Springfield Sockeye Hatchery

Master Plan for the Snake River Sockeye Program

Volume 1: Master Plan

November, 2010

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Master Plan

November 2010

Submitted by the

Idaho Department of Fish and Game

Boise, Idaho

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EXECUTIVE SUMMARY

The Springfield Hatchery Master Plan addresses the next phase in the Snake River Sockeye Captive Brood Program through construction of a new sockeye smolt production hatchery and implementation of associated program management goals. The first phase of the program, the captive broodstock phase, has achieved sufficient success that the Idaho Department of Fish and Game is proposing to initiate Phase 2, population re-colonization. The increased production capacity required to accomplish recolonization of Sawtooth basin lakes would be achieved at a hatchery complex proposed in Bingham County, Idaho. Dedicated to production of Snake River sockeye smolts, the resulting adult returns from fish produced at this facility would provide sufficient broodstock to meet re-colonization goals in Redfish, Pettit and Alturas lakes.

The Springfield Hatchery would be developed at the site of an abandoned trout hatchery that was purchased by the Idaho Department of Fish and Game. Functioning artesian wells would supply the quality and quantity of groundwater necessary to meet sockeye production objectives. Isolated from other anadromous populations, the site also allows implementation of critical best management practices for disease control during sockeye production. All sockeye smolts produced at Springfield would be transported to the Sawtooth basin for release in targeted recolonization areas.

As described in this Master Plan, implementing a self-sustaining anadromous hatchery program for Snake River sockeye is expected to achieve the recruit-per-spawner levels, and therefore adult return levels, needed to facilitate population recovery. The production capabilities of the proposed Springfield Hatchery are a key component to achieving this recovery objective. As more locally-adapted sockeye adults return to Sawtooth basin, it is expected that natural selection and local adaptation will increase the productivity of the population. The Springfield Hatchery program would then transition to Phase 3, implementing a sliding-scale model that integrates broodstock and escapement management driven by natural production.

The Snake River sockeye program focuses first and foremost on population conservation. In the short term, the goal has been to slow the loss of critical population genetic diversity and prevent species extinction. The biological goal described in this Master Plan is to increase the number of adults spawning naturally in the system. The survival boost afforded by sockeye smolt releases from the proposed Springfield Hatchery is expected to produce adults surplus to broodstock needs that would be used for this purpose. Over time, the objective is to have an average adult escapement of 2,000 fish over two generations. To meet NOAA Fisheries recovery criteria, 1,000 of these fish must be produced in Redfish Lake and 500 each in two additional lakes. The program proposes to achieve the 500 adult fish escapement target in Pettit and Alturas lakes. In the long term, the goal is to re-establish a natural population that can be de-listed and even provide treaty and sport harvest opportunities.

ACKNOWLEDGEMENTS

The Idaho Department of Fish and Game extends a hearty thanks to the following individuals for their contribution to this Snake River Sockeye –Springfield Hatchery Master Plan: Andy Appleby, Daniel Lita, Mort McMillen, Kevin Malone, Lars Mobrand, Joan Nichol, Marci Pape, Robyn Redekopp, Mark Reiser, Shannon Riper, Terry Scanlan, and Dan Warren.

ABBREVIATIONS AND ACRONYMS

AHA	All "H" Analyzer
BPA	Bonneville Power Administration
CFR	Code of Federal Regulations
cfs	cubic feet per second
CWT	Coded-wire tag
DPS	Distinct Population Segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Ecologically Significant Unit
fpp	Fish per pound
FWP	Columbia Basin Fish and Wildlife Program
HGMP	Hatchery Genetics Management Plan
HOR	Hatchery-origin
HOS	Hatchery-origin Spawners
HSRG	Hatchery Scientific Review Group
ICTRT	Interior Columbia Technical Recovery Team
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
IFWF	Idaho Fish and Wildlife Foundation
ISAB	Independent Scientific Advisory Board
ISRP	Independent Scientific Review Panel
LSRCP	Lower Snake River Compensation Plan
M&E	Monitoring and evaluation
mm	millimeter
MOA	Memorandum of Agreement
MPG	Major Population Group
NOAA Fisheries	National Oceanic and Atmospheric Administration – Fisheries
NOR	Natural-origin
NPCC	Northwest Power and Conservation Council

ODFW	Oregon Department of Fish and Wildlife
pHOS	Proportion of hatchery fish present on the spawning grounds
PIT	Passive Integrated Transponder
PNI	Proportionate Natural Influence
pNOB	Proportion of Natural-origin Broodstock
Rm	River mile
RME	Research, monitoring and evaluation
R/S	Recruit per spawner
SAR	Smolt-to-adult (SAR survival rate is measured from the point where a juvenile fish is released or captured to their return to the same point as an adult)
SBT	Shoshone-Bannock Tribe
SBSTOC	Stanley Basin Sockeye Technical Oversight Committee
TAC	Technical Advisory Committee
TRT	Technical Review Team
U of I	University of Idaho
USFWS	U.S. Fish and Wildlife Service
VSP	Viable Salmon Population

1.0 OVERVIEW OF PROPOSED PROGRAM AND MASTER PLAN ORGANIZATION

The proposed Springfield Hatchery represents a significant step forward in the nearly 20-year-old Snake River sockeye captive broodstock program. Objectives for the next phase of this program and facilities necessary to achieve them are described in detail in this Master Plan and accompanying appendices. These objectives are not only those of the Idaho Department of Fish and Game (IDFG), but those of its long-term program partner, NOAA Fisheries. Regionally, the importance of program expansion is clearly stated in the 2008 Federal Columbia River Power Supply (FCRPS) Biological Opinion (Idaho et al. 2008) and the 2008 Memorandum of Understanding between the State of Idaho and the FCRPS Action Agencies, or Fish Accords (see Appendix B).

The proposed Springfield Hatchery site is some distance from the natal watershed of the Snake River sockeye population (the upper Salmon River subbasin). Located in the upper Snake River subbasin in Bingham County, Idaho (see Figure 1-1), Springfield Hatchery is a former trout production complex acquired by the State of Idaho because it possess a number of attributes required for high quality aquaculture: ample high quality, pathogen free groundwater with a temperature profile well suited for salmonid culture, geographical isolation from other salmonid species and a less severe climate in which to conduct the program. Most existing hatchery facilities would be demolished and/or reconstructed to accommodate the proposed program.

The Springfield Hatchery Master Plan describes this new facility and how it will be integrated into the ongoing Snake River sockeye program. Section 1 summarizes the program, its purpose and history. Attributes and status of this sockeye population are also presented. Section 2 focuses on the goals and objectives of the program, continuing in Section 3 with a discussion of how these goals are consistent with the Northwest Power and Conservation Council's (NPCC) eight scientific principles, general Step 1 requirements as well as the requirements of aquaculture programs. The geographic and environmental context of the two subbasins is described in Section 4, the Salmon River subbasin (juvenile release and adult collection area) and Upper Snake River subbasin (egg incubation and juvenile rearing site). Program operations would have more significant biological interactions in the Upper Salmon River subbasin where sockeye broodstock would be collected and smolts and adults would be released. Section 4 also places the Springfield Hatchery program in the context of subbasin management and species recovery objectives. Section 5, 6 and 7 are the heart of the Master Plan, describing the proposed program, monitoring and evaluation strategies, and facilities. Finally, Chapter 8 is a presentation of the estimated program and facility costs.

Six appendices provide supporting technical details that will contribute to an understanding of the Springfield Hatchery Program origins, its water supply, conceptual design and construction cost details, as well as the preliminary monitoring and evaluation program.

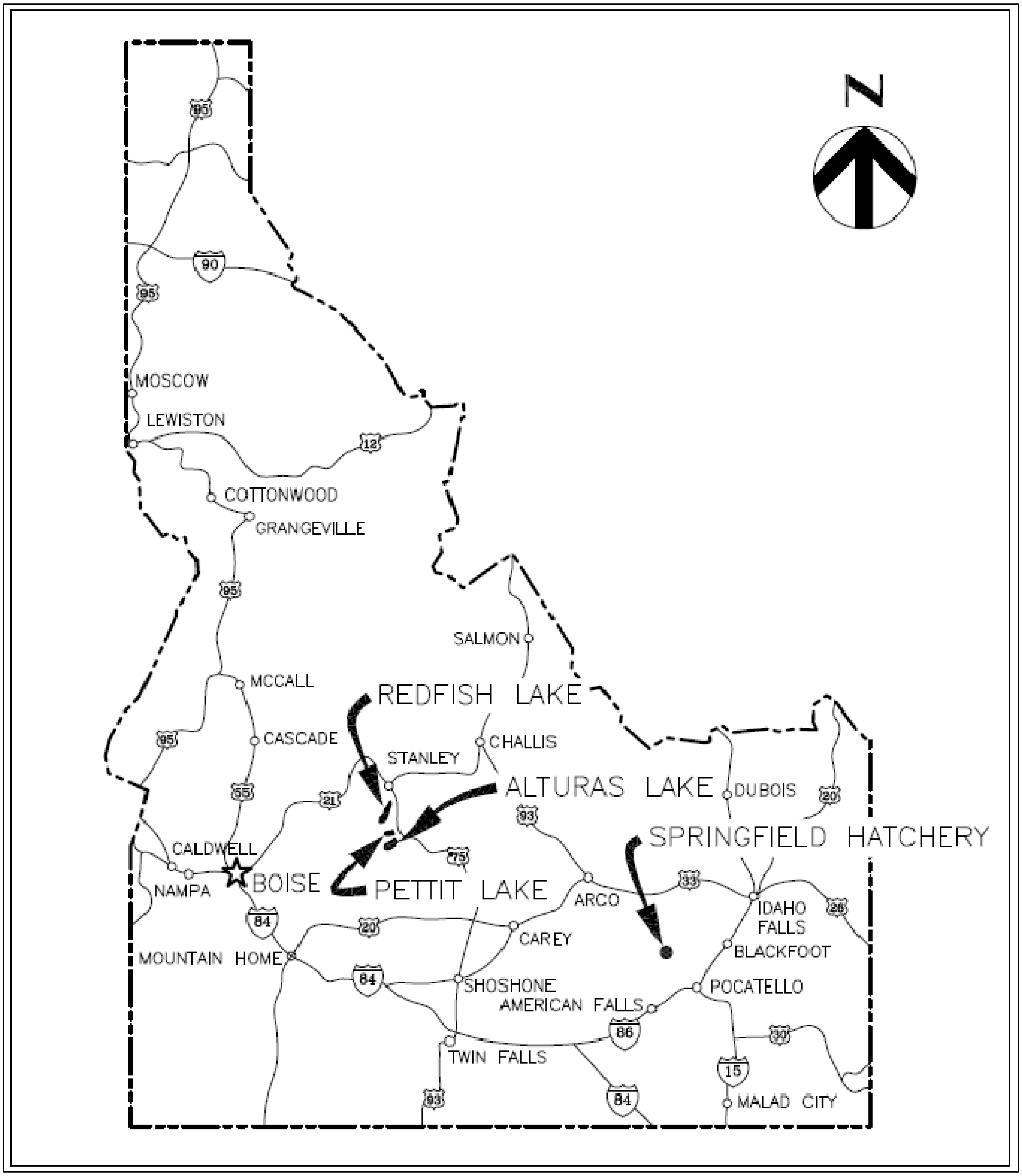


Figure 1-1. Project Location.

1.1 DESCRIPTION OF THE SOCKEYE PROGRAM

The Snake River sockeye captive broodstock program was founded in 1991 by the Idaho Department of Fish and Game (IDFG) and NOAA Fisheries to prevent species extinction. This program incorporates the use of hatchery facilities, captive broodstock technology, genetic support, and a comprehensive monitoring and evaluation plan to maintain the genetic resource and to continue rebuilding the number of sockeye in the natural environment.

To guard against catastrophic loss at any one brood facility, the captive broodstock components of the program are duplicated at facilities in Idaho (Eagle Fish Hatchery) and Washington (Manchester Research Station and Burley Creek Fish Hatchery). Broodstock are collected at the Sawtooth Hatchery weir and at Redfish Lake. Eggs produced from annual spawning events at Eagle and Manchester hatcheries are transferred to either Oxbow Fish Hatchery in Oregon or to Sawtooth Fish Hatchery in Idaho for continued culture and release.

Annually, the program produces eggs, juveniles and adults for reintroduction into natal waters (currently Redfish, Alturas, and Pettit lakes in the Sawtooth basin). The program uses a “spread-the-risk” reintroduction strategy and has an ongoing research effort to determine the most successful release options.

The captive broodstock program continues to this day. In the near term, production at the proposed Springfield Hatchery would not replace the safety net programs at Manchester and Eagle Hatchery. Captive broodstock production of smolts and adults will continue until consistent numbers of anadromous adults resulting from juveniles reared at the Springfield Hatchery are available to meet juvenile and pre-spawn adult release objectives. At that juncture, a sliding-scale strategy will be implemented to guide either the reduction and or elimination of one or both of the captive brood facilities. In addition, a long-term plan has been developed for how natural- and hatchery-origin adults are used in the Springfield Hatchery broodstock, should conditions permit. As more natural-origin adults return, they will constitute a larger portion of the hatchery broodstock. As some hatchery-origin adults derived from those natural adults are allowed to spawn in the wild, the composite population will become locally adapted to the habitat and survival is expected to increase.

Developing production facilities at Springfield will meet the intent of the 2008 FCRPS Biological Opinion (NOAA 2008) and the Idaho Fish Accords (Idaho et al. 2008; see Appendix B) which call for the acquisition of suitable space to expand the smolt rearing component of the program to produce between 500,000 and 1 million full-term smolts annually for release to Sawtooth basin waters.

1.2 SNAKE RIVER SOCKEYE

1.2.1 Life History, Distribution and Population Status

All Snake River sockeye salmon are included in one Evolutionarily Significant Unit (ESU). The ESU is comprised of a single Major Population Group (MPG) and a single extant population spawning and rearing in Redfish Lake. It also includes artificially propagated sockeye salmon from the Snake River sockeye captive broodstock program. The Redfish Lake population is the last remaining in a group of what were likely independent populations occupying the Sawtooth basin.

According to the Salmon River Subbasin Assessment (NPCC 2004):

> *"The life history of sockeye salmon is the most variable of all the Pacific salmon, with a wide variety of adaptations for specialized conditions. Sockeye salmon life history differs from other Pacific salmon in their use of lakes for the early freshwater rearing. In addition to the anadromous form, two additional life history forms of O. nerka are recognized, kokanee commonly exist in landlocked and anadromous accessible waters and residual sockeye salmon (the non-migratory form) associated with anadromous populations."*

Juvenile sockeye salmon rear from one to two years in the lake(s) prior to smoltification. Outmigration of sockeye salmon smolts from the Sawtooth basin begins in early April, peaks in mid-May, and is complete by mid-June. Smolts are either age 1 or age 2, and the percentage of each varies between 2 and 98%, respectively. No pattern in the timing of migration is apparent between age 1 and age 2 smolts. Fork lengths of smolts vary from 45 to over 120 mm.

Adults generally spend from one to three years in the ocean; the vast majority are 2-ocean fish. After passing through eight dams associated with the FCRPS, adult sockeye salmon arrive at the traps on Redfish Lake Creek or at the Sawtooth Hatchery between mid-July and early September. Spawning takes place on the lake shoreline from late September through November, peaking in mid-October.

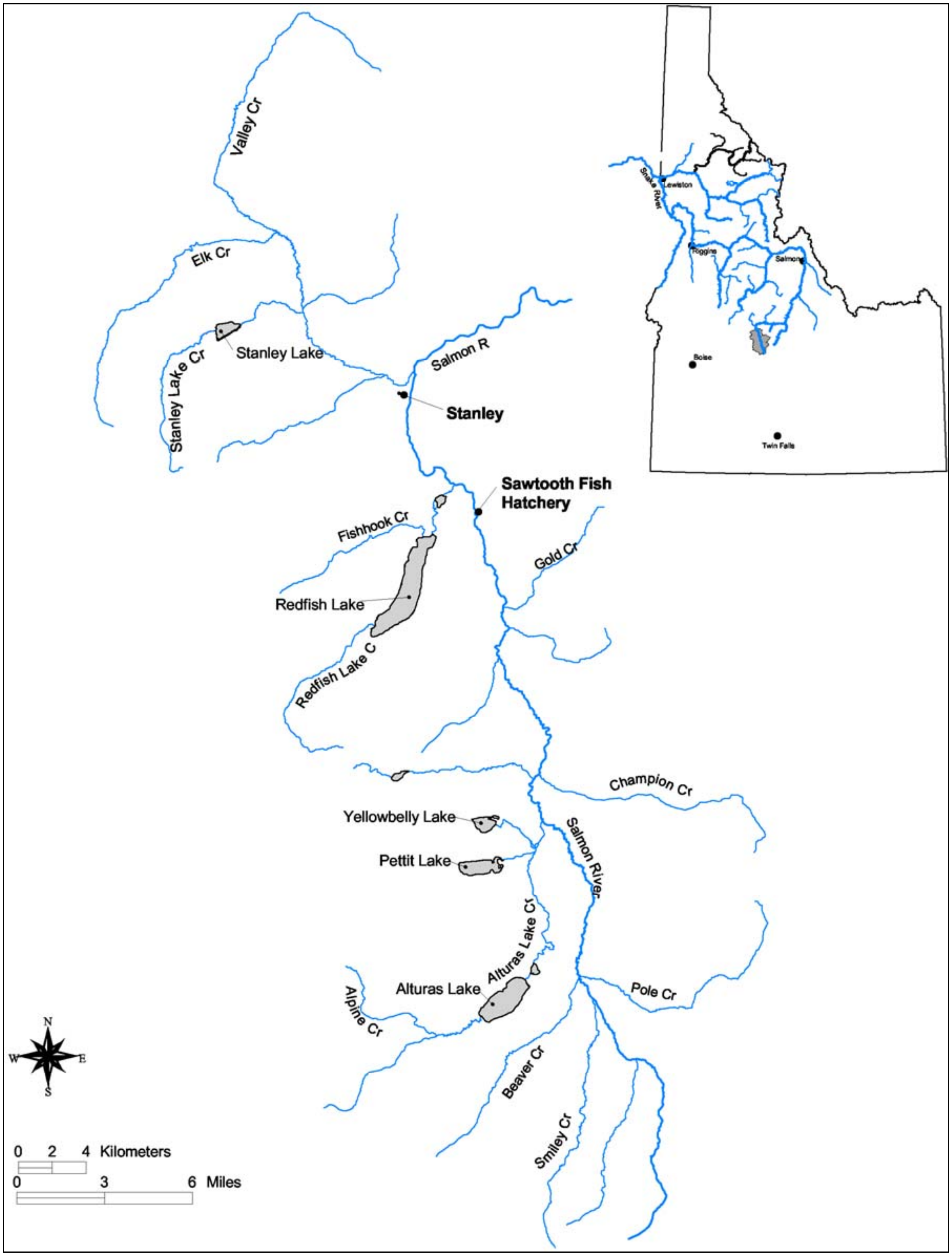
1.2.2 Conservation Status

The Snake River sockeye salmon ESU was listed as Endangered under the federal Endangered Species Act in 1991 (56FR 58619) and includes all anadromous and resident sockeye salmon from the Snake River Basin, Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake captive broodstock program (Figure 1-2).

Designated critical habitat for Snake River sockeye includes all Columbia River estuarine areas and river reaches upstream to the confluence of the Columbia and Snake rivers; all Snake River reaches from the confluence of the Columbia River upstream to the confluence of the Salmon River; all Salmon River reaches from the confluence of the Snake River upstream to Alturas Lake Creek; Stanley, Redfish, Yellowbelly, Pettit, and Alturas lakes (including their inlet and outlet creeks); Alturas Lake Creek; and that portion of Valley Creek between Stanley Lake Creek and the Salmon River (NOAA 2008).

1.2.3 Habitat Status

Spawning and rearing habitat in natal streams and lakes of the Sawtooth basin is high quality and considered near pristine by IDFG biologists. To protect the anadromous adults from disturbance in nearshore spawning habitat associated with recreational use at Redfish Lake, IDFG typically does not allow returning fish to enter the lake until after Labor Day, a strategy that has been successful. Some tributaries are inaccessible to adult migrants due to the presence of obstructions; however, these obstructions are being targeted for removal as funds become available. For example, passage barriers on Alturas and Pettit creeks (an irrigation intake and a concrete fish barrier) were modified in the early 1990s to allow anadromous sockeye into these historical habitats.



Source: IDFG

Figure 1-2. Snake River Sockeye ESU.

The lakes where sockeye juvenile rear for extended periods of time are classified as oligotrophic (i.e., low primary productivity). Nutrient supplementation of the lakes in recent years has stimulated primary productivity and the development of a favorable zooplankton forage community. Non-native kokanee salmon directly compete with anadromous sockeye for zooplankton forage in most Sawtooth basin lakes and thus a program has been implemented for their elimination. The kokanee fishery was reopened in 1995 and extends from Memorial Day (after anadromous smolt outmigration) through the first week of August (prior to anadromous adult returns).

Designated critical habitat is identified in Section 1.4.2. The major factors limiting the conservation value of this habitat for Snake River sockeye are the effects on the migration corridor posed by the mainstem lower Snake and Columbia River federal hydropower system, reduced tributary stream flows and high temperatures experienced by outmigrating smolts and returning adults. Their migratory corridor between Redfish Lake Creek and Yankee Fork Creek are water quality limited for temperature (IDEQ 2005 as cited in NOAA Fisheries 2008), which may reduce survival of returning adults in late July and August.

1.2.4 Harvest Status

Snake River sockeye are currently incidentally harvested in freshwater fisheries. Ocean fishing mortality on Snake River sockeye is assumed to be zero. Fisheries in the mainstem Columbia River that affect Snake River sockeye were managed subject to the terms of the U.S. v. Oregon Interim Management Agreement for 2005-2007 under which non-Indian fisheries in the lower Columbia River are limited to a harvest rate of 1%. Treaty Indian fisheries are limited to a harvest rate of 5 to 7% depending on the run size of upriver sockeye stocks. Actual harvest rates over the last ten years have ranged from 0 to 0.9%, and 2.8 to 6.1%, for the non-Indian and treaty fisheries, respectively. Residual sockeye may be incidentally harvested in the Redfish Lake recreational fishery. IDFG conducts this fishery under permit from NOAA Fisheries (No. 1481) within parameters to protect natural sockeye, including a fishing closure from August 7 to January 1, and informational signs and news releases.

1.3 PROGRAM NEED AND JUSTIFICATION

The purpose of the Snake River sockeye broodstock and hatchery program is to mitigate for fish losses caused by the construction and operation of the Federal Columbia River Power System (FCRPS). In the 2008 FCRPS Biological Opinion (NOAA 2008), NOAA-Fisheries established a juvenile sockeye production target for this hatchery program of up to one million smolts. This level of hatchery production, combined with natural production, is expected to achieve the adult production criterion required for delisting this species. The interim delisting criterion is for a population of 2,000 adult sockeye, of which 1,000 must be in Redfish Lake and 500 in each of two additional lakes. To meet this criterion, the program is using a three-tiered approach: (1) increasing number of anadromous adult sockeye returns; (2) incorporating more natural-origin returns in hatchery spawning designs and increasing natural spawning escapement; and (3) moving towards the development of an integrated conservation hatchery program that achieves the Hatchery Scientific Review Group (HSRG) recommended proportionate natural influence (PNI) levels. Analysis of data presented in Section 5 indicates that a self-sustaining anadromous hatchery program for Snake River sockeye is likely to achieve the Recruit per Spawner (R/S) levels (and therefore adult return numbers) needed to be successful. In addition, excess adults are anticipated from both the anadromous and captive brood programs for adult reintroduction efforts to proceed as described. The production capabilities of the Springfield Hatchery are a key component to the success of this approach.

1.4 HISTORY OF SNAKE RIVER SOCKEYE CONSERVATION AQUACULTURE

Precipitous declines of Snake River sockeye salmon *Oncorhynchus nerka* led to their Federal listing as endangered in 1991 (56 FR 58619). In that same year, the IDFG initiated a captive broodstock program to maintain and prevent extinction of species.

Origins of the program are described by Plaster et al. (2007):

> *"The Snake River sockeye salmon captive broodstock program was founded from the following sources: 1) 16 anadromous adult returns that were trapped between 1990 and 1998 and retained for hatchery spawning, 2) 26 residual adults that were trapped between 1992 and 1995 and retained for hatchery spawning, and 3) 886 smolts that were trapped between 1991 and 1993, reared until maturity, and spawned in the hatchery. Second, third, and fourth generation lineages of the founders are currently in captive broodstock culture. Both IDFG and National Oceanic and Atmospheric Administration (NOAA) Fisheries maintain Snake River sockeye salmon captive broodstocks. Groups of fish are reared at two facilities to avoid the potential catastrophic loss of the unique genetics of the stock. Idaho Department of Fish and Game rears annual captive broodstocks from the egg stage to maturity at Eagle Fish Hatchery in Eagle, Idaho."*

In 1999, the first hatchery-produced anadromous sockeye salmon returned to the program. In that year, seven age-3 adults (six males and one female) were trapped at weirs in the Sawtooth subbasin. In 2000, the program experienced its first significant return of hatchery-produced adults when 257 sockeye salmon returned to collection facilities on Redfish Lake Creek and the upper Salmon River at the IDFG Sawtooth Fish Hatchery (Table 1-1). Between 2001 and 2009, over 1,500 hatchery-produced sockeye salmon adults returned to the Sawtooth basin. In 2010, the number of adult sockeye passing over Lower Granite Dam (presumed to be Redfish Lake origin) was over 2,200 (as of October 1, 2010).

Through 2009, the IDFG and NOAA Fisheries hatchery programs produced in excess of 1,417,000 pre-smolts, 750,000 smolts, 4,000 adults, and 1,000,000 eyed-eggs for reintroduction to Sawtooth basin lakes and tributary streams. Between 1991 and 2009, an estimated 1,143,000 hatchery-produced sockeye salmon smolts emigrated from these lakes. In the most recent years with available data (2004-2006 brood years), the average hatchery smolt to adult survival (SAR) rate was 0.5% (range-0.23-1.1) and an average recruit per female spawner of 7.0. During those same years, estimates of natural Redfish Lake SAR survival rates averaged 1.41% (range 0.84-1.92) with an average recruit per female spawner of 2.5 (data supplied by IDFG). Table 1-2 provides detail on SAR rates for brood years 2004-2006.

Table 1-1. Hatchery and natural sockeye returns to Redfish Lake, 1999-2009.

Return Year	Total Return	Natural Return	Hatchery Return	Observed (Not Trapped)	Naturals Kept for Broodstock	Hatchery Kept for Broodstock
1999	7	0	7	0	0	7
2000	257	10	233	14	4	39
2001	26	4	19	3	0	9
2002	22	6	9	7	0	0
2003	3	0	2	1	0	2
2004	27	4	20	3	4	20
2005	6	2	4	0	2	4
2006	3	1	2	0	1	2
2007	4	3	1	0	3	1
2008	650	142	457	51	25	48
2009	833	85	732	16	63	84

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

Table 1-2. SAR return rates for brood years 2004-2006.

Brood Year	2004	2005	2006
Estimated or actual smolt emigration (total number of emigrants)	0.259%	0.644%	0.388%
Estimated emigration from Redfish Lake pre-smolt releases	0.035%	0.133%	0.200%
Estimated migration from Alturas and Pettit pre-smolt releases (combined)	0.086%	0.216%	0.160%
Actual emigration from Sawtooth-reared smolt release	0.232%	0.384%	0.306%
Actual emigration from ODFW-reared smolt release	0.463%	1.116%	0.525%
Estimated emigration from natural production in Redfish Lake	0.841%	1.496%	1.924%
Estimated emigration from natural production in Alturas and Petit lakes (combined)	0.163%	0.112%	0.084%

Source: Project annual reports to Bonneville Power Administration and project annual reports to NOAA Fisheries for ESA Section 10 activities.

According to NOAA Fisheries (2010), the hatchery program has been quite successful:

> *"Adult sockeye returns to Lower Granite Dam (1,219) were nearly 9.7 times the 10-year average (FPC 2010a). For this ESU, adults that return to spawn are almost entirely produced by the captive broodstock program. The population had already experienced an extreme genetic bottleneck before the program was initiated. Kozfkay et al. (2008) described the mating strategy employed to minimize any further depression due to inbreeding. More recently, scientists at the NWFSC and Montana State University have evaluated the success of the program described by Kozfkay et al. using the broodstock's pedigree history (Waples 2010). Their results show that the current population contains over 90% of the genetic variation of its founders. Thus, the program's efforts appear to have been effective in minimizing additional losses of genetic variation".*

2 PROGRAM GOALS AND OBJECTIVES

The primary goals of the sockeye program focus first and foremost on conservation, secondarily on harvest. In the short term, IDFG's goal is to slow the loss of critical population genetic diversity and heterozygosity, and to prevent species extinction. The long-term goal is to re-establish a natural population that can be de-listed and even provide treaty and sport harvest opportunities. These goals are briefly summarized below and explained in more detail in Section 5.

2.1 BIOLOGICAL GOALS

The biological goal is to increase the number of adults spawning naturally in the system. The survival boost afforded by the proposed Springfield Hatchery is expected to produce adults surplus to broodstock needs that can then be used for this purpose. Over time, the objective is to have an average adult escapement of 2,000 fish over two generations. To meet NOAA Fisheries interim-recovery criteria, 1,000 of these fish must be produced in Redfish Lake and 500 each produced in two additional lakes. The program proposes to achieve the 500 adult fish escapement target in Pettit and Alturas lakes.

As natural production increases to a point where these recovery objectives are met, the program will be converted to an integrated conservation-type consistent with the recommendations of the HSRG (HSRG 2004). At such a point, the program may be reduced in size or possibly eliminated if adult production goals are exceeded.

2.2 CONSERVATION GOALS

The conservation goal of the Snake River sockeye program is to ensure the long-term persistence of a viable, healthy and harvestable population of sockeye salmon in the Snake River. The program is designed to assist in the recovery of the Snake River sockeye ESU by protecting the remaining genetic resources of the species and by providing the juvenile and adults needed to restore natural production in Redfish Lake, Pettit Lake and Alturas Lake. As natural production increases, the conservation program will be converted to an integrated-type program following the recommendations of the HSRG. This program would serve as a safety net in case of future poor survival periods.

2.3 HARVEST GOALS

The program has a secondary goal of providing harvest opportunities to tribal and sport fishers in the Snake and Salmon rivers. This goal is not expected to be attained for at least another decade or more. Until this population is large and healthy enough to support even a minor level of direct harvest, the emphasis of the program will be conservation. This will require that harvest rates on Snake River sockeye in lower Columbia River fisheries remain low for the foreseeable future.

The long-term harvest goal will become the primary goal of the program once Snake River sockeye are de-listed under the ESA. This goal will be met through a combination of natural-origin (NOR) and hatchery-origin (HOR) production.

3 CONSISTENCY WITH NPCC STEP 1 REQUIREMENTS FOR ALL PROJECTS

A description as to how progression of the Snake River sockeye program to its next phase meets the Northwest Power and Conservation Council's (NPCC) eight scientific principles and three-step planning process is presented below.

3.1 OVERVIEW OF 3-STEP PROCESS

The Major Project Review was established by the NPCC as a means to thoroughly review projects seeking funding by the Bonneville Power Administration (BPA) through the Columbia River Basin Fish and Wildlife Program. The premise is that only projects targeted to meet a need within the Columbia River Basin and which are clearly defined in terms of biological benefits will be eligible for funding. Project proponents must think carefully about what they want to achieve and how they want to achieve it. Projects must also be designed to be as economical as possible. The long-term implications of proposed projects as well as the short-term gains must be considered. The goal of the Major Project ("Step") Review is to consider funding only for programs that have successfully completed the planning process from project concept to final design. As stated in the NPCC's Major Project Review document (NPCC 2006), "Any new project funded through the Council's Columbia River Basin Fish and Wildlife Program must be thoroughly reviewed in advance to ensure its design, construction and proposed operations are compatible with the environment and consistent with financial planning for the subbasin where it is located and the Columbia Basin as a whole."

The NPCC Step Review is based on policies detailed in the 2009 Columbia Basin Fish and Wildlife Program (FWP). The FWP presented eight scientific principles used to shape any fish and/or wildlife project that takes place in the Basin. The eight principles, in turn, were the basis for the requirements contained in the NPCC Major Projects Review document (NPCC 2006). Every project that comes before the NPCC for funding must be consistent with the eight scientific principles and the Major Projects requirements, both in spirit and in fact.

3.1.1 Step 1

The Step Review links environmental reviews and funding to specific phases of project development and planning. The first step is development of a plan at a conceptual level. This is considered the preliminary, or feasibility, stage and "is important in identifying all major components and elements" as well as showing the initial layout of components at the proposed site and/or within the proposed plan. Conceptual designs and associated cost estimates are expected to have a variance (contingency) of plus or minus 35 to 50%. The concept of the proposed project is described in a master plan (this document) that is submitted to the NPCC for review. Approval of a master plan by the NPCC is accompanied by a notice to proceed to Step 2.

3.1.2 Step 2

In Step 2, the proposed project is further refined and is submitted for environmental review under the National Environmental Policy Act (NEPA) —usually an environmental impact statement (EIS) or environmental assessment (EA). Step 2 is also known as the "progress review phase" when any major difficulties in the design and proposal are identified. More details are presented to assure that the project is economically viable and financially responsible and meets "the intent and scope of the previous decision." Expected variance in cost estimates from Step 2 design to final design is plus or minus 25 to 35%. At this stage, any changes to the proposed project between Steps 2 and 3 should be minor. Approval of this phase by the NPCC allows the project proponent to proceed with Step 3.

3.1.3 Step 3

Step 3 is the detailed/final design phase. At this stage, a detailed design review has been carried out and cost assumptions developed that represent the best available estimate of construction costs for the project. Final designs are formulated for all facilities, with an expected variance of plus or minus 10 to 15%. The NEPA review is finalized in this stage. Program, research, and monitoring and evaluation (M&E) costs are also presented as final estimates.

3.2 CONSISTENCY WITH THE NPCC EIGHT SCIENTIFIC PRINCIPLES

The NPCC reviews proposed projects according to elements of the Eight Scientific Principles presented in the Columbia River Basin Fish and Wildlife Program (NPCC 2009). These principles and the Step 1 review elements are discussed in more detail in the sections that follow. Consistency with the NPCC Artificial Production Strategies is described in Section 3.4.

3.2.1 Principle 1: The abundance, productivity and diversity of organisms are integrally linked to the characteristics of their ecosystems.

> *"The physical and biological components of ecosystems together produce the diversity, abundance and productivity of plant and animal species, including humans. The combination of suitable habitats and necessary ecological functions forms the ecosystem structure and conditions needed to provide the desired abundance and productivity of specific species."* (NPCC 2009)

The quality and quantity of both aquatic (freshwater and ocean) and terrestrial habitats required for Snake River sockeye to complete their life history will largely determine if program goals can be achieved. For this population of fish, habitat conditions in the spawning and rearing portion of their development are considered to be near pristine. In contrast, the juvenile and adult migration corridor these fish must navigate to and from the spawning grounds has been heavily influenced by human development including multiple dams, agriculture, fish harvest and hatchery production. These activities resulted in substantial mortality to the population which was sufficient to drive adult abundance to a level that required the implementation of a captive broodstock program to prevent extinction (only 4 adults returned in 1991).

Since the 1990s, the region has been working to improve migration corridor conditions so that survival rates are sufficient to allow the sockeye population to recover. This work will continue in the future as part of the FCRPS Biological Opinion (NOAA 2008).

Although freshwater rearing and spawning habitat is of high quality, IDFG and the Shoshone-Bannock Tribe have been implementing actions designed to further improve it. These actions include the removal of migration barriers on Pettit and Alturas lake creeks, implementation of lake fertilization to improve carrying capacity, and kokanee control measures to reduce intraspecific competition (Kohler et al. 2009). All of these actions combined are expected to increase population abundance, diversity and spatial structure.

In the long term, the proposed hatchery program is expected to provide substantial conservation benefits to the population and harvest benefits to local communities. The IDFG recognizes that the program poses a risk to native fish communities (Section 3.3.7). Hatchery fish compete with native fish populations for food and space, reduce population fitness by breeding with wild fish, and their culture may increase disease load to streams. To reduce these impacts, the Master Plan provides a stepwise progression (Phases) that incorporates the hatchery concepts put forth by the HSRG (2004), including: (1) controlling the proportion of hatchery fish on the spawning grounds and wild fish used as broodstock, (2) reducing hatchery production over time as natural production increases, and (3) following HSRG hatchery operational guidelines to the extent possible.

3.2.2 Principle 2: Ecosystems are dynamic, resilient and develop over time

> *"Although ecosystems have definable structures and characteristics, their behavior is highly dynamic, changing in response to internal and external factors. The system we see today is the product of its biological, human and geological legacy. Natural disturbance and change are normal ecological processes and are essential to the structure and maintenance of habitats."*
> (NPCC 2009)

Habitat quality and quantity is constantly changing due to both natural and human factors. Habitat that may support sockeye production today may not in the future. This is why the program will, over time, begin developing sockeye populations in multiple locations (i.e., Redfish, Pettit and Alturas lakes). The IDFG recognizes that conservation aquaculture programs alone cannot resolve physical habitat limitations; however, preserving the population's genetic diversity and variability with this hatchery program can help perpetuate the range of genetic and life history expressions that coevolved with historic ecological regimes in the Sawtooth basin.

Monitoring activities described in Section 6 are designed to detect and track habitat changes over time, from egg deposition through rearing and migration, and adult returns back to the spawning grounds. Monitoring will provide managers with information about whether or not performance objectives are being achieved, survival conditions are improving or declining, and identify areas where additional actions may be needed.

3.2.3 Principle 3: Biological systems operate on various spatial and time scales that can be organized hierarchically

> *"Ecosystems, landscapes, communities and populations are usefully described as hierarchies of nested components distinguished by their appropriate spatial and*

> *time scales. Higher-level ecological patterns and processes constrain, and in turn reflect, localized patterns and processes. There is no single, intrinsically correct description of an ecosystem, only one that is useful to management or scientific research. The hierarchy should clarify the higher-level constraints as well as the localized mechanisms behind the problem."* (NPCC 2009)

The IDFG recognizes that in regards to habitat quality and human impacts, the ecosystem is best described graphically as a pyramid. The smallest human impacts occur at the top of the pyramid, which represents spawning and rearing areas, with impacts becoming larger the further downstream (toward the pyramids base) one looks. This hierarchy implies that from a habitat perspective, the greatest gain in population abundance, productivity and diversity can be accumulated by working lower in the system on improving migration corridor survival rates, reducing harvest levels and improving estuary conditions. Unfortunately, like the pyramid, the amount of resources and effort required to remove material (i.e., reduce impacts) from the bottom of the pyramid is an order of magnitude greater than at the top, and for many impacts, infeasible from a policy perspective.

This Master Plan therefore focuses on implementing actions that are within IDFG control and yet still increase population abundance, productivity and diversity. The proposed hatchery program will produce sufficient adults to eliminate the need for the captive broodstock program that has been needed to prevent extinction of this important species. If, over time, juvenile and adult survival rates improve to the point where healthy returns of adults are common place, hatchery production will be reduced accordingly. Where possible, IDFG will continue to work in natal streams and lakes to improve and protect habitat, recognizing that these improvements are likely to be small or their effectiveness reduced because of downstream mortality factors.

3.2.4 Principle 4: Habitats develop, and are maintained, by physical and biological processes.

The NPCC Fish and Wildlife Program states:

> *"Habitats are created, altered and maintained by processes that operate over a range of scales. Locally observed conditions often reflect more expansive or non-local processes and influences, including human actions. The presence of essential habitat features created by these processes determines the abundance, productivity and diversity of species and communities. Habitat restoration actions are most effective when undertaken with an understanding and appreciation of the underlying habitat-forming processes."*

Program participants have implemented an intense and collaborative research and monitoring effort to determine those habitat actions that are likely to improve sockeye production (Kohler et al. 2009). These efforts, and their underlying basis, are reviewed by the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC). The SBSTOC is composed of representatives from all participating agencies (BPA, NOAA-Fisheries, IDFG, University of Idaho, and the Shoshone-Bannock Tribes). The SBSTOC was formed in 1991 to guide new research, coordinate ongoing research, and actively participate in all technical elements of the Snake River sockeye salmon recovery effort.

Because Sawtooth basin habitat is of high quality, emphasis has been placed primarily on protection and secondarily on the elimination/reduction of those limited human impacts that have degraded this habitat. It is recognized that protecting existing high quality habitat ensures that the features this habitat provides to fish remain intact.

3.2.5 Principle 5: Species play a key role in developing and maintaining ecological conditions.

> *"Each species has one or more ecological functions that may be key to the development and maintenance of ecological conditions. Species, in effect, have a distinct job or occupation that is essential to the structure, sustainability and productivity of the ecosystem over time. The existence, productivity and abundance of specific species depend on these functions. In turn, loss of species and their functions lessens the ability of the ecosystem to withstand disturbance and change."* (NPCC 2009)

Sockeye provide an important source of marine derived nutrients to the lake and stream systems of the Upper Salmon River subbasin. The lakes where these fish rear are classified as oligotrophic, meaning they have insufficient natural nutrients to support a large base of aquatic organisms. Sockeye carcasses provide nutrients that increase both primary and secondary production, which in turn produce larger numbers (and biomass) of native fish species. Historically, anadromous sockeye accounted for approximately 3% and 2% of the annual phosphorous and nitrogen load in Redfish Lake (Gross et al 1998). Returning adults from the hatchery program will provide more of these nutrients than are currently provided by natural production and the limited number of hatchery fish released to the lakes.

Marine derived nutrients also fertilize riparian plant communities. Riparian plants provide shade which maintains suitable water temperatures for anadromous fish. The plants also return nutrients to the lakes and streams in the form of organic matter such as insects, increasing system productivity. Finally, adult and juvenile sockeye also provide food for both aquatic and terrestrial species.

3.2.6 Principle 6: Biological diversity allows ecosystems to persist in the face of environmental variation.

> *"The diversity of species, traits and life histories within biological communities contributes to ecological stability in the face of disturbance and environmental change. Loss of species and their ecological functions can decrease ecological stability and resilience. It is not simply that more diversity is always good; introduction of non-native species, for example, can increase diversity but disrupt ecological structure. Diversity within a species presents a greater range of possible solutions to environmental variation and change. Maintaining the ability of the ecosystem to express its own species composition and diversity allows the system to remain productive in the face of environmental variation."* (NPCC 2009)

The IDFG recognizes that over time, population abundance, productivity and diversity are best maintained or increased by restoring sockeye to as many historical locations as possible, given limited resources. This is important because the water temperature and system productivity of each lake may result in different run-timing, age structure (adult and juvenile) and overall survival, i.e., increased life-history diversity. Increased life-history diversity creates a population more able to withstand environmental variability, thereby ensuring its persistence through time.

Increased hatchery production provides a solution, through higher egg-to-smolt survival, to maintain population abundance for the long term. It is also recognized that migration corridor conditions are not likely to improve dramatically from current levels. There is considerable risk that a combination of poor migration survival and poor ocean survival rates may cause the natural population to fail. The anadromous hatchery program provides an insurance policy against just such an occurrence, while reducing the domestication impacts of captive breeding and protecting the substantial investment the region has made to conserve this population.

3.2.7 Principle 7: Ecological management is adaptive and experimental.

> *"The dynamic nature, diversity, and complexity of ecological systems routinely disable attempts to command and control the environment. Adaptive management — the use of management experiments to investigate biological problems and to test the efficacy of management programs — provides a model for experimental management of ecosystems. Experimental management does not mean passive "learning by doing," but rather a directed program aimed at understanding key ecosystem dynamics and the impacts of human actions using scientific experimentation and inquiry."* (NPCC 2009)

Since its inception, the sockeye captive broodstock program has incorporated a scientifically developed and reviewed monitoring, evaluation and action plan. The SBSTOC was formed in 1991 to guide new research, coordinate ongoing research, and actively participate in all technical elements of the Snake River sockeye salmon recovery effort. Such actions as lake fertilization and captive broodstock activities have been successful because of this scientifically-based approach. Program success and failures have been well documented and provide other researchers the information required to perform similar activities (Baker et al. 2008, Peterson et al. 2008, Frost et al. 2008, Powell et al. 2010). This approach will be continued in the program described in this Master Plan.

3.2.8 Principle 8: Ecosystem function, habitat structure and biological performance are affected by human actions.

> *"As humans, we often view ourselves as separate and distinct from the natural world. However, we are integral parts of ecosystems. Our actions have a pervasive impact on the structure and function of ecosystems, while at the same time, our health and well being are tied to these conditions. These actions must be managed in ways that protect and restore ecosystem structures and conditions necessary for the survival and recovery of fish and wildlife in the basin. Success depends on the extent to which we choose to control our impacts so as to balance the various services potentially provided by the Columbia River Basin."* (NPCC 2009)

As described in responses to the first seven principles, human activity (past, present and future) can and will seriously impact the natural world, and such impacts have been considered in developing this sockeye program. Additionally, IDFG recognizes that while we are able to control some of our actions, others, such as the presence of the federal hydropower system, lie outside of this control. To reduce human impacts to the ecosystem, IDFG proposes to:

- Protect high quality habitat currently present in spawning and rearing areas
- Implement harvest and hatchery fish marking policies that protect naturally produced sockeye salmon
- Operate hatchery facilities in accordance with the recommendations of the HSRG to the extent possible given limited resources
- Reduce hatchery production levels over time as program goals are achieved
- Work with NOAA Fisheries, the Shoshone-Bannock Tribes and other parties to achieve mainstem Columbia River juvenile and adult survival objectives and habitat improvements required in the FCRPS Biological Opinion (NOAA 2008).
- Continue the scientifically based research, monitoring, and evaluation program to identify limiting factors, and eliminate these factors to the extent possible

3.3 STEP 1 REQUIREMENTS FOR ALL PROJECTS

The components of this section are a bit duplicative of other more detailed sections, but still are included here as a point-by-point match-up with Step 1 guidelines that allows the ISRP to review the document in a way that best suits their needs.

3.3.1 Link to Other Projects, Activities and the Desired Endstate

As shown in Table 3-1, the measures proposed in this Master Plan are but one effort contributing to the protection and restoration of migration and rearing habitat for anadromous sockeye in the Snake River Basin, and specifically in the Upper Salmon River subbasin. Table 3-2 summarizes ongoing BPA-funded actions that are part of the Snake River sockeye captive broodstock program.

Table 3-1. Other projects targeting habitat and sockeye population restoration in the Salmon River subbasin.

Contractor	Title/Project No.	Purpose	Summary
University of Idaho	Genetic Analysis of *Oncorhynchus nerka*/ 1990-093-00	Artificial Propagation	Until FY 2007, the University of Idaho provided genetic support for the sockeye salmon captive brood program. Beginning in FY07, this responsibility was assumed by the IDFG (Project No. 2007-402-00) – see below. The genetics portion of the IDFG contract will: comprehensively identify the genetic structure of Redfish Lake *O. nerka*, provide long-term information about the genetic identity of returning anadromous sockeye, define the relatedness of populations of *O. nerka* in the Columbia Basin, and provide information to monitor the change or loss of genetic biodiversity among *O. nerka* populations throughout the Columbia Basin and in particular, endangered populations in Redfish Lake, Idaho. The DNA methods used to examine sockeye populations have widely been used and can be compared directly with other ongoing or collateral genetic work.
Shoshone-Bannock Tribes (SBT)	Sockeye Salmon Habitat and Limnological Studies/ 1991-071-00	Habitat	Evaluates nursery lake habitat conditions encountered by juvenile sockeye salmon during their freshwater rearing phase. Physical and biological parameters are monitored in four Sawtooth Valley lakes. Limnological data are used to develop estimates of sockeye salmon carrying capacities for each lake. Background kokanee biomass estimates are developed using hydroacoustic technology. This information, along with limnological data, are evaluated prior to developing annual stocking recommendations for hatchery-produced juvenile sockeye planted in Pettit and Alturas lakes and conducts intensive fish community investigations in Pettit lake to evaluate competition between hatchery rainbow trout and reintroduced sockeye salmon. Since FY07, this project has operated as Project No. 2007-402-00.
IDFG	Redfish Lake Sockeye Salmon Captive Broodstock Program/ 1991-072-00	Habitat and Artificial Production	IDFG is maintaining captive broodstocks of Redfish Lake sockeye salmon to protect and enhance the population. IDFG also monitors and evaluates populations in the Stanley Basin. Kokanee populations are evaluated in Pettit, Alturas, and Redfish lakes through trawling and creel surveys. Sockeye smolts out-migrating from Redfish Lake are monitored at a weir located on Redfish Lake Cr. The weir is also used to collect returning anadromous adults. Bull trout populations are monitored in Redfish and Alturas lake tributaries. IDFG is also comprehensively identifying the genetic structure of Redfish Lake sockeye. The captive broodstock program at Eagle Hatchery is duplicated at NOAA Fisheries' Manchester and Burley Creek facilities. Since FY07, this project has operated as Project No. 2007-402-00.

Contractor	Title/Project No.	Purpose	Summary
NOAA	Redfish Lake Sockeye Salmon Captive Broodstock Rearing and Research/ 1992-040-00	Artificial Propagation	NOAA Fisheries maintains a captive broodstock of Redfish Lake sockeye salmon. NOAA Fisheries rears fish full-term to adult in freshwater, or from smolt to adult in pumped, filtered, and UV-sterilized seawater. Spawning protocols are approved by SBSTOC members and are designed to maximize genetic diversity. Pre-spawning adults, eyed eggs, and juveniles are returned to Idaho to aid recovery efforts. Since FY07, this project has operated as Project No. 2007-402-00.
Custer Soil and Water Conservation District	Upper Salmon River Anadromous/ 1993-062-00	Habitat	The goal of the project is to improve anadromous fish passage in both specific local reaches and the overall aquatic health of the subbasin by: developing an effectiveness assessment; reducing fine sediments in the spawning gravel through BMP implementation and restoration of floodplain function; reducing the numbers of physical migration barriers; restoring natural physical processes that will enhance geomorphic structure of channels; increasing riparian vegetation adjacent to channels and provisions for adequate in stream flows for migration, spawning and rearing in the upper Salmon River Basin; reducing temperatures in the system.
IDFG	Idaho Fish Screening Improvement/ 1994-015-00	Habitat	Provides management and operational support for a capital construction program dedicated to protecting anadromous fish from loss in water diversions, improving fish passage at diversions for juvenile and adult anadromous fish, and improving stream flow conditions where possible.
Lemhi Soil and Water Conservation District	Idaho Model Watershed Habitat/ 1994-017-00	Habitat	The scope is to protect, enhance and restore anadromous and resident fish habitat in a sustainable manner that balances resource protection and land use practices. Project activities include development of alternative management plans and development of grazing plans or conservation easements with private landowners. Re-establishing riparian communities with willow plantings and including strategies for maintaining and enhancing good fish habitat.
SBT	Salmon River Habitat Enhancement/ 1994-050-00	Habitat	The Tribe's Salmon River Enhancement (SRHE) project continues to monitor and evaluate the Yankee Fork Salmon River, East Fork Salmon River and Upper Salmon River, in which they have sponsored some habitat enhancement work to improve production of salmonids. Target goals established for fine sediment have been reached and responses from the biotic community have been favorable. The SRHE program proposes to continue ongoing M&E activities in the previously enhanced areas and analysis and feasibility studies for enhancement in new areas.

Contractor	Title/Project No.	Purpose	Summary
Lemhi Soil and Water Conservation District	Upper Salmon River Diversion/ 1996-007-00	Habitat	The overall objective of this multi-year project has been to reduce the number of irrigation diversions, enhance instream flows through water conservation measures by converting from flood to sprinklers and reduce juvenile delay and entrapment and improve survival by construction of NOAA-Fisheries approved fish screens on the Upper Salmon River.
Custer Soil and Water Conservation District	Restore 12 Mile Reach of Upper Salmon River/ 1999-019-00	Habitat	Contract funds efforts to restore the geomorphic diversity, reduce bank erosion, lower summer temperatures and improve critical fish habitat in the Salmon River. Activities include spring development, reconnection, diversion removal, fencing, side-channel enhancement, substrate improvements, etc.
Idaho Office of Species Conservation	Lower Lemhi & Salmon River Passage/ 2001-067-00	Habitat	Establish fish passage and reconfigure diversions on the Lower Lemhi River.
ODFW	Sockeye Smolt Program/ 2005-012-00	Artificial Propagation	The ODFW Oxbow Fish Hatchery was modified to rear up to 150,000 Snake River sockeye smolts. Eyed-eggs produced at the IDFG Eagle Fish Hatchery and the NOAA Burley Creek Fish Hatchery supply the Oxbow program. All smolts produced at the Oxbow Fish Hatchery are released in receiving waters in the Sawtooth Valley of Idaho. Since FY07, this project has operated as Project No. 2007-402-00.
Custer Soil and Water Conservation District	Idaho Watershed Habitat Restoration - Custer District/ 2007-268-00	Habitat	Project scope is to implement high priority action items to maintain, enhance and restore fish habitat and fish passage in the priority stream segments of the Upper Salmon Basin area within administrative boundaries of Custer Soil and Water Conservation District. Projects developed under this contract include installing a riparian fence along 4.5 miles of the Upper Salmon near Stanley and riparian plantings in lower Stanley.
IDFG	Rearing Expansion for Snake River Sockeye Salmon/ 2007-276-00	Artificial Propagation	This capital proposal addresses the need to increase the return of anadromous Snake River sockeye salmon to Idaho. Incorporating "fit" anadromous adults into the captive spawning design is a recommended action for this closed population.
Idaho Office of Species Conservation	Idaho Watershed Habitat Restoration – Lemhi/ 2007-394-00	Habitat	Upper Salmon Basin Watershed Program is a partnership between the State of Idaho and BPA and has resulted in the successful implementation of numerous habitat improvement projects.
IDFG	Upper Salmon Screen Tributary Passage/ 2007-399-00	Habitat	Contract will fund fence installation to protect riparian corridors, riparian plantings, and elimination of passage barriers. These activities prevent migration problems/blockages and streambed sedimentation within the boundaries of the Custer Soil and Water Conservation District lands.

Contractor	Title/Project No.	Purpose	Summary
IDFG	Snake River Sockeye Captive Propagation/ 2007-402-00	Artificial Propagation	Consolidation of five previous stand alone projects related to the Snake River sockeye salmon captive broodstock program. These projects are: 1991-072-00, 1992-040-00, 2005-012-00, 1991-071-00, and 1990-093-00). See Table 3.2 for descriptions.
University of Idaho	Assessment of Functional Biological Differences Between Natural and Hatchery-Raised Redfish Lake Sockeye /2007-503-00	Artificial Propagation	The project will use microarray analysis and quantitative PCR to quantify differences in gene expression between natural and hatchery-raised Redfish Lake sockeye salmon. Functional differences will then be correlated with reproductive success.
SBT	ESA Habitat Restoration/ 2008-903-00	Habitat	Contract will fund high priority habitat restoration/rehabilitation projects within the Upper Salmon Subbasin, Yankee Fork Subbasin, and Valley Creek, including removing the diversion on Elk Creek II.

Source: CBFWP 2010

Table 3-2. Descriptions of Projects under Snake River Sockeye Captive Propagation (BPA Project Number 2007-402-00) in FY2007-FY2018.

Contractor	Title/Contract No.	Purpose	Summary
IDFG	Idaho Sockeye Smolt PA/35436	Hatchery	Contract will fund preliminary work to rear 500,000 to 1,000,000 sockeye smolts. Potential real properties will be identified, criteria to evaluate properties will be developed, and real property will be selected.
NOAA-Fisheries	NOAA Sockeye Captive Brood Rearing and Research/40175	Hatchery - Captive Brood	Project will continue to maintain at least 300 fish from each of three brood years in the safety net for the Snake River Sockeye ESA-listed stock. In aggregate, these actions will continue to prevent the extinction of Snake River sockeye salmon and produce fish for release in the rebuilding this ESA listed species.
IDFG	IDFG Sockeye Salmon Captive Brood/42983	Hatchery - Captive Brood	Contract funds IDFG's participation in the Snake River Sockeye Salmon Captive Broodstock Program and includes two areas of effort: 1) sockeye captive broodstock culture, and 2) sockeye salmon research and evaluations.
ODFW	ODFW Sockeye Salmon Captive Brood/44562	Hatchery	Contract funds Oxbow Fish Hatchery to provide rearing space for sockeye smolt production. Oxbow Fish Hatchery rears between 60,000 and 150,000 sockeye smolts annually.

Contractor	Title/Contract No.	Purpose	Summary
SBT	Shoshone Bannock Snake River Sockeye Habitat/45080	Habitat	Project objectives including: 1) monitor limnological parameters of the Sawtooth Valley lakes to assess lake productivity; 2) monitor sockeye salmon smolt migration from the captive rearing program release of juveniles and eyed-eggs into Pettit and Alturas lakes; 3) reduce the number of mature kokanee spawning in Fishhook and Alturas Lake Creek; 4) monitor spawning kokanee escapement and estimate fry recruitment in Fishhook and Alturas Lake creeks; 5) conduct sockeye and kokanee salmon population surveys; 6) evaluate potential competition and predation between stocked juvenile sockeye salmon and a variety of fish species in Pettit, and Alturas lakes; and 7) assist IDFG with captive broodstock production activities.
NOAA Fisheries	NOAA Sockeye Salmon Captive Brood/45325	Hatchery - Captive Brood	Contract funds separate captive brood populations at Eagle, Idaho and Burley, Washington. The NOAA-Fisheries captive broodstock project produces up to 250 maturing fish for use in the adult release or for artificial spawning programs during the contract cycle. The project supplies up to 125,000 eyed eggs for use in the egg box program or rearing in the fry and smolt production programs at Oregon's Oxbow hatchery and IDFG's Sawtooth Hatchery; the project will maintain at least 300 fish from each of three brood years in the safety net for this ESA-listed stock.
IDFG	Sockeye Hatchery Planning and Development/47285	Hatchery	Contract will fund preliminary design work associated with the BiOp proposed action to rear 500,000 to 1,000,000 sockeye smolts and addressing the NPCC 3-step process. Includes the development of a Master Plan, preliminary Design, Value Engineering, Final Design and cost estimates.
IDFG	Sockeye Salmon Captive Brood/47584	Hatchery - Captive Brood	Tasks under this contract include : 1) develop captive broodstocks from Redfish Lake sockeye salmon, culture broodstocks and produce progeny for reintroduction; 2) determine the contribution hatchery-produced sockeye salmon make toward avoiding population extinction and increasing population abundance; 3) describe *O.nerka* population characteristics for Sawtooth Valley lakes in relation to carrying capacity and broodstock program reintroduction efforts; 4) utilize genetic analysis to discern the origin of wild and broodstock sockeye salmon to provide maximum effectiveness in their utilization within the broodstock program; 5) transfer technology through participation in the technical oversight committee process, provide written activity reports, and participate in essential program management and planning activities.
BPA	PIT Tags - Snake River Sockeye Captive Propagation (IDFG)/ BPA-3724, BPA-4096		Purchase PIT-tags for Snake River sockeye salmon.

Contractor	Title/Contract No.	Purpose	Summary
BPA	Land Acquisition for Sockeye/ BPA-4310	Habitat	Acquire land for protection of riparian areas.
BPA	Snake River Captive Propagation - PIT-Tags/BPA-4936		Purchase PIT-tags for Snake River sockeye salmon.
BPA	Springfield Trout Hatchery (Land Acquisition)/BPA-5203	Hatchery	Purchase the land required for sockeye hatchery development.
BPA	PIT-Tags – Snake River Sockeye Captive Propagation/BPA-5208, BPA-5552		Purchase PIT-tags for Snake River sockeye salmon.
ODFW	ODFW Sockeye Salmon Captive Brood/CR-154438	Hatchery – Captive Brood	ODFW's Oxbow Fish Hatchery is currently providing rearing space for sockeye smolt production. Oxbow Fish Hatchery rears between 60,000 and 150,000 sockeye smolts annually.
NOAA	NOAA Sockeye Salmon Captive Brood/CR-163129	Hatchery – Captive Brood	The maintenance of geographically separate captive brood populations at Eagle, Idaho and Manchester-Burley, Washington is a key factor in reducing the risk of catastrophic loss of Redfish Lake sockeye salmon gene pool from mechanical failure, human error, or disease. NOAA-Fisheries expects to produce up to 250 maturing fish for use in adult release or for artificial spawning programs during the contract cycle. It is anticipated the project will supply up to 125,000 eyed eggs for use in the egg box program or rearing in the fry and smolt production programs at Oxbow Hatchery and Sawtooth Hatchery. The project will continue to maintain at least 300 fish from each of three brood years in the safety net for this ESA listed stock.
SBT	Shoshone Bannock Tribes Snake River Sockeye Habitat/Cr-164992	Habitat	Project objectives include: 1) monitor limnological parameters of the Sawtooth Valley lakes to assess lake productivity; 2) monitor sockeye salmon smolt migration from the captive rearing program release of juveniles and eyed eggs into Pettit and Alturas lakes; 3) reduce the number of mature kokanee spawning in Fishhook Creek and Alturas Lake Creek; 4) monitor spawning kokanee escapement and estimate fry recruitment in Fishhook and Alturas Lake creeks; 5) conduct sockeye and kokanee salmon population surveys; 6) evaluate potential competition and predation between stocked juvenile sockeye salmon and a variety of fish species in Pettit and Alturas lakes; and 7) assist IDFG with captive broodstock production activities.

Source: CBFWP 2010

3.3.2 Biological Objectives with Measurable Attributes

The primary goal of this program is the conservation of Snake River sockeye. The program is designed to assist in achieving recovery objectives for this species. NOAA Fisheries defined an interim recovery goal of 1,000 adult natural-origin sockeye returning to Redfish Lake and 500 adults returning to two additional lakes (NOAA Fisheries 2008). The IDFG proposes to meet these 500 natural-origin adult escapement goals in Pettit and Alturas lakes. Progress toward achieving these escapement levels will be monitored at weirs located on Redfish Lake Creek, on the Salmon River at the Sawtooth Hatchery weir, and possibly other facilities at Pettit and Alturas lakes in the future. The proposed Springfield Hatchery will contribute significantly toward achieving this biological goal by first, establishing a self-sustaining anadromous brood hatchery program which will reduce the reliance on captive brood hatchery adults and lower the risk of domestication. Second, the program will provide surplus anadromous and captive adults for direct planting into Redfish and Pettit lakes to increase natural juvenile production from those lakes. And finally, surplus captive brood Redfish Lake adults will be used to recolonize Alturas Lake, transitioning to an Alturas Lake hatchery program if needed.

3.3.3 Expected Project Benefits

Restoration of Snake River sockeye to healthy (i.e., sustainable) levels is important from cultural, economic, legal and biological perspectives.

Culturally, sockeye are an important species to Native American communities which relied on them for food and religious ceremonies. Expanding production under the proposed Springfield program would help ensure that these benefits could be sustained in the future.

Economically, restoration of the species would reduce costs associated with ESA recovery actions. As run-size increases, the need for expensive captive brood facilities will be reduced and ultimately eliminated. If run sizes exceed recovery objectives, it may be possible to reduce all hatchery production, translating into substantial cost savings for the region.

Legally, sockeye recovery would mean that obligations under the ESA will have been achieved.

Biologically, the project would restore sockeye populations in Pettit and Alturas lakes and expand ongoing population restoration efforts in Redfish Lake. Over time, locally-specific life history traits would evolve, contributing to genetic and biological diversity that will enhance population survival. This species also contributes important marine derived nutrients to these lakes that are critical for maintaining not only sockeye production, but also other aquatic and terrestrial species. Program success will be dependent on actions designed to protect habitat used by sockeye for spawning, rearing and migration. As was the case with marine derived nutrients, habitat protection and improvement actions being undertaken as part of other processes for sockeye also produce benefits for other species.

3.3.4 Implementation Strategies Relative to Current Conditions and Restoration Potential

The proposed program focuses on the hatchery actions required to achieve Snake River sockeye recovery objectives. The program is designed to produce fish that are as similar as possible in genetics and behavior as natural populations given that the native run of sockeye reached near extinction levels. This approach is consistent with the Columbia Basin Fish and Wildlife Plan (NPCC 2009) primary artificial production strategy that states:

> *"Artificial production can be used, under the proper conditions, to 1) complement habitat improvements by supplementing native fish populations up to the sustainable carrying capacity of the habitat with fish that are as similar as possible, in genetics and behavior, to wild native fish, and 2) replace lost salmon and steelhead in blocked areas."*

3.3.5 Relationship to Regional Habitat Strategies

The habitat strategy for the Snake River sockeye program is consistent with that of the Columbia Basin Fish and Wildlife Plan (NPCC 2009). Investigations by IDFG biologists have concluded that sockeye spawning and rearing habitat in the Sawtooth basin is mainly intact and of high quality. For these habitats, the program will be operated consistent with the following NPCC strategy:

> *"Where the habitat for a target population is largely intact, then the biological objectives for that habitat will be to preserve the habitat and restore the population of the target species up to the sustainable capacity of the habitat. When the biological potential of a target population is high, biological risk should be avoided and restoration should be by means of natural spawning and rearing. When the biological potential of the target population is limited by external factors, such as the presence of mainstem dams or other factors, supplementation is a possible policy choice to augment natural capacity and productivity, in a limited fashion that ensures that the majority of production will be the result of natural spawning."*

Modifications to the Snake River sockeye program proposed in this Master Plan focus on expanding smolt production numbers, broodstock management capabilities and potentially developing separate broodstocking programs for Redfish, Pettit and Alturas lakes through construction of a new hatchery; additional habitat measures are not proposed. Because population productivity and abundance potential is limited by the high mortality sockeye experience migrating through the FCRPS (an external factor), artificial production is important to augment natural production. The accelerated level of artificial production that will occur with operation of the Springfield Hatchery is expected to be necessary for quite some time in order to reestablish the population after natural production was reduced to less than 20 fish in the 1990s. Eventually, as natural sockeye abundance increases, hatchery production will be reduced substantially.

Migration conditions for juvenile and adult sockeye upstream of the FCRPS have been degraded as a result of human development. The level of degradation is such that it is unlikely that the habitat can be restored to "intact" condition; however, improvements are possible and will be pursued as part of other processes (see examples in Table 3-1). These improvements are expected to increase Snake River sockeye survival over time.

3.3.6 Alternatives Considered

In proposing the Springfield Hatchery, the IDFG seeks to meet both broodstock and conservation goals. IDFG's broodstock goal is to rear up to one million localized sockeye salmon smolts for outplanting in Sawtooth basin lakes. The conservation goal is to ensure the long-term persistence of a viable, healthy and harvestable population of sockeye in the Snake River.

The Upper Snake River sockeye population is currently supported by a complex program that relies upon facilities in Idaho, Oregon and Washington to sustain what was a critically imperiled population. Success of this program has paved the way for larger-scale localized broodstock collection that is the foundation of the proposed program components. A number of alternative strategies for the Snake River sockeye program were examined by IDFG as part of this planning effort. In selecting the alternative presented in this Master Plan, among other factors, the IDFG considered the ability of different approaches to meet conservation and broodstock goals, reduce long-term costs, and provide sufficient localized broodstock to restore populations adapted to the specific conditions of lakes in the Sawtooth basin. Alternative approaches evaluated include:

- **Maintain current captive broodstock program**. Under this strategy, the program would continue as it is currently operated. Broodstock would be collected in the basin and reared at Eagle, Burley, and Manchester facilities; production groups would continue to be reared at Oxbow and Sawtooth hatcheries. Releases back to the Sawtooth basin would consist of eggs, pre-smolts, smolts and captive brood adults.

- **Eliminate captive broodstock program and rely on natural production only**. With this strategy, broodstock no longer would be collected at the Sawtooth Hatchery weir or at the Redfish Lake Creek weir. Returning adults would be allowed to volitionally access habitat upstream of the Sawtooth Hatchery. The population would rely upon current habitat conditions in Redfish, Pettit and Alturas lakes.

- **Five Lake Recovery Strategy**. Returning adult sockeye would be introduced to five lakes in the Sawtooth basin: Redfish, Pettit, Alturas, Stanley and Yellowbelly.

These alternatives were rejected as they did not meet identified conservation goals, were too costly, had a high risk of failure or required more resources for implementation than are currently available. A more detailed discussion of each alternative is presented in Section 5.3.

3.3.7 Historical and Current Status of Fish Populations in the Salmon River Basin

Historically, the upper Salmon River and its tributaries contained healthy populations of native salmonids, including bull trout, westslope cutthroat trout, rainbow trout, mountain whitefish, sockeye salmon, Chinook salmon, and steelhead trout. Spawning populations of sockeye salmon were known to exist in Redfish, Pettit, and Alturas lakes. Many of the native fish populations have declined due to human impacts both within the region and downstream, including the construction of hydroelectric dams on the Columbia and Snake rivers. Five species of salmonids found in the Salmon River Basin are listed under the Endangered Species Act (Table

3-3). Other rare and sensitive species in the basin include arctic grayling, golden trout, lake trout, mountain sucker, Pacific lamprey, redband trout, and westslope cutthroat.

Table 3-3. ESA status of fish populations in the Salmon River Basin.

Species	Federal Status (Date listed)[a,b]	State Ranking[a,c]
Bull trout (*Salvelinus confluentus*)	Threatened, G3 (6/10/1998)	S3
Spring/Summer Chinook salmon (*Oncorhynchus tschawytscha*)	Threatened, G5 (4/22/1992)	S1
Fall Chinook salmon (*Oncorhynchus tschawytscha*)	Threatened, G5 (4/22/1992)	S1
Steelhead trout (*Oncorhynchus mykiss*)	Threatened, G5 (6/17/1998)	S3
Sockeye salmon (*Oncorhynchus nerka*)	Endangered, G5 (1/2/1992)	S1
Westslope cutthroat trout	Not listed under ESA, G4	S3
Redband trout	Not listed under ESA, G5	S4

[a] G= Global Ranking, S= State Ranking
1= Critically imperiled, 2=Imperiled, 3=Vulnerable, 4=Apparently secure, 5=Secure
[b] NatureServe 2010
[c] IDFG 2005

Twenty-six species of fish are currently found in the Upper Salmon watershed, including limited numbers of the listed species (see Section 4.1.6.1 for a complete list). Fisheries occur for brook trout, cutthroat trout, rainbow trout, and steelhead in the Upper Salmon River. Fish assemblages change from lake to lake throughout the region. Wild cutthroat trout can be found in most streams and lake outlets. Specific information about the major lakes in the area is presented below.

The limiting factor in these lakes is often nutrients and forage fish. A nutrient enhancement program is currently underway at Pettit and Alturas lakes to enhance primary productivity and improve forage conditions for juvenile sockeye salmon (Kohler et al. 2009).

Kokanee, the non-anadromous form of sockeye salmon, are not known to be native to lakes in the Upper Salmon subbasin (Kohler et al. 2009). Prior to the 1950s, however, kokanee were stocked in several of the Sawtooth basin lakes to provide angling opportunities. These non-native kokanee directly compete for forage with native fish, including sockeye, and a program has been implemented to eliminate kokanee from this system.

The five Sawtooth basin lakes are relatively small, glacially formed lakes with cool water temperatures and low productivity (Table 3-4). Each are oligotrophic: mean summer total phosphorus (TP) concentrations in the epilimnion range from 3.1 to 11.6 ug/L; surface chlorophyll a concentrations range from 0.3 to 2.0 ug/L; and mean summer secchi disk transparencies range from 9.8 to 17.8 m, excluding Stanley Lake which ranges from 5.0 to 10 m.

Redfish Lake is approximately 900 miles from the mouth of the Columbia River. There are 383 miles of free flowing river from Redfish Lake to the mouth of the Salmon River and an additional 519 miles impacted by eight dams on the Snake and Columbia rivers.

Table 3-4. Morphological features of the Sawtooth Valley lakes.

Lake	Area (km^2)	Volume (m^3)	Mean Depth (m)	Drainage Area (km^2)
Stanley	0.81	10.4	13	39.4
Redfish	6.15	269.9	44.10	108.1
Yellowbelly	0.73	10.4	14.3	30.4
Pettit	1.62	45.0	28.0	27.4
Alturas	3.38	108.2	32.0	75.7

Source: Kohler et al. 2009

Native fish species found in this nursery lake system include: sockeye/kokanee salmon (*Oncorhynchus nerka)*, steelhead/rainbow trout (*O. mykiss)*, Chinook salmon (*O. tshawytscha)*, cutthroat trout (*O. clarki lewisi*), bull trout (*Salvelinus confluentus*), mountain whitefish (*Prosopium williamson*), sucker (*Catastomus spp.*), redside shiner (*Richardsonius balteatus*), dace (*Rhinichthys spp.*), northern pikeminnow (*Ptychocheilus oregonensis*), and sculpin (*Cottus spp.)*. Nonnative species include brook char (*S. fontinalis*) and lake trout (*S. namaycush*). The only pelagic species besides *O. nerka* are redside shiners. The two species are not sympatric because of differing vertical distributions.

Hatchery rainbow trout are stocked by IDFG throughout the summer in all lakes except for Redfish and Yellowbelly lakes. Sport fishing for salmonid fishes is open on all lakes as well as inlet and outlet streams.

3.3.7.1 Stanley Lake

Stanley Lake (Figure 3-1) supports rainbow trout, kokanee, and lake trout. It is regularly stocked with rainbow trout by IDFG. Brook trout, Chinook salmon, cutthroat trout, and various species of sculpin and sucker are found in Stanley Lake Creek, the outlet of the lake. A barrier was installed to prevent fish from migrating into the lake in the 1960s; it remains today.

Recreation facilities at Stanley Lake include three campgrounds, a day use area, a boat launch, and hiking trails. The lake is a common fishing destination for both shore and boat fishermen.

3.3.7.2 Redfish Lake

Kokanee are a target game fish species in Redfish Lake. Other species present in the lake include sockeye salmon, Chinook salmon, and steelhead. Sockeye salmon are the only fish stocked here, where the production potential exceeds that of other Sawtooth basin lakes. Downstream, Little Redfish Lake and Redfish Lake Creek also contain bull trout and cutthroat trout.

Redfish Lake is the largest of the Sawtooth basin lakes and provides the most amenities to visitors (Figure 3-2). The north end of the lake hosts developed recreation opportunities, including the Redfish Lake Lodge (restaurant, cabin, and boat rentals), Forest Service campgrounds, boat launch, day-use areas and a visitor center. Tours on the lake are common, as are motorized and non-motorized pleasure and fishing boats.

Figure 3-1. Stanley Lake

Figure 3-2. Redfish Lake

3.3.7.3 Yellowbelly Lake

Target game fish species in Yellowbelly Lake include brook trout and cutthroat trout; the latter are stocked in most years. Currently, a concrete barrier on the Yellowbelly Lake outlet prevents access by anadromous fish. A rockfall formation is located a quarter mile below this barrier, where Yellowbelly Lake Creek flows through pore spaces of a boulder field. A trap-and-haul operation would be necessary to create access for anadromous migrants to the habitat above the barriers.

Yellowbelly Lake hosts no developed campgrounds and development around the lake is minimal.

3.3.7.4 Pettit Lake

Pettit Lake contains kokanee, rainbow trout, and sockeye salmon. Both rainbow trout and sockeye are planted in the lake annually. Development on Pettit Lake is limited to one campground and day use area, mountain cabins, and a boat launch (Figure 3-3).

Figure 3-3. Pettit Lake

3.3.7.5 Alturas Lake

Fisheries for kokanee and rainbow trout occur in Alturas Lake. Brook trout, bull trout, and the occasional Chinook salmon or steelhead can also be found. Rainbow trout and sockeye salmon are stocked in Alturas Lake annually. Alturas Lake is one of the more developed lakes in the Sawtooth basin with three campgrounds, day use areas and a boat launch (Figure 3-4).

Figure 3-4. Alturas Lake

3.3.8 Current and Planned Management of Anadromous and Resident Fish

The following sections present a brief overview of current and planned management activities that may influence the ongoing Snake River sockeye program, or activities that would be affected by the proposed program expansion. This discussion addresses activities in the upper Salmon River watershed. Because the proposed Springfield facility would be an isolated operation that will neither collect nor release sockeye locally, management activities in the Upper Snake Subbasin where it is proposed are not presented.

Over 150 projects are aimed at restoring fish and wildlife habitat in the Upper Salmon watershed (Ecovista 2004). Activities most frequently include water diversion modifications, riparian fencing, and access management. Other activities that may affect the Snake River sockeye program are stream structure modifications, riparian modifications, and fish passage improvements. A comprehensive list of these management activities is presented in the draft Salmon Subbasin Plan (Ecovista 2004).

3.3.8.1 Idaho Department of Fish and Game

The IDFG has the authority to manage resident fisheries in Idaho and co-manages anadromous fisheries under a Fisheries Management Plan for the years 2007-2012 (IDFG 2006). The six-year focus of the anadromous fish program is to maintain hatchery-supported steelhead and Chinook salmon fisheries in Idaho and take management actions necessary to preserve wild steelhead, Chinook, and sockeye salmon. The IDFG's long-range goal for the anadromous fish program is to preserve Idaho's salmon and steelhead runs and recover them to provide benefit for all users.

Key management objectives to achieve this goal are to: (1) maintain genetic and life history diversity and integrity for both naturally- and hatchery-produced fish; (2) rebuilt naturally-producing populations of anadromous fish to use existing and potential habitat at an optimal level; (3) achieve equitable mitigation benefits for losses of anadromous fish caused by development of the hydroelectric system on the Snake and Columbia rivers; (4) improve overall life cycle survival sufficient for delisting and recovery by addressing key limiting factions identified in hydropower, habitat, harvest, and hatchery effects; (5) allow consumptive harvest by sport and treaty fishers; and (6) coordinate regional management with Idaho anadromous management to ensure achievement of Idaho management objectives and long-range program goals.

Anadromous mitigation research projects that are being undertaken by IDFG during the 2007-2012 period include:

- Documenting the contribution hatchery-produced salmon and steelhead make towards meeting management and mitigation objectives
- Maintaining captive broodstocks of Snake River sockeye salmon and documenting the efficacy of various reintroduction strategies.
- Developing an integrated, web-based anadromous hatchery database
- Developing fine-scale genetic profiles for natural-origin salmon and steelhead

The following objectives of the 2007-2012 management plan may affect sockeye populations in the upper Salmon River watershed:

- **Maintain existing natural spawning populations of salmon.** Allow natural production to sustain existing naturally produced populations. Limit outplanting of hatchery fish, other than direct hatchery releases, to support supplementation research and areas devoid of naturally producing populations of salmon. Continue smolt monitoring to gain natural production and survival information.
- **Reestablish sockeye runs to historic habitats when population levels become sufficient to do so.** Evaluate benefits of lake fertilization to enhance kokanee and sockeye smolt production. Evaluate introductions of sockeye back into Redfish, Alturas, and Pettit lakes.
- **Maintain and improve habitat quality of mainstem and tributary production areas.** Work cooperatively with willing landowners through the Upper Salmon Basin Watershed Project, in priority areas, to maintain and enhance critical spawning and rearing areas for resident and anadromous fishes. Encourage land management activities on public and private properties that further improve the quality of natural production areas. Participate in grazing allotment management plan review. Encourage implementation of grazing management plans that eliminate negative grazing impacts to fishery productivity and survival. Participate in interagency mining oversight committees to review operating plans and work with regulatory agencies to require strict compliance with mining laws to protect water quality and fish populations.

Develop monitoring programs for fish populations and fish habitat relative to mining activities, if needed. Continue to monitor and evaluate benefits from habitat projects.

- I**mprove anadromous juvenile and adult fish passage in the Salmon River.** Work with federal land managers and private irrigators to alleviate passage problems in the mainstem Salmon and tributaries due to irrigation diversions and dewatering.

To further these goals and objectives, the IDFG manages/conducts several programs in the subbasin for sockeye salmon. IDFG participates in sockeye captive broodstock culture, research and evaluation of hatchery and wild populations, and performs genetic analysis (with the University of Idaho). IDFG also assists the Custer Soil and Water Conservation District with habitat enhancement in the upper Salmon subbasin. This work includes fence installation, riparian plantings, and removal of passage barriers. Additionally, IDFG maintains fish screens to prevent anadromous fish entrainment into irrigation systems. Some of these screens include PIT-tag remote sensing for entrainment and migration timing.

3.3.8.2 Shoshone-Bannock Tribes

The Shoshone-Bannock Tribes are involved in the rehabilitation of the Snake River sockeye salmon stock and participate in several state and federal programs.

The Tribes have funding through the Bonneville Power Administration to conduct sockeye salmon habitat and limnological research. Under this funding, they are evaluating nursery lake habitat conditions encountered by juvenile sockeye during their freshwater rearing phase. Physical and biological parameters, including phosphorus and nitrogen, are monitored in four Sawtooth Valley lakes. Limnological data are being used to develop estimates of sockeye salmon carrying capacities for each lake.

Kokanee in these lakes directly compete with sockeye for forage, and the Shoshone Bannock Tribes are evaluating this potential competition and predation between stocked juvenile sockeye salmon and non-native kokanee. Kokanee biomass estimates are developed using hydroacoustic technology. Kokanee and limnological data are evaluated prior to developing annual stocking recommendations for hatchery-produced sockeye. Decisions to add nutrients to sockeye nursery lakes are made annually and are also based on these data. The responsibility for monitoring and evaluating hatchery-produced juvenile sockeye planted in Pettit and Alturas lakes is shared between IDFG and the Shoshone-Bannock.

Other efforts of the Shoshone-Bannock Tribes that may support the Snake River sockeye salmon program include the Snake River Habitat Enhancement project and various habitat restoration efforts in the Upper Salmon subbasin. The Shoshone-Bannock Tribes also support the IDFG sockeye program and assist IDFG with captive broodstock production activities (see Table 3-2).

3.3.8.3 NOAA Fisheries

NOAA Fisheries is charged with ensuring that all sockeye enhancement programs follow the outlines established by the U.S. v. Oregon Columbia River Fish Management Plan and the FCRPS Biological Opinion (NOAA Fisheries 2008). The 2008 FCRPS Biological Opinion calls for increasing survival rates of fish passing through the dams; managing water to improve fish survival, reducing the numbers of juvenile and adult fish consumed by fish, avian, and marine mammal predators; improving juvenile and adult fish survival by protecting and enhancing tributary and estuary habitat; implementing safety net and conservation hatchery programs to assist recovery; and ensuring that hatchery operations do not impede recovery.

NOAA Fisheries maintains a geographically separate captive brood population of Snake River sockeye at the Manchester-Burley Laboratories in Washington. In the near term, this captive brood population will remain an important factor in reducing the risk of catastrophic loss of the Snake River sockeye salmon gene pool. This facility produces up to 250 maturing fish for use in adult release or for artificial spawning programs and also supplies up to 125,000 eyed-eggs for use in the egg box program or rearing in the fry and smolt production programs at Oxbow and Sawtooth hatcheries.

3.3.9 Consistency with Recovery and Watershed Management Plans

The Snake River sockeye program is consistent with key species recovery and watershed management plans as discussed below.

3.3.9.1 2008 FCRPS Biological Opinion and Idaho Fish Accords

The 2008 FCRPS Biological Opinion (NOAA Fisheries 2008) and the MOA between the State of Idaho FCRPS Action Agencies (Idaho et al. 2008) call for the acquisition of suitable hatchery rearing space to produce between 500,000 and 1 million full-term sockeye smolts annually for release to Sawtooth Valley waters. The proposed Springfield Hatchery described in this Master Plan would enable IDFG to expand the current broodstock production levels in order to achieve this objective, and therefore would be consistent with both guidance documents.

3.3.9.2 Snake River Sockeye Recovery Plan

A recovery plan for Snake River sockeye is currently in preparation and will likely be available in 2011. IDFG has been working with NOAA Fisheries to develop this plan. The IDFG has submitted a draft Snake River Sockeye Salmon Recovery Strategy to NOAA Fisheries for their consideration and incorporation into recovery planning (see Appendix C).

The IDFG strategy incorporates the use hatchery facilities, captive broodstock technology, genetic support and a comprehensive monitoring and evaluation plan to maintain the population and to continue rebuilding numbers of sockeye in the wild. Specifically, a three-phased program is proposed. Phase 1 would increase smolt production at the new Springfield Hatchery. Currently there is insufficient incubation and juvenile rearing space available at Sawtooth and Oxbow hatcheries and both facilities have higher priority mitigation mandates that make sockeye program expansion impractical. From 500,000 to one million smolts would be produced at Springfield for release in the Sawtooth Valley. Increasing hatchery capacity would, in turn, address one of the factors limiting sockeye recovery – too few anadromous adult returning to the collection sites.

In Phase 2, recovery efforts would transition from a captive brood program to a conventional conservation program, incorporating more anadromous adults in breeding plans and for volitional spawning in area lakes. As number of natural-origin adults increases in the Sawtooth

Valley, the Springfield Hatchery program would be transitioned to an integrated program in Phase 3. Integrated broodstock and escapement management plans would be driven by the natural population so as to increase local adaption and population fitness.

3.3.9.3 Salmon Subbasin Plan

The Salmon Subbasin Plan (Ecovista 2004) developed biological objectives for Salmon River sockeye. Natural spawning escapement was identified as 2,000 adult sockeye based on a target smolt-to-adult survival rate of 4%. This level of natural escapement was derived from NOAA-Fisheries abundance delisting criteria. The plan envisions the continued use of hatchery production to meet this abundance criterion. How hatchery production will be used to achieve these objectives is described in Section 5.

3.3.10 Comprehensive Environmental Assessment

Under the NPCC Step-Review process for aquaculture facilities, project proponents are asked to describe the status of their comprehensive environmental assessment. Upon approval of this Step 1 Master Plan, the IDFG will initiate preparation of a detailed environmental assessment that meets the criteria of the National Environmental Policy Act (NEPA). This assessment will provide a foundation for compliance with a number of other environmental and regulatory requirements. This section provides an overview of the most significant environmental compliance steps to be undertaken during Step 2.

3.3.10.1 NEPA

The National Environmental Policy Act (NEPA) of 1969, as amended (42 USC 4321 et seq.), requires federal agencies to assess and disclose the effects of a proposed action on the environment prior to funding, approving, or implementing an action.

An Environmental Assessment (EA) that examines the environmental consequences of developing and operating the Springfield Sockeye Hatchery will be prepared to address NEPA requirements. This process will include public outreach to assist the IDFG in identifying key issues that should be addressed in the environmental analysis. As the primary funding entity, it is likely that BPA will be the lead federal agency for the NEPA effort.

3.3.10.2 Endangered Species Act

The Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.), requires federal agencies to ensure that actions they authorize, fund or conduct are not likely to jeopardize the continued existence of any ESA proposed or listed species or their designated critical habitat.

Snake River sockeye were listed as “endangered” under the ESA in 1991 (56 Federal Register 58619). Designated critical habitat includes all Columbia River estuarine areas and river reaches upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches upstream to the confluence of the Salmon River; all Salmon River reaches upstream to Alturas Lake; Redfish, Pettit, Alturas, Stanley and Yellowbelly lakes (including their inlet and outlet streams); Alturas Lake Creek; and that portion of Valley Creek between Stanley Lake Creek and the Salmon River (NOAA Fisheries 2008).

Biological Opinion

Section 7 of the ESA directs federal departments and agencies to ensure that actions authorized, funded, and/or conducted by them are not likely to jeopardize the continued existence of any federally proposed or listed species, or result in destruction or adverse modification of critical habitat for such species. Section 7(c) requires that federal agencies contact the USFWS and/or the NOAA Fisheries (the Services) before beginning any construction activity to determine if federally listed threatened and endangered species or designated critical habitat may be present in the vicinity of a proposed project. A Biological Evaluation/Assessment (BE/BA) must be prepared if actions by a federal agency or permits issued by a federal agency will result in construction and if the Services determine that threatened and endangered species may occur in the vicinity of a proposed project. The Service uses this document as the basis of a Biological Opinion that will outline criteria to ensure the project does not further jeopardize an endangered species. The IDFG will prepare a BA that addresses the potential effects of the aquaculture program on aquatic and terrestrial species.

The 2008 FCRPS Biological Opinion (NOAA Fisheries 2008) recommended mitigation for operational effects of the Snake River dams on sockeye. Measures recommended for sockeye include acquiring suitable rearing space to produce between 500,000 and 1 million full-term smolts annually for release into the upper Salmon River watershed.

Recovery Plan

NOAA-Fisheries is in the process of preparing a recovery plan for Snake River sockeye. The IDFG provided scientific advice in the form of draft recovery language that identifies several strategies to achieve recovery (Appendix C). These include using state-of-the art hatchery facilities, captive broodstock, genetic support and a comprehensive monitoring and evaluation program to continue rebuilding the population. The IDFG participates in the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) along with NOAA Fisheries, BPA, Shoshone Bannock Tribes and the University of Idaho. This group was formed in 1991 to guide new research, coordinate ongoing research and participate in all technical aspects of the Snake River sockeye recovery effort.

3.3.10.3 Clean Water Act

Consistency of project construction and operation will be demonstrated with various regulatory programs under the Federal Water Pollution Control Act (Clean Water Act). The authority to review the programs for consistency with Section 401 is the responsibility of the Idaho Department of Environmental Quality (IDEQ). Section 404 of this act is administered by the Corps of Engineers. Effects of developing the proposed hatchery facilities on wetland habitat will be evaluated by the Corps, an effort that will require delineation of existing wetlands. Another Clean Water Act component is administered by the Environmental Protection Agency (EPA) is the National Pollution Discharge Elimination System (NPDES) permit for hatchery construction (and the associated Stormwater Pollution Prevention Plan). An additional NPDES permit will be required for hatchery operations if production reaches a regulated level.

3.3.10.4 National Historic Preservation Act

Funding this project is considered an undertaking within Section 106 of the National Historic Preservation Act of 1966, as amended (P.L.89-665, 16 U.S.C. 470). Section 106 requires that every federal agency take into account how each of its undertakings could affect historic properties. Historic properties are districts, sites, structures and traditional cultural places that are eligible for inclusion on the National Register of Historic Places. As the lead federal agency, BPA will ensure that all necessary steps to evaluate potential effects on listed properties and as required by Section 106 are undertaken, including consultation with Tribes and the state regarding other cultural resource values.

3.3.10.5 State Approvals

Developing the proposed aquaculture facilities will require various regulatory approvals from State of Idaho agencies. The IDFG will lead this effort, which will be based on environmental and engineering analyses of potential project construction and operational effects. Permitting requirements will be verified during Step 2 planning and preliminary design; approvals sought during Step 3, final design.

3.3.11 Monitoring and Evaluation Programs

Monitoring and evaluation of factors affecting Snake River sockeye are ongoing at a regional and local level. Many of these programs are summarized in Tables 3-1 and 3-2. Measures conducted by the IDFG specific to the sockeye program include selecting broodstock that represent the genetic diversity of the entire run; marking all hatchery-produced pre-smolts and smolts; monitoring numbers, location and genetics of anadromous returns; annually approving production releases that will not exceed the carrying capacity of basin lakes; incorporating genetic profiles of the founder population and annual returns for the annual spawning matrix; and following fish health protocols and pathogen containment in the captive brood program.

3.3.12 Cost Estimates

Cost estimates to construct the proposed Springfield Hatchery and to operate it for ten fiscal years have been developed to the concept stage over ten fiscal years as required by NPCC's Major Projects Review (NPCC 2006). These estimates provide a planning baseline from which to refine costs, evaluate alternatives, and protect against budget expansion as the project progresses through the preliminary (Step 2) and final design (Step 3) phases and implementation. This Master Plan addresses only the newly proposed hatchery component of the ongoing Snake River Basin sockeye program.

Completing the Council's Three-Step process often requires three to five years. During this time, considerable planning, design, environmental compliance and analysis of alternatives will occur. A generalized list of program areas and a preliminary timeline linking costs to planning; construction; capital equipment; environmental compliance; operations and maintenance; and research, monitoring, and evaluation is presented in Figure 8-1 for FY 2010 through FY 2020. A cost summary by program area is shown in Table 8-2. Cost estimates for the program are presented in the year in which they are expected to occur from FY 2010 through FY 2020 and are shown in Table 8-10. Future costs for operations, maintenance, monitoring and evaluation, and capital construction generally follows the principals for inflation and cost escalation described by the Independent Economic Analysis Board in their white paper on Project Cost Escalation Standards (NPCC 2007). Estimated costs in Section 8 reflect the efficiencies of implementing planning and construction of facilities as a single project (i.e., not phased) and completing construction in one season.

In summary, it is estimated that planning and design of the Springfield complex will be approximately $ 1.2 million and construction will cost approximately $13.5 million. Annual operations, maintenance, monitoring and evaluation are roughly projected to be $1.06 million.

3.4 STEP 1 REQUIREMENTS FOR ARTIFICIAL PRODUCTION PROJECTS

This section summarizes the consistency of the Snake River sockeye program with the NPCC's artificial production strategies defined in provisions of the Columbia Basin Fish and Wildlife Program.

3.4.1 Consistency with Artificial Production Policies and Strategies

Program operation has been designed to be consistent with the NPCC's artificial production strategy and inherent recommendations. The ten artificial production strategies are presented below in bold italics, immediately followed by an assessment of the consistency of the proposed program with the strategy.

The purpose and use of artificial production must be considered in the context of the ecological environment in which it will be used.

The size of the Snake River sockeye program is designed to achieve the species recovery objectives identified by NOAA Fisheries. This level of abundance will maintain the ecological function sockeye salmon provide to the streams and lakes of the Salmon River. Additionally, as humans are a major component of the ecosystem, the program recognizes that anthropogenic impacts such as agriculture and power generation will continue indefinitely into the future. Thus in order to achieve program objectives, the number of fish released takes into consideration losses associated with these activities.

Artificial production must be implemented within an experimental, adaptive management design that includes an aggressive program to evaluate the risks and benefits and address scientific uncertainties.

From its outset in 1991, the captive broodstock program for Snake River sockeye has been adaptively managed. This approach was necessitated by the fact that the region had little experience with this type of program. Accordingly, the program developed around a detailed research, monitoring and evaluation program summarized in the HGMP (Appendix A) that examined phases of sockeye life history, fish culture practices, and the quality and quantity of existing habitat to support both hatchery and natural production. This research, monitoring and evaluation (RME) program will continue as the captive brood program is shifted to an integrated conservation program (see Section 5.4). A description of the RME plan being developed in conjunction with the proposed Springfield Hatchery is presented in Section 6.

Hatcheries must be operated in a manner that recognizes that they exist within ecological systems whose behavior is constrained by larger-scale basin, regional and global factors.

Factors outside the scope of the Snake River sockeye program will continue to directly affect its success. The primary constraint affecting this population and the program is fish passage through the FCRPS. According to the 2008 FCRPS Biological Opinion (NOAA Fisheries2008), approximately 50 percent of the juvenile Snake River sockeye and 20 percent of returning adults will be killed migrating though the FCRPS each year. Additionally, varying ocean conditions will cause large fluctuations in adult returns to the basin. The program incorporating the Springfield Hatchery has been sized to account for these factors in order to ensure that population recovery goals are achieved (see Section 1.3).

A diversity of life history types and species needs to be maintained in order to sustain a system of populations in the face of environmental variation.

Implementing the proposed program will accelerate recovery of Snake River sockeye salmon in the Sawtooth basin, ensuring that the species and the benefits it provides to the ecosystem are maintained. Sockeye adult carcasses (both natural- and hatchery-origin) will supply the nutrients that other aquatic and terrestrial species require to maintain healthy population abundance levels. Furthermore, increasing natural fish escapement to three historic spawning areas will result in the widest range of life histories possible given the habitat present. As more locally-adapted adults return to collection sites, it is expected that natural selection and local adaptation will increase the productivity of the population. Program management will be adjusted to a sliding-scale model that integrates broodstock and escapement management driven by the natural population.

Naturally selected populations should provide the model for successful artificially reared populations, in regard to population structure, mating protocol, behavior, growth, morphology, nutrient cycling, and other biological characteristics.

The physical, demographic and behavioral (e.g., migration timing) characteristics of hatchery sockeye will constantly be monitored and compared to the natural population migrating to and from the system. Genetic data have been collected over time to ensure that proper breeding protocols are implemented and maintained. These analyses will continue under this expanded aquaculture program.

The entities authorizing or managing an artificial production facility or program should explicitly identify whether the artificial propagation product is intended for the purpose of augmentation, mitigation, restoration, preservation, research, or some combination of those purposes for each population of fish addressed.

Initially, the primary goal of the program is the conservation and recovery of Snake River sockeye. As adult run sizes increase, the program will add a harvest objective to meet both tribal treaty rights and the needs of local communities. More specific information on program goals and strategies is presented in Section 5.4.

Decisions on the use of the artificial production tool need to be made in the context of deciding on fish and wildlife goals, objectives and strategies at the subbasin and province levels.

The ongoing program is designed to meet the fisheries management and ESA goals establish by NOAA Fisheries for Snake River sockeye. Production limitations at the existing facilities are hampering efforts to achieve these goals. Smolts produced at the proposed Springfield Hatchery would accelerate reestablishment of locally adapted anadromous adults that would be integrated into the hatchery broodstock and allowed to spawn naturally. Hatchery production is complemented by habitat actions proposed throughout the basin as part of subbasin and recovery planning that will not only improve the viability of sockeye, but also steelhead, Chinook, bull trout and other aquatic species important to the ecosystem.

Appropriate risk management needs to be maintained in using the tool of artificial propagation.

The transition from a captive brood to an anadromous brood hatchery program is an attempt to limit the risk to the population from domestication. As the program achieves triggers defined for transiting to Phase 3, it would be operated consistent with the recommendations of the HSRG (2004). This will reduce genetic and ecological risks that the hatchery may pose to natural populations. The existing research, monitoring and evaluation program will be enhanced (Section 6) to monitor activities associated with the additional smolt production.

Production for harvest is a legitimate management objective of artificial production, but to minimize adverse impacts on natural populations associated with harvest management of artificially produced populations, harvest rates and practices must be dictated by the requirements to sustain naturally spawning populations.

Harvest rates on sockeye salmon will be consistent with the conditions of US v Oregon and levels dictated by the 2008 FCRPS Biological Opinion (NOAA Fisheries 2008). Harvest is a secondary objective of the program until adult escapement levels achieve minimum sustainable threshold values (see Section 3.4.3).

Federal and other legal mandates and obligations for fish protection, mitigation, and enhancement must be fully addressed.

The Snake River sockeye program is a requirement of the 2008 FCRPS Biological Opinion (NOAA Fisheries 2008) and the Idaho Fish Accords (State of Idaho and FCRPS Action Agencies 2008). All other relevant legal mandates for fish protection, mitigation and enhancement will be incorporated into the program. Over time, the program may provide the harvestable levels of adult sockeye required to meet tribal fishing rights.

3.4.2 Hatchery and Genetics Management Plan

A draft Snake River sockeye HGMP is provided in Appendix A of this Master Plan.

3.4.3 Harvest Plan

For the foreseeable future, Snake River sockeye will be managed as currently occurs given their status as an ESA listed species. Ocean fishing mortality on Snake River sockeye is assumed to be zero and they may be incidentally harvested in freshwater fisheries. Fisheries in the mainstem Columbia River that affect Snake River sockeye are managed subject to the terms of the U.S. v. Oregon Interim Management Agreement for 2005-2007. Non-Indian fisheries in the lower Columbia River are limited to a harvest rate of 1%. Treaty Indian fisheries are limited to a harvest rate of 5 to 7% depending on the run size of upriver sockeye stocks.

In-basin harvest may be possible over time as adult returns to spawning areas increase. The response of the population to increased production levels will be monitored to determine changes in natural abundance, distribution and growth. However, it is anticipated that surplus adults needed to support a directed harvest would not be available for at least a decade or more.

3.4.4 Conceptual Facility Design

Conceptual design of the proposed Springfield Hatchery is described in Section 7.3 and illustrated in the figures included in Appendix D. An existing but abandoned trout hatchery has been acquired for conversion to an isolated sockeye rearing facility. Due to their deteriorated condition and inappropriate configuration for sockeye, most key components will be demolished and reconstructed. Proposed facilities include a hatchery building with incubation and early rearing components, well head and piping improvements, rearing raceways, effluent treatment ponds and three new residences.

3.5 CONSISTENCY WITH OTHER REQUIREMENTS, RECOMMENDATIONS AND PLANNING PROCESSES

3.5.1 Consistency with ISRP Recommendations and Guidance

The ISRP last reviewed the Redfish Lake sockeye program in 2004 as part of the NPCC's review of captive broodstock programs (ISRP 2004). At that time, the ISRP provided several general comments which applied to all captive propagation programs and some specific to the Redfish Lake program. These are summarized below.

3.5.1.1 General ISRP Comments

In their review, the ISRP asked that a decision tree be developed that reflects the current state of the scientific understanding of the salient risks and incorporates pertinent data from the programs. They stated:

> *"A "decision tree" should not only describe the biological and environmental considerations that led to a decision to bring a population into captive propagation, but also describe the biological and environmental factors that will lead to decisions to continue or discontinue the program. Are there trigger*

points" or metrics that drive decisions about implementation of the program?" (ISRP 2004)

To address the ISRP concerns, a decision tree (using biological triggers) has been incorporated into the Master Plan (see Section 5.4, Proposed Program Strategy). Because the decision was made years ago to start a captive broodstock program, the rationale for the program origin is not explicitly stated in this document. Instead, the decision tree describes how decisions will be made in the future regarding such activities as adult escapement, fish production numbers, release points and program termination.

3.5.1.2 Specific ISRP Comments on the Snake River Sockeye Program

ISRP concerns expressed in 2004 about the Snake River sockeye program are listed below in bold italics. The IDFG's responses follow each comment and are relevant to the proposed program expansion addressed in this Master Plan.

- ***Emphasis on reporting production numbers (by life stage) as an indicator of program success***

  Success of the expanded program will be linked to the viable salmon population parameters of abundance, productivity, life-history diversity and spatial structure. Release number by life stage, or total hatchery production, will be monitored as an indicator of hatchery culture success, but not program performance (see Appendix A).

- ***Census counts do not demonstrate a viable population***

  Run size data presented to the ISRP in 2004 indicated that adult abundance averaged 73 sockeye for the 1999-2004 time periods. At this level of escapement, runs were not deemed viable. In contrast, sockeye run size in 2008, 2009 and 2010 was 650, 833 and 1,316 (as of 9/29/10), respectively. Recent run-size is an order of magnitude greater than was observed at the time of the previous ISRP review. These data indicate that the run may be reaching self-sustaining levels. However, because other Columbia River sockeye runs have also increased in size these same years, there is concern that numbers may once again decline as ocean conditions become less favorable for sockeye production. The anadromous hatchery program is designed to increase abundance of the population as a whole so they may better weather low ocean productivity cycles, and prevent the need for reinitiating a captive brood program that this program is designed to replace.

3.5.2 Consistency with HSRG Recommendations

The HSRG reviewed the Snake River sockeye program in 2008 and recommended that it be shifted to an integrated conservation program with a release size of 750,000 smolts. They also agreed with the 2008 FCRPS Biological Opinion that IDFG investigate capturing broodstock at Lower Granite Dam for transport to Idaho. Additionally, they suggested that a downstream facility be used to release juveniles and capture broodstock. The idea behind each recommendation is to increase adult escapement to the program and spawning grounds.

The Master Plan is consistent with all HSRG recommendations with the exception of using a downstream facility to capture broodstock and release juveniles. This action may be explored in the future if the expanded smolt production program fails to produce sufficient adults to meet NOAA recovery objectives. The decision to implement a downstream program would be based on juvenile and adult survival rates through the FCRPS given increased production from the new Springfield facility (see Section 6.4.2). Currently, IDFG is of the opinion that survival rates have improved sufficiently so that broodstock needs can be achieved with increased production from Springfield.

4 LOCAL AND REGIONAL CONTEXT FOR AQUACULTURE PROGRAM

Two distinct subbasins are associated with the proposed Springfield Hatchery program, the upper Salmon River and the upper Snake River subbasins. Sockeye would be collected from and released into the Sawtooth Valley of the Upper Salmon Subbasin. They would be incubated and reared at a new hatchery near American Falls Reservoir in the Upper Snake Subbasin.

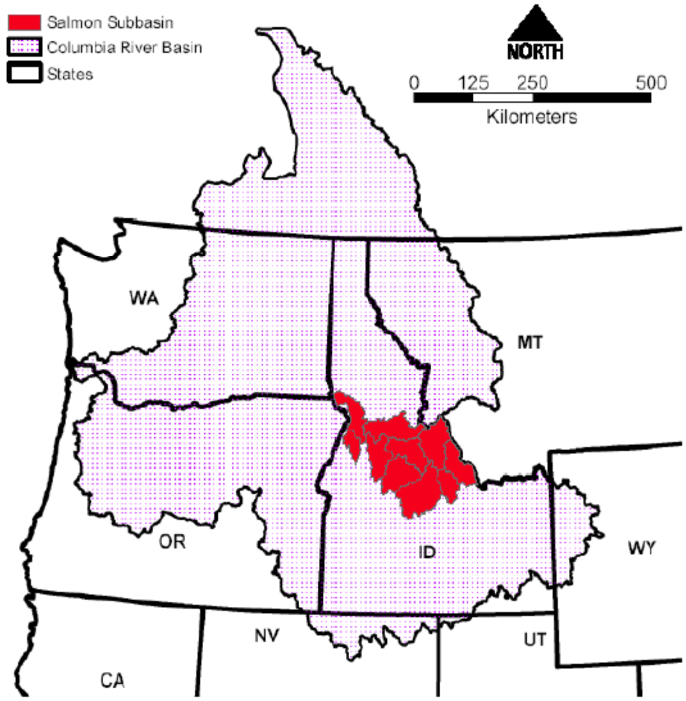
The Salmon River flows approximately 410 miles through central Idaho before joining the Snake River in lower Hells Canyon. Draining an area of 13,984 square miles, the Salmon River subbasin is one of the largest in the Columbia River (Figure 4-1). Key spawning and rearing habitat for Snake River sockeye is in the upper Salmon River subbasin. Although geographically separated, the Springfield Hatchery is proposed to be constructed approximately 140 miles away in the upper Snake River subbasin, near the town Springfield. This previously developed hatchery site is owned by the IDFG and possesses an ample high quality artesian water supply.

4.1 GEOGRAPHIC AND ENVIRONMENTAL CONTEXT

In this section, we first describe habitat and conditions important to this sockeye population in the upper Salmon River subbasin setting, followed in Section 4.1.7 with a description of the upper Snake River subbasin.

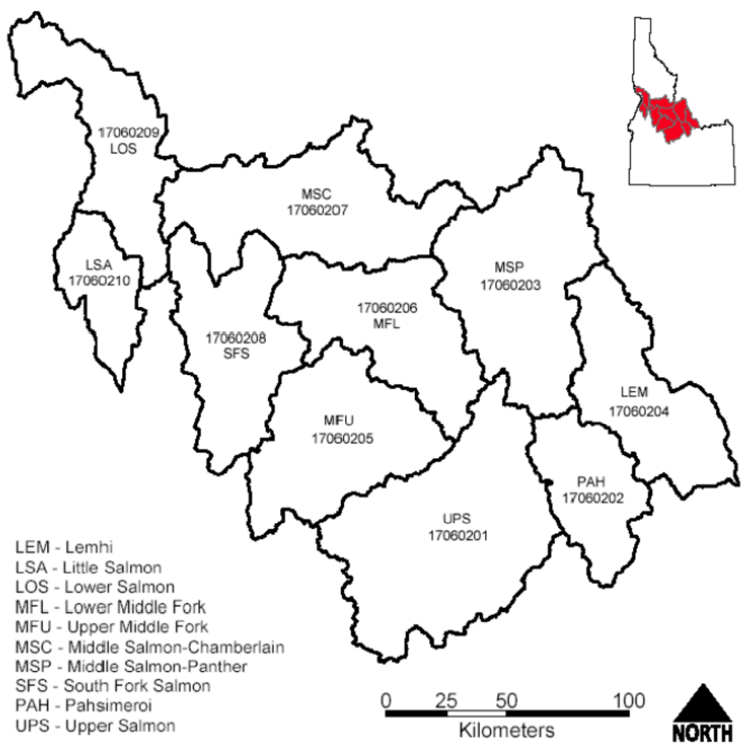
4.1.1 Location

The Salmon River subbasin encompasses 10 watersheds in the northern Rocky Mountains of central Idaho. Most of the subbasin is characterized by an intricate mosaic of moderate- to high-elevation mountain ranges and the deeply cut valleys of the Salmon River Mountains. Elevation within the subbasin ranges from 12,661 feet on the summit of Mount Borah to 2,165 feet at the mouth of the Salmon River. The Upper Salmon watershed, the largest of the major watersheds in the subbasin, drains an area of 1,550,777 acres (Figure 4-2). The headwaters of the Salmon River originate at the southern boundary, in the Boulder Mountains and Galena Summit. The Frank Church River of No Return Wilderness forms the northern boundary of the subbasin, the Pahsimeroi Mountains are to the east and the Sawtooth Mountains form the western border.



Source: Ecovista 2004

Figure 4-1. Location of the Salmon Subbasin within the Columbia River Basin



Source: Ecovista 2004

Figure 4-2. Major hydrologic units (watersheds) within the Salmon River subbasin

Adult collection and smolt releases from the Snake River sockeye program occur in the headwaters of the upper Salmon River in the Sawtooth basin. This area includes Stanley, Redfish, Yellowbelly, Pettit, and Alturas lakes. Stanley Lake and Stanley Lake Creek drain into Valley Creek, a tributary to the upper Salmon River downstream of the town of Stanley. Redfish, Yellowbelly, Pettit and Alturas lakes are all tributaries to the upper Salmon River upstream of Stanley.

4.1.2 Climate

A broad gradient of climatic conditions occur in the Salmon River subbasin, although the area typically experiences cold winters and warm, dry summers. Mean annual precipitation in the easternmost portion of the subbasin is typically half that of the western portions. In the upper Salmon watershed, approximately 70% of the precipitation falls within the spring and fall (IDEQ 2003), although convective showers are common in early summer. The wettest months are April, May, and June, with the driest months occurring from January through March (BLM 1998).

The seasonal distribution of precipitation influences terrestrial and aquatic habitats. Thunderstorms in the late spring and summer cause variable precipitation patterns throughout the watershed. In some instances, high intensity storms can cause flash flooding and subsequent erosion damage within a stream system. Diverse snowmelt patterns may cause significant runoff events in the early spring through summer, with lower elevations melting in early spring while snowmelt in the higher elevations occurs in early to mid-summer. Rain-on-snow events in the spring also contribute to increased stream flows.

Maximum summer temperatures can exceed 100˚F with minimum winter temperatures below 0˚F (BLM 1998). The average maximum monthly temperatures for the subbasin range from 78˚F in Stanley to 85˚F in Challis (Idaho Climate Summaries 2010). The average monthly minimum temperatures range from -0.8˚F in Stanley to 9.4˚F in Challis. During winter months, extended durations of extremely cold temperatures may cause water bodies to ice over. Ice build-up within streams and rivers of the region can cause flooding or severe bank damage as the ice breaks away from the banks.

4.1.3 Geology, Soils and Land Types

Stream erosion since the Cenozoic era has formed the narrow, V-shaped valleys, steep valley side slopes, and relatively narrow ridge systems found throughout the Salmon River subbasin. Major alpine glacier systems formed several mountain ranges, including the large-scale glacially-derived physiographic features (e.g., broad U-shaped valleys) that are prominent in the upstream portions of the upper Salmon watershed. The geomorphology of the eastern Upper Salmon, however, was formed by sub-parallel block fault ridges. The Lost River and Lemhi ranges represent the northernmost extent of Basin and Range terrain, where high mountain peaks rise rapidly from broad, gentle valleys.

The upper Salmon River subbasin is in the Idaho Batholith and Middle Rockies ecoregions (McGrath et al. 2001), where the geology consists primarily of metamorphic and sedimentary rocks, granite, volcanic rocks, and alluvium.

4.1.4 Hydrology

As part of the Columbia River Basin hydrologic region, 65 major streams and 261 named streams drain the subbasin (Figure 4-3). The principle drainage is the Salmon River, encompassing 1,550,777 acres from its headwaters to the confluence with the Pahsimeroi River (IFWIS 2003). It remains one of the last major free-flowing rivers in the west.

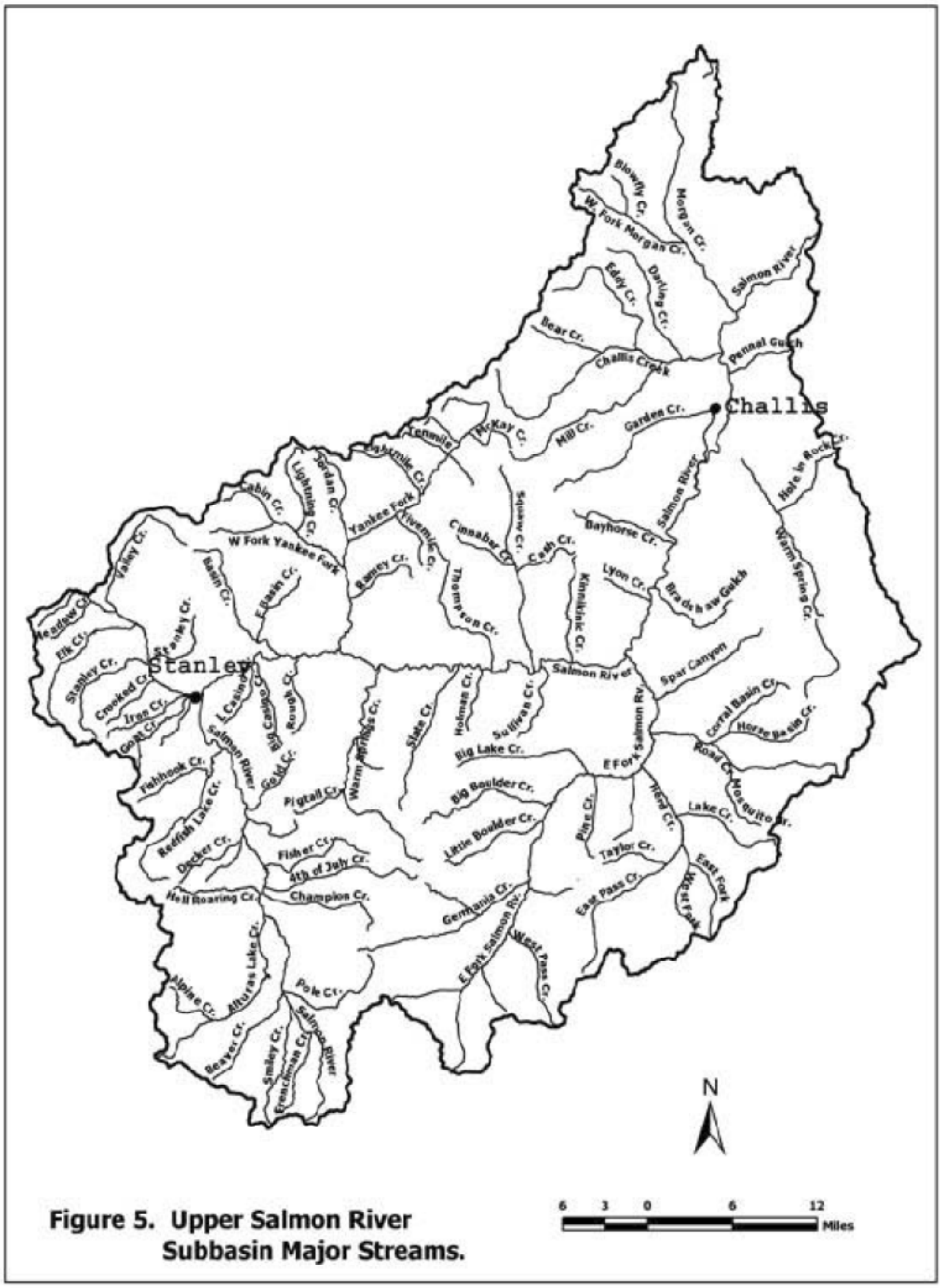


Figure 5. Upper Salmon River Subbasin Major Streams.

Source: IDEQ 2003

Figure 4-3. Major streams in the Upper Salmon River Subbasin

Floodplains in the Upper Salmon River vary from headwaters downstream. For example, the Sawtooth Valley floodplain is fairly broad, while in downstream canyon reaches, the floodplain is much narrower as the river cuts through the steep, V-shaped valleys that typify the region. Tributaries to the Salmon River in the subbasin are relatively small with steep gradients. The East Fork of the Salmon is the largest tributary in the Upper Salmon River subbasin. The lower portions of the East Fork have gradients less than 1% with an average channel width between 40 to 60 feet.

The only long-term USGS gaging station on the Salmon River is near the confluence with the Yankee Fork (Station 13296500, Salmon River below Yankee Fork near Clayton, ID). This gage measures runoff from 33% of the subbasin and reports an average annual runoff of 707,100 acre-feet. The next gage is 108 miles downstream from the Yankee Fork gage and 45 miles from the Upper Salmon watershed outlet (Station 13302500, Salmon River at Salmon, ID). The mean annual runoff from this station is nearly twice that of the Yankee Fork station at 1,392,000 acre-feet. Seasonal peak flows occur in late spring to early summer from snowmelt; an average of 68% of the annual total for the Yankee Fork station occurs between April and July (NRCS 2008). Daily peak flows usually occur in summer due to thunderstorms. Low flow occurs in late summer through winter. The only station upstream of the Yankee Fork gage is located on Valley Creek, near Stanley, Idaho (Station 13295000). Diversions upstream of this station irrigate about 3,000 acres. There are no stations monitoring outflow from Redfish, Yellowbelly, Pettit, or Alturas lakes.

4.1.5 Water Quality

Water quality in the upper Salmon River is affected by land uses, local geology, and discharge, conditions that vary throughout the subbasin. In the high mountainous areas above the principle drainage, surface water is of high quality. As it flows into the lower reaches, the water quality tends to become more degraded. Degradation occurs as sediments and other pollutants are deposited into the stream. Primary pollutant sources include excessive streambank erosion, mine tailings and waste rock, agriculture practices, road runoff, and runoff from developed areas. Surface waters are also affected by irrigation impoundments and diversion structures that sometimes preclude tributary flow from reaching the Salmon River.

4.1.6 Habitat and Biota

4.1.6.1 Fish

The Salmon River subbasin is generally characterized by clear, cool mountain streams. Historically, most streams contained a number of native salmonids, including bull trout, sockeye salmon, westslope cutthroat trout, rainbow trout, mountain whitefish, Chinook salmon, and steelhead trout. Currently, the subbasin is known to support 37 species of fish, of which 26 are native and 11 nonnative (Ecovista 2004). Twenty-six of these species have been found in the Upper Salmon watershed (Table 4-1), including the sole remaining population of anadromous sockeye salmon within the Snake River basin. The subbasin contains 1,031 miles of designated critical habitat for the listed Snake River spring/summer Chinook and sockeye salmon (NRCS 2008), as well as connected habitats for Pacific lamprey, white sturgeon, and other native nongame fishes. The watershed contains approximately 1,355 miles of essential fish habitat. Critical habitat for bull trout is proposed in the Salmon subbasin; critical habitat for sockeye salmon was designated in 1993 and includes five lakes (Redfish, Alturas, Stanley, Pettit, and Yellowbelly) and their connecting tributaries including the mainstem Salmon River.

Table 4-1. Fish known to inhabit the Upper Salmon watershed.

Species	Origin[a]	Status[b]
Arctic grayling (*Thymallus arcticus*)	I	R
Bridgelip sucker (*Catostomus columbianus*)	N	C
Brook trout (*Salvelinus fontinalis*)	I	O
Bull trout (*Salvelinus confluentus*)	N	T
Golden trout (*Oncorhynchus aquabonita*)	I	R
Kokanee salmon (*Oncorhynchus nerka kennerlyi*)	I	O
Lake trout (*Salvelinus namaycush*)	I	R
Largescale sucker (*Catostomus macrocheilus*)	N	C
Longnose dace (*Rhinichthys cataractae dulcis*)	N	C
Mottled sculpin (*Cottus bairdi semiscaber*)	N	C
Mountain sucker (*Catostomus platyrhynchus*)	N	R
Mountain whitefish (*Prosopium williamsoni*)	N	C
Northern pikeminnow (*Ptychocheilus oregonensis*)	N	C
Pacific lamprey (*Lampetra tridentate*)	N	S
Rainbow trout (*Oncorhynchus mykiss*) unknown origin	I	C
Rainbow x cutthroat trout hybrid	I	C
Redband trout (*Oncorhynchus mykiss gibbsi*)	N	S
Redside shiner (*Richardsonius balteatus balteatus*)	N	C
Shorthead sculpin (*Cottus confusus*)	N	U
Sockeye (*Oncorhynchus nerka*)	N	E
Speckled dace (*Rhinichthys osculus*)	N	C
Spring Chinook (*Oncorhynchus tschawytscha*)	N	T
Summer Chinook (*Oncorhynchus tschawytscha*)	N	T
Summer steelhead (*Oncorhynchus mykiss*)	N	T
Torrent sculpin (*Cottus rhotheus*)	N	C
Westslope cutthroat (*Oncorhynchus clarki lewisi*)	N	S

[a]Origin: N = native, I = introduced
[b]Status: C = common, O = occasional, R = rare, S = sensitive, T = threatened, E = endangered, U = unknown
Source: Ecovista 2004

Sockeye Salmon

Snake River sockeye are a single MPG that spawn and rear in Redfish, Pettit and Alturas lakes in the upper Salmon River subbasin. The MPG includes those sockeye propagated in the Redfish Lake captive broodstock program. Sockeye life history differs from that of other Pacific salmonids in their use of lakes for early rearing. The natural life cycle of this population, described in Section 1.4, includes a one- to two-year freshwater lake juvenile stage. Smolts outmigrate in the spring from Sawtooth Valley lakes and then spend from one to three years in the ocean. Adults return to their natal waters in late summer and spawn on lake shorelines in the fall. Snake River sockeye are listed as endangered and their historic habitat is designated as critical. Habitat and harvest information is summarized in Section 1.4.3 and 1.4.4; population status is presented in Section 5.1.

Chinook Salmon

Adult spring/summer Chinook salmon enter the Columbia River on their upstream spawning migration from February through March and arrive at their natal tributaries in the Upper Salmon watershed from June through August. Spawning generally occurs in August and September. Juveniles exhibit a river-type life history strategy, rearing in their natal streams during their first summer before beginning their migration to the ocean. After reaching the ocean as smolts, the fish typically rear two to three years in the ocean before beginning their migration back to freshwater.

The Upper Salmon subbasin supports some of the most important spawning and rearing habitats for Snake River spring/summer Chinook salmon. Chinook spawn in all sizes of rivers and streams in the subbasin, and most streams are designated critical habitat (IDEQ 1999). Adult Chinook arrive in May and June and spawn from August to October. Spawning Chinook can be found in the mainstem Salmon River above Redfish Lake Creek, Alturas Lake Creek and other moderate-sized tributaries. Valley Creek and its tributaries also provide spawning habitat. Currently, Chinook do not use Stanley, Redfish, Yellowbelly, Pettit, or Alturas lakes for spawning.

Bull Trout

Bull trout are a species of char native to Idaho, Nevada, Oregon, Washington, Montana, and western Canada. Bull trout are patchily distributed at multiple spatial scales from river basin to local watershed, and individual stream reach levels. Due to widespread declines in abundance, bull trout were listed as threatened in Idaho in 1998, and listed throughout their range in the United States in 1999. On January 13, 2010, the USFWS proposed to revise its 2005 designation of critical habitat for bull trout, which includes a substantial portion of the Salmon River subbasin. A total of 5,045 stream miles are proposed as critical habitat in the Salmon River subbasin.

The Upper Salmon watershed includes core habitat areas for bull trout populations. Bull trout distribution tends to be patchy even when population numbers are strong and habitat is good (USDA FS/BLM 1998). In the Salmon River basin, bull trout generally spawn in mid- to late-September through October (IDEQ 1999). Threats to bull trout in this area include channelization, diking, riprap, loss of riparian vegetation, and changes in channel dynamics such as floodplain access in low elevation reaches.

Westslope Cutthroat Trout

Westslope cutthroat trout have a known native range that includes the upper Missouri basin downstream to Fort Benton, Montana, the headwaters of the Judith, Milk and Marias rivers, the upper Kootenay River above Libby, Montana, the entire Clark Fork drainage of Montana and Idaho, the Spokane River above Spokane Falls, and the Salmon and Clearwater drainages of Idaho. Westslope cutthroat migrate from lake and river habitats to tributary spawning grounds, where spawning occurs from March to July. Young typically spend 2 or 3 years in streams before migrating downstream to lake habitats. After 1 to 3 years in the lake, sexual maturation occurs, typically at age 4 or 5 and at lengths of 300 to 400 mm. An average maximum weight is about 1.5 kg.

Westslope cutthroat trout experience similar issues as bull trout in the Upper Salmon region. Cutthroat trout are now primarily found in smaller headwater streams, and the larger, migratory form is essentially extinct from the subbasin (IDEQ 1999). Hatchery cutthroat are stocked into mountain lakes, and re-introduction of cutthroat and bull trout is taking place in Valley Creek (IDEQ 1999).

Other Fish Species

Rainbow trout are the most widely distributed native salmonid in the upper Salmon River (IDEQ 1999). Population surveys tend not to separate young steelhead from resident rainbows, often inflating the number of steelhead in the basin (IDEQ 2003). Anadromous species have been impacted more than resident salmonids by habitat degradation, streamflow alteration, and diversions in the lower watershed that prevent migration. Non-native salmonids, such as golden trout, lake trout, and brook trout, and other non-native fish, including sunapee char and arctic grayling, have all been introduced into various high mountain lakes, lowland lakes, rivers and streams in the upper Salmon watershed (USDA FS/BLM 1998). Brook trout are widely distributed and are found in many tributaries within the subbasin (IDEQ 1999).

Detailed life histories of trout species found in the Salmon River are described in Behnke (1992) and for other freshwater species, see Scott and Crossman (1973).

4.1.6.2 Wildlife

A broad diversity of wildlife occupy the Salmon subbasin (Table 4-2), including 389 vertebrate species. Of these, 32 are wildlife species of concern (Ecovista 2004). The upper Salmon watershed in particular is known to support 20 species of concern, including the federally listed Canada lynx and gray wolf (*Canis lupis*). Federally listed northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) may pass through the Upper Salmon watershed, but there are no documented occurrences.

The peregrine falcon, which was recently delisted, currently nests in the Salmon subbasin. The grizzly bear (*Ursus arctos horribilis*), a threatened species, historically occurred throughout the watershed but is now extirpated from the area.

Ninety-one mammal species are identified as occurring within the Salmon subbasin, including 9 big game, 4 forest carnivore, and 59 small mammal species. Information on the distribution and status of small mammals within the upper Salmon watershed is not available.

The Salmon River subbasin supports more than 272 bird species that use the area during at least part of the year. These include nationally renowned populations of raptors, an abundance of waterfowl, sage grouse, numerous songbirds, and a remnant population of sharp-tailed grouse. The distribution of these avian species within the upper Salmon watershed is not available.

Table 4-2. Federally listed (threatened or endangered) and rare animal species within the Upper Salmon watershed.

Species/Guild	G-Rank/S-Rank[a]	Documented Occurrences[b]
Forest Carnivores		
Fisher (*Martes pennanti*)	G5/S1	3
Canada lynx (*Lynx lynx*)	G5/S1/Threatened	26
North American wolverine (*Gulo gulo luscus*)	G4T4/S2	39
Gray Wolf (*Canis lupis*)	G4/S3	unknown
Small Mammals		
Kit fox (*Vulpes macrotis*)	G4/S1	1
Long-eared myotis (*Myotis evotis*)	G5/S3?	2
Long-legged myotis (*Myotis volans*)	G5/S3?	2
Merriam's shrew (*Sorex merriami*)	G5/S2	1
Pygmy rabbit (*Brachylagus idahoensis*)	G4/S2	4
Western small-footed myotis (*Myotis ciliolabrum*)	G5/S4?	2
Yuma myotis (*Myotis yumanensis*)	G5/S3?	1
Raptors		
Bald eagle (*Haliaeetus leucocephalus*)	G5/S3B,S4N	2
Northern goshawk (*Accipiter gentilis*)	G5/S4	2
Peregrine falcon (*Falco peregrines anatum*)	G4/S2 Delisted 08/99	3
Cavity Nesters		
Black-backed woodpecker (*Picoides arcticus*)	G5/S3	1
Boreal owl (*Aegolius funereus*)	G5/S2	1
Flammulated owl (*Otus flammeolus*)	G4/S3B,SZN	1
Pygmy nuthatch (*Sitta pygmaea*)	G5/S1	1
Three-toed woodpecker (*Picoides tridactylus*)	G5/S2	5
Migratory Birds		
Long-billed curlew (*Numenius americanus*)	G5/S2	1
Reptiles and Amphibians		
Western toad (*Bufo boreas*)	G4/S4	2

[a] G-rank = global conservation ranking, S-rank = State conservation ranking.
[b] Documented occurrences as of 2004. Source: Ecovista 2004

4.1.6.3 Vegetation

The dominant forest vegetation includes lodgepole pine/subalpine fir mix (USDA FS/BLM 1998). Abundance varies with elevation, with whitebark pine more locally abundant at higher elevations. Other conifers include limber pine and Engelmann Spruce (BLM 1998). Stands of Douglas fir become abundant at lower elevations, with almost pure stands on northerly aspects.

Rocky Mountain juniper, limber pine, quaking aspen, and black cottonwoods are common in low elevation woodlands.

Historical forest settings contained more prominent areas of montane shrubland than current period forests. This is believed to be due to decades of fire suppression practices, and current forest stands that are overstock and dominated by shade-tolerant species. These areas have multiple canopy layers where they were once more open, single-layered stands composed of fire-tolerant species (Hann et al. 1997). Current vegetation cover types occupying the greatest percentage of the watershed are Basin and Wyoming big sagebrush (13%), lodgepole pine (13%), mixed subalpine forest (13%), mountain big sagebrush (12%), and subalpine pine (13%) (Scott et al. 2002).

4.1.7 Upper Snake River Subbasin

The Springfield Hatchery is proposed in southeast Idaho, near the unincorporated town of Springfield in Bingham County (Figure 4-4). The site is within the Upper Snake River Subbasin and the American Falls HUC (17040206) in the Upper Snake Accounting Unit.

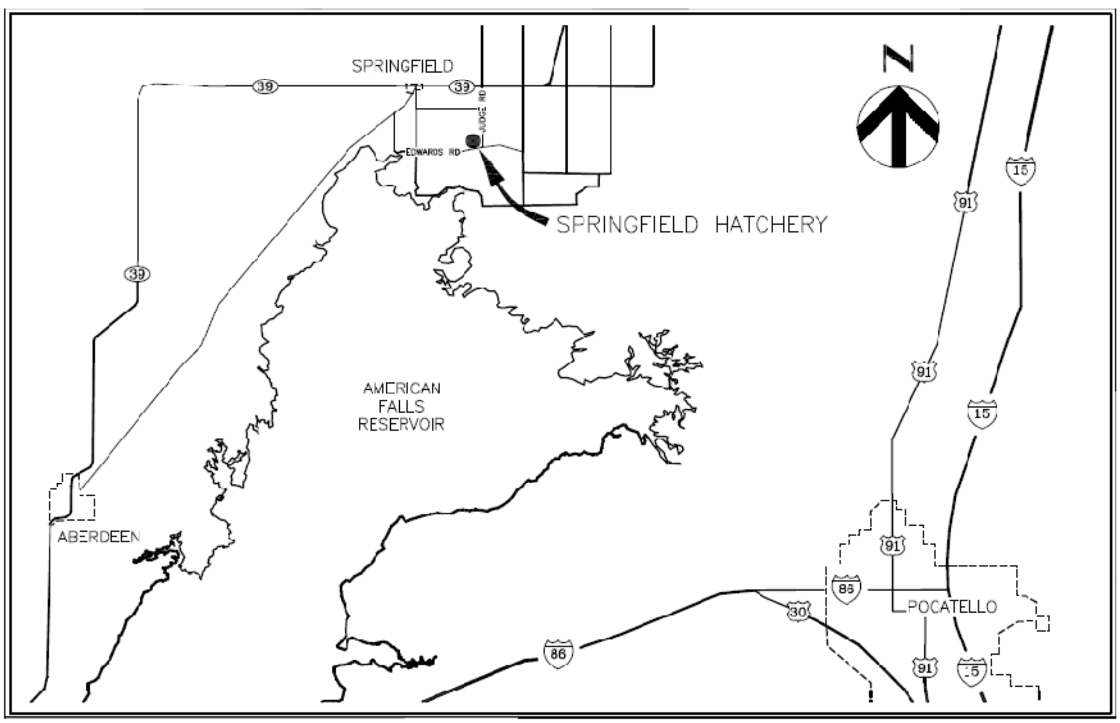


Figure 4-4. Springfield Hatchery Location

4.1.7.1 Upper Snake River Subbasin Climate, Soils, and Hydrology

Climate in the upper Snake River subbasin is characterized by extreme temperature ranges, with a record low of -40°F and a record high of 104°F (Idaho Climate Summaries 2010). Winter low temperatures average 13°F and summer high temperatures average 82°F. Average annual precipitation is 10 inches, largely falling in April and May (Idaho Climate Summaries 2010).

The Springfield Hatchery is proposed near the division between the Upper Snake River Plain and the Eastern Snake River Basalt Plains ecoregions (McGrath 2001). Soils in this area are generally well draining loam, with occasional deposits of lava rock (Soil Survey Staff 2010). Tests at the Springfield Hatchery site show that surface soils are sandy silts that extend from ground surface down to 2 to 3 feet. Sands, silty sands, clayey sands and clay were all observed below surface silts. Ground water level varied throughout test from as shallow as 4.5 feet below ground surface to as deep as 6.5 feet below ground surface (Engineering Science & Construction 2007).

Geology in the Upper Snake subbasin is characterized largely by basalt flows in the lowlands of the central and southern parts of the subbasin, and by intrusive volcanic, sedimentary, and metamorphic rocks in the uplands and mountains to the north, south, and east. The oldest volcanic formations in the watershed are those associated with the Snake River Plain: an 80- to 110-km wide crescent of lava covering most of southern Idaho.

There are at least nine artesian wells and a spring associated with the Springfield site. These issue from the East Snake Plain aquifer. Several flow into the four-acre Crystal Springs Pond. All of these springs combine at the perimeter of the property to form Boom Creek (also known as Boone Creek) that flows south into American Falls Reservoir. The American Falls Reservoir is the largest in Idaho with a surface area of 56,055 acres at a pool elevation of 4,354.4 feet (IDEQ 2006). The primary purpose of the reservoir is irrigation. Refill typically starts in October and continues through winter and early spring. Irrigation season begins in June and the reservoir is drawn down as outflow exceeds inflow. The hydrograph for the downstream region is now highly modified: spring flows are reduced while summer flows are increased for water delivery to downstream irrigators. Water fluctuations in the reservoir can vary widely depending on water year and irrigation demand. Other sources of water for the reservoir are the Snake and Portneuf rivers and other spring-fed creeks between Blackfoot and the Fort Hall Bottoms.

4.1.7.2 Fish, Wildlife and Vegetation

At the Springfield site, the four-acre Crystal Springs Pond creates high value habitat for terrestrial and resident aquatic species. Abandoned trout hatchery facilities are in close proximity to the southern perimeter of this pond. Brown trout and rainbow trout are stocked by the IDFG (IFWIS 2010a) to support a popular recreational fishery. Many species of birds can be found in the marshes and sage/shrub land around the hatchery site (Table 4-3). Big game in the area include deer, elk, antelope, mountain lion and wolf. Small game include rabbit and hare.

Native vegetation in the area consists primarily of sagebrush, rabbit brush, and various grasses. Crops grown include hay, wheat, barley, sugar beets, potatoes, and pasture, all of which require irrigation.

Table 4-3. Bird species known to be found near the Springfield Hatchery.

Species	Season, Abundance
Geese, Swans and Ducks	
American Widgeon	Resident, abundant
Barr Goldeneye	Summer, uncommon / Winter, uncommon
Blue-winged Teal	Summer, uncommon
Bufflehead	Resident, common
Canada Goose	Resident, abundant
Cinnamon Teal	Summer, abundant / Winter, rare
Com Goldeneye	Summer, rare / Winter, abundant
Gadwall	Resident, abundant
Green-winged Teal	Summer, common / Winter, uncommon
Mallard	Resident, abundant
Northern Pintail	Resident, common
Northern Shoveler	Summer, common / Winter, rare
Ring-necked Duck	Summer, uncommon / Winter/Migrant, common
Snow Goose	Migrant, common
Trumpeter Swan	Resident, uncommon
Hawks and Eagles	
American Kestrel	Resident, abundant
Bald Eagle	Resident, uncommon
Osprey	Summer, common
Rails and Coots	
Virginia Rail	Summer, common / Winter, rare
Shorebirds	
American Avocet	Summer, common
Black-necked Stilt	Summer, uncommon
Greater Yellowlegs	Migrant, common
Lesser Yellowlegs	Migrant, common
Long-billed Dowitcher	Migrant, common
Shrikes	
Northern Shrike	Migrant/Winter, uncommon
Sparrows and allies	
White-crowned Sparrow	Resident, common
Starling	
European Starling	Resident, abundant
Terns	
Caspian Tern	Summer, uncommon
Thrushes	
American Robin	Resident, abundant
Waxwings	
Bohemian Waxwing	Migrant/Winter, common
Wrens and Dipper	
Marsh Wren	Summer, abundant / Winter, rare

Source: IFWIS 2010b

4.2 SOCIOECONOMIC CONTEXT

4.2.1 Upper Salmon Subbasin

The Upper Salmon watershed lies within Custer County, Idaho (population 4,077 in 2005). Challis is the largest community, with a population of 853 in 2004, followed by Stanley, with 97 people (IDC 2010). Custer County ranks 38th among Idaho counties in population and third in area. The federal government owns over 93% of the county. Public lands are shared by the Sawtooth National Recreation Area (35%), the Salmon-Challis National Forest (34%), the Bureau of Land Management (BLM) Challis Resource Area (24%), and the State of Idaho (2%).

Mining and agriculture are the major industries, with trade, services and government providing the largest employment opportunities. Historically, cattle ranching, logging and mining have played important economic roles in the area economy. Today, mining activity has declined and cattle ranching is the dominant economic activity. The number of farms in the county increased from 1992 to 2002, although the average farm size has decreased from 527 acres to 462 acres (IDC 2010). Grazing pressure has remained relatively constant for over 40 years, albeit with some shifts from sheep to cattle.

Recreation and tourism are important to this area. Both Stanley and Challis rely heavily on seasonal recreation activities such as whitewater rafting, boating, fishing, hunting, hiking, and camping. The area's geographic features, including Hells Canyon, Redfish Lake, and Borah Peak, the highest point in Idaho at an elevation of 12,662 feet, also draw tourists to the region. Competition for limited recreational resources between different uses within this subbasin is also increasing.

4.2.2 Upper Snake River Subbasin

The proposed Springfield Hatchery would be constructed in Bingham County (population 44,051 in 2006), which ranks 7th among Idaho counties in population and 12th in area. The largest community in the county is Blackfoot, with a population of 11,007 in 2006. The closest incorporated community to the site is Aberdeen, with a population of 1,809 in 2006 (IDC 2010). In contrast with Custer County, most land in Bingham County is privately owned (58.6%), while the rest is divided between federal (mostly BLM - 29.3%) and state ownership (11.7%) (IDC 2010).

Agriculture and food processing are the basic industries while services, trade, and government provide major employment. The number of farms in the county has remained relatively constant over the last ten years at approximately 1,200, although the average size decreased from 1,070 acres in 1992 to 645 acres in 2002.

4.3 RELATIONSHIP TO SUBBASIN PLANS AND OTHER RECOVERY PLANS

4.3.1 FCRPS BiOp and Idaho's Fish Accords MOA

The proposed Springfield Hatchery sockeye program is consistent with the *2008 Columbia Basin Fish Accords, Memorandum of Agreement between the State of Idaho and FCRPS Action Agencies* (Idaho et al. 2008). Specifically, the accords state that BPA will make funds available to acquire and develop a new conservation hatchery facility to produce up to one million Snake River sockeye salmon smolts annually for reintroduction back to the habitat.

Several conditions are associated with this funding: 1) biological benefits are to be confirmed by experts; 2) NOAA must determine that the hatchery program will not impede and where possible will contribute to recovery; and 3) obtain all necessary permits for hatchery construction and operation. The IDFG is also directed to participate in the 3-Step Process and ISRP review through the NPCC's CBFW Program. This master plan represents Step 1 of this three step process and seeks to confirm conditions (1) and (2).

The benefits of this proposed program are also consistent with the 2008 Fish Accords, as Springfield Hatchery will expand the safety-net program and increase sockeye salmon smolt releases to between 500,000 and 1 million fish annually. These releases will help meet the viable threshold populations for recovery goals across the Salmon River subbasin.

4.3.2 Lower Snake River Compensation Plan

The Lower Snake River Fish and Wildlife Compensation Plan (LSRCP), authorized in 1976, describes a program to compensate for fish and wildlife losses caused by the construction of Ice Harbor, Lower Monumental, Little Goose, and Lower Granite lock and dam projects on the lower Snake River in Washington and Idaho (http://www.fws.gov/lsnakecomplan/). One of the primary tools identified in this plan to return anadromous fish runs to pre-project levels is through construction of fish hatcheries. Several hatcheries were built to meet smolt production targets set for fall Chinook salmon, spring/summer Chinook salmon, steelhead, and resident trout. Sockeye salmon recovery objectives were not included as part of the LSRCP.

Currently, the LSRCP works cooperatively with IDFG and the Shoshone-Bannock Tribes to provide hatchery space for the Redfish Lake sockeye salmon propagation program. If the proposed Springfield Hatchery program is successfully developed, the smolts produced will replace those produced at LSRCP facilities, such as the Sawtooth Hatchery, and allow these resources to be used to accomplish the previously established LSRCP goals.

4.3.3 Salmon River Subbasin Plan

The *Salmon Subbasin Plan* (Ecovista 2004) was developed as part of the NPCC's Columbia River Basin Fish and Wildlife Program to help direct BPA's funding of projects that mitigate for damage to fish and wildlife caused by the development and operations of the federal Columbia River hydropower system. The overall vision for the plan is:

> *"…a productive and sustainable ecosystem that is resilient to natural and human disturbance, with diverse, native aquatic and terrestrial species, which will support long-term sustainable resource-based activities and harvest goals, while managing the impacts and needs of a growing human population."*

The plan's guiding principles include:

- Protect, enhance, and restore habitats to sustain and recover native aquatic and terrestrial species diversity and abundance with emphasis on the recovery and delisting of Endangered Species Act listed species.
- Foster ecosystem stewardship of natural resources, recognizing all components of the ecosystem, including the human component.
- Provide opportunities for local natural resource-based economies to coexist and participate in recovery of aquatic and terrestrial species.
- Develop a scientific foundation to diagnose ecosystem problems, design, prioritize, monitor, and evaluate management to better achieve Plan objectives.
- Enhance species populations to healthy levels that support tribal treaty and public harvest goals.

In addition to these guiding principles, the Salmon Subbasin Plan identifies a list of problem statements, biological objectives, and strategies. The strategies and monitoring activities outlined for the Springfield Hatchery sockeye program would contribute to meeting a number of the biological objectives identified in the Salmon Subbasin Plan. Specifically, the program would be consistent with the following:

Aquatic Objective 1A: Increase the number of naturally spawning adults to achieve recovery goals in Table 4-4 within 24 years (timeline is consistent with the NPCC's Fish and Wildlife Program). This should amount to a 4% SAR for sockeye (minimum) as measured at Lower Granite Dam and in the tributaries.

Aquatic Objective 1B: Achieve goals defined in Table 4-4 for the Salmon subbasin through application of artificial propagation programs. Minimize short-and long-term genetic, ecological, and life history effects on wild populations.

Table 4-4. Anadromous sockeye salmon adult return objectives for the Salmon subbasin.

Goals	Long-term Return	Natural Spawning Component	Hatchery Component		Treaty and Non-treaty Harvest Component
			Broodstock Need	Rack Return	
Future	8,000-44,500	2,000[1]			2,000[2]
Current mean (range)		28[3] (0-257)	Undefined	28[3] (0-257)	0

[1] NOAA interim abundance delisting criteria.
[2] Goals from 1990 Salmon and Steelhead Production Plan
[3] All anadromous returning sockeye salmon regardless of release or retention for hatchery spawning.

Aquatic Objective 3A: Address data gaps necessary to measure freshwater survival and productivity.

Aquatic Objective 3C: Address data gaps necessary to measure progress towards delisting and full recovery as identified in Table 4-4.

The Salmon Subbasin Plan states that artificial propagation may be necessary to achieve adult return objectives identified in Table 4-4. HGMPs would be used as guidelines to minimize potential genetic, ecological, or life history effects of supplemented fish on wild/natural populations. Monitoring and evaluation would accompany supplementation efforts to determine project effectiveness, to identify and describe potential risks, and to provide the information necessary for adaptive management of the program. This Master Plan describes how hatchery production would be used to help achieve these objectives.

4.3.4 Upper Snake River Subbasin Plan

The proposed Springfield Hatchery would be constructed within the geographic area assessed in the Upper Snake River Subbasin Plan (CH2MHill 2004) which includes the Snake River and its tributaries from Shoshone Falls, Idaho to its headwaters in Wyoming. The proposed sockeye program was not considered in this subbasin plan. No sockeye would be released to waters of this subbasin; the Springfield Hatchery would rear sockeye for transport and release back into the upper Salmon River watershed. Outflow from the hatchery forms Boom Creek that flows into American Falls Reservoir, where there is potential to have an effect on resident fish species. Because hatchery effluent will meet NPDES requirements and operation is expected to be within existing TMDL waste load allocations, this effect is expected to be minor (see Sections 7.2.2 and 7.3.3).

4.3.5 Snake River Sockeye Recovery Plan

IDFG has submitted a proposed draft Snake River Sockeye Salmon Recovery Strategy to NOAA-Fisheries for consideration in recovery planning (Appendix C). This strategy recommends incorporating hatchery facilities, captive broodstock technology, genetic support and a comprehensive monitoring and evaluation plan to maintain the population and rebuilding the number of naturally-produced. These actions and facilities are directly addressed by the expanded program described in Sections 5 and 6 of this Master Plan.

4.4 RECENT MANAGEMENT STRATEGIES AND CONTEXT

4.4.1 Habitat

Snake River sockeye rearing and spawning habitat in/near the Sawtooth basin is considered to be in excellent condition as it is in an area that has experienced limited human impacts. Ongoing effects are related to recreational activities such as hiking, river rafting, fishing and hunting. A number of homes have been built around Redfish, Alturas and Pettit lakes and parks, campgrounds and boat launches are popular destinations.

At the time of the initial listing (NMFS 1991), the greatest habitat problem faced by the ESU was probably the lack of access to any of the lakes but Redfish. The fish barriers on Alturas and

Pettit Lake creeks (an irrigation intake and a concrete rough fish barrier, respectively) were modified to facilitate passage of anadromous sockeye into these historical habitats in the early 1990s (Teuscher and Taki 1996, cited in Flagg et al. 2004).

Although access to the spawning and rearing lakes is now considered functional, large portions of the migration corridor in the mainstem Salmon River (i.e., between Redfish Lake Creek and Yankee Fork Creek and between Thompson Creek and Squaw Creek) are water quality limited for temperature (IDEQ 2003), which is likely to reduce the survival of adult sockeye returning to the Upper Salmon River subbasin in late July and August.

Lakes used for juvenile sockeye rearing currently have relatively low productivity and are considered naturally oligotrophic. Since 1995, the Shoshone Bannock Tribes have been supplementing nitrogen and phosphorus and controlling non-native kokanee salmon competitors (i.e., for food resources) in the Sawtooth Valley lakes where Springfield releases would be occur (Redfish, Pettit, Alturas, and potentially Stanley lakes). Based on water quality and biological sampling described in their annual reports (e.g., Kohler et al. 2007), these management strategies are increasing the carrying capacities of the lakes for rearing juvenile Snake River sockeye salmon. Non-native kokanee salmon directly compete for zooplankton forage in most Sawtooth Valley lakes and thus a program has been implemented for their elimination.

According to NOAA Fisheries (2008), the major factors limiting the conservation value of critical habitat for the ESU are the effects on the migration corridor posed by the mainstem lower Snake and Columbia River federal hydropower system (see Section 4.4.3), reduced tributary stream flows and high temperatures experienced by outmigrating smolts and returning adults.

The USDA (2003) recommended the following site-specific measures to improve habitat conditions in the Salmon River basin:

- Reduce lakeshore recreation pressure, particularly in shallow areas where sockeye spawn currently or historically
- Restore or maintain native vegetation that provides naturally resilient and productive shoreline habitats, through management of lakeside recreation and other human development
- Correct causes of listing Salmon River as water-quality limited (sediment and temperature) between the confluence of Redfish Lake Creek and that of Squaw Creek with the upper Salmon River.

4.4.2 Hatcheries

4.4.2.1 Current Program Facilities

Precipitous declines of Snake River sockeye salmon led to their Federal listing as endangered in 1991 (NMFS 1991). In that same year, the IDFG initiated a captive broodstock program to maintain Snake River sockeye salmon and prevent species extinction. Since the inception of the program, all returning anadromous adult sockeye salmon (16 wild fish), several hundred Redfish

Lake wild out-migrating smolts, and several residual sockeye salmon adults have been captured and used to develop captive broodstocks at the Eagle Fish Hatchery and at the Manchester Research Station and Burley Creek fish hatcheries. Eggs produced from annual spawning events at these facilities are either planted in egg boxes (in Pettit Lake) or transferred to either the Oxbow Fish Hatchery or the Sawtooth Fish Hatchery for continued culture and release (IDFG 2010). Each of these program facilities is briefly described below. Production levels are listed in Section 5.4.1.1.

Eagle Fish Hatchery – Eagle Fish Hatchery, operated by IDFG, is located in Ada County, Idaho near the town of Eagle. This is a captive broodstock facility; typically no releases occur here. In years of high anadromous sockeye returns, a portion of the returning sockeye will be incorporated into the captive broodstock program and incubated at Eagle.

Sawtooth Fish Hatchery – The IDFG operates the Sawtooth Fish Hatchery on the Salmon River in Custer County, Idaho near the town of Stanley. Sawtooth Fish Hatchery rears sockeye salmon to pre-smolt (Age 1) and full-term smolt (Age 1.5) annually. Pre-smolts are reared on well water before release to Sawtooth basin lakes. During the last six months of rearing, smolts are transferred into Salmon River water, after which they are released to the Salmon River and Redfish Lake with no additional acclimation.

Manchester Research Station – Manchester Research Station is in Kitsap County, Washington near the City of Port Orchard. It is operated by NOAA Fisheries and provides a land-based seawater captive broodstock rearing complex. NOAA Fisheries rears sockeye salmon to mature adults (Age 3, 4, and 5). These adults are reared at both the Burley Creek Hatchery and Manchester Research Station. Mature adults are transferred to Idaho in September and released directly into Redfish Lake.

Burley Creek Fish Hatchery – Burley Creek Fish Hatchery is also operated by NOAA Fisheries in Kitsap County, Washington. Freshwater swim-up fry-to-adult rearing is conducted here. This fresh water hatchery is designed as a protective rearing facility for salmonid captive broodstocks.

Oxbow Fish Hatchery – Oxbow Fish Hatchery is in Multnomah County, Oregon near the town of Cascade Locks. Operated by the Oregon Department of Fish and Wildlife, this facility rears sockeye (eyed-egg to smolt) for the program. Smolts are transferred from Oxbow Fish Hatchery to the Sawtooth basin and released directly to the Salmon River and/or Redfish Lake Creek.

Adaptively managed, the ongoing program produces eggs and fish for reintroduction into Redfish, Alturas, and Pettit lakes. The program uses a “spread-the-risk” reintroduction strategy and conducts research to determine the most successful release options.

Consistent with language contained in the FCRPS’s Biological Opinion and the Idaho Fish Accords, the program is currently calling for the production of between 500,000 and 1 million full-term smolts annually for release to Sawtooth Valley waters. Currently, juvenile sockeye salmon are reared at the Sawtooth Fish Hatchery (a Lower Snake River Compensation Plan facility) and at the Oxbow Fish Hatchery (a Mitchell Act facility).

4.4.2.2 Proposed Program Facilities

Under the proposed program, the existing Springfield Hatchery (located in Bingham County, near the town of Springfield) would be used to rear the up to 1 million juvenile sockeye required for this program. The hatchery site is located on IDFG property, receives its water from 9 artesian wells (springs), and has a water right of 50 cfs.

The Springfield Hatchery was historically used to rear trout and would be modernized to rear sockeye salmon (see Section 7). This facility was selected for use as rearing space as existing fish hatcheries in the region are not available. In addition, to prevent the possible spread of IHN (prevalent in sockeye hatcheries) in the Salmon River subbasin, the Springfield facility, which discharges effluent to an area outside of the anadromous fish zone, provides an excellent location for rearing sockeye.

Because rearing space is extremely limited at the Eagle, Oxbow and Sawtooth fish hatcheries (i.e., these facilities are operating at or very near capacity), the Springfield Hatchery would provide additional rearing space needed to meet program requirements.

4.4.3 Hydropower

Compared to Snake River spring/summer Chinook salmon, there is relatively little route-specific information on the survival of Snake River sockeye salmon through the Federal Columbia River Power System. However, NOAA Fisheries (2010) indicated that approximately 50 percent of the juvenile and adult fish leaving the area are killed as they migrate through the eight Columbia River and Snake River hydroelectric projects. Additionally, sockeye smolt survival from the Salmon River to Lower Granite Dam has ranged from 26.7% to 50.9% (NOAA Fisheries 2010). The reason for these large losses relative to other anadromous species is unclear, but sockeye salmon juveniles appear to be prone to descaling.

Juvenile and adult survival rates are expected to increase by less than 10% with the implementation of the NOAA 2008 Biological Opinion. This is one of the reasons that the program may consider collecting adult sockeye at Lower Granite Dam as a means to increase adult escapement to spawning areas.

Based on data for other species of Snake River salmon and steelhead, recent modifications to FCRPS adult passage facilities, including increased reliability of water supply systems for fish ladders and improved ladder exit conditions to prevent injury and delay, probably reduced mortality for this species. NOAA Fisheries estimates that the current survival rate of adult sockeye from Bonneville to Lower Granite dams is 81.1% (about 97.1% per project) based on an expansion of data for adult sockeye bound for Lake Wenatchee and the Okanogan River (NOAA Fisheries 2008).

4.4.4 Harvest

Snake River sockeye salmon are listed as Endangered under the ESA; as a result, there are no specific harvest objectives for this program.

According to NOAA Fisheries (2008), few sockeye are caught in ocean fisheries. Ocean fishing mortality on Snake River sockeye is assumed to be zero. Fisheries in the mainstem Columbia River that affect Snake River sockeye are currently managed subject to the terms of the U.S. v. Oregon Interim Management Agreement for 2005-2007. These fisheries are limited to ensure that the incidental take of ESA-listed Snake River sockeye does not exceed specified rates.

Non-Indian fisheries in the lower Columbia River are limited to a harvest rate of 1%. Treaty Indian fisheries are limited to a harvest rate of 5 to 7%, depending on the run size of upriver sockeye stocks. Actual harvest rates have ranged from 0 to 1.8%, and 2.8 to 7.0%, respectively. In addition, Snake River sockeye are currently incidentally harvested in freshwater fisheries.

There are no direct fisheries on sockeye salmon in the Snake River. Fish may incidentally be captured/caught in fisheries for other species; however, this number is extremely low as sockeye salmon are difficult to catch using hook and line fishing techniques. There is a need to provide fish for harvest to meet tribal treaty obligations and to provide additional sport fishing opportunity in Idaho waters. Harvest is a long term objective for the program, but as noted previously in Section 1.2.4, it is unlikely to be met in the next 10 years.

5 PROPOSED SOCKEYE PROGRAM

5.1 SNAKE RIVER SOCKEYE POPULATION STATUS

The Snake River sockeye salmon ESU was listed under the federal Endangered Species Act in 1991 and includes all anadromous and residual sockeye salmon from the Snake River Basin, as well as artificially propagated sockeye salmon from the Redfish Lake captive brood propagation program.

The Interior Columbia Technical Recovery Team (ICTRT) designated at least three historical populations within the Sawtooth basin: Redfish Lake (including Little Redfish), Alturas Lake, and Stanley Lake. The Redfish Lake sockeye population includes both anadromous and residualized sockeye that spawn synchronously with the anadromous fish. Two other lakes – Pettit Lake and Yellowbelly Lake – may have supported independent populations; however; currently available information did not allow the ICTRT to determine their status with certainty.

In addition, three other lakes or groups of lakes in the Snake River drainage supported sockeye populations: Warm Lake (in the South Fork Salmon drainage); Payette, Upper Payette and Little Payette lakes (Payette River drainage); and Wallowa Lake (Grande Ronde drainage). The distance between these lakes or groups of lakes is consistent with observed distances between extant ESUs of lake-spawning sockeye, suggesting that each of these groups would likely have been separate major population groups and may have been separate ESUs.

Historically, it was estimated that as many as 40,000 sockeye returned to the Upper Salmon River subbasin each year (NPCC 2004). Hatchery- and natural-origin adult returns in 2008, 2009 and as of September 29, 2010 were 650, 833 and 1,316 sockeye, respectively.

The recovery goal for abundance is 1,000 naturally-produced adults returning to Redfish Lake and 500 naturally-produced adults returning to two additional lakes. This ESU has a very high risk of extinction (NOAA Fisheries 2008).

5.2 BIOLOGICAL GOALS

The primary goal of the sockeye program is conservation of the species. The captive broodstock program, initiated in 1991, was designed to protect the genetic legacy of Snake River sockeye. This program has been successful in achieving this objective as evidenced by the increased number of adult sockeye returning to natal streams and lakes since 2008.

Increased adult production now affords managers the opportunity to move away from captive brood and to implement a more conventional hatchery program where broodstock are collected, eggs incubated, and resulting juveniles released to natal areas to rear and migrate to the ocean. A major goal of the program therefore is to eliminate the captive brood program. The biological aspect of this goal is to increase the number of adults spawning naturally in the system. The survival boost afforded by the proposed Springfield Hatchery is expected to produce adults surplus to broodstock needs that can then be used for this purpose. Over time, the objective is to have an average adult escapement of 2,000 fish over two generations. To meet NOAA Fisheries recovery criteria, 1,000 of these fish must be produced in Redfish Lake and 500 each in two additional lakes. The program proposes to achieve the 500 adult fish escapement target in Pettit and Alturas lakes.

As natural production increases to a point where these recovery objectives are met, the program will be converted to an integrated conservation type consistent with the recommendations of the HSRG (HSRG 2004). At such a point, the program may be reduced in size or possibly eliminated if adult production goals are exceeded.

5.3 POTENTIAL SOCKEYE MANAGEMENT STRATEGIES CONSIDERED

Three alternative management strategies were considered for the sockeye program. A brief description of each and a rationale for their elimination are provided below. The proposed strategy is described in Section 5.4.

- **Maintain current captive broodstock program indefinitely**. While this ongoing program has been successful at protecting the remaining genetic resources of the species, achieving recovery goals requires that this program be phased out. The captive brood program has insufficient rearing space to produce the numbers of juveniles needed to fully re-seed available habitat. The cost of the program is very high. Finally, the long-term effect on population genetics and the ability of cultured fish to reproduce in the wild is unknown. The latter is considered high risk, with risk increasing over time based on the hypothesis that the longer fish are cultured, the more adapted the fish become to the hatchery environment rather than the natural environment.

- **Eliminate captive broodstock program and rely on only natural production.** Although relatively large numbers of adult sockeye have returned these last few years, sockeye production increased region-wide in 2010, indicating that ocean conditions are likely the primary factor responsible for this increase. Given the oscillations in ocean productivity, as productivity enters a downward phase, sockeye abundance will also decline, resulting in fewer adult returns. How small the run may become under less favorable ocean conditions is not known. What is known however is that the hydropower system inflicts 50 percent mortality on both juvenile and adult sockeye migrating to and from spawning areas in the Sawtooth basin. During drought years, this mortality rate is even higher. Given these mortality rates, it is apparent that a combination of low survival through the hydropower system and poor ocean conditions could result in extinction of the population. Some level of hatchery production will be required to maintain sockeye production until it is proven that the productivity of the re-established natural population can overcome natural and human induced mortality.

- **Five Lake Recovery Strategy.** The biological resources are not available to pursue the five-lake strategy at this time or in the foreseeable future. Given the goal of recovery of the ESU (three populations with a total of 2,000 adults; 1,000 in Redfish and 500 each into other lakes), the two lakes with the highest production potential after Redfish Lake were identified for restoration efforts. The ongoing program has been in the captive brood phase since the 1990s and has just recently seen enough natural- and hatchery -origin adults to begin restoration efforts in Redfish Lake, the area deemed to have the highest sockeye production potential. Restoration efforts using Redfish Lake captive brood will also continue in Pettit and Alturas lakes. Alturas Lake efforts will transition to an Alturas Lake captive brood program if needed.

5.4 PROPOSED PROGRAM STRATEGY

The strategy selected by the IDFG for the next phase of the sockeye program focuses primarily on hatchery production, and secondarily on habitat. This is not to dismiss the value of actions to improve sockeye productivity through management of the hydropower system and harvest, rather, the implementation of these actions are, for the most part, outside of the direct control of IDFG, and therefore are not emphasized in this Master Plan. In contrast, IDFG can influence hatchery and habitat components of the program. In this section, we describe the phases proposed to be integrated into the expanded hatchery program (Section 5.4.1) and habitat actions that would benefit the population (Section 5.4.2). How these measures would be adaptively managed is described in Section 6.

5.4.1 Hatchery Strategy

The proposed hatchery strategy is designed to address the key viable salmonid population parameters of abundance, spatial structure and diversity (McElhany et al 2000). The approach emphasizes improving abundance as the hatchery program transitions from the existing captive broodstock to a conventional hatchery program. This will be achieved by focusing actions on Redfish Lake, the lake with the highest sockeye production potential. Improvements in spatial structure and sockeye life-history diversity will be gained by implementing hatchery actions in two additional lakes, Pettit and Alturas.

IDFG proposes to implement the hatchery component of the program in three phases:

- Phase 1- Captive broodstock (already in progress)
- Phase 2- Re-colonization
- Phase 3- Local Adaptation

Hatchery fish will be released into three locations, prioritized based on their sockeye production potential: (1) Redfish Lake, (2) Pettit Lake, and (3) Alturas Lake.

Phase 1 is ongoing, yet to achieve Snake River sockeye recovery objectives, Phase 2 would be implemented (as described in this Master Plan) to produce up to one million smolts. These smolts would be raised at the proposed Springfield Hatchery. Smolts would be released to Redfish Lake, providing returning adults needed for natural spawning that would generate juveniles, and then the adults needed to achieve recovery objectives for this lake.

Phase 2 would also implement an adult supplementation program in Pettit Lake using Redfish Lake captive brood adults, anadromous natural-origin adult returns to the existing Pettit Lake weir and surplus hatchery-origin returns from the Redfish Lake program. All other life stage releases would be eliminated from the program.

Adult supplementation would be used to re-colonize habitat in Alturas Lake in Phase 2. Initially, captive brood adults from the Redfish Lake program would be used for reintroduction. This approach would continue as long as adults are available, or until adult returns achieve population targets. This approach would transition, if needed, to using captive brood adults from Alturas Lake brood and anadromous adult returns to the Alturas Lake weir. The captive brood adults would be produced from juveniles of Alturas Lake-origin or the eggs of anadromous adults returning to the lake. Using Alturas Lake-origin fish for captive brood activities is important because the adult run-timing to this lake is believed to have been earlier than for Pettit or Redfish lakes. This is critical as it will develop much needed diversity within this ESU.

Hatchery- and natural-origin run-sizes back to the Sawtooth subbasin would be used to “trigger” management decisions such as reducing/eliminating the captive brood programs, implementing Phase 3 of the program, reducing hatchery production, or shifting resources to new areas (e.g., Pettit and Redfish lake sockeye restoration may require allocation of additional resources). These triggers are described in detail in Section 5.4.1.2 and are summarized in the illustration presented in Figure 5-1. A description of each phase of the proposed program is presented below.

5.4.1.1 Phase 1- Captive Broodstock

The program is currently in Phase 1, Captive Broodstock. This phase successfully protected the remaining genetic resources of Snake River sockeye and increased total adult abundance from 16 individuals between 1991 and 1998 to over 2,000 in return year 2010 (Kalinowski et al. 2010). It has done so by incorporating hatcheries, captive broodstock technology, genetic support, and a comprehensive monitoring and evaluation plan to maintain the genetic resource.

To guard against catastrophic loss at any one brood facility, the captive broodstock components of the program are duplicated at facilities in Idaho (Eagle Fish Hatchery) and Washington (Manchester Research Station, Burley Creek Fish Hatchery). Eggs produced from annual spawning events are transferred to either Oxbow Fish Hatchery or the Sawtooth Fish Hatchery for continued culture and release into the Sawtooth basin.

Annually, the program produces eggs and fish for reintroduction into natal waters of Redfish, Alturas, and Pettit lakes. The program uses a "spread-the-risk" reintroduction strategy and conducts ongoing research to determine the success of the release options.

Current production and release sites by life stage for the program are as follows:

- 50,000 eyed-eggs planted in egg boxes in Pettit Lake
- 100,000 pre-smolts planted in Redfish, Alturas and Pettit lakes (combined release)
- 150,000 smolts planted at the outlet of Redfish Lake and in the Salmon River upstream of the Sawtooth Hatchery
- 400 full-term captive brood hatchery adults planted in primarily Redfish Lake

Because the program is producing large numbers of returning anadromous adults (1,215 in 2009; 2,201 in 2010)[1] the program is ready to be transitioned to Phase 2- re-colonization. As Phase 2 is implemented, the captive broodstock program for Redfish Lake sockeye will be eliminated. This will occur when the 5-year running average of hatchery- and natural-origin adult sockeye returns to the Sawtooth Fish Hatchery and Redfish Lake exceeds 2,150 adults (see trigger discussion in Section 5.4.1.2.1).

5.4.1.2 Phase 2- Re-colonization

In this Phase, the existing captive brood program will be transitioned to conventional hatchery production that uses anadromous adults as broodstock. Sufficient numbers of anadromous adults have been returning to begin developing this conventional hatchery program. The primary objectives of Phase 2 will be (1) gene banking and (2) providing anadromous adults to re-colonize available habitat. These anadromous adults will allow managers to phase out the use of Redfish Lake captive broodstock to produce the eggs and juveniles required for re-colonization activities. Proposed program activities in Phase 2 are described below for each of the three targeted lakes, Redfish, Pettit and Alturas. The key criteria used to manage the program in Phase 2 are:

- Minimum proportion of natural-origin adults used as broodstock (pNOB) will be 10%
- Returning adults prioritized for broodstock
- Average minimum natural-origin escapement of 500 adult sockeye
- Average minimum natural-origin and hatchery-origin escapement of 1,300 adult sockeye
- Harvest rate of less than 3% of natural- origin returns

[1] Measured at Lower Granite Dam

These criteria will act as the decision rules for the program (see Table 6-2). Hatchery management and decision-making will be consistent with achieving the criteria. Decision rules will be developed further in IDFG's Step 2 submittal.

Sockeye production will increase up to 1 million smolts (at 10-20 fish per pound) in Phase 2. All fish released from the program will be marked by removal of the adipose fin. A subset of the release will be tagged with a coded-wire tag (250,000) and PIT-tag (50,000). These tags will allow managers to calculate harvest rates in fisheries and determine adult and juvenile survival rates through the FCRPS.

5.4.1.2.1 Redfish Lake

Under the assumption shown in Table 5-1 for the Redfish Lake program component, all-H analyzer modeling (AHA) results indicate that producing 1.0 million smolts would be sufficient to maintain broodstock (1,150), achieve a average minimum natural-origin escapement of 500 adults and produce the surplus hatchery-origin returning adults needed to meet adult escapement goals for Redfish Lake (1,000) and Pettit Lake (500) (Table 5-2). The lakes were prioritized based on assumed adult sockeye production potential.

Table 5-1. AHA modeling assumptions for the Phase 2 Redfish Lake conventional hatchery program.

Habitat			
Adult productivity (R/S)	4.0	Adult capacity	5,000
Hydro			
Juvenile survival rate through FCRPS	0.36	Adult survival rate through FCRPS	0.54
SAR of NOR	1%	SAR of HOR	0.40%
Harvest			
NOR harvest rate	3%	HOR harvest rate	3%
Hatchery			
pNOB	10%	pHOS	77%
NOR brood number	115	HOR brood number	1,035
Hatchery recruits per spawner	3.5	PNI	Not applicable
Total HOR Smolt Production – 1 million			

Notes:
R/S: Adult recruits per spawner
SAR: Smolt-to-adult survival rate
NOR: Natural-origin adults
HOR: Hatchery-origin adults
pHOS: Proportion of the natural spawning population that consists of hatchery-origin adults
PNI: Proportionate natural influence

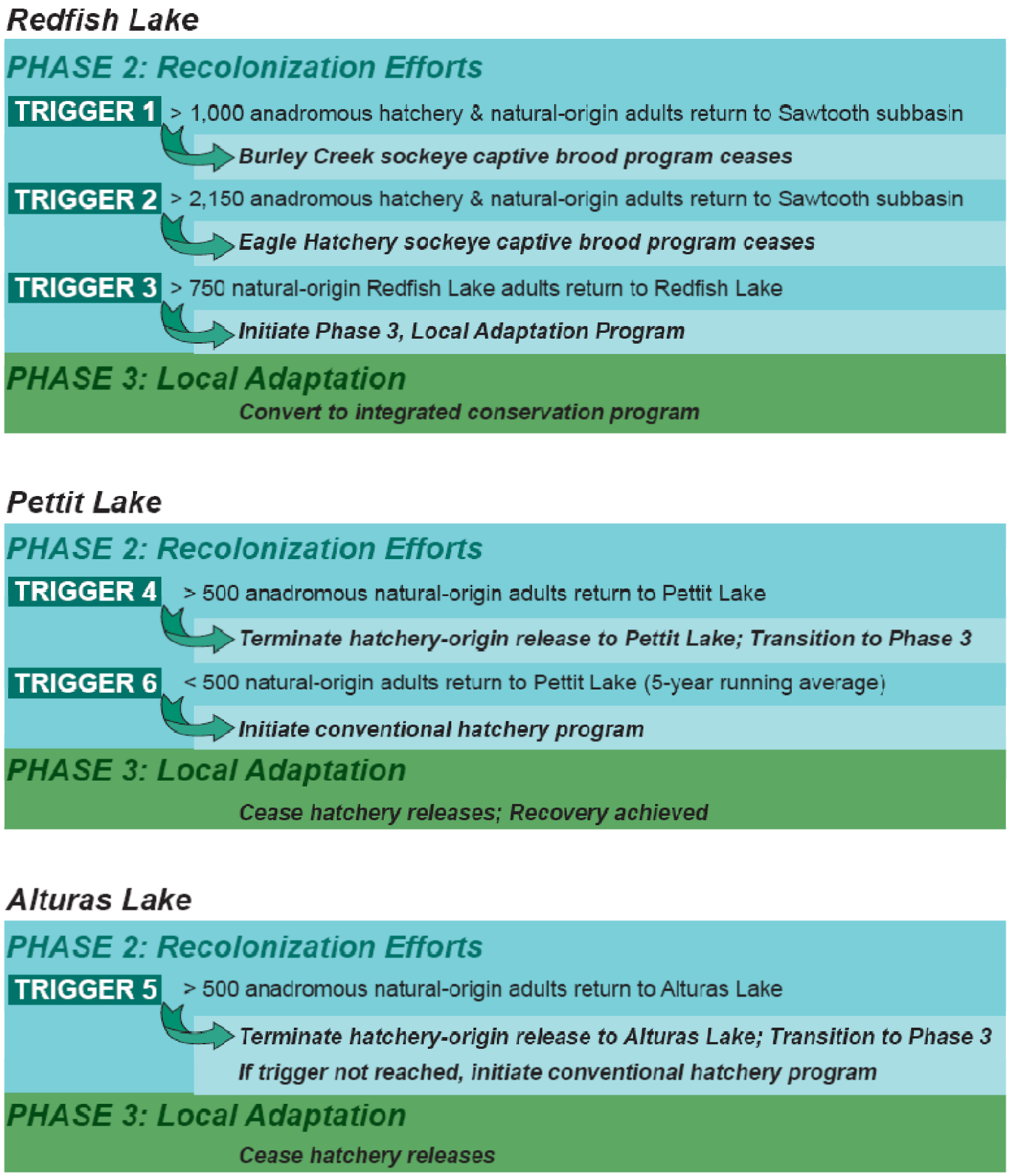
Table 5-2. AHA modeling results for the Phase 2 conventional hatchery program escapement.

Parameters	Number of Sockeye Adults		
	Max	Min	Ave
Natural-origin spawning (NOS) escapement	2,182	160	522
Hatchery-origin spawning (HOS) escapement	6,638	1,153	2,173
Hatchery-origin spawner effective escapement (assumes 10% fitness loss)	5,310	922	1,739
Total natural escapement (NOS and all HOS)	*8,820*	*1,361*	*2,695*
Total Harvest	892	151	286
Hatchery Broodstock	1,150	1,150	1,150
Surplus at Hatchery	5,604	118	1,139
Total Run-size	16,466	2,731	5,270

One million sockeye smolts required for Phase 2 will be produced at the new Springfield Hatchery near American Falls Reservoir. Although this site is many miles from the Sawtooth basin, it offers a number of advantages. The benefits of this location are that it has a high quality and available source of groundwater. In addition, hatchery effluent will not discharge to waters that support anadromous fish production, preventing potential viral and bacterial pathogens from hatchery operations entering streams that support ESA listed populations.

The preferred collection point for Phase 2 broodstock will be the Redfish Lake weir. Collecting fish here would prevent the program from collecting adults bound for Pettit and Alturas lakes. Phase 2 also includes collecting anadromous adults at Lower Granite Dam, an experimental action designed to increase the total number of potential spawners returning to the Sawtooth basin. Currently, it is estimated that approximately 25-50% of the sockeye passing Lower Granite Dam survive passage to collection facilities such as the Sawtooth weir (NOAA Fisheries 2010). The collection of adult sockeye at Lower Granite Dam was an action called for in the 2008 FCRPS Biological Opinion (NOAA Fisheries 2008). The experiment would be undertaken under drought conditions when adult survival rates to the spawning grounds are expected to be extremely low due to high stream temperatures and associated low river flow.

The number of anadromous sockeye adults returning to capture facilities will act as management triggers for the program. These triggers are illustrated in Figure 5-1 and are described below.



Note: Trigger descriptions are summarized in this figure; see complete description in text.

Figure 5-1. Program Management Triggers by Lake and Program Phase

***Trigger 1**: When the 5-year running average of anadromous hatchery-origin and natural-origin adults to the Sawtooth subbasin exceeds 1,000, the captive brood program at Burley Creek will be terminated. (i.e., no new brood years will be brought into the program)*

> **Rationale**: A run size of 1,000 natural- and hatchery-origin adults, combined with production from the Eagle Fish Hatchery, provides a sufficient level of production to eliminate the need for the Burley Creek “safety net” program, a program designed as a production back-up in case of a catastrophic failure at the Eagle facility.

***Trigger 2**: When the 5-year running average of anadromous hatchery-origin and natural-origin adults to the basin exceeds 2,150 fish, the captive brood activities for Redfish Lake sockeye at Eagle Hatchery will cease (i.e., no new brood years will be brought into the program).*

> **Rationale**: This level of adult return shows that the broodstock (1,150) and natural adult escapement (1,000) goals are being achieved on a consistent basis, program has proven itself and that a captive brood program is no longer needed.

In short, redundant facilities would be eliminated as the success of the program becomes evident. Returning anadromous hatchery-origin and natural-origin sockeye adults will be prioritized in the following manner:

1. Hatchery broodstock
2. Escapement target for Redfish Lake
3. Escapement target for Pettit Lake

Anadromous hatchery-origin adults from the program would not be released into Pettit Lake until combined hatchery- and natural-origin escapement to Redfish Lake exceeds 3,800 fish (Table 5-3)[2]. This is approximately the pre-dam production potential of Redfish Lake as estimated by Gross et al. 1998. Allowing adult escapement to exceed the target adult escapement of 1,000 adults would provide managers an opportunity to observe Redfish Lake productivity and fish habitat use over a wide range of escapement levels.

Table 5-3. Adult sockeye hatchery broodstock requirements and natural escapement targets for Redfish Lake, Pettit Lake and Alturas Lake at various HOR and NOR run-sizes.

Run-Size	Hatchery Broodstock			Natural Escapement Targets		
HOR + NOR	No. HOR	pNOB (10%)	Total	Redfish Lake	Pettit Lake	Alturas Lake
1,150	1,035	115	1,150	0	0	0
1,500	1,035	115	1,150	350	0	0
2,000	1,035	115	1,150	850	0	0
2,500	1,035	115	1,150	1,350	0	0
3,000	1,035	115	1,150	1,850	0	0
3,500	1,035	115	1,150	2,350	0	0
4,000	1,035	115	1,150	2,850	0	0
4,500	1,035	115	1,150	3,350	0	0
5,000	1,035	115	1,150	3,800	50	0
5,500	1,035	115	1,150	3,850	500	0
6,000	1,035	115	1,150	4,000	850	0
6,500	1,035	115	1,150	4,200	1,150	0
7,000	1,035	115	1,150	4,400	1,450	0

Note: pNOB is the proportion of natural origin adults used as broodstock

[2] Egg and pre-smolt plants to these two lakes would continue.

Surplus anadromous hatchery-origin adults would NOT be released to Alturas Lake. Because of its higher elevation, this system had an earlier adult return timing than either Pettit or Redfish lakes. Redfish Lake captive brood adults would continue to be released to Alturas and Pettit lakes as long as the Burley Creek and/or Eagle programs are operated in an effort to recolonize those habitats.

Anadromous hatchery broodstock would consist of 90% hatchery-origin adults and 10% natural-origin adults respectively (i.e., a pNOB of 10%) (Table 5-1). The 10% pNOB value was selected based on HSRG guidelines which state:

> *…pNOB should be a minimum of 10% to avoid divergence of the hatchery population from the natural component, even when pHOS is zero.* (HSRG et al. 2004)

Natural-origin adults surplus to broodstock needs would be allowed to spawn naturally in natal areas. In this phase of the program, restrictions would not be placed on the proportion of the natural spawning population that consists of hatchery-origin adults (pHOS). However, targets for pHOS would be established once the program moves to Phase 3.

The number of smolts and captive adults that would be released into Redfish, Pettit and Alturas lakes is shown in Table 5-4.

Table 5-4. Sockeye release numbers and the date, source, size and location of hatchery-reared Snake River sockeye.

Age Class	Source	Maximum Number	Size (fpp)	Release Date	Location
Redfish Lake					
Smolts	Springfield	500,000	10 – 20 fpp	May 1-10	Redfish Lake Subbasin
Smolts	Springfield	500,000	10 – 20 fpp	May 11-20	Redfish Lake Subbasin
Pettit Lake					
Redfish Lake Captive Adults	Eagle	200[a]	0.25	September/ October	Pettit Lake
Alturas Lake					
Redfish Lake Captive Adults/Alturas Lake Captive Adults	Eagle	200[a,b]	0.25	August	Alturas Lake

a- Source of captive brood is Pettit Lake or Redfish Lake-origin fish
b- Source of captive brood is Alturas Lake-origin fish

A natural-origin adult escapement level will be used as the trigger to transition the program to Phase 3. The trigger is as follows:

Trigger 3: *When the 5-year running average natural-origin recruit adult escapement level to Redfish Lake exceeds 750 fish, the program will transition to Phase 3-Local Adaptation.*

> **Rationale**: At this run-size, sufficient natural-origin adults are available wherein removing the numbers needed for broodstock would still result in achieving a minimum natural-origin adult escapement objective of 500 fish.

Achieving this trigger will likely require that fish passage survival through the hydropower system increases substantially (Table 5-5). Under current conditions (with a low fish passage survival rate), the average number of natural-origin adults returning to the basin is 522 fish. In contrast, under the high fish passage survival assumption, average adult escapement to the basin increases to 1,636 fish (Table 5-5).

Table 5-5. The maximum, minimum and average number of sockeye produced under Low and High fish passage assumptions through the FCRPS.

	Fish Passage Survival Rate*		Number of Sockeye Adults		
Parameters	Juvenile Survival Rate	Adult Survival Rate	Max	Min	Ave
Low Fish Passage Survival Rate- NOS Escapement**	0.36	0.57	2,182	160	522
High Fish Passage Survival Rate- NOS Escapement***	0.50	0.80	5,798	741	1,636

*- Based on AHA modeling assuming a Redfish Lake population productivity and capacity of 3.5 and 4,000, respectively. Additionally, the numbers in the table reflect a 10% reduction in NOR abundance caused by incorporating NOR adults into the hatchery broodstock.

**- Low fish passage survival rates are based on current estimates of adult and juvenile survival rates through the FCRPS.

***- High fish passage survival rates are based on adult and juvenile survival rates required in the 2008 FCRPS BiOp.

Although it is assumed that fish passage survival needs to increase to achieve the natural-origin adult escapement target (1,000), it is recognized that the ability of Redfish Lake to support a more productive and larger population of sockeye than was modeled in AHA is also possible. Higher productivity could result in the trigger being achieved without a corresponding increase in passage survival. Because measuring productivity is difficult and requires multiple generations before estimates can be accurately made, the trigger to move to Phase 3 is simply based on adult returns, a metric that is easily calculated each year because of the accuracy of counting stations at Lower Granite Dam, the Sawtooth weir and Redfish Lake weir.

5.4.1.2.2 Pettit Lake

Adult supplementation would be used to restore fish production in Pettit Lake in Phase 2. An adult supplementation strategy was selected based on the following rationale:

- Outplanting adults rather than juveniles ensures that the entire life-cycle of the fish is completed in nature rather than artificially in the hatchery environment. Consequently, resulting juvenile production is free of influences from the hatchery environment.
- Under the adult supplementation strategy, fish managers will be able to measure spawning success within a single generation. In contrast, in a juvenile supplementation program, the spawning success of returning adults will not be known until one generation later.
- Competition is reduced between naturally produced juveniles and hatchery juveniles released into rearing areas. This action is likely to increase the number of naturally produced fish leaving the system each year.

A total of 200 adults from the Redfish Lake captive brood facilities would be released to Pettit Lake each year. Surplus anadromous hatchery-origin adults from the Redfish Lake program would be released to Pettit Lake when the run size of the Redfish program exceeds 3,800 adults (hatchery- and natural-origin).

A pedigree analysis would be conducted by taking tissue samples of all adults returning to an adult trap to be located at the outlet to Pettit Lake[3]. This analysis will determine the reproductive success (adult recruits per spawner) of captive brood, natural-origin adult and hatchery-origin adult spawners. This information would be used to adjust the number and type of adult releases made to Pettit Lake.

The following trigger would be used to end adult hatchery releases to Pettit Lake:

Trigger 4*: When the 5-year running average natural-origin adult escapement level to Pettit Lake exceeds 500 fish, HOR releases to the lake will be terminated.*

> **Rationale**: A 500 fish natural-origin recruit escapement achieves the recovery objective and eliminates the need for continued hatchery production.

5.4.1.2.3 Alturas Lake

To restore sockeye production into this system, adult supplementation would occur using Redfish lake captive brood (until the Eagle and Burley creek programs are discontinued), transitioning to Alturas Lake-origin fish (using adult returns to that system). The rationale for this strategy is the same as that presented for Pettit Lake (Section 5.4.1.2.2).

Each year, 200 captive brood adults would be released to the lake to spawn naturally. The source of these fish would be first, from the existing Eagle and Burly creek captive brood programs then, either from juveniles captured migrating from the lake or eggs taken from

[3] The Pettit Lake adult trap is not included in the costs presented in this Master Plan as it would be funded through existing monitoring programs.

anadromous adults returning to the adult trap at the lake entrance[4]. Because adult run-timing is thought to have been earlier than Redfish Lake, surplus HOR adults from the anadromous Redfish hatchery program would not be released to Alturas Lake.

As with Pettit Lake, a pedigree analysis would determine the reproductive success of different releases, the results of which would be used to adjust release types and numbers.

The following trigger would be used to end adult hatchery releases to Alturas Lake:

Trigger 5: *When the 5-year running average NOR adult escapement level to Alturas Lake exceeds 500 fish, HOR releases to the lake will be terminated.*

Rationale: A 500-fish natural-origin recruit escapement achieves the recovery objective and eliminates the need for continued hatchery production.

5.4.1.3 Phase 3- Local Adaptation

Program activities in Phase 3 are presented below for each of the three lakes, Redfish, Pettit and Alturas.

5.4.1.3.1 Redfish Lake

Phase 3 begins when Trigger 3 is achieved. At that time, the hatchery program for Redfish Lake would be converted into an integrated conservation program (using broodstock returning to Redfish Lake), following the guideline and recommendations of the HSRG (HSRG 2004). This phase of the program has three objectives:

1. **Protect the genetic resources of Snake River sockeye**- This would be accomplished by having a hatchery program of sufficient size that adult abundance is able to maintain the composite population (HOR and NOR) over time.

2. **Develop a composite hatchery and natural population that is locally adapted to the environmental conditions present in the basin**- This would be achieved by following HSRG guidelines for an integrated hatchery program.

3. **Provide the surplus HOR adults needed to achieve recovery objectives in Pettit Lake** – Hatchery production would be maintained at sufficient levels to produce more adults than are needed for the Redfish Lake broodstock and natural escapement goals. These surplus fish would be released to Pettit Lake if recovery objectives for that system have not been met during Phase 2.

The program would be operated to achieve the following criteria:

- Minimum hatchery production of 400,000 smolts from Springfield
- Proportionate natural influence of > 0.67 (based on a 5-year rolling average)
- Proportion of hatchery-origin spawners (pHOS) < 30%

[4] The Alturas Lake adult trap is not included in the costs presented in this Master Plan as it would be funded through existing monitoring programs.

- Minimum NOR adult escapement of 500
- Minimum HOR and NOR escapement and composition achieves PNI objective
- NOR harvest rate of 3% or less

The importance of these performance criteria in achieving the conservation objectives of this program is described in the Integrated Conservation discussion below.

Integrated Conservation Program for Snake River Sockeye

According to the HSRG, a hatchery program is considered to be an integrated type if:

> *"…the intent is for the natural environment to drive the adaptation and fitness of a composite population of fish that spawns both in a hatchery and in the wild."* (HSRG 2004)

The influence of the hatchery and natural environments on the adaptation of the composite population (NOR and HOR) is determined by the proportion of natural-origin broodstock in the hatchery (pNOB[5]) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The larger the ratio pNOB/(pHOS+pNOB), the greater the strength of selection in the natural environment relative to that of the hatchery environment. The ratio is referred to as the proportionate natural influence (PNI). When the primary purpose of an integrated hatchery is conservation, it is referred to as an integrated conservation program.

This integrated conservation program would be operated to achieve a 5-year running average PNI of >0.67. The 0.67 value is the level recommended by the HSRG for populations that have high biological significance. The size of the program could be as large as 600,000 smolts if the habitat, hydro, harvest and hatchery assumptions used for AHA modeling are achieved (Table 5-6). However, if these assumptions were not met, then program size would be adjusted accordingly to ensure that HSRG guidelines for PNI and pHOS were achieved.

Estimated sockeye production for the integrated conservation program is presented in Table 5-7. The data in this table show that NOR escapement averages 1,122 adults, and ranges from 287 to 4,202. This level of sockeye production achieves the recovery objective of 1,000 adults in Redfish Lake.

It should be noted that the program would always be operated to achieve a minimum escapement level of 500 NOR adults when possible. This could require reducing hatchery production in some years to decrease the number of NORs used as broodstock for the program. An in-season management plan would be used to determine program size, pHOS and pNOB objectives on a yearly basis (see Section 6, Monitoring and Evaluation).

Under the habitat and hydro assumptions stated in Table 5-6, a program sized at 600,000 smolts would produce sufficient surplus hatchery-origin adults (average of 4,665) for stocking into Pettit Lake and other lakes (e.g., Stanley or Yellowbelly) if required by NOAA Fisheries as part of any future recovery effort. The surplus adults may also be taken in directed fisheries above Lower Granite Dam; however, harvest would be considered the lowest priority use of these fish.

[5] Terminology: NOR = Natural-origin return, HOR = Hatchery-origin return, NOB = Natural-origin fish included in hatchery broodstock, HOS = Hatchery-origin fish in the natural spawning escapement.

Table 5-6. AHA modeling assumptions for the Redfish Lake integrated conservation program.

Habitat			
Productivity	4.0	Capacity	5,000
Hydro			
Juvenile survival rate through the FCRPS	0.50	Adult survival rate through the FCRPS	0.8
SAR of NOR	2%	SAR of HOR	0.83%
Harvest			
NOR harvest rate	3%	HOR harvest rate	Variable based on impacts to NOR
Hatchery			
pNOB	35%	pHOS	16%
NOR brood number	242	HOR brood number	450
Hatchery recruits per spawner	7.2	PNI	0.69
Total HOR Smolt Production – 600,000			

Table 5-7. Estimated sockeye natural escapement, harvest, hatchery and total adult production for the Redfish Lake integrated conservation program (600,000 smolt release).

	Number of Sockeye Adults		
Parameters	Max	Min	Ave
Natural-origin spawning (NOS) escapement	4,202	287	1,122
Hatchery-origin spawning (HOS) escapement	821	142	269
Hatchery-origin spawner (HOS) effective escapement (assumes 10% fitness loss)	657	114	215
Total natural escapement (NOS & all HOS)	*5,023*	*454*	*1,391*
Total Harvest	807	142	261
Hatchery Broodstock	692	692	692
Surplus at Hatchery	15,168	2,263	4,665
Total Run-size	21,661	3,497	6,980

5.4.1.3.2 Pettit Lake

The triggers used to determine Phase 3 activities for Pettit Lake are:

Trigger 6*: Five years after implementing the Redfish Lake integrated conservation program, if the 5-year running average of NOR adult escapement is less than 500 adults to Pettit Lake (Trigger 4), a conventional hatchery program may be implemented for this system.*

Rationale: A run-size of less than 500 NOR adults indicates that the recovery objective has not been achieved, possibly justifying the need for a hatchery program.

The decision to implement a hatchery program at this time would not solely be based on NOR escapement numbers. Data collected on natural juvenile production, estimated adult recruits per spawner, FCRPS survival rates and the smolt-to-adult return rates would all be considered in the decision-making process. These data may indicate that the production potential of the lake is less than assumed, or that survival rates through the FCPRS are insufficient to achieve objectives given lake production potential.

Under the assumption that Pettit Lake has the potential to produce 500 adult sockeye, hatchery actions that would be implemented at this point in time would be as follows:

- **5-year running adult average NOR > 500** - All hatchery releases to Pettit Lake would be eliminated (Trigger 4) because the recovery objective has been achieved.

- **5-year running adult average NOR >250 but <500** - A 100,000 smolt program would be implemented with a pNOB of 100% using fish reared at Springfield Hatchery. This would require approximately 110 natural-origin adults. No Redfish Lake-origin adults would be released into Pettit Lake once adults from this program begin returning to the basin. In short, at this stage, the program assumes that using fish adapted to Pettit Lake for hatchery production, rather than fish from another watershed (Redfish Lake), would increase the chance of program success.

- **5-year running adult average NOR < 250** - Surplus hatchery-origin adults from the Redfish Lake program would continue to be released to Pettit Lake. The program would have a minimum escapement target of 1,000 adults (NOR and HOR). Emphasis would be placed on adult releases as this ensures that resulting juveniles are free of hatchery influence and are therefore adapted to the natural environment to the extent possible.

5.4.1.3.3 Alturas Lake

Hatchery activities in Phase 3 would depend upon the success of the Redfish Lake, Pettit Lake, and Alturas Lake programs in Phase 2. If Alturas Lake recovery objectives have not been achieved, then lessons learned from all three programs would be applied to select a preferred approach. The reduction in smolt/adult production from Springfield and Eagle hatcheries (of Redfish Lake sockeye) would allow sufficient rearing space to handle any hatchery production scenario likely required for Alturas Lake.

5.4.2 Habitat Strategy

IDFG will continue management actions designed to protect the high quality sockeye spawning and rearing habitat present in natal spawning and rearing areas. Emphasis will be placed on actions that:

- Reduce lakeshore recreation pressure, particularly in shallow areas where sockeye spawn currently or historically

- Restore or maintain native vegetation that provides naturally resilient and productive shoreline habitats through management of lakeside recreation and other human development

- Correct the causes of the Salmon River being listed as water-quality limited (sediment and temperature) between the confluences of Redfish Lake Creek and Squaw Creek with the upper Salmon River.

To address sediment and temperature effects, IDFG and other resource managers are exploring options to create a more natural hydrograph for the Salmon River upstream of the East Fork Salmon River. To increase base flows, the agencies are also identifying areas where wetlands could be restored, riparian habitat improved and are encouraging more efficient irrigation that may result in increased groundwater discharge.

Studies will continue on the efficacy of using lake fertilization to improve juvenile rearing habitat. Additionally, the program calls for allowing (when available) large numbers of both hatchery- and natural-origin adults to spawn naturally in the system. The carcasses of these fish would contribute nutrients to improve system productivity and ability to support juvenile production.

The Shoshone Bannock Tribes and IDFG are continuing efforts to control non-native kokanee in Redfish Lake, Pettit Lake, Alturas Lake and Stanley Lake (Kohler et al. 2009).

5.4.3 Hydropower and Other Diversions

The 2008 FCRPS Biological Opinion (NOAA Fisheries 2008) identifies a set of actions that the Corps of Engineers will implement to improve juvenile and adult sockeye survival rates through the FCRPS. These actions include improvements in flow and water temperature, reduction in total dissolved gas, fish passage improvements at dams and spillways, as well as alterations to the juvenile transportation program.

5.4.4 Harvest Strategy

The program does not expect to produce harvest benefits for many years. Current harvest management is based on NOAA-Fisheries regulations for the protection of listed sockeye, Chinook and steelhead.

5.4.5 Proposed Facilities

Transitioning the Snake River sockeye program from a captive broodstock program to an anadromous (conventional) hatchery program, then to re-colonization and finally local adaptation in available habitats will require increasing the available rearing space for smolt production. The proposed method for this transition is to produce significant numbers of adults surplus to broodstock needs. The proposed smolt program at the Springfield Hatchery would be capable of meeting the 500,000 to one million smolt goal identified in the FCRPS Biological Opinion and in the Idaho Fish Accords. Facilities required to accomplish this are described in Section 7 and include a new hatchery building with egg incubation stacks, 18 indoor early rearing troughs, 24 outdoor raceways, and all supporting facilities including three new residences for operators. Key attributes of the Springfield site are sufficient high quality groundwater, full isolation from other salmonids, adequate space to develop sockeye-appropriate facilities, and an already permitted land use type.

6 RESEARCH, MONITORING, EVALUATION

6.1 DECISION MANAGEMENT FRAMEWORK

The conservation and recovery of Snake River sockeye is the primary objective of the program. The objective will be achieved by implementing a three-phased hatchery program designed to increase sockeye abundance, spatial structure and life history diversity (Section 5).

In addition to the monitoring activities described in Section 11 of the Snake River Sockeye HGMP (Appendix A), decision triggers and decision rules (Section 6.3) based on natural- and hatchery-origin adult returns to the basin would be used to adaptively manage the program on a yearly basis. As adult run size increases, the goal of the triggers is to eliminate redundant facilities (e.g., those needed for captive brood) and to determine when the program transitions to the next phase of implementation. Because sockeye run size defines when actions are to be taken, the time frame for implementing major milestones is uncertain. However, the ability to measure the triggers would be highly accurate due to managers' ability to quantify adult returns at weirs and hatchery facilities.

Included in the program is a detailed monitoring and evaluation plan designed not only to determine when triggers are achieved, but also to track such parameters as juvenile and adult abundance, survival rates, genetic structure, reproductive success, lake(s) productivity, harvest rates, run-timing, as well as interactions with other species.

The program has scientific oversight, performed by the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC), a team of technical experts assembled to review program results and to guide program direction. The SBSTOC will continue to fill this important role through all three phases of the program.

6.2 ONGOING AND PROPOSED M&E PROGRAMS, PERFORMANCE STANDARDS AND INDICATORS

The proposed monitoring and evaluation plan will be designed to ensure that the program achieves the performance standards established for natural production and in-hatchery culture practices and operations (Table 6-1). The benefits and risks to sockeye populations for each standard are also provided in the table. A more detailed description of the monitoring and evaluation program is presented in the draft HGMP (Appendix A). This plan will be developed further in Step 2 of the three-step planning process.

Table 6-1. Performance standards, indicators, benefits and risks and proposed monitoring and evaluation for the sockeye program.

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
Hatchery Operations and Facilities			
Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Broodstock are sourced throughout the return and/or spawning period as appropriate; brood sourced from all spawn crosses and from equalized individual and family representation.	Achieving the broodstock indicator ensures that the hatchery population reflects the characteristics of the natural population to the extent possible by including natural-origin fish as broodstock, collecting fish randomly throughout the entire portion of the run, and including both jacks and adults into the broodstock. As these indicators become less representative of the natural population, the more divergent the two populations become, thereby reducing natural population productivity and diversity. Poor mating protocols may reduce genetic diversity and thereby reduce overall population productivity and reproductive success in the natural environment.	Annual spawning and brood sourcing will be consistent with Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) and NOAA Northwest Fisheries Science Center genetics staff recommendations. Fish for broodstock will be collected throughout the entire run period. Males and jacks will be incorporated in ratios reflective of the natural population over time. Intensive annual genetic monitoring of captive and anadromous contributors at the Eagle Fish Genetics Laboratory. Genetic variation is protected by selecting broodstock that represent the genetic diversity of the entire run, selecting fish over the entire length of the run, selecting individuals from each release strategy, equalizing sex ratios and by equalizing family contribution.
Adult Holding and Spawning Survival Rate	> 95% survival	High survival rates ensure that hatchery operations are not inadvertently selecting for certain genetic or behavioral characteristics.	Hatchery culture staff will enumerate loss by life stage for each brood year. Data to be reported in annual operating reports.
Egg-to-Fry Survival Rate	>85% survival		
Fry-to-Parr Survival Rate	> 90% survival		
Parr-to-Smolt Survival Rate	> 95% survival		

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
Release Timing, Fish Health, Size and Condition of Released Fish	Fish size, release date and range are similar to natural fish to the extent possible given that their survival rate achieves objectives. Released fish certified by pathologist to be disease-free.	Releasing healthy fish at the correct size and time increases overall survival and reduces the release numbers needed to achieve conservation and harvest objectives. Releasing fish that are too large may increase competition with natural fish populations. A mismatch between release timing and environmental conditions required for good survival may reduce overall hatchery and natural fish performance.	Natural fish populations will be monitored both in rearing lakes and as they migrate from the system. Data will be collected on fish abundance, size and migration timing. Culture staff will track juvenile HOR size, growth rates, health and abundance. These data will be reported in annual reports.
Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	HOR identification rate of >98%	Being able to identify HOR fish allows managers to determine program success and reduce/control negative impacts to natural populations.	HOR juveniles will be marked with a combination of coded wire-tags (CWT), PIT-tags and/or adipose clips.
Fish release numbers and location do not reduce NOR juvenile production in lakes and other areas	Fish release location consistent with SBSTOC recommendations	HOR fish compete with NOR populations for both food and space and therefore have the potential to reduce natural production. Selecting proper release locations and timing limits this effect.	The SBSTOC will make yearly recommendations of the number of HOR juvenile sockeye and adults released into the system. These recommendations will be based on the results of research designed to determine lake(s) productivity and juvenile production potential for a given year.
Similar hatchery-origin and natural-origin smolt-to-adult survival rate (SAR)	SAR of HOR > SAR NOR fish	The higher the SAR, the lower the level of hatchery production required to achieve program goals. Smaller hatchery releases result in reduced competition with natural-origin fish which should increase their survival.	Smolts released or captured at monitoring facilities will be marked with a combination of CWT, PIT-tags and or adipose clips. Adult production will be enumerated in fisheries, carcass surveys, dams and weirs. Smolt-to-adult survival rates will be developed for both hatchery- and natural-origin fish migrating from Redfish Lake, Pettit Lake and Alturas Lake. Data will be made available to regional data centers for analysis and storage. For an example see the DART link below: http://www.cbr.washington.edu/trends/index.php

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread, or amplification of fish pathogens. Follow co-managers' fish health disease policy	Necropsies of fish to assess health, nutritional status, and culture conditions. Performance indicators will be based on test performed.	Having fewer and less severe disease outbreaks reduces the disease risks that hatchery populations and operations pose to natural populations.	Staff will conducts health inspection of cultured fish. Pathologist implements corrective actions as needed.
Water diversions and withdrawals do not impact access to spawning and rearing areas	All in-river structures and diversions designed to meet NOAA Fisheries passage criteria	Water diversions and structures can kill juvenile fish through impingement on screens, block or delay access to key habitat, and reduce the amount of this habitat through dewatering of the stream channel	Fish passage facilities and water diversions that have the potential to negatively impact fish will be monitored throughout the year. Screens are constantly inspected for impinged fish and cleaned as needed. Biologists working at weirs and other facilities monitor for fish delay and injury as part of their daily work.
Hatchery effluent discharge requirements are met (Clean Water Act)	Various based on regulations	Achieving high quality hatchery effluent maintains water quality in the receiving stream. Good water quality is essential for the production of all anadromous fish species. Hatchery effluent that degrades water quality may decrease the survival and overall productivity of the natural population.	All hatchery facilities will operate under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit.
Natural Production and Harvest Monitoring			
Achieve Natural Spawner Abundance Targets	Triggers achieved	Program success is determined by the number of NOR adults on the spawning grounds. The higher this value, the more likely the population will be able to maintain itself over time. Triggers also are used to determine when HOR releases are reduced or eliminated, thereby decreasing risk of the program to the natural population.	Determined by monitoring adult escapement to Redfish, Pettit and Alturas lakes

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
Incorporate sufficient number of NOR adults into broodstock collection	pNOB of at least 10%	Achieving the pNOB standard (10%) ensures that the hatchery population does not diverge from the natural component.	The origin (hatchery or natural) of adult fish will be enumerated and classified using genetic analysis and marking information at weirs located on target streams. All natural-origin fish not used for broodstock will be released upstream of the weirs to spawn. Broodstock will consist of at least 20% NOR adults.
Adult run-timing (HOR and NOR)	HOR and NOR run-timing curves are similar over time	For integrated programs, the run-timing of hatchery and natural runs should match, as this is an indicator that the two populations are expressing similar life-histories, and that both are being exposed and adapting to the full range of environmental conditions present in the basin. A mismatch in run-timing between the two populations (HOR and NOR) indicates that hatchery practices are selecting for life-histories dissimilar to those being expressed by the natural population. The two populations may become more divergent over time resulting in greater genetic impacts to NOR populations from hatchery fish spawning in the natural environment. This could include a loss in productivity, diversity and spatial structure.	NOR and HOR run-timing data will be collected at weirs located at Redfish Lake and the Sawtooth Hatchery. Weir counting stations may be located at Alturas and Pettit lakes in later phases to better enumerate adult production and timing for these two systems.
Juvenile abundance over time in Pettit, Alturas and Redfish lakes	Increasing trend	Increasing juvenile abundance over time indicates that natural production levels and system productivity are improving.	Juvenile traps will be operated at the outlets of Redfish, Pettit and Alturas lakes. Trap operations and costs are covered by on-going monitoring efforts outside of the Master Plan.
Achieve ESA defined harvest rates on NOR adults	Variable	Managing the system to NOT exceed identified harvest levels maximizes the number of NOR adults returning to spawning areas.	In-season harvest rates are monitored as part of a regional efforts conducted by federal, state, and tribal entities

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
Achieve the Proportion of Hatchery-Origin Spawners (pHOS) targets	pHOS decreases over the three phases of the program	Limiting the proportion of hatchery fish on the spawning grounds (pHOS) reduces possible genetic impacts to the natural population. The more dissimilar the two populations, the larger the risk hatchery strays pose. In a well integrated program, the proportion of natural-origin fish in the hatchery brood (pNOB) must exceed the proportion of hatchery fish on the spawning grounds (pHOS). This is to ensure that the populations posses similar genetic and phenotypic traits.	Weir counts and spawning carcass surveys will be used to determine/manage pHOS.
Proportionate Natural Influence (PNI)	> 0.67 (Phase 3)	Achieving the PNI goal >0.67 ensures that the natural, rather than the hatchery environment, is driving local adaptation. Fish better adapted to the natural environment are more productive and more resilient to environmental change. Low PNI (<0.50) is an indicator that the hatchery environment is driving local adaptation. Fish adapted to this environment are less likely to perform well in the wild and therefore reduce the productivity and diversity of the natural component of the combined population.	Natural escapement rates of HOR and NOR will be monitored and controlled both at the hatchery and the spawning grounds. Natural escapement HOR/NOR ratios will be achieved by operating adult weirs at Redfish Lake and Sawtooth Hatchery. Intensive annual genetic monitoring of captive and anadromous contributors to be performed at Eagle Fish Genetics Laboratory.
Reproductive success of naturally spawning HOR and NOR adults	HOR adult recruits per spawner > NOR adult recruits per spawner	Having HOR recruit per spawner (R/S) values > NOR indicates that the program is producing fish adapted to the natural environment as these HOR spawners produce as many returning adults as their NOR counterparts.	Genetic analysis (e.g., pedigree) will be used to determine reproductive success of various hatchery release strategies and the natural population

Performance Standard	Indicator	Benefits and Risks	Monitoring and Evaluation
Straying of program fish to other subbasins or areas	< 5% other subbasins or areas	Good homing fidelity of HOR fish to the hatchery or targeted areas is important for eliminating the genetic risks hatchery fish pose to wild fish from interbreeding. The higher the homing fidelity, the lower the risk. High homing rates also ensure that broodstock are available for culture so that wild populations do not need to be excessively used to achieve production targets.	Regional monitoring and evaluation efforts used to track stray rates out-of-subbasin stray rates

6.3 IN-SEASON MANAGEMENT AND DECISION RULES

Because salmon abundance is highly variable over time, the hatchery program is being designed to be highly flexible from both a production and facilities operations standpoint. To achieve this flexibility, a set of decision rules are being developed to guide (a priori) management decisions on a yearly basis (i.e., In-season Management). The purpose of the decision rules is to assure that hatchery operations and harvest achieve the abundance, composition (HOR and NOR) and distribution goals for the natural population.

These decision rules will be finalized in the Step 2 Master Plan submittal. These rules will vary by program phase. The proposed decision rules for the Redfish Lake program component are shown in Table 6-2. Decision rules for the Pettit Lake and Alturas Lakes program components would be developed in Step 2.

Table 6-2. Phase 2 and Phase 3 decision rules for the Redfish Lake sockeye integrated conservation program.

Natural Escapement	Phase 2	Phase 3
Minimum natural-origin (NOR) escapement	250	500
Highest priority for NOR adult returns	Broodstock	Natural escapement*
pNOB	10%	35% or proportion required to achieve PNI target
Minimum hatchery production	Not applicable	400,000 smolts
Minimum hatchery-origin spawners (HOS) + natural-origin spawners (NOS) escapement	1,300	Number required to achieve PNI target
Proportion hatchery-origin spawners (pHOS)-maximum target for integrated program***	Variable	<30%
PNI	Not applicable	5-year rolling average >0.67
Maximum NOR harvest	3%	3%
Maximum HOR harvest	3%	Variable**

* The NOR priority would change to broodstock if NOR abundance were to drop to below 150 adults in any given year.
** HOR harvest rates would be set to ensure that the 3% NOR rate was not exceeded.
*** Actual pHOS will vary depending on HOR and NOR run size. The values in this row are the upper limit of pHOS based on HSRG guidelines.

In Phase 3, achieving the decision rules would result in hatchery production varying from year to year based on NOR abundance. At higher NOR abundance levels, sufficient NOR adults are available to achieve full production. As NOR abundance decreases, fewer NORs are available for broodstock, and hatchery production will decrease on a sliding scale. Hatchery production would not drop below 400,000 smolts in Phase 3 as these fish provide a safety net for protecting the genetic resources of the species.

6.4 ONGOING RESEARCH

Research associated with the program is focused in three areas: (1) captive broodstock operations, (2) the effectiveness of the Corps of Engineers fish transport program to improve juvenile sockeye survival, and (3) lake fertilization and resulting primary and secondary productivity. A brief description of each of these research elements is provided below.

6.4.1 Snake River Sockeye Salmon Captive Broodstock Program Research Element

An extensive research program is being conducted by IDFG and program cooperators as part of the captive brood program to determine the contribution different hatchery release strategies have on increasing the abundance of sockeye salmon in the Snake River Basin. The captive broodstock program reintroduction plan follows a “spread-the-risk” philosophy incorporating multiple release strategies and multiple lakes (Hebdon et al. 2004). Progeny from the captive broodstock program are reintroduced to Sawtooth Valley waters at different life stages using a variety of release options including: (1) eyed-egg plants to in-lake incubator boxes in November and December, (2) pre-smolt releases direct to lakes in October, (3) smolt releases to outlet streams in May, and (4) pre-spawn adult releases (hatchery-reared) direct to lakes in September.

6.4.2 Snake River Sockeye Salmon Bypass vs. Transport Pilot Study

Little information is available on the survival of sockeye salmon through the Corps’ hydropower system and fish transport system. With higher adult returns to the Sawtooth subbasin in 2007 and 2008, there was an opportunity to PIT-tag hatchery reared juvenile sockeye to begin to get estimates of in-river survivals, collection efficiencies, and eventually smolt-to-adult survival rates (SAR). In an effort to better estimate in-river survivals and SARs, a pilot study was initiated in 2009 by the Army Corps of Engineers to examine the different management strategies of transport, bypass, and spill on the SARs of Snake River sockeye. PIT-tagged sockeye smolts were released in the spring of 2009 near Stanley and allowed either to migrate through the hydropower system or be collected for transportation. This program will continue through at least 2011.

6.4.3 Lake Fertilization Study

A fertilization study is being undertaken in Pettit and Alturas lakes to determine if primary productivity can be increased. An increase in system productivity is expected to increase forage for juvenile sockeye salmon (Kohler et al. 2007). For example, in 2008, a total of 71 kg phosphorus (P) and 1,448 kg nitrogen (N) were added to Pettit Lake. Alturas Lake received supplemental nutrient applications of 89.9 kg phosphorus (P) and 1,778 kg nitrogen (N). Nutrients were applied at a ratio of approximately 20:1 N:P by mass to avoid stimulation of nitrogen fixing cyanophytes. Research is on-going and results to date will be available in 2011. The study is being conducted by the Shoshone-Bannock Tribe and Biolines Environmental Consulting using funding from BPA.

7 CONCEPTUAL DESIGN OF FACILITIES

7.1 OVERVIEW OF FACILITIES

The ongoing Snake River sockeye program is supported by a variety of facilities in three states. Adult collection facilities are in the upper Salmon River watershed; incubation and rearing facilities are at Eagle and Sawtooth hatcheries in Idaho, at the Manchester Research Station and Burley Creek Hatchery in Washington, and at Oxbow Hatchery in Oregon. The proposed Springfield Hatchery will centralize larger scale sockeye rearing in order to achieve the self-sustaining population goals discussed in Section 5.4 above. The proposed facilities, described in Section 7.3, would be constructed at the site of a former trout hatchery and packing plant in Bingham County, Idaho. While the intent is to continue to use the Eagle and Manchester/Burley Creek facilities for safety net population rearing, use of these facilities is proposed to be phased out over time (see Sections 5.4.1.2 and 6.2). The current condition of this site and existing facilities are described in Section 7.2.

7.2 EXISTING FACILITIES

This section describes the existing Springfield site features and improvements proposed by IDFG.

7.2.1 Adult Collection Facilities

Adult anadromous fish for the Snake River sockeye program are presently collected at the following locations:

- A permanent trap at a barrier on the Upper Salmon River at IDFG's Sawtooth Hatchery

- A temporary trap, installed each year in Redfish Lake Creek approximately one mile below the outlet of Redfish Lake

- An existing trap at Lower Granite Dam is a secondary collection site that potentially will be used in years when fish returns are low.

Collected fish are transported daily to adult holding facilities at Eagle Hatchery, near Boise. The Snake River Sockeye HGMP, presented in Appendix A, includes a detailed description of the support and safety net facilities in Oregon, Washington and Idaho. The HGMP recommends adult collection infrastructure improvements to support increased sockeye smolt production; however, these improvements are not included in the scope of this Master Plan. Facilities for the Snake River sockeye captive broodstock program operate at Eagle Hatchery and NOAA's Manchester Research Station and Burley Creek Hatchery. Because modifications are not proposed to these facilities, they are not further described in this section of the Master Plan.

7.2.2 Overview of Existing Springfield Site Facilities

The existing Springfield facilities are located in Bingham County, on a 73-acre parcel owned by IDFG that is made up of two smaller parcels (Figure 7-1). The 43-acre northern parcel supports all existing facilities and is separated from the 30-acre southern parcel by Edwards Road, a county-maintained road. Both parcels are relatively flat, sloping from elevation 4394 feet near the northeast property corner to 4380 feet near the southwest property corner.

The northern parcel was developed as a private trout farm, known as Crystal Springs Hatchery, which is now abandoned. Existing improvements include nine artesian wells, two large banks of concrete raceways, an office/hatchery building, a small shop, a cannery/processing plant that also contains offices, a feed storage silo, and a single family residence. With the exception of the residence, all facilities are abandoned and in deteriorating condition. The parcel also features a 4-acre public fishing pond known as Crystal Springs Pond, which has a recently constructed concrete outlet control structure. A public parking area and access trail to the pond is immediately west of the former cannery building.

The southern parcel is generally an unimproved field and wetland. There is an existing sanitary drainfield system on the north edge of the parcel that was used to dispose of wastewater from the cannery building. Barbed wire fencing marks the site boundaries, and a barely visible dirt road extends along the western perimeter.

A 50 cfs water right was perfected by the former trout hatchery and will be used for the sockeye hatchery. In addition, discharge from the trout facility was factored into the 2006 total maximum daily load (TMDL) allocations established for the American Falls Subbasin Assessment (IDEQ et al. 2006). Fish production at the Springfield site has an IDEQ authorized discharge allocation of 1.22 tons/year of phosphorus, 6.7 tons/year of nitrogen, and 61.1 tons/year of suspended sediment.

Existing facilities are described in more detail below and unless otherwise stated, are all on the 43-acre northern parcel.

7.2.3 Process Water Systems

As noted above, there are nine artesian wells located on the northern parcel. The wells are approximately 250 feet deep, tapping into a productive, confined aquifer that has a water-bearing stratum of sand and gravels approximately 45 feet thick. Each well has a vertical steel pipe casing, shut-off valve, and an overflow outfall pipe consisting of a short section of horizontal steel discharge pipe as shown in Figure 7-2. Water discharging from seven of the wells flows over land in small artificial channels or pipes into Crystal Springs Pond. The other two wells, in addition to a small spring, flow into an artificial channel that enters the north end of the abandoned rearing raceways. From the raceways, this water flows to the south, eventually combining with the Crystal Springs Pond overflow stream before leaving the site. A 48-inch-diameter corrugated metal culvert conveys the combined flow under Edwards Road as it leaves the site and forms Boom Creek. Boom Creek flows southwesterly two to three miles and enters the Snake River at American Falls Reservoir.

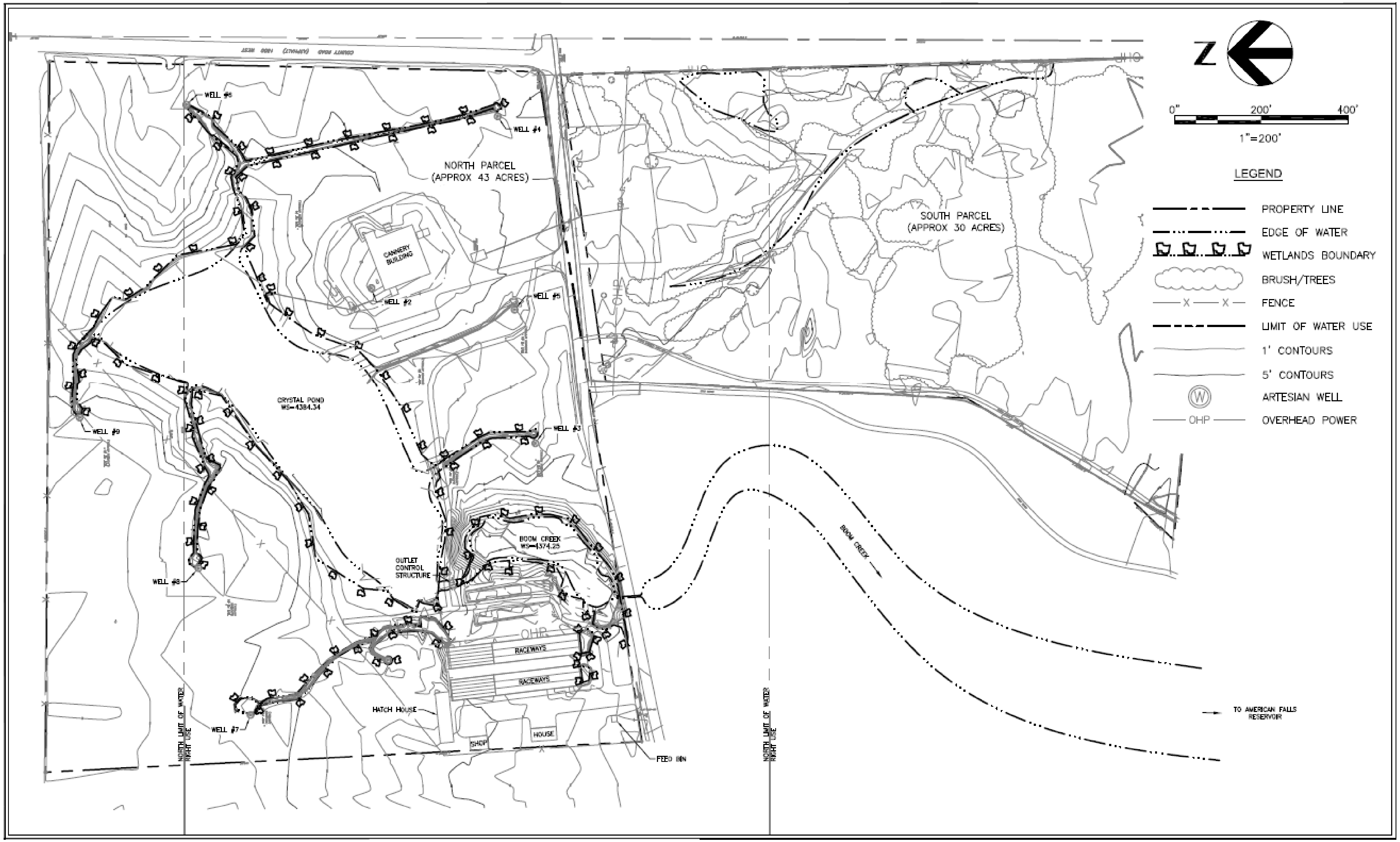


Figure 7-1. Springfield Hatchery Existing Site Conditions

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Figure 7-2. Well head and artesian flow at the overflow outfall of Well #8

Over the last five years, IDFG conducted studies of the artesian flow rates and the underlying aquifer. The combined artesian flow from the wells has been measured at 17 to 18 cfs (7,600 to 8,100 gpm), although flows dropped as low as 8 cfs in spring 2008. An additional 5 to 6 cfs is estimated to be entering Crystal Springs Pond directly from sub-surface springs. Overflow outfall pipe elevations at each well head range from 4388 to 4393 feet, with shut-in static water levels 3 to 7 feet above the overflows when wells are closed one at a time (Clear Water Geosciences 2008), or up to 20 feet above overflow when closed simultaneously. Appendix F provides additional information about the existing aquifer and process water supply system.

Several key water quality parameters were measured during aquifer testing activities in November 2010:

- Average temperature (7 wells measured) 10.24° C
- pH 6.9
- Conductivity 565-595
- Dissolved Oxygen 6.0 to 6.7 mg/l
- Dissolved Nitrogen 107%

Based on the previous trout farm operations at this site, the water supply is known to be well suited for fish production. Detailed water chemistry tests have been conducted and analysis is mostly complete, with no major items of concern noted (see Appendix F). The primary water pre-treatment step will be to increase the dissolved oxygen content of the water supply to near saturation, and reduce dissolved nitrogen to 100% or less, and reduce carbon dioxide to 1.0 mg/l or less, as described in Section 7.3.3.2 below.

7.2.4 Utility Systems

All existing facilities interconnect with utility systems. Services include electrical power from Idaho Power and communications lines from Frontier Communications. Potable water is provided from separate on-site wells using pumps and hydro pneumatic tank systems. In addition, two propane tanks are located near the abandoned cannery building.

Both single phase and three-phase overhead power lines service the existing buildings from the southwest corner of the parcel, and a three phase underground service extends to the cannery building via a pad-mounted transformer on the north side of the building. Idaho Power's existing three phase overhead power lines roughly parallel Edwards Road. These power lines are adequately sized to meet the needs of the proposed facilities.

7.2.5 Fish Culture Facilities

As shown on Figure 7-1, the existing indoor and outdoor trout production facilities were constructed at the lowest elevation portion of the northern parcel to take advantage of gravity flow from the artesian wells. They were evaluated as part of the 2007 Trout Hatchery Master Plan (ES & C 2008) and were found to be in poor condition. The walls, roof and electrical systems of the indoor incubation and early rearing building has experienced severe water damage from condensation and will be demolished as part of the proposed project. The concrete outdoor rearing raceways are configured in two banks, each with a total footprint of 50 feet by 300 feet; the concrete has deteriorated and is not serviceable (Figure 7-3). Artesian water from Wells #1 and #7 presently flows through the bottom of two of the easterly raceway channels.

Figure 7-3. Existing raceways to be demolished

East of the rearing raceways, two earthen ponds (approximately 40 feet wide and 200 feet long) appear to have been used as effluent settling ponds. They have not been maintained and the easterly pond has developed into an artificial wetland, while the westerly pond supports upland vegetation.

7.2.6 Hatchery Housing and Administration

There is one single family residence, currently occupied by an IDFG caretaker, adjacent to the raceways (Figure 7-1). Offices and indoor rearing facilities were housed in a 3,600-square-foot building near the abandoned rearing raceways; these are in poor condition and will be demolished as part of the proposed project.

7.2.7 Other Support Facilities

Although the small 1,200-square-foot shop building is serviceable, its west wall was constructed on the adjacent property. The IDFG has determined that it will be demolished in order to resolve this land use conflict.

As shown on Figure 7-1, a newer masonry block cannery building occupies approximately 12,600 square feet of the southeast quadrant of the parcel. The ground floor contains large rooms with concrete floors, designed for harvesting and processing large quantities of commercially grown trout. A smaller area on the second floor, accessible only by stairs, is mostly office and light storage space. The building has partially deteriorated and would require structural analysis and major rehabilitation if it were to be used for the proposed program. At this time, the project has assigned no proposed use or costs to the abandoned cannery building.

The on-site wastewater disposal system associated with the cannery will be retained for possible disposal of sanitary wastes from the proposed hatchery. The septic tank for the system is located 100 feet south of the building, with a gravity flow pipe routed south under Edwards Road to a large drainfield on the southern parcel.

Existing site drainage, flow control structures and culverts will generally be retained to manage surface water flow from the site.

7.2.8 Subsurface Conditions

In the course of geotechnical work performed in 2007, nine test pits were excavated on the northern parcel. The results of these investigations were summarized in the Trout Hatchery Master Plan (ES & C 2008). The report characterized the site surface soils as mainly sandy silts that are two to three feet thick, underlain by sands, silty sands, clayey sands and clays. Test pits revealed groundwater elevations 4.5 to 6.5 feet below existing grades. Prior to backfilling, 4-inch PVC piezometers were installed in eight of the test pits to monitor groundwater levels. Ongoing monitoring by IDFG shows groundwater levels that vary seasonally from 2.5 to 6.5 feet below ground surface.

7.2.9 Crystal Springs Pond- Public Fishing Site

As a condition of the property purchase, IDFG agreed to maintain the four-acre Crystal Springs Pond as a public fishing site (Figure 7-4). The pond is supplied by artesian flows from up to seven existing wells. A paved parking area, an access trail, and two 16-foot docks are maintained by IDFG, which also periodically stocks the pond with rainbow trout. Because of bio-security concerns, it is unusual to include this type of recreational amenity in conjunction with a sockeye hatchery, particularly due to possible transmission of the IHN virus[6] .

Figure 7-4. Crystal Springs Pond Viewed from the Public Dock

Diverting artesian flows that currently supply the pond for use in the hatchery may increase water residence time in the pond, with a potential minor effect on water quality. Because there also appears to be upwelling spring flow entering the pond (probably from a separate shallower aquifer), this reduction in flow may be adequately mitigated. Any such change is not expected to compromise trout populations or recreational uses. To ensure this is the case, pond water quality will be monitored over time to determine if any changes in hatchery water use are needed to provide more flow through the pond.

7.3 PROPOSED FACILITIES

Preliminary space planning for the proposed Springfield Hatchery improvements showing square footage area requirements for various critical functions is presented in Table 7-1.

[6] There is potential for IHN-infected trout in Crystal Springs Pond to come in contact with the outdoor sockeye raceways, for example, if transported by a raptor and dropped into a raceway when sockeye are present. Human transmission through direct contact with both water systems could also occur. Although such biohazards are unlikely, the potential effect is significant and must be considered in facility design.

Table 7-1. Preliminary Springfield Hatchery space planning.

Function	Space Required
Egg Receiving and Preparation Area	150 SF
Incubation – 72 Stacks	1,200 SF
Quarantine Room	200 SF
Early Rearing – 18 Troughs, 4 ft x 40 ft in pairs	6,900 SF
Flex Tank Area	1,000 SF
Entry Vestibule (2)	140 SF
Public Display	0 SF
Manager's Office	150 SF
4 Staff Offices (open office)	500 SF
Conference Room	400 SF
Mud Room/Janitor Closet	150 SF
Men's Restroom & Showers	250 SF
Women's Restroom & Showers	250 SF
Misc. Storage	150 SF
Chemical Storage	300 SF
Water Treatment (Degassing and Chilling)	300 SF
Multipurpose Room (Lab)	180 SF
Electrical Room	200 SF
Mechanical Room	200 SF
Circulation	1000 SF
Hatchery Building Subtotal	13,620 SF
Utility Building or Wing	
Dry Storage	400 SF
Feed Storage – Cool Room	600 SF
Walk-in Freezer	150 SF
Vehicle Storage/Maintenance	600 SF
Shop	600 SF
Generator Room	230 SF
Circulation @ 10%	250 SF
Utility Building or Wing Subtotal	2,830 SF
Outdoor Facilities	
Pumphouses – 8 @ 150 sf	1,200 SF
Outdoor Rearing - 24 Raceways	53,100 SF
Effluent Treatment	3,000 SF
Parking and Circulation	55,000 SF
Outdoor Facility Subtotal	112,300 SF

Figure7-5 presents a conceptual layout for the main hatchery building. Concept drawings in Appendix E present preliminary designs for all Springfield Hatchery components that would be sited on three acres of previously disturbed land in the southwest portion of the site (see Figure 7-6).

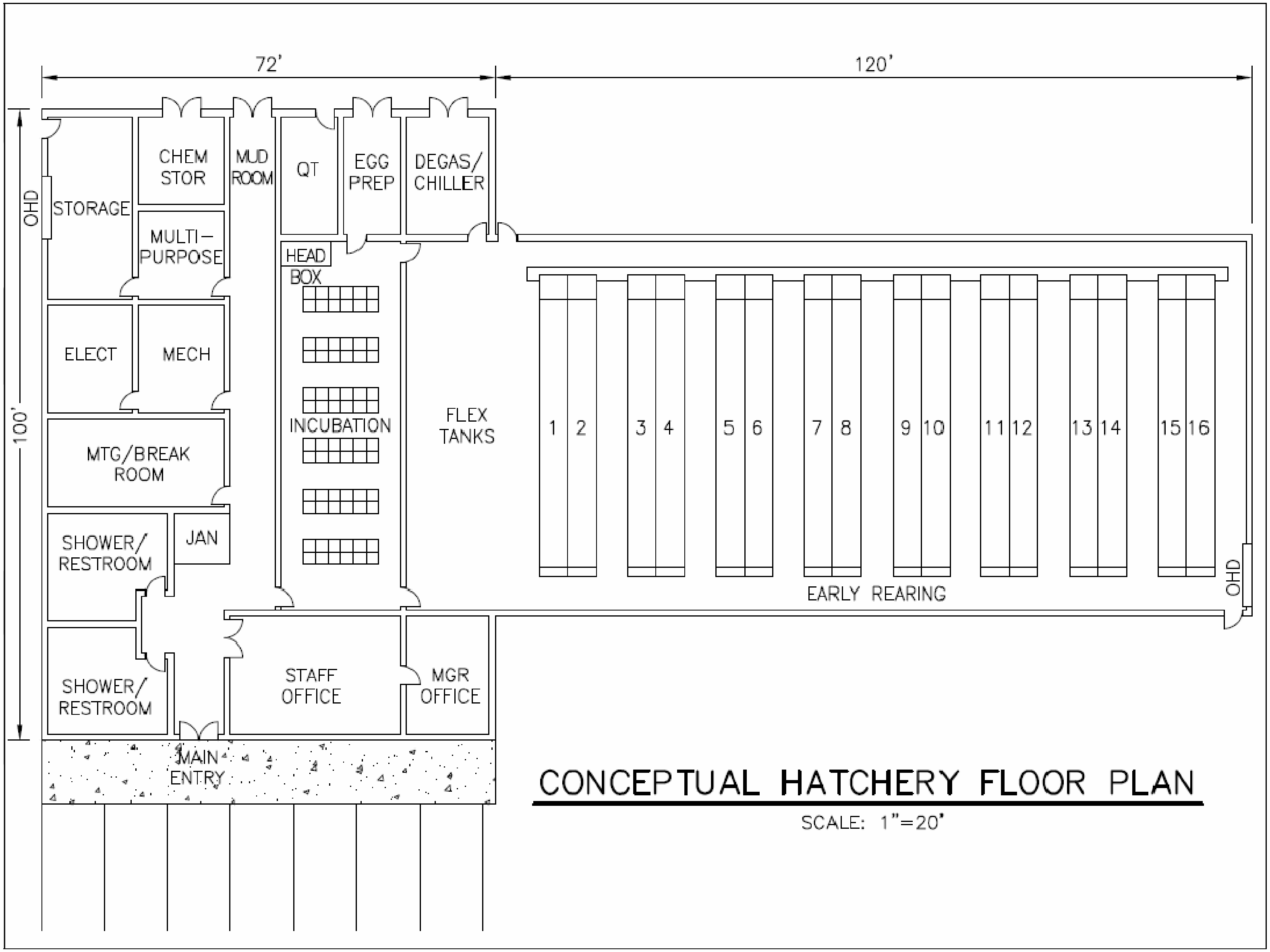


Figure 7-5. Proposed Hatchery Building Floor Plan

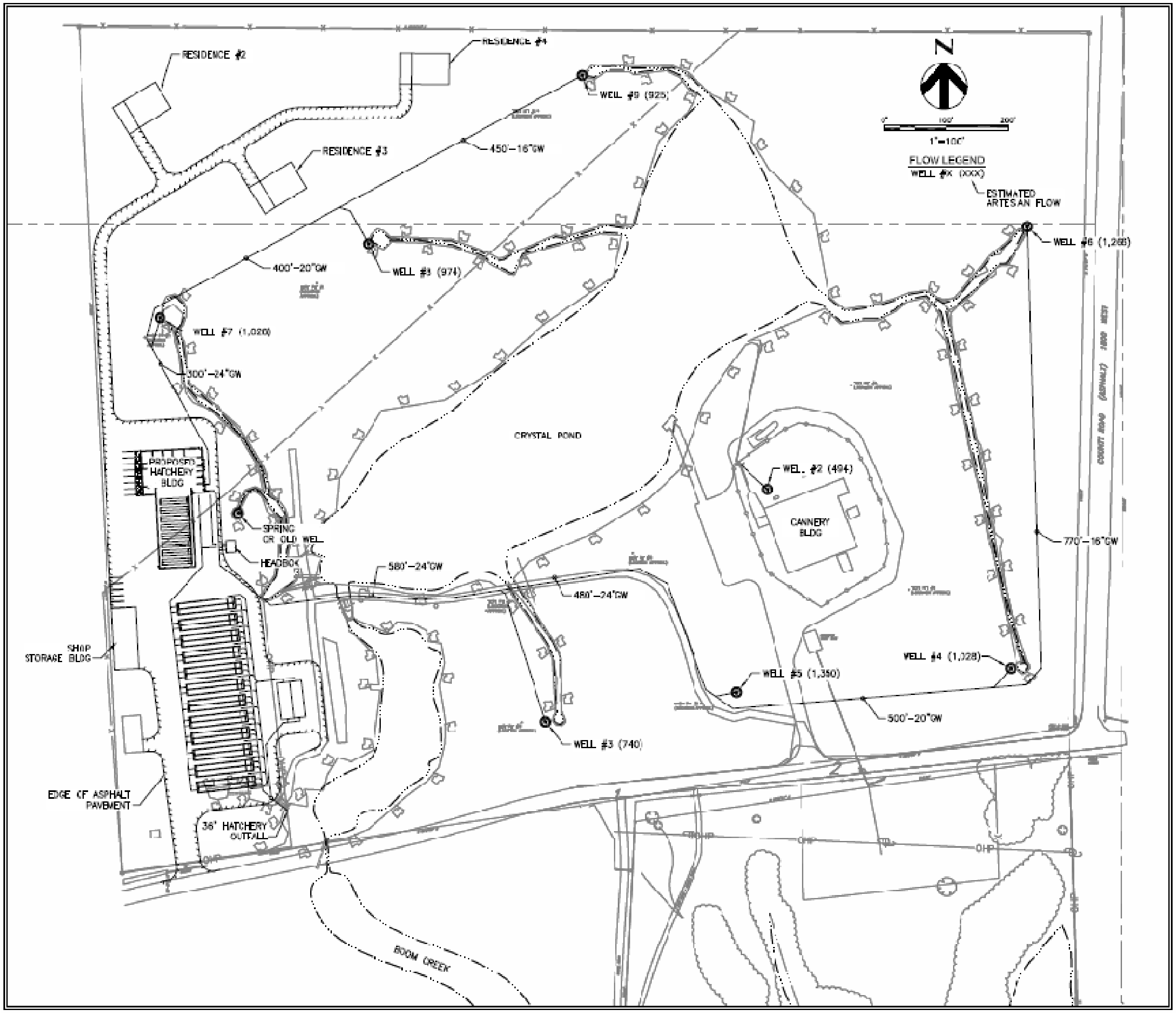


Figure 7-6. Proposed Springfield Hatchery Facilities

7.3.1 Adult Collection Facilities

No improvements to adult collection facilities are proposed under this Master Plan. Eyed eggs will be supplied to the proposed hatchery from IDFG's Eagle Hatchery.

7.3.2 Overview of Springfield Hatchery and Associated Structures

Proposed facilities for the Springfield Sockeye Hatchery include a new hatchery building with offices, lab, restrooms, chemical storage, feed storage, vehicle maintenance, incubation and early rearing tanks, mechanical/electrical rooms, and a chiller/degassing headbox room. Outdoor facilities include water supply well improvements, degassing head boxes, rearing raceways and effluent treatment ponds. Three new residences are also proposed. Each of these features is described below and illustrated in the drawings included in Appendix D.

7.3.3 Process Water Systems

Process water system improvements are a key element of the proposed hatchery. The artesian aquifer that underlies the site provides an excellent source of high quality groundwater for fish rearing, and is the primary reason this site was selected for the project. A hydrogeology report is presented in Appendix F, with recent test pumping results and detailed recommendations for aquifer development to meet the hatchery program water demands. In general, the design approach will be to use gravity flow artesian well water to the greatest degree possible in order to minimize pumping costs.

The water delivery system features a flexible design in order to supply water to critical hatchery functions during low water years, while minimizing pumping to reduce energy costs. The preliminary water budget shown in Table 7-2 indicates that in an average water year, artesian flows will be adequate to meet hatchery demand for at least six months (May through October). During the peak months (November through April), up to four of the highest producing wells will probably need to be pumped in order meet water supply demand. Once pumps are turned on, the amount of artesian flow available to the non-pumped wells will likely decline; however, gravity-supplied flow may still be available.

Table 7-2. Projected peak monthly flows (in gallons per minute) by sockeye lifestage.

Month	Incubation Flow	Early Rearing Flow	Juvenile Rearing Flow	Total Flow
January	362		8,310	8,585
February		250	9,320	9,570
March		480	9,680	10,160
April		1,080	11,820	12,900
May		1,460		1,460
June			1,970	1,70
July			3,000	3,000
August			3,460	3,460
September			4,260	4,260
October			5,440	5,440
November	362		6,120	6,400
December	362		6,850	7,130

In order to achieve energy efficiency, flexibility and reliability in the water system design, the following factors need to be considered and discussed prior to initiating preliminary design work:

- **Elevation to which gravity flow artesian flow can be delivered**. The existing wells are widely spaced around the site as shown in Figure MP-1 in Appendix D. Static water elevations under shut-in conditions range from 4391 to 4398 feet. Overflow outlet pipe elevations range from 4388 to 4393 feet.

- **Aquifer productivity has been in decline for an extended period due to increased irrigation withdrawals and perhaps weather conditions**. Pump sizes and setting depths will be designed to accommodate these trends.

- **Existing ground elevations**. The existing grade of the proposed hatchery building site is 4387 to 4388 feet. The existing top of slab elevation at the proposed raceway area is from 4377 feet on the south end to 4380 feet on the north end.

- **Dissolved oxygen and total gas pressure in the existing supply**. This will indicate to what degree oxygenation and degassing treatment will be required as a pre-treatment measure.

- **Groundwater elevations at the proposed building, raceway and effluent treatment pond locations**. In the course of geotechnical work performed in 2007, several test pits were excavated on the northern parcel. These pits, and follow-up piezometer monitoring by IDFG, indicated groundwater elevations are 4.5 to 6.5 feet below existing grades. None of the pits were excavated near the proposed raceways; however, the water table is expected to be closer to the surface in this area due to its lower elevation. Raceway design will have to consider buoyancy effects from potential high seasonal groundwater levels.

- **Elevation of receiving waters for hatchery effluents**. The wetlands below the Crystal Springs Pond outlet control structure have an approximate water surface elevation of 4374.25 feet. The invert elevation of the proposed raceways and settling ponds will need to be two to three feet above this elevation to ensure gravity flow drainage.

The conceptual hydraulic profile (Figure 7-7) shows the following key elevations:

- Static water level in artesian wells — 4393 to 4397 feet
- Water surface of proposed outdoor rearing ponds — 4383.5 feet
- Floor elevation of proposed hatchery — 4386 feet
- Incubator/early rearing water surface — 4389 feet
- Hatchery headbox water surface elevation — 4395 feet

These elevations will be refined during the preliminary design process to ensure that the hatchery water supply system is flexible, reliable, and energy efficient.

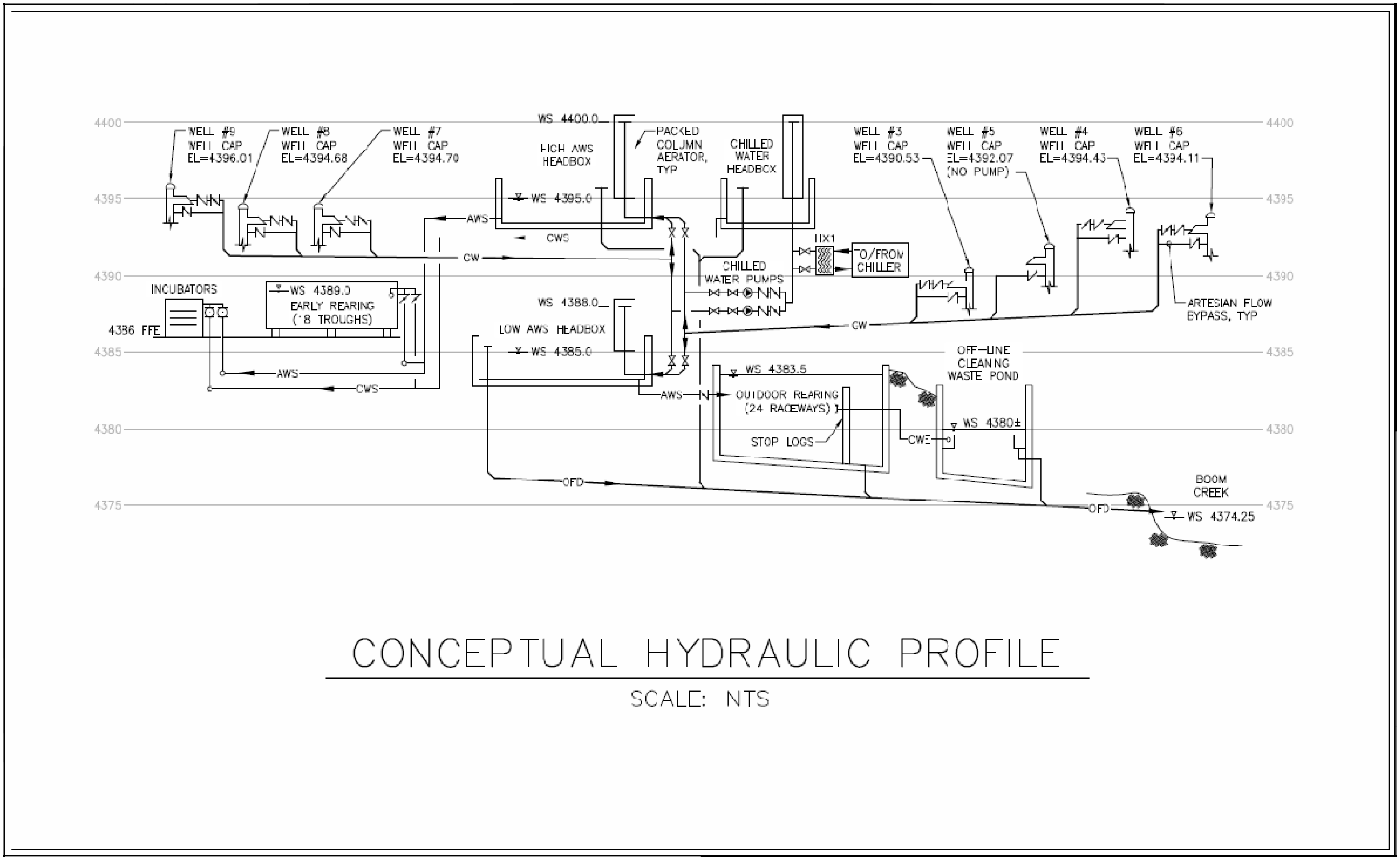


Figure 7-7. Conceptual Hydraulic Profile

Figure MP-5 (Appendix D) shows a conceptual design of a water collection piping system that will deliver water from each well to a central hatchery headbox. The proposed collection system is configured in two separate pipelines: a south system that collects water from Wells 3 through 6, and a north system that collects water from Wells 7 through 9. It may be feasible to run one of the pipelines in gravity flow artesian mode to provide lower elevation raceway flows, while the other pipeline is operated in pumped mode to provide supply water to higher elevations for incubation or early rearing.

The supply water will be treated in aeration/degassing units to raise the dissolved oxygen levels to near saturation and reduce dissolved nitrogen levels. The configuration of headboxes and aeration units will be studied and evaluated during future design phases.

7.3.3.1 Well Head Design

A unique approach to well head design will need to be incorporated to allow most of the existing wells to deliver either pumped or artesian flow. Figure 7-8 shows a conceptual configuration of plumbing improvements at a typical well head. The existing water right requires that flow be measured at the points of diversion, potentially dictating that each well have a meter configured to measure both artesian and pumped flows. Test pumping indicates that the wells tend to produce sand when the pumps are first started up. Provisions will be included for temporary blow-offs in order to minimize the amount of sand that enters the supply system. General weather and freeze protection will be an important well head design consideration and several alternatives are being evaluated. Heated well houses, subsurface pitless adapter units, and insulation with heat trace are under consideration.

Preliminary investigations and predictions indicate that drawdown of the aquifer during pumping will be moderate, on the order of 30 to 40 feet. Friction losses in piping systems and static lift to degassing units will add an additional 15 to 20 feet to pump head requirements. Low head, high volume pumps are proposed for up to six of the existing wells. Four of the pumps would be normal duty during peak demand periods with the two remaining pumps for standby duty. Each pump would have a preliminary design point of approximately 3,200 gallons per minute, at 60 feet of total dynamic head. Pump motors would be in the 50 to 60 horsepower range to meet present day aquifer conditions and may be upsized by 10 to 15 horsepower to accommodate predicted declines in aquifer levels over the next 20 years. Pump motors would be equipped with reduced voltage soft starters, or perhaps variable frequency drives and automatic controls. Each pump would be connected to an emergency generator (two total) to reduce the risk of interruptions to the hatchery water supply.

7.3.3.2 Head Box Design

Groundwater typically has low (below saturation point) dissolved oxygen (DO) levels, and high nitrogen and/or total dissolved gas (TDG) levels. The conceptual design includes dual elevation degassing head boxes; a lower elevation head box for degassing and oxygenating artesian flows (approximate water surface elevation 4,385), and a higher elevation head box for degassing and oxygenating pumped flows (approximate water surface elevation 4,395 or higher). Counter-current air-flow may be used to strip carbon dioxide depending on the results of pilot testing to be completed during the preliminary design phase.

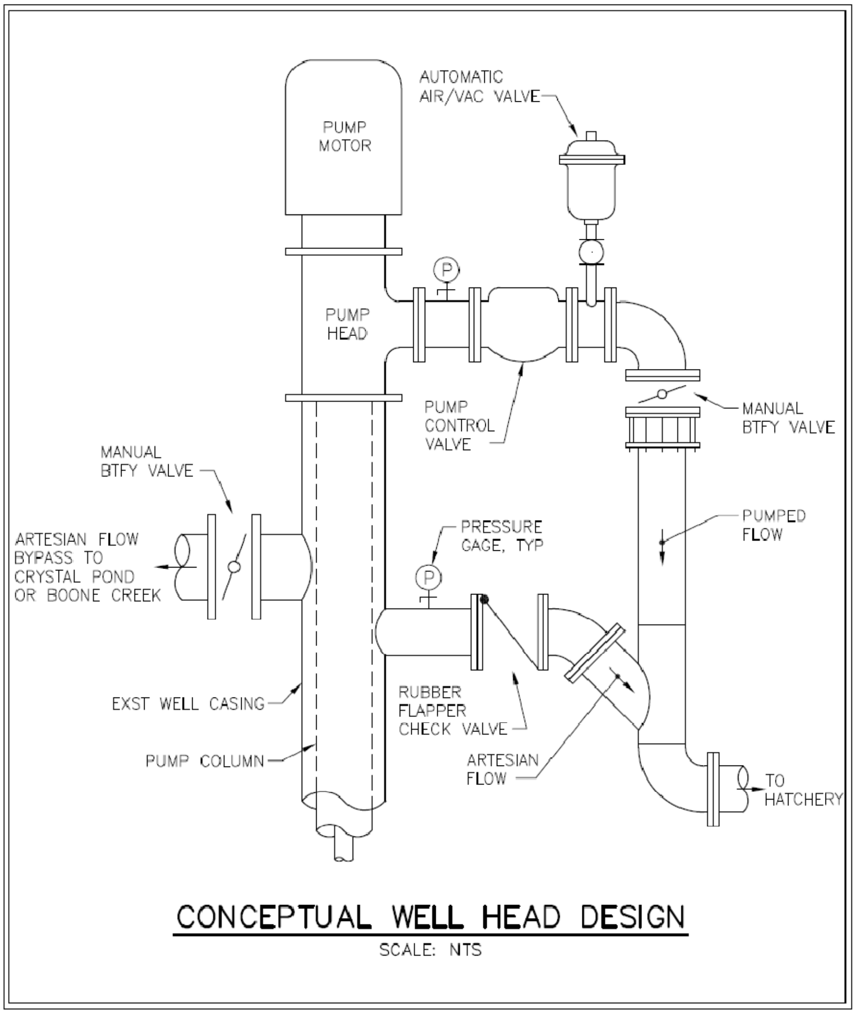


Figure 7-8. Conceptual Well Head Design

There may also be a need for a chiller and associated chilled water head box and piping system that would be used to slow the development rate of eggs and fry in order to produce smolts that meet targets for fish size and release dates. To chill 25% of the incubation flow by 5° F, a 15 to 20 ton chiller will be required for a 70 gpm, single pass flow through system. The final sizing of the chilling system will be determined in during the preliminary design process.

7.3.4 Utility Systems

Utility system improvements are needed to serve the proposed fish hatchery facilities as follows:

- **Power**: Overhead power presently extends to within 100 feet of the proposed hatchery building. A new pad-mounted transformer and three-phase underground electrical service will be provided to the new building and the northern well pumps from this location. A standby diesel generator will provide standby power via an automatic transfer switch at this location. Conductors will be installed in the conduit. Each of the electrical feeds to the well(s) will be tapped from these conductors in manholes as required.

The in order to reduce costs, the southern wells will be powered from the existing 300 KVA service located at the cannery building (if it is retained by IDFG). An additional standby diesel generator will provide standby power via an automatic transfer switch at this location. Conduit would be routed in the pipeline trench when practical. An underground feed from the distribution panel will be trenched in order to minimize conductor length. Conductors will be installed in the conduit. Each of the electrical feeds to the well(s) will be tapped from these conductors in manholes as required (see drawing MP-8 and the one line diagram [MP-9] in Appendix D). If it is determined that the cannery building is to be demolished, the design for the southern wells will need to be reevaluated.

- **Communications**: Phone and data service is available to the site and will be extended to the new hatchery building and residences.

- **Potable Water**: One of the existing artesian wells will become a dedicated potable water well. The potable water demand will increase significantly with construction of three additional residences. A medium pressure well pump and pressure tank system will be installed to meet domestic water demands.

- **Domestic Wastewater**: A large existing septic tank and drainfield system constructed for the abandoned processing plant may be able to serve the hatchery facility. Each of the new residences will have a dedicated septic tank and drainfield. The potable well selected to provide drinking water to the residences will be at least 200 feet away and up-gradient from the closest drainfield(s).

- **Stormwater**: Run-off from the newly developed portions of the site will be directed into filter strips or bio-swales for treatment before discharging into the existing surface drainage systems.

7.3.5 Incubation Facilities

Eyed eggs will be delivered to the Springfield Hatchery each November. The eggs will be disinfected with iodophor in small batches in an egg preparation room and then loaded into heath tray incubators at 4,000 eggs per tray. Excess iodophor will be disposed of by land application or stored in a pump-out tank for periodic remote disposal.

Due to concerns with horizontal disease transmission, the incubators will be configured in four tray stacks with isolation baffles in between each stack. Pathogen-free groundwater will be provided at a flow rate of 4 to 5 gpm to each stack. A total of 72 stacks and 280 to 360 gpm of supply flow will be required. A smaller separate quarantine incubation room will be provided for research and experimental egg handling operations. Both chilled and ambient groundwater supplies will be provided to each incubator.

A hard-piped chemical feed system will be used to deliver argentine or formalin treatments to the main water supply for the incubator stacks on a daily basis to prevent fungus growth on the eggs. Overflow water from the incubators will fall through gratings into floor trenches that convey the water into the hatchery drain system. Adequate dilution flow will be maintained through the hatchery drain system avoid exceeding chemical concentration limits in the hatchery outfall.

7.3.6 Rearing Facilities

- **Early Rearing**: Beginning in February, swim up fry will be transferred from the incubators into early rearing troughs located in a 60- by 120-foot room adjacent to the incubation area. The troughs illustrated in this master plan are 42-foot-long, 4-foot-wide and 2.75-foot deep fiberglass tanks, configured in pairs, with narrow access aisles between each pair. Other styles of troughs will be evaluated during the preliminary design phase. Pathogen free groundwater will be supplied to the upstream end of each rearing trough through a valved connection for flow control. Typical flow rates to each trough will be 80 gallons per minute, at an average temperature of 10° C. Each trough will have screens for segregating and retaining batches of fish, and stop logs or standpipes for water level control. A grated floor trench will run the length of the room at the downstream end of the troughs to collect overflow/drain water and route it into the hatchery drain pipe system. A cleaning waste drain pipe will be routed inside the floor trench to collect and convey vacuumed cleaning wastes to an off-line settling basin.

- **Juvenile Fish Marking**: In late May or early June, IDFG will transfer the sockeye juveniles from the early rearing troughs into large outdoor rearing raceways. The target size for transfer is 200 fish per pound, large enough to be marked during the transfer process in order to reduce overall fish handling. A marking trailer will be mobilized and located in the paved area in between the early rearing room and outdoor raceways. Temporary piping and fish pumping systems will be used to convey the young fish from the early rearing troughs into the marking trailer. After marking, temporary gravity flow piping will be used to transfer the fish into the outdoor raceways.

- **Outdoor Rearing**: The outdoor raceways used for juvenile rearing will be constructed of cast in place concrete, with inlet, outlet and intermediate screens to retain and segregate fish, and stop logs to control water level. The bioprogram (see Appendix D) indicates a total of 22 raceways are required to meet the production goal of one million smolts at 9 fish per pound. Two extra raceways are planned to provide some flexibility in fish handling operations. The 24 raceways will be arranged in 12 pairs, with a six-foot-wide access aisle between each pair. The rearing area of each raceway will be 80 feet long, 8 feet wide, with an average water depth of 4 feet, and a volume of 2,560 cubic feet. An 8- to 10-foot-long quiescent zone will be provided at the downstream end of each raceway to allow settleable solids to separate from the water column. The quiescent zone will have a recessed floor that can be used as a kettle during fish harvest operations.

Up to 540 gallons per minute of groundwater will be supplied to the upstream end of each raceway via a 6-inch valved connection. The overflow drain from each raceway will be piped into a common drain that discharges into the wetland that forms the headwaters of Boom Creek. A separate cleaning waste vacuum piping system will be used to collect settled solids for each raceway and convey the concentrated wastes to an off-line settling pond.

The proximity of the Crystal Springs Pond public fishing area creates potential disease vectors (birds and fish), particularly for the transmission of the IHN virus into the rearing facilities. For this reason, a roof structure over the entire outdoor rearing raceway area is under consideration and is included in the project costs as a recommended bio-security feature. Chain link fence or heavy duty predator netting is proposed for the sidewalls, with regularly spaced gates for worker access.

7.3.7 Hatchery Housing and Administration

The existing residence will be retained and remodeled for use in the new hatchery complex. Situated near the main entrance to the facility, this house will allow staff to monitor traffic in and out of the complex. Three additional housing units are planned, and will be located in the more private area to the north of the proposed hatchery building. The residences will be designed to meet IDFG residential housing standards.

Administration facilities will consist of offices within the main hatchery building. A 150-square-foot manager's office with a door and a 500-square-foot open office area for support staff are planned.

7.3.8 Other Support Facilities

Support facilities located in the main hatchery building will include a conference room/break room, mud room, restrooms and showers, chemical storage, a multi-purpose room (lab), and mechanical and electrical rooms. Additional support facilities, including dry storage, feed storage/cool room, walk-in freezer, vehicle storage and maintenance, shop and emergency generator rooms may be located in the main building or in a separate building as shown on the proposed site plan (see Figure 7-6).

7.3.9 Effluent Treatment Facilities

As noted above, cleaning wastes from early rearing and juvenile rearing cells will be removed using piped vacuum systems that will convey the concentrated wastes (primarily fish feces and un-eaten feed), to a dual cell off-line settling pond. Each of the two settling pond cells will be sized to treat the peak cleaning waste flow from the facility. This will allow one cell to be dewatered and cleaned out without interrupting normal hatchery operations. The settling ponds will be designed to meet guidelines of the Idaho Department of Environmental Quality and US Environmental Protection Agency CFR 40 for confined animal feeding operations.

Preliminary sizing indicates that two side-by-side cells, 15 feet wide by 40 feet long by 4 feet deep, would allow hatchery operators to vacuum clean at least two raceways at a time, with a vacuum flow of 100 gpm each. This is a safety factor four times the IDFG-recommended minimum size. Preliminary calculations also indicate that the nutrient and sediment loads in the hatchery effluent will be far below the TMDL allocation limits identified in Section 7.2.2.

7.4 DEVELOPMENT AND OPERATION SCHEDULES

Planning level production and operations schedules for the proposed Springfield Hatchery have been developed based on the program described in Sections 1 and 5 and the facilities described in Sections 7.1 through 7.3. These schedules demonstrate how the target production of up to one million sockeye salmon smolts will be achieved.

The primary biological variables used to prepare the preliminary operations schedule include water temperature (a species specific condition factor for sockeye), density and flow indices. Water temperature is the primary determining factor in the development and growth rate of fish. The groundwater supply to be used for all stages of incubation and fish rearing will provide relatively constant year round water temperatures. A temperature of 9.5° C was assumed for the winter incubation period and 10° C was used for the early rearing and juvenile rearing periods. Based on these primary biological variables and the sockeye production goals, specific biocriteria were developed and form the basis of the preliminary operations schedule shown in Table 1 of Appendix E. This schedule depicts water use by month and space requirements for each operational area of the fish culture process, including incubation, early start-up rearing and juvenile rearing in outdoor raceways.

The basis of the values used for bio-programming and the criteria used to formulate the operations schedule and water requirements are provided in detail in Appendix D.

The preliminary operations schedule covers a two-year period in order to understand and incorporate overlapping water requirements for juvenile fish (reared to a smolt stage) from two brood years on site at one time. A summary of the full operations schedule (the upper section of Table 1 in Appendix D) shows the timing of incubation, early indoor rearing and juvenile outdoor rearing in raceways. The adult holding component of the program is an existing function that begins each August at off station facilities and runs continuously through the end of October. A summary schedule of the functions proposed at Springfield is:

- Eyed-egg incubation would occur from October through mid-February
- Early rearing in indoor troughs would begin in late January to mid-February and extend through May
- Outdoor juvenile rearing would begin in June and run through the following April

The resulting water requirements show a peak flow of 26.2 cfs (11,783 gpm) to the outdoor rearing facilities for a given brood year, and a concurrent demand of 2.4 cfs (1,077 gpm) for early rearing supply to the successive brood year in April of each year. Thus the total peak demand is estimated to be 28.6 cfs.

8 COST ESTIMATES

8.1 APPROACH TO COST ESTIMATION

8.1.1 Basis of Estimates

The costs presented in this section are consistent with Council's Step Review, Step 1 Master Plan requirements (NPCC 2006). These conceptual costs are a planning baseline from which to refine costs, evaluate alternatives, and protect against budget expansion as the proposed project progresses through the preliminary (Step 2) and final design (Step 3) phases and implementation.

The approach used in this Master Plan to estimate future costs for both operations and capital construction generally follows the principals for inflation and cost escalation described by the Independent Economic Analysis Board in their white paper on Project Cost Escalation Standards (NPCC 2007).

Project cost estimates are based on the proposed program and conceptual designs presented in Sections 1, 5 and 7. As described in previous sections of this Master Plan, IDFG is proposing to construct new facilities at the Springfield, Idaho site (Figures 7-4 through 7-7). Cost estimates for land acquisition, facility planning and design, construction, acquisition of capital equipment, and environmental compliance are presented for the proposed hatchery facilities (Sections 8.2 through 8.6). Research, monitoring, and evaluation, as well as operations and maintenance, are also discussed (Sections 8.7 and 8.8). A tabular summary of project costs is provided in Section 8.1.3 and a 10-year summary of all costs projected from FY 2010 through FY 2020 is presented in Section 8.9.

The proposed facilities will incorporate best management practices for culture of sockeye salmon, which call for isolating incubation lots and rearing groups to avoid disease problems while still ensuring efficient operations and activities for each life stage of the cultured species.

Cost estimates are provided for all program areas from FY 2010 through FY 2020. Construction costs can fluctuate significantly from year to year, as shown in the Engineering News Record (ENR) Construction Cost Index (http://enr.com), which has recorded costs since 1913. Since 1978, changes in annual national averages for construction costs have ranged from +11.6% in 1978 to -0.1% in 2009. The fluctuation range of average construction costs from 1997 through 2010 has been between -0.1% and +9.1%.

At the time this Master Plan was finalized, the construction industry was still experiencing a downturn; however, it is uncertain how various government programs and other market forces may affect costs over the life of the proposed project. Based on the historical information cited in the ENR, construction cost estimates for the Springfield facilities have been escalated at about 3.5% annually to the proposed year of construction. Cost estimates for operations, maintenance, research, monitoring, and evaluation are escalated at 3% annually from FY 2010 through FY 2020. Although these types of costs tend to be more stable historically, the estimates may be high or low in any given year depending on the state of the economy, but, at this time, they are considered to be reasonable. Signs of economic recovery are emerging; therefore, deferring or delaying portions of the project could dramatically increase implementation costs of the proposed facilities.

8.1.2 Funding

A Memorandum of Agreement (MOA) was reached by the State of Idaho, the BPA, U.S. Army Corps of Engineers, and the US Bureau of Reclamation regarding long-term funding for projects related to the “protection and recovery of salmon and steelhead listed under the Endangered Species Act …” The MOA recognizes the State of Idaho as a “partner in pursuit of the protection and recovery of upper Salmon River listed evolutionarily significant units (ESUs).” “Long-term” funding indicates BPA funding for ten years. The parties to the agreement consider that its provisions are consistent with NPCC’s major project requirements and review (Section 3.0). More information on the MOA, also referred to as the Fish Accords, is found in Section 3.3.9.1 and Appendix B.

The draft FCRPS (RPA Hatchery Strategy 2, Action 42) includes language specifically directing the Action Agencies to fund expansion of the ongoing safety net program to increase sockeye salmon smolt releases to between 500,000 and one million fish annually. Anadromous adults that return to the program from increased reintroduction efforts will be used in controlled hatchery spawning events as well as released to the habitat to spawn naturally.

Specifically, to meet the intent and terms of the MOA, this project would acquire and develop a new conservation hatchery designed to produce up to one million Snake River sockeye salmon smolts annually for reintroduction in the Sawtooth basin. The flexibility to accommodate additional conservation hatchery programs as well as localized broodstock development programs would be incorporated into the design of the facility.

8.1.3 Cost Sharing with Other Organizations and Entities

Cost sharing will be an important aspect of funding the proposed program. Conceptual costs take into consideration the extensive amount of cost sharing that is occurring in current programs and that is expected to continue into the future.

Most cost sharing identified for the IDFG's Snake River sockeye program currently relates to the captive broodstock program. Cost sharing includes both direct funding and in-kind support. Table 8-1 shows the cost sharing entities involved, including IDFG, NOAA Fisheries, Oregon Department of Fish and Wildlife, and the Shoshone-Bannock Tribes. While these cash and in-kind contributions are not shown as direct deductions from the line item budgets presented in this document, they were considered when developing cost estimates if they potentially affected a cost area in the future.

8.1.4 Program Areas and Major Milestones

Completing the Council's Three-Step process often requires three to five years. During this time, considerable planning, design, environmental compliance and analysis of alternatives will occur. A generalized list of program areas and a preliminary time line linking costs to planning; construction; capital equipment; environmental compliance; operations and maintenance; and research, monitoring, and evaluation is presented in Figure 8-1 for FY 2010 through FY 2020. A cost summary by program area is shown in Table 8-2. Cost estimates for each program are presented in the year in which they are expected to occur and are shown in Table 8-10; costs are escalated from FY 2010.

8.2 COST ESTIMATES FOR LAND ACQUISITION

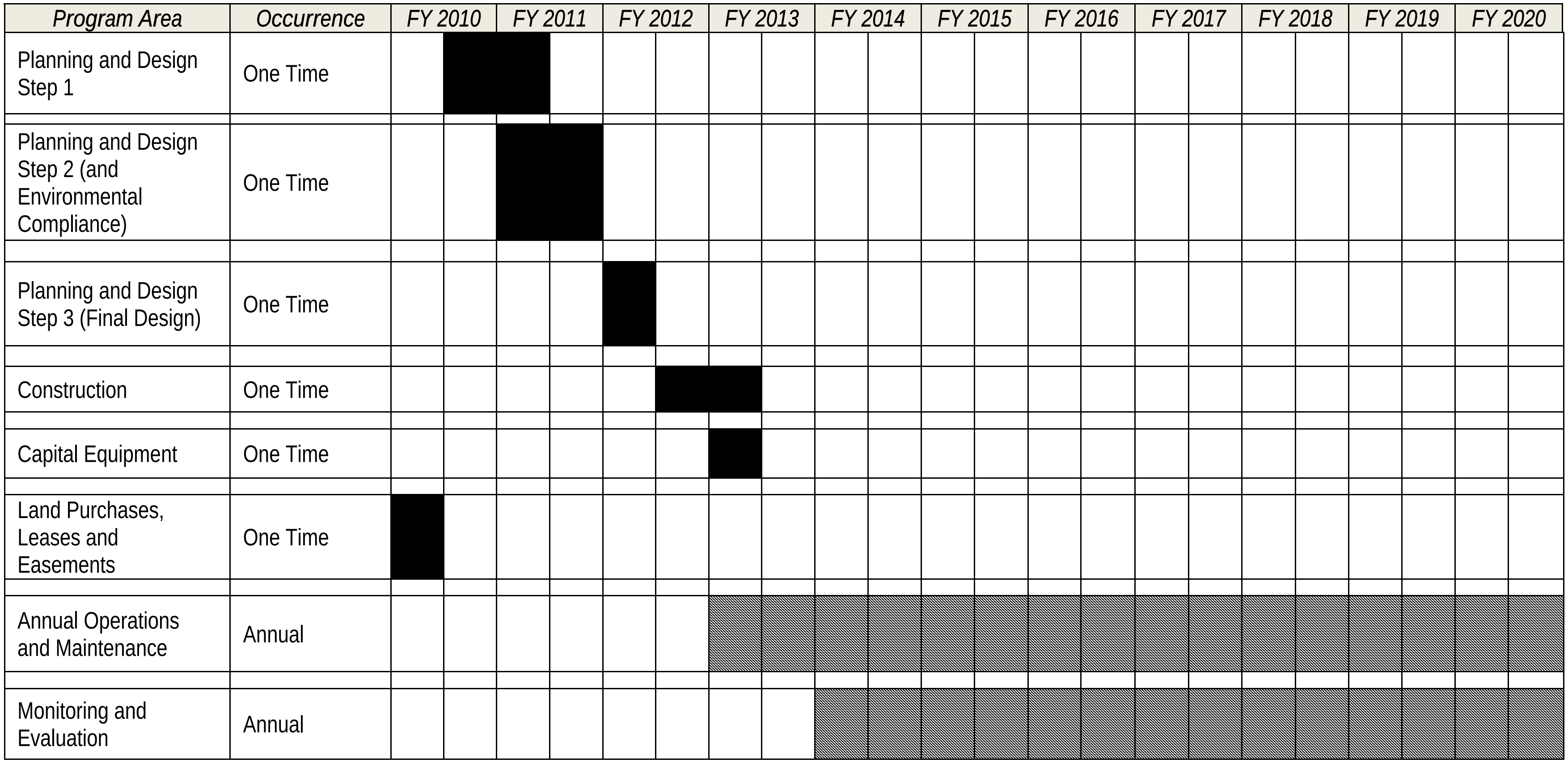
The Idaho Fish and Wildlife Foundation acquired the site of the former Springfield Trout Hatchery in Bingham County. The 73-acre site consists of two parcels that are separated north and south by Edwards Road (Figure 7-1). In July 2010, BPA acquired the site from the Idaho Fish and Wildlife Foundation for $4.75 million (Table 8-2). Funding for the acquisition was provided through BPA's 2008 Columbia Basin Fish Accords agreement with the State of Idaho (Idaho et al. 2008). The details of the acquisition involved purchasing the land from the Idaho Fish and Wildlife Foundation for $1.96 million and establishing a trust fund totaling $2.79 million for the IDFG to offset the loss of the Springfield site as a resident trout hatchery for the state.

Table 8-1. Summary of cost sharing for Springfield Hatchery Sockeye Program.

Funding Source or Organization	Date / Fiscal Year	Item or Service Provided	Cash or In-Kind Contribution	Status	Amount
Idaho Department of Fish and Game	FY 2007 – FY 2009	Facility improvements for Snake River Sockeye Captive Brood Program	In-Kind	Confirmed	$18,000
Idaho Department of Fish and Game	FY 2007 – FY 2008	On the ground contribution for Snake River Sockeye Captive Brood Program	In-Kind	Confirmed	$21,150
Idaho Department of Fish and Game	FY 2009	On the ground contribution for Snake River Sockeye Captive Brood Program	Cash	Confirmed	$379,300
Idaho Department of Fish and Game	FY 2007 – FY 2009	Oversight and planning and personnel for Snake River Sockeye Captive Brood Program	In-Kind	Confirmed	$42,000
NOAA Fisheries	FY 2007 – FY 2009	Personnel and facilities for Snake River Sockeye Captive Brood Program	In-Kind	Confirmed	$548,889
Oregon Department of Fish and Wildlife	FY 2007	Facility improvements, Oxbow Hatchery for Snake River Sockeye Captive Brood Program	Cash and In-Kind	Confirmed	$95,725
Oregon Department of Fish and Wildlife	FY 2007	Hatchery O&M and personnel services Oxbow Hatchery for Snake River Sockeye Captive Brood Program	Cash and In-Kind	Confirmed	$60,300
Shoshone-Bannock Tribes	FY 2007	Cost share with USFS for habitat work at Redfish and Alturas lakes for improving water quality	In-Kind	Confirmed	$15,300
				Totals	$1,180,664

Notes and Assumptions:

- Estimates are provided from the Cost Share Report in BPA's Pisces system
- Cost shares relate to the Snake River Sockeye Captive Brood Program
- Figures provided are consistent with the FY 2007 – FY 2009 Proposal as of October 19, 2010 (Project 2007-402-00)
- Estimated cost shares are accounted for in all budgets presented
- Most of the cost shares shown are from BPA funding



Notes & Assumptions:

Assumes proposed Step 2 and Step 3 funding is available on this schedule
Assumes a design/build or modified design/build approach is utilized between Step 2 and Step 3
Assumes construction starting in early 2012 (one year schedule is dependent on a Spring 2012 construction start)
Assumes all proposed facilities and improvements are built in one construction season (during FY 2012 and early FY 2013)
Assumes no major environmental compliance issues are identified beyond what is described in Section 3.3.10
O&M expenditures will likely start during the last phases of construction (FY 2013) allowing for training and handoff of new facilities and equipment
M&E expenditures will likely start after the last phases of construction (FY 2014)

Figure 8-1. Springfield Hatchery General Timeline for Key Milestones and Expenditures.

Table 8-2. Summary of key expenditures by program area.

Program Area	Estimated Cost	Occurrence	Level of Certainty
Planning & Design Step 1 *	$298,405	One Time	Contract to develop Step 1 Master Plan
Planning & Design Step 2 **	$500,000	One Time	Placeholder (less than concept)
Planning & Design Step 3 ***	$400,000	One Time	Placeholder (less than concept)
Construction	$13,579,928	One Time	Concept (+/- 35% to 50%) (escalated to 2012 dollars)
Capital Equipment	$218,249	One Time	Concept (+/- 35% to 50%) (escalated to 2013 dollars)
Environmental Compliance Step 2 (Permitting, EA, Other)	$136,733	One Time	Concept (+/- 35% to 50%) Completed during Step 2 (2011 dollars)
Land Purchases, Leases & Easements ****	$4,750,000	One Time	Expenditure complete
Annual Operations & Maintenance / Springfield Hatchery Programs	$769,795	Annual	Concept (+/- 35%) (escalated to 2013 dollars)
Monitoring & Evaluation *****	$286,998	Annual	Concept (+/- 35%) (escalated to 2014 dollars)

Notes and Assumptions:

- * Shows the actual contract figure for completion of a Step 1 Master Plan
- ** Shows an estimated placeholder cost estimate based on the conceptual construction cost
- *** Shows an estimated placeholder cost estimate based on the conceptual construction cost
- **** Land cost was $1.96 million; remainder went to a trust fund totaling $2.79 million with IDFG to offset the loss of the Springfield site as a resident (trout) fish production facility for Idaho
- ***** Monitoring and Evaluation includes annual tagging costs of over ~$125,000
- Budget figures assume that work would proceed on the timeline shown in Figure 8-1

8.3 COST ESTIMATES FOR FACILITY PLANNING AND DESIGN

IDFG has solicited input from a range of experts during Step 1 conceptual planning in order to avoid significant design and program changes in later planning stages. IDFG also sought to validate the program, design criteria, and cost estimates to the maximum extent possible through comprehensive early reviews. IDFG intends to continue to solicit input and review by a team of knowledgeable individuals through the Step 2 and 3 processes.

8.3.1 Step 1 Conceptual Planning and Design

The total budget for the conceptual planning and design work is about $298,405 (Table 8-2). This figure is based on a contracted amount to complete the Step 1 Master Plan and includes conceptual planning, engineering, and development of the Step 1 Master Plan and ultimately responding to the NPCC and ISRP review of this Master Plan.

8.3.2 Step 2 Preliminary Planning and Design

The preliminary planning and design stage, intended to meet the Council's Step 2 requirements, is designed to identify any major difficulties or concerns with the program and facility designs. Step 2 design work should provide sufficient detail and specifics to assure that the intent and scope of Step 1 conceptual design work can be met and to further refine the cost estimates. Step 2 will include refinement of scientific information, environmental compliance and ESA reviews. In addition, IDFG may implement a value analysis (also known as value engineering) near completion of the Step 2 planning and design work.

A placeholder of $500,000 has been identified for Step 2 preliminary planning, environmental compliance, site investigations and design. Initiation of this work is proposed in FY 2011 (Table 8-2). This budget includes costs for drilling test wells, surveying and other investigative geotechnical work. The budget may need further refinement depending on the outcome of the Step 1 Master Plan approval process.

8.3.3 Step 3 Final Planning and Design

A placeholder of $400,000 (Table 8-2) has been identified for the Step 3 final planning and design stage. It is anticipated that this work will begin in FY 2012. Refinement of the Step 3 planning and design budget will occur in Step 2 during development of the preliminary design.

The cost estimates provided for planning and design assume that facilities will be developed along the timeline shown in Figure 8-1. Should the program be delayed or implemented in phases, costs for planning and design could increase if facility designs, construction specifications and planning and design documents are performed in multiple packages. The proposed schedule will result in more cost effective planning and implementation for Step 2, Step 3, implementation of construction, and long-term program operations.

Step 3 is the final design review prior to construction. Development plans are advanced to a confidence level of +/- 10 to 15% and are ready for bid. A 100% cost estimate accompanies this submittal along with details on all operational plans.

IDFG proposes, and respectfully asks that the Council consider the following steps to accelerate post-Step 3 project implementation. Rather than starting a bid process and contracting a successful bidder for construction following Step 3 approval (which can take up to a year for a major project), IDFG proposes to adopt a design/build approach. Following completion of the Step 2 preliminary design, IDFG, would competitively solicit a construction firm to work in partnership with the design engineers and fish culturists to develop the Step 3 final design. Selection of a construction firm would be based on the firm's estimated costs, experience, approach and other critical considerations. The firm would provide representatives to work with design engineers to complete the Step 3 final design, resulting in a constructible and cost effective design. A final construction contract would be negotiated at completion of the final design and Step 3 approval.

This approach would provide the most realistic construction cost estimate possible in Step 3. Because of contractor pre-selection, it would also allow IDFG and BPA to begin construction immediately after formal NPCC approval of the Step 3 design submittal and the acquisition of necessary permits. This approach could compress the overall timeline for implementation, resulting in significant cost savings and reduced risk without altering the Council's requirements for the Step 3 submittal or approval, while also helping to ensure that these vitally needed new facilities are adequately reviewed and completed at the earliest possible juncture.

8.4 CONSTRUCTION

These costs are concept estimates based on a conceptual design. Due to the level of uncertainty, an approximately 20 to 25% contingency is applied to each construction cost area. Such a contingency is largely dependent on the number of uncertainties associated with the project and the amount of pre-investigation work completed. Estimated construction costs represent a maximum range and likely cost reductions would be identified in future planning stages through analysis of alternatives and elimination of many uncertainties.

The current estimate for capital construction is based on the descriptions of facilities and infrastructure provided in Section 7.2, Existing Facilities, and Section 7.3, Proposed Facilities.

8.4.1 Probable Construction Costs

Existing facilities components include nine artesian wells, two large banks of concrete raceways, an office/hatchery building, a small shop, a cannery/processing plant that also contains offices, a feed storage silo, and a single family residence. The site also features a 4-acre public fishing pond, Crystal Springs Pond, and an associated public parking and access area. Construction costs associated with renovating and or demolishing existing facilities are included in Table 8-3; details of this work are provided in Section 7.3. Figure 7-5 shows the layout for the main hatchery building. Proposed new hatchery components include process water systems, well head modifications, a head box, utility systems, incubation facilities, rearing facilities, housing, administration and other support facilities, and effluent treatment facilities.

Table 8-3 summarizes the estimated construction costs for each component of the Springfield Hatchery. Costs are broken down into major infrastructure and facility components and are based on the scope and conceptual descriptions presented in Section 7. Details of these estimates are found in Appendix E-1. The estimated construction budget for Springfield Hatchery is $13.5 million. These estimated costs do not include land purchase or lease (these costs are presented in Section 8.2). These estimates are based on conceptual design and include a contingency of about 25% to accommodate the level of uncertainty at this stage.

The IDFG proposes to implement all components of the Springfield Hatchery as a single project. Phasing construction over two years would likely increase overall costs and the proposed hatchery components are relatively simple.

Table 8-3. Summary of estimated construction costs.

Description	Total
Process Water Supply to Head Boxes	$1,384,712
Head Boxes, Chiller and Degassing	$287,217
Site Work and Utilities	$715,940
Process Water Distribution and Drains	$260,240
Hatchery Building – 14,275 SF	$3,290,096
Shop/Storage Building – 2,830 SF	$515,725
Outdoor Rearing – 24 Production Raceways	$3,917,248
Effluent Settling Structure – Dual Cell	$122,675
Hatchery Housing – Remodel (1), New (3)	$787,500
Construction Cost Subtotal	*$11,281,353*
Inflation/Escalation to Mid-Point Construction *	$12,071,048
Mob/Demob, General Conditions***	$1,508,880
Subtotal	$13,579,928
Taxes **	$0
Probable Total Cost (2012 Dollars)	$13,579,928

Notes & Assumptions:

- Cost estimate in 2010 dollars
- *Inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- ** Tax exempt
- *** Mobilization/Demobilization: General conditions include inflation/escalation at 3% to mid-point construction date of 2012 (7% total from 2010 to mid-2012)
- Costs should be considered conceptual (+/- 35% to 50%)

8.5 CAPITAL EQUIPMENT

Implementing the proposed program will require acquisition of new equipment. The new Hatchery will require investment in various types of equipment from office furniture and laboratory equipment to water systems. Table 8-4 lists the potential types of equipment by functional area of the proposed operation and their probable costs. A conceptual estimated budget of $218,000 (escalated from FY 2010 to FY 2013, when equipment would be needed) has been included for capital equipment associated with the new facilities and operation.

Table 8-4. Capital equipment budget by facility/hatchery functional area.

Description	Total Cost (FY 2010 Dollars)	Total Cost (FY 2013 Dollars)
Office Equipment	$4,700	$5,123
Computers / Printers	$0	$0
Office Furniture and Cabinets	$9,800	$10,682
Communications Equipment	$15,728	$17,144
Housing Equipment and Furniture / Permanent Staff Housing	$9,500	$10,355
Housing Equipment and Furniture / Temporary Staff Housing	$13,900	$15,151
Shop Equipment	$15,500	$16,895
Buildings / Facilities Needs	$6,500	$7,085
Transportation	$0	$0
Water System Operation	$2,200	$2,398
Incubation	$2,600	$2,834
Fish Transport	$55,500	$60,495
Sockeye Rearing at Hatchery	$30,600	$33,354
Sockeye Rearing at Acclimation Ponds	$0	$0
Tagging	$0	$0
M&E Equipment	$0	$0
Technical / Lab Equipment	$8,700	$9,483
Disinfection Equipment (Other Disease and Pathology Needs)	$5,500	$5,995
Other	$19,500	$21,255
Total	$200,228	$218,249

Notes & Assumptions:

- Costs shown in 2010 and 2013 dollars
- Expenditures will occur in late 2012 and 2013
- Costs are escalated at 3% annually
- Costs should be considered conceptual (+/- 35% to 50%)
- Items are not duplicated in the capital construction and operating budgets

8.6 ENVIRONMENTAL COMPLIANCE

Developing the proposed Springfield Hatchery as part of the ongoing Snake River sockeye program will incur environmental compliance costs subsequent to this master planning stage. Compliance steps for the proposed program will include the National Environmental Policy Act (NEPA), a Biological Assessment under the Endangered Species Act, and other laws and regulations that are discussed in Section 3.3.10. Table 8-5 presents the estimated cost by potential permit or other compliance requirement. Costs are estimated to be approximately $137,000 to meet all requirements to implement the project.

Table 8-5. Estimated cost of environmental compliance.

Project Area/Permit/Requirement	Estimated Cost to Complete (2010 dollars)	Estimated Cost to Complete (2011 dollars)
Water Supply / Quality		
Groundwater Right (need to be determined)	$5,000	$5,150
NPDES General Construction Stormwater (EPA) and Storm Water Pollution Prevention Plan (SWPPP)	$10,000	$10,300
NPDES – Hatchery Discharge (EPA/IDEQ)	$7,000	$7,210
Section 401 Water Quality Certification	$5,500	$5,665
Planning Approvals		
NEPA EA or EIS and Record of Decision	$75,000	$77,250
ESA Section 7 Compliance – Biological Opinion	$10,000	$10,300
Section 106 Cultural Resources Clearance	$5,000	$5,150
Wetland Delineation	$8,000	$8,240
Construction		
Section 404 (wetlands impacts) (Corps)	$3,000	$3,090
Bingham County Commercial Building Permits	$2,500	$2,575
Bingham County Road Permits	$1,500	$1,545
Fugitive Dust Control (IDEQ)	$250	$258
Total	$132,750	$136,733

Notes & Assumptions:

- Assumes majority of expenditures will occur in FY 2011
- Costs should be considered conceptual (+/- 35% to 50%)
- Concept completed during Step 2 (2011 dollars)

8.7 OPERATIONS AND MAINTENANCE

The following sections present cost estimates associated with operations and maintenance of the proposed Springfield Hatchery program.

8.7.1 Annual Operating Costs

Operating costs for the proposed hatchery are shown in Table 8-6. Expenses include such items as payroll, utilities, vehicles, supplies, maintenance, some specific tagging expenses and potential subcontracted support services. The IDFG estimates that the annual budget for operations and maintenance will be $704,000 annually. If this estimate is escalated from 2010 to 2013 dollars (the year that these expenses would be incurred), operational expenses would be about $770,000 annually.

Table 8-6. Annual operating expenses.

Expense Area	Estimated Operations Costs (2010 dollars)	Estimated Operations Costs (2013 dollars)
Payroll (Taxes, Benefits, Mark-ups)	$385,134	$420,847
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	$10,512	$11,487
Repairs and Maintenance (Site, Buildings, Equipment)	$9,000	$9,834
Rent and Lease (Equipment, Vehicles)	$46,103	$50,378
Program Supplies (Shop, Office)	$7,500	$8,195
Program Supplies (Lab, Water System, Eggtake, Incubation)	$9,700	$10,599
Program Supplies (Rearing and Release)	$115,200	$125,882
Program Supplies (Tagging, Tag Recovery)	$0	$0
Utilities (Electrical, Telephone)	$98,960	$108,137
Travel Costs (Mileage, Lodging, Per diem)	$10,476	$11,447
Education and Training	$1,505	$1,644
Subcontracts (Professional Fees, Testing, Sampling)	$8,000	$8,742
Facility Insurance	$2,382	$2,603
Total	$704,472	$769,795

Notes & Assumptions:

- Full annual operating costs expected to start in FY 2013
- Estimated costs for existing operations program do not include M&E costs
- Tagging costs are included as M&E cost estimates
- Costs are escalated from 2010 to 2013 at 3% annually
- Costs should be considered conceptual (+/- 35% to 50%)

8.7.2 Projected Operating Expenses

Operating expenses from FY 2010 to FY 2020 are shown in Table 8-7. It is expected that the facility would be constructed in FY 2012 and 2013 and operational costs would start to be incurred in FY 2013. Cost estimates for operations, maintenance, research, monitoring, and evaluation are escalated at 3% annually from FY 2010 through FY 2020. These types of costs tend to be more stable historically than construction costs.

Table 8-7. Springfield Hatchery operating expenses- 10-year projection.

Expense Area	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Payroll (Taxes, Benefits, Mark-ups)	$385,134	$396,688	$408,589	$420,847	$433,472	$446,476	$459,871	$473,667	$487,877	$502,513	$517,589
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	$10,512	$10,827	$11,152	$11,487	$11,831	$12,186	$12,552	$12,928	$13,316	$13,716	$14,127
Repairs and Maintenance (Site, Buildings, Equipment)	$9,000	$9,270	$9,548	$9,834	$10,129	$10,433	$10,746	$11,069	$11,401	$11,743	$12,095
Rent and Lease (Equipment, Vehicles)	$46,103	$47,486	$48,911	$50,378	$51,889	$53,446	$55,049	$56,701	$58,402	$60,154	$61,959
Program Supplies (Shop, Office)	$7,500	$7,725	$7,957	$8,195	$8,441	$8,694	$8,955	$9,224	$9,501	$9,786	$10,079
Program Supplies (Lab, Water System, Eggtake, Incubation)	$9,700	$9,991	$10,290	$10,599	$10,917	$11,244	$11,582	$11,929	$12,287	$12,656	$13,035
Program Supplies (Rearing and Release)	$115,200	$118,656	$122,215	$125,882	$129,658	$133,548	$137,555	$141,681	$145,932	$150,310	$154,819
Program Supplies (Tagging, Tag Recovery)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Utilities (Electrical, Telephone)	$98,960	$101,929	$104,987	$108,137	$111,381	$114,722	$118,164	$121,709	$125,360	$129,121	$132,995
Travel Costs (Mileage, Lodging, Per diem)	$10,476	$10,790	$11,114	$11,447	$11,790	$12,144	$12,508	$12,884	$13,270	$13,668	$14,078
Education and Training	$1,505	$1,550	$1,597	$1,644	$1,694	$1,745	$1,797	$1,851	$1,906	$1,964	$2,022
Subcontracts (Professional Fees, Testing, Sampling)	$8,000	$8,240	$8,487	$8,742	$9,004	$9,274	$9,552	$9,839	$10,134	$10,438	$10,751
Facility Insurance	$2,382	$2,454	$2,527	$2,603	$2,681	$2,762	$2,845	$2,930	$3,018	$3,108	$3,202
Totals	$704,472	$725,606	$747,374	$769,795	$792,889	$816,676	$841,176	$866,411	$892,404	$919,176	$946,751

Notes & Assumptions:

- Estimated costs are escalated at 3% annually in all operational areas

8.8 RESEARCH, MONITORING, AND EVALUATION

A conceptual framework for the proposed monitoring and evaluation plan will be designed to ensure that the program achieves the performance standards established for natural production and in-hatchery culture practices and operations (Section 6). A more detailed description of the monitoring and evaluation program is presented in the draft HGMP (Appendix A). This plan will be developed further in Step 2 of the three-step planning process. This section provides estimated conceptual costs for research, monitoring and evaluation associated with descriptions in Section 6.

8.8.1 Annual Research, Monitoring and Evaluation Costs

Costs associated with monitoring and evaluation are summarized in Table 8-8. The majority of the expected costs are for fish tagging and labor, including the costs to mark and/or tag one million smolts. The IDFG estimates that the annual budget for monitoring and evaluation will be about $287,000 annually. If this estimate is escalated from 2010 dollars to 2014 (when costs would start to be incurred), operational expenses would be $323,000 annually.

Table 8-8. Annual monitoring and evaluation expenses.

Expense Area	Estimated Annual Expenses (2010 dollars)	Estimated Annual Expenses (2014 dollars)
Payroll (Taxes, Benefits, Mark-ups)	$120,797	$135,958
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	$8,687	$9,777
Repairs and Maintenance (Site, Buildings, Equipment)	$5,377	$6,052
Rent and Lease (Equipment, Vehicles)	$8,533	$9,604
Program Supplies (Shop, Office, Lab)	$7,031	$7,913
Program Supplies (Tagging, Tag Recovery)	$827	$931
Utilities (Electrical, Telephone)	$2,895	$3,258
Travel Costs (Mileage, Lodging, Per diem)	$4,956	$5,578
Education and Training	$1,241	$1,397
Subcontracts (Professional Fees, Testing, Sampling)	$125,827	$141,619
Postage, Dues and Subscriptions	$828	$932
Total	$286,998	$323,019

Notes & Assumptions:

- Estimates shown in 2010 and 2014 dollars
- Costs are escalated from 2010 to 2014 at 3% annually
- Costs should be considered conceptual (+/- 35% to 50%)

8.8.2 Projected Research, Monitoring and Evaluation Costs

Estimated monitoring and evaluation expenses from 2010 to 2020 are shown in Table 8-9. It is expected that the facility would be constructed in FY 2012 and FY 2013 and monitoring and evaluation costs would start to be incurred in 2014. Cost estimates for operations, maintenance, research, monitoring, and evaluation are escalated at 3% annually from FY 2010 through FY 2020.

8.9 TEN-YEAR FUTURE COST SUMMARY

Estimated 10-year costs to operate the Springfield Hatchery program from FY 2010 through FY 2020 are presented in Table 8-10. As stated in Section 8.1.3, costs for each program area are escalated to the year in which they are expected to occur. This estimated cost summary assumes planning and implementation of new facilities for Springfield Hatchery would occur in 2010 through 2012.

As previously noted, consistent with Step 1 of the Council's Three-Step process, cost estimates at this stage are conceptual. The IDFG will refine these estimates during the Step 2 and Step 3 planning phases. This 10-year estimated cost summary is designed to be a planning tool and will be updated as costs are refined.

Table 8-9. Monitoring and evaluation expenses- 10-year projection

Expense Area	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Payroll (Taxes, Benefits, Mark-ups)	$120,797	$124,421	$128,154	$131,998	$135,958	$140,037	$144,238	$148,565	$153,022	$157,613	$162,341
Vehicles (Fuel, Oil, Maintenance, Mileage, Insurance)	$8,687	$8,947	$9,216	$9,492	$9,777	$10,070	$10,372	$10,684	$11,004	$11,334	$11,674
Repairs and Maintenance (Site, Buildings, Equipment)	$5,377	$5,538	$5,704	$5,876	$6,052	$6,233	$6,420	$6,613	$6,811	$7,016	$7,226
Rent and Lease (Equipment, Vehicles)	$8,533	$8,789	$9,053	$9,324	$9,604	$9,892	$10,189	$10,495	$10,809	$11,134	$11,468
Program Supplies (Shop, Office, Lab)	$7,031	$7,242	$7,459	$7,683	$7,913	$8,151	$8,395	$8,647	$8,906	$9,174	$9,449
Program Supplies (Tags, Tag Recovery)	$827	$852	$877	$904	$931	$959	$987	$1,017	$1,048	$1,079	$1,111
Utilities (Electrical, Telephone)	$2,895	$2,982	$3,071	$3,163	$3,258	$3,356	$3,457	$3,560	$3,667	$3,777	$3,891
Travel Costs (Mileage, Lodging, Per diem)	$4,956	$5,104	$5,258	$5,415	$5,578	$5,745	$5,918	$6,095	$6,278	$6,466	$6,660
Education and Training	$1,241	$1,278	$1,317	$1,356	$1,397	$1,439	$1,482	$1,526	$1,572	$1,619	$1,668
Subcontracts (Professional Fees, Testing, Sampling)	$125,827	$129,601	$133,489	$137,494	$141,619	$145,867	$150,243	$154,751	$159,393	$164,175	$169,100
Postage, Dues and Subscriptions	$828	$853	$878	$905	$932	$960	$989	$1,018	$1,049	$1,080	$1,113
Totals	$286,998	$295,608	$304,476	$313,610	$323,019	$332,709	$342,690	$352,971	$363,560	$374,467	$385,701

Notes & Assumptions:

- Estimated costs are escalated at 3% annually in all expense areas

Table 8-10. Ten year summary of future costs - FY 2010 to FY 2020.

Program Area	Fiscal Year										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A. Land Purchases, Leases and Easements											
A.1. Land Purchase/Lease/Easement	$4,750,000										
B. Planning and Design											
B.1. Step 1: Concept Engineering, Planning	$298,405										
B.2. Step 2: Prelim Engineering, Planning, Environmental Compliance		$500,000									
B.3. Step 3: Final Engineering, Planning			$400,000								
C. Construction											
C.1. Estimated Construction Costs			$6,789,964	$6,789,964							
D. Capital Equipment											
D.1. Capital Equipment				$218,249							
E. Environmental Compliance											
E.1. Environmental Compliance		$125,000	$11,733								
F. Operations and Maintenance											
F.1. Springfield Hatchery Programs				$769,795	$792,889	$816,676	$841,176	$866,411	$892,404	$919,176	$946,751
G. Monitoring and Evaluation											
G.1. Monitoring & Evaluation Program					$323,019	$332,709	$342,690	$352,971	$363,560	$374,467	$385,701
Total Estimated Capital Costs	$5,048,405	$625,000	$7,201,696	$7,008,212	$0	$0	$0	$0	$0	$0	$0
Total Estimated O&M Costs	$0	$0	$0	$769,795	$1,115,908	$1,149,385	$1,183,866	$1,219,382	$1,255,964	$1,293,643	$1,332,452
Total Estimated Costs	$5,048,405	$625,000	$7,201,696	$7,778,007	$1,115,908	$1,149,385	$1,183,866	$1,219,382	$1,255,964	$1,293,643	$1,332,452

- A.1. Land purchases, leases and easements (land purchase is complete at a cost of $1.96 million; see Section 8.2)
- B.1. Step 1 Planning (based on current expenditures to complete planning)
- B.2. Step 2 Planning based on percentage of estimated construction costs (escalated to FY 2011 dollars)
- B.3. Step 3 Planning based on percentage of estimated construction costs (escalated to FY 2012 dollars)
- C.1. Estimated construction costs assume 50% occurs in FY 2012 and 50% in FY 2013 (escalated from FY 2010 to mid FY 2012 dollars)
- D.1. Capital Equipment, estimated lump sum for equipment items not shown in construction estimate (escalated from FY 2010 to FY 2013 dollars)
- E.1. Environmental Compliance Costs (assumes 90% of expenses occur in FY 2011 and 10% of expenses in FY 2012) (escalated from FY 2010 to FY 2011 dollars)
- F.1. O&M Cost Springfield Hatchery Program (costs escalated at 3% annually from 2010 dollars) assumes start-up in FY 2013
- G.1. Monitoring and evaluation program (costs escalated at 3% annually from 2010 dollars) assumes start-up in FY 2014

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Idaho Department of Fish and Game, November 2010

Springfield Sockeye Hatchery
Master Plan for the Snake River Sockeye Program

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