Passage and Flow Considered Anew: Wild Salmon Restoration Via Hydro Relicensing

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"*For obtaining a free course for fish thro' such Caulds, Dams or Damheads as are already erected or hereafter may be made in the River Tweed or other rivers connected with.*"[1]

I. TWO CENTURIES OF SALMON NAVIGATING HYDRO

There is a tendency to think of the impacts of hydropower facilities on salmon stocks as a more recent phenomenon, as an issue that emerged in the mid Twentieth Century in the period when most of the large-scale on-stream dams were constructed in the United States. As evidenced by the quote above, relating to passage of the 1807 River Tweed Act by the British Parliament, however, the law has struggled to reconcile the interests of salmon and hydropower for more than two centuries.[2]

The River Tweed forms the border between England and Scotland and is one of the most productive salmon and sea trout fisheries in the United Kingdom.[3] The River Tweed (as its name suggests) is associated with the woolen textile mills that began to operate along the waterway in late 1700s and early 1800s, mills that were powered by waterwheels.[4] The textile mills along the River Tweed were often built upland, away from the river's edge, and water was diverted to the off-stream waterwheels adjacent to the mills through instream construction of impoundments called "caulds" to collect water, which was then diverted through channels to the waterwheels and then returned downstream back to the rivers. To the consternation of both commercial and recreational salmon fishermen, these instream mill caulds often blocked the upstream and downstream passage of salmon and sea trout.[5]

To address this problem, in 1807 the British Parliament passed the River Tweed Act, establishing the River Tweed Commissioners, and

1. W. Ass'n, Mission Statement, supporter of the 1807 River Tweed Act (AUG. 1, 1805), *in* CAROLINE BALFOUR, THE EARLY DAYS OF THE RIVER TWEED COMMISSIONERS 31 (2007).

2. *Act to Amend and Rent More Effectual Three Acts, Made in the Eleventh, Fifteenth and Thirty-seventh Years of His Present Majesty, for the Regulation and Improvement of the River Tweed*, 47 G. 3 c. 29 (Apr. 25, 1807) [hereinafter *1807 River Tweed Act*]; *see generally* BALFOUR, *supra* note 1.

3. *See generally* BALFOUR, *supra* note 1.

4. *Id.* at 31-34.

5. *Id.* at 31-34.

providing them with authority to undertake certain measures to safeguard salmon and sea trout stocks.[6] More particularly, to address the problem of instream impoundments to collect and deliver water to textile mill waterwheels, Article XI of the 1807 River Tweed Act provides:

> [a]ll mills dams/dikes/weirs and other permanent obstructions in the river to be altered or constructed to allow the free run of fish. If proprietors/occupiers do not comply, Commissioners & Overseers to give notice in writing to do so within 14 days. If nothing happens, Commissioners & Overseers may order the work to be done at the expense of the proprietor/occupier.[7]

Pursuant to Article XI of the River Tweed Act (which remains in effect today), we see that as early as 1807, there were provisions in English law that provided not only that it was unlawful for instream hydropower facilities to obstruct the "free run of fish," but that furthermore it was the financial responsibility of the operators of such instream hydropower facilities to modify their facilities to ensure such fish passage.[8] If the operators of the facility refused to make these modifications within two weeks' notice, the River Tweed Commissioners were authorized under the 1807 River Tweed Act to make modifications themselves and send the operator the bill.[9]

In the United States, the approach to reconciling the relationship between salmon stocks and hydropower facilities has been quite different than the approach reflected in the River Tweed Act. Compared to 1807, we now have a much more advanced understanding of the particular habitat needs of salmon and how these habitat needs are impacted by on-stream dams. For instance, we now better appreciate that cold-water fish like salmon cannot survive higher water temperatures, and higher water temperatures are often associated with reduced downstream flow due to the diversion and impoundment of water upstream.[10] As a second example, we now know that salmon require the presence of gravel instream for spawning habitat, yet such gravel is often trapped behind

6. *1807 River Tweed Act*; *see* BALFOUR, *supra* note 1, at 43-48.
7. *1807 River Tweed Act*, art. XI; *see* BALFOUR, *supra* note 1, at 44.
8. *Id.*
9. *Id.*
10. TROUT UNLIMITED, HEALING TROUBLED WATERS: PREPARING TROUT AND SALMON HABITAT FOR A CHANGING CLIMATE 3 (Aug. 2007).

upstream impoundments.[11] Lastly, there is now scientific literature showing that salmon are particularly suited to spawning in the higher elevation reaches of a watershed, but upstream passage to and downstream passage from such higher elevation reaches is often blocked by impoundments.[12]

Despite our more advanced understanding of the ways that on-stream hydroelectric ("hydro") facilities can adversely impact salmon stocks, in the United States it has proven difficult to establish regulatory mechanisms to ensure that such facilities are operated in a manner that provides for the upstream and downstream passage of salmon and salmon's habitat needs. In this respect, Twenty-First Century hydro regulation in the United States has been slow to incorporate the principles and remedies reflected in the 1807 River Tweed Act.

With this broader historical context in mind, this article reviews efforts in the United States to better address the relationship between the condition of fisheries and the operation of on-stream dams. More specifically, this paper reviews the fishery-related aspects of the Federal Power Act ("FPA").[13] The FPA requires operators of most existing on-stream hydro facilities in the United States to periodically apply to the Federal Energy Regulatory Commission ("FERC") to relicense such facilities.[14]

As detailed below, the FERC hydro relicensing process in the United States has often provided an effective mechanism to modify the terms of dam operations to reduce the adverse impacts on fisheries, particularly impacts on wild Pacific Coast salmon. This experience with FERC relicensing suggests that a transparent and scientifically rigorous regulatory framework to periodically review and modify the way dams operate can play a critical role in the restoration of wild fish stocks.

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11. CAL. DEP'T OF WATER RES., OROVILLE FACILITIES – HIGHLIGHTS OF THE SETTLEMENT AGREEMENT FOR LICENSING (2008).

12. *See generally* Peter M. Rudberg, Marisa Escobar, Julie Gantenbein & Nicholas Niiro, *Mitigating the Adverse Effects of Hydropower Projects: A Comparative Review of River Restoration and Hydropower Regulation in Sweden and the United State*s, 27 GEO. INT'L ENVTL. L. REV. 251 (2015).

13. Federal Power Act, 16 U.S.C. §§ 791-793, 796-825r (2012).

14. HYDROPOWER REFORM COAL., CITIZEN TOOLKIT FOR EFFECTIVE PARTICIPATION IN HYDROPOWER RELICENSING 1 (2005).

II. INSTREAM CONDITIONS NEEDED BY WILD PACIFIC COAST SALMON AND MISPLACED RELIANCE ON HATCHERY SALMON

To understand the relationship between FERC hydro relicensing and wild salmon stocks, two preliminary points need to be explained at the outset. The first point is to identify the lifecycle and particular habitat needs of wild Pacific Coast salmon. The second point is to recount historic reliance on hatchery salmon as an anticipated replacement for wild salmon in the context of the initial approval and licensing of many Pacific Coast hydro facilities.

A. Wild Pacific Coast Salmon Habitat Needs

All wild Pacific Coast salmon are anadromous, meaning they spawn and spend the first period of their life in freshwater rivers, streams, and creeks. The juvenile salmon then migrate downstream to the ocean where they spend several years in saltwater, ultimately returning upstream to their natal freshwater river, stream, or creek to reproduce and die.[15] Below are some of the conditions wild Pacific Coast salmon need to complete this lifecycle, and an overview of how on-stream dams can impact these conditions.

1. Downstream and Upstream Passage

To make the journey from their upstream freshwater spawning grounds to the ocean, wild Pacific Coast salmon need downstream passage from these grounds to the sea. Such downstream passage for salmon can be adversely impacted by dams in two ways. First, if no water is being released from a dam, salmon migrating downstream will find themselves trapped and confined to the reservoir located behind the dam. Second, if water is being released into high-speed turbines to generate hydro power, salmon migrating downstream can be killed as they pass through the spinning turbines. Some dams include fish ladders, which enable some outgoing salmon to go around the dam or avoid being pulled into the turbines. Sometimes outgoing salmon are collected upstream of the turbines, and then trucked below the dam where they are then released.[16]

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15. *See generally* TROUT UNLIMITED, *supra* note 10.

16. *See generally* Rudberg, Escobar, Gantenbein & Niiro, *supra* note 12.

On their return journey from the ocean to their natal fresh water spawning grounds, wild Pacific Coast salmon need upstream passage. Such upstream passage can be blocked by dams preventing salmon from reaching their natal spawning grounds to reproduce. Some dams include fish ladders for upstream passage which enable some returning salmon to navigate their way upstream around the impoundment. Sometimes returning salmon are collected below the dam, and then trucked above the dam where they are released.[17]

2. Maintaining Cold-water Temperatures

Salmon are cold-water fish with limited tolerance for higher water temperatures. Salmon prefer water temperatures below fifty-five degrees (Fahrenheit), and suffer reduced growth and survival rates as water temperatures get closer to sixty degrees (Fahrenheit), and are generally unable to survive in water warmer than sixty degrees (Fahrenheit).[18]

Instream water temperatures tend to be hottest in the summer, which is also when water stored in reservoirs behind dams is used most intensely for agriculture and irrigation. The result is that there is often reduced releases of upstream water from dams at the time of year when increased air temperatures are pushing water temperatures up. The reduced volume of water flowing downstream causes downstream waters to warm, increasing salmon mortality rates.

Increased and timely reservoir releases of cold water can help maintain the downstream cold-water habitat conditions that salmon need, but such releases are often opposed by stakeholders who would like to divert reservoir water out of stream or would like the reservoir releases to occur only at times when hydro power generation is needed.[19] Releasing reservoir water downstream during periods when the turbines are not operating is sometimes referred to as "spilling" water.

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17. *See generally Id.*

18. *See generally* TROUT UNLIMITED, *supra* note 10.

19. Paul Stanton Kibel, *A Salmon Eye Lens on Climate Adaptation*, 19 OCEAN & COASTAL L.J. 65, 71-72 (2013) ("Additional quantities of cold water from upstream dams/reservoirs can be released to reduce the temperature of downstream waters. . . . The additional of reservoir water for this purposes, however, may be resisted by agricultural and municipal users of water stored in reservoir behind such dams." *Id.*).

3. Gravel and Woody Debris for Spawning Habitat

Salmon require shallow water with clean gravel beds to spawn and reproduce. Spawning can also be adversely affected if the velocity of the water where the eggs have been laid is too high, as this tends to wash the eggs out of the gravel and downstream.[20] One of the ways the velocity of rivers, streams, and creeks can be reduced is by the presence of large woody debris, *e.g.* fallen trees, which can create calmer eddies with reduced flow speeds.[21]

The presence of upstream impoundments often traps gravel and woody debris behind the dam, so that the presence of these features and conditions is reduced downstream below the dam. The release of reservoir water for hydro power generation, which is designed to maximize the velocity of the water passing through the turbine, can result in high velocity flows below the dam which can wash out gravel and woody debris in these downstream reaches.

B. Replacing Wild Salmon with Hatchery Salmon

Many of the on-stream dams on salmon-bearing rivers on the Pacific Coast of the United States were built in the period from 1940 to 1970. In the time period in which these dams were built, there was a basic understanding of the lifecycle of wild Pacific Coast salmon, and more specifically, there was a recognition that wild salmon stocks would be adversely impacted by the blockage of downstream and upstream passage resulting from the dams.[22]

At the time these dams were constructed (from 1940 to 1970), however, the approach was generally not to consider how the design or operation of dams could be modified to maintain wild salmon stocks. Rather, at that time, the focus was on developing "hatchery salmon" facilities below the dams to replace the wild salmon stocks that would be lost or reduced as a result of the dams. In her 2004 article, *The Salmon Hatchery Myth: When Bad Policy Happens to Good Science*, Melanie Kleiss explains:

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20. Wash. Dep't of Fish and Wildlife, *Sockeye (Red) Salmon*, STATE. OF WASH., http://wdfw.wa.gov/fishing/salmon/sockeye (last visited Dec. 14, 2015) ("Successful egg and alevin survivals are dependent on clean spawning gravels and low to moderate winter stream flows.").

21. CAL. DEP'T OF WATER RES., *supra* note 11.

22. *See generally* Hitoshi Araki, Barry A. Berejikian, Michael J. Ford & Michael S. Blouin, *Fitness of Hatchery-Reared Salmonids in the Wild*, 1:2 EVOLUTIONARY APPLICATIONS 342 (2008).

> [h]atcheries create their stocks by killing returning adult females, harvesting their eggs, and fertilizing them with sperm from returning males. After incubation and hatching, the offspring are then raised in a captive environment until they are ready to migrate to the ocean.[23]

Unfortunately for the salmon, and the indigenous communities and fishers reliant on the salmon, the salmon hatchery programs have generally not been successful, and there is a growing body of scientific data and literature on how hatchery salmon are in fact contributing to the further decline of wild salmon stocks.[24]

There are two primary reasons hatchery salmon mitigation has fallen short. First, numerous scientific studies have confirmed that hatchery salmon have lower overall survival rates than wild Pacific Coast salmon, as well as significantly lower breeding success rates than wild Pacific Coast salmon.[25] Second, when large numbers of juvenile hatchery salmon are released into rivers from their captive environment, they are particularly aggressive and tend to out compete wild juvenile salmon for food.[26] The result of these two dynamics is that hatchery salmon tend to displace and further deplete wild salmon stocks, but these hatchery salmon then later have trouble surviving and reproducing.[27]

These tendencies and interactions were not well understood when most Pacific Coast dams were initially approved and constructed in the 1940-1970 period. Going forward, however, in the context of proceedings to relicense hydro facilities, there is no longer a credible scientific basis to rely on hatchery salmon programs to effectively offset the loss of wild salmon stocks. This recognition has led to an increasing focus on how the design and operation of existing hydro facilities can be modified to restore wild salmon stocks. It is in this context, of the previous experience with misplaced reliance on hatchery salmon mitigation, that the FERC relicensing process can assume a pivotal role.

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23. Melanie E. Kleiss, *The Salmon Hatchery Myth: When Bad Policy Happens to Good Science*, 6 MINN. J.L. SCI. & TECH. 431, 433 (2004).

24. *See generally* JIM LICHATOWICH, SALMON WITHOUT RIVERS (1999).

25. *See* Kleiss, *supra* note 23, at 438-39.

26. *See* Kleiss, *supra* note 23, at 439-40.

27. Edward D. Weber & Kurt D. Fausch, *Interactions Between Hatchery and Wild Salmonids in Streams: Differences in Biology and Evidence for Competition*, 60 CAN. J. FISHERIES & AQUATIC SCI. 1018 (2003).

III. FISHERY ASPECTS OF HYDRO RELICENSING IN THE UNITED STATES

A. Federal Power Act Provisions Regarding Fisheries

The requirements of the FPA apply to all non-federal hydro facilities operated on navigable waters in the United States.[28] Although hydro facilities operated by the United States Bureau of Reclamation (a federal agency) are outside the scope of the FPA, there are many other hydro facilities operated by non-federal entities that the FPA covers.[29] For instance, in California, on-stream hydro facilities operated by such non-federal entities as the California Department of Water Resources (a state agency),[30] the East Bay Municipal Utility District (local/regional public agency),[31] and Pacific Gas & Electric (private water utility)[32] are subject to FPA relicensing.

Under the FPA, FERC issues initial hydro facility licenses for periods of thirty to fifty years.[33] Once an initial license is set to expire, the project operator must apply for a new license through the relicensing process.[34] During relicensing, FERC evaluates the project and determines whether continued project operation is in the public interest and, if so, under what conditions.[35]

Between 1993 and 2005, FERC relicensed about 350 hydro projects in the United States.[36] Of these relicensed hydro facilities, FERC required fish passage improvements or other fish restoration improvements in more than forty-percent of the new licenses.[37] FERC's authority and obligation to include these fish restoration conditions in the

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28. 16 U.S.C. §§ 791a-823c; *see* HYDROPOWER REFORM COAL., *supra* note 14 ("In 1935 Congress enacted the Federal Power Act . . . Part I regulated non-federal hydropower projects in order to contribute to the comprehensive development of our rivers for energy generation and other beneficial uses." *Id.* at 5).

29. 16 U.S.C. §§ 791a-823c.

30. *See* CAL. DEP'T OF WATER RES., *supra* note 11.

31. *See Lower Mokelumne River: P-2916*, HYDROPOWER REFORM COAL., http://hydroreform.org/projects/lower-mokelumne-river-p-2916 (last visited Dec, 14, 2015) (FERC Project No. 2916).

32. *See Drum-Spaulding Project Relicensing Website*, PAC. GAS AND ELEC. CO., http://www.eurekasw.com/DS/default.aspx (last visited Dec. 14, 2015) (FERC Project No. 2310).

33. 16 US.C. § 799; HYDROPOWER REFORM COAL., *supra* note 14, at 1.

34. HYDROPOWER REFORM COAL., *supra* note 14, at 1.

35. *Id.*

36. *Id.*

37. *Id.*

relicensing process derives from Sections 10(a), 10(j) and 18 of the FPA.[38] Sections 10(j) and 18 of the FPA set forth how FERC's relicensing authority interacts with the authority of the two other federal agencies with main authority for fishery management, the National Marine Fisheries Service ("NMFS") and the United States Fish & Wildlife Service ("FWS").

Section 10(a) of the FPA provides that a project must serve the public interest in the river basin, not just the licensee's interest in hydropower generation.[39] More specifically, Section 10(a)(1) requires that a license must ensure that the project:

> will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the *adequate protection, mitigation, and enhancement of fish and wildlife* (*including related spawning grounds and habitat*).[40]

Section 10(j)(1) of the FPA requires that a FERC license "adequately and equitably protect, mitigate damages to, and enhance fish and wildlife (including related spawning grounds and habitat) affected by the development, operation and management of the project."[41] NMFS, FWS, or a state fish and wildlife department may recommend such conditions.[42] If timely submitted, the FPA provides that FERC must generally include such conditions in the license.[43]

Section 18 of the FPA requires NMFS or FWS to prescribe a facility for fish passage (such as a fish ladder or a trapping site to recollect fish for truck transport), operation and maintenance of the facility, and any other conditions necessary to ensure effective passage.[44] A section 18 prescription may apply to upstream or downstream passage.[45] As with section 10(j) of the FPA, FERC must generally

38. 16 U.S.C. §§ 803(a), (j), 811.
39. *Id.* § 803(a).
40. *Id.* (emphasis added).
41. *Id.* § 803(j)(1).
42. *Id.*
43. *Id.*
44. *Id.* § 811
45. *Id.*

incorporate a section 18 fish passage prescription submitted by NMFS or FWS.[46]

B. Right of Non-Operator Stakeholders to Intervene in Hydro Relicensing Proceedings

The operator of a hydro facility applying for relicense and FERC are often not the only parties to the relicensing process. Other interested parties, such as environmental organizations, fishery groups, and indigenous tribes, are permitted to file an administrative motion with FERC to intervene in FERC licensing and relicensing proceedings.[47] So long as this motion is timely filed with FERC, the FPA provides that this motion to intervene will be automatically granted.[48]

An intervenor has two fundamental rights in connection with FERC licensing proceedings: (1) it will be served with all of the documents that are filed in the proceeding because the intervenor will be included in the service list; and (2) it may file a motion with FERC during the administrative proceedings or after a final decision, seek rehearing or judicial review.[49] The active and effective participation of intervenors often plays an important role in the scope of issues considered during the proceedings, as well as the terms and conditions proposed in the final license.[50] For instance, an intervenor may assert that the absence of relicense terms providing for fish passage or minimum release flows violates the FPA or other environmental laws, and that it will seek judicial review of the license if such terms are not included. The right of an intervenor to seek judicial review of license terms can provide incentives for both FERC and the applicant to meaningfully address the concerns raised by an intervenor.

C. Relation of Hydro Relicensing Process to National Environmental Policy Act, Endangered Species Act, and Clean Water Act

The implementation of sections 10(a), 10(j), and 18 of the FPA are closely related to compliance with three other federal laws: the

46. *Id.*

47. 18 C.F.R. § 385.2010 (2015); HYDROPOWER REFORM COAL., *supra* note 14, at 62-64.

48. 18 C.F.R. § 385.2010; HYDROPOWER REFORM COAL., *supra* note 14, at 62-64.

49. 18 C.F.R. § 385.214(a) (2015); HYDROPOWER REFORM COAL., *supra* note 14.

50. HYDROPOWER REFORM COAL., *supra* note 14.

National Environmental Policy Act ("NEPA")[51], the Endangered Species Act ("ESA")[52], and the Clean Water Act ("CWA").[53]

In connection with FERC's relicensing decision, NEPA requires the preparation of an environmental impact statement that must consider alternatives and mitigation measures to reduce the adverse impacts of the project on fisheries.[54] Under the ESA if the continued operation of the hydro project will result in death or injury to fisheries listed as endangered, NMFS or FWS must prepare a biological opinion that includes conditions to ensure the project does not jeopardize the survival of the species.[55] The alternatives and mitigation measures identified in the environmental impact statement (prepared pursuant to NEPA) and the conditions set forth in the biological opinion (prepared pursuant to the ESA) often serve as the basis for the fishery restoration terms later included in FERC's relicensing decision.[56]

Section 401 of the CWA requires that all discharges into navigable waters comply with state water quality standards.[57] Hydro facilities licensed under the FPA are subject to section 401 water quality certification requirements, sometimes referred to as "401 Certification."[58] State water quality standards often relate to fishery habitat conditions, such as adequate instream flow or water temperatures.[59] If a state government denies water quality certification for a hydro facility located in the state, FERC may not issue a license for the facility.[60] Similarly, if a state government issues water quality certification for a hydro facility subject to certain terms and conditions, FERC must include these terms and conditions in its license.[61] For instance, a state government could deny a requested 401 Certification for a hydro facility on the grounds that the facility does not provide sufficient flows below the dam to maintain fisheries in good condition, or it could issue a water quality certification requiring certain enhanced downstream releases of water for fisheries. In this way, the 401 Certification process provides states with

51. National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321-4347 (2012).
52. Endangered Species Act of 1973, 16 U.S.C. §§ 1531-1544 (2012).
53. Clean Water Act, 33 U.S.C. §§ 1251-1388 (2012).
54. HYDROPOWER REFORM COAL., *supra* note 14, at 50-57.
55. *Id*. at 25-27, 94.
56. *Id.* at 25-27, 50-57, 94.
57. 33 U.S.C. § 1341.
58. HYDROPOWER REFORM COAL., *supra* note 14, at 29-30, 95.
59. *Id.*
60. *Id.*
61. *Id.*

legal authority to insist that FERC-licensed hydro facilities operate in a manner that is sufficiently protective of fisheries.

D. Relicensing in Action: Case Studies on Hydro and Wild Salmon

1. Oroville Hydro Relicensing on the Feather River in California

Oroville Dam was built in the 1960s by the California Department of Water Resources ("DWR") on the Feather River, north of Sacramento, California.[62] The Feather River flows south until it empties into the Sacramento River, and the Sacramento River flows south to San Francisco Bay and eventually out to the Pacific Ocean.[63] The initial 1957 Oroville permit was for fifty years, expiring in 2007.[64]

At the time Oroville Dam was built, there were extensive salmon spawning grounds upstream of where the dam would be located.[65] Oroville Dam is 770 feet high, the tallest dam in the United States, with no fish ladders to provide for upstream or downstream passage of salmon.[66] Lake Oroville has a water storage capacity of over 3.5 million acre-feet.[67] For the reasons discussed above, at the time Oroville Dam was built, the DWR proposed to develop a hatchery salmon program below the dam to compensate for the dam's anticipated adverse impacts on wild salmon.[68] Although hatchery salmon now account for the majority of salmon on the lower Feather River, the overall numbers of salmon on the lower Feather River have declined drastically since Oroville was built. There are also studies indicating that the hatchery

62. CAL. DEP'T OF WATER RES., *supra* note 11.

63. *Id.*

64. *Id.* at 2.

65. *Upper Feather River Watershed*, SACRAMENTO RIVER WATERSHED PROGRAM, http://www.sacriver.org/aboutwatershed/roadmap/watersheds/feather/upper-feather-river-watershed (last visited Jan. 18, 2016) ("Historically, parts of the Upper Feather River were habitat for migrating Chinook salmon and steelhead; however, early construction of PG&E hydro facilities, culminating with the construction of Oroville Dam in the 1960s, prevented these salmonoid species from reaching the upper watershed.").

66. Dep't of Water Res., *California State Water Project*, STATE OF CAL. http://www.water.ca.gov/swp/facilities/Oroville/LakeDam.cfm, (last visited Dec. 14, 2015); *see also* Ted Sommer, Debbie McEwan & Randall Brown, *Factors Affecting Chinook Salmon Spawning in the Lower Feather River*, *in* FISH BULLETIN 197 – CONTRIBUTIONS TO THE BIOLOGY OF CENTRAL VALLEY SALMONIDS, VOLUME 1, 269-297 (Randall L. Brown, Cal. Dep't of Water Res. ed., 2001).

67. Dep't of Water Res., *supra* note 66.

68. Sommer, McEwan & Brown, *supra* note 66, at 271.

salmon may be contributing to the decline of wild salmon stocks on the lower Feather River.[69]

During the Oroville relicensing proceedings, there was considerable focus on what could and should be done to restore wild salmon runs.[70] In 2006, after several years of negotiations between FERC, DWR, and fishery stakeholders, an agreement was reached over the terms and conditions to be included in the new license.[71]

Given the height of Oroville Dam, the prospects of installing fish ladders to provide for upstream and downstream salmon passage was generally viewed as a cost-prohibitive and unfeasible modification.[72] Instead of fish passage, the new relicensing terms focused on a three-pronged approach to improve habitat for wild salmon in the portions of the Feather River below Oroville Dam.[73]

The first prong of the Oroville relicensing wild salmon restoration conditions concentrated on flow and water temperature improvements. Under the terms of the new license, sufficient water from Lake Oroville (the reservoir behind Oroville Dam) must be released to maintain water temperatures in the lower Feather River at below fifty-six degrees Fahrenheit, from September 1 to September 30, and below fifty-five degrees Fahrenheit, from October 1 to May 31.[74] These periods cover the main spawning and migration seasons for salmon on the Feather River.[75]

The second prong of the Oroville relicensing wild salmon restoration conditions concentrated on gravel supplementation. As discussed above, salmon spawn in gravel in clear shallow water. Oroville Dam blocks gravel passing downstream to the lower Feather River, which has reduced salmon spawning habitat.[76] Under the terms of the

69. *Id.* at 292.

70. STATE OF CAL., RES. AGENCY, DEP'T OF WATER RES., SETTLEMENT AGREEMENT FOR LICENSING OF THE OROVILLE FACILITIES: FERC PROJECT NO. 2100 (Mar. 2006) [hereinafter SETTLEMENT AGREEMENT].

71. *Id.*

72. *Id.* at 107, 109.

73. *Id.*

74. *Id.* at 62; CAL. DEP'T OF WATER RES., *supra* note 11, at 8.

75. SETTLEMENT AGREEMENT, *supra* note 70, at A-18 to A-21; CAL. DEP'T OF WATER RES., *supra* note 11.

76. Wash. Dep't of Fish and Wildlife, *supra* note 20; SETTLEMENT AGREEMENT, *supra* note 70, at A-18 to A-21; CAL. DEP'T OF WATER RES., *supra* note 11.

new license, DWR will deliver and deposit 8,300 cubic yards of gravel in specified locations below the dam.[77]

The third prong of the Oroville relicensing wild salmon restoration conditions concentrated on supplementation of large woody debris. Large woody debris (such as fallen trees) creates essential habitat elements for salmon like pools and eddies with reduced water velocity.[78] Oroville Dam currently blocks the downstream movement of large woody debris in the lower Feather River.[79] The new Oroville relicensing terms require placement of several hundred pieces of large woody debris in locations on the lower Feather River that maximize benefits for salmon.[80]

If fully implemented, collectively these measures hold the prospect of contributing significantly to the restoration of wild salmon stocks that spawn in the lower Feather River. The value of these fish restoration improvements, over the course of the new license, has been estimated at around $450,000.[81] While this figure may initially appear to be a significant amount of money, it represents a small percentage of the value of the hydro-electricity and water that will be delivered during this same license period.[82]

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77. SETTLEMENT AGREEMENT, *supra* note 70; CAL. DEP'T OF WATER RES., *supra* note 11, at 106 (B-14).

78. SETTLEMENT AGREEMENT, *supra* note 70; CAL. DEP'T OF WATER RES., *supra* note 11, at 56 (A-7).

79. HYDROPOWER REFORM COAL., *Oroville Settlement Benefits Feather River and Local Community*, (Mar. 21, 2006), *available at* http://www.hydroreform.org/news/2006/03/21/oroville-settlement-benefits-feather-river-and-local-community (last visited Feb. 20, 2015) ("The water supply and hydropower operations of Oroville Dam cause significant adverse impacts to the Feather River, including the degradation and loss of spawning and rearing habitat for listed spring run Chinook and steelhead trout, degraded water quality, loss of beneficial sediments and **large woody debris**, and diminished river recreation opportunities." (bold added)).

80. SETTLEMENT AGREEMENT, *supra* note 70; CAL. DEP'T OF WATER RES., *supra* note 11, at 57 (A-8).

81. SETTLEMENT AGREEMENT, *supra* note 70; CAL. DEP'T OF WATER RES., *supra* note 11, at 88 (A-39).

82. HYDROPOWER REFORM COAL., *supra* note 14, at 21 ("while the costs of a mitigation measure may appear high, they may be modest as a fraction of the net project revenues or when distributed among ratepayers.").

2. *Pelton Hydro Relicensing on the Deschutes River in Oregon*

The Pelton Round Butte Project ("Pelton Dam") is located on the Deschutes River in Oregon.[83] The Deschutes River, with a sockeye salmon fishery, flows in a northerly direction to its confluence with the Columbia River.[84] The Columbia River then flows east where it empties into the Pacific Ocean. Pelton Dam was completed in 1965, pursuant to a fifty-year license, and is owned and operated jointly by Portland General Electric Company ("PGE") and the Warm Spring Confederated Tribes.[85] Pelton Dam, whose official name is the Round Butte Development, stands 440 feet tall and creates a reservoir (Lake Billy Chinook) with a gross storage capacity of 535,000 acre-feet of water.[86] It is therefore considerably smaller in terms of both height and reservoir storage capacity than Oroville Dam.[87]

Unlike Oroville Dam, Pelton Dam was designed with an adjacent fish ladder to assist wild salmon with upstream and downstream passage around the dam.[88] Unfortunately, due to the slack water and circular currents in Lake Billy Chinook behind the dam, outbound juvenile salmon were usually unable to find the adjacent fish ladder that would provide them with downstream passage to the Pacific Ocean.[89] When Pelton Dam came up for relicensing, a main focus of study and contention was on how to modify the design and/or operation of the facility to improve downstream migration of wild salmon.[90]

The solution that emerged became known as the Selective Water Withdrawal facility ("SWW"). The SWW is a 273-foot tall underwater tower in Lake Billy Chinook capped by an intake module that collects fish migrating downstream and separately sends water to the turbines to

83. *LIHI Certificate #25 – Pelton Round Butte Project, Oregon*, LOW IMPACT HYDROPOWER INST., http://lowimpacthydro.org/lihi-certificate-25-pelton-round-butte-project-oregon-ferc-2030/ (last visited Dec. 14, 2015) (certified on Mar. 28, 2007); *see also* LOW IMPACT HYDROPOWER INST., REVIEW OF APPLICATION FOR RE-CERTIFICATION BY THE LOW IMPACT HYDROPOWER INSTITUTE OF THE PELTON-ROUND BUTTE PROJECT 1 (Sept. 18, 2015), *available at* http://lowimpacthydro.org/wp-content/uploads/2007/03/Pelton-Round-Butte-Final-Report-Sept-2015.pdf).

84. *LIHI Certificate # 25*, *supra* note 83.

85. *Id.*

86. *Id.*

87. *Id.*; *see also supra* notes 66-67.

88. LOW IMPACT HYDROPOWER INST., *supra* note 83, at 2.

89. *Id.*

90. *Id.*

generate hydro-electricity.[91] At the intake structure, fish are collected into two screens and sorted. Non-anadromous fish (such as bull trout) are returned to Lake Billy Chinook. Juvenile salmon move into a floating fish transfer facility, are then loaded into a truck for transport and released below the dam to continue their migration to the Pacific Ocean.[92]

The SWW was completed in 2009 and in its first five years of operation a significant increase in salmon returns have occurred.[93] The SWW cost $100 million to build. [94] As with the costs associated with the salmon restoration efforts related to the Oroville Dam relicensing, this $100 million figure may represent a small percentage of the value of the hydro-electricity and water that will be delivered during the license period.[95]

The SWW component of the Pelton Dam relicensing represents an innovative effort to improve downstream passage for wild salmon, but the experimental nature of the proposed solution will require careful monitoring. More specifically, there remain questions about how the collection and transport of the juvenile salmon under the SWW approach may affect their long-term survival and reproduction rates.[96] It should be remembered that there were also initially high hopes for the effectiveness of hatchery salmon programs, and in the early years these hatcheries produced increased numbers of salmon heading downstream.[97] The shortcomings of hatchery salmon operations were not fully understood until smaller salmon returned that often failed to reproduce.[98]

Notwithstanding these concerns, the SWW can still be seen as an attempt to address the downstream passage failures of the original design and operation of Pelton Dam. Because the SWW includes a rigorous monitoring program, there should be opportunities to revisit and modify

91. *Id.*; *see* Dylan J. Darling, *Return of the Sockeye Salmon*, DESCHUTES RIVER CONSERVANCY (Aug. 25, 2012), http://www.deschutesriver.org/media/news/return_of_the_sockeye_salmon.

92. *See* Darling, *supra* note 91.

93. *Id.*

94. *Id.*

95. *Id.*; *see also* HYDROPOWER REFORM COAL., *supra* note 14, at 21 ("while the costs of a mitigation measure may appear high, they may be modest as a fraction of the net project revenues or when distributed among ratepayers.").

96. *See supra* notes 22-27 and accompanying text.

97. *Id.*

98. *Id.*

wild salmon restoration strategies related to Pelton Dam if the SWW proves less successful than anticipated.[99]

3. La Grange Hydro Licensing on Tuolumne River in California

La Grange Dam is located on the Tuolumne River in California, which is a tributary to the San Joaquin River that flows into San Francisco Bay and then to the Pacific Ocean.[100] The dam was constructed in the 1890s by the Modesto and Turlock Irrigation Districts to store and divert water for agricultural irrigation.[101] In the 1920s, a hydroelectric power station was added to the facility.[102] La Grange Dam is built of cyclopean rubble masonry and stands 127.5 feet high and 336 feet wide.[103] It presently provides no downstream or upstream fish passage.[104]

La Grange Dam was constructed many years before the FPA went into effect, and therefore was not required to receive a FERC license before being built. In 2012, FERC issued an order to the Dam's operators requiring them, for the first time, to apply for a license.[105] In this sense, the FERC regulatory posture for La Grange Dam is an initial licensing for an existing hydro facility rather than relicensing for a previously licensed facility.[106]

The wild salmon and anadromous steelhead trout stocks on the Tuolumne River have been in decline for several decades.[107] In 2009,

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99. SETTLEMENT AGREEMENT CONCERNING THE RELICENSING OF THE PELTON ROUND BUTTE HYDROELECTRIC PROJECT, FERC PROJECT NO. 2030 at App. A (July 13, 2004), *available at* http://www.lowimpacthydro.org/assets/files/lihi-cert-app-files/3PRBSettlementAgreement7-16-04FINAL.pdf [hereinafter PELTON ROUND BUTTE HYDROELECTRIC PROJECT SETTLEMENT AGREEMENT].

100. NAT'L MARINE FISHERIES SERV., COMMENTS ON PROPOSED STUDY PLAN FOR THE LAGRANGE HYDROELECTRIC PROJECT, P-14581-000 (Dec. 4, 2015) (on file with *Pub. Land & Resources L. Rev.*).

101. *Id.*

102. *Id.*

103. *Id.*

104. *Id.*

105. John Holland, *La Grange Dam Catches the Eye of Government*, MODESTO BEE (Dec. 31, 2012), *available at* http://www.tuolumne.org/content/article.php/20130102091549292.

106. *Id.*

107. NAT'L MARINE FISHERIES SERV., PUBLIC DRAFT RECOVERY PLAN FOR EVALUATION OF SIGNIFICANT UNITS OF SACRAMENTO RIVER WINTER RUN SALMON AND CENTRAL VALLEY SPRING-RUN CHINOOK SALMON AND DISTINCT POPULATION SEGMENTS OF CENTRAL VALLEY STEELHEAD (2009), *available at* http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_ste

NMFS released a report titled *Public Draft Recovery Plan for Evaluation of Significant Units of Sacramento River Winter Run Salmon and Central Valley Spring-Run Chinook Salmon and Distinct Population Segments of Central Valley Steelhead*.[108] This 2009 NMFS Report found that a primary stressor leading to salmon and steelhead decline was the blockage of access to historical upstream habitat by the La Grange Dam.[109]

Under the FPA's relicensing procedures, one of the first steps is for FERC to determine the issues that need to be evaluated by the applicant in connection with its application.[110] In their initial study proposal to FERC, the operators of La Grange Dam did not propose to conduct studies concerning modifying facility design or operations to allow fish passage.[111] In the context of the La Grange Dam relicensing, NMFS, as well as several conservation groups that were intervenors[112] in the FERC proceeding submitted comments to FERC urging that the operators of the dam be required to conduct a fish barrier assessment and evaluate the alternative of installing fish passage facilities.[113]

As a NMFS December 14, 2014, comment letter to FERC explained:

> [t]he completion of La Grange Dam in 1894 constituted a permanent and complete blockage to upstream

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elhead/domains/california_central_valley/public_draft_recovery_plan_october_2009.pdf.

108. *Id.*

109. *Id.*

110. WATER AND POWER LAW GRP., COMMENTS ON BEHALF OF CONSERVATION GROUPS REGARDING PRE-APPLICATION DOCUMENT AND SCOPING DOCUMENT AND STUDY REQUEST FOR LA GRANGE PROJECT (July 22, 2014) (filing on behalf of American Rivers, American Whitewater, California Sportfishing Protection Alliance, California Trout, Central Sierra Environmental Resource Center, Friends of the River, Golden West Women's Flyfishers, Merced Fly Fishing Club, North California Federation of Flyfishers, Pacific Coast Federal of Fishermen's Association, Trout Unlimited, and the Tuolumne River Trust), *available at* http://calsport.org/doc-library/pdfs/247.pdf; NAT'L MARINE FISHERIES SERV., *supra* note 100.

111. WATER AND POWER LAW GRP., *supra* note 100; NAT'L MARINE FISHERIES SERV., *supra* note 100.

112. Intervenors included: American Rivers, California Sportfishing Protection Alliance, California Trout, Friends of the River, Golden West Women's Flyfishers, Northern California Federation of Flyfishers, Pacific Coast Federation of Fishermen's Associations, Trout Unlimited and the Tuolumne River Trust.

113. WATER AND POWER LAW GRP., *supra* note 110; NAT'L MARINE FISHERIES SERV., *supra* note 100.

> anadromous fish migrations to their historical spawning and rearing grounds. The La Grange Diversion Dam is a 125 [foot] tall dam that completely lacks any fish passage structures or improvements – these are indisputable facts, as is the conclusion that La Grange Diversion Dam and the Project have continued to the present day to act as a complete barrier to upstream anadromous fish migration. . . . [The] NMFS Recovery Plan identifies the upper Tuolumne River above La Grange . . . as a candidate area for reintroducing California Central Valley (CV) steelhead and spring-run Chinook salmon. . . . [I]t is clear that a comprehensive evaluation of fish passage should be conducted as part of the La Grange [Integrated Licensing Proceeding].[114]

On February 2, 2015, FERC issued its determination in the La Grange licensing proceeding, agreeing with NMFS and the intervenor conservation groups that the operators of the facility will be required to conduct both a Fish Passage Facilities Alternative Assessment and a Fish Passage Barrier Assessment. In making this determination, FERC noted "[t]he information collected in this study would help define the nature and degree to which the dam and powerhouse are barriers and impediments to the upstream migration of anadromous salmonoids."[115]

At this point, it remains to be seen what analysis or findings will be included in the fish passage and fish barrier studies, and how the results of these fish passage and fish barrier studies may ultimately affect the terms and conditions FERC includes in the license for the La Grange facility. However, based on the La Grange FERC licensing proceeding to date, it can be expected that NMFS and the aforementioned conservation groups will press for the incorporation of fish passage modification terms in the license to help restore the declining salmon and steelhead runs on the Tuolumne River.

IV. LOW IMPACT HYDROPOWER INSTITUTE CERTICATION FOR RELICENSING OF EXISTING HYDRO FACILITIES

The Low Impact Hydropower Institute ("LIHI") is a United States-based independent nonprofit organization dedicated to reducing

114. NAT'L MARINE FISHERIES SERV., *supra* note 100, at 4 (bracketed text in original).

115. *Id.*

the harmful impacts of hydro projects by creating a credible and transparent standard to evaluate the environmental performance of hydro facilities.[116] Through the establishment of the Low Impact Hydropower Certification Program ("LIHI Certification Program"), LIHI certifies hydroelectric facilities seeking to minimize the harmful impacts of their operations as compared with other hydro facilities based on objective criteria.[117] The LIHI Certification Program covers both new proposed hydro facilities and the relicensing of existing hydro facilities.[118]

To be certified as low impact, a hydro facility must satisfy criteria in the following eight areas: (1) river flows; (2) water quality; (3) fish passage and protection; (4) watershed protection; (5) threatened and endangered species protection; (6) cultural resource protection; (7) recreation; and (8) compliance with facilities recommended for removal.[119] A hydro facility that satisfies these criteria will be certified as a low impact hydro facility and can use this certification when marketing hydroelectric power to consumers and purchasers.[120]

A comprehensive review of all the LIHI Certification Program criteria is beyond the scope of this paper, but below is additional information on the two criterion that often relate most directly to wild salmon stocks—river flows and fish passage and protection.

A. LIHI River Flows Criterion

The LIHI River Flows criteria are designed to ensure that a river has healthy flows for fish, wildlife, and water quality, including seasonal flow fluctuations where appropriate.[121] For instream flows, a LIHI certified facility must comply with recent resource agency recommendations for flows.[122] If there are no qualifying resource agency flow recommendations, an applicant can meet one of two alternative standards: (1) meet the flow levels using the Aquatic Base Flow methodology or the "good" habitat flow level under the Montana-Tennant methodology; or (2) present a letter from a resource agency

116. LOW IMPACT HYDROPOWER INST., CERTIFICATION HANDBOOK (Apr. 2014), *available at* http://lowimpacthydro.org/wp-content/uploads/2014/08/LIHI_Handbook-_INTERIM_DRAFT_CLEAN_040914.pdf.

117. *Id.* at 5.

118. *Id.* at 9-10.

119. *Id.* at 13-15.

120. *Id.* at 13.

121. *Id.*

122. *Id.*

prepared for the application confirming the flows at the hydro facility are adequately protective of fish, wildlife, and water quality.[123]

B. LIHI Fish Passage and Protection Criterion

The Fish Passage and Protection criterion are designed to ensure that the facility provides effective fish passage for anadromous fish (such as salmon), and protects fish from entrainment in turbines and water diversion structures.[124] For anadromous fish, a certified facility must be in compliance with both recent mandatory prescriptions regarding fish passage and recent resource agency recommendations regarding fish protection.[125] If anadromous fish historically passed through the facility area but are no longer present, the facility will pass this criterion if the applicant can show: (1) that the fish are not extirpated or extinct in the area due in part to the facility; and (2) that the facility has made a legally binding commitment to provide any future fish passage recommended by a resource agency.[126]

When no recent fish passage prescription exists for anadromous fish, and the fish are still present in the area, the facility must demonstrate either there was a recent decision that fish passage is not necessary for a valid environmental reason or, that existing fish passage survival rates at the facility are greater than ninety-five percent over eighty-percent of the run, or provide a letter prepared for the application by the FWS or the NMFS confirming the existing passage is appropriately effective.[127]

V. CONCLUSION—HYDRO AND THE FREE RUN OF FISH

In the United States, many Pacific Coast dams were initially designed and approved on the assumption that hatchery salmon programs would replace the lost wild salmon stocks caused by the dams.[128] The hydro relicensing process set forth in the Federal Power Act provides an important opportunity to re-examine the ways dams operate now that this initial assumption has proven faulty. This hydro relicensing process allows such questions as fish passage and downstream flows to be considered anew with improved science and fresh eyes.

123. *Id.*
124. *Id.* at 14.
125. *Id.*
126. *Id.*
127. *Id.*
128. Kleiss, *supra* note 23.

The broader legal and policy take-away is that the operation and design of hydro facilities can be modified over time to greatly reduce adverse impacts on fisheries. Such modifications are unlikely to occur, however, unless there is an effective mechanism in place to force operators of existing dams to periodically and systemically identify and incorporate feasible fish restoration measures. Without such a mechanism, the faulty fishery assumptions and chronic operational flaws of existing hydro facilities may continue in perpetuity.

The FERC hydro relicensing process therefore offers a way to bring the principles and remedies reflected in the 1807 River Tweed Act into the modern era, so the "free run of fish" and the condition of our wild salmon stocks moves from the periphery to the mainstream of the law's efforts to define the fishery conservation obligations of those who are granted permission to operate on-stream hydro facilities on our rivers.[129]

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129. *See generally 1807 River Tweed Act*; BALFOUR, *supra* note 1.