

The Kilarc Steelhead Project

An Alternative To the Demolition of the Kilarc Hydropower Project

**Surrender Path addressing the Kilarc (Old Cow Creek)
Portion of PG&E's
FERC P-606, Kilarc – Cow Creek Project**

Davis Hydro, June 2009
Davis, California

Forward

Davis Hydro came late on the scene to the surrender by PG&E of the Kilarc-Cow Creek FERC P-606 hydro license. When we arrived, looking for a place to do fish research, the opportunity to try to save the hydropower as well as the community services it provides became our interest. Fairly quickly, we realized that we could use some of the profits from the hydropower to undertake projects that would benefit the fish. After two years of study, we believe that the first and most effective way to help the fish in this area is to use the headrace to provide a major source of juveniles by establishing a new fish bypass. We also propose continuing the cold water and using hydropower profits to improve downstream conditions. The reasoning behind this is that there is some adult habitat in the Old Cow Creek, but little to no spawning beds and difficult and limited upstream passage.

We conclude that what is best for the fish, best for the community, and, through green power, best for the planet, is to use the facilities to grow and emit juvenile fish and cooler water downstream.

This Proposed is the product of those ideas. The present description of the mechanics of this proposal is complemented by two forthcoming documents: A document providing the arguments identifying why the Kilarc Steelhead Proposal is preferred in comparison with dismantling of facilities as proposed by PG&E and a document explaining how these facilities may be helpful to scientific research with regards to anadromous fish.

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**An Alternative Surrender Path addressing the Kilarc (Old Cow Creek)
Portion of PG&E's
FERC P-606, Kilarc – Cow Creek Project**

The Kilarc Steelhead Project alternative to PG&E's facilities dismantling proposal involves the transfer of assets (land and intact facilities) from PG&E to a new nonprofit Kilarc Trust organization that will be the custodian responsible for ensuring that the facilities achieve specified natural resource conservation and enhancement benefits. Should targets remain unmet after a specified performance period, the facilities would be dismantled as originally proposed by PG&E, utilizing a remediation bond or other funding source that may be underwritten by PG&E at the time of transfer in lieu of expending its resources for immediate dismantling.

The FERC has the opportunity to retain jurisdiction over the project by granting a new entitlement to continue hydropower generation. KC Kilarc Hydro, with the support of Davis Hydro, proposes to lease the requisite facilities from the Kilarc Trust organization, providing the financial and manpower support to facilities maintenance, and accepting responsibility for meeting performance standards that would be a condition of the hydropower license, either established by the FERC or as mandatory 4(e) conditions of the National Marine Fisheries Service (NMFS).

The following facilities modifications are proposed to enable research, and the aggressive spawning and rearing of steelhead, to address the concerns of the resource agencies.

The Physical Plan

The proposed Kilarc Project (the Project) has several elements. Overall, the site will remain much as it is now, the only obvious change to the casual visitor will be the addition of educational signs and a fish screen. However, from a fish's perspective, the site will have changed completely. First, the most central change will be the conversion of the headrace to a fish spawning ground. Second, a screen and fish return path to the Old Cow bypass channel will be constructed for fish fry moving downstream in the headrace canal. Finally, there are a series of other elements that may be used to support the Project addressing such factors as genetic selectivity, predation control, budget, and research interests of the Kilarc Trust.

As a better understanding of how to maximize spawning production is achieved, a clear management program will emerge to balance extensive spawning, habitat augmentation, and support for related research. Starting at the upstream end, a preliminary design of

these new facilities is described in the following sections. Figure 1 depicts the entire project area.

The Diversion

Water will continue to be diverted from the Old Cow into the headrace¹ just as it is currently. (See Figures 1 and 2, Diversion; water flows downstream towards the left.) The amounts of water being diverted and returned will be the same as currently (up to 52 cfs). No changes are anticipated at the diversion. Upstream migration is not an opportunity or issue due to down and immediate upstream barriers, so the current facilities will remain unchanged. By diverting water out of the channel, it will be possible to build screens, filters, and silt traps in the quiet of the canal rather than the riverbed, increasing their simplicity and reliability.

The Upstream Screen, Filter, and Pipe Return

An ongoing management and research effort will facilitate natural flow of food in to the spawning channel while minimizing the intrusion of silt, predators, as well as rainbow without a history of anadromy. The problem with the diversion for the Kilarc project is the introduction of adult predatory brown trout, non-anadromous rainbow and other unwanted species into the spawning areas. It may also become desirable to control arthropods and other carnivores in the canal. The first fish screen is a design option located just downstream of the current gauging station which will be retained. It has several possible uses depending on need. The exact use and even the need for the screen to be built will be determined by the Science Committee and the funding by the Kilarc Trust. Expected uses, integrated with the fish production plan are:

- Removing mud, leaves, and debris from the incoming water stream,
- Prohibiting fish and adult crustaceans from coming downstream into the spawning beds, and
- Inhibiting spawning fish² from migrating upstream.

¹ The Kilarc Canal is the project headrace and is also depicted on some maps as a ditch; we will use the term headrace and canal interchangeably.

² The term “fish” will be used from here on to generally mean the target fish we are helping to restore the anadromous eco-type of rainbow trout.

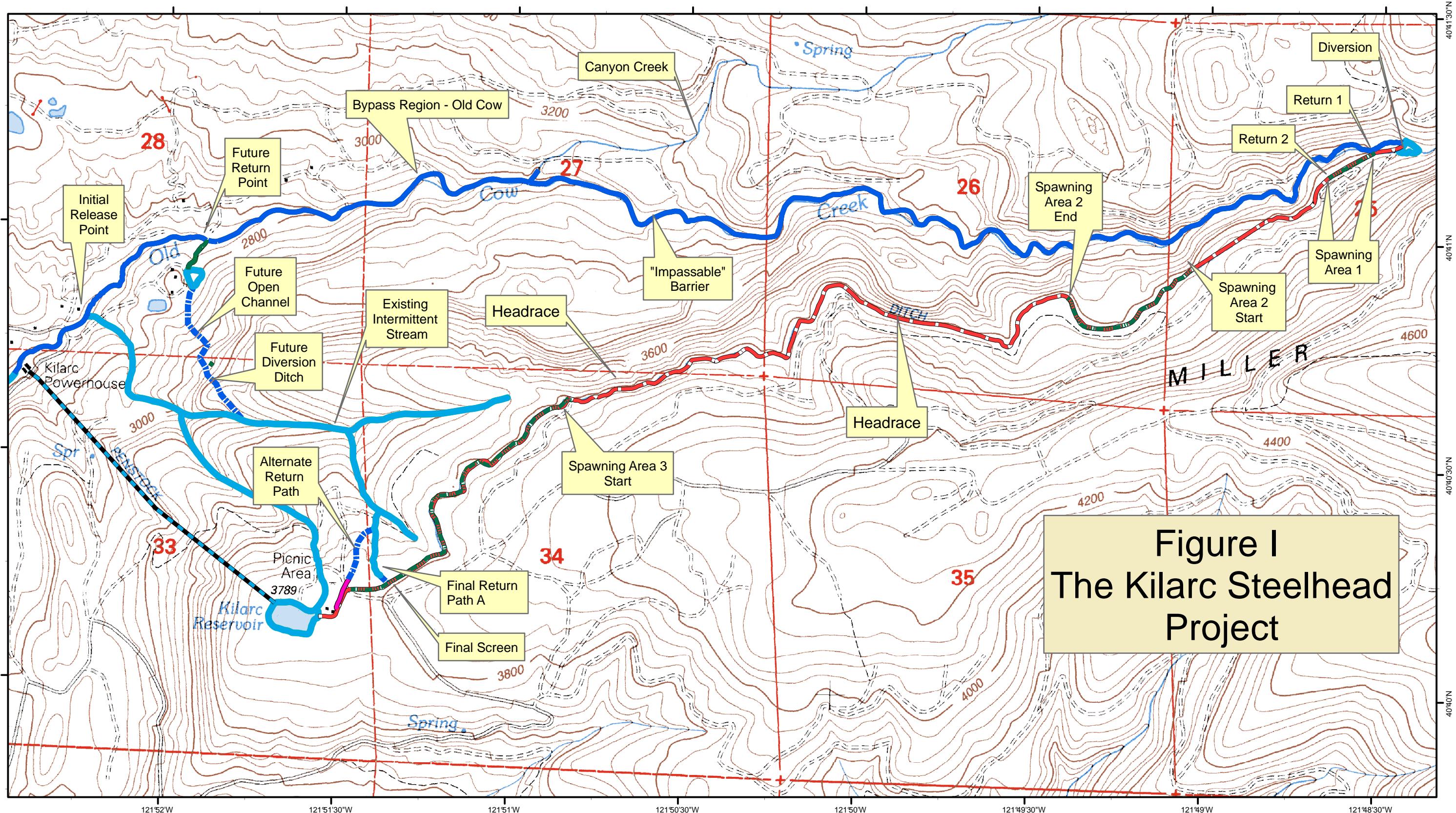
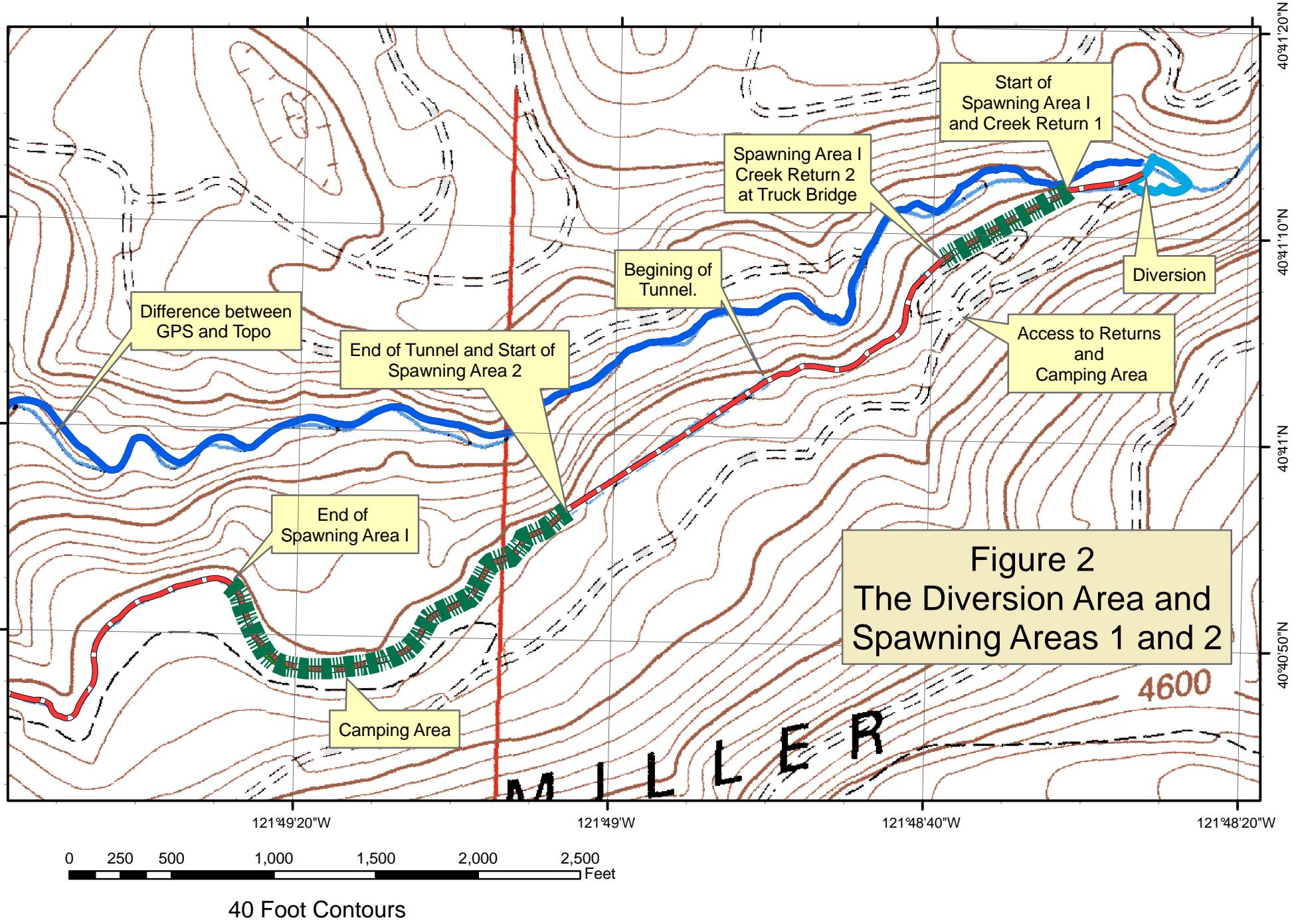


Figure I
The Kilarc Steelhead
Project

0 0.25 0.5 1 1.5 2 2.5 3 3.5 Miles

0 1,050 2,100 4,200 6,300 8,400 Feet



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The filter at Return 1 is designed to return to the Old Cow most of the silt that enters the headrace. This is useful in prolonging the life of the new spawning beds in the canal. At the same time this filter has to be set up to pass down the headrace as much floating food as possible for adult and juvenile trout. This water passage will also serve to inhibit fish from moving upstream out of the headrace should that be useful. Alternatively, inflatable dams might be installed at the downstream ends of the habitat areas to increase water depth during scheduled low flow events to allow the upstream migration and return of any adult³ fish to the stream through this passage well above the lower barriers in the bypass.

The impetus for allowing emission of fish up near the diversion is based on the problem of upstream migration in the bypassed region of the Old Cow. It is considered by all to be impassable except in extreme flood conditions. This means that by injection fry at this high point in the river, it will be possible to take advantage of the juvenile habitat in the upper reach of the Old Cow below the diversion. While this habitat is modest, it is arguably over a quarter mile in length and is supplied cold clean water throughout the year.

The first inflatable dam would be just below the first return pipe. The dam would be approximately 1 foot tall and U-shaped to allow pooling in parts of the flume so that fry and silt would be channeled into the return pipe and there would be a low enough jump that any upstream migrating adult fish could pass. All these features would be installed but only operated as part of a fish production scheme.

The First Habitat Area

Just beyond the first screen and extending down to the bridge is the first habitat area. It is characterized by isolation from the Old Cow and by distance and barriers from the lower, larger habitat areas. It features easy physical access and wide slow water with a side concrete retaining wall on much of the length. This is the smallest habitat area extending less than a quarter mile in length. It has simple access from both ends in the summer, but difficult access in the winter.

³ It is not expected that there will be many adults in the canal as there is and will be little preferred habitat. However, should some wish to migrate upstream beyond the provided spawning beds, the dams are present to address that option.

At the end of the first habitat area, by the existing vehicle bridge, there may be a second river return used to channel further silt and small fry downstream during parts of the year back into the upper reach of the Old Cow. In this way, the small first habitat area serves as the spawning grounds for a reach in stream that needs it. This fish return is not intended for large fish, or any fish over an inch in length; it is provided primarily to remove silt from the headrace and to provide a second upstream insemination flow for the bypass channel. The design of this filter minimizes the loss of natural food drifting downstream and may serve other multiple purposes including predator control, mud/silt diminution, and juvenile fish return.

The Second Habitat Area

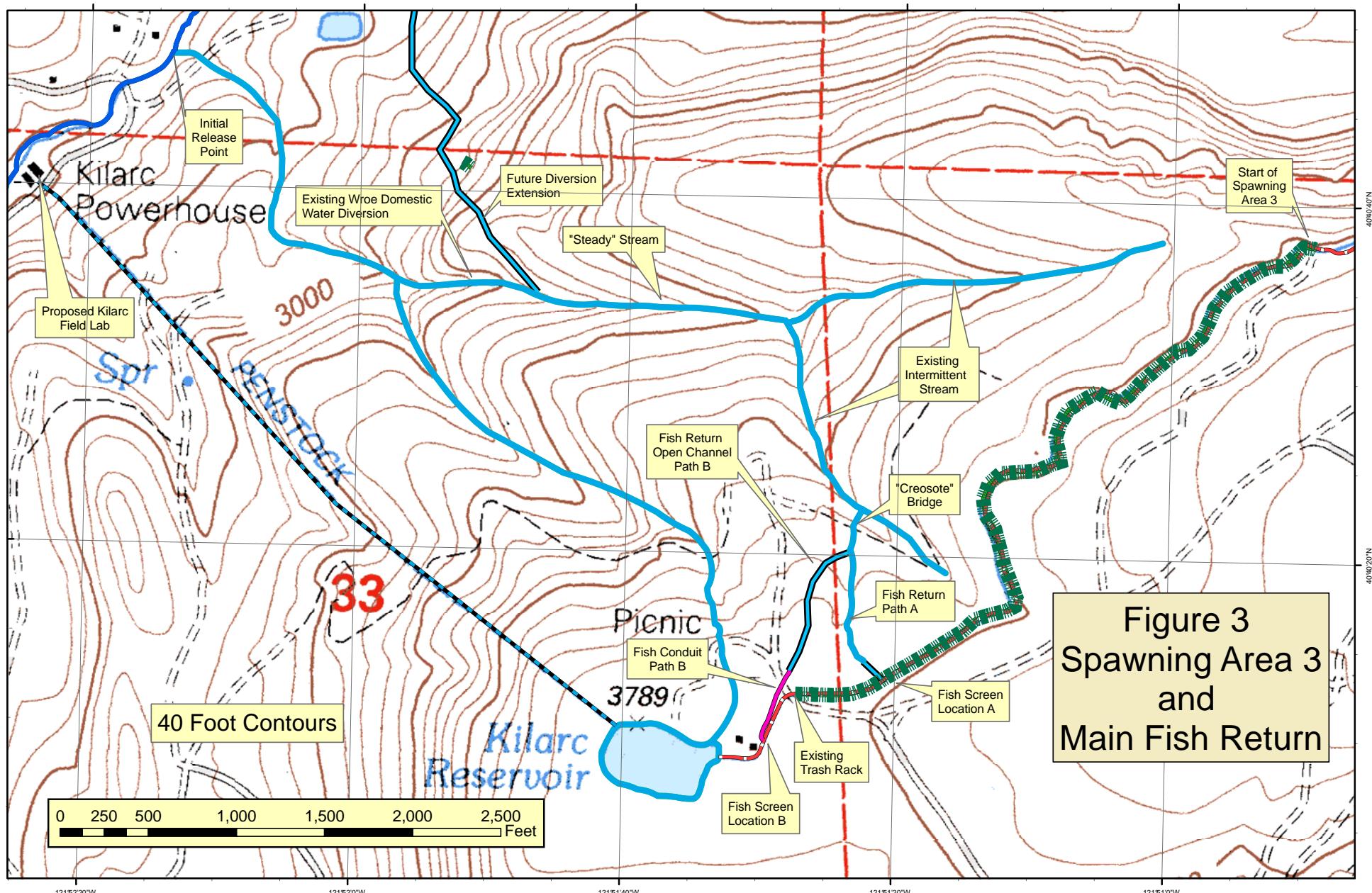
The second habitat area is much longer, more than double the length of the first, and extends from the tunnel down to where the headrace is forced out into a narrow concrete and steel passage along very steep cliff faces. This site is characterized by difficult access for trucks, most of it being only accessible to trucks by passage through the headrace at temporary fords. Human access to the center is much easier; there are even some excellent camping sites. It also is difficult to access in the winter.

This habitat area is characterized by shade and rough compacted soil rock banks. The area is ideal for studying the optimal amounts of cover, small woody debris, small boulders, water shear, and other similar factors. Because of mechanical equipment access difficulties, studies of matrix variation, large boulders and large woody debris would be difficult. At the beginning and end of this reach, as at all others, it is possible that there could be filters sampling the passing water for various biological indicators such as detached eggs or young fish moving downstream. (See White Paper R-1 – forthcoming describing the science to be done in the habitat areas.)

The Third Habitat Area

The third habitat area extends downstream from the second to last drain gate to end at the current trash rack area near the Kilarc picnic/parking area (see Figure 3). This habitat is about a half mile long with two distinct segments.

Upstream is a relatively isolated area that is easily truck accessible. It is ideal for studies relating to varying composition of the surrounding matrix. The easy access and uniformly quasi-open conditions provide opportunities for discrete behavior studies such



as the effects of varying amounts of cover, water shear conditions and territorial interactions.

The downstream area is easily seen looking upstream from the existing trash rack. It is wide, uncovered, shallow, and easily accessible for all purposes. It is ideal for public displays – public education and public interaction connecting the public to the spawning program of the fish and at the same time educating them about what can be done to improve the viability of the fish downstream. The area has access to power for projects. There is now no cover so it is a perfect place to study varying amounts of cover and woody debris that the simple access for trucks will permit.

At the same time, the simple access triggers the difficulty of having trout spawning facilities in areas where there is active fishing. This will be addressed as the operation of the facility evolves. For now, it is not intended that the fish stay in the headrace for more than two years. In that case, fishing pressure should exist only on the spawners and this is only for a brief period of the year. Brown trout now spawn in the headrace, but they spawn in the fall allowing for active management to inhibit this practice and minimize their predation in the headrace.

The Screen and Major Fish Return Channel

At the end of the third habitat study area and very near the parking/picnic area is the fish screen and the start of the major fish return. During the season of primary downstream movement, the screen is in place to deflect most fry into a fish return channel down to the Old Cow. During other seasons, the screen may be used for predator control, including brown trout control. An upstream screen would also be in use preventing most debris from reaching the finer fry screen.

Currently there are two designs under consideration for the return channel:

1. Location A (see Figure 3). The primary design is to place the screen at the overflow gate a hundred feet upstream of PG&E's trash rack. If the diversion screen were in this area, the diverted fish moving down the headrace would be put directly into an old channel that leads quickly to a small natural channel connected to the Old Cow. If desired, fish moving upstream from the Forebay can also be returned to the natural channel, or they may be blocked by this screen. The existing trash rack is transparent to all fish at all life stages under consideration.

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2. Location B. The alternative plan is to place the screen very near where the picnic tables are, at the south end of the parking lot. This would allow for a longer screen, but would involve a longer and partially buried return path. This proximity to humans would be valuable for education, but it would be more susceptible to vandalism and human interference with its operation. The additional length of the spawning ground is not useful as there is plenty available upstream less impacted by human presence.

With either location of the screen, the juvenile fish would be quickly conveyed through the wall of the canal and into a small, open flume that will lead down to the channel that passes under the Creosote Bridge – about an eighth of a mile north of the existing trash rack. This channel is now damp year round now from leakage at the spill gate. About 2 cfs flow would carry the fry and the odd adult downward migrant downstream under the bridge. This stream joins a larger existing one just to the north of the bridge. This stream is currently observed to have some minimal water in it all year. With the augmentation of another 2 cfs, it will be a suitable conveyance for fry all spring, extending to cover most or all of the downward migration period. There would be no effort made to provide upstream migration.

After reaching this watercourse, the fish would be conveyed down the natural drainage to the Old Cow. This stream is tapped part way down as a diversion to supply domestic water to the Todd Wroe house. Mr. Wroe's diversion box inlet would have to be screened. He is cooperating in these developments.

Current plans include the use of the existing return to the Old Cow to start, but as soon as funds permit, diversion of this stream across the land slightly so that it will enter the Old Cow about a quarter of a mile upstream of the current entrance, to take advantage of the additional habitat. Mr. Wroe is pleased to provide an easement for this purpose in exchange for a small amount of the flow to maintain his pond. Predation would have to be controlled in the pond as well as at his diversion box. When Mr. Wroe wants to sell the house, it may be acquired for use by the project.

The Forebay

The forebay would remain as it is, stocked only with the desired species. It is assumed that the state would stock it with undifferentiated mixtures of rainbow trout. Some local brown trout will come in as juveniles from upstream spawning unless prevented by screening.

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An alternative practice would be to cull out all brown and rainbow extant and seed the forebay with rainbow from known anadromous populations. These fish would be encouraged to pass upstream in the spring and spawn naturally in the new gravel beds.

Other methods might be used that are similar to those in a hatchery; they involve use of known anadromous stock as breeders. The methods to be used would be decided upon by the Science Committee of the Kilarc Trust. The work would be carried out by the Licensee under License conditions spelled out by the FERC in consultation with NMFS.

The Natural Channel of the Old Cow near the Diversion

Immediately upstream of the diversion is a volcanic wall with very steep gradients with limited habitat. Above that are significant resident rainbow trout in the area below Buckhorn Lake.

The Old Cow channel immediately below the diversion structures contains nearly a half mile of reasonable adult and juvenile steelhead habitat. Human access to the top half of this area is simple from the current facilities most of the year. Thus, with a small amount of work this could be a combined use adult/juvenile habitat with fishing access.

Accessibility will mean that it will be fished out of adults, so a constant supply of fry will have to be supplied from the first habitat return pipes. By injecting fry, especially fry with anadromous parentage, into the upper reaches of the Old Cow, full use of the limited habitat of the Old Cow can be made.⁴

The Presently Bypassed Middle Reach of the Old Cow

A half-mile or so from the diversion, the Old Cow enters an incised valley cut into the pyroclastic outflow of volcanic materials. This middle section is difficult to access and has a mostly rock and boulder bottom. The long stretches of solid rock bottom are derived from the effluvial surfaces of successive waves of volcanism. Access to this area is difficult, infrequent, and only allowed with the permission of Sierra Pacific. Due to the limited potential habitat of this area, the project is focused on maximizing the benefit of habitat in the headrace. The potential for spawning in the canal will be greater than in this reach.

⁴ This measure, if carried out with known anadromous parentage, will be the most effective restoration measure for the bypass region.

Below that, the canyon narrows and there are innumerable barriers to migration including one that is 12 feet high with only an 18 inch deep pool in front of it. Well below this, the flow from North Canyon enters the river. From here on the gradient is less severe, but the bottom is still made up of rock and boulders. The small quantity of sand is angular and full of silt from the proximate walls containing grit.

New Plans for the Lowest Bypass Mile of the Old Cow: The Wroe Juvenile Habitat Area

The lowest mile of the current bypassed reach contains some reasonable adult and juvenile habitat areas. It is all private land and not accessible without permission from private landholders above the Fern Road bridge across the Old Cow just above the powerhouse. Fishing is not permitted. Mr. Wroe owns the land and Old Cow stream frontage in this area. The Fish Return Path stream crosses his land.

Relations with Mr. Wroe currently are excellent. He welcomes projects and fish enhancement. Through his property, over a mile of Creek access is available from the research station for research projects on adult and some juvenile habitat with a steady supply of cool water from three sources: numerous springs mostly on the North side of the Old Cow, flow in from North and South Canyon Creeks, and some from the Diversion. It is in this area that we intend to return the fry to grow into fingerlings. It is the area in which they would have the greatest chance of surviving due to the more modest gradient, cold water, and some lateral feeding areas. In this case, Davis Hydro is partnering with the private land holder to use this area as a fish habitat and a fish habitat research area with conditions quite different from those found in the headrace.

The Power House Area

From the bridge down to the powerhouse is the only stretch with public access to this lower area, and it will be the only access to the whole reach if the hydropower diversion is removed as no public access will exist upstream.

The old transformer building will be turned into the Kilarc Field Station for fish research and an office for the hydropower. It will have a wet lab, a dry lab, Internet facilities, a simple kitchen, and bunk area for people staying over. The facilities will be Spartan but adequate for field research.

The installation of a new control system is a possibility. This will allow for telemetering, not only of the station and headrace data for the hydropower but hopefully for a range of research. For example, monitoring at the screens may include fish counters and flow measures, while other mesh-enabled telemetry facilities may serve the whole of the site for special projects. This will allow for the biological monitoring at any degree of detail at any point in the study area, including any portion of the Old Cow in the area that can be reached by the telemetry radios to which the researcher has access.

Off-Project Elements

The Kilarc Trust will allocate a share of the profits for off-project environmental projects to complement the on-project fish enhancements. The following potential features are sample “off project” elements and will require the cooperation of many parties. Some may be possible, some may not. Most of them will have to be debated and improved through consultation with local land owners and agency partners.

Other Diversions

Davis Hydro plans to work with downstream hydropower and other water diverters especially during the downward migration season to maintain screening along the Old Cow. Currently, nothing is planned. We expect the Kilarc Trust will take a holistic approach to fish enhancement and allocate their funds where they can be most effective not only for the benefit of local fishers and the community but for the fish as components of the whole Sacramento ecosystem. The hydropower operator will be able to help either as part of his FERC License conditions or as a contractor.

German Ditch

We plan to approach the German Ditch Association about permitting us to install and maintain a fish return facility in their South Cow Diversion to assure all members of the Association obtain delivery of their water, while improving downstream fish passage. We also will be talking to them about informal upstream fish passage and downstream improvements that should help during low flow conditions.

South Cow Hydro

We will work with any developments on the South Cow to improve habitat along that stream primarily because it has extensive habitat for all life stages and ecotypes of salmon and steelhead.

Fish Guidance Research

Davis Hydro was initially attracted to this area for field testing of its fish guidance technology. A possible application of this will be the direction of returning fish up the South Cow rather than the Old Cow. This off-project emphasis is not due to reasons of hydropower, but simply because of the accessibility and better habitat of the South Cow. Further suggested research projects will be discussed in a forthcoming research projects paper.

Summary

This alternative is an elaboration of a simple common idea: a fish passage facility, a new fish screen and return near the end of the Kilarc canal, will return small fish to the Old Cow. With augmentation, the Kilarc headrace can be made into an extensive complex of various types of spawning areas that will be more productive than the steep/narrow bypassed section of the river. Due to the difficulty of upstream migration, the growing and emission of juvenile steelhead from the area is a positive remediation plan for the fish. Further, this plan provides the means to maintain and expand fish production and research under the guidance of an independent non-profit Kilarc Trust.

Further, this alternative continues green power production, continues supplying cold water to maintain downstream habitat, and continues to supply and expand all community services.