Enclosure III

Final Section 7(a) Determination and Report, Wild and Scenic Rivers Act

Hells Canyon Complex Hydroelectric Project

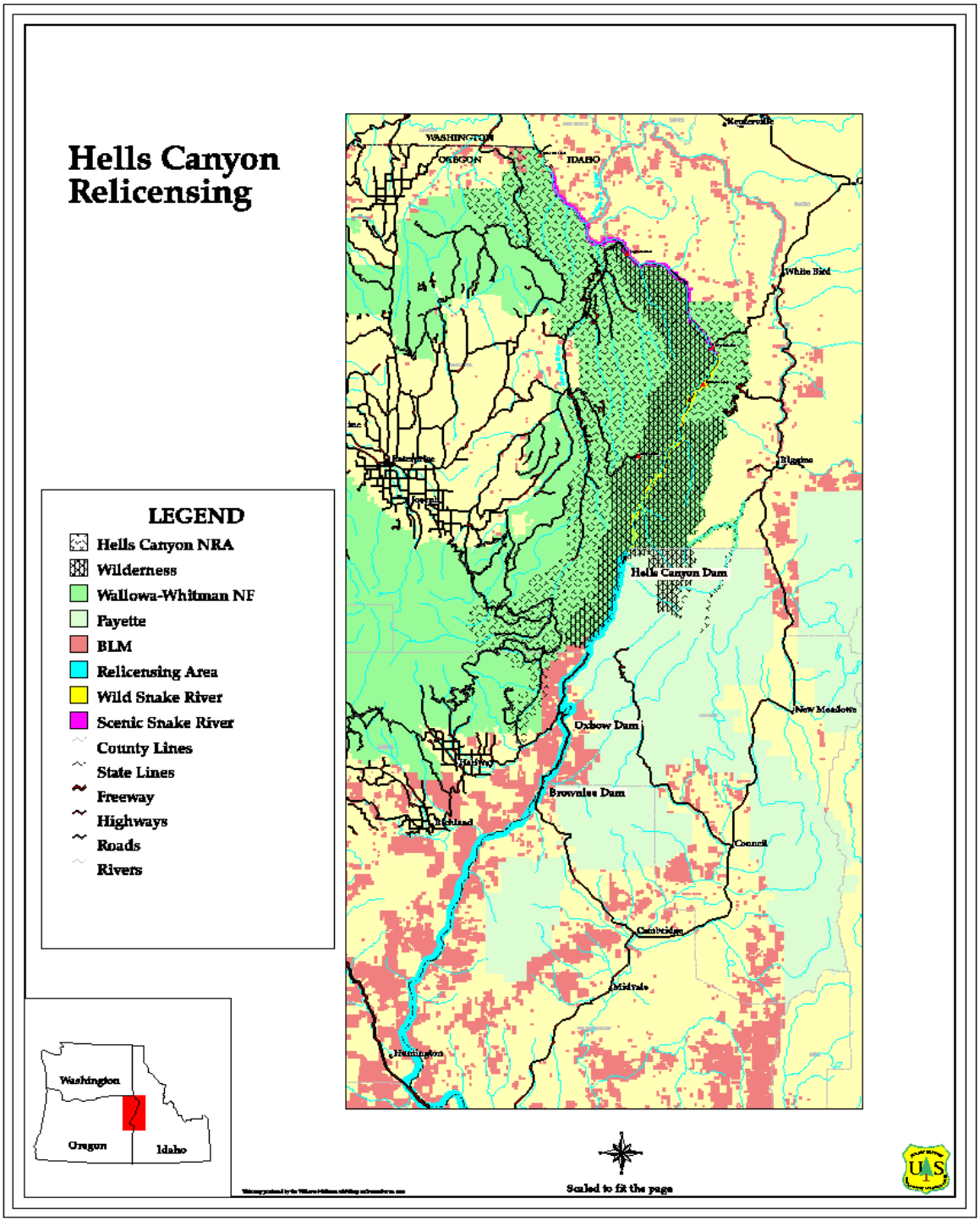
Snake Wild and Scenic River
Wallowa-Whitman National Forest

October 30, 2007

INTRODUCTION

Hells Canyon, on the Oregon/Idaho border, is the deepest canyon in North America and includes Idaho Power Company's (IPC) largest hydroelectric generating complex – the Hells Canyon Complex (HCC). The HCC consists of three hydroelectric facilities (each with a dam, reservoir, and powerhouse) on the segment of the Snake River forming the border between Idaho and Oregon (see map below). The three project facilities are Brownlee, Oxbow and Hells Canyon. The upstream boundary of the project area is at the upstream margin of Brownlee Reservoir (river mile 343); the downstream boundary is below Hells Canyon Dam (river mile 247). This is the area considered the project boundary for the license. In addition to the project boundary area, IPC included the free-flowing section of the Snake River below Hells Canyon Dam downstream to near the Oregon/Washington State line at river mile 176 in the study area. The total river distance of the IPC study area is approximately 170 miles.

Through the Hells Canyon National Recreation Area (HCNRA) Act (P.L. 94-199, 1975), Congress added 67.5 miles of the Snake River to the National Wild and Scenic Rivers System (National System). The designated river begins below Hells Canyon Dam and flows north to an eastward extension of the north boundary of section 1, township 5 north, range 47 east, Willamette Meridian. The designated river is classified in two segments: the wild segment from Hells Canyon Dam north to Upper Pittsburg Landing, approximately 31.5 miles, and the scenic segment from Upper Pittsburg Landing to the lower terminus described above, approximately 36 miles. The Forest Service manages the 4.2 mile segment below the lower terminus of the designated river to the Wallowa-Whitman National Forest Boundary (Oregon/Washington State line) with the same direction as for the designated river.


Hells Canyon Relicensing
LEGEND
Hells Canyon NRA
Wilderness
Wallowa-Whitman NF
Payette
BLM
Relicensing Area
Wild Snake River
Scenic Snake River
County Lines
State Lines
Freeway
Highways
Roads
Rivers
WASHINGTON
OREGON
IDAHO
White Bird
Hells Canyon Dam
Oxbow Dam
Brownlee Dam
New Meadows
Council
Cambridge
Midvale
Huntington
Weiser
Baker City
Joseph
Riggins
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Washington
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Idaho

BACKGROUND

Snake Wild and Scenic River:
The outstandingly remarkable values (ORVs) of the Snake Wild and Scenic River (WSR) are: scenery, recreation, geology, wildlife, fisheries, cultural resources, vegetation/botany and ecology. More specifically from the *Wild and Scenic Snake River Recreation Management Plan* (USDA Forest Service, 1994):

- Scenery – The Snake WSR, flowing through a portion of the HCRNA, is recognized nationally for its scenic qualities. The river corridor includes small sandy beaches, grass- and pine-covered benches with rugged mountains rising behind them, spectacular rock formations, and the sight and sounds of the river itself. Great contrasts of landform, vegetation, color, climate, and sound are evident in the corridor.
- Recreation – The Snake WSR offers a blend of motorized and nonmotorized boating in a setting that is unique in North America. The scenic beauty of the canyon and challenge and risk associated with whitewater boating attract float boat and power boat recreationists to the river. A wide range of other recreation activities, including fishing, hunting, hiking and backpacking, are available in this unique backcountry river setting.
- Geology – The geology of the canyon provides research potential and portrays the complex geologic history of the canyon and western North America.
- Wildlife – The Snake WSR includes a number of regionally and nationally significant wildlife species. The river corridor includes significant migration, wintering, and year-round habitat for these wildlife species.
- Fish –The Snake WSR supports several stocks of anadromous fish, including fall and spring/summer Chinook salmon, sockeye salmon, summer steelhead, trout (redband and bull), and Pacific lamprey, as well as several other resident species of native fish. The river also provides habitat for a large, isolated white sturgeon population. Fall and spring/summer Chinook, sockeye salmon, summer steelhead and bull trout are listed as Threatened under the Endangered Species Act (ESA). The Hells Canyon reach of the Snake River is considered critical habitat for fall Chinook salmon. These diverse fish stocks are important internationally, nationally and regionally for their commercial, historic values, and contribution to river ecology. The Snake River is known nationally and regionally for its abundant, unique and diverse sport fishery. (This section is updated to reflect current status of species and habitat.)
- Cultural – One of the richest accumulations of riverine archeological resources in western North America is enjoyed by visitors to the Snake WSR and the river provides unlimited research potential for the historic and prehistoric cultural resources of the canyon.
- Vegetation/Botany – Few locations in the Pacific Northwest, or western North America, equal the Snake River canyon in the concentration and number of rare or endemic plant species. The river canyon includes populations of MacFarlane's four-o'clock (ESA threatened species), other species that are candidates for listing, and species on the Forest Service sensitive plants list.
- Ecology – The north-trending Snake River canyon is a deep fissure between the mountainous uplifts of the Seven Devils in Idaho and Wallowas in Oregon, creating specialized plant communities as a result of unique microclimates. A number of

Research Natural Areas have been designated in recognition of the importance of the river corridor environment. The canyon's special environment fosters unusual and specific relationships in the flora and fauna of the area.

Existing Project Description:
The HCC is the largest nonfederal hydroelectric facility licensed on National Forest System lands in the Pacific Northwest. The HCC is made up of three dams, related reservoirs and powerhouses: Brownlee, Oxbow, and Hells Canyon. On December 15, 1950, the applicant submitted an application with the Federal Power Commission (FPC, now the Federal Energy Regulatory Commission or FERC) for the Oxbow Project indicating their intent to develop the Hells Canyon reach of the Snake River with a series of five dams and powerhouses. After years of national debate, the FPC issued the project license on August 4, 1955, for the three-dam complex that now exits. Construction on Brownlee Dam began on November 10, 1955, and was completed in January of 1959. Oxbow Dam work was started in December of 1957, and was completed in November of 1961. Construction began on the Hells Canyon Dam in August of 1964, with the completion of the project in December of 1967. The 1166-megawatt project provides power over a 20,000 square mile region to over 814,000 potential customers in southern Idaho and eastern Oregon.

Proposed Project Structures and Operations:
This summary of project structures and operations, based on direction from the Wild and Scenic Rivers Act (WSRA) for evaluation of effects of projects outside the WSR corridor, is focused on proposed HCC components most likely to affect the scenic, recreational, fish, or wildlife values of the Snake WSR.

No substantial changes or additions are proposed to the project's structures. IPC does intend to modify the existing fish trapping facility at Hells Canyon Dam to handle and capture all fish that migrate into the traps. While this protection, mitigation and enhancement measure is not detailed, it is not assumed to expand below the toe of the dam and into the designated river.

In the current license the minimum flow requirement is 5,000 cubic feet per second (cfs) and a ramp rate of 1 foot per hour measured at Johnson Bar, 18 river miles downstream of Hells Canyon Dam. However, through Article 43 of the license, IPC is required to cooperate with the Army Corps of Engineers (ACOE) to provide flows in the interest of both power and navigation. Through negotiation, this minimum flow has been increased to provide for navigation below Hells Canyon Dam for the summer months of July, August and September. Based on the most recent negotiation (2005), the minimum flow is 8,500 cubic feet per second (cfs) or the 3-day moving average at Brownlee Reservoir inflow if such flow is below 8,500 cfs.

In their Final License Application (FLA), IPC proposed the following operational scenario (IPC, 2003):

- October 21 through December 11 – Continued implementation of the fall Chinook flow program with no ramping.
- December 12 through May 31 – Maximum stage change 1 foot/hour. No daily limit.
- June 1 through September 30 – Maximum stage change 1 foot/hour. 10,000 cfs daily flow change limit.
- October 1 through October 20 – Maximum stage change 1 foot/hour. No daily limit.

This flow regime incorporates modification required to protect spawning fall Chinook (October 21-December 11). The proposed minimum flow is the same as in the existing license (5,000 cfs and a maximum stage change of 1 foot/hour measured at Johnson Bar) with recognition of 6,500 cfs as the typical minimum flow coordinated with the ACOE. A daily change limit is proposed during the summer recreation season (10,000 cfs).

In addition to flow operations below Hells Canyon Dam, IPC proposes to help the Forest Service stabilize several archaeological sites in the designated river as a stewardship measure, although they do concede that project operations are causing demonstrable impacts to these archaeological sites. The goal is to protect the approximate 20 sites that may require stabilization below Hells Canyon Dam through a variety of techniques and in coordination with Idaho or Oregon State Historic Preservation Office, federal agencies, private landowners and Native American Tribes (dependent on project location).

Proposed project operations will continue to affect resources downstream of the project, specifically:

- Scenery – HCC operations affect landscape character attributes provided by the water, beaches and sand bars, and riparian vegetation of the Snake WSR. Increased algae has reduced water clarity in the summer months, this murky water results in reduced foreground color interest and reduced sight distance into the water. Important landscape character qualities such as the color, line, and texture of beaches and river bars are eliminated by the gradual disappearance of these features. Foreground and middle ground color contrast and variety, textural contrast, and visual interest along the river are reduced because the riparian vegetation along the water's edge has changed and contracted as a result of HCC operations.
- Recreation – Controlled flows have extended the season of use for boating activities. The minimum flows negotiated between IPC and the ACOE provide increased recreational access. Reduction of sand beaches negatively affects the recreation setting, changing user's recreational patterns and preferences and decreasing the overall recreation experience.
- Fish – Numbers of all anadromous species, at a low point when the river was designated, have generally stable or increasing short-term trends. This is due

primarily to other actions associated with federal listing under ESA. Project ramping exceeds natural storm-flow patterns and adversely affects fish and fish habitat. Ramping is believed to be responsible for impacts to fall Chinook rearing habitat and to adversely impact fisheries habitat for other salmonids during the rest of the year. Beaches and terraces of the sort used by outmigrant Chinook are disappearing due to entrapment of sediments by the upstream HCC and the resulting lack of sediment transport into the reach.

- Riparian Wildlife Habitat – Riparian vegetation establishment, recruitment and longevity are dependent upon water dynamics and suitable substrates. HCC operations have altered the seasonal, daily, and hourly flow patterns, thereby altering the hydrologic conditions and sediment scour and deposition rates. These factors will continue to affect the ability of native riparian vegetation to maintain a functioning riparian community and the species dependant on it.

SECTION 7(a) REQUIREMENTS

Section 7(a) of the WSRA provides a specific standard for review of developments below or above a designated river.

> Developments below or above a designated river may occur as long as the project "will not invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area on the date of designation..." This standard applies to projects outside the river corridor but on the same river or tributary as is the case with the Snake River.

The Hells Canyon Dam marks the upper terminus of the Snake WSR, with the lower terminus located at the eastward extension of the north boudary of section 1, T.5N., R.47E., W.M.

The HCNRA Act includes language in Section 6(b) relative to flow requirements below Hells Canyon Dam:

> "No flow requirements of any kind may be imposed on the waters of Snake River below Hells Canyon Dam under the provisions of the WSRA, of this subchapter, or any guidelines, rules or regulations adopted pursuant hereto."

This provision does not void the Forest Service's authority under WSRA Section 7(a) to evaluate and make a finding as to whether continued project effects diminish the four stated values (scenery, recreation, fish or wildlife). Should any of the ongoing effects rise to the level of unreasonable diminishment, however, any proposed modification of flows to mitigate could be no more than a recommendation.

The basis for evaluating the project are the resource conditions and project's operating mode at the date the river was added to the National System (December 1975). The

initial question to be addressed is whether the project proposal **invades the designated river**. The term invade is defined as encroachment or intrusion upon.

The next question to be answered, relative to the standard in Section 7(a), is whether the project proposal will **"unreasonably diminish"** any of the specified values. Given that the standard implies some diminution of values may be acceptable, there are two questions to consider:

1. Does the proposed project (IPC FLA) cause diminution of the scenic, recreational, fish or wildlife values of the designated river as present at the date of designation?

2. If there is diminution, is it unreasonable? This would suggest an evaluation of the magnitude of the loss. Factors to be considered include: (1) Whether the value contributed to the designation of the river (i.e., outstandingly remarkable); and, (2) the current condition and trends of the resource. (If diminution is determined unreasonable, measures may be recommended to reduce adverse effects to within acceptable levels.)

RATIONALE FOR DETERMINATION

The basis for this final Section 7(a) determination is the project as proposed in the Final Environmental Impact Statement (FEIS), Hells Canyon Hydroelectric Project. FERC/FEIS-0199F, August 2007.

The Forest Service, as principal land management agency in the project area, has utilized staff knowledge and considerable additional available data. The accompanying WSR Section 7(a) Report summarizes the results of this review and evaluation.

DETERMINATION

This final determination is based on the HCC project as it is proposed to operate under the FERC Staff recommendation in the FERC/FEIS-0199F. The Forest Service has made this final determination under Section 7(a) coincident with the timing of submittal of the final 4(e) terms and conditions and informed by evaluation of the project under the National Environmental Policy Act.

Invade the Area:
Assuming modifications to the existing fish trapping facility at Hells Canyon Dam do not expand below the toe of the dam and into the designated river, the licensee does not propose construction of any project works in the WSR corridor. Therefore, the project proposal will not invade the area.

Scenic, Recreation, Fish, and Wildlife Values:
The continued degradation of sandbars adversely affects all four values that Congress directs the river-administering agency evaluate for a water resources project above a designated WSR. The degradation of sandbars along the Snake River below Hells Canyon Dam since the completion of the HCC has been well documented (Grams and Schmidt, 1991 and 1999). In addition to the scientific literature, this finding is informed by peer review of IPC's technical reports that address sediment-related impacts below HCC (Vincent and Andrews, 2002; Wilcock, Schmidt and Grams, 2002), and considerable analysis conducted by Forest Service staff (USDA Forest Service, 2005). There is no disagreement among the technical experts, including IPC's consultants – sand beaches below Hells Canyon Dam have decreased in number and area since completion of the HCC.

Quoting from Grams and Schmidt (1999):

> "Low sediment concentrations downstream from Hells Canyon Dam severely limits the amount of deposition that can occur. And for active sandbars, successive years of low deposition rates results in net erosion."

This net erosion has reduced the number and area of sandbars below Hells Canyon Dam from 98 and approximately 20 acres in 1973, respectively (near the date of the river's designation in 1975), to an estimated number of 30 and approximately 6 acres in 2007 (the anticipated licensing date), with no sandbars predicted to remain along about 60 miles of the 67.5-mile Snake WSR at the end of the licensing period (2037). As sandbars are depleted due to reduced sand supply, the river velocity is able to shift to the toe of the floodplain terraces, resulting in increased terrace erosion.

The most significant effects to the Snake WSR are on scenery and recreation. For scenery, the predicted disappearance of sand beaches eliminates an important attribute of the river's landscape character and compromises the scenic integrity goals for the WSR. Elimination of sand beaches also adversely affects both the recreation setting and visitor's experience (e.g. mooring, camping, and day-use activities). As beaches disappear, recreation use is displaced to river terraces. Terraces are not only less valued by recreationists because they have fewer desired recreation site attributes, the displaced recreational use adversely affects historic and prehistoric resources (a WSR ORV) located on the terraces.

Regarding effects to fish, river sediments are becoming coarser and more armored as finer particles are washed away by clear water flows. Sandbars are also important habitat for juvenile fall Chinook salmon and their depletion may contribute to increased mortality due to predation from smallmouth bass. A reduction in fine sediments has the potential to decrease habitat suitable for lamprey. The HCC has and will continue to have a negative effect on riparian wildlife habitat communities and the species they support. Lack of sediment recruitment, and daily and weekly flow fluctuations are reducing the vigor and longevity of riparian wildlife habitat communities along the Snake River downstream of Hells Canyon Dam to the confluence of the Salmon River.

The standard under Section 7(a) of the WSRA accepts that a water resources project above a designated river may have adverse effects on the river's scenery, recreation, fish, or wildlife values so long as such effects do not rise to the level of "unreasonable diminution." The extensive information provided in the accompanying report and by my filing under the Federal Power Act, document that the negative affects to fish and wildlife habitat, although chronic, existed at the date of the river's designation. However, the continued depletion of sand beaches and bars is estimated to result in the complete elimination of this important attribute of scenery and recreation by the end of the new license period and, thus to rise to the level of unreasonable diminution.

To address these concerns, the Forest Service included a preliminary license condition under section 4(e) of the FPA that would require the Licensee to establish a mitigation fund for use by the Forest Service to fund sandbar maintenance and restoration activities. This condition was included for adoption by FERC Staff in their recommended alternative in the FEIS (August 2007). With the inclusion of this condition in the new license, I find that the continued operation of the HCC will not unreasonably diminish the scenery and recreation resources of the Snake WSR.

/s/ *Linda Goodman* October 30, 2007

LINDA GOODMAN Date
Regional Forester, Region 6
USDA Forest Service

WILD AND SCENIC RIVERS SECTION 7(a) REPORT

This Wild and Scenic Rivers Act (WSRA) Section 7(a) Report summarizes the results of evaluation of the Hells Canyon Complex (HCC) hydroelectric project as it is proposed to operate in Idaho Power Company's (IPC) final license application (FLA) (IPC 2003). The HCC is located directly above the designated Snake Wild and Scenic River (Snake WSR). The WSRA specifies that such projects may occur as long as they "will not invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area on the date of designation..."

This report begins with a section on operational effects of HCC, which is a general description of the principal HCC effects on flow regimes, sediment delivery, and erosional processes. Next the report is divided into sections addressing scenery, recreation, fish, and wildlife. Each resource section includes evaluation criteria, background and a resource evaluation.

OPERATIONAL EFFECTS OF THE HCC

Flow Regimes:
In the current license the minimum flow requirement is 5,000 cubic feet per second (cfs) and a ramp rate of 1 foot per hour measured at Johnson Bar, 18 river miles downstream of Hells Canyon Dam. However, through Article 43 of the license, IPC is required to cooperate with the Army Corps of Engineers (ACOE) to provide flows in the interest of both power and navigation. Through negotiation, this minimum flow has been increased to provide for navigation below Hells Canyon Dam for the summer months of July, August and September. Based on the most recent agreement (IPC, 2003), the minimum flow is 8,500 cfs or the 3-day moving average at Brownlee Reservoir inflow if such flow is below 8,500 cfs.

In their FLA, IPC proposes the following operational scenario (IPC, 2003):

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Sediment Delivery and Erosional Processes:
The HCC traps sand that would otherwise be available to replenish sandbars in the Snake River below Hells Canyon Dam. Brownlee Reservoir began filling in 1958, Oxbow in 1961 and Hells Canyon in 1967. The number of sandbars between Hells Canyon Dam and the Salmon River confluence (nearly 60 miles of the designated Snake WSR) decreased from 216 (approximately 46 acres) in 1964 to 98 (approximately 20 acres) in 1973, and to 60 (approximately 13 acres) in 1982 (both National Forest System and private lands) (Grams and Schmidt, 1991). Based on aerial photo studies, Grams and Schmidt (1991) reported a 75-80% reduction in the frequency, area and volume of the sandbars below Hells Canyon Dam during the period 1964-1982.

Most of this change took place between 1964 and 1973 as a result of the first peak flows (1965, 1971 and 1972) to occur in the canyon following the closure of the dams (Grams and Schmidt, 1991). These flows resulted in mobilization and erosion of sand from sandbars, as is normal under high flows, and carried much less sand to replenish the sandbar areas. During this same period, high terraces also actively eroded, as a function of decreased sandbars and their stabilizing function. Sandbar erosion continues but at a much slower rate. Grams and Schmidt (1991) state that the number of sandbars declined by 2 percent, and the area of exposed sand declined by about 4 percent between 1982 and 1990. The authors postulate that the decreasing rate of erosion is due to a lack of fine sediment input, armoring of the remaining sites, and the fact that the remaining beaches are located at the most effective sediment trapping sites in the system and are thus more resistant to erosion.

Grams and Schmidt (1999) evaluated the same sites to assess change between 1990 and 1999. This time span contained the flood for the period of record for Hells Canyon in January, 1997. In this more recent survey, the authors showed no significant change in the number of sandbars between 1982 and 1999. However, at the three sites evaluated, they observed a decrease in the volume of sand in the bars and erosion in the high terraces associated with the sand bars along the river margins (Grams and Schmidt, 1999). Sandbar material is moved in some areas at flows as low as 10,000 cfs (Parkinson, 2005) making replenishment critical to the maintenance of sandbars.

The Forest Service has completed a projection for the number and acres of2sandbars in 2007 and 2037, the date of anticipated licensing and the end of the license period. Using an annual decrease of 2% per year since 1982, the number of sandbars in 2007 is 30 and approximately 6 acres, with no sandbars remaining at the end of the license period (USDA Forest Service, 2006).

SCENIC

Evaluation Criteria:
The evaluation criterion for the scenery resource is the scenic integrity rating of the Snake WSR landscape character (scenic integrity features that are affected by the proposed project operations are water, sand beaches, and riparian vegetation).

Background:
Scenery is one of the outstandingly remarkable values (ORV) of the Snake WSR. As the ORV is described in the *Wild and Scenic Snake River Recreation Management Plan* (USDA Forest Service, 1994), the river corridor includes small sandy beaches, grass and pine-covered benches with rugged mountains rising behind them, spectacular rock formations, and the sight and sounds of the river itself. Great contrasts of landform, vegetation, color, climate, and sound are evident in the corridor.

As is evident from this text, many scenic features comprise the outstandingly remarkable scenery of the Snake WSR. The landscape character of Hells Canyon has been formed by catastrophic events and by slow, incremental processes resulting from weathering and climate change. The river and its tributaries are ever eroding their surroundings and transporting materials through this corridor. The Snake is a strong, powerful river that churns through huge rapids, twists around rocky points and courses along the length of deep narrow corridors. It provides a dramatic contrast to the surrounding arid cliffs and canyons. The vertical landforms of the steep canyon walls dominate this surrounding environment. Rock formations and cliffs tower over the river. This landscape is a very harsh and vertical place.

The river's water, sand beaches, and riparian vegetation are the landscape character features most affected by the HCC. In this rocky, harsh, vertical environment, these features—clear river water, sand beaches, and riparian vegetation—are important contributors to the "great contrasts" of the Snake WSR's landscape character. These features provide a visual oasis from the craggy, rock formations, steep cliffs, and walls of the canyon. They provide smooth horizontal lines, colors, and soft textures that are welcoming and restful to the eye of travelers in the river corridor and provide contrast to the surrounding, harsh environment.

The Snake WSR visual quality objectives are: wild section, preservation; scenic section, retention (USDA Forest Service, 1994). In current Forest Service evaluation of scenery resources, these visual quality objectives are termed scenic integrity objectives (USDA Forest Service, 1995). In this current terminology, the scenic integrity objectives for the Snake WSR are that they have "Very High" (formerly preservation) and "High" (formerly retention) scenic integrity ratings.

Resource Evaluation:
Water Quality—The quality and quantity of water of the Snake WSR has been affected by HCC operations and this effect will continue under proposed operations. The water is not clear. During summer months the water becomes a murky-green color because of increased amounts of algae in the water due to higher temperatures created by HCC operations. The alga created murkiness of the water, reduces the sight distance into the water, and hinders the view of fish, rocks, gravel and sand formations and other features of the river bottom. There is a slick coating of algae on the shoreline boulders. All of these effects have and will continue to reduce the value of this feature of the landscape character.

Sand Beaches—Sand beaches are an aesthetic attribute of Hells Canyon that has been seriously affected by the HCC. Depletion of sand bars as described in the introduction to this report will continue under proposed HCC operations and will reduce the value of this feature of landscape character. Approximately 40% of the Snake WSR beaches and sandbars (in area and number) disappeared between 1973 and 1982. The remaining sand bars and beaches will continue to change to gravel, diminish in size, or be entirely lost. As this trend continues and sand beaches are gradually transformed to gravel, are diminished, or are lost, important landscape character qualities contributed by the color, line, and texture of sand beaches are lost. For example, the cobble appearance of gravel bars does not provide a visual contrast with surrounding rocks and rock cliffs as do sand beaches with their variation in color and texture.

Riparian Vegetation—Vegetation is sparse in Hells Canyon, what does exist is of great visual value. The riparian vegetation within the Snake WSR corridor has been reduced and the species composition changed by HCC operations (USDA Forest Service 2006). Theses effects will continue under proposed operations. Reduced riparian vegetation means less color contrast with surrounding rock, and the change in species composition results in reduced textural contrast and interest.

Resource Evaluation Summary—The effects of HCC operations to the unique water, sand beaches, and riparian vegetation features of the Snake WSR reduce the scenic integrity rating of the Snake WSR landscape character. This reduction has changed the scenic integrity rating from very high or high, as it was near the time the river was designated, to moderate at the present time. All of the effects discussed above will continue to reduce the scenic integrity of the Snake WSR landscape character under the proposed HCC operations.

RECREATION

Evaluation Criteria: The evaluation criteria for the recreation resource are the quantity and quality of near-river recreation sites along the Snake WSR.

Background:
Recreation is an ORV of the Snake WSR. The desired future condition for river recreation from the *Wild and Scenic Snake River Recreation Management Plan* (USDA Forest Service, 1994) applicable to the HCC FLA is to provide:

- A unique blend of whitewater boating opportunities
- A year-round diverse sport fishery
- The recreation experiences available at the time the area was established

The overall management emphasis is to maintain a diversity of recreation experiences and opportunities, compatible with the WSRA and the Hells Canyon National Recreation Area (HCNRA) Act.

On-river recreation use increased dramatically with the construction of the HCC. Prior to construction of the HCC dams, recreational opportunities were limited in the winter by ice, in the spring by high water, and in the late summer and fall by low water. The controlled flows of HCC operation have, in contrast, extended the season of use to make virtually year-round recreation possible. The paved access road from Hells Canyon Dam to the launch facility at Hells Canyon Creek has also facilitated increased recreation. Improved power and float boat technology and abundant publicity and controversy over the proposal to dam the last remaining free-flowing segment of the middle Snake from Hells Canyon Dam to Asotin (in Washington state) were also responsible for increased interest in the area and increased use. Forest Service visitor use reports show a 147% increase in visitor use (from 12,454 visits to 30,367 visits) during the primary season from 1979 – 1991(USDA Forest Service, 1994, page I-3) . In 1993 there were 36,164 recreationists on the Snake WSR. Since 1993, the amount of on-river use has varied from year to year, depending on river conditions, weather, etc. In 2003, 27,299 recreationists visited the Snake WSR during the primary summer use season.

Access for boating is the same today as it was when the river was designated in 1975. The wild segment is accessed on the Idaho side immediately downstream of Hells Canyon Dam and at Pittsburg Landing. Access from the Oregon side, in the scenic segment of the middle river, is maintained at Dug Bar. Washington State access is provided at the Heller Bar launch. Each of these access points existed at the date of designation and substantial improvements have been made to each site to accommodate increasing use by both float and power boaters. These improvements have included: sanitation services, concrete boat ramps, hardened road surfaces and public agency contact kiosks or stations.

When the river was designated, and continuing today, commercial and private float and power boat use are the most pursued recreation activities of the Snake WSR. On-river recreation is one of the most valued attributes of the Snake WSR. The 16-mile section from Hells Canyon Dam through Rush Creek includes all of the river's Class IV rapids and is the most challenging for whitewater boaters. Downstream from Rush Creek, the river becomes somewhat easier to negotiate with Class II and III rapids. In a controlled flow study conducted by the Pacific Northwest River Basin's Commission in 1973, the whitewater boat crew described that portion of the river from Hells Canyon Dam to Sheep Creek as "big, exciting water, rivaling the Grand Canyon of the Colorado as a whitewater boating experience." Wild Sheep and Granite Creek rapids are described as the "most dangerous and exciting rapids" in the study area (Pacific Northwest River Basins Commission, 1974).

Sand beaches provide an element of respite and repose in contrast with the harsh, rocky, sometimes vertical river banks. The visual and tactile experience of sand beaches along the river is an important aesthetic feature. Studies characterizing Snake WSR recreation have been conducted by the Forest Service over the years since designation and also recently by IPC; these studies consistently indicate that certain preferred overnight mooring locations and availability of beaches are directly related to the river recreationists' overall satisfaction with their trip on the Snake WSR. For example, information from user surveys shows that beach sites are highly valued but scarce along the river, during peak use season unoccupied sites are hard to find, and that these sites attract such high use that they are very impacted (Krumpe et al. 1989, Amberg et al. 2005). A recent IPC study (Shelby and Whittaker 2002) indicates the importance of beaches to the recreational experience and that these areas are key components of river use for landing/mooring boats, play areas and camping/day use. The most preferred recreation site attributes (for example, close to the river, good view of the river, good boat landing, flat area for sleeping, easy access for unloading) are all provided by sand beaches (Shelby and Whittaker, 2003, Figures 15 and 16).

Resource Evaluation:
The controlled flow regime proposed for HCC operation (see discussion at beginning of this report) will continue provide the same nearly year-round boating opportunity that has been available on the river since Hells Canyon Dam began operation before the river was designated.

The rapid flow changes (ramping) of existing and proposed HCC flow regimes, however, are the single biggest concern for boaters on the Snake WSR. Shelby and Whittaker (2002) provide the following survey information about impacts to boaters. About 93% of floaters and 84% of power boaters identified flow fluctuations as a major problem affecting the quality of their overall recreation experience. The most commonly identified impacts to boaters in this survey were: affect on their ability to moor boats at recreation sites, limits on choices of campsites, boaters having to wake up at night to check or move their boats, access to beaches and campsites, ability of boaters to leave their boats at day-use stops, problems with navigation (running rapids), swamping or

stranding boats, flooded camps, limitations on trip times, problems with fishing, damage to boats, and slippery rocks. In general, due to the nature of their visits, Shelby and Whittaker (2002) found that floaters were more likely to notice effects to campsites and facilities while power boaters tended to notice impacts to fishing more.

As noted at the beginning of this report, HCC traps sand which would otherwise be available to replenish beaches and sandbars in Hells Canyon. This depletion has reduced the size and availability and other desired qualities of these highly valued riverine features for recreationists. This overall loss of sandbars has changed the recreation setting and the experience that river users have had in the past, thus reducing the quality of the recreational experience of the Snake WSR. Float boat recreation users have indicated a preference for sandy beaches for ease of access (Shelby and Whittaker 2003, page 32). Additionally, these areas provide the preferred access and mooring locations for power boaters (Shelby and Whittaker 2003, page 38-39). This visitor survey also reported that about 75% of river recreationists agreed that beaches provide better camp and picnic sites on the river than upland sites. The HCC effects to sand bars and beaches are predicted to continue under proposed HCC operations and this continuing loss of riverine recreation sites, therefore, will continue to have a direct effect on recreationists' use and enjoyment of the Snake WSR. It is probable that these highly valued recreation sites will completely disappear along about 60 miles of the 67.5 mile designated river by the end of the proposed license period.

In addition, as sandbars and terraces erode away recreationists are forced to compete more for preferred camps, and to move upslope. Displacement upslope is creating adverse impacts to known archeological sites—a cumulative effect in conjunction with impacts to these sites due to terrace erosion caused by HCC operations.

The need to protect these archeological sites also results in increasing managerial presence and controls over recreationists. A recent study (Amberg et al., 2005) found that one of the most common complaints from Snake WSR recreationists was increased management controls in general. Another common complaint found in this study, about favored locations near the river, was the presence of "weeds." As discussed at the beginning of this report and in the wildlife section regarding riparian habitat (also see USDA Forest Service 2006), the sediment and flow regimes created by HCC operation have directly contributed to the spread of invasive plant species and created conditions that give these unwanted species a competitive advantage over native plant species. These effects have been present since designation and are predicted to increase with proposed HCC operations.

Resource Evaluation Summary—The IPC proposal for the HCC will result in some project effects that will continue in the same manner as when the river was designated: continuing to hamper boaters' ability to negotiate rapids, causing problems with mooring and campsites, contributing to boat stranding or swamping. Proposed HCC operations will also continue and increase impacts on natural features along the shoreline highly

valued by recreationists such as riparian vegetation, and on the most favored recreation sites such as beaches. Some of these most favored recreation sites (beaches and sandbars) are predicted to disappear altogether along about 60 miles of the 67.5 mile designated river by the end of the proposed license period.

FISHERIES

Evaluation Criteria:
The evaluation criteria for fisheries are fish populations and fish habitat (sediment regime and water quality).

Background and Resource Evaluation:
Fish are an ORV of the Snake WSR (USDA Forest Service, 1994). The Snake River in the HCNRA provides needed habitat for a variety of native resident and anadromous fish species including; summer steelhead, fall Chinook salmon, spring/summer Chinook salmon, redband trout, and bull trout. The Hells Canyon reach of the Snake River is considered critical habitat for fall Chinook salmon. The Snake River within the HCNRA also provides habitat for a large, isolated white sturgeon population. In addition, numerous warmwater game fish and native non-game fish are present in the mainstem river and tributaries.

Species—Three anadromous fish species use the Snake WSR to fulfill at least part of their life-history stages: Chinook salmon, summer steelhead, and Pacific lamprey. Chinook salmon are divided into races (fall and spring/summer). These races are addressed by the US Fish and Wildlife Service (FWS) under the Endangered Species Act (ESA) as separate species due to their uniquely different life histories. These races are also identified by the timing of their entry to freshwater during their spawning run. Fall Chinook salmon spawn in the mainstem Snake River while spring/summer Chinook and steelhead spawn mainly in tributaries. Fall Chinook juveniles migrate to the sea within a few months of hatching while juvenile spring/summer Chinook and steelhead all spend at least one year in the riverine environment prior to smoltification. It is believed that coho salmon may have also once been present in the Snake River but this is unverified. Fall Chinook are the species/race most dependent on Snake WSR habitats since they are obligatory mainstem spawners. Other anadromous salmonids use the river mostly as a migratory corridor with some spawning and rearing taking place as well.

All of the anadromous species have shown drastic declines since construction of the HCC. Some of the decline can be attributed to HCC dam blockage and the rest to a combination of factors including: habitat loss and degradation, poor ocean foraging conditions, downstream Columbia and Snake River dams, competition/hybridization with hatchery fish, and mortality associated with commercial and sport fisheries. Of all these species, fall Chinook salmon have suffered the greatest decline, probably due to the fact that they are obligatory mainstem spawners. The most productive historical spawning

habitat in the Snake River was located upstream of the HCC. Access to this habitat is currently blocked by the HCC and thus unavailable for these fish. As a result, they are forced to spawn in less suitable habitats downstream of the project. Only a minor part of their original spawning and rearing habitat is currently available between the top of Lower Granite pool and Hells Canyon Dam.

Pacific lamprey were once an important source of food for native peoples and nutrients for young salmon and steelhead. Pacific lamprey are documented to use the HCNRA, but little information concerning their abundance and distribution in the area exists. Lamprey are also an anadromous species which return when sexually mature to spawn in freshwater environments. Lamprey enter freshwater from May to September but do not spawn until the following spring (Simpson and Wallace, 1978). Lamprey spawn in smaller gravel patches. After hatching, the larval amocoete life stage burrow into mud and sand and remain as filter feeders for up to seven years before outmigrating to the ocean where they begin the parasitic stage of their life cycle. The carcasses of this species provide marine-derived nutrients for aquatic and terrestrial production.

Bull trout, redband trout, and white sturgeon are resident native fish found in the mainstem Snake River and its tributaries. Although little is known about bull trout populations or habitat use within the HCNRA, as a species, bull trout have declined throughout the Snake River Basin. Bull trout are currently listed as a Threatened Species under the ESA. Both migratory and resident bull trout use the Snake River and tributaries for spawning and rearing.

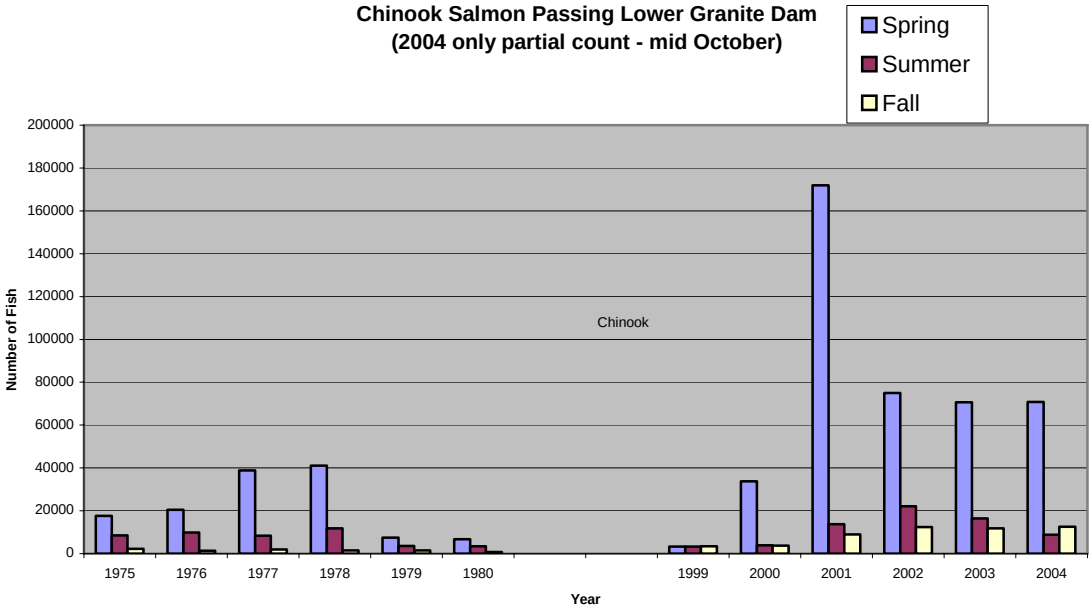
Resident sturgeon historically had an anadromous life history. This was eliminated for the Snake River fish by the construction of the Columbia and lower Snake River dams since sturgeon do not migrate through fish ladders as effectively as salmonids. Sturgeon are a long-lived species. Sexual maturity does not occur until approximately 10-15 years of age (Simpson and Wallace, 1978).

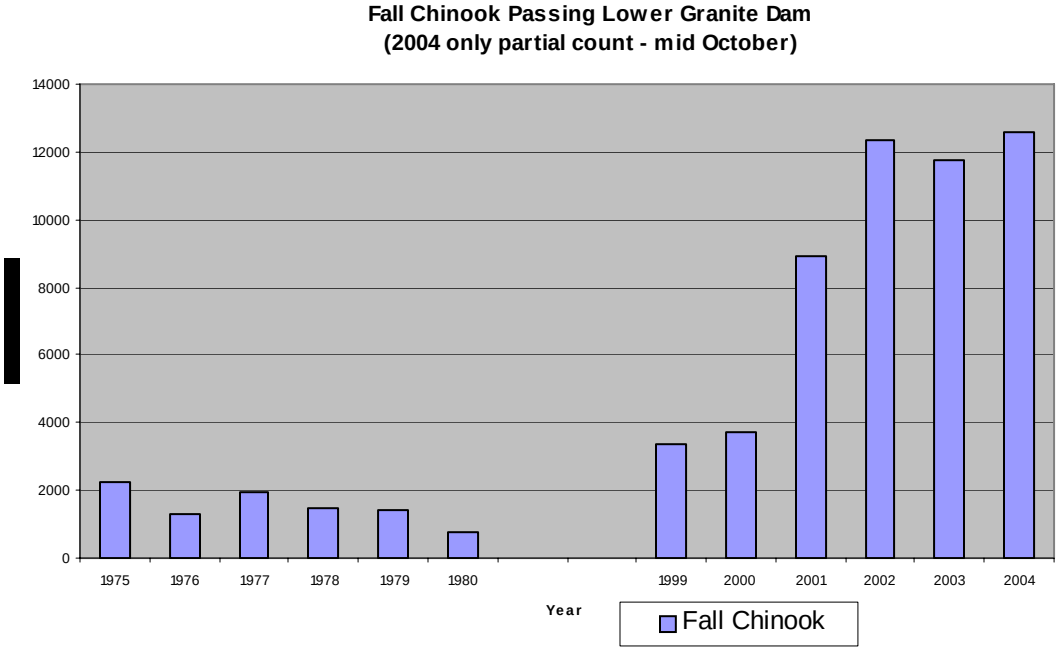
Warmwater game fish, including several species of catfish, crappie, and smallmouth bass, have been introduced to the Snake WSR and have established reproducing populations. These species are the focus of anglers during the summer since they actively feed when the water is warmer and are associated with the river banks where they are available to anglers. Coldwater species introduced into the HCNRA include: west slope cutthroat trout and brook trout. Numerous native non-game fish are also found throughout the HCNRA.

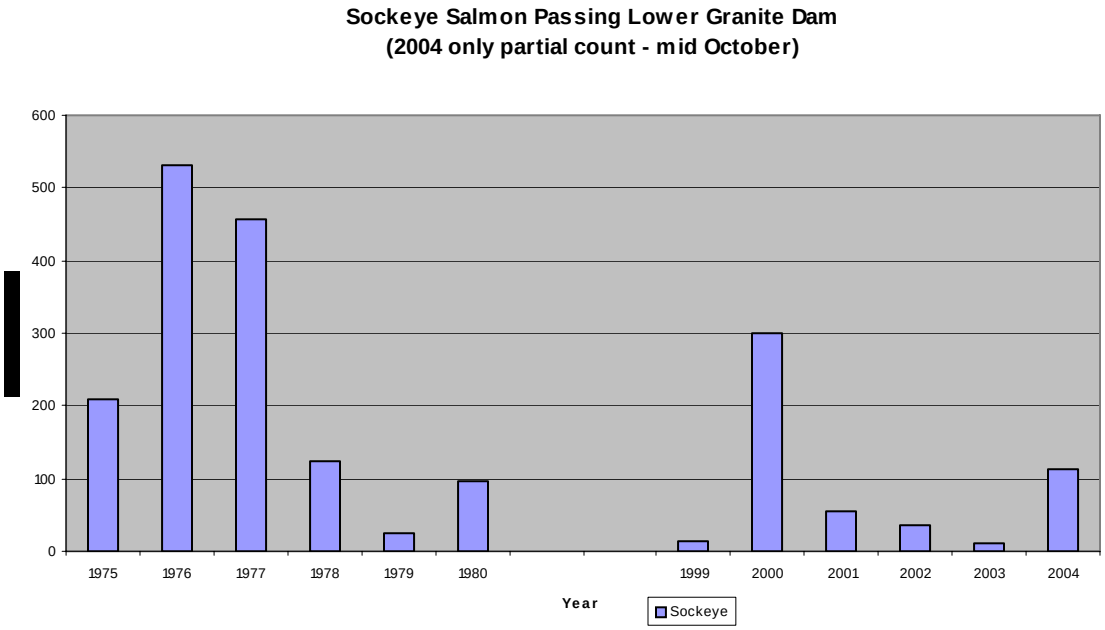
Anadromous Salmonids Status—Fall Chinook, spring/summer Chinook, sockeye salmon, summer steelhead and bull trout are all ESA listed as Threatened Species. Recovery of listed species has been a primary focus of state and federal agencies since the first listing of fall Chinook salmon in 1992. Sockeye salmon were present in the mid-Snake but have become extinct due to blockage by HCC and other dams. They still traverse the lower part of the HCNRA on their migration to the Salmon River to spawn in Redfish Lake.

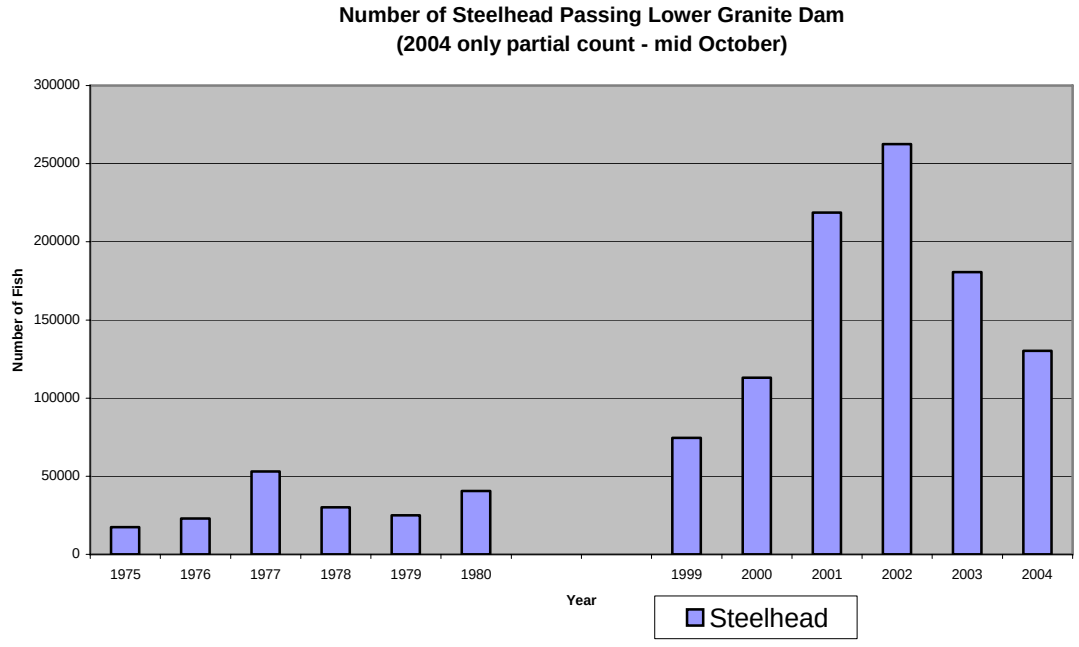
Armour (1990) estimate that historically, over 1 million anadromous fish (steelhead, sockeye, coho, and Chinook salmon) migrated to areas upstream of HCC to spawn. By the time HCC was completed runs in the mid-Snake had been reduced to about 10,000 steelhead, 24,000 fall Chinook and 4,100 spring Chinook. All Snake River Chinook runs were ESA listed in 1992. There has been a decline in Snake River fall Chinook from 72,000 in 1940 to 500 natural spawners from 1992-1996. Long-term trend is down despite a recent upwards trend. It is estimated that 47% of the population is hatchery produced. Snake River spring/summer Chinook had an estimated historical abundance of 1.5 million adults in the 1800s. The population was estimated at 3820 natural spawners in 1999. These races are also dominated by hatchery fish with 61% of escapement being hatchery derived. Long and short-term trends are generally considered negative (NOAH Fisheries, 1999). As shown by the following figures displaying passage for fall, spring and summer Chinook at Lower Granite Dam, some increase in numbers has occurred in the last four years.

The following figures display adult fish passage data for species of interest for Lower Granite Dam from the mid-70s and for the last five years. Lower Granite is the upstream-most of the Federal Dams on the Lower Snake River. Fish counted through the ladder at Lower Granite either enter the Clearwater River in Idaho or continue up the Snake into the Wild and Scenic River reach (designated river corridor) or one of its tributaries. Although the data displayed in the following figures does not specifically pertain to the Snake WSR, it does provide comparison of the relative run strength for each species/race from the date of designation (1975) to the present. Groves and Chandler (2001) noted an R^2 value of 0.7984 when evaluating the relationship of adult fall Chinook salmon allowed to escapement past Lower Granite Dam and the corresponding number of redds constructed in the Snake River. It is assumed in this report that this comparison is essentially accurate for the other anadromous species as well.


Chinook Salmon Passing Lower Granite Dam
(2004 only partial count - mid October)
Spring
Summer
Fall
Number of Fish
Chinook
Year
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
1975
1976
1977
1978
1979
1980
1999
2000
2001
2002
2003
2004

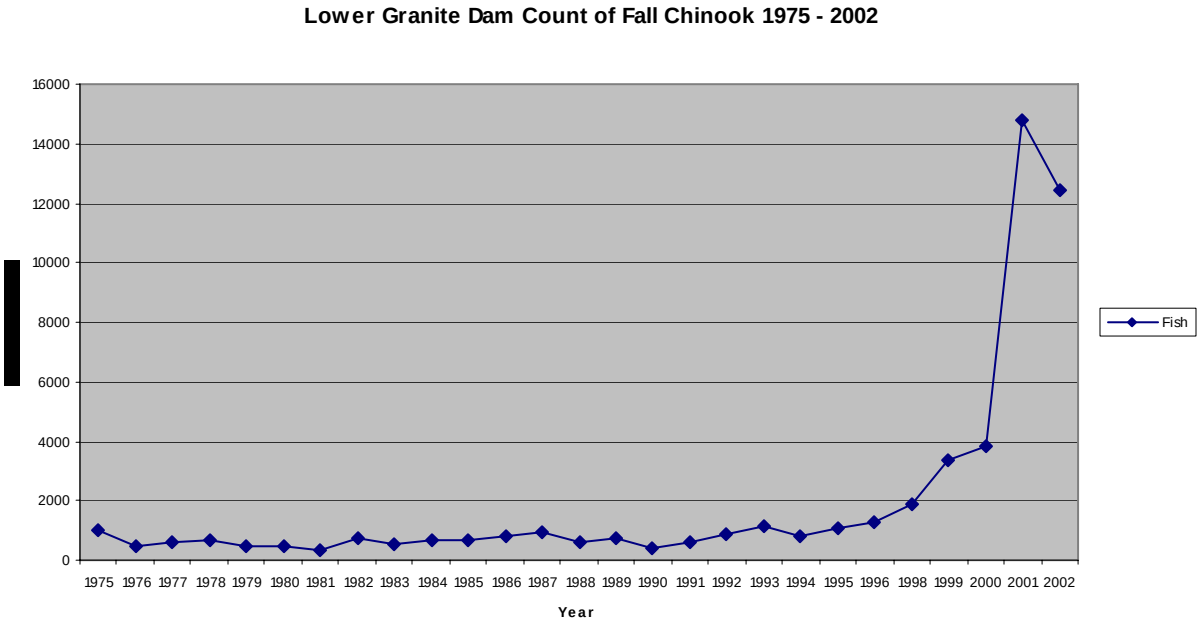

Fall Chinook Passing Lower Granite Dam
(2004 only partial count - mid October)
14000
12000
10000
8000
6000
4000
2000
0
1975
1976
1977
1978
1979
1980
1999
2000
2001
2002
2003
2004
Year
Fall Chinook

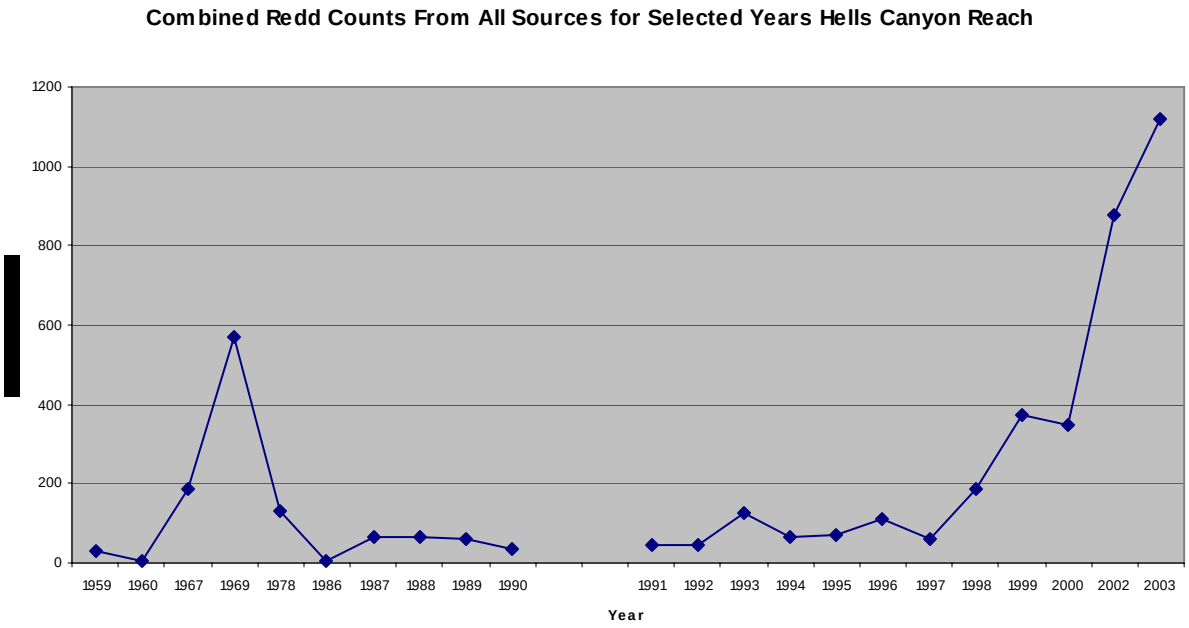




Population surveys, since the 1992 listing, have found stocks of fall Chinook as low as 306 spawners in some years. Since the year 2000, the spawning population of fall Chinook has increased to between 857 and 6630. Stocks of returning wild summer steelhead and spring Chinook that use HCNRA tributaries are more abundant than fall Chinook, but remain listed. The cumulative mortality of both adult and juvenile migrants through the eight downstream dams is high. Although efforts to reduce this mortality are

being made throughout the system, this problem has not been resolved.





Pacific lamprey are known to be declining rapidly, and it is believed that passage over eight dams to reach the HCNRA may be a significant factor. Although fish ladders at mainstem Columbia/Snake River dams are being retrofitted to provide passage for lamprey, lack of access to upstream habitats; predation by warmwater species, northern

pikeminnow and other fish in mainstem reservoirs; and, habitat loss/degradation have contributed to declines in the local population. The HCC has blocked their access to upstream spawning and rearing habitat. Virtually no information is available on lamprey numbers and habitat utilization in the Snake WSR. The following table shows the number of lamprey observed passing upstream of Lower Granite Dam in recent years. While salmon and steelhead passage counts represent a fairly accurate approximation of the numbers of fish passing the mainstem dams, lamprey counts do not. Lamprey are notoriously difficult to count because they migrate mainly at night and can avoid being seen through the counting windows by moving along below the counting windows or otherwise avoiding detection. For these reasons, these numbers should be used only as an index and should not be considered an accurate count of lamprey passing the dam.

Lamprey counts at Lower Granite Dam:

Year	Number of Lamprey
1999	NA*
2000	28
2001	27
2002	138
2003	282
2004**	123

*Lamprey were not counted until 2000
** Count only partial

Groves and Chandler (2001) summarize passage data at dams that indicates lamprey population declines have been widespread in the Columbia system. These declines have ranged from estimates at Bonneville Dam on the lower Columbia of 350,000 lamprey in the early 1960s to 22,830 in 1997. At Ice Harbor Dam on the lower Snake counts have declined from 50,000 lamprey in the early 1960s to 1454 in 1997. This same pattern holds for the mid-Columbia projects with lamprey counts at Rocky Reach Dam declining from 17,500 in the early 1960s to 1405 in 1997.

Resident Fish Status—Redband trout are listed as a Forest Service Regional Forester Sensitive Species. Bull trout populations in the HCNRA are believed to be stable although limited population data is available and additional studies are needed to verify their distribution, habitat use and abundance (FWS personal comment, 2005). This species uses the mainstem Snake River as winter habitat and the tributaries for cold water refugia and spawning.

White sturgeon are a species of concern for state and federal agencies. Research by IPC on white sturgeon indicates that the population in the HCNRA is stable and relatively abundant. Recruitment of juveniles into the population is occurring and the overall age structure is improving. The sturgeon population in the Hells Canyon reach is the largest in the Snake River upstream of Lower Granite Dam. IPC studies have stated that this

population can be considered "reasonably" healthy based on relative abundance, having a wide range of size classes and stages of maturity ranging from immature juveniles to reproducing adults (Lepla et al., 2001). These authors also indicate that fish condition has not declined since earlier surveys in the mid to early '70s and 80s, and the percentage of fish in size groups greater than 92 cm (3 feet) and between 3-6 feet have increased since the 1970s. The primary reason for this increase in larger fish is due to the enactment of restrictive angling regulations in the reach. This fishery has been limited to catch and release only since 1970.

Introduced warmwater species such as small mouth bass, carp, and catfish are abundant and stable throughout the HCNRA. Limited information concerning native non-game fish indicates they are present and maintaining their population levels.

Fisheries Population Summary—The following is a summary of the current status of fish species identified in the 2003 (USDA Forest Service, 2003) relative to their status at the date of designation (1975):

Fall Chinook Salmon – Increasing – short-term upward trend
Spring Chinook Salmon – Increasing – short-term upward trend
Summer Chinook Salmon – Stable or Increasing – short-term upward trend
Steelhead Trout – Increasing – short-term upward trend
Sockeye Salmon – Decreasing
Pacific Lamprey – Decreasing
Bull Trout – Likely stable but little data
White Sturgeon – Increasing – short-term upward trend

Although all species (particularly the anadromous species) are far below historical numbers, populations of all but two of the species identified in 2003 (USDA Forest Service, 2003) are either stable or increasing relative to their numbers at the date of designation. Sockeye salmon, one of the declining species, use the mainstem river only as a migratory corridor and are little affected by HCC operations or other activities associated with the project. Two populations of sockeye historically occurred in the Snake River. This included the remnant but still existant Upper Salmon/Redfish Lake population and a population centered on the Payette Lakes area upstream of present day HCC. The Payette Lakes population was terminated when Black Canyon Dam was constructed on the Payette River in the 1920s (Chapman and Chandler, 2003). Primary causes of the decline of this species are the "4Hs" in the Columbia River Basin (downstream hydropower projects, hatchery influence, harvest, and habitat loss). These effects have been exacerbated by critically low numbers in the run when listed and the distance from ocean to headwater spawning and rearing areas in Central Idaho.

While Pacific lamprey numbers are low and declines are occurring across their distribution, the influence of HCC on this species is also unclear. They are also tributary spawners, relying on smaller substrates and lower velocities than those present in the Snake WSR. Lack of passage at HCC has undoubtedly reduced the amount of available

habitat for this species. In addition, reductions in sediment transport caused by the HCC may have adversely affected spawning, and reduced the available habitat for amocoete larvae during their freshwater residence time.

Fisheries Habitat—*Flow Regulation*- Flows in the HCNRA Snake River are regulated by the HCC except during peak events that exceed the powerhouse capacity of 30,000 cfs. Flows are held constant during the fall and winter period (Oct 21-Dec 11) to protect spawning fall Chinook salmon. Minimum flow of the river during these stable spawning flows is approximately 7000-9000 cfs. The purpose of maintaining constant flows during spawning is to ensure that redd sites are not de-watered and spawners are not chased off redds by fluctuating flows. Following the fall Chinook program, daily load-following is reinitiated. This results in daily up and down ramping of the river at a rate not to exceed one foot per hour (as measured 18 miles down river from the dam). This ramping rate is the highest for any anadromous fish-inhabited river in the Northwest (Anderson and Padula, 2003).

Project ramping exceeds natural storm-flow patterns and adversely affects fish and fish habitats. Ramping is believed to be responsible for impacts to fall Chinook rearing habitat in the HCNRA. After emergence, fry and juveniles utilize slow water areas along the river margins as they outmigrate. These areas typically contain smaller substrates including sands and fines. Fry key in on areas with finer sediments, low velocities, and gentle bankslope as preferred habitat during their outmigration (Garland and Tiffan, 1998). Beaches and terraces of the sort used by outmigrant Chinook are disappearing due to entrapment of sediments by the upstream HCC and the resulting lack of sediment transport into the reach. More than half of the beaches and bars have been lost since HCC closure (Gramms and Schmidt, 1999—also see introduction to this report for additional details). In addition, the daily (sometimes multiple times/day) up and downramping force migrating fry to adjust to constantly changing water stages and habitat conditions. This reduces the habitat quality and affect fry/juvenile survival and growth.

Stranding and entrapment of fall Chinook fry and other species also occurs as a result of the ramping regime imposed by IPC. Brink and Chandler (2005) evaluated the entrapment of fall Chinook fry at 26 sites during spring ramping events in 2005. They found that the densities of fish in the entrapment sites started to peak around the third week of April. Entrapment numbers ranged from 1 fish/pool/event to over 10,000 fish/pool/event. Six pools accounted for the majority of the entrapped fish: 1) Durham Bar, 2) Little Bar, 3) Lower Pine Bar, 4) Imnaha, 5) Big Sulfur, 6) Russell Bar. Preliminary results indicated that a total of 157,644 fish (fall Chinook only) were trapped with 414 estimated mortalities during the study. No information is presented on other species, but the study states other species were a very minor part of the sample and were mostly steelhead smolts. The only mortality (or actual stranded fish) they observed were in situations where water “subbed out” in the pools or possibly in the immediate vicinity surrounding the pools. There was no attempt at calibrating mortality counts. Dead fry are typically very difficult to see in this type of cobble substrate so without some form of

calibration these numbers should be considered underestimates.

IPC did not directly assess stranding associated with downramping events. However, Witty and Thompson (1974) documented stranding of salmonids and other species during index surveys along the Snake River as river stage declined.

White sturgeon spawning occurs when peak flow events provide the best spawning conditions. The HCC regulates flow events and reduces the number of these peak events. Although the population has maintained itself and increased the number of older individuals, there is a possibility that the reduction in the number of peak flow events could be impacting white sturgeon spawning success and the recruitment of young white sturgeon in the HCNRA

Water Quality-The water quality produced by the HCC does not meet state and federal standards. Dissolved oxygen in late summer is low enough to be lethal to some species of fish for approximately 7 miles below Hells Canyon Dam.

Due to the large number of hydropower projects in the basin, total dissolved gas (TDG) concentrations exceeding the state standard of 110% is a systemic problem in the Columbia River system. Excessive TDG levels have been documented to cause injury and mortality to fish. Highest TDG concentrations generally occur during spill events and are passed through the system or added to at each project. TDG levels downstream of Hells Canyon Dam have been documented to exceed 135%. Although "off-gassing" occurs to some degree at rapids in the river, elevated TDG levels persist at least as far down as the Salmon River confluence. IPC (2002) found that at spill events exceeding 19,000 TDG levels were still >110% 67 miles downstream of Hells Canyon Dam. Spill events between 9,000 and 13,000 cfs resulted in elevated TDG levels maintained 47 miles downstream and, at a spill of 2,400 cfs, standards were exceeded 17 miles downstream. No data is available for earlier periods but it is expected that TDG levels were at least as high or higher.

Flow regulation within the HCC results in higher than normal water temperatures in the fall in the mainstem Snake River throughout the HCNRA, and also results in colder than normal temperatures during the winter. Prior to the construction of HCC, most fall Chinook spawning took place in the Marsing reach of the Snake River. Water temperatures in this reach were warmer than in the reaches of the Snake River downstream of the HCC to which spawning is now restricted. Presently, fry emerge, rear and migrate later than they did historically (Connor, 1998). Connor (1998) proposes that this delay in early life history is one factor that contributed to the decline of the species and its eventual listing.

As noted at the beginning of this report, the sediment regime of the Snake WSR is greatly affected by the HCC and will continue to be affected by the proposed project operations. Submerged sandbars are an important habitat for juvenile fall Chinook salmon during their short residence time in Hells Canyon. Garland and Tiffan (1998) found subyearling

salmon were most abundant over sandy substrates although they were also found over almost all other substrates except for bedrock cliffs. This correlates with much other information collected in the Snake River system for both riverine and reservoir habitats. Garland and Tiffan (1998) suggest that bankslope gradient and velocity seemed to be the primary factors determining fish presence. Nelle and Bennett (1998) found little evidence of smallmouth bass predation on fall Chinook juveniles except following mass releases of hatchery fish. They concluded that the low observed predation was a result of a lack of habitat overlap between the species. While both species peferred littoral zones with low water velocities, the preference of fall Chinook for sandy substrates lowered their potential as a prey species for bass which preferred rocky substrate and structure. Thus, the continued decrease in the number and size of beaches in the system as a result of the interruption of sediment transport may contribute to increased mortaility due to predation from smallmouth bass.

In addition, as stated previously in this report, larval lamprey are dependent on sandy or muddy substrates during the freshwater stage of their lifecycle. Although it is unclear how many lamprey are present in the Hells Canyon reach, a reduction in fine sediments has the potential to decrease habitat suitability for this species of interest.

Resource Evaluation Summary—*Fish Populations*—Numbers of all anadromous species were at a very low point when the river was designated. Generally there has been a stable or increasing trend for most species of interest since designation. This is due primarily to other actions associated with Federal listing: restrictions on fishing; fish passage improvements at mainstem Columbia and lower Snake River dams; and, habitat restoration efforts. The two anadromous species (sockeye and lamprey) that are still declining are less dependent on the mainstem Snake River. Sockeye use the Snake primarily as a migratory corridor to and from habitats in the headwater of the Salmon River and lamprey are primarily tributary spawners.

Due to limited sampling, little is known about bull trout distribution and density in the river. No modifications of operations at HCD to benefit bull trout are contained in the FEIS although the USFS and USFWS recommended that FERC include in the new license a study to determine effects of several different operational scenarios on this species with the results of the study informing decisions to change operations to benefit bull trout and other aquatic species. The proposed fish passage plan for bull trout at HCC is an effort to reconnect isolated headwater populations with the mainstem population downstream of the project. In addition, the FEIS directs IPC to fund habitat improvement activities in tributaries to the project which would have some benefit to localized populations of bull trout upstream of the Wild and Scenic River. These actions should increase the viability potential for these isolated headwater populations but potential positive effects to the WSR bull trout population resulting from fish passage at HCC are longterm and uncertain. Regardless of the uncertainty surrounding the effectiveness of upstream actions on populations downstream, these actions will not have a negative effect on the Wild and Scenic River bull trout population.

Fish Habitat – Habitat had already been degraded at time of designation and continues to be degraded during the current license. Depending on the effectiveness of any mitigation measures required in a new 401certification for the project – some habitat parameters — Total Dissolved Gas, Dissolved Oxygen, and possibly temperature are expected to improve within the next license term. The extent of any new water quality mitigation measures is unknown at the present time since IPC has withdrawn their latest 401 Application and will be reapplying for a water quality certificate for the project before the end of the year. The reduced springtime ramping rate identified in FERC's FEIS may result in some improvement to rearing and outmigration habitat for fall Chinook salmon spawned in the Hells Canyon reach.

Much of the degradation had already occurred by date of designation, however beach/terrace erosion is still occurring. In addition, streambed armoring may be decreasing the value of available spawning sites for fall Chinook. Although the extent of HCC project effects are unknown due to a lack of data, fall Chinook spawning will continue to be restricted to the Snake WSR reach since passage is not proposed in the FLA. This could have significant impacts to the population in the future if the only available spawning habitat for this listed species is degraded.

WILDLIFE

Evaluation Criteria:
The evaluation criteria for wildlife are the quality and quantity of the wildlife habitat within the riparian zone of the Snake WSR.

Background:
Wildlife is an ORV of the Snake WSR. The Snake WSR and the area within the river corridor downstream of Hells Canyon dam to the confluence of the Salmon River provide an outstanding diversity of habitats for nationally or regionally important populations of indigenous wildlife species. This diversity is enhanced by mosaics in vegetation resulting from abrupt changes in aspect, elevation, temperature, moisture, geology, soil depth, and the effects of fire.

A listing of the species that inhabit or use the HCNRA can be found in *Wildlife Habitats in Managed Forests, the Blue Mountains of Oregon and Washington* (Thomas et al., 1979), updated with recent information from the field. Many of the bird species occur only as migrants. Managing for species richness is important. A key component for managing viable populations of all species is to provide a wide variety of habitat conditions in all plant associations.

In the Snake WSR reach downstream from Hells Canyon Dam, a narrow band of diverse riparian communities intermittently follow the river and its many tributaries. Limited in geographic area, this riparian zone is vital because of its biological diversity (Braatne et al., 2002). Riparian vegetation is that which is influenced by the river, or influences the river. This means vegetation immediately along the normal water levels that hang over

the river's edge, providing shade, nutrients, and structure. Riparian sites include fluvial surfaces such as stream banks, stream channels, active channel shelves, active floodplains and overflow channels (Kovalchik, 1987). River-dependent riparian vegetation also grows many feet back from the river's edge, in areas where high flows have scoured, then delivered silt, sand and seeds to the floodplain areas. Areas of high quality riparian habitat provide resources necessary for survival, reproduction, and movement of fish and wildlife species, and thus contribute to the maintenance of local and regional biological diversity (Rosenberg et al., 1997).

Seventy-five percent of all wildlife species found within the HCNRA are directly dependent upon, or disproportionately use, riparian habitat (Thomas et al., 1979). In riparian habitats, the vegetative components fulfill the ecological needs of the greatest array of wildlife species (Ohmart, 1996).

The management goal for riparian wildlife habitat within the HCNRA and the Snake WSR is to ensure the protection and maintenance of riparian and aquatic habitat and maintain viable populations of native and desired nonnative riparian and aquatic vertebrate and invertebrate species (USDA Forest Service, 2003).

Resource Evaluation:
Upland Wildlife Habitat—Reports (USDA Forest Service 1981, IPC 2003, and Blair et al. 2002) have identified that the riparian and upland zones of the HCNRA were badly over-grazed and trampled by early grazing and land clearing operations. With the elimination or reduction of commercial grazing allotments and stocking rates, some recovery of these habitats had taken place by the Snake WSR's designation date. However, recovery was primarily attributed to "invader" and "increaser" vegetative species, many of which still dominate these sites. One of the increaser species is hackberry, a disjunct species from the Southern Rockies that is not only present in the upland wildlife habitat, it now dominates much of the riparian zone. For discussion of riparian hackberry effects to the Snake WSR, see following discussion of riparian vegetation. The HCC does not affect upland habitat of the Snake WSR.

Riparian Wildlife Habitat—The riparian zone of the Snake WSR is affected by the project in three ways. First, operation of the project's turbines varies the water level in the river between 5,000 and 33,000 cfs—which is 10 feet of vertical change. "Load following" power production results in extreme water level fluctuations in this zone daily. Second, because of the their large storage capacity, the project reservoirs affect the concentrations of sediment in flows up to 100,000 cfs, which is around 12 vertical feet higher than the 33,000 cfs level. The project will continue to reduce supply of sand and silt at all flows up to 100,000 cfs. The third effect is to the transport and deposition of seeds along shorelines. Flood control operations have reduced the frequency of peak flows, thereby resulting in a shortage of barren, moist nursery sites at shoreline elevations required for riparian vegetation establishment. The riparian vegetation that existed at the date of designation in 1975 will continue to experience decreased supply of silt and sand

for the substrate, and will continue to be affected by extreme daily and weekly flow fluctuations under proposed HCC operations.

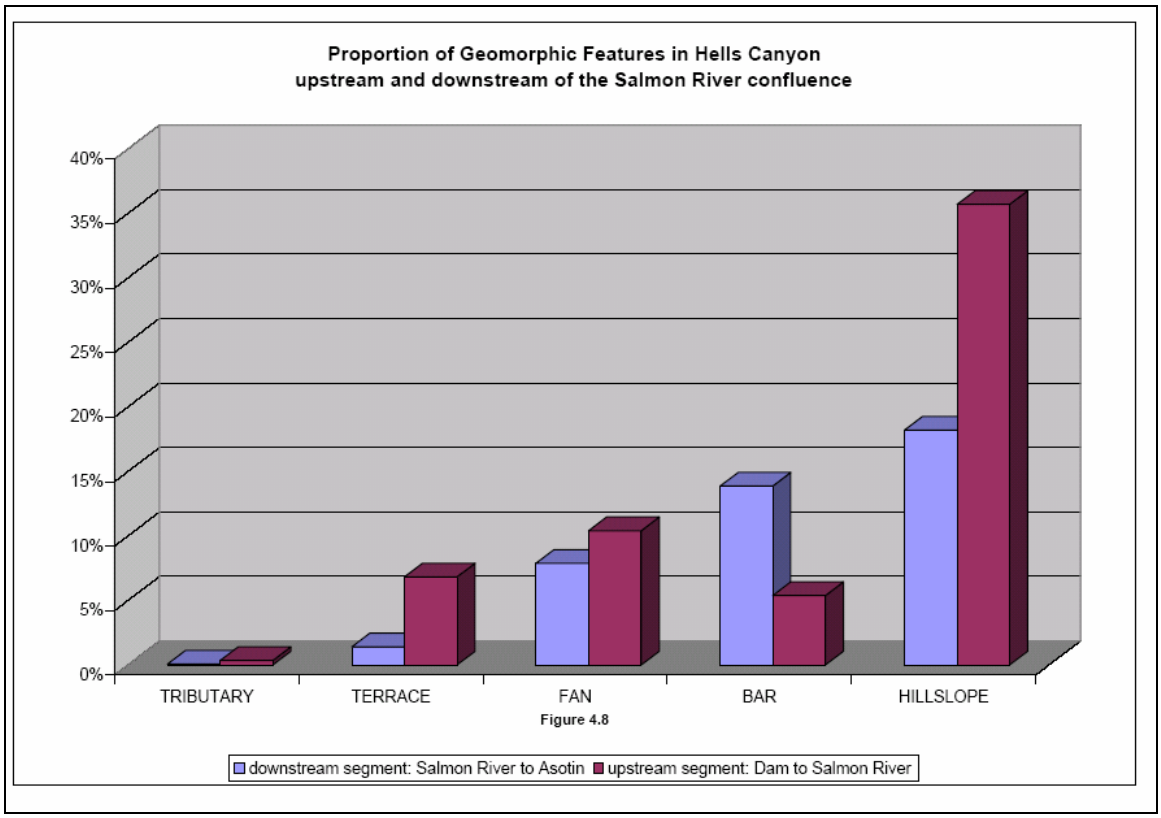
The ACOE, North Pacific Division, inventoried riparian habitat and associated wildlife species along the Columbia and Snake Rivers to establish baseline data (McKern, 1976). The study area was divided into 25-specific study segments. Segment No. 22 is defined as the Snake River from Hells Canyon Dam downstream to the confluence of the Salmon River. All vertebrate wildlife exclusive of fish was inventoried in the study area. Inventory data identified 25 mammals, 91 birds, 10 reptiles and amphibians and 149 plant species in Segment No. 22.

Species groups affected by the reduction of riparian habitat include aquatic furbearers and their prey base (small mammals), songbirds, bats, and the breeding success of amphibians (McKern, 1976). The riparian vegetation is also important to chukar partridge, mule deer, beaver, raccoon, porcupine and other forms of terrestrial wildlife as food and cover to varying degrees at certain times of the year (Pacific Northwest River Basins Commission, 1974, p. 122). The report stated that maintenance of riparian vegetation can be affected by river flow and stage, since the succulence and productivity of this vegetation is dependent upon the abundant water supply available to the plant roots supplied by the river. Further, it states that a definite flow volume is not as important as the frequency of flow fluctuation, so long as some water is in the river.

In the studies outlined above, researchers noted the effects on riparian vegetation within and near the level of the fluctuating water levels. They identified that riparian communities in the regulated Snake River are younger, are in a narrow band and have less canopy cover than like riparian communities on the unregulated Salmon River. The studies suggest the reason for the less robust riparian community is the lack of fine sediment recruitment, and the fluctuating water levels from project operations. In pre-project conditions, sand that was naturally mobilized and transported by high flows was replaced by more silt and sand. Now the Hells Canyon reservoirs trap and stop the recruitment of materials that would form new deposits in the interstitial spaces between cobbles and boulders that provide the basis of riparian vegetative growth. The effects of both the reduced sediment recruitment and hourly and daily fluctuating water levels on plant species and communities inhibits reestablishment of riparian communities.

Braatne et al. (1999) stated that due to the lack of sediment deposition, the Snake River sandbar willow communities below Hells Canyon Dam are largely relic populations and that the type and volume of sediments contributed by side-tributaries are not sufficient to promote the active recruitment of fine-sediment dependent species, such as sandbar willow. In addition, hackberry has been encroaching on the riparian zone formerly occupied by willows. This encroachment is most likely due to higher summer base flows under HCC operations and because of hackberry adaptations such as root suckers and sprouts.

The ongoing effects of the project will be slightly different along the shoreline depending on the characteristics of the river's edge. The following figure (Miller et al., 2002, Figure 4.8) shows the types and percentage of shoreline in different geomorphic classes. The table following this figure shows the geomorphic classes (feature), material type and source (Miller et al., 2002). In these sites there is both the lower and upper zone, but the one thing all zones and sites have in common is the continuing low rates of sand and silt supply.



Report E.1-2 Appendix C Table 3.1 - List of Geomorphic Features

Geomorphic Feature	Material Type	Source
Hillslope	Rock	Colluvial
Terrace	Boulders	Alluvial
Fan	Cobbles	N/A (rock)
Tributary	Gravel	
Bar	Sand	

Hillslopes are primarily steep areas underlain by bedrock. Along these shorelines, the riparian zone is often bedrock, boulders, and large cobbles. Within the 10-vertical-foot fluctuation zone, riparian vegetation is severely affected by both flow fluctuation and reduction in sand and silt supply. Small deposits of sand and silt in the interstitial spaces

provide some rooting material. Some soil material will move downslope from above, but the continued flow fluctuations will continue to the wash away and weather the small patches of soil through saturation and desiccation. This effectively leaches nutrients from any silt or sand material as it begins to form soils in these patches. Hillslopes occupy approximately 35% of the 59.3 miles of shoreline. Riparian vegetation that occupies this feature is affected by the daily and weekly flow fluctuation in the 10-vertical-foot band between 5,000 and 33,000 cfs.

Debris fans include tributary, land slide, talus and debris-flow/avalanche features, with tributary fans being the dominant type. Miller et al. (2002) indicate that over 420 debris fans enter the river channel in Hells Canyon (roughly 3 fans per km). The table above shows that debris fans consist of cobbles and gravel. These areas are important for diversity and abundance of wildlife because of the habitat associated with the tributary riparian zone, and because they often provide wildlife travel corridors. Riparian vegetation on debris fans within the lower flow fluctuation zone is greatly reduced by the lack of sediment and flow fluctuations.

Bar features include primarily sandbars. Sandbars form where the river's current is slower during high flow events. The largest bars form in eddy-deposition zones, downstream of rock outcrops and fans. If available, sand is mobilized and transported from these areas and is resupplied on a frequent enough basis that vegetation does not become established. In the upper beach area, above the fluctuation zone, some vegetation becomes established periodically. The project has decreased the sand supply to these upper areas.

The material in terrace features, as shown on the table above, is primarily boulders, delivered under the extremely high flows of the Holocene epoch. The upper and lower shoreline portions of these high terraces are very steep, and are affected much like hillsides, although more supply of sand and silt may be available from upslope. Another type of terrace feature is the floodplain terraces that have formed along the less-steep areas of shoreline, and often just upslope from sandbars. These sites are formed by high flows occurring in intervals of 100 years or less, which carry high sediment loads. The sediment concentrations in these flows will continue to be reduced by the project, thus being unavailable to replenish the floodplain terraces.

Resource Evaluation Summary—The HCC has and will continue to have a negative effect on riparian wildlife habitat communities and the species they support by its project operations. Lack of sediment recruitment, and daily and weekly flow fluctuations are reducing the vigor and longevity of riparian wildlife habitat communities along the Snake River downstream of Hells Canyon Dam to the confluence of the Salmon River.

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