River, WA
Y5 Willow and Deception Creeks, AK
Y6 ---

HSI pink

Velocity						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00		0.20				
0.50		1.00				
1.50						
2.00						
2.50						
3.00		1.00				
3.50						
4.00						
4.50						
5.00		0.00				
5.50						
6.00						
6.50						
8.00		0.00				



Depth						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00		0.00				
0.50		1.00				
2.00						
3.00						
4.00						
5.00						
6.00						
7.00						
7.50						
8.00		1.00				
8.50						
9.00						
9.50						
10.00						

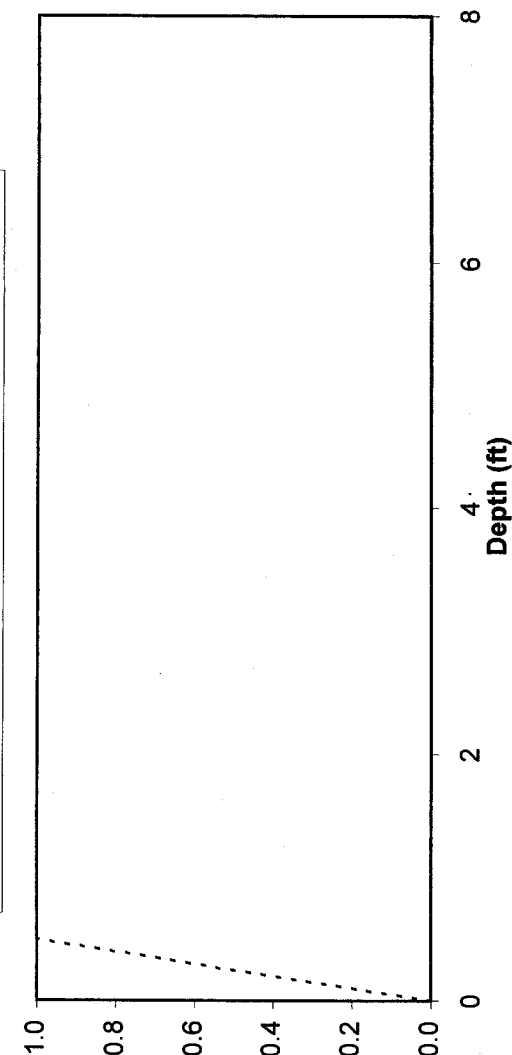


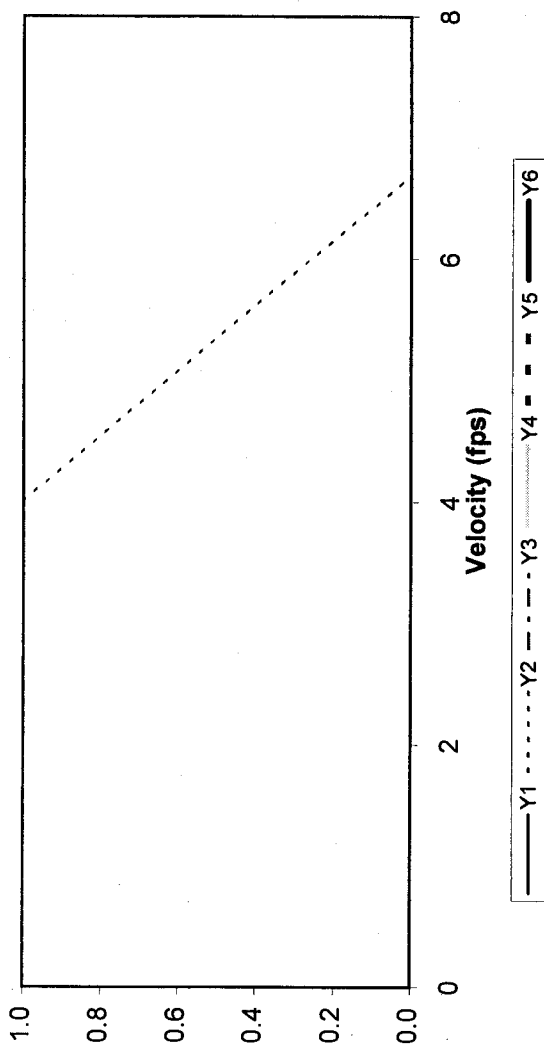
Figure XX. Species: Pink salmon
Lifestage: Fry

Source: Y1 - ----
Y2 - Raleigh and Nelson 1985
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

Location: Y1 - ----
Y2 - Generic
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

HSI pink

Velocity						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00		1.00				
1.00						
1.50						
2.00						
2.50						
3.00						
3.50						
4.00		1.00				
4.50						
5.00						
6.70		0.00				
6.00						
6.50						
8.00		0.00				



Depth						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00		0.00				
0.20		0.00				
0.40	0.00					
0.41	1.00					
0.60		1.00				
4.00						
5.00						
6.00						
7.00						
7.50						
8.00	1.00	1.00				
8.50						

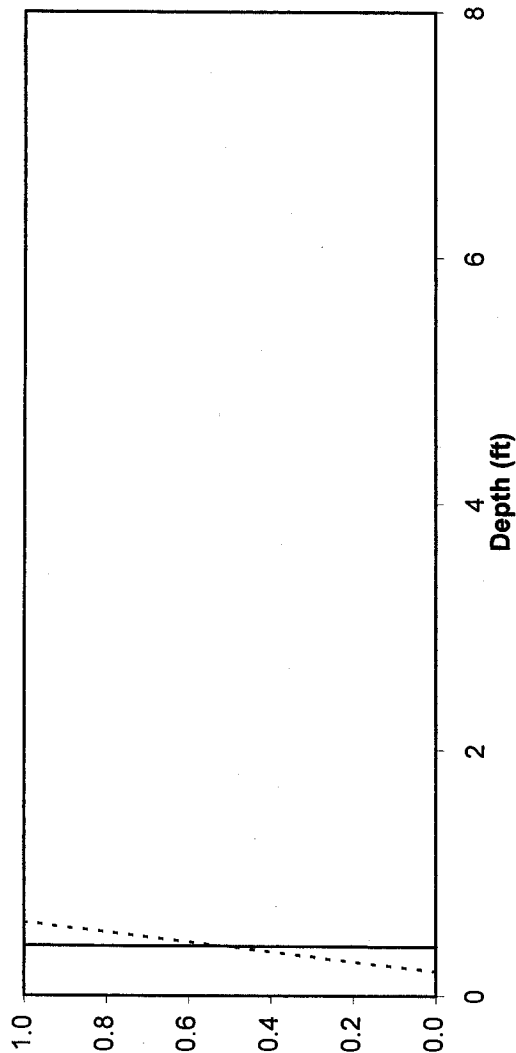


Figure XX. Species: Pink salmon
Lifestage: Adult

Source: Y1 - ADF&G 1981
Y2 - Raleigh and Nelson 1985
Y3 - ---
Y4 - ---
Y5 - ---
Y6 - ---

Location: Y1 - Generic
Y2 - Generic
Y3 - ---
Y4 - ---
Y5 - ---
Y6 - ---

HSI cutthroat

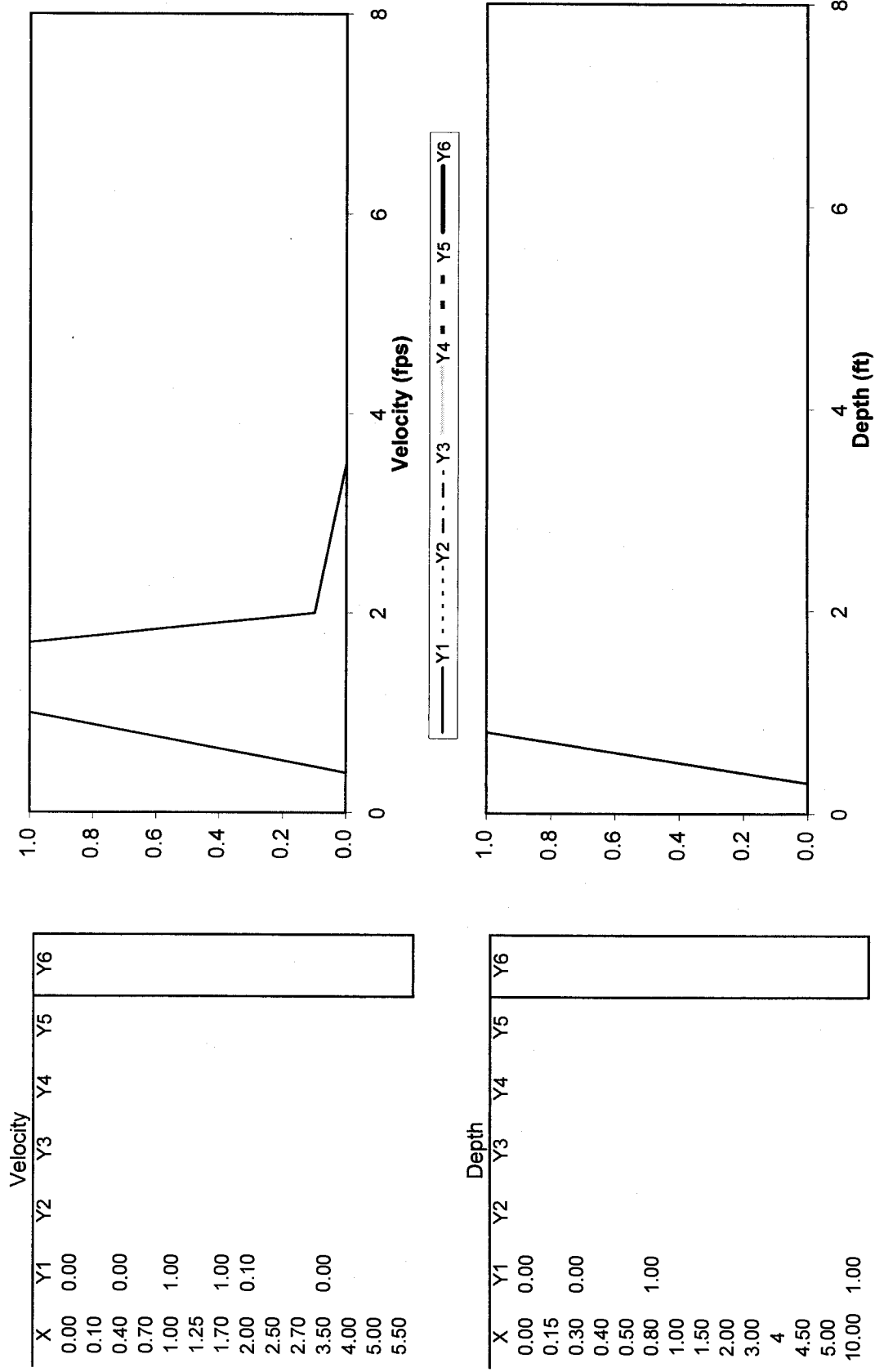


Figure XX. Species: Cutthroat trout
 Lifstage: Spawning/Incubation
 Source: Y1 - WDW 1989
 Y2 -
 Y3 -
 Y4 -
 Y5 -
 Y6 - Recommended curve
 Location: Y1 - fallback (Green River)
 Y2 -
 Y3 -
 Y4 -
 Y5 -
 Y6 -

HSI cutthroat

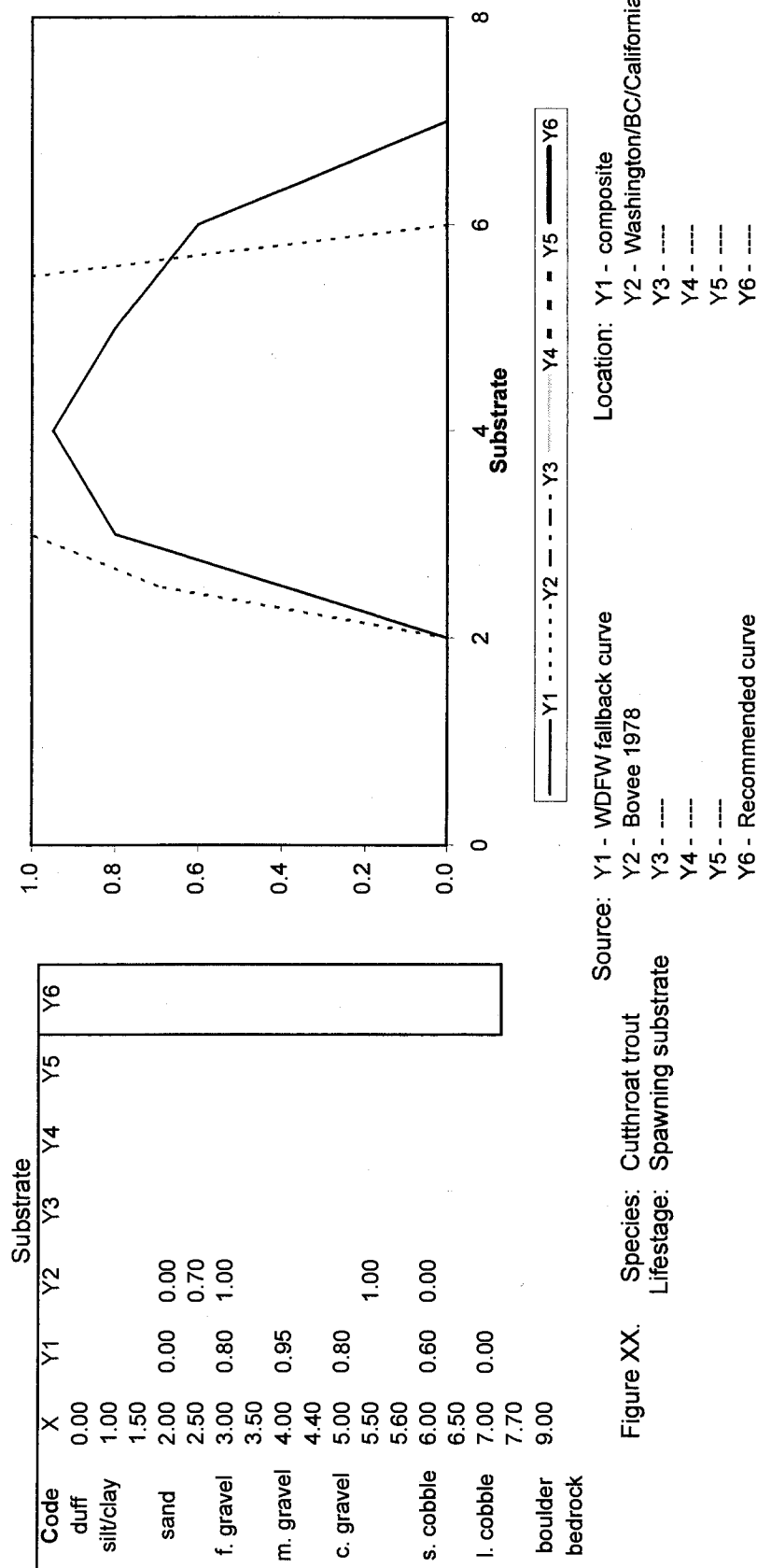
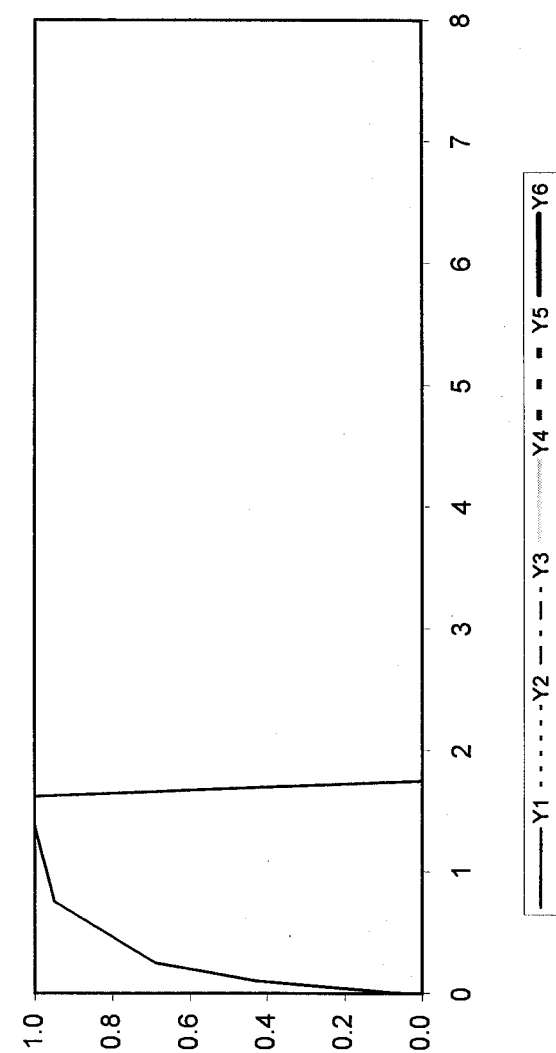
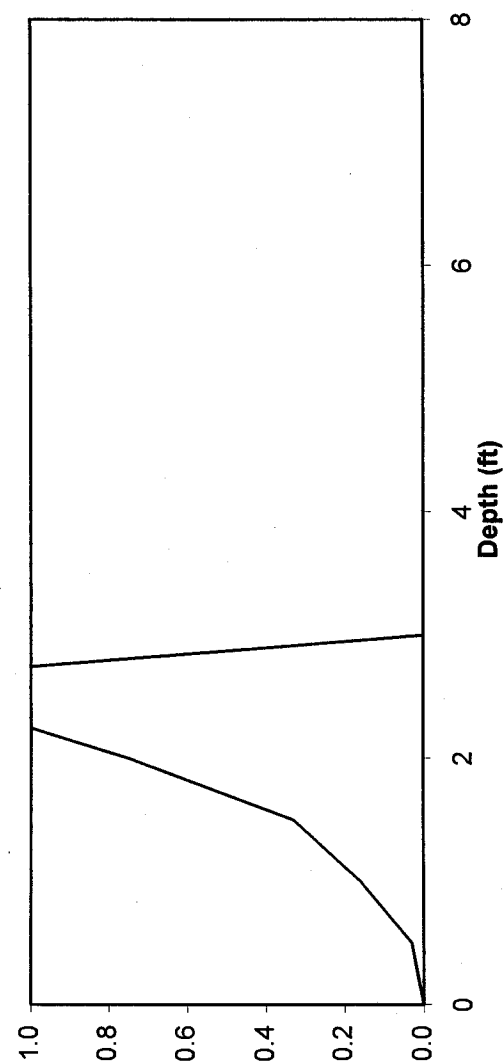


Figure XX. Species: Cutthroat trout
 Lifstage: Spawning substrate

HSI cutthroat



X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.05					
0.10	0.43					
0.25	0.69					
0.75	0.95					
1.37	1.00					
1.62	1.00					
1.75	0.00					
4.00						
4.50						
5.00						
5.50						
6.00						
6.50						
7.00						



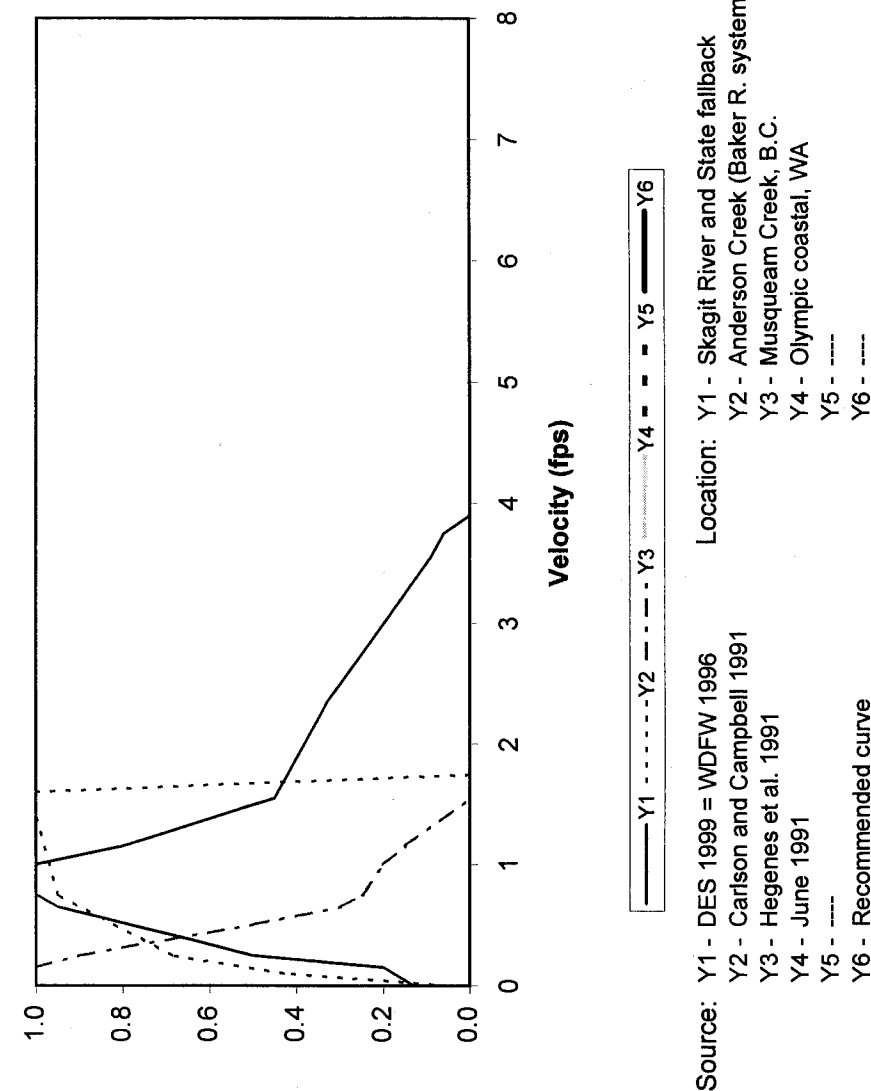
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00					
0.50	0.03					
1.00	0.16					
1.50	0.33					
2.00	0.75					
2.25	1.00					
2.75	1.00					
3.00	0.00					
7.50						
8.00						
8.50						
9.00						
9.50						
10.00						

Figure XX. Species: Cutthroat trout
Lifestage: Juvenile rearing

Source: Y1 - Carlson and Campbell 1991
Y2 - ----
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - Recommended curve

Location: Y1 - Anderson Creek (Baker R. system)
Y2 - ----
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

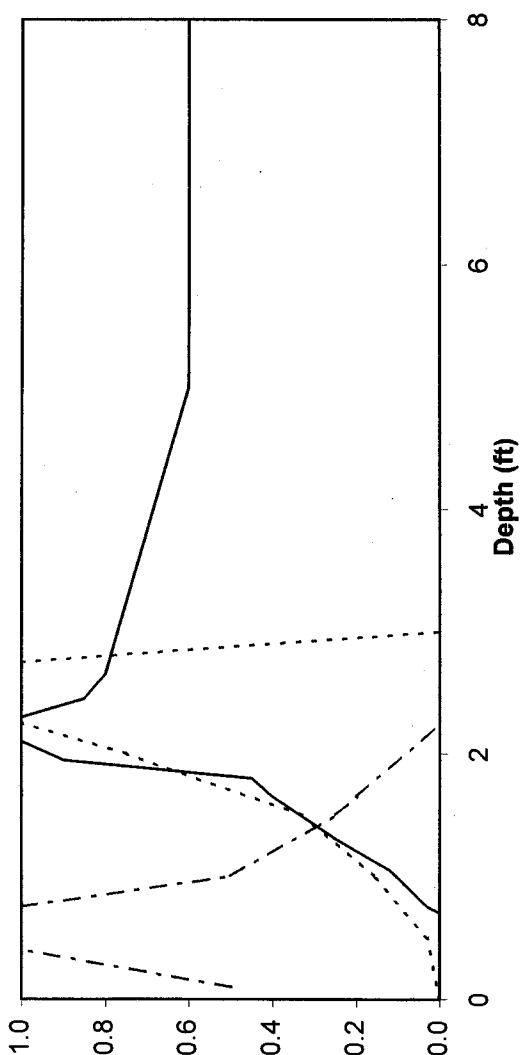
HSI cutthroat



X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.13	0.05				
0.10		0.43				
0.15	0.20		1.00			
0.25	0.50	0.69	0.90			
0.50			0.50			
0.65	0.95		0.30			
0.70						
0.75	1.00	0.95	0.25			
1.00	1.00		0.20			
1.15	0.80		0.15			
1.40		1.00				
1.55	0.45		0.00			
1.60		1.00				
1.75		0.00				
2.35	0.33					
3.25	0.15					
3.55	0.09					
3.75	0.06					
3.90	0.00					
7.00	0.00					

Figure XX. Species: Cutthroat trout
 Lifstage: Adult rearing

HSI cutthroat



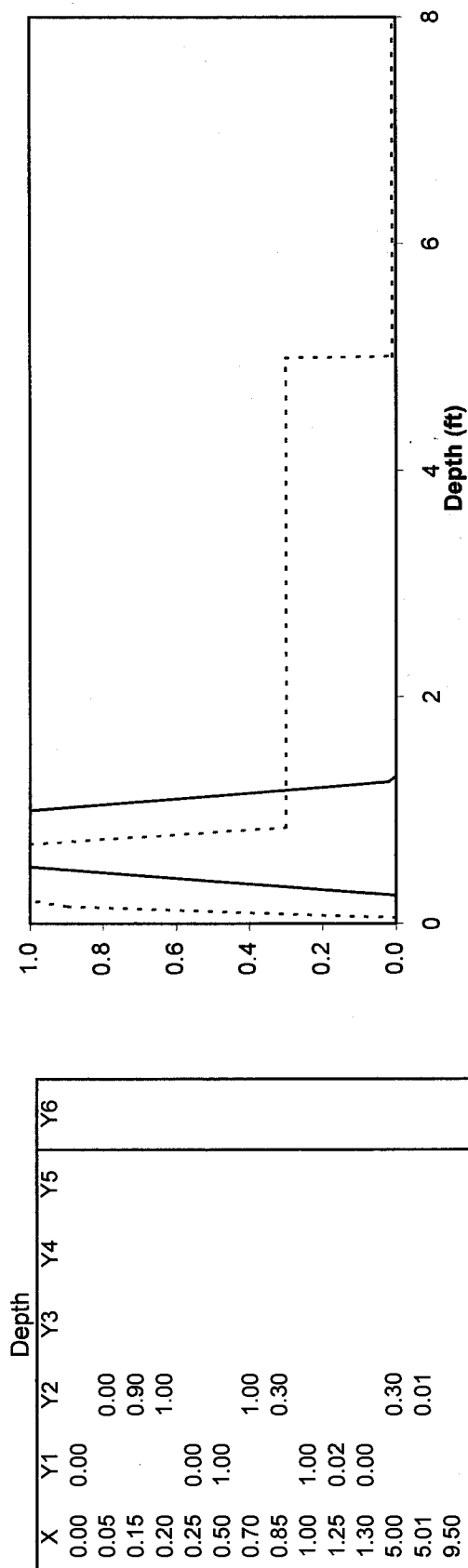
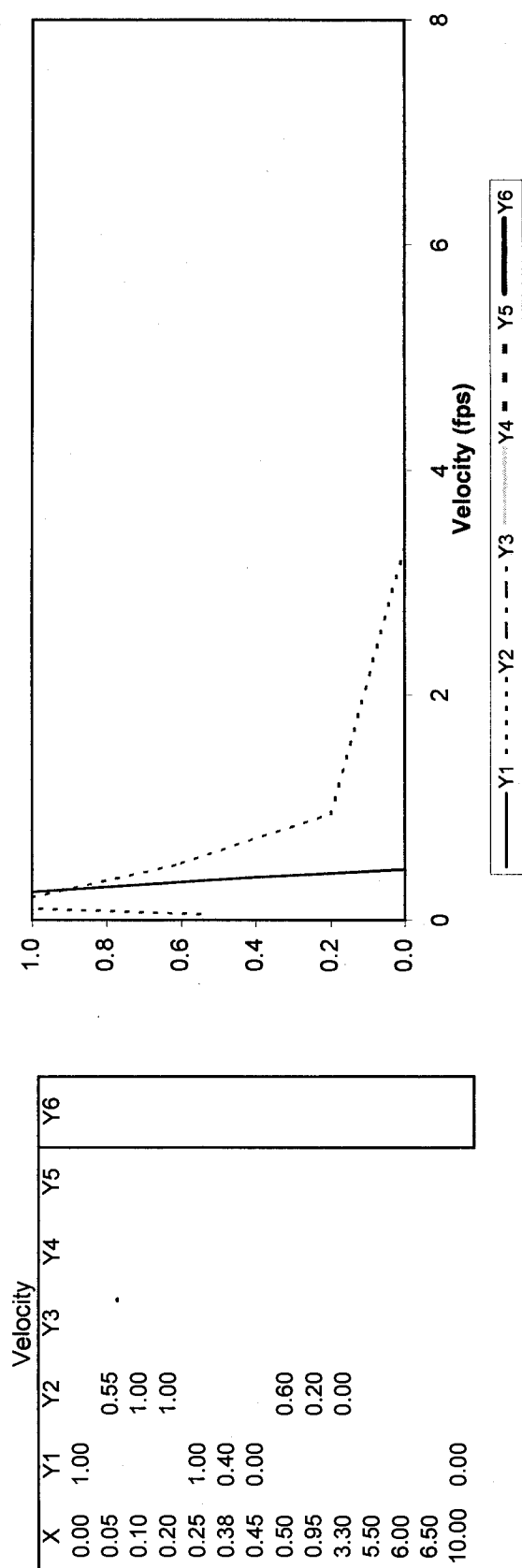
Source: Y1 - DES 1999 = WDFW 1996
Y2 - Carlson and Campbell 1991
Y3 - Heggenes et al. 1991
Y4 - June 1981
Y5 - ----
Y6 - Recommended curve

Location: Y1 - Skagit River and State fallback
Y2 - Anderson Creek (Baker R. system)
Y3 - Musqueam Creek, B.C.
Y4 - Olympic coastal
Y5 - ----
Y6 - ----

X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00				
0.10			0.50			
0.40			1.00			
0.50		0.03				
0.70	0.00					
0.75	0.03		1.00			
1.00		0.16	0.50			
1.05	0.12					
1.30	0.25					
1.50		0.33	0.25			
1.65	0.40		0.20			
1.80	0.45					
1.95	0.90					
2.00		0.75				
2.10	1.00					
2.25		1.00	0.00			
2.30	1.00					
2.45	0.85					
2.65	0.80					
2.75		1.00				
3.00		0.00				
5.00	0.60					
10.00	0.60					

Figure XX. Species: Cutthroat trout
Lifestage: Adult rearing

HSI cutthroat

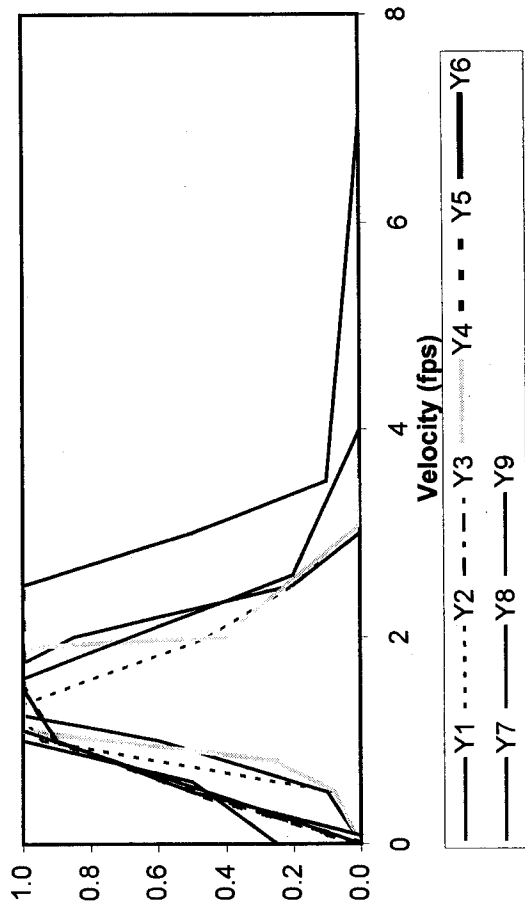
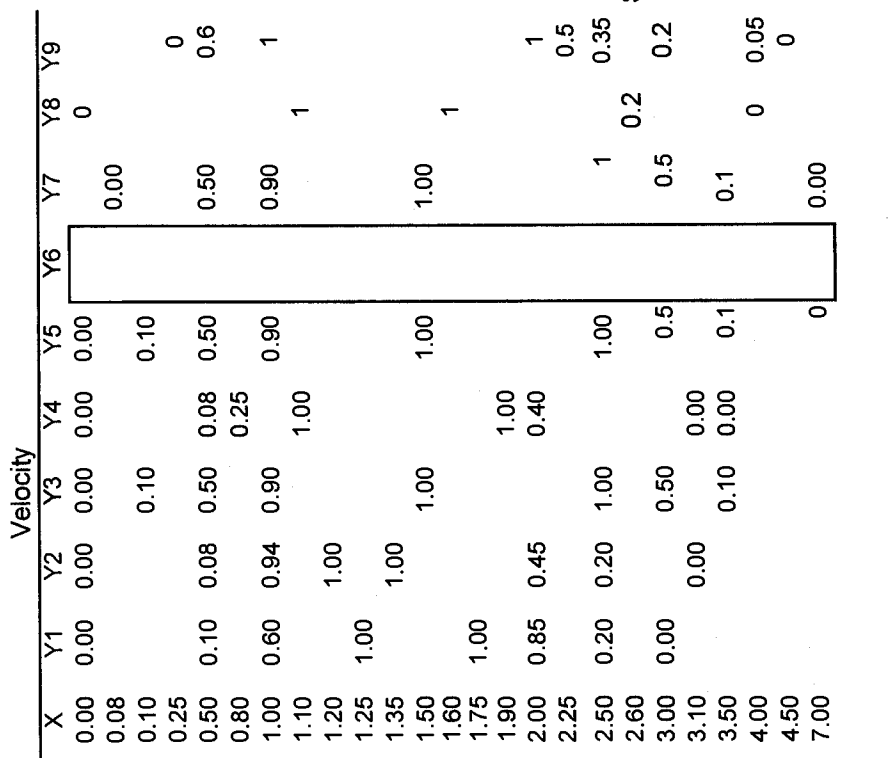


Source: Y1 - Carlson and Campbell 1991
 Y2 - WDFW 1996
 Y3 - ---
 Y4 - ---
 Y5 - ---
 Y6 - Recommended curve

Location: Y1 - Anderson Creek (Baker R. system)
 Y2 - Fallback curve, composite
 Y3 - ---
 Y4 - ---
 Y5 - ---
 Y6 - ---

Figure XX. Species: Cutthroat trout
 Lifstage: Fry rearing

HSI coho

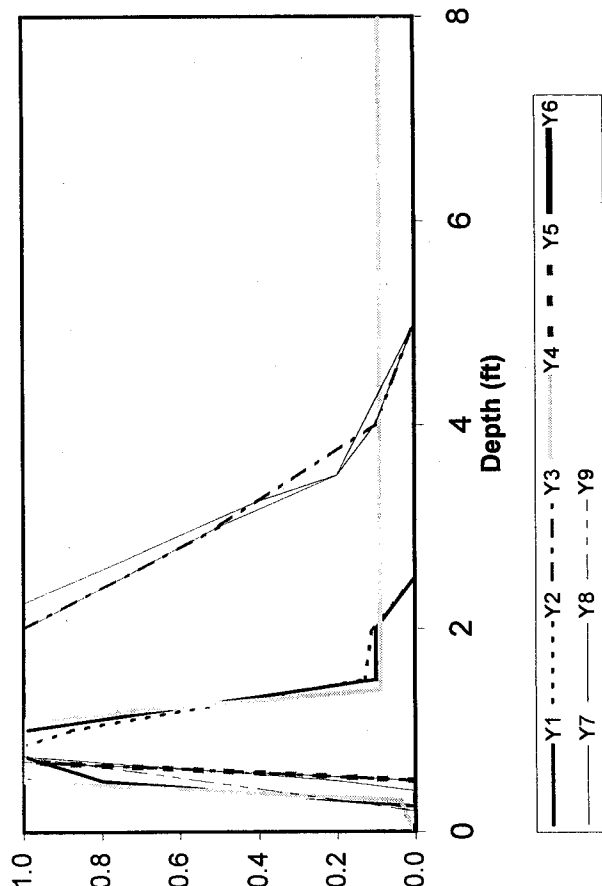


Source: Y1 - Wampler 1980
Y2 - Bovee 1978
Y3 - Baldrige 1981
Y4 - Sams and Pearson 1963
Y5 - Lyons and Nadeau 1985
Y6 - Recommended curve
Y7 - Arctic Environmental 1981
Y8 - R2 Resource Consultants 1998
Y9 - Hosey 1986

Location: Y1 - Skokomish River, WA and tribs.
Y2 - Generic
Y3 - Terror and Kizhuyak Rivers, AK
Y4 - Oregon
Y5 - Wilson R. & Tunnel Creek, AK
Y6 -
Y7 - Terror Lake, AK
Y8 - Lostine River, OR
Y9 - White River, WA

Figure XX. Species: Coho salmon
Lifestage: Spawning/Incubation

HSI coho



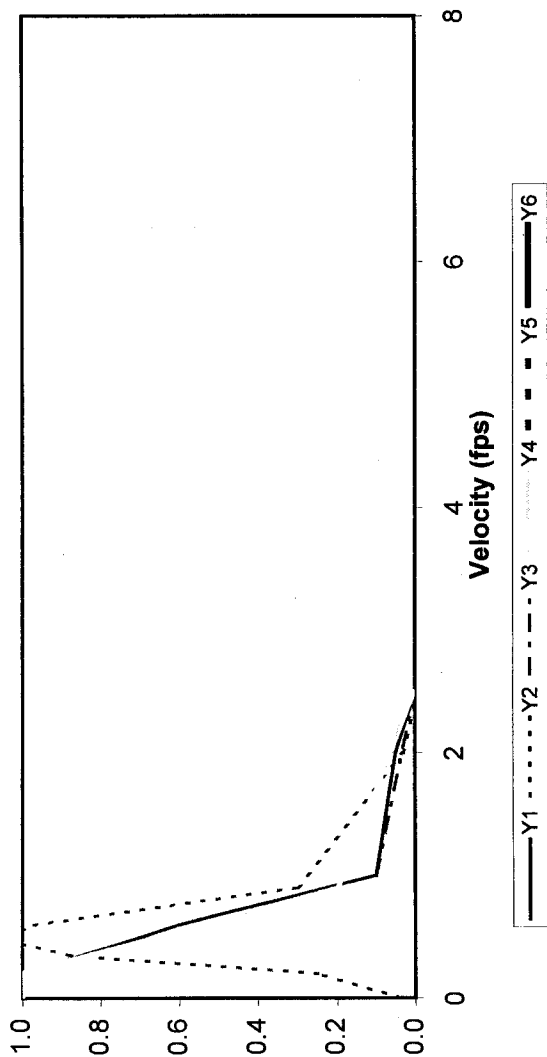
Location: Y1 - Skokomish River, WA and tribs.
Y2 - Generic
Y3 - Terror and Kizhuyak Rivers, AK
Y4 - Oregon
Y5 - Wilson R. & Tunnel Creek, AK
Y6 -
Y7 - White River, WA
Y8 - Terror Lake, AK
Y9 - Lostine River, OR

Depth	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.20	0.00	0.04	0.08	0.04	0.00	0.00	0.00	0.00	0.00
0.25	0.00	0.04	0.08	0.04	0.00	0.00	0.00	0.00	0.00
0.30	0.00	0.04	0.08	0.04	0.00	0.00	0.00	0.00	0.00
0.40	0.00	0.04	0.08	0.04	0.00	0.00	0.00	0.00	0.00
0.50	0.80	0.98	0.00	1.00	0.00	0.00	0.00	0.00	0.00
0.60	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.85	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.10	1.00	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.40	0.10	0.13	1.00	0.09	1.00	1.00	1.00	1.00	1.00
1.50	0.10	0.11	1.00	0.09	1.00	1.00	1.00	1.00	1.00
2.00	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
2.25	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
2.50	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
3.00	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
3.25	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
3.50	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
4	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
5.00	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
6.00	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00
8.00	0.00	0.00	0.50	0.09	1.00	1.00	1.00	1.00	1.00

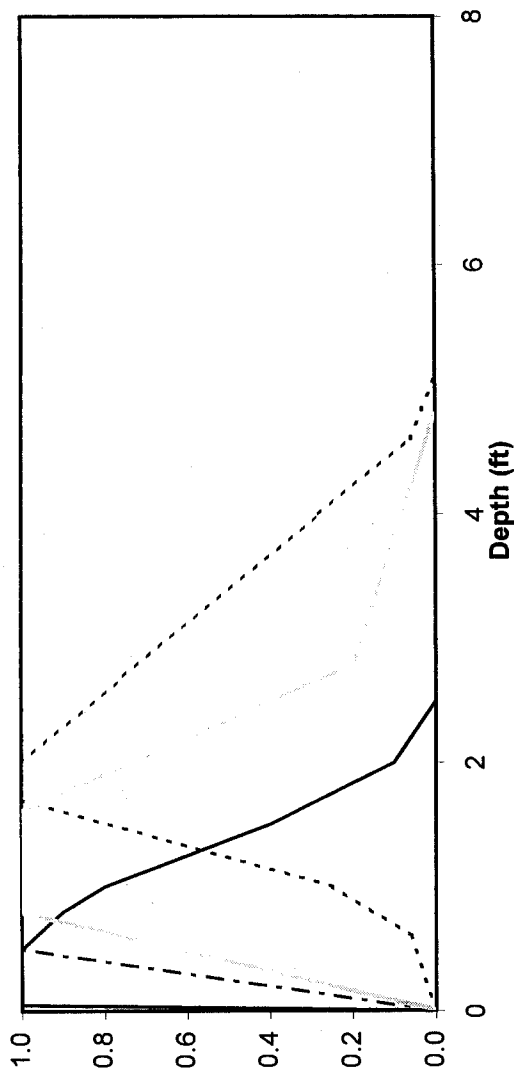
Figure XX. Species: Coho salmon
Lifestage: Spawning/Incubation

HSI coho

Velocity						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	1.00	0.04	1.00	1.00		
0.20	1.00	0.25	1.00	1.00		
0.35		0.88				
0.45		1.00				
0.55		1.00				
0.60	0.60	0.97	0.60			
0.90		0.30		0.20		
1.00	0.10		0.10			
2.00	0.05	0.03				
2.40		0.00				
2.50	0.00		0.00	0.00		
6.00						
6.50						
7.00						



Depth						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00	0.00	0.00		
0.05	1.00					
0.50	1.00		1.00			
0.60		0.06				
0.80	0.90			1.00		
1.00	0.80	0.25				
1.50	0.40			1.00		
1.60						
1.70		1.00				
2.00	0.10	1.00				
2.50	0.00					
2.70		0.75				
2.80						
4.00		0.28		0.20		
4.60		0.06				
4.80						
5.10		0.00	1.00			



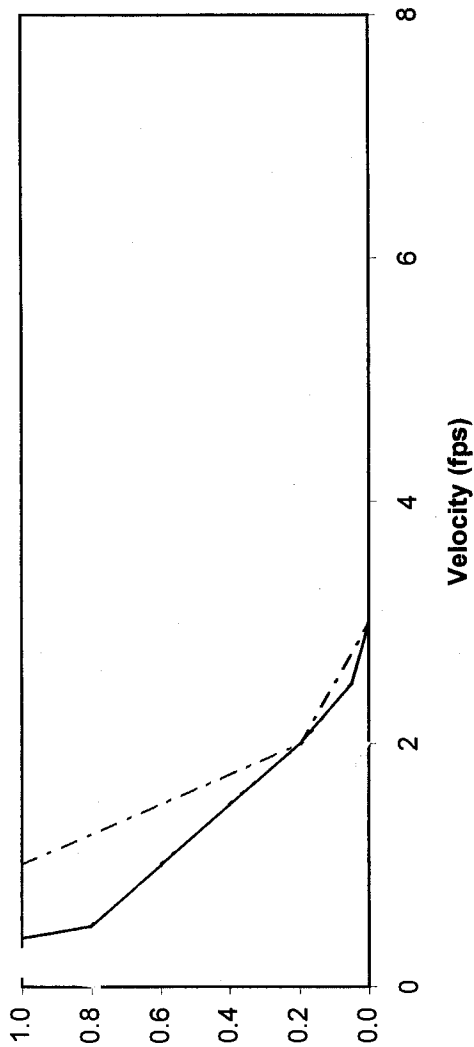
Source: Y1 - Baldrige 1981 (Arctic Env. 1981)
 Y2 - Bovee 1978
 Y3 - Lyons and Nadeau 1985
 Y4 - R2 Resource Consultants 1998
 Y5 - ----
 Y6 - Recommended curve

Location: Y1 - Terror and Kizhuyak Rivers, AK
 Y2 - Generic
 Y3 - Wilson R. & Tunnel Creek, AK
 Y4 - Lostine River, OR
 Y5 - ----
 Y6 - ----

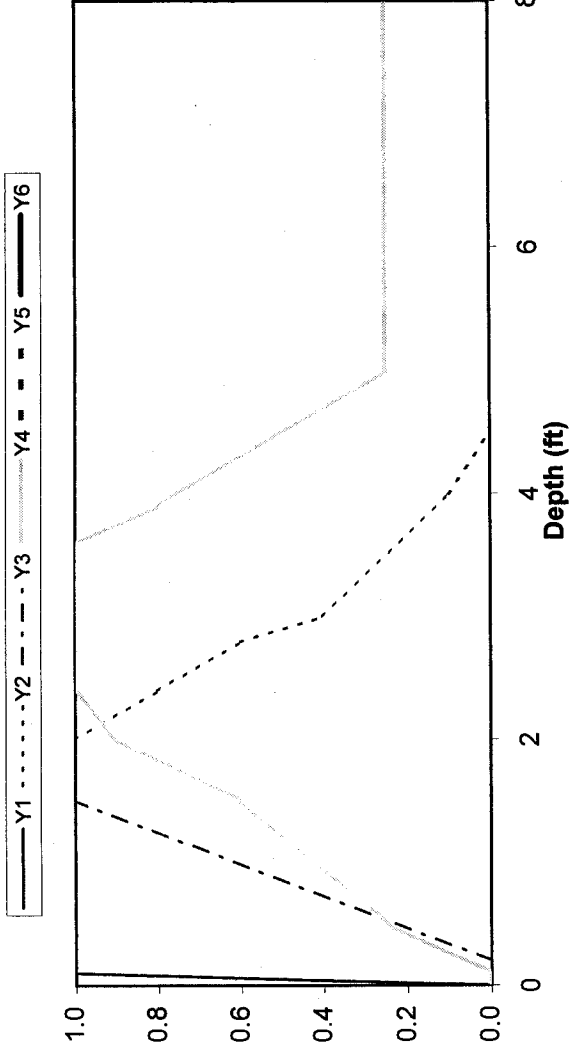
Figure XX. Species: Coho salmon
 Lifstage: Fry rearing

HSI coho

Velocity					
X	Y1	Y2	Y3	Y4	Y5
0.00	1.00	1.00	1.00	0.78	Y6
0.10				1.00	
0.30				1.00	
0.40	1.00	1.00			
0.50	0.80	0.80		0.20	
1.00	0.60	0.60	1.00		
1.10				0.20	
1.50	0.40	0.40			
2.00	0.20	0.20	0.20	0.00	
2.50	0.05	0.05			
3.00	0.00	0.00	0.00		
3.50					
7.00					



Depth					
X	Y1	Y2	Y3	Y4	Y5
0.00	0.00	0.00		0.00	Y6
0.10	1.00	1.00		0.00	
0.20			0.00		
0.50				0.25	
1.40					
1.50			1.00	0.60	
2.00		1.00		0.90	
2.40		0.80		1.00	
2.80		0.60			
3.00		0.40			
3.60				1.00	
3.90				0.80	
4.00		0.10			
4.50		0.00			
5.00			1.00	0.25	
10.00	1.00			0.25	

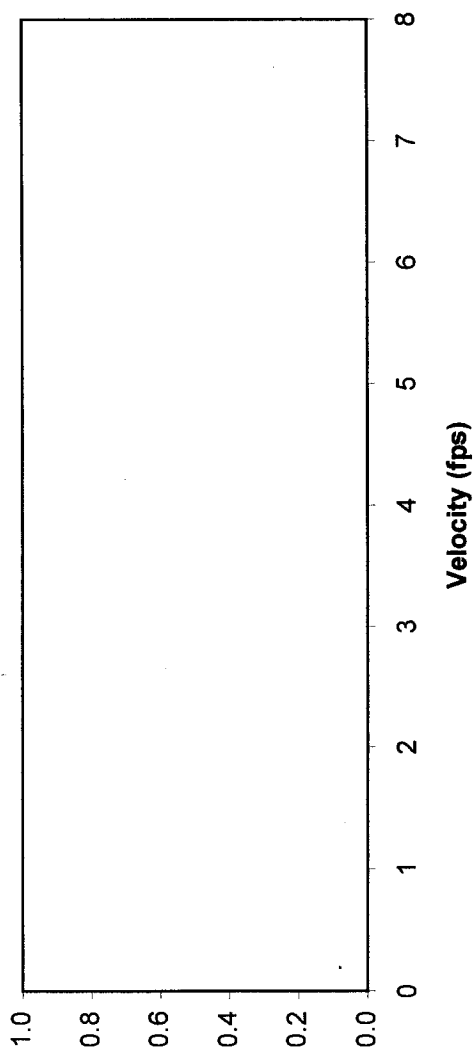
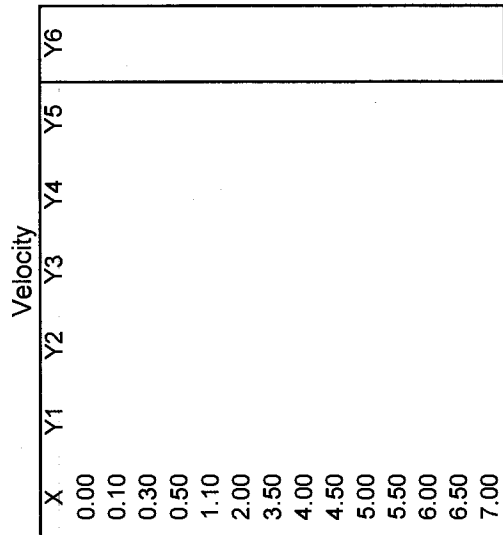


Source: Y1 - Lyons and Nadeau 1985
 Y2 - Baldrige 1981 (Arctic Env. 1981)
 Y3 - R2 Resource Consultants 1998
 Y4 - DES 1999 (unspecified rearing)
 Y5 - ----
 Y6 - Recommended curve

Location: Y1 - Wilson R. & Tunnel Creek, AK
 Y2 - Terror and Kizhuyak Rivers, AK
 Y3 - Lostine River, OR
 Y4 - Skagit River, WA
 Y5 - ----
 Y6 - ----

Figure XX. Species: Coho salmon
 Lifstage: Juvenile rearing

HSI coho



Legend: Y1 - solid line, Y2 - dotted line, Y3 - dash-dot line, Y4 - dashed line, Y5 - long-dashed line, Y6 - solid line

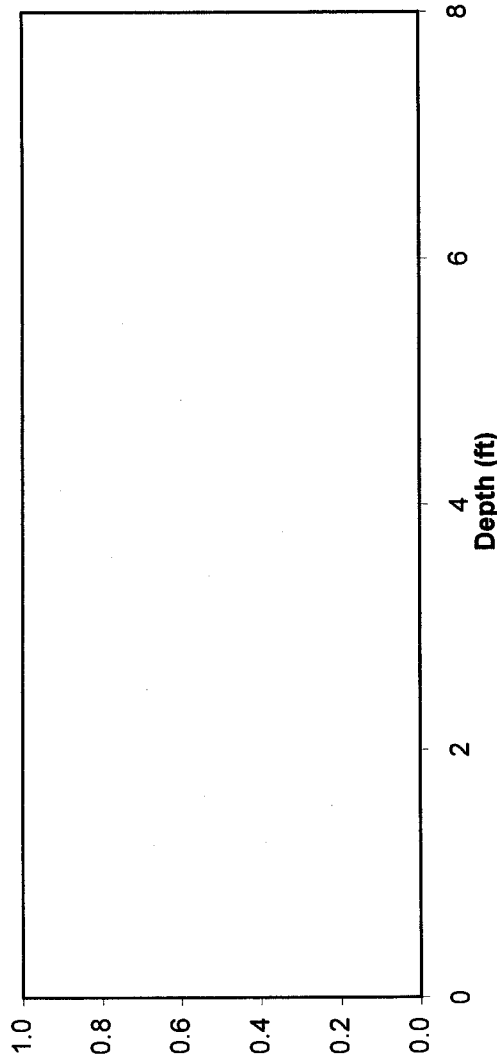
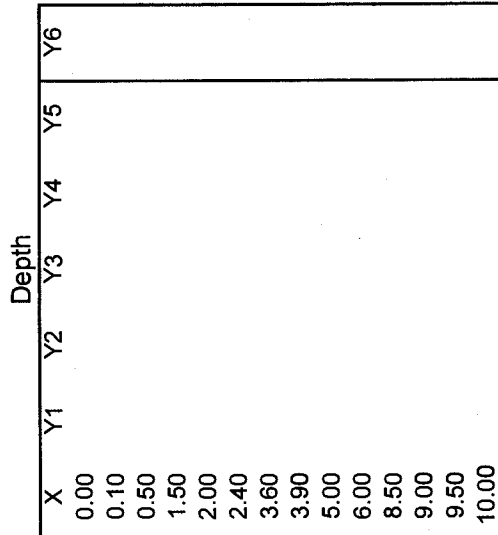


Figure XX. Species: Coho salmon
Lifestage: Adult rearing

Source: Y1 -
Y2 -
Y3 -
Y4 -
Y5 -
Y6 - Recommended curve

Location: Y1 -
Y2 -
Y3 -
Y4 -
Y5 -
Y6 -

HSI coho

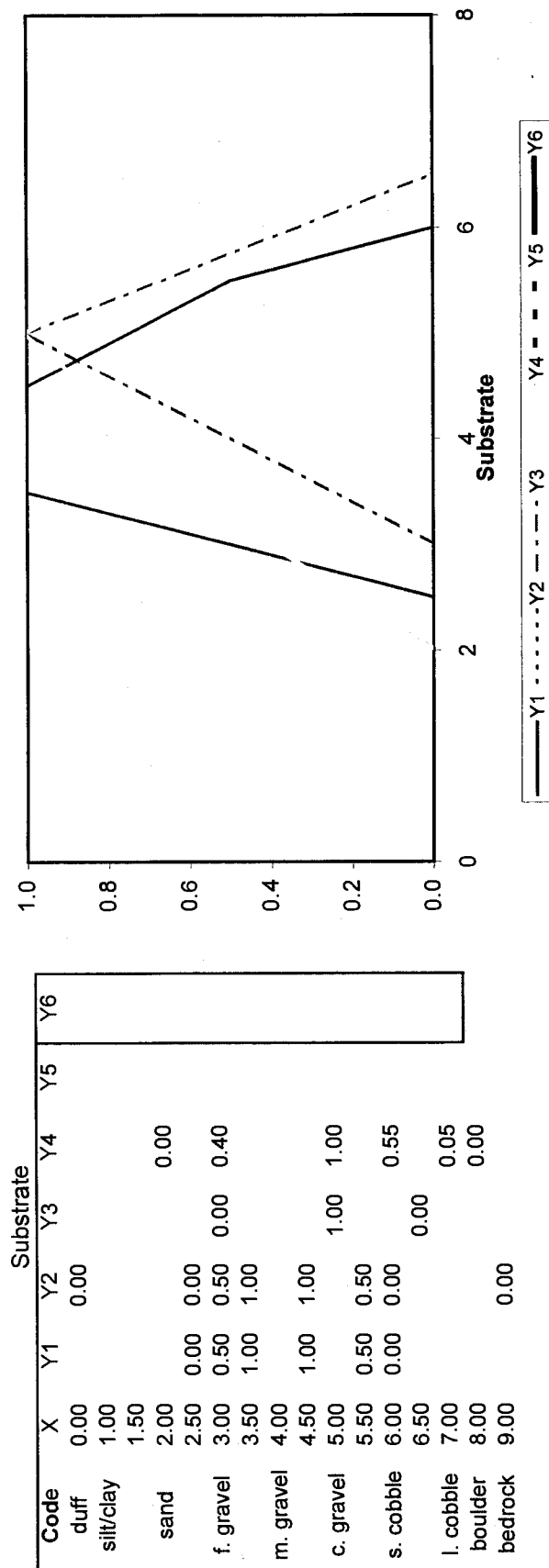


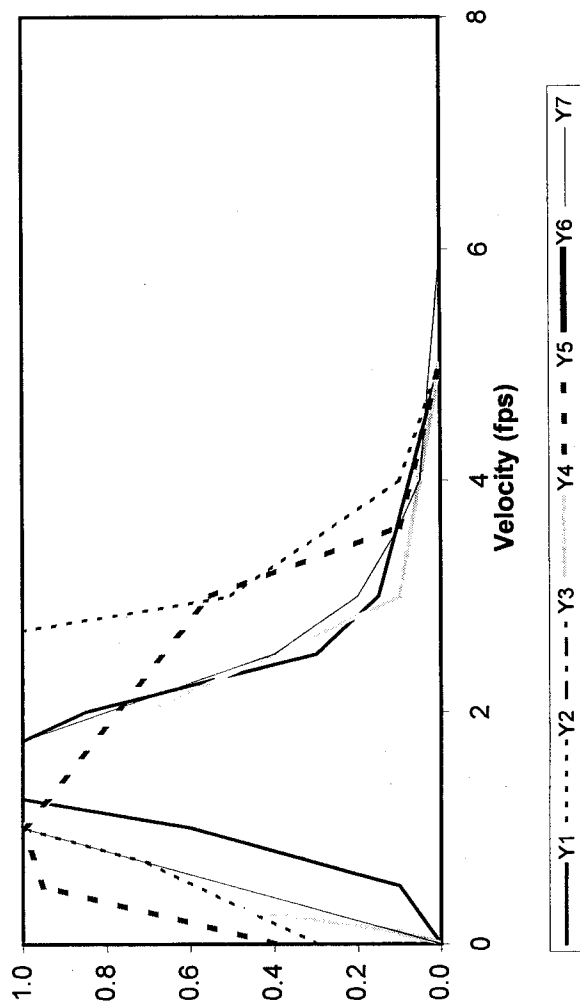
Figure XX. Species: Coho salmon
Lifestage: Spawning substrate

Source: Y1 - Baldrige 1981 (Arctic Env. 1981) Y2 - Lyons and Nadeau 1985 Y3 - Wampler 1980 (same as Bovee 1978) Y4 - R2 Resource Consultants 1998 Y5 - ---- Y6 - Recommended curve

Location: Y1 - Terror and Kizhuyak Rivers, AK Y2 - Wilson R. & Tunnel Creek, AK Y3 - Skokomish River, WA Y4 - Lostine River, Oregon Y5 - ---- Y6 - ----

HSI chum

X	Velocity						
	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00	0.00	0.30		0.00	0.40		0.00
0.10			0.10	0.10			
0.50	0.10		0.90	0.90	0.95		
0.70		0.70					
1.00	0.60	1.00	1.00	1.00	1.00		1.00
1.25	1.00						
1.75	1.00						1.00
2.00	0.85		0.70	0.70			0.80
2.50	0.30						0.40
2.70		1.00					
3.00	0.15	0.50	0.10	0.10	0.55		0.20
3.60					0.10		0.10
4.00	0.00	0.10					0.05
5.00	0.00	0.00	0.00	0.00	0.00		0.00
6.00							



e XX. Species: Chum salmon
Lifestage: Spawning/Incubation

Source: Y1 - Wampler 1980
Y2 - DES 1999
Y3 - Baldrige 1981 (same #s as Y4)
Y4 - Lyons and Nadeau 1985
Y5 - Hale et al. 1985
Y6 - Recommended curve
Y7 - Hosey 1987

Location: Y1 - Skokomish R., WA and tribs.
Y2 - Skagit River, WA
Y3 - Terror and Kizhuyak Rivers, AK
Y4 - Wilson River Tunnel Creek, AK
Y5 - generic
Y6 -
Y7 - White River, WA

HSI chum

X	Y1	Y2	Y3	Y4	Y5	Y6	Y7
0.00				0.00	0.00		
0.15			0.00	0.00	0.00		
0.24			1.00	1.00			0.00
0.25	0.00						1.00
0.40		0.00					
0.50	0.80	0.50					
0.75	1.00						
1.00	1.00	1.00			1.00		
1.50	0.50		1.00	1.00			1.00
2.00	0.10		0.80	0.80			0.75
3.00	0.00	1.00			1.00		0.45
4			0.2	0.20			0.20
4.50			0.10	0.10			0.10
5.00		0.20	0.00	0.00			0.00
6.00		0.00					
10.0							

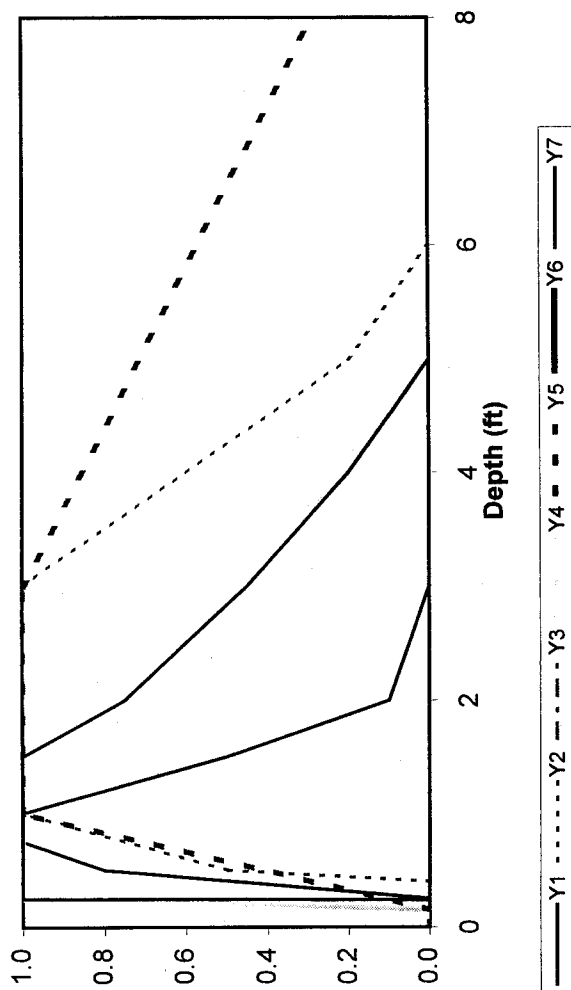


Figure XX. Species: Chum salmon

Lifestage: Spawning/Incubation

Source:

Y1 - Wampler 1980

Y2 - DES 1999

Y3 - Baldrige 1981 (same #s as Y4)

Y4 - Lyons and Nadeau 1985

Y5 - Hale et al. 1985

Y6 - Recommended curve

Y7 - Hosey 1987

Location: Y1 - Skokomish R., WA and tribs.

Y2 - Skagit River, WA

Y3 - Terror and Kizhuyak Rivers, AK

Y4 - Wilson River Tunnel Creek, AK

Y5 - generic

Y6 -

Y7 - White River, WA

HSI chum

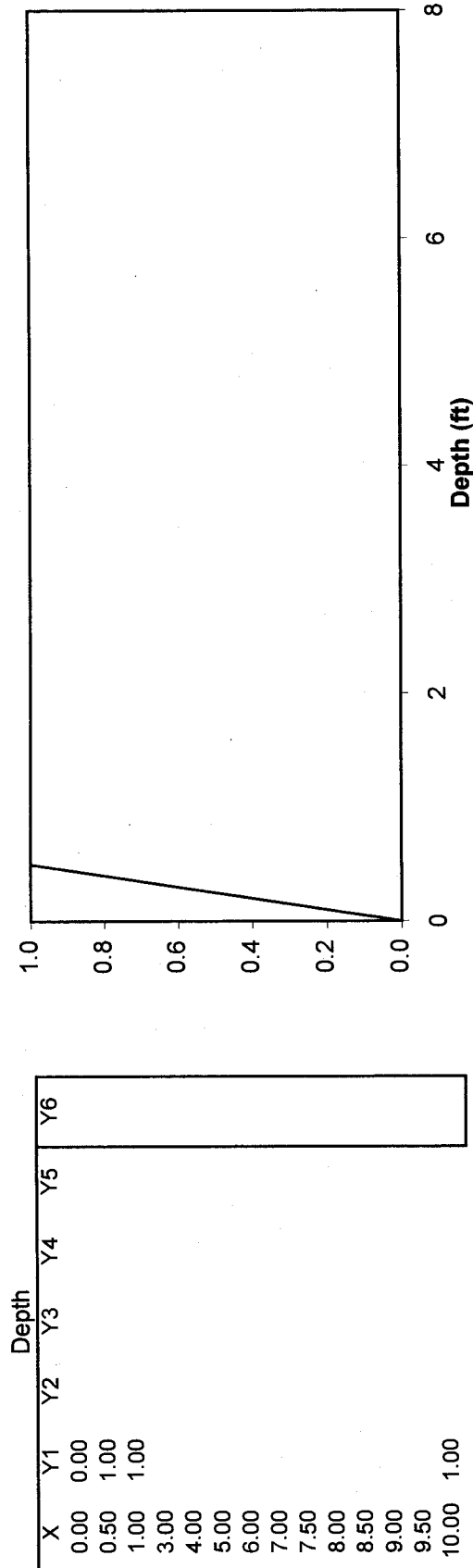
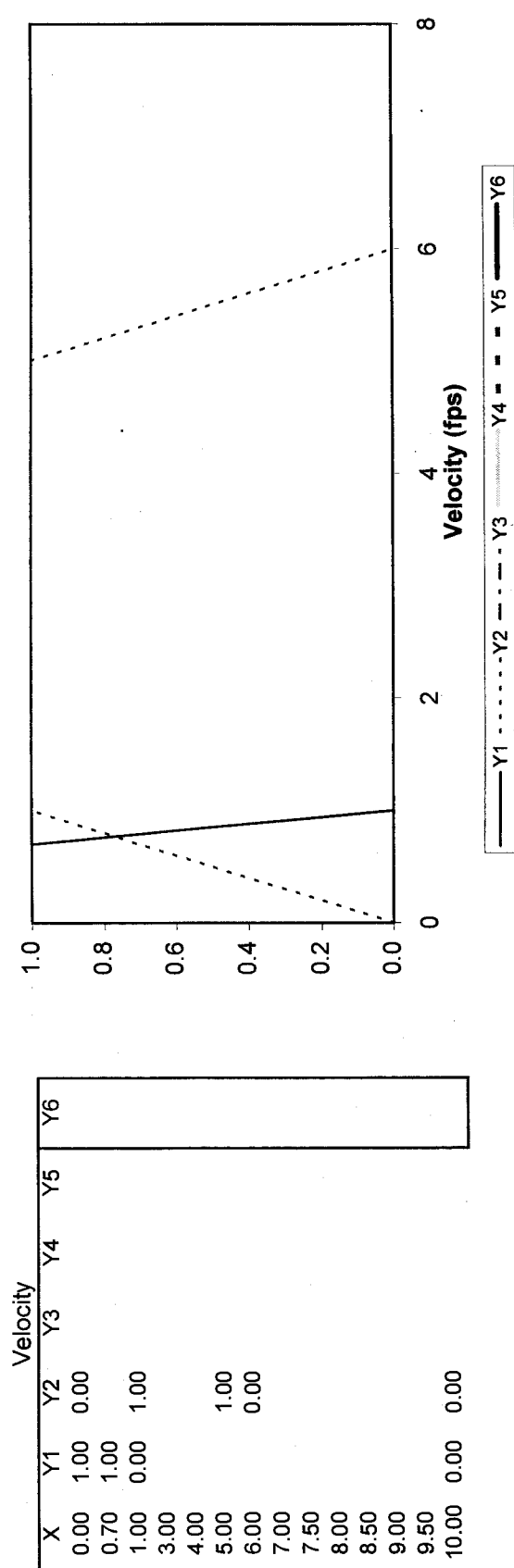


Figure XX. Species: Chum Salmon
Lifestage: Fry rearing

Source: Y1 - Hale et al. 1985 (feeding)
Y2 - Hale et al. 1985 (emigration)
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - Recommended curve

Location: Y1 - Generic
Y2 - Generic
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

HSI chum

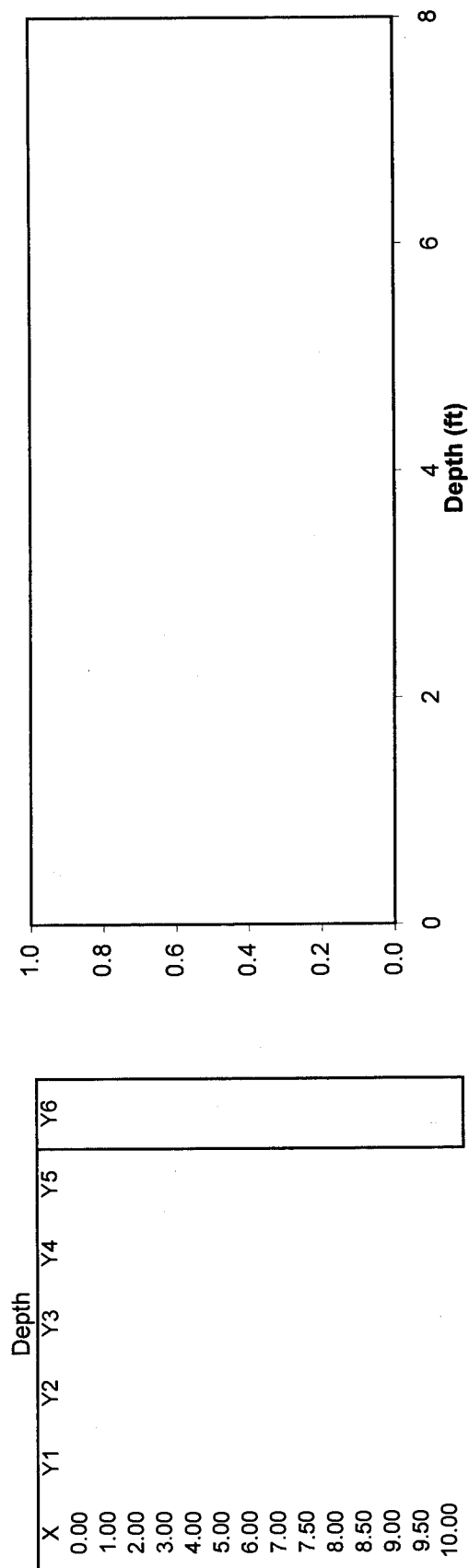
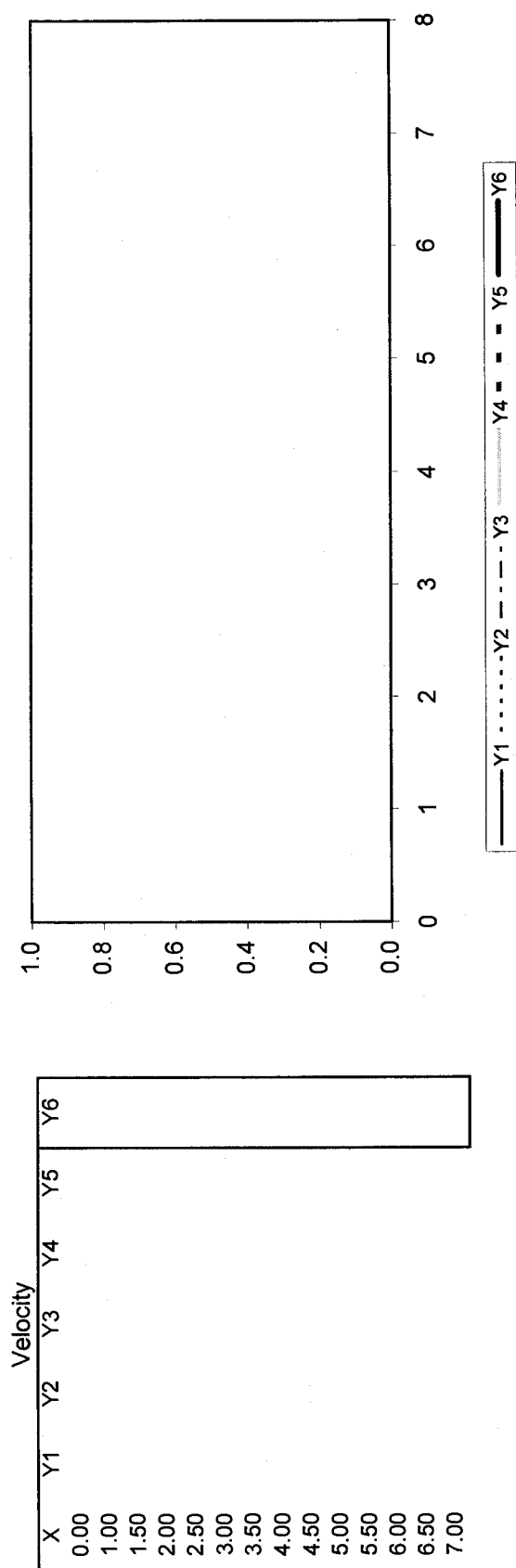


Figure XX. Species: Chum Salmon
Lifestage: Juvenile rearing

Source: Y1 - ----
Y2 - ----
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - Recommended curve

Location: Y1 - ----
Y2 - ----
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

HSI chum

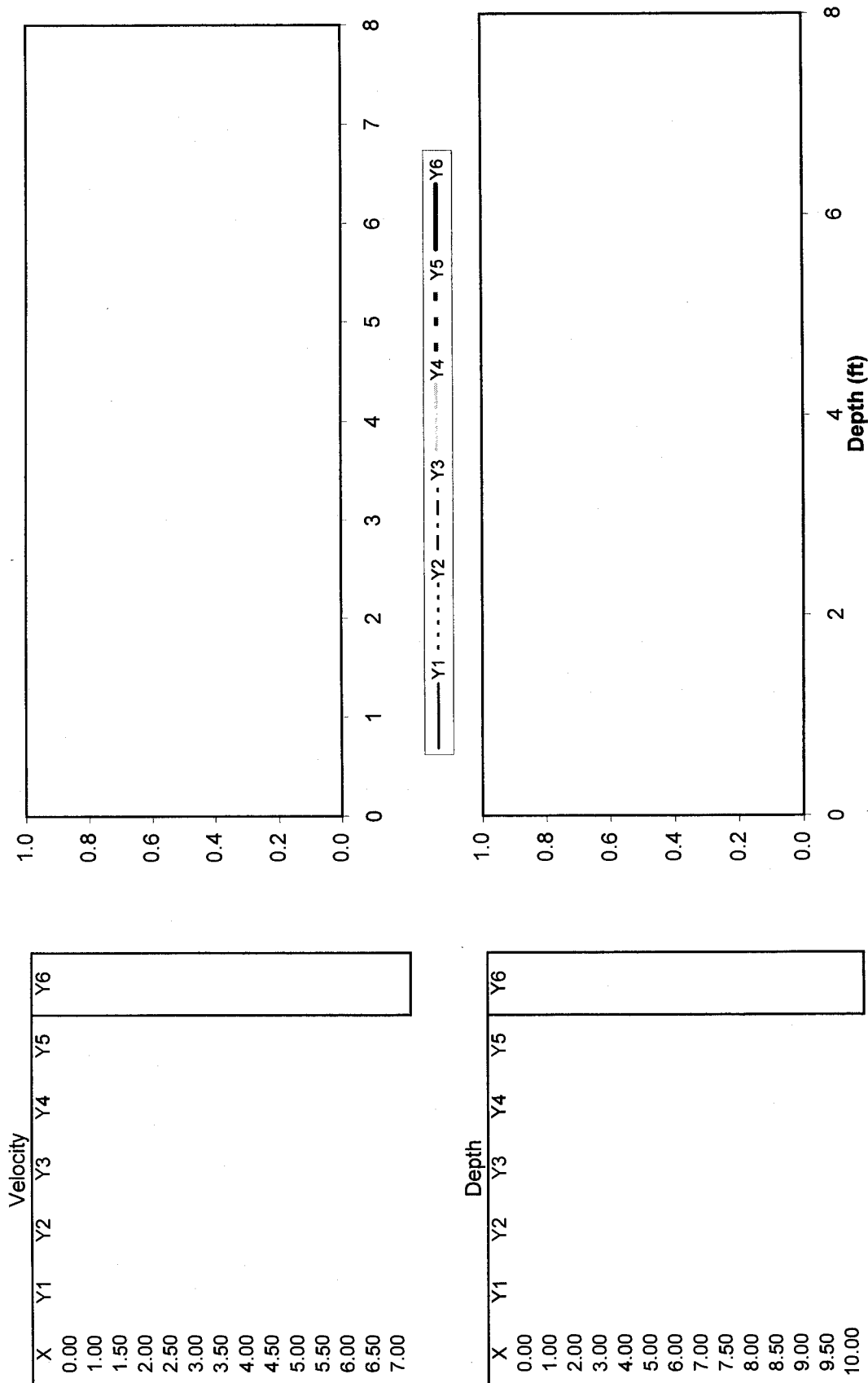


Figure XX. Species: Chum salmon
Lifestage: Adult rearing

Source: Y1 - ----
Y2 - ----
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - Recommended curve

Location: Y1 - ----
Y2 - ----
Y3 - ----
Y4 - ----
Y5 - ----
Y6 - ----

HSI chum

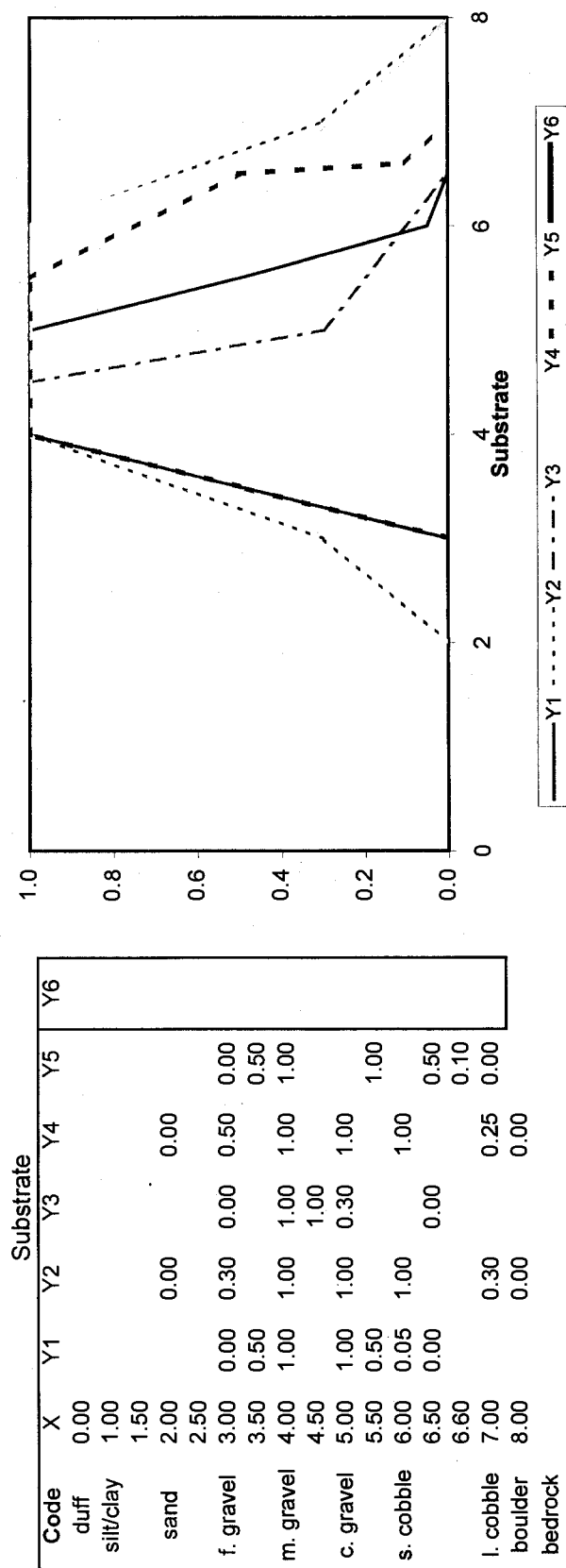


Figure XX. Species: Chum salmon
Lifestage: Spawning substrate

Source: Y1 - Baldridge 1981
Y2 - DES 1999
Y3 - Wampler 1980 (assumed IFG coding)
Y4 - WDFW 1996 (fallback curves)
Y5 - Lyons and Nadeau 1985
Y6 - Recommended curve

Location: Y1 - Terror and Kizhuyak Rivers, AK
Y2 - Skagit River, Washington
Y3 - Skokomish River, WA
Y4 - Kennedy Crk, Dosewallips and Duckabush Rivers
Y5 - Wilson River, Tunnel Creek, AK
Y6 - ----

Species	Life History Stage/Body Length	Docu- ment #	Reference	Cat. I/II/III	Stream Location	Stream Name	Stream Type/Size	Type of Curves
PINK	Adult		Raleigh and Nelson 1985	I & II	generic	generic		Velocity, depth
	Spawning	13		I & II				Depth, velocity, substrate
	Fry migration			I				Depth, velocity, substrate
	Adult, spawning	1	Krueger 1981	II	Alaska	generic		Passage, substrate, velocity
	Spawning	10	Lyons and Nadeau 1985	I	Alaska	Wilson River Tunnel Creek		Depth, velocity, substrate
	Spawning	6	Estes et al. 1981	I & II	Alaska	Willow Creek Deception Creek	Wet channel approx. 40-50 ft.	Depth, velocity, substrate
	Spawning	3	Baldrige 1981	I	Kodiak, Alaska	Terror and Kizhuyak Rivers	approx. 50-100 ft. wetted channels	Depth, velocity, substrate
	Spawning	7	Hosey 1986		WA	White River?		Depth, velocity
	Spawning	17	DES 1999	I & II	WA	Skagit River	Lower mainstem	Depth, velocity, substrate
	Spawning	24	Wampler 1980	I	WA	North and S. Fk. and mainstem Skokomish River		Depth, velocity, substrate
CHUM	Spawning	25	WDFW 1996		WA	Dosewallips, Duckabush, N. Fk. Stillaguamish and Squire Creek		Depth, velocity, substrate
	Spawning	31	Puget 1989 (based on WDW 1989)		WA	Upper Nooksack basin		Depth, velocity
	Spawning, incubation	10	Lyons and Nadeau 1985	I & II	SE Alaska	Wilson River Tunnel Creek		
	Spawning	3	Baldrige, 1981	I	Kodiak, Alaska	Terror and Kizhuyak rivers	approx. 50-100 ft. wetted channels	Depth, velocity, substrate

Species	Life History Stage/Body Length	Docu- ment #	Reference	Cat. I/II/III	Stream Location	Stream Name	Stream Type/Size	Type of Curves
	Spawning	8	Hale et al. 1985	II	WA	Skagit River	Mainstem	Velocity, depth
	Incubation, fry	8	Hale et al. 1985	II	generic			Velocity, depth, substrate
	Spawning	7	Hosey 1986		WA	White River?		Depth, velocity
	Spawning	17	DES 1999	I & II	WA	Skagit River	Lower mainstem	Depth, velocity, substrate, cover
	Spawning	24	Wampler 1980	I	WA	North and S. Fk. and mainstem Skokomish River		Depth, velocity, substrate
	Spawning	25	WDFW 1996		WA	Kennedy Creek, Dosewallips and Duckabush R.		Depth, velocity, substrate
COHO	Spawning, juvenile, fry, incubation	10	Lyons and Nadeau 1985	I & II	SE Alaska	Wilson River Tunnel Creek		Depth, velocity, substrate
	Spawning, rearing	11	McMahon 1983		generic	riverine		Temperature
	Fry, juvenile, spawning	3	Baldrige 1981	I	Kodiak, Alaska	Terror and Kizhuyak Rivers	approx. 50-100 ft. wetted channels	Depth, velocity, substrate
	Spawning	4	Bustard and Narver 1975	II	B.C., Vancouver Island	Camation Creek		Depth, velocity, substrate
	Fry, juvenile, spawning	7	Hosey 1986		WA	White River?		Depth, velocity
	Spawning, fry	16	Bovee 1978	II	Idaho/ Oregon			Depth, velocity, substrate
	Rearing	17	DES 1999	I & II	WA	Skagit River	Lower mainstem	Depth, velocity, substrate, cover
	Spawning	15	Sams and Pearson 1963		Willamette Valley, OR	varied		Depth, velocity

Species	Life History Stage/Body Length	Docu- ment #	Reference	Cat. I/II/III	Stream Location	Stream Name	Stream Type/Size	Type of Curves
	Spawning	24	Wampler 1980	I	WA	North and S. Fk. and mainstem Skokomish River		Depth, velocity, substrate
	Spawning, juvenile, fry	28	R2 Resources 1998	II	Oregon	Lostine River	Small rivers, large streams in OR and WA	Depth, velocity, substrate
	Juvenile	25	WDFW 1996					Depth, velocity
DOLLY VARDEN / BULL TROUT	Spawning, fry, juvenile	3	Baldrige 1981	I	Kodiak, Alaska	Terror and Kizhuyak Rivers	approx. 50-100 ft. wetted channels	Depth, velocity, substrate
	Rearing	17	DES 1999		WA	Skagit River	Lower mainstem	Depth, velocity, substrate, cover
	Spawning, juvenile, fry	28	R2 Resources 1998	II	Oregon	Lostine River	Small rivers, large streams in OR and WA	Depth, velocity, substrate
	Rearing (adult)	28	R2 Resources 1998	II	Oregon	Lostine River	Small rivers, large streams in OR and WA	Depth, velocity, substrate
	Spawning	25	WDFW 1996		WA, OR	Eastslope Cascade Mt.	Streams	Depth, velocity
	Juvenile, adult	25	WDFW 1996	II	generic			Depth, velocity
CUTTHROAT	Rearing	17	DES 1999	I & II	WA	Skagit River		Depth, velocity, substrate, cover
	Rearing (>9cm)	26	Heggnes et al 1991	I	B.C.	Musqueam Creek	Small coastal stream	Depth, velocity, substrate, cover
	Fry, adult	25	WDFW 1996	II	generic			Depth, velocity, substrate
	Adult	33	June 1981	II	Olympic Penn. WA		Headwater streams	Depth, velocity, substrate
	Adult, juvenile	29	Carlson and Campbell 1991 (based on Beak 1989)			Anderson Creek		Depth, velocity

REFERENCES FOR APPENDIX B

- 1 Krueger, S. W. 1981. Freshwater habitat relationships pink salmon (*Oncorhynchus gorbuscha*). Alaska Dept. of Fish and Game, Anchorage.
- 2 Arctic Environ. Information and Data Center. 1981. An assessment of environmental effects of construction and operation of the proposed Terror Lake Hydroelectric Facility, Kodiak Alaska. Instream flow studies. Final report. Univ. of Alaska, Anchorage. 418 p. (same as #3)
- 3 Baldrige, J. E. 1981. Appendix 3, Development of habitat suitability criteria. Arctic Environ. Information and Data Center, Terror Lake project, Alaska. (see #2)
- 4 Bustard, D. R., and D. W. Narver. 1975. Aspects of the winter ecology of juvenile coho salmon and steelhead trout. Journal of the Fisheries Research Board of Canada 32:667-680.
- 5 Corning, R.V., and G. Elliott. 1987. An evaluation of IFIM curves developed for the Swanson River rainbow trout populations. Draft report for U.S. Fish and Wildlife Service, Alaska Invest. Field Office. Anchorage, Alaska. 24 p. (taken from #32)
- 6 Estes, C., K. Hepler, and A. Hoffman. 1981. Willow and Deception creeks instream flow demonstration study. Alaska Department of Fish and Game. Prepared for the USDA, Soil Conservation Service.
- 7 Hosey and Associates. 1986. Unpublished White River Criteria Curves.
- 8 Hale, S. S., T. E. McMahon, and P. C. Nelson. 1985. Habitat suitability index models and instream flow suitability curves: Chum salmon. U. S. Fish and Wildlife Service. Biol. Report 82(10.108).
- 9 Estes, C. and K. J. Kuntz. 1986. Kenai River habitat study. Volume 27, July 1, 1985 - June 30, 1986, Federal Aid in Fish Restoration and Anadromous Fish studies. Alaska Department of Fish and Game, Juneau, Alaska.
- 10 Lyons, S. M. and R. L. Nadeau. 1985. Instream flow investigations Wilson River and Tunnel Creek. U.S. Fish and Wildlife Service, Habitat Resources Program. Anchorage, Alaska.
- 11 McMahon, T. E. 1983. Habitat suitability index models: Coho salmon. U. S. Fish and Wildlife Service, FWS/OBS-82/10.49.

- 12 Raleigh, R. F., T. Hickman, R. C. Solomon, and P. C. Nelson. 1984. Habitat suitability information: Rainbow trout. U. S. Fish and Wildlife Service, FWS/OBS-82/10.60.
- 13 Raleigh, R. F. and P. C. Nelson. 1985. Habitat suitability index models and instream flow suitability curves: Pink salmon. U.S. Fish and Wildlife Service Biological Report 82(10.109).
- 14 Raleigh, R. F. and P. C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: Chinook salmon. U.S. Fish and Wildlife Service Biological Report 82(10.122).
- 15 Sams, R. E., and L. S. Pearson. 1963. The depth and velocity of water over redd sites selected by various salmonid species. Environmental Management section, Oregon Department of Fish and Wildlife, Portland.
- 16 Bovee, K. D. 1978. Probability-of-use criteria for the Family Salmonidae. Instream Flow Information Paper No. 4. FWS/OBS-78/07. 80 p.
- 17 Duke Engineering and Services, Inc. 1999. Final technical report lower Skagit River instream flow studies appendices. Prepared for Public Utility District No. 1 of Skagit County and City of Anacortes.
- 18 Campbell, R. F. and J. H. Neuner. 1985. Development of seasonal habitat preference criteria for rainbow trout (*Salmo gairdneri*) in western Washington Cascade mountain streams. Draft report prepared by Beak Consultants, Incorporated.
- 19 Beak Consultants Inc. 1991. Hydro energy development company instream flow study report for the Youngs Creek hydroelectric project. Prepared for Hydro West Group, Inc., Bellevue, Washington.
- 20 See 15
- 21 Wampler, P. L. 1985. Habitat preference curves for hatchery reared juvenile fall chinook salmon in a small western Washington stream. Trans. U.S. Fish and Wildlife Service, Olympia, WA.
- 22 Connor, E., D. Reiser, and P. DeVries. 1995. Site specific habitat suitability curves for the White River, Washington: 1993-1994 study results. Prepared by R2 Resource Consultants for Perkins Coie, Bellevue, Washington.
- 23 Campbell, R. F., J. H. Neuner, and B. R. Eddy. 1984. Verification of habitat utilization criteria for juvenile fall chinook salmon in the North Fork of the Lewis River,

Washington. Prepared by Northwest Energy Services Company for Pacific Power and Light Company, Portland, Oregon.

- 24 Wampler, P. L. 1980. Instream flow requirements of the lower North Fork, South Fork, and mainstem Skokomish River. U.S. Fish and Wildlife Service, Olympia, Washington.
- 25 Washington State. 1996. Instream flow study guidelines. Washington Dept. of Fish and Wildlife.
- 26 Heggenes, J., T. G. Northcote and A. Peter. 1991. Seasonal habitat selection and preferences by cutthroat trout (*Oncorhynchus clarki*) in a small, coastal stream. Canadian Journal of Fisheries and Aquatic Sciences 48: 1364-1370.
- 27 Beak Consultants, Inc. 1985. Sandy River instream flow study for the City of Portland. Oregon.
- 28 R2 Resource Consultants, Inc. 1998. Lostine River instream flow study. Prepared for the Nez Perce Tribe and Oregon Dept. of Fish and Wildlife.
- 29 Carlson and Campbell. 1991. Instream flow study report for the Anderson Creek hydroelectric project. FERC No. 10416. Prepared for Hydrowest Group, Inc. by Beak Consultants, Inc., Kirkland, Washington. **(These curves are from other sources, i.e. WDW 1989)**
- 30 Washington State. 1989. Instream flow study guidelines. Washington Dept. of Fisheries.
- 31 Puget Sound Power and Light Company. 1989. Instream flow study for the Nooksack Falls project, FERC project No. 3721. Bellevue, Washington. **(Mostly from WDW 1989)**
- 32 EA Engineering, Science, and Technology. 1990. Habitat suitability curve analysis Idaho instream flow studies. Prepared for: Bureau of Indian Affairs, Portland, Oregon.
- 33 June, J. A. 1981. Life history and habitat utilization of cutthroat trout (*Salmo clarki*) in headwater streams on the Olympic Peninsula, Washington. M.S. thesis. University of Washington, Seattle.

From: Cory Warnock
Sent: Wednesday, December 18, 2013 12:08 PM
To: Schick, Lesli J (DNR)
Cc: Emily Andersen
Subject: RE: Draft INHT Meeting Minutes For Review

Thanks, Lesli.

From: Schick, Lesli J (DNR) [mailto:lesli.schick@alaska.gov]
Sent: Wednesday, December 18, 2013 11:58 AM
To: Cory Warnock
Subject: RE: Draft INHT Meeting Minutes For Review

Hi Cory,
Attached are my comments. There are 4 comments in the document.
Please let me know if you have any questions.
Thanks,
-lesli

Lesli Schick
Iditarod Trail Easements
Department of Natural Resources
550 W 7th Ave, Suite 900C
Anchorage, AK 99501
Phone: (907) 334-2679, Fax: (907) 269-8930
Email: lesli.schick@alaska.gov

From: Cory Warnock [mailto:cory.warnock@mcmillen-llc.net]
Sent: Tuesday, December 10, 2013 1:37 PM
To: rstoall@fs.fed.us; Russell, Pamela J (DNR); jeavis@fs.fed.us; Van Massenhove, Katherine B -FS (kvanmassenhove@fs.fed.us); Schick, Lesli J (DNR); Duvall, Shina A (DNR)
Cc: Mike Salzetti; Dwayne Adams; Emily Andersen
Subject: Draft INHT Meeting Minutes For Review

Hi all,

Attached are the draft INHT meeting minutes from our 11/13/13 meeting in Girdwood. If you all could please take a few moments to review over the next week or so (by 12/17/13), I'd appreciate it. Providing any comments via a word document and/or email will be fine. I'll plan on finalizing late next week. Thanks to all who attended for the valuable discussion and development of a process for resolution.

Thanks and I'll look forward to hearing from you,

Cory

Cory Warnock
Senior Licensing and Regulatory Consultant

Grant Lake Hydroelectric Project (FERC No. 13212)
Iditarod National Historic Trail Meeting
Girdwood Ranger District Conference Room Girdwood, AK
November 13, 2013, 1:00 pm to 3:00 pm

In Attendance

Robert Stovall, United States Forest Service (USFS)
Pam Russell, Alaska Department of Natural Resources (ADNR)
John Eavis, USFS
Kathy Van Massenhove, USFS
Lesli Schick, ADNR *[via phone]*
Shina duVall, ADNR *[via phone]*
Mike Salzetti, Kenai Hydro (KHL)
Dwayne Adams, USKH
Kim Graham, USKH
Cory Warnock, McMillen, LLC

Meeting Summary

Introductions and Agenda

Dwayne Adams (USKH) began the meeting with introductions and then reviewed the proposed meeting agenda (see [Attachment 1](#)):

- Project Overview and Update
- Licensing Status
- Iditarod National Historic Trail (INHT) Easement Alternatives
 - Review of mapped route
 - Photo tour of possible solution
- Discussion of Agency Viewpoints
- Review of steps forward for resolution
- Adjourn

Project Description

Mike Salzetti (KHL) presented an overview and history of the Grant Lake Hydroelectric Project (Project) (see PowerPoint included as [Attachment 2](#)). Mike S. gave a general description of the utility, Homer Electric Association (HEA), noting that Kenai Hydro, LLC (KHL), the applicant for the Project, is a wholly-owned subsidiary of HEA. Mike S. shared three primary reasons why HEA was pursuing the Project 1) to meet the Board of Director's and the state of Alaska's goals for an increase in its renewable energy assets; 2) that as its own power producer, HEA now has the generation portfolio and operational control to accommodate renewable energy projects, and 3) to create a long-term, stable energy source in light of higher gas prices and the potential of future gas shortages.

Mike S. briefly described the history of the proposed Project to date, explaining that feasibility studies were conducted for four potential sites (Grant Lake, Falls Creek, Ptarmigan Lake, and Crescent Lake); two of which (Grant Lake and Falls Creek) were carried forward and environmental baseline studies were conducted in 2009. Mike went on to describe why Grant Lake was selected as the preferred Project location. He described the upstream fish passage barrier at the outlet to Grant Lake (beginning of Grant Creek), the steep topography around Grant Lake and the fact that only stickleback and sculpin have ever been documented in the lake. Mike stated that aside from the obvious power potential that exists at the site, these natural resource characteristics make it an attractive site with the likelihood of minimal adverse impacts to the natural environment.

Mike went on to describe the current Project infrastructural proposal, associated operational parameters, etc. He noted that an engineering contractor has been retained and will be working with KHL to refine infrastructure and operations over the next year, in advance of the Draft License Application (DLA) being distributed for stakeholder review. The review of infrastructure included a map documenting not only specific Project operational components but the proposed access road/transmission corridor as well.

Mike then went on to describe the proposed access road and infrastructural issues associated with the INHT. He stated that the primary issues were:

- The access road and trail share a need for the same natural terrain
- Current INHT alignment is co-located with the proposed powerhouse location

Mike indicated that KHL has solved the access road issue by rerouting the proposed access road so that it has just a single 90° crossing of the INHT.

Mike finished his presentation by asking for any questions and stating that all documents related to the licensing that have developed thus far could be found on KHL's website at:

www.kenaihydro.com.

- *Comment:* Pam Russell (ADNR) asked if .pdf'd presentations could be sent to her.
Response: Cory Warnock (McMillen) stated that all meeting documents (agenda, presentations, minutes, etc.) would be posted to the KHL website.
- *Comment:* Pam Russell asked if water temperature changes as a result of turbine operation had been evaluated and if so and the temperatures were adversely impacted, would a change in turbine type be considered.
Response: Mike Salzetti stated that a combination of water quality results from 2013 work and engineering feasibility work would evaluate if any issues existed.
- *Comment:* Robert Stovall (USFS) asked who owned the land on the "Seward Highway" side of Trail Lakes Narrows.
Response: Mike Salzetti (KHL) stated that almost all of the proposed Project was located on State Land but that multiple entities within the State governed various sections of the land. He stated that the area Robert was referring to was governed by as a Kenai River Special Management Area (KRSMA). Pam Russell confirmed this. Mike went on to

state that the Kenai Peninsula Borough is considering selecting land  in the Trail Lakes area, including along the shoreline of the Trail Lakes. However, the land has not been conveyed at this point thus the land remains in State hands...

Licensing Overview

Cory Warnock (McMillen) gave a brief summary of the licensing process being utilized by KHL (Traditional Licensing Process). Cory then went on to describe KHL's current status within this process and the fact that 2013 was primarily devoted to conducting a suite of natural resource studies on Grant Creek, Grant Lake and the surrounding Project area. He stated that natural resource reports were currently being developed and next steps included internal completion of those reports and subsequent meetings with stakeholders to discuss results along with continuing engineering feasibility work. All of this is being collaboratively done in advance of the development of the DLA which is currently scheduled for draft distribution to the stakeholders for review in the first half of 2015.

INHT Easement Alternatives

Dwayne Adams (USKH) presented a description of the current INHT and Project layouts and went on to describe the issue and two proposed re-route options (see PowerPoint included as [Attachment 3](#)).

Dwayne began by displaying a map showing the current infrastructural positioning for the Project along with the proposed location for the INHT through the Project area. He went on to state that KHL evaluated the area for an INHT re-route alternative that would:

- Provide separation with Project infrastructure
- Avoid any drainage concerns
- Expose the user to a large variety of forest types
- Maximize views of surrounding lakes and mountains

Dwayne stated that KHL had previously conducted a mapping and on the ground exercise to identify a re-route option in the Project Area. He stated that as part of this recent effort, USKH also conducted an evaluation and he felt that the re-route option USKH has identified accomplishes all of the bullets listed above and, in addition and based upon professional opinion, creates a higher level of global user experience through the area.

Dwayne then displayed photos of the various segments of the preferred alternative (USKH) through the Project area. Emphasis was placed on locations showing what was assessed as improvements to the user experience based on variables such as view, terrain alteration, forest type variety, etc. Special attention was placed on certain areas that provided a unique experience.

Dwayne then went on to describe KHL's current understanding of the process for resolution with the various stakeholders. He acknowledged the somewhat unique nature of the process and opened the floor for discussion and collaboration related to refinement of the re-route process.

 Number: 1 Author: ljschick Subject: Sticky Note Date: 12/18/2013 11:45:34 AM -08'00'

The land has been selected by the KPB, but no decision has been issued by the State approving it.

- *Comment:* Lesli Schick (ADNR) stated that from a process perspective, the State Platting and Survey Department would issue an order for easement to approve the re-route and that the four entities that need to be involved in the initial review would be:
 - o USFS
 - o Kenai Peninsula Borough (KPB)
 - o KRSMA
 - o South Central Regional Office of ADNR

Lesli went on to say that once these four entities agreed, a public notice and agency review would take place that would involve other stakeholder agencies to some degree. She went on to say that from a KPB perspective, Marcus Mueller, KPB Land Management Officer, would be the first contact and then the habitat division would deal with any buffer issues.

A general process discussion then took place involving all parties. Once complete, Cory Warnock (McMillen) attempted to verbally outline the approach for resolution with the following steps:

1. The four principle agencies agree to the proposed reroute
2. A public notice and review period occurs
3. KHL develops a Memorandum of Understanding (MOU) to be reviewed and signed by pertinent parties
4. KHL discusses this approach with FERC to gain informal approval of process in advance of DLA submittal
5. The MOU and associated documentation is incorporated into the License Application for FERC review

The group agreed that in general, this approach was a good starting point but additional review of internal processes and discussion would be needed prior to formalizing the approach.

- *Comment:* John Eavis (USFS) stated that he appreciated Dwayne's presentation and the effort placed in identifying a re-route option that maximized the user experience. He went on to state that the "wilderness experience" associated with the trail was important and asked if the re-route would result in an audible change related to highway noise.
Response: Kim Graham (USKH) stated that during the survey, most of the noise at the site was associated with snow machines and float planes and that it was very intermittent and the noise climaxed quickly and subsided.
- *Comment:* Pam Russell (ANDR) asked if the proposed re-route would impact the money recently put into the "Vagt Lake pull-out".
Response: John Eavis (USFS) stated that it would not.

Dwayne asked if the stakeholders would like to have a site visit to review the proposed re-route location and if so, when. The group did agree that a site visit would be beneficial but the

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The Southcentral Regional Office approves the reroute of the easement. The survey unit issues the survey instructions and approves the plat required to issue the easement for the reroute.

aforementioned process should progress over the winter and then the site visit could occur in late spring/early summer.

- *Comment:* John Eavis stated that there was nothing “magic” about the original route design other than the bridge location across Grant Creek which sought to minimize construction costs. There was no reason that other options couldn’t meet those same expectations with respect to user experience.
- *Comment:* Shina duVall (ADNR) asked about the Section 106 process for the Project and if the INHT trail was assessed during the 2013 Cultural work.
Response: Cory Warnock stated that the INHT was discussed to some extent and the draft Cultural Resources Report was currently in development and meeting planning would be taking place over the next month or so. Dwayne said that he had spoken to Mike Yarborough (Cultural Resource Consultants) and he stated that the proposed INHT was not cited in this area to respond to any historic location and he saw nothing from a historic perspective that would preclude a re-route.

A general process discussion then took place during which, Pam Russell (ADNR) stated that she’d need agreement from Shina’s department (State Historic Preservation Office, (SHPO)) prior to discussing the issue with KRSMA.

- *Comment:* Lesli Schick (ADNR) stated that even if it is determined that the proposed trail doesn’t invoke Section 106 measures, it will require some sort of trail agreement for what it has been designated to be  1

Cory Warnock suggested that a portion of the aforementioned Cultural meeting be reserved for discussion related to the INHT. The group agreed.

A bit more global discussion related to a site visit took place and further agreement related to late spring/early summer was gained.

- *Comment:* John Eavis (USFS) stated that eventually, KHL would need to develop the MOU letter and submit to the 4 primary agencies mentioned above. He went on to ask how FERC’s NEPA process plays into things.
Response: Cory Warnock stated that KHL would begin development of the MOU letter after the Cultural (Section 106) meeting. He went on to say that once a process was fully developed with this group, he intended on calling the FERC representative for the Grant Lake Project, Ken Hogan and discussing the approach with him. Given the licensing process being used (TLP) Mr. Warnock stated that developing a collaborative approach prior to receiving FERC input would be the best approach. Mr. Warnock stated that he’d report back to the group once the FERC communication had taken place.
- *Comment:* Lesli Schick (ADNR) reiterated that KHL would also have to submit an application for an easement after the four primary parties concurred on the re-route.
Response: Cory Warnock stated that that was understood and reiterated KHL’s intent to develop the MOU letter after the Cultural (Section 106) meeting.

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add "as a commemorative route of the INHT" to the end of the sentence

- *Comment:* Mike Salzetti (KHL) asked what level of detail should be included in the MOU letter.
Response: John Eavis (USFS) stated that he'd do some research and get back to KHL with some specifics.
- *Comment:* Lesli Schick (ADNR) stated that she'd be the coordinator for MOU letter evaluation and that it was important to realize that this process will be reviewed as a State project separate of the Section 106 review. What eventually will be needed for formal approval, will be the four primary agencies discussed above to confirm with Lesli the re-route will not adversely impact the trail. She additionally stated that the \$100 application fee could be submitted at any time and would help in identifying it as a current project.
Response: Mike Salzetti (KHL) acknowledged that he understood and stated that KHL would be submitting the fee soon.
- *Comment:* Pam Russell (ADNR) asked if the recent State Supreme Court ruling related to the disposal of land impacted the Project.
Response: Mike Salzetti (KHL) suggested that we keep the court ruling and the INHT issue separate. 
- *Comment:* John Eavis and Kathy Van Massenhove (USFS) stated that they would identify the appropriate individuals within the USFS to consult with. They stated that ultimately, the letter from a USFS perspective would be sent to Terry Marceron (Forest Supervisor).

Closing

Dwayne Adams thanked everyone for their participation, acknowledged the value of the meeting and adjourned the proceedings.

Attachments

Attachments are available on the Work Groups page at www.kenaihydro.com.

Attachment 1: Meeting Agenda

Attachment 2: KHL Project Presentation

Attachment 3: KHL Re-route Alternatives Presentation

Attachment 4: Map of Project Area and Proposed Re-route

 Number: 1 Author: ljschick Subject: Sticky Note Date: 12/18/2013 11:54:18 AM -08'00'

As Pam Russell and I pointed out, a court ruling affecting DNR cannot legally be separated from this issue if it is found to pertain to it.

From: John Blum <john.blum@mcmillen-llc.com>
Sent: Wednesday, December 18, 2013 4:24 PM
To: Cory Warnock; 'Miller, Monte D (DFG)'; 'Eric Rothwell'; 'Klein, Joseph P (DFG)'; 'Mouw, Jason E B (DFG)'; jeffry_anderson@fws.gov; 'Mike Salzetti'
Cc: Emily Andersen
Subject: Revised Grant Lake HSC curves
Attachments: Proposed HSC curves for Grant Creek 12-18-2013.docx

Good afternoon:

After our last conversation, I have had additional review and synthesis of curves developed and/or used in Alaska streams. I have looked at all the curves that were examined when developing HSC curves for the Sawmill Creek project (coho and steelhead), as well as those considered for the Falls Creek project (coho and char). I've also looked at Burger's Chinook fry curves on the Kenai River. I want to thank Monte and Jeff for providing these sources. These were in addition to the Cooper Creek curves. Given the extensive literature review provided in these reports, I went through them all and eliminated those from different types of systems, Category I curves, etc. and got it down to a workable number of curves. In some species and life stages (rainbow trout adult rearing, for example), there still weren't very many to review.

I graphed all the pertinent curves and made proposed a recommended set of curves to use. Please review these by next Monday; on Tuesday, I will run these or the recommended revised curves for the 18 transects and produce WUA for each species and life stage by transect and reach.

As Monte and I discussed earlier this week, I see this as the beginning of the process. We have many things yet to decide as a group as we move the analysis forward. These include, among other things, species and life history stage periodicity, hydrology to use for time series analysis, which are the target species and life stages for each month, etc. These curves are just to get us going.

Thank you all for your input. Please get back to me with any comments by COB Monday, and I'll get to work generating the WUA graphs and tables. Merry Christmas, everyone!

John

REVISED WORKING DRAFT

EVALUATION OF HABITAT SUITABILITY CRITERIA (HSC)

FOR

GRANT CREEK INSTREAM FLOW STUDY

Presented to:

AQUATIC WORK GROUP

Prepared for:

Homer Electric Association

Prepared by:

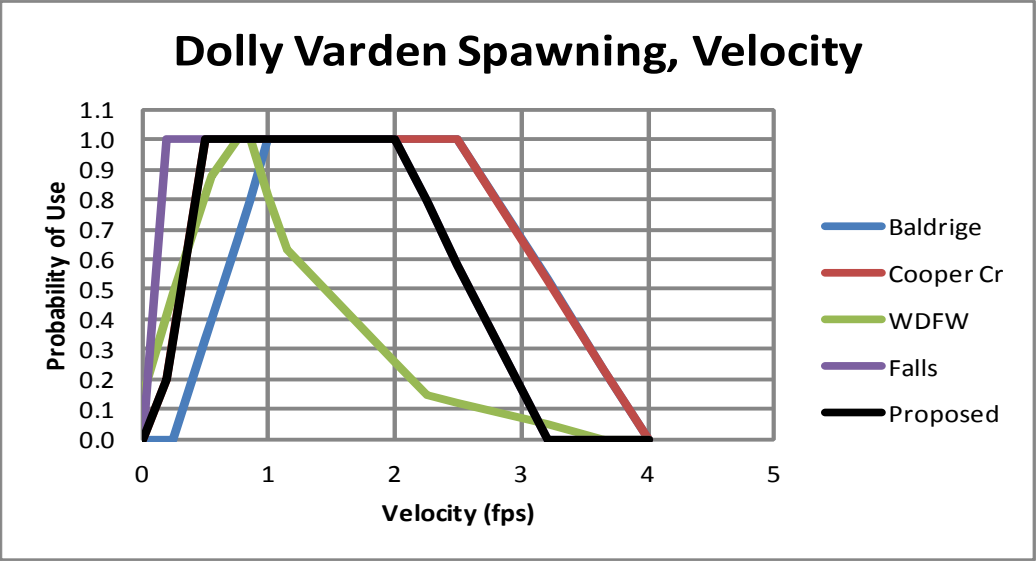
McMILLEN
DESIGN with Vision. BUILD with Integrity.

McMillen, LLC

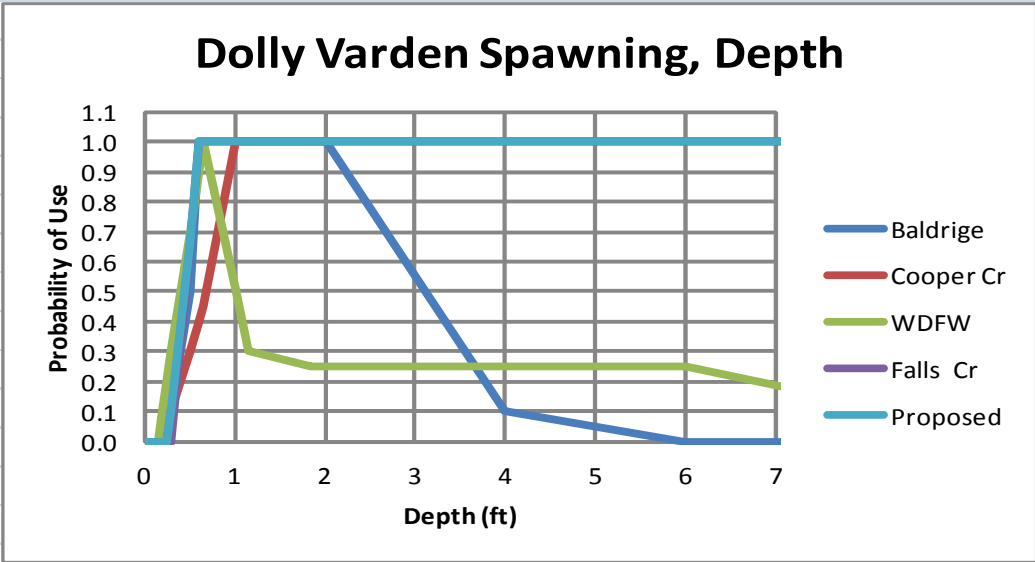
December 18, 2013

Dolly Varden, Spawning

Velocity	Baldrige	Cooper Cr	WDFW	Falls Cr	Proposed
0.00	0.00	0.00	0.15	0.00	0.00
0.20		0.20		1.00	0.20
0.25	0.00				
0.50		1.00			1.00
0.55			0.88		
0.75			1.00		
0.85			1.00		
1.00	1.00				
1.15			0.63		
2.00				1.00	1.00
2.25			0.15		
2.50	1.00	1.00			
3.20				0.00	0.00
3.65		0.23	0.00		
4.00	0.00	0.00	0.00	0.00	0.00

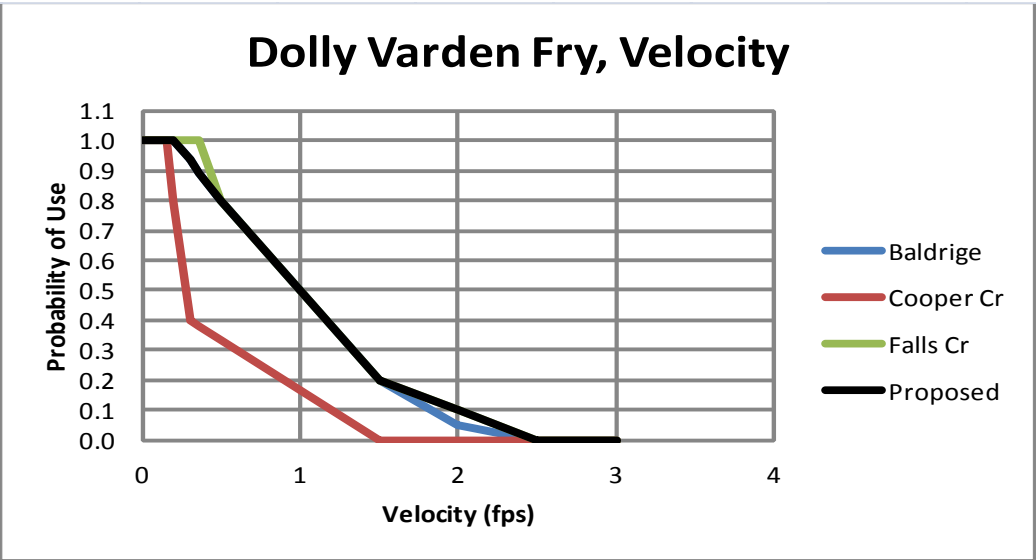


Depth	Baldrige	Cooper Cr	WDFW	Falls Cr	Proposed
0.00	0.00	0.00	0.00	0.00	0.00
0.15			0.00		
0.20		0.00			
0.25	0.00				
0.30				0.00	0.10
0.50	0.50				0.67
0.60	1.00			1.00	1.00
0.65			1.00		
1.00		1.00			
1.15			0.30		
1.85			0.25		
2.00	1.00				
4.00	0.10				
6.00	0.00	1.00	0.25		
10.00	0.00	1.00	0.00	1.00	1.00

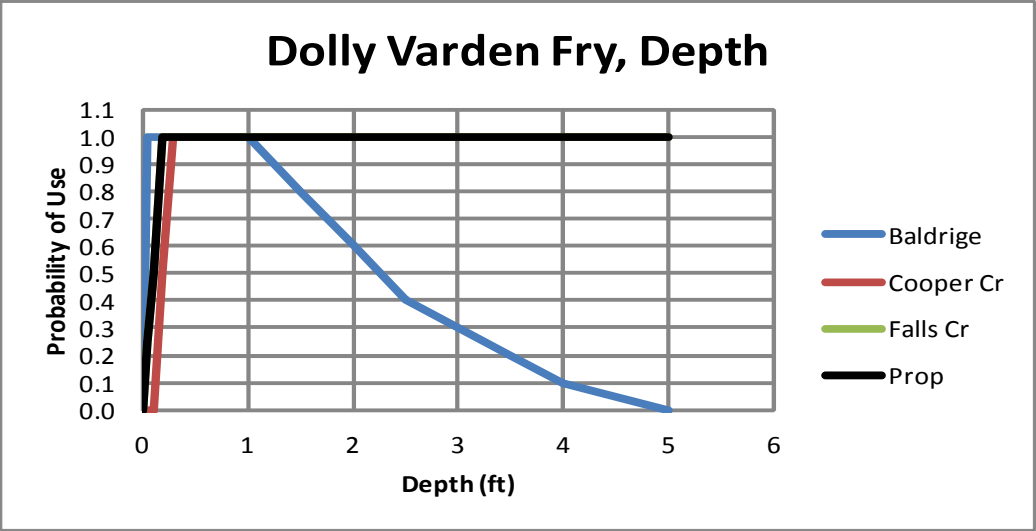


Dolly Varden, Fry Rearing

Velocity	Baldrige	Cooper	Falls Cr	Proposed
0.00	1.00	1.00	1.00	1.00
0.15		1.00		
0.20	1.00			1.00
0.30		0.40		
0.36			1.00	
0.50	0.80		0.80	0.80
1.50	0.20	0.00	0.20	0.20
2.00	0.05			
2.50	0.00		0.00	0.00
3.00	0.00	0.00	0.00	0.00

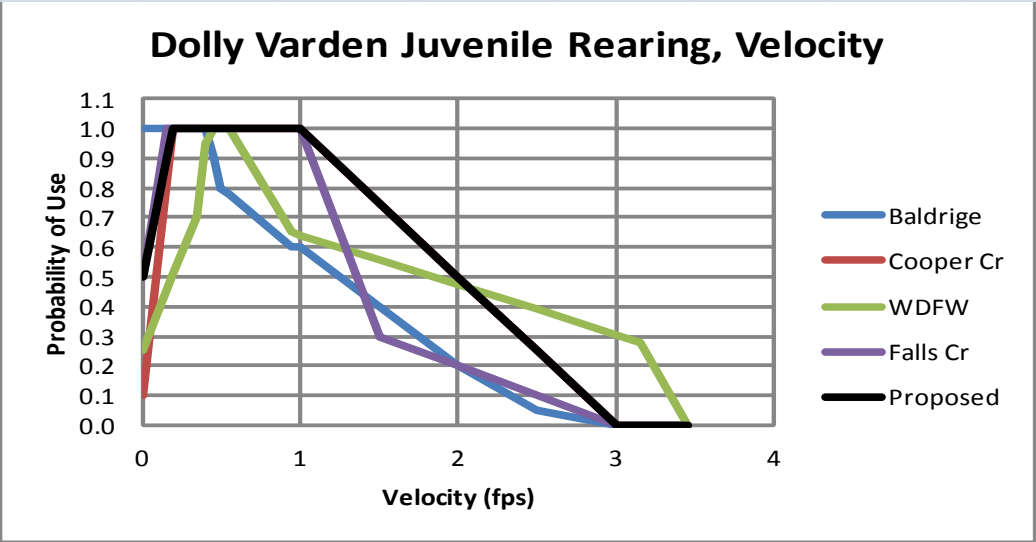


Depth	Baldrige	Cooper	Falls Cr	Proposed
0.00	0.00	0.00	0.00	0.00
0.05	1.00			
0.10		0.00		
0.20			1.00	1.00
0.30		1.00		
1.00	1.00			
1.50	0.80			
2.00	0.60			
2.50	0.40			
3.50	0.20			
4.00	0.10			
5.00	0.00	1.00	1.00	1.00

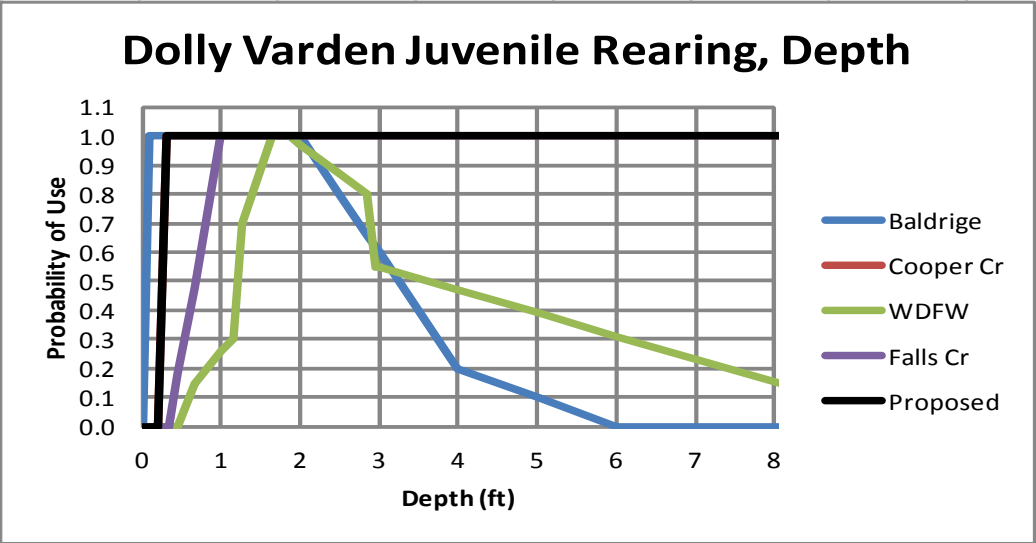


Dolly Varden, Juvenile Rearing

Velocity	Baldrige	Cooper Cr	WDFW	Falls Cr	Proposed
0.00	1.00	0.10	0.25	0.50	0.50
0.16				1.00	
0.20	1.00	1.00	0.51		1.00
0.35			0.70		
0.40	1.00				
0.45			1.00		
0.50	0.80				
0.55			1.00		
0.95			0.65		
1.00	0.60	1.00		1.00	1.00
1.50	0.40			0.30	
2.00	0.20				
2.50	0.05				
3.00	0.00	0.00		0.00	0.00
3.15			0.28		
3.45			0.00		0

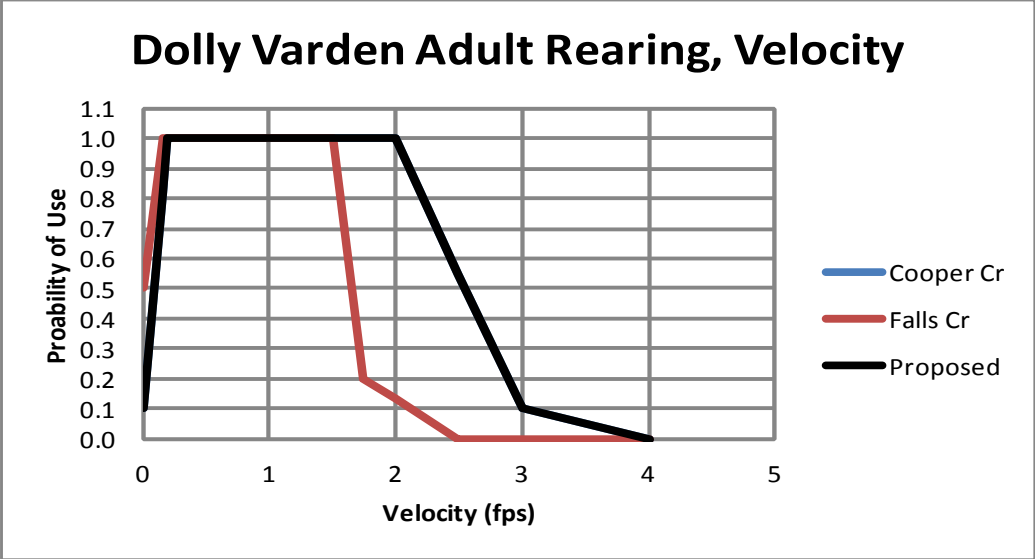


Depth	Baldrige	Cooper Cr	WDFW	Falls Cr	Proposed
0.00	0.00	0.00	0	0.00	0.00
0.10	1.00				
0.20		0.00			0.00
0.30		1.00			1.00
0.33				0.00	
0.45			0		
0.65			0.15		
1.00				1.00	
1.15				0.30	
1.25				0.70	
1.65				1.00	
1.85				1.00	
2.00	1.00				
2.50	0.80				
2.85				0.80	
2.95				0.55	
3.00	0.60				
4.00	0.20				
5.00	0.10				
6.00	0.00	1.00		1.00	
10.00			0		1.00

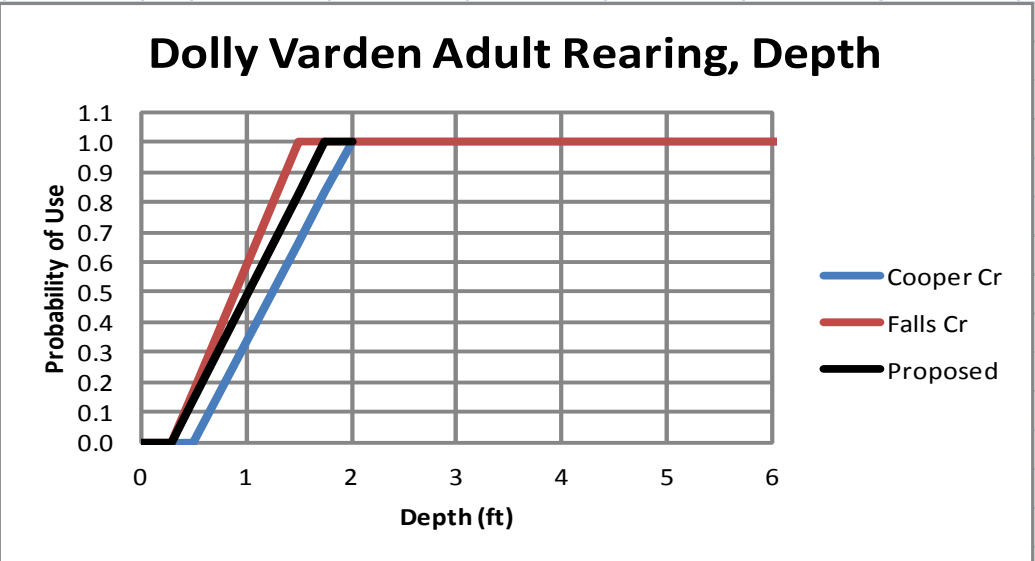


Dolly Varden, Adult Rearing

Velocity	Cooper Cr	Falls Cr	Proposed
0.00	0.10	0.50	0.10
0.16		1.00	
0.20	1.00		1.00
1.50		1.00	
1.75		0.20	
2.00	1.00		1.00
2.50		0.00	
3.00	0.10		0.10
4.00	0.00	0.00	0.00



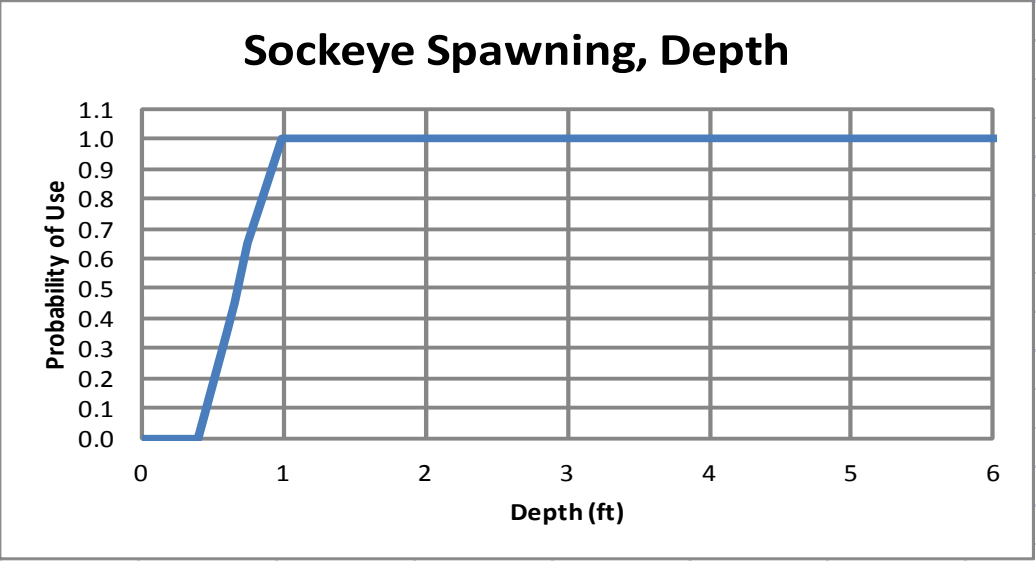
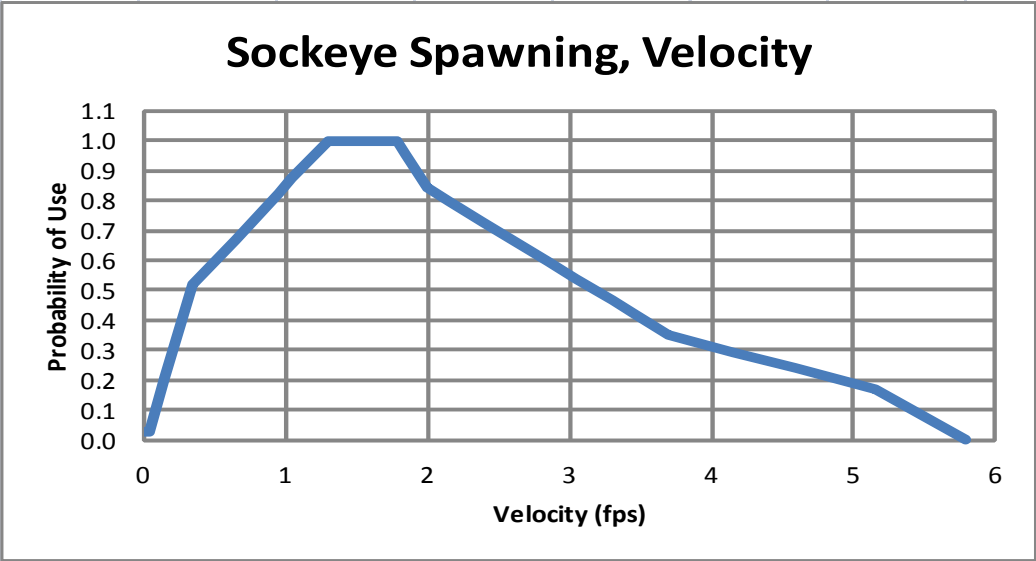
Depth	Cooper Cr	Falls Cr	Proposed
0.00	0.00	0.00	0.00
0.30		0.00	0.00
0.50	0.00		
1.50		1.00	
1.75			1.00
2.00	1.00		
7.00	1.00	1.00	1.00



Sockeye Salmon Spawning

Velocity	Grant C
0.00	0.03
0.05	0.03
0.15	0.21
0.35	0.52
0.65	0.67
1.05	0.87
1.30	1.00
1.79	1.00
2.00	0.84
2.40	0.72
2.85	0.60
3.30	0.47
3.70	0.35
4.15	0.29
4.60	0.24
5.15	0.17
5.80	0.00
10.00	0.00

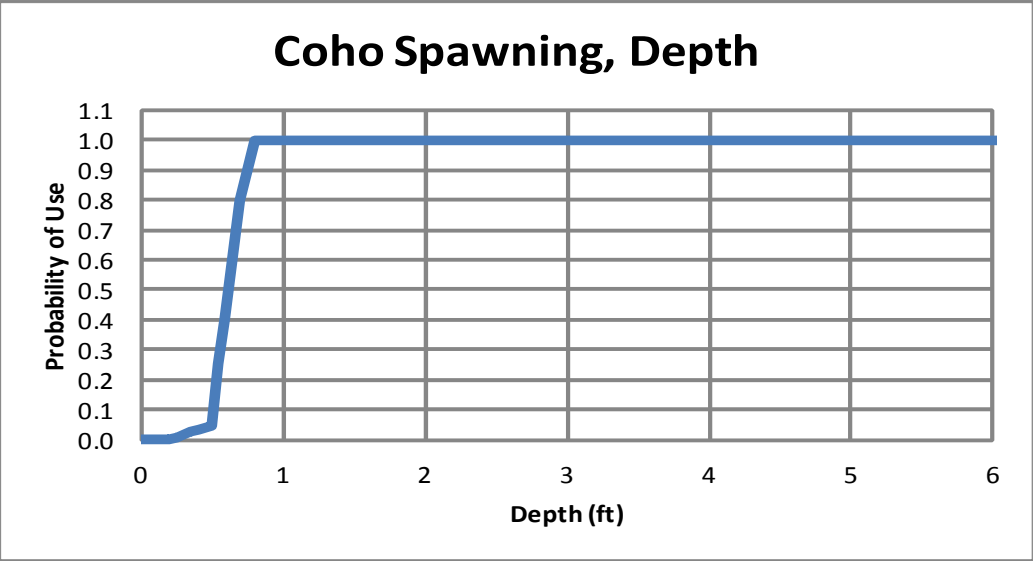
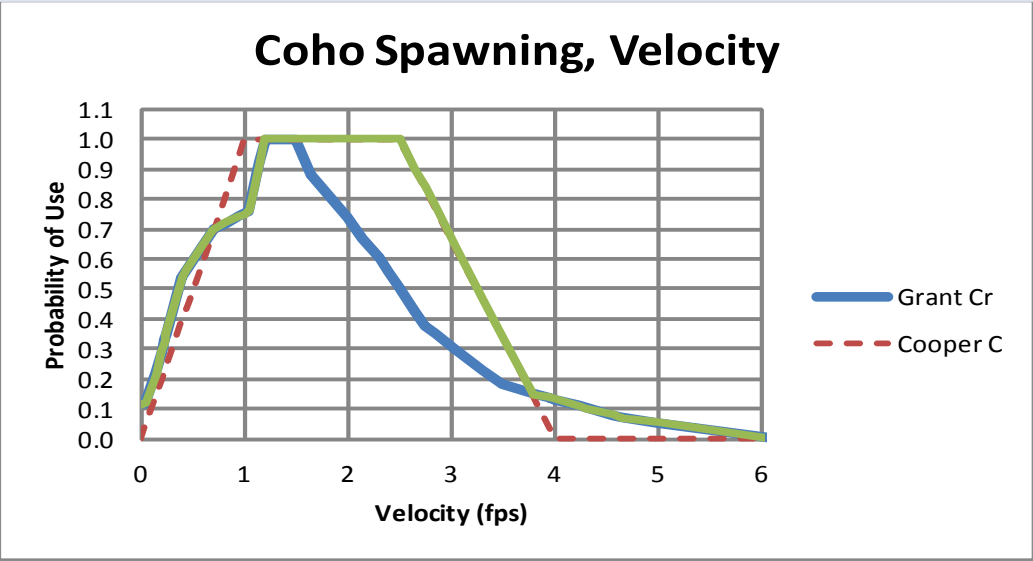
Depth	Grant C
0.00	0.00
0.40	0.00
0.60	0.34
0.75	0.65
0.85	0.78
1.00	1.00
10.00	1.00



Coho Salmon, Spawning

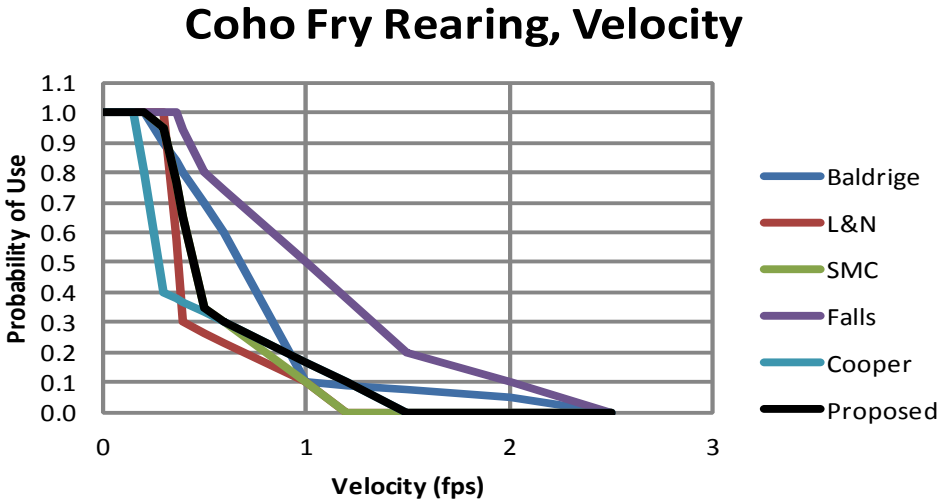
Velocity	Grant Cr	Cooper Cr	Proposed
0.00	0.12	0.00	0.12
0.05	0.12		0.12
0.15	0.22		0.22
0.25	0.35		0.35
0.40	0.54		0.54
0.45	0.57		0.57
0.70	0.70		0.70
0.95	0.74		0.74
1.00	0.75	1.00	0.75
1.05	0.76		0.76
1.20	1.00		1.00
1.49	1.00		
1.65	0.88	1.00	
2.00	0.74		
2.15	0.67		
2.40	0.56		
2.50	0.51	1.00	1.00
2.65	0.43		
2.75	0.38		
3.05	0.30		
3.50	0.18		
3.95	0.14	0.04	0.14
4.00	0.13	0.00	0.13
4.25	0.11	0.00	0.11
4.65	0.07	0.00	0.07
5.00	0.05	0.00	0.05
6.14	0.00	0.00	0.00

Depth	Grant Cr
0.00	0.00
0.20	0.00
0.35	0.03
0.50	0.05
0.70	0.80
0.80	1.00
10.00	1.00

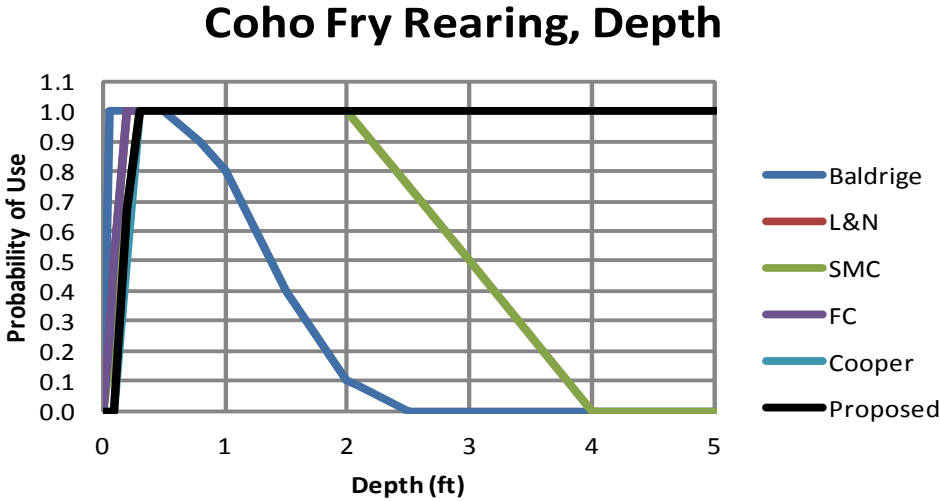


Coho Salmon, Fry Rearing

Velocity	Baldrige	L&N	Sawmill	Falls Cr	Cooper Cr	Proposed
0.00	1.00	1.00	1.00	1.00	1.00	1.00
0.15					1.00	
0.20	1.00		1.00			1.00
0.30		1.00	0.95		0.40	0.95
0.36				1.00		
0.40		0.30				
0.50			0.35	0.80		0.35
0.60	0.60					
1.00	0.10	0.10	0.10			
1.20		0.00	0.00			
1.50				0.20	0.00	0.00
2.00	0.05					
2.50	0.00			0.00	0.00	0.00



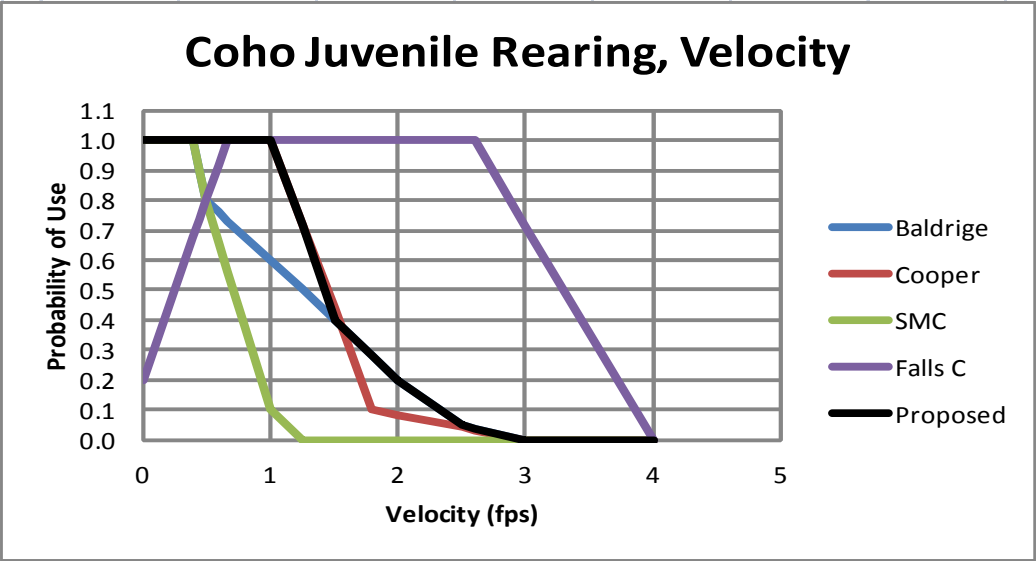
Depth	Baldrige	L&N	Sawmill	Falls Cr	Cooper Cr	Proposed
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.05	1.00					
0.10					0.00	0.00
0.20		1.00	0.67	1.00		0.67
0.30			1.00		1.00	1.00
0.50	1.00					
0.80	0.90					
1.00	0.80					
1.50	0.40					
2.00	0.10		1.00			
2.10			0.95			
2.50	0.00		0.75			
3.00			0.50			
4.00			0.00			
5.10		1.00		1.00	1.00	1.00



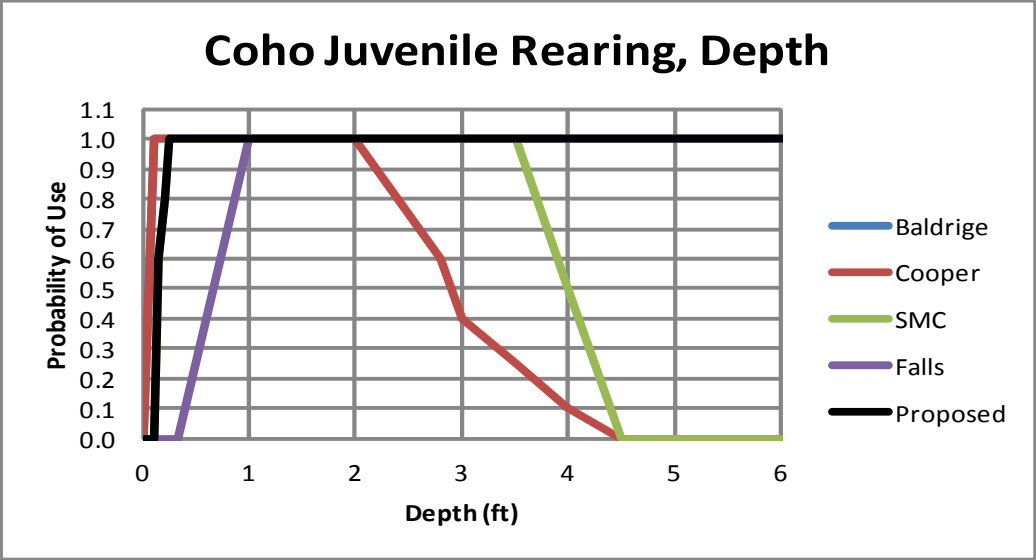
L&N = Lyons and Nadeau (1985)

Coho Salmon, Juvenile Rearing

Velocity	Baldrige	Cooper Cr	Sawmill	Falls Cr	Proposed
0.00	1.00	1.00	1.00	0.20	1.00
0.40	1.00		1.00		
0.45			0.90		
0.50	0.80		0.80		
0.60			0.66		
0.67				1.00	
0.80			0.38		
1.00	0.60	1.00	0.10		1.00
1.25			0.00		
1.50	0.40				0.4
1.80		0.10			
2.00	0.20	0.20			0.20
2.50	0.05	0.05			0.05
2.60				1.00	
3.00	0.00	0.00	0.00		0.00
4.00				0.00	

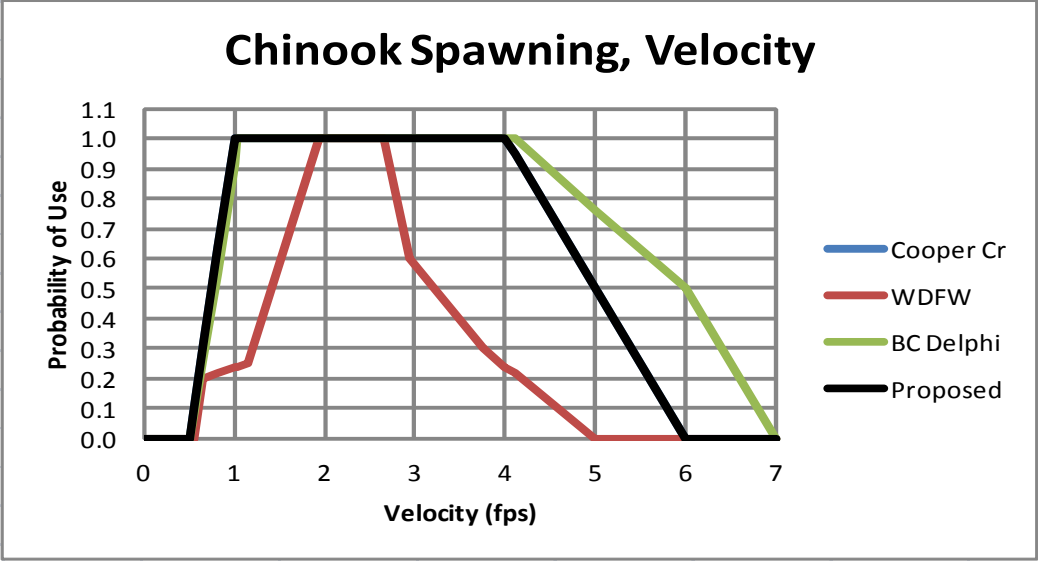


Depth	Baldrige	Cooper Cr	Sawmill	Falls Cr	Proposed
0.00	0.00	0.00	0.00	0.00	0.00
0.10	1.00	1.00	0.00		0.00
0.15			0.60		0.60
0.20					
0.25			1.00		1.00
0.33				0.00	
1.00				1.00	
2.00		1.00			
2.40		0.80			
2.80		0.60			
3.00		0.40			
3.50			1.00		
4.00		0.10	0.50		
4.50		0.00	0.00		
5.00	1.00	0.00		1.00	1.00

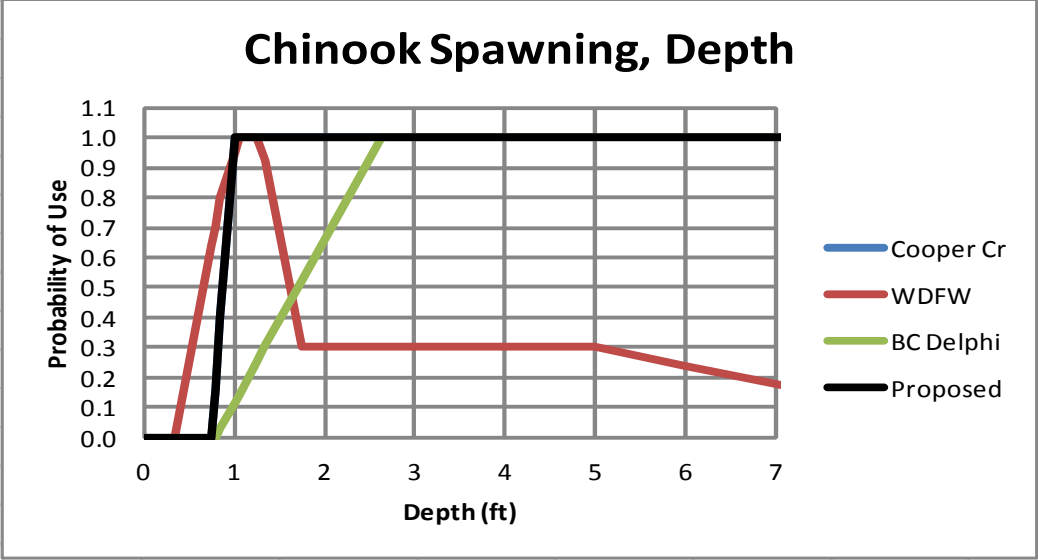


Chinook Salmon, Spawning

Velocity	Cooper Cr	WDFW	BC Delphi	Proposed
0.00	0.00	0.00	0.00	0.00
0.50	0.00		0.00	0.00
0.55		0.00		
0.65		0.20		
0.82			0.55	
1.00	1.00			1.00
1.04			1.00	
1.15		0.25		
1.95		1.00		
2.65		1.00		
2.95		0.60		
3.75		0.30		
4.00	1.00			1.00
4.10			1.00	
5.00	0.50	0.00		0.50
6.00	0.00		0.50	0.00
7.00	0.00	0.00	0.00	0.00

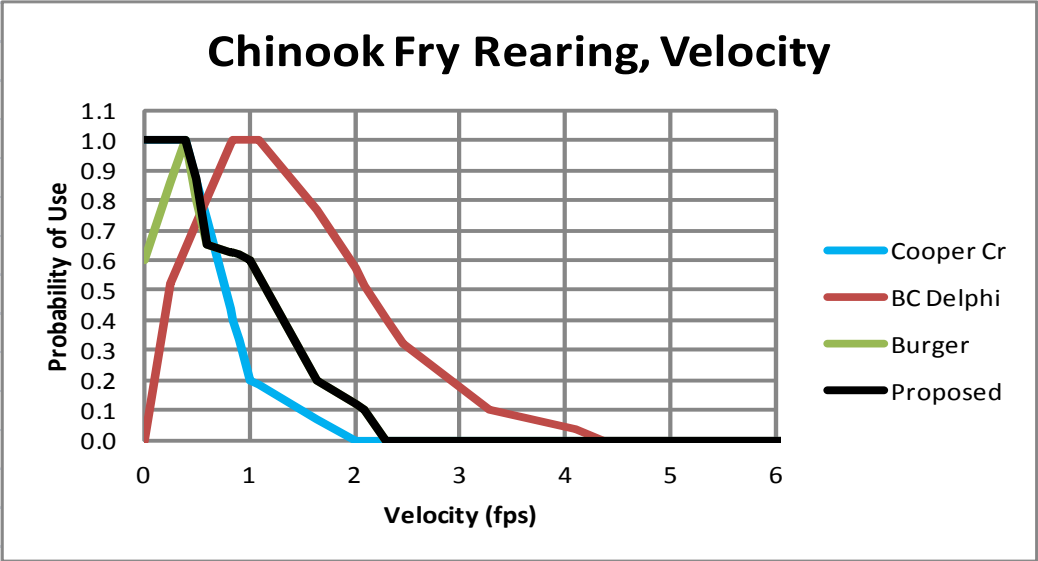


Depth	Cooper Cr	WDFW	BC Delphi	Proposed
0.00	0.00	0.00	0.00	0.00
0.35		0.00		
0.75	0.00			0.00
0.79			0.00	
0.85		0.80		
1.00	1.00			1.00
1.05		1.00		
1.25		1.00		
1.35		0.92		
1.75		0.30		
2.62			1.00	
5.00		0.30		
6.00				
10.00	1.00	0.00	1.00	1.00

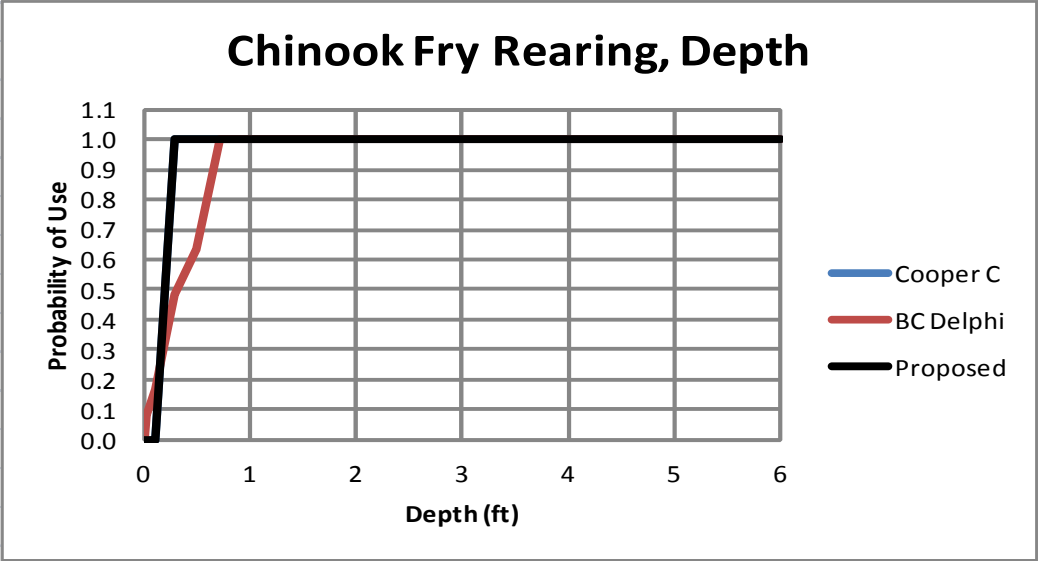


Chinook Salmon, Fry Rearing

Velocity	Cooper Cr	BC Delphi	Burger	Proposed
0.00	1.00	0.00	0.60	1.00
0.26		0.52		
0.40	1.00		1.00	1.00
0.50			0.80	0.87
0.60			0.65	0.65
0.82		0.99		
0.85		1.00		
0.90			0.62	0.62
1.00	0.20		0.60	0.60
1.08		1.00		
1.64		0.77	0.20	0.20
2.00	0.00			
2.10			0.10	0.10
2.30			0.00	0.00
2.46	0.00	0.32		
3.28	0.00	0.10		
4.10	0.00	0.04		
4.36	0.00	0.00		
7.00	0.00	0.00	0.00	0.00

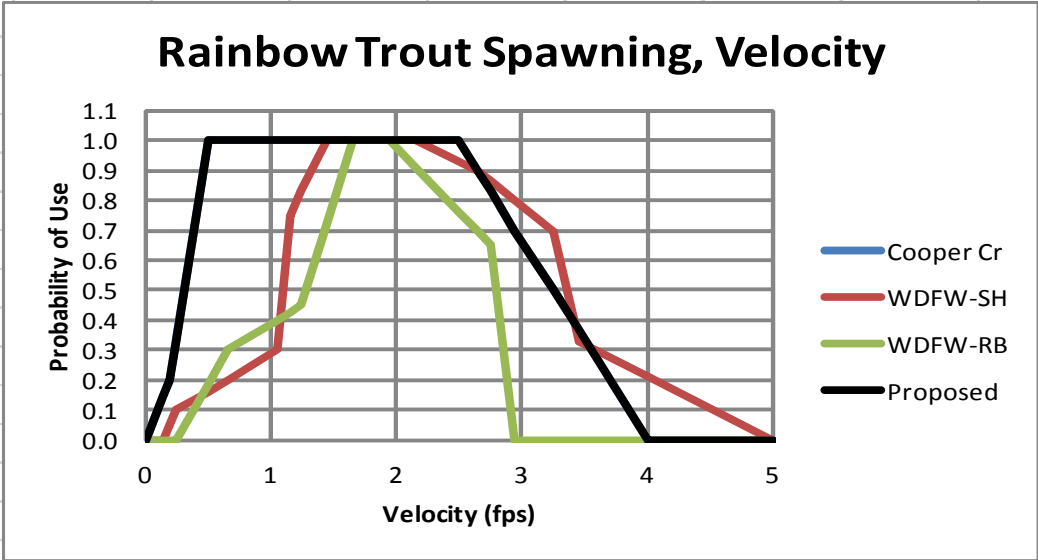


Depth	Cooper C	BC Delphi	Proposed
0.00	0.00	0.00	0.00
0.03		0.08	
0.10	0.00		0.00
0.30	1.00		1.00
0.49		0.63	
0.72		1.00	
6.00	1.00	1.00	1.00



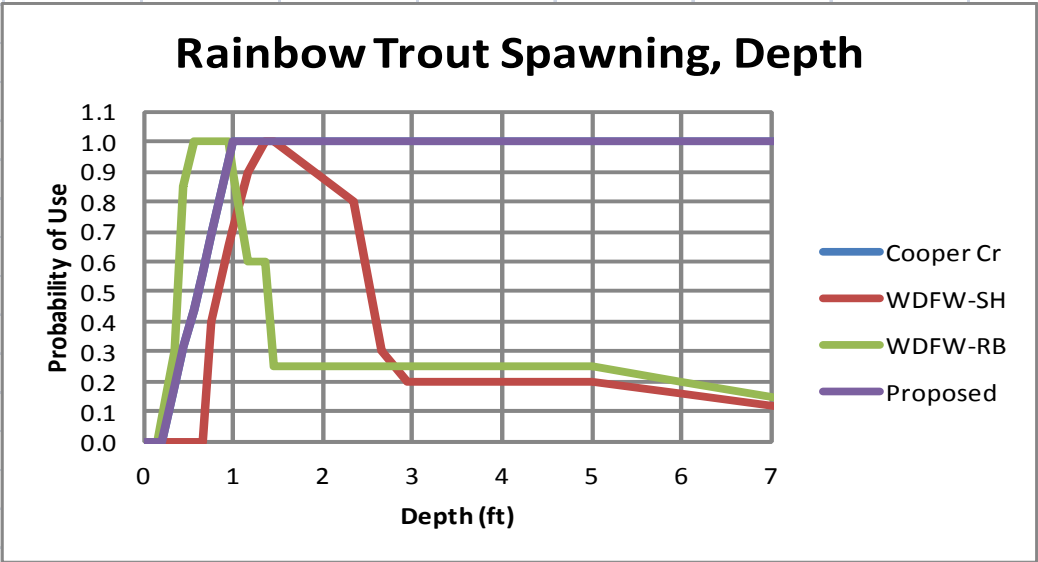
Rainbow Trout, Spawning
Velocity

Velocity	Cooper Cr	WDFW-SH	WDFW-RB	Proposed
0.00	0.00	0.00	0.00	0.00
0.15		0.00		
0.20	0.20			0.20
0.25		0.10	0.00	
0.50	1.00			1.00
0.65			0.30	
1.05		0.30		
1.15		0.75		
1.25			0.45	
1.45		1.00		
1.65			1.00	
1.95			1.00	
2.15		1.00		
2.50	1.00			1.00
2.65		0.90		
2.75			0.65	
2.95			0.00	
3.25		0.70		
3.45		0.33		
4.00	0.00			0.00
5.00	0.00	0.00	0.00	0.00



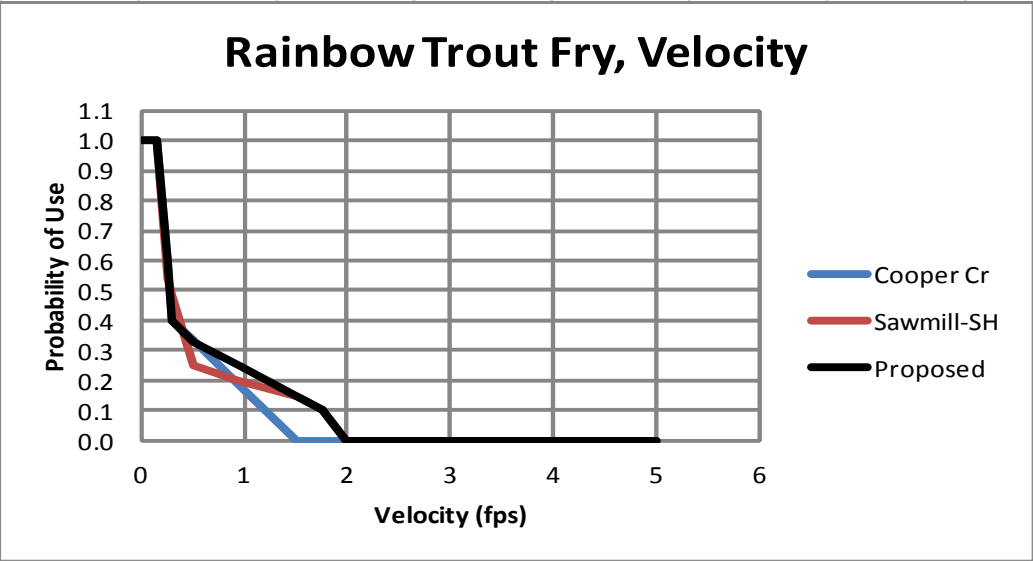
Rainbow Trout, Spawning
Depth

Depth	Cooper Cr	WDFW-SH	WDFW-RB	Proposed
0.00	0.00	0.00	0.00	0.00
0.15			0.00	
0.20	0.00			0.00
0.35			0.30	
0.45			0.85	
0.55			1.00	
0.65		0.00		
0.75		0.40		
0.95			1.00	
1.00	1.00			1.00
1.15		0.90		
1.35		1.00	0.60	
1.45		1.00	0.25	
2.35		0.80		
2.65		0.30		
2.95		0.20		
5.00		0.20	0.25	
10.00	1.00	0.00	0.00	1.00

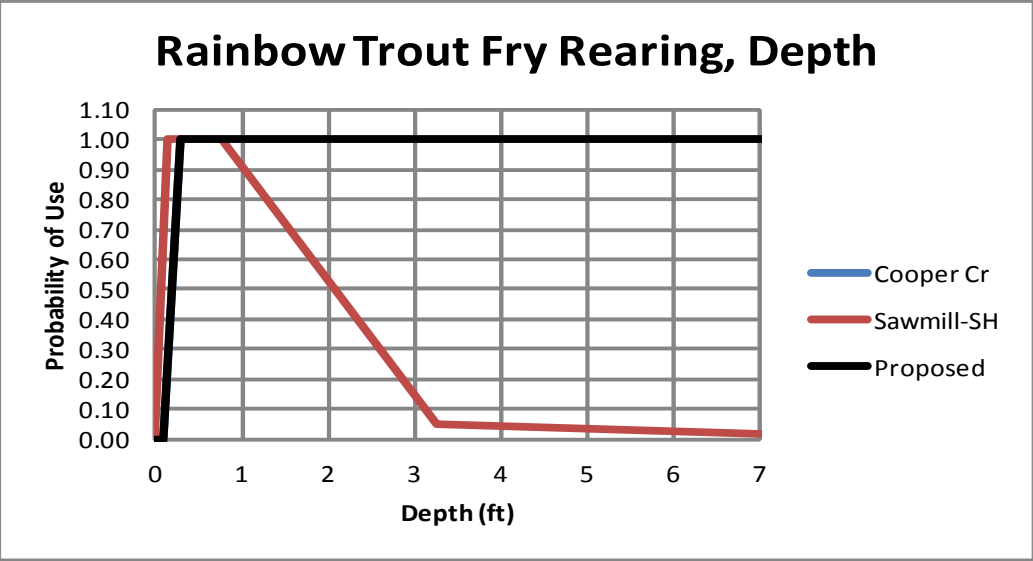


Rainbow Trout
Fry Rearing

Velocity	Cooper Cr	Sawmill-SH	Proposed
0.00	1.00	1.00	1.00
0.15	1.00	1.00	1.00
0.25		0.54	
0.30	0.40		0.40
0.50		0.25	0.33
0.95		0.20	
1.50	0.00	0.15	0.15
1.75		0.10	0.10
1.80		0.08	0.08
2.00		0.00	0.00
5.00	0.00	0.00	0.00

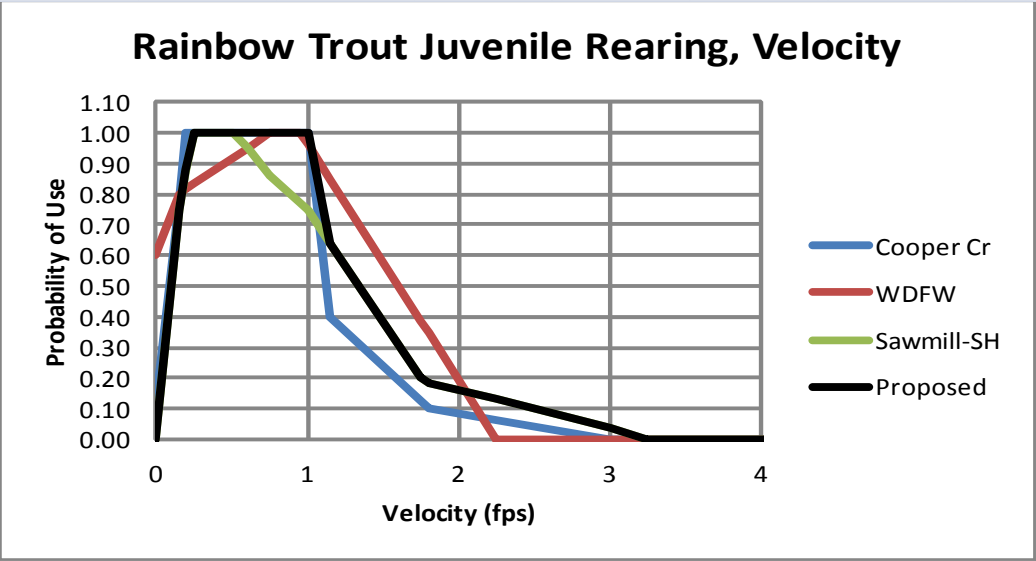


Depth	Cooper Cr	Sawmill-SH	Proposed
0.00	0.00	0.00	0.00
0.10	0.00		0.00
0.15		1.00	
0.30	1.00		1.00
0.75		1.00	
3.25		0.05	
9.00	1.00	0.00	1.00

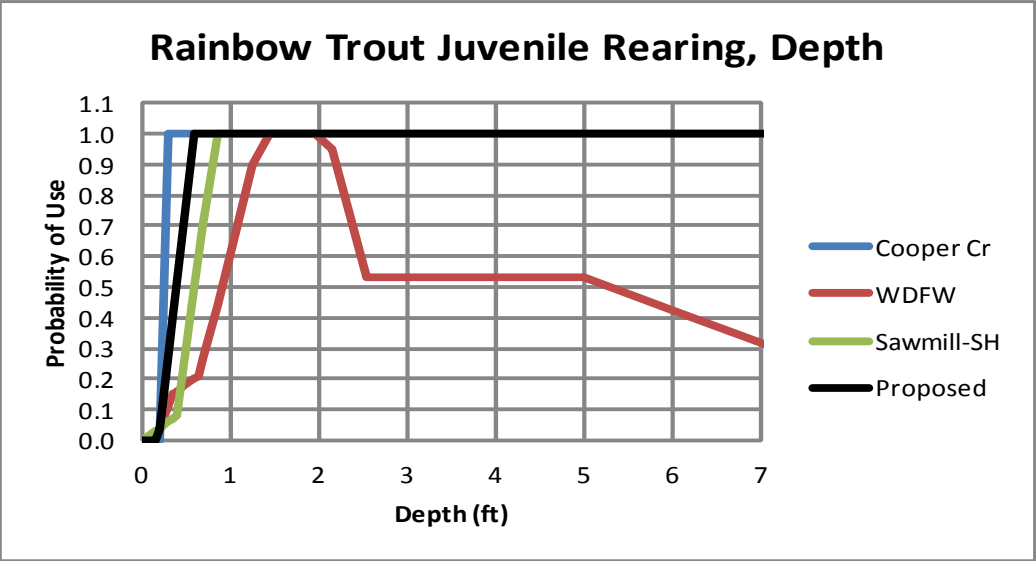


Rainbow Trout
Juvenile Rearing

Velocity	Cooper Cr	WDFW	Sawmill-SH	Proposed
0.00	0.10	0.60	0.00	0.00
0.15		0.80		0.75
0.20	1.00			0.88
0.25			1.00	1.00
0.50			1.00	
0.60			0.95	
0.75		1.00		
0.95		1.00		
1.00	1.00		0.75	1.00
1.15	0.40			0.64
1.75			0.20	0.20
1.80	0.10			
2.25		0.00		
3.00	0.00		0.04	0.04
3.25			0.00	0.00
5.00	0.00	0.00	0.00	0.00

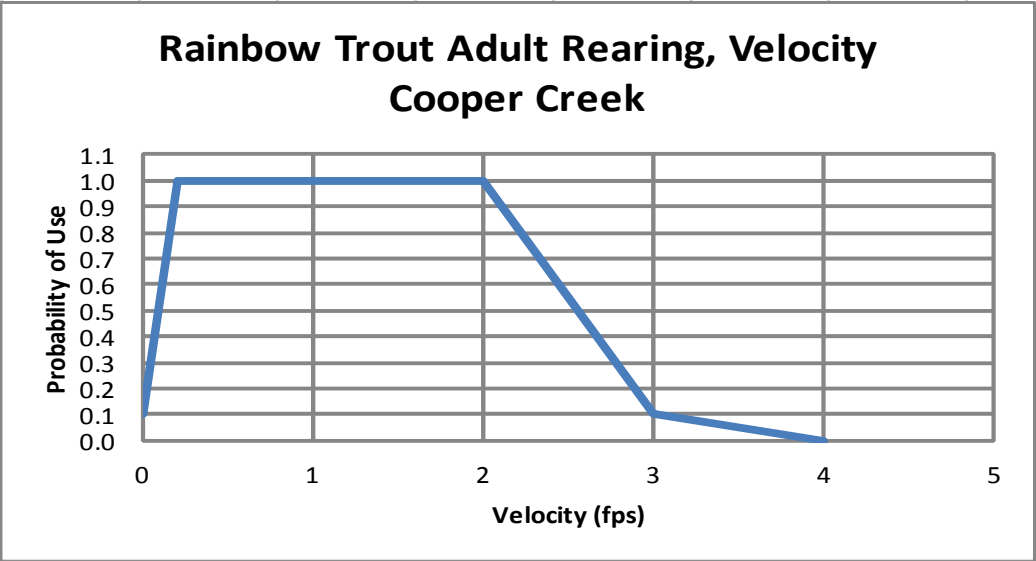


Depth	Cooper Cr	WDFW	Sawmill-SH	Proposed
0.00	0.00	0.00	0.00	0.00
0.15		0.00		0.00
0.20	0.00			0.04
0.30	1.00			
0.35		0.15		
0.40			0.08	
0.50			0.29	
0.60			0.50	1.00
0.65		0.21		
0.70			0.70	
0.85			1.00	
1.25		0.90		
1.45		1.00		
1.95		1.00		
2.15		0.95		
2.55		0.53		
5.00		0.53		
10.00	1.00	0.00	1.00	1.00

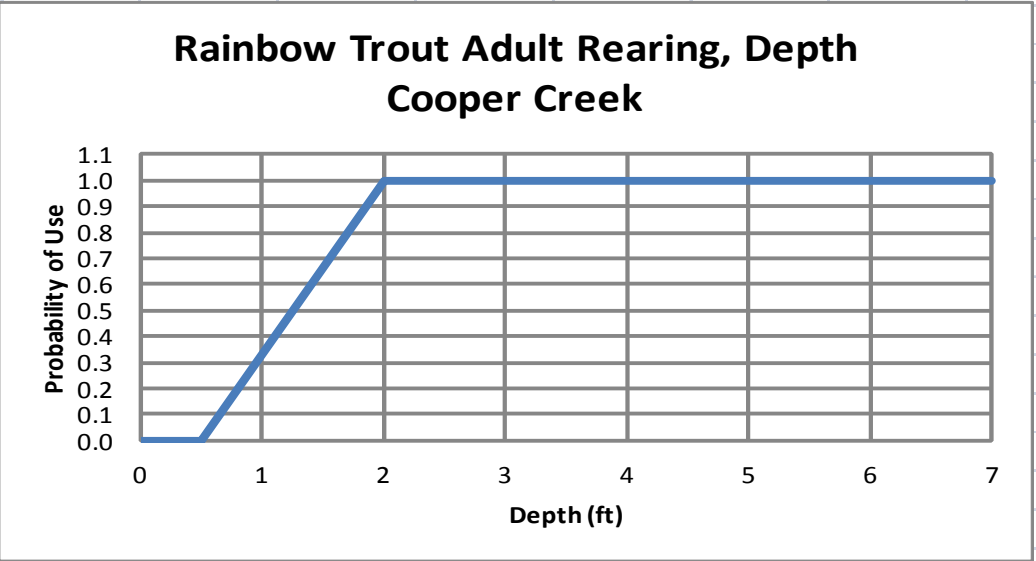


Rainbow Trout
Adult Rearing

Velocity	Cooper Cr
0.00	0.10
0.20	1.00
2.00	1.00
3.00	0.10
4.00	0.00



Depth	Cooper Cr
0.00	0.00
0.50	0.00
2.00	1.00
7.00	1.00



Generic Cover Codes and HSC Values

Code	Type of Cover	Fry	Juvenile
0.1	Undercut Bank	1.00	1.00
0.2	Overhanging Vegetation	1.00	1.00
0.3	Rootwad including partly undercut)	1.00	1.00
0.4	Log Jam/submerged brush pile	1.00	1.00
0.5	Logs(s) parallel to bank/rip-rap	0.30	0.80
0.6	Aquatic Vegetation	1.00	0.80
0.7	Short (<1') terrestrial grass	0.40	0.10
0.8	Tall (>3') dense grass	0.70	0.70
0.9	Vegetation beyond the bank-full waters edge	0.20	0.20

Proposed Substrate Codes and HSC Values

AK	WDFW	Material	Size	Spawning				Rearing
				Chinook	Coho	Sockeye	RB/DV	All
0	1	Organic	Organic	0.00	0.00	0.00	0.00	1.00
1	2	Sand/Silt	< 2mm	0.00	0.00	0.00	0.00	1.00
2	3	Small Gravel	2 - 8 mm	0.30	0.40	0.40	0.50	1.00
3	4	Medium Gravel	8 - 32 mm	1.00	1.00	1.00	1.00	1.00
4	5	Large Gravel	32 - 64 mm	1.00	1.00	1.00	1.00	1.00
5	6	Small Cobble	64-128 mm	1.00	0.70	0.70	1.00	1.00
6	7	Large Cobble	128-256	0.50	0.00	0.00	0.50	1.00
7	8	Boulder	> 266 mm	0.00	0.00	0.00	0.00	1.00
8	9	Bedrock	Bedrock	0.00	0.00	0.00	0.00	1.00

From: Miller, Monte D (DFG) <monte.miller@alaska.gov>
Sent: Thursday, December 19, 2013 1:43 PM
To: John Blum; Cory Warnock; 'Eric Rothwell'; Klein, Joseph P (DFG); Mouw, Jason E B (DFG); jeffry_anderson@fws.gov; 'Mike Salzetti'
Cc: Emily Andersen
Subject: RE: Revised Grant Lake HSC curves

John,

This e-mail is to let you know that ADF&G will not be able to complete review and internal discussions on the HSC's until the second week of January. We typically require a 30 day review period to discuss internally and respond on projects. This time of year is especially bad with staff using leave around the holidays, and for some, a mandatory leave use (use it or lose it). We will be following up with a letter to identify some additional information needs necessary to evaluate the HSC's you have developed.

Monte D. Miller
Statewide FERC Hydropower Coordinator
Alaska Department of Fish and Game
Division of Sport Fish / RTS
333 Raspberry Road
Anchorage, Alaska, 99518-1565

(907) 267-2312**From:** John Blum [<mailto:john.blum@mcmillen-llc.com>]
Sent: Wednesday, December 18, 2013 3:24 PM
To: 'Cory Warnock'; Miller, Monte D (DFG); 'Eric Rothwell'; Klein, Joseph P (DFG); Mouw, Jason E B (DFG); jeffry_anderson@fws.gov; 'Mike Salzetti'
Cc: 'Emily Andersen'
Subject: Revised Grant Lake HSC curves

Good afternoon:

After our last conversation, I have had additional review and synthesis of curves developed and/or used in Alaska streams. I have looked at all the curves that were examined when developing HSC curves for the Sawmill Creek project (coho and steelhead), as well as those considered for the Falls Creek project (coho and char). I've also looked at Burger's Chinook fry curves on the Kenai River. I want to thank Monte and Jeff for providing these sources. These were in addition to the Cooper Creek curves. Given the extensive literature review provided in these reports, I went through them all and eliminated those from different types of systems, Category I curves, etc. and got it down to a workable number of curves. In some species and life stages (rainbow trout adult rearing, for example), there still weren't very many to review.

I graphed all the pertinent curves and made proposed a recommended set of curves to use. Please review these by next Monday; on Tuesday, I will run these or the recommended revised curves for the 18 transects and produce WUA for each species and life stage by transect and reach.

As Monte and I discussed earlier this week, I see this as the beginning of the process. We have many things yet to decide as a group as we move the analysis forward. These include, among other things, species and life history stage

periodicity, hydrology to use for time series analysis, which are the target species and life stages for each month, etc. These curves are just to get us going.

Thank you all for your input. Please get back to me with any comments by COB Monday, and I'll get to work generating the WUA graphs and tables. Merry Christmas, everyone!

John

From: John Stevenson <john.stevenson@bioanalysts.net>
Sent: Tuesday, December 31, 2013 3:35 PM
To: Ayers, Scott D (DFG)
Cc: Mark Miller; Cory Warnock; Emily Andersen
Subject: Grant Creek Data Submission
Attachments: image001.gif; image003.jpg; Grant Creek FRP data submission form 5 3 - BioAnalysts December 31 2013.xlsx

Hi Scott,

Attached is our data submission form for Grant Creek. Please note that for all radio-tagged fish, I entered the channel/code in the comment column, and our tags were on 148 MHz using the channel designations developed by Lotek Engineering (i.e., channel 1 is frequency 148.320, channel 2 is 148.340, etc.). As we discussed on the phone, all juveniles that were marked using Bismark Brown dye are also identified in the comment column. If you have any questions, let me know.

Thanks, John

John R. Stevenson
Fisheries Biologist
BioAnalysts, Inc.
16541 Redmond Way, #339
Redmond, WA 98052
(425) 883-8295; (206) 390-7116 (cell)



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MT204	60.456961	-149.3602034	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:49	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	63	fork	2.6					measured and released			
MT204	60.456961	-149.3602034	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:49	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	65	fork	3					measured and released			
MT204	60.456961	-149.3602034	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:49	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	65	fork	2.6					measured and released			
MT204	60.456961	-149.3602034	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:49	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	65	fork	2.6					measured and released			
MT204	60.456961	-149.3602034	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:49	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	72	fork	3.6					measured and released			
MT204	60.456961	-149.3602034	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:49	John R. Stevenson, Mark D. Miller	Minnow Trap	sculpin-unspecified	juvenile/adult	82	total	6					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Dolly Varden	juvenile	115	fork	13.8					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	72	fork	4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	63	fork	2.6					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	58	fork	2.2					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	55	fork	1.6					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	64	fork	2.6					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	64	fork	2.8					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Dolly Varden	juvenile	106	fork	10					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	63	fork	2.8					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	72	fork	4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	47	fork	2.2					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	61	fork	2.4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	120	fork	18.6					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Dolly Varden	juvenile	106	fork	10.4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	67	fork	3					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	63	fork	2.6					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	sculpin-unspecified	juvenile/adult	90	total	6.6					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	62	fork	2.4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	66	fork	3					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	70	fork	3.4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	60	fork	2.2					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	60	fork	2.4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	65	fork	2.8					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	60	fork	2.2					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	58	fork	2					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	50	fork	1.4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	55	fork	1.6					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	52	fork	1.4					measured and released			
MT205	60.456995	-149.3600205	NAD83	GPS	Grant Creek (1-4)	8/20/13 12:58	John R. Stevenson, Mark D. Miller	Minnow Trap	sculpin-unspecified	juvenile/adult	53	total	1.4					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	71	fork	4.2					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	76	fork	4.8					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	65	fork	2.8					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	75	fork	3.4					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	62	fork	2.6					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	64	fork	2.6					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	79	fork	5					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	70	fork	3.6					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	70	fork	3.8					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	70	fork	3.6					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	60	fork	2.2					measured and released			
MT206	60.456618	-149.3599034	NAD83	GPS	Grant Creek (1-4)	8/20/13 13:08	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	65	fork	2.6					measured and released			
MT207	60.456484	-149.357762	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:05	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	78	fork	4.8					measured and released			
MT207	60.456484	-149.357762	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:05	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	105	fork	11.8					measured and released			
MT207	60.456484	-149.357762	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:05	John R. Stevenson, Mark D. Miller	Minnow Trap	Dolly Varden	juvenile	60	fork	2					measured and released			
MT207	60.456484	-149.357762	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:05	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	69	fork	3.2					measured and released			
MT207	60.456484	-149.357762	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:05	John R. Stevenson, Mark D. Miller	Minnow Trap	Dolly Varden	juvenile	82	fork	4					measured and released			
MT207	60.456484	-149.357762	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:05	John R. Stevenson, Mark D. Miller	Minnow Trap	Dolly Varden	juvenile	58	fork	2.4					measured and released			
MT207	60.456484	-149.357762	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:05	John R. Stevenson, Mark D. Miller	Minnow Trap	sculpin-unspecified	juvenile/adult	84	total	6.2					measured and released			
MT208	60.456513	-149.3577442	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:13	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	77	fork	5.4					measured and released			
MT208	60.456513	-149.3577442	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:13	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	70	fork	3.6					measured and released			
MT208	60.456513	-149.3577442	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:13	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	83	fork	5.6					measured and released			
MT208	60.456513	-149.3577442	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:13	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	64	fork	2.8					measured and released			
MT208	60.456513	-149.3577442	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:13	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	69	fork	3.4					measured and released			
MT208	60.456513	-149.3577442	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:13	John R. Stevenson, Mark D. Miller	Minnow Trap	Dolly Varden	juvenile	66	fork	2.2					measured and released			
MT208	60.456513	-149.3577442	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:13	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	67	fork	3.2					measured and released			
MT209	60.456305	-149.3571639	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:20	John R. Stevenson, Mark D. Miller	Minnow Trap	sculpin-unspecified	juvenile/adult	75	total	4.2					measured and released			
MT209	60.456305	-149.3571639	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:20	John R. Stevenson, Mark D. Miller	Minnow Trap	sculpin-unspecified	juvenile/adult	87	total	7.4					measured and released			
MT209	60.456305	-149.3571639	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:20	John R. Stevenson, Mark D. Miller	Minnow Trap	rainbow trout	juvenile	91	fork	7.8					measured and released			
MT209	60.456305	-149.3571639	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:20	John R. Stevenson, Mark D. Miller	Minnow Trap	Chinook Salmon	juvenile	94	fork	7.8					measured and released			
MT209	60.456305	-149.3571639	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:20	John R. Stevenson, Mark D. Miller	Minnow Trap	Dolly Varden	juvenile	67	fork	2.8					measured and released			
MT209	60.456305	-149.3571639	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:20	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	65	fork	2.8					measured and released			
MT209	60.456305	-149.3571639	NAD83	GPS	Grant Creek (1-4)	8/20/13 14:20	John R. Stevenson, Mark D. Miller	Minnow Trap	coho salmon	juvenile	61	fork	2.6					measured and released			
MT210	60.456535	-149.35656	NAD83	GPS	Grant Creek (1-																

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Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	21-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	533	MEFK	2460	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	21-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	556	MEFK	2620	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	21-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	576	MEFK	3220	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	21-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	587	MEFK	3280	Male	measured and released	radio tagged-esophageal		16/27
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	21-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	615	MEFK	4540	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	23-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	559	MEFK	3100	Male	measured and released	radio tagged-esophageal		13/14
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	23-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	587	MEFK	3280	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	23-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	605	MEFK	4060	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	23-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	610	MEFK	4310	Male	measured and released	radio tagged-esophageal		14/20
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	23-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	602	MEFK	4550	Male	measured and released	radio tagged-esophageal		15/22
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	24-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	533	MEFK	2560	Male	measured and released	radio tagged-esophageal		16/28
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	24-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	562	MEFK	2990	Male	measured and released	radio tagged-esophageal		14/16
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	24-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	583	MEFK	3310	Male	measured and released	radio tagged-esophageal		16/29
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	24-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	607	MEFK	3940	Male	measured and released	radio tagged-esophageal		13/15
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	24-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	613	MEFK	4500	Male	measured and released	radio tagged-esophageal		15/23
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	24-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	612	MEFK	4640	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	545	MEFK	2980	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	570	MEFK	3010	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	559	MEFK	3350	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	575	MEFK	3440	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	595	MEFK	3540	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	627	MEFK	3980	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	634	MEFK	4340	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	635	MEFK	4870	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	518	MEFK	2070	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	577	MEFK	2810	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	565	MEFK	3000	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	572	MEFK	3380	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	598	MEFK	3540	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	608	MEFK	3900	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	593	MEFK	3960	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	604	MEFK	4480	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	26-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	628	MEFK	4650	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	566	MEFK	3000	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	565	MEFK	3140	Male	measured and released	radio tagged-esophageal		5/14
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	595	MEFK	3270	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	593	MEFK	3280	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	588	MEFK	3370	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	604	MEFK	3370	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	587	MEFK	3420	Female	measured and released	radio tagged-esophageal		6/34
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	598	MEFK	3480	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	578	MEFK	3690	Male	measured and released	radio tagged-esophageal		8/74
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	582	MEFK	3770	Male	measured and released	radio tagged-esophageal		7/54
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	27-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	680	MEFK	3860	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	546	MEFK	2380	Female	measured and released	radio tagged-esophageal		6/35
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	547	MEFK	2670	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	539	MEFK	2680	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	545	MEFK	2730	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	572	MEFK	2790	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	567	MEFK	3080	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	602	MEFK	3520	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	606	MEFK	3670	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	611	MEFK	3730	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	589	MEFK	3810	Male	measured and released	radio tagged-esophageal		8/75
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	614	MEFK	3910	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	608	MEFK	4030	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	627	MEFK	4060	Female	measured and released	radio tagged-esophageal		7/55
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	631	MEFK	4100	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	610	MEFK	4250	Female	measured and released	radio tagged-esophageal		5/15
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	630	MEFK	4360	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	625	MEFK	4850	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	671	MEFK	6450	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	493	MEFK	1970	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	531	MEFK	2500	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	540	MEFK	2640	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	550	MEFK	2750	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	582	MEFK	3080	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	587	MEFK	3240	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	593	MEFK	3450	Female	measured and released	radio tagged-esophageal		8/59
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	620	MEFK	4380	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Sep-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	637	MEFK	4800	Male	measured and released	radio tagged-esophageal		5/16
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	505	MEFK	1840	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	555	MEFK	2460	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	543	MEFK	2570	Male	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	550	MEFK	2880	Female	measured and released	radio tagged-esophageal		8/60
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	582	MEFK	3100	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	595	MEFK	3340	Female	measured and released			
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	611	MEFK	3500	Female	measured and released	radio tagged-esophageal		6/36
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	597	MEFK	3790	Male	measured and released</			

Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	652	MEFK	4200	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	640	MEFK	4330	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	542	MEFK	2560	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	595	MEFK	3440	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	590	MEFK	3630	Male			measured and released	radio tagged-esophageal	5/17
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	608	MEFK	3720	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	599	MEFK	3920	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	597	MEFK	4000	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	620	MEFK	4160	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	623	MEFK	4280	Female			measured and released	radio tagged-esophageal	6/37
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	540	MEFK	2310	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	582	MEFK	2440	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	527	MEFK	2520	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	536	MEFK	2540	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	556	MEFK	2600	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	560	MEFK	2690	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	538	MEFK	2710	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	560	MEFK	2710	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	568	MEFK	2760	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	557	MEFK	2790	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	558	MEFK	2860	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	580	MEFK	2960	Female			measured and released	radio tagged-esophageal	7/57
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	592	MEFK	2990	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	584	MEFK	3130	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	596	MEFK	3300	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	587	MEFK	3310	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	604	MEFK	3430	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	601	MEFK	3600	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	588	MEFK	3630	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	609	MEFK	3700	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	620	MEFK	3870	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	610	MEFK	3960	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	633	MEFK	4100	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	644	MEFK	4350	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	651	MEFK	4530	Female			measured and released	radio tagged-esophageal	8/61
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	654	MEFK	4790	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	658	MEFK	5690	Male			measured and released	radio tagged-esophageal	5/18
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	479	MEFK	1490	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	551	MEFK	2620	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	563	MEFK	2820	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	582	MEFK	2970	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	578	MEFK	3000	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	587	MEFK	3150	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	588	MEFK	3170	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	613	MEFK	3240	Female			measured and released	radio tagged-esophageal	8/62
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	592	MEFK	3430	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	609	MEFK	3460	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	599	MEFK	3630	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	610	MEFK	3740	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	596	MEFK	3920	Male			measured and released	radio tagged-esophageal	7/58
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	596	MEFK	4010	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	616	MEFK	4130	Male			measured and released	radio tagged-esophageal	6/38
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	650	MEFK	4260	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	668	MEFK	5010	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	555	MEFK	2760	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	611	MEFK	3700	Male			measured and released	radio tagged-esophageal	6/39
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	638	MEFK	4530	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	540	MEFK	2020	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	524	MEFK	2190	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	567	MEFK	2570	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	582	MEFK	3100	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	582	MEFK	3340	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	610	MEFK	3530	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	620	MEFK	3560	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	616	MEFK	3770	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	7-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	624	MEFK	4300	Female			measured and released	radio tagged-esophageal	7/43
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	7-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	630	MEFK	4430	Male			measured and released	radio tagged-esophageal	5/19
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	8-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	569	MEFK	2600	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	8-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	578	MEFK	3090	Male			measured and released	radio tagged-esophageal	6/40
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	604	MEFK	3410	Male			measured and released	radio tagged-esophageal	5/20
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	586	MEFK	3590	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	613	MEFK	3630	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	619	MEFK	3740	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	588	MEFK	3920	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	618	MEFK	4240	Male			measured and released	radio tagged-esophageal	8/63
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	627	MEFK	4570	Male			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	657	MEFK	4720	Female			measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	10-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	451	MEFK	1450	Female					

Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	10-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	582	MEFK	3190	Female		measured and released	radio tagged-esophageal	5/21
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	10-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	605	MEFK	3620	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	10-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	644	MEFK	4700	Male		measured and released	radio tagged-esophageal	8/64
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	575	MEFK	2720	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	550	MEFK	2890	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	600	MEFK	3190	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	610	MEFK	3410	Female		measured and released	radio tagged-esophageal	6/41
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	612	MEFK	3470	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	597	MEFK	3640	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	610	MEFK	3950	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	645	MEFK	4120	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	641	MEFK	4200	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	12-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	448	MEFK	1300	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	12-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	448	MEFK	1380	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	12-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	595	MEFK	3420	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	12-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	615	MEFK	3460	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	558	MEFK	2820	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	557	MEFK	2870	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	575	MEFK	2880	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	590	MEFK	3120	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	587	MEFK	3140	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	580	MEFK	3240	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	593	MEFK	3460	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	635	MEFK	4010	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	639	MEFK	4150	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	664	MEFK	5460	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	13-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	668	MEFK	6090	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	14-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	488	MEFK	1510	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	14-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	485	MEFK	1570	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	14-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	564	MEFK	2720	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	15-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	508	MEFK	2080	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	15-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	594	MEFK	3090	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	15-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	598	MEFK	3150	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	15-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	580	MEFK	3510	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	15-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	635	MEFK	4450	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	16-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	502	MEFK	2340	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	16-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	542	MEFK	2530	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	17-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	608	MEFK	3580	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	22-Oct-13	John R. Stevenson; Mark D. Miller	Weir	coho salmon	adult	591	MEFK	3030	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	10-Sep-13	John R. Stevenson; Mark D. Miller	Weir	Dolly Varden	adult	545	MEFK	1844	Female		measured and released	radio tagged-esophageal	2/14
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	2-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	428	MEFK	1260	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	402	MEFK	900	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	424	MEFK	1080	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	462	MEFK	1510	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	407	MEFK	1010	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	400	MEFK	870	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	438	MEFK	1090	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	7-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	436	MEFK	1180	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	415	MEFK	900	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	14-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	455	MEFK	1280	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	15-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	430	MEFK	1160	Female		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	23-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	460	MEFK	1140	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Aug-13	John R. Stevenson; Mark D. Miller	Weir	pink salmon	adult	506	MEFK	2050	Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	24-May-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	343	MEFK	462.6	Unknown		measured and released	Radio tagged-surgically	2/11
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	500	MEFK	1571.2	Male		measured and released	Radio tagged-surgically	17/31
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	15-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	402	MEFK	767.4	Male		measured and released	Radio tagged-surgically	2/17
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	15-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	348	MEFK				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	17-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	357	MEFK	548.2	Female		measured and released	Radio tagged-surgically	17/44
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	17-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	431	MEFK				measured and released	Radio tagged-surgically	2/12
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	25-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	345	MEFK	406.2	Female		measured and released	Radio tagged-surgically	17/32
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	28-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	309	MEFK	334	Female		measured and released	Radio tagged-surgically	2/18
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	349	MEFK		Male		measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Jun-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	304	MEFK	252.6	Male		measured and released	Radio tagged-surgically	17/25
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	1-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	382	MEFK	634	Female		measured and released	Radio tagged-surgically	2/21
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	309	MEFK	269.2	Male		measured and released	Radio tagged-surgically	2/22
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	348	MEFK		Male		measured and released	Radio tagged-surgically	17/45
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	373	MEFK	551.6	Male		measured and released	Radio tagged-surgically	17/26
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	357	MEFK	535.4	Female		measured and released	Radio tagged-surgically	2/13
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	329	MEFK	398.2	Male		measured and released	Radio tagged-surgically	2/19
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	411	MEFK	724.8	Female		measured and released	Radio tagged-surgically	17/33
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	7-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	385	MEFK	582.6	Male		measured and released	Radio tagged-surgically	17/46
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	9-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	318	MEFK	314	Female		measured and released	Radio tagged-surgically	17/37
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	10-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	335	MEFK	487.2	Male		measured and released	Radio tagged-surgically	17/38
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	300	MEFK	284.2	Male		measured and released	Radio tagged-surgically	2/23
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	11-Jul-13	John R. Stevenson; Mark D. Miller	Weir	rainbow trout	adult	329	MEFK	318	Male		measured and released	Radio tagged-surgically	17/27
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	29-Jul-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	543	MEFK	2360	Female		measured and released	radio tagged-esophageal	9/11
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	30-Jul-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	573	MEFK	3190	Female		measured and released	radio tagged-esophageal	10/31
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	31-Jul-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	555	MEFK		Male		measured and released	radio tagged-esophageal	12/72
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	31-Jul-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	579	ME						

radio tagged-esophageal

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Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	551	MEFK	3150	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	557	MEFK	3240	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	580	MEFK	3250	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	553	MEFK	3340	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	572	MEFK	3370	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	574	MEFK	3470	Female				radio tagged-esophageal	9/16	
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	566	MEFK	3520	Male				radio tagged-esophageal	9/17	
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	579	MEFK	3800	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	580	MEFK	3850	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	599	MEFK	3880	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	3-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	622	MEFK	4070	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	423	MEFK	1230	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	448	MEFK	1550	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	474	MEFK	1590	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	458	MEFK	1790	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	449	MEFK	1870	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	470	MEFK	1910	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	494	MEFK	2230	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	504	MEFK	2230	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	520	MEFK	2300	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	521	MEFK	2360	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	519	MEFK	2410	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	540	MEFK	2550	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	557	MEFK	2560	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	531	MEFK	2600	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	531	MEFK	2600	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	519	MEFK	2660	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	551	MEFK	2740	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	549	MEFK	2770	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	558	MEFK	2770	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	551	MEFK	2790	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	541	MEFK	2810	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	553	MEFK	2870	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	556	MEFK	2870	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	544	MEFK	2920	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	547	MEFK	2920	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	553	MEFK	2920	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	580	MEFK	2970	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	565	MEFK	3010	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	536	MEFK	3050	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	560	MEFK	3070	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	565	MEFK	3070	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	559	MEFK	3140	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	541	MEFK	3320	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	557	MEFK	3440	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	555	MEFK	3620	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	567	MEFK	3720	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	583	MEFK	3880	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	4-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	566	MEFK	3940	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	431	MEFK	1230	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	447	MEFK	1400	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	461	MEFK	1450	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	446	MEFK	1580	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	455	MEFK	1590	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	505	MEFK	1840	Female				radio tagged-esophageal	12/62	
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	469	MEFK	1860	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	497	MEFK	2000	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	493	MEFK	2050	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	474	MEFK	2100	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	515	MEFK	2270	Female				radio tagged-esophageal	9/18	
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	531	MEFK	2340	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	522	MEFK	2410	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	508	MEFK	2430	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	503	MEFK	2450	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	527	MEFK	2540	Female				radio tagged-esophageal	11/58	
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	541	MEFK	2680	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	539	MEFK	2690	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	527	MEFK	2810	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	559	MEFK	2980	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	529	MEFK	3000	Male				radio tagged-esophageal	12/61	
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	553	MEFK	3010	Female				radio tagged-esophageal	11/57	
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	550	MEFK	3270	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	557	MEFK	3330	Male				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	588	MEFK	3640	Female				measured and released		
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	5-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	572	MEFK	4240	Male				radio tagged-esophageal	10/38	
Weir	60.45710	-149.36028	NAD83	MAP	Grant Creek	6-Sep-13	John R. Stevenson; Mark D. Miller	Weir	sockeye salmon	adult	446	MEFK	1640	Male				measured and released		
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