Lewis River Hydroelectric Projects

Merwin Hydroelectric Project (FERC No. 935)
Yale Hydroelectric Project (FERC No. 2071)
Swift No. 1 Hydroelectric Project (FERC No. 2111)
Swift No. 2 Hydroelectric Project (FERC No. 2213)

USDA Forest Service
Gifford Pinchot National Forest

EXISTING INFORMATION ANALYSIS

1. Flow and Sediment Regime

Prepared by: Ruth Tracy, Forest Hydrologist (August 2000)
Updated by Karen M. Thompson[1], Monument Hydrologist
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I. Existing Situation

The four Lewis River hydroelectric projects alter flow and sediment regimes within the Lewis River Basin, which results in changes to the physical structure and function of the aquatic and riparian ecosystem and the distribution and abundance of aquatic and riparian species. The projects alter the magnitude, frequency and timing of peak flow events, and reduce base flows in free-flowing reaches downstream of the projects, and cause sediment storage rather than transport to tributary reaches downstream of the reservoirs. Project operations have also dewatered the mainstem Lewis River reach between the Swift Dam and Yale Reservoir, known as the Swift by-pass reach. Continued inundation, dewatering and blockage of the Lewis River and its tributaries, when considered cumulatively, has permanently altered the downstream passage of sediment and large wood, and the upstream movement of aquatic and riparian species normally present in a free-flowing riverine system. This represents a continuing effect of the Lewis River hydroelectric system.

Peak and Base Flows

Swift Reservoir is drawn down between November and February as flows are accelerated and storage space is created to buffer downstream reservoirs from peak flow events. This results in the delay of large peak flow events due to the reservoir's function to store flood flows and power generating operations. Project operations can reduce the discharge of lesser peak flow events when peak flows are retained within the reservoirs. This changes the magnitude, timing and frequency of these peak flows in downstream reaches. These events are critical to channel structure maintenance and large woody debris routing.

[1] (360) 449-7826

Project operations reduce baseflow in the Swift bypass reach and downstream of the reservoirs. Baseflows in the bypass reach consist of groundwater accretion and tributary flows. The reduction of instream flows alters habitat conditions by reducing water velocity, depth and wetted streambed area, thereby reducing habitat for fish, amphibians, benthic invertebrates and other species. Reduced baseflows increase stream temperature in the bypass reach, which reduce habitat suitability for temperature sensitive aquatic species. Subsurface aquatic habitats (hyporheic zones) are reduced as a result of decreases in wetted streambed area. These well oxygenated aquifer layers extend out from the margins of the stream, are sites for nutrient cycling and support species contributing to the food chain. Biological connectivity within the riparian area for riparian dependent species is disrupted by this lack of hydrological connectivity in the by-pass reach.

The Lewis River hydroelectric dams also alter the base flows below Merwin Reservoir. Mean monthly flows prior to dam construction were measured for only eight years and ranged from 840-1,402 cfs in August and 822-2,007 cfs in September (U.S. Geological Survey, 1985). Minimum flow requirements specified in Article 49 for the Merwin Hydroelectric Project for the reach below Merwin Dam were developed in 1983 with consideration of spawning and rearing habitat for fall chinook salmon enhancement. These minimum flow requirements are specified as 1,200 cfs during the period between August 1 and October 15. This results in flows with less variation among years than the normal range of flows that occurred under natural conditions. Designating one flow for minimum flows during the low flow period decreases the variation in which riparian and aquatic species habitat evolved.

Sediment Transport

The maintenance of a sediment and flow regime in the Lewis River similar to pre-development is important to meeting the provisions of the Clean Water Act, as well as the Northwest Forest Plan's Aquatic Conservation Strategy. Changes in the flow and sediment regime resulting from the construction of three dams have affected channel structure, the aquatic and riparian habitat, and habitat connectivity both upstream and downstream of the projects. Changes in the flow and sediment regime continue to affect the production capability of aquatic species in the Lewis River Basin.

The curtailment of sediment movement through the river system created two primary adverse effects: 1) the reduction or alteration of sediment storage and transport to downstream reaches including their floodplains, and 2) storage of sediments in inundated channels from present reservoir water levels.

Swift Reservoir is managed to retain most of the sediments contributed by the upper reaches of the Lewis River Basin, thereby decreasing reservoir storage capacity (Frank Shrier, PacifiCorp, personal communication). The reduction in sediment transport has limited downstream supply of desired sediments such as spawning gravels, as well as the transport of finer sediments that would normally have reached lower gradient reaches in the Lewis River and the Columbia River estuary.

The inundation of Drift Creek, Pine Creek, Range Creek and other tributaries that flow into the

upper half of Swift reservoir results in increased sediment storage at the mouths of these streams due to reservoir water elevations limiting sediment transport during high flow events. Increased sediment storage contributes to disconnected riparian habitat and degraded channel habitat resulting in loss of spawning areas and invertebrate population complexity (food source for fish).

Downstream of Swift Reservoir, project operations dewater the Swift Creek by-pass, resulting in a reach with flows consisting only of groundwater accretion and tributary flows. Instream flow reductions in combination with the reduction in sediment transport from the upper watershed have resulted in a relatively homogenous channel that is infrequently subjected to extreme peak flows (introduced via spill), which abruptly resets the bypass channel.

Contrary to expected deficits, spawning gravels below Merwin Dam are abundant. Potential reasons may include 1) the low gradient reach and channel form prevents gravels from being transported, 2) the presence of a historically deep depositional area, 3) tributary inputs within this channel section may have good source areas, and 4) back eddies and channel hydraulics may work to retain gravels. Historical events including extensive fires, timber harvest and splash damming may have resulted in the acceleration of erosion and transport of sediment and gravels from upstream sources. An altered but stable channel below Merwin Dam and above Eagle Island may have been created by the projects as peak flows were dampened (channel maintenance flows changed) during the same time period that the coarse sediment supply was reduced. Floodplain confinement at the mouth of the Lewis River and/or changes in the timing of peak flows along the Columbia River may also contribute to the lack of gravel transport in the reach between Merwin Dam and Eagle Island.

The disruption of transport and recruitment of large wood also affects sediment transport and storage. These effects are described in the EIA for Large Woody Debris Recruitment and Routing. The removal of large wood can decrease sediment storage capacity, facilitating scour to bedrock in some areas and reducing habitat suitability for anadromous salmonids and other aquatic organisms.

Providing flow and sediment regimes that closely mimic natural flows and geomorphological processes to the greatest extent biologically and technically feasible is the desired goal. This could optimize conditions downstream by reestablishing proper channel function and assuring channel maintenance for riparian and aquatic biota life cycles (i.e. spawning, rearing, holding).

II. Forest Plan Direction

The Gifford Pinchot National Forest Land and Resource Management Plan Amendment 11 (1995) provides the management direction for all National Forest System lands and their associated resources directly affected by or within the project vicinity of the four hydroelectric projects in the Lewis River system. Amendment 11 is a compilation of the prevailing direction and standards and guidelines from the Record of Decision for the Northwest Forest Plan and the Gifford Pinchot National Forest Management Plan (1990).

The Aquatic Conservation Strategy (ACS), a core component of the Northwest Forest Plan, provides management direction aimed at maintaining or restoring the ecological health and functioning of watersheds and the aquatic ecosystems contained within them. Specifically,

objectives 5, 6 and 9 pertain the most to this Existing Information Analysis. These objectives are stated as follows:

> *Objective 5 – Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.*
>
> *Objective 6 – Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.*
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> *Objective 9 – Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.*

The Northwest Forest Plan Standard and Guideline LH-2 states: "During the relicensing of hydroelectric projects, (the Forest Service shall) provide written and timely license conditions to FERC that emphasize in-stream flows and habitat conditions that maintain or restore riparian resources and channel integrity."

Most of the federally managed lands that flow into the uppermost reservoir in the Lewis Basin are designated as Tier 1 Key Watersheds. Tier 1 Key Watersheds were selected based on their direct contribution to anadromous salmonid and bull trout conservation. Key watersheds are highest priority for watershed restoration.

The Forest Service Land adjacent to Swift Reservoir (Drift Creek) is designated as Management Area Category Wildlife Special. Standard and guidelines for Wildlife Special Management Area Category include recommendation to improve wildlife and fisheries habitats (Chapter 4 Administratively Withdrawn – Wildlife Special).

III. Information Analysis

Five studies have been conducted to date that describe flow and sediment conditions in the Lewis River Basin:

- WTS-1: Physiographic Setting and Stream Channel Classifications. The study objective was to describe the general characteristics of the Lewis River watershed and to group study area streams for further analysis. The study contains a very general description of the physical processes that form the basin, but very little detail regarding conditions upstream of Swift Reservoir.

- WTS-2: Streamflow Study. The objective of the streamflow study was to describe current and historic flow conditions at selected gages in the Lewis River watershed. The study analyzes daily flows, peak flows, and rates of flow change (ramping rates) to characterize the hydrology in six reaches, including the Lewis River upstream of Swift Reservoir, the Swift bypass reach, the Lewis River between Merwin Dam and Eagle

Island, Speelyai Creek upstream of the diversion, Speelyai Creek downstream of the diversion, and the Swift No. 2 power canal.

The study was to address several relicensing questions including how the project affects baseflows in the Lewis River downstream of the dams, and how timing, frequency, magnitude and/or duration of high flows in the Lewis River downstream of the dams, what are the historical and current hydrological patterns, etc.

- WTS-3: Stream Channel Morphology and Aquatic Habitat Study. This study was intended to document existing aquatic habitat characteristics in "project-affected" stream reaches, and to assess how operation of the Lewis River Projects will affect stream morphology and aquatic habitat characteristics during the period of the new license, and to provide information on the effects of potential management changes to water, wood and sediment inputs and assess potential enhancement options in project-affected reaches.

  Several key questions related to project-affected reaches, which included Lewis River downstream of Merwin Dam, the Swift bypass reach and Speelyai Creek downstream of the canal diversion. The study addresses transport of spawning gravels below Merwin. It discusses historical large wood accumulation and the role of the dams in large wood transport. The studies do not address inundated reaches, the Lewis River upstream of Swift Reservoir, or tributaries to the reservoirs or the mainstem Lewis River.

- WTS-4: Swift Bypass Reach Synthesis Study. This study was designed to document current environmental conditions of the Swift bypass reach, including aquatic, water quality and riparian habitat conditions, and project operations.

- AQU-2. Swift Bypass Reach Instream Flow Study. This study analyzes the area of available aquatic habitat for different species and life stages at different flows using the Physical Habitat Simulation (PHABSIM) model of the Intream Flow Incremental Methodology (Bovee 1982). Results of the model were to display potential aquatic habitat at different flow regimes in the bypass reach.

- AQU-9. Speelyai Creek Connectivity and Speelyai Hatchery Protection Study. This study was to identify measures necessary for operation of the Speelyai Diversion within the parameters of the existing water right.

IV. Preliminary Forest Service Objectives

In order to meet Aquatic Conservation Strategy objectives 5, 6, and 9, Forest Service will support actions that strive to re-establish and maintain the connectivity of the river system including physical and biological processes so that native aquatic species in the Lewis River Basin can utilize all available habitats and maximize their productivity levels. The Forest Service would support efforts to mimic as closely as biologically and technically feasible, the flow and sediment regimes, which provide for the maintenance and enhancement of channel structure and habitat for aquatic and riparian dependent species.

- Enhance the Swift Bypass Reach to the extent possible with the existence of the Swift Dam. This will include restoring instream flows (including specifying ramping rates) and recruiting spawning gravels, large woody debris and/or other needed structure to create habitats for aquatic, riparian and terrestrial species that occur within the Lewis Basin.

- Support agency enhancement alternative proposals that meet Forest Plan objectives.

V. Information Needs

The following information would fill apparent information gaps in aquatic and watershed process studies that have been completed to date. These were listed as study objectives in the original EIA for Flow and Sediment Regime (August 2000) that was submitted to the applicants in response to Scoping Document 1.

1. Estimate changes to the timing, frequency and magnitude of high flow events and base flows (WTS 2).

2. Evaluate the historic and current source areas, transport reaches, and depositional areas for sediment and characterize present channel features such as spawning gravel beds, side channels, and woody debris complexes. Identify the processes that directly contribute to the changes and trends in channel morphology since initiation of project operations (WTS-3).

3. Assess the project related effects of flow and sediment regime changes to aquatic and riparian habitats. Assess the cumulative effects of changes to sediment transport on a basin level (WTS-2).

4. Determine changes from altered flow and sediment regime to the subsurface aquatic habitats and species abundance. Estimate any consequences to the aquatic and riparian food chain (WTS-2)

5. Assess connectivity between riparian and aquatic habitats as they relate to channel morphology and sediment transport processes (WTS-3 for "project affected area"; AQU-9 for Speelyai Creek).

6. Estimate how changes in project operations can improve downstream aquatic and riparian habitat and estimate desired flows for instream enhancement measures. Study needs include in-stream flow analysis at the Swift by-pass reach (AQU-2) and Lewis River below Merwin Dam (WTS-3 to downstream end of Eagle Island), evaluation of ramping rates of all four projects (WTS-2), and evaluation of existing spawning gravels and potential for gravel augmentation.

7. Information collected regarding flow, sediment and large wood need to be integrated with the results from aquatic habitat evaluations and other relevant studies to determine areas where enhancement would benefit riparian and aquatic resources. The integration of studies will aid in an overall evaluation of habitat quality, and contribute to the prioritization of habitat restoration needs as related to Protection, Mitigation, and Enhancement (PM&E) requirements.