

**An Alternative Proposal to Facilities Removal
Kilarc – South Cow Hydropower Project**

Consisting of

KC-I - An Alternative for the Kilarc Facilities

and

KC-II - An Alternative for the South Cow Facilities

Discussion Document to be considered for the

Disposition of Facilities

of the Kilarc-Cow Creek Hydropower Project

as part of the

FERC Project 606 Surrender Process

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Forward

This document focuses on one main issue: What is the best way to protect Central Valley steelhead fish in Cow Creek?

Davis Hydro is new on the scene and presents in this working document a KC alternative to the removal of facilities that PG&E has declined to relicense for hydropower generation. This working document thus addresses the need to identify the best disposition of facilities, in the same sense as any alternative is proposed prior to being studied and modified under the NEPA process. The original P-606 hydropower license has expired and the license expiration requires FERC to re-evaluate what conditions are appropriate and desirable going forward. This “no destroy” alternative is essentially the “no project” alternative, because, just as the FERC license surrender process is implemented in a parallel fashion to the license application process, it provides a path for PG&E to be relieved of its license responsibilities without immediately making changes to structures (“no build”), while “no action” is not acceptable.

Davis Hydro staff do not pretend to be fish biologists. The assumptions made in formulating the alternatives discussed here are preliminary and will evolve as biologists contribute information and new insights. The focus of this paper is not to resolve biological issues but to raise them and to formulate a path to see that they are resolved in a manner that best serves the resource and stakeholders. We have put down here our reasoning to date and hope that the reader will assist us in any corrections to our assumptions and help us all formulate the best path to help the fish and serve the members of the community. We hope that good biology will result from these initial efforts at defining the problems and their alternative solutions.

In this proposal, KC LLC is the legal entity established by its parent company, Davis Hydro, to operate the Kilarc facility and if advisable the South Cow facility. Davis Hydro will supply full support to the effort. KC LLC will undertake restoration, fish-related research, fiscal responsibility, and operation of the project.

Davis Hydro, Davis California, September 10, 2007

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The Need for an Alternative

Pacific Gas and Electric Company (PG&E) and the resource agencies agreed in March 2005 on a plan to surrender the Federal Energy Regulatory Commission (FERC) License to Project 606. That plan involved “decommissioning” the project, including the removal of all impediments to anadromous fish and some preservation of the powerhouse facilities while discontinuing all hydropower generation. This report focuses on the facility removal aspects of PG&E’s plan. These creeks are undammed to the sea and could provide additional spawning and/or rearing habitat to salmonids protected under the Federal and/or State Endangered Species Act (ESA) and the Magnuson-Stevens Fisheries Conservation and Management Act of 1996.

Background

Davis Hydro learned of this project in March of this year, well after the resource agencies had agreed with the project owner, PG&E, on a plan to remove all impediments for the anadromous fish as part of their license surrender process. Davis Hydro’s petition to the FERC to start new license proceedings was denied and will not be considered until PG&E’s present license (606) is surrendered. Thus, Davis Hydro stands with members of the community, who were not included in development of PG&E’s agreement with the agencies, as an intervener intending to find alternatives to the significant adverse impacts of the facilities removal proposed in the agreement and to bring fresh ideas for anadromous fish enhancement to the PG&E surrender process.

Davis Hydro has a history of balancing hydropower interests and fish enhancement interests. The objective of this KC alternative is to ask, “How can a small hydroelectric project be used as a green power resource in the Cow Creek Watershed in a way that meets fish resource goals and respects community interests?” To answer that objective, Davis Hydro has set up the KC LLC limited partnership to enable a “no-destroy” Alternative disposition for FERC Project 606. KC LLC has as its mission to take responsibility for environmental enhancements and endangered fish restoration, through hydropower operation of facilities such as those to be surrendered by PG&E.

Introduction

KC LLC proposes a specific two-part alternative to be studied as part of the PG&E surrender process. The different possible elements of this alternative are designed to meet or exceed the fish restoration goals of the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG). To analyze the problem of fish optimization while meeting human needs, we break the FERC-licensed project into two parts. Each part can stand alone, addressing the effects of selecting a particular disposition of facilities:

1. KC-I – The Kilarc Powerhouse and associated water works
2. KC-II – The South Cow Creek Powerhouse and associated water works

Each project part can be evaluated separately and each alternative part can be implemented separately, independent of what happens in the other part. Communication has begun with the stakeholders identified thus far whose cooperation and help will be needed and who will affect the eventual success of the proposed fish enhancement measures.

The KC-I Alternative is intended to meet the goal of the many citizens of Whitmore and the surrounding area to “Save Kilarc” (i.e., leave the Kilarc reservoir along with its fishing intact) while maximizing steelhead recovery by using revenues from Kilarc hydropower generation to research the effects of implementing habitat modifications and fish population management activities. A second proposal, the KC-II Alternative provides for fish enhancement as well as delivery of water rights of ranchers along the Abbott Ditch. Attendant enhancement, demonstration, and research incorporated into both parts of the KC alternative, assure that whatever becomes of the Kilarc-Cow Project, it will be the best for all concerned.

KC LLC is primarily interested in the Kilarc hydropower generation and concerned about its effects on Old Cow Creek resources. This KC-I Alternative includes a discussion of opportunities to enhance the habitat in the South Cow as remediation for any potential harm from water diversions on Old Cow Creek to the anadromous fish population within the larger Cow Creek Watershed.

Scope

While this document focuses on the best way to protect Central Valley steelhead fish in Cow Creek, the project alternative ultimately approved by the FERC for implementation must balance the direct and indirect effects of the project on all resources.

First, it is essential to recognize what any project alternative can or cannot do. While the desired benchmark for many of the target fish would perhaps be the undiverted river from a time when all human and human-related activity in the area did not exist, no project alternative can restore the area to that virginal state, removing the burden of local population and agriculture with irrigation demand, and potentially ignoring the needs of maintaining other endangered species that have only made their home in the area since humans have introduced appropriate habitat (or pushed species from other areas).

Second, it is essential to measure indirect effects of the project such as would result from discontinuing rather than continuing the generation of green power. If the green power output from the Kilarc Cow Creek project is decreased, a corresponding increase in fossil fuel generation will occur to make up for the lost power.¹ Resulting CO₂, SO₄, CO, VO₃, NO_x etc. emissions will cause an increase in green house gases which result in fish habitat reductions downwind across the US from thermal and chemical effects. If a project alternative is suggested that would reduce green generation from this project, there may or may not be an increase locally in anadromous fish, but there will definitely be an increase in acid rain downwind incrementally destroying fish and their habitat. Therefore, analysis of any alternative that diminishes green power output must include the external effects this action will have on the destruction of our air quality and on the fish resources in rivers and streams across the state and the US.

It is convenient for the proponent of any action (to build dams or decommission them) to consider only the local actions and their consequences. However State agencies and regulators are concerned about State level impacts of an action, while Federal agencies address national concerns. It is this very national perspective of fish endangerment that is of concern here. The loss of the fish is a national concern, and therefore both the beneficial and detrimental effects of

¹ Loss of green power will cause nearly a 1 for 1 increase in fossil-based replacement generation because any additional demand will be met predominantly by fossil generation with its downwind acid rain, and widespread environmental damage. Notable, in this case (as in New England), major damage will be done to the fish through acid rain. See *Grueneich* p. 23 and related dockets for extensive documentation of marginal California generation for the foreseeable future.

any action must be considered and benchmarked on the same scope. The scope of the effects of the loss of green power is measured from today's real conditions both in the atmosphere, and in our national streams. Area wide effects of any alternative must be analyzed for their total effects on an agency's purview by the agency responsible.

Internalization of externalities is the principal reason for any regulatory agency's existence. All environmental and regulatory agencies are internalizing external effects of local decisions. In this case they will consider the effects on the fish from the replacement fossil power on other water bodies, the downstream sediment during deconstruction, and other "off project" effects.

Metrology

In evaluating alternatives, the difficulty lies in determining what should be measured and to what should it be compared (Tullos 2007). The National Environmental Policy Act (NEPA) requires that an Environmental Impact Statement (EIS) rigorously evaluate all reasonable alternatives in comparative form to provide to decision-makers and the public a clear basis for choice among options. The level of analysis devoted to each alternative must be substantially similar to that devoted to the proposed action.²

The perceived opportunity to use PG&E's license surrender to promote recovery of special status anadromous fish species may be the single determinant of which project alternative is ultimately selected for implementation. The basis of comparison for the effects of each alternative should be against existing conditions, and against future without-project conditions, because of the uncertainty involved in predicting the effects of certain actions on the species of concern. The standard of comparison is not a virgin, non human-populated countryside. Under ESA we are not trying to preserve countryside, or even area of habitat. We may not, in this case, even be evaluating fish counts, as rainbow trout are, or may be with the help of man, prolific. We are addressing the prevalence of a fish *behavior* that differentiates special status steelhead from rainbow trout. This behavior may or may not have much to do with local habitat, but does have something to do with genetic make-up or other unknown factors. With clarification, habitat may fail as a metric to provide any useful guidance. Clearly, with no habitat there are no fish,

² 40 C.F.R. 1502.14; Forty Questions Nos. 1 and 5(b) found in 46 Fed. Reg. 18026 (March 23, 1981), as amended, 512 Fed. Reg. 15618 (April 25, 1986)

but in the case of rainbow trout, better habitat may or may not result in migration. It is less than clear that the better the habitat, the more likely fish would be to migrate out of that habitat. Due to this unknown connection between habitat and behavior (our desired outcome), measuring the effect of fish enhancement or habitat improvement efforts is therefore as much an art as a science.

Methods of measuring anadromous fish population have been developed primarily for salmon. While all salmon and trout are salmonids, the migratory and spawning difference between steelhead and salmon include potential multiple migrations and spawning by steelhead, as well as the potential for juveniles to remain as resident fish, as opposed to undergoing smoltification and anadromy. Rainbow trout may or may not migrate to sea. They may only migrate part way to the sea, they may return quickly, as “half-pounders”, or they may take years to return. They may migrate more than once. The differences from salmon are profound. These differences make the studies of steelhead populations, migrations, and the efficacy of intervention measures very difficult to measure.

Two metrics we do have at the moment – The first being *habitat area*, and the other being *barriers to migration*. Other habitat metrics such as water quality and temperature are also important. These metrics describe habitat, not the key defining feature of steelhead, the act of migrating to the sea and returning. This discussion proceeds by addressing quantity and quality of habitat, but more important, engineering modifications to that habitat to induce population growth and migration.

General Benefits of the KC Alternative

This Alternative design is driven by the reality that the best analysis of what the fish need, what can be done to help them, and how the community can best participate in the process *cannot be resolved quickly*. The studies needed and the organization of the response to those studies will simply take too long to be completed within the timeframe suggested by the surrender timetable (Tullos 2007). In this alternative plan, described below, adequate time is exercised for implementing fish restoration measures which involve the community as well as private facilities. In this plan, a newly created Kilarc Environmental Trust (KET)³ conducts

³ This could be a composed of, or similar to, a subcommittee of the existing Cow Creek Watershed Management Group, similar to the Cow Creek Technical Advisory Team.

studies, and directs the expenditures of study funds generated by continued operation of the hydro in an independent and timely manner.

The community has to respond within the framework that will meet the requirements of the resource agencies. However, this community response, led by KC LLC, cannot be undertaken or even studied in the timeframe of the current surrender plan. Under the KC Alternative described here, PG&E is quickly and economically relieved of all responsibility other than the decommissioning bond to be exercised only if and as necessary. If willing, PG&E could play a major part on the KET Board of Directors.

Under this Alternative, the State, Federal, and local agencies involved in protecting fish have a positive relationship with the community. KC LLC becomes an agent funded to implement and maintain many of the fish enhancement measures⁴. Equally important, this project enables not only maintenance, but active research in a study of a complex phenomena over a time frame that is compatible with the life and behavior cycles of the fish. The Cow Creek Watershed Management Group and other related NGOs obtain a permanent funded local agent in-place and hands-on to affect environmental measures. This becomes a source for matching funds and an agent to get the projects built and maintained.

In the following sections the KC Alternative is described for review and comment by all concerned.

⁴ We will undertake these projects learning from and in collaboration with existing groups such as the Western Shasta Resource Conservation District that defined and is implementing similar projects with the collaboration of the Cow Creek Watershed Management Group. See for example, Engstrom, et al 2002; this referenced proposal was partially funded in a revised form and progress reports of that work are available from the Western Shasta Resource Conservation District.

Alternative KC-I to the Demolition of PG&E Project Facilities

This alternative consists of the following elements:

- PG&E will leave the Kilarc facilities in place
- The recreation facilities and canal will be transferred to Shasta County
- KC LLC will pay the County for water conveyance
- FERC will allow continued operation of the entire Kilarc facility in production/research mode
- KC LLC will operate the facility, implement remediation, and research
- KC LLC will demonstrate supplemental remediation measures for the whole Old and South Cow Creek areas over a 5-year study period
- All project facilities will be decommissioned and/or relicensed per the surrender plan and study results after evaluation of the 5 years of studies

Simplified Sequence of Events for the KC-1 Alternative

- PG&E studies alternatives prior to surrender⁵
- FERC approves surrender plan
- PG&E bonds and forms trust fund for facility removal costs
- PG&E sells license and associated lands and leases to KC LLC prior to surrender

During the following 5 year period, KC owns and operates the whole project under an Annual FERC license. KC LLC retains a bond⁶ on PG&E to undertake any needed decommissioning work if it is eventually needed.

- KC LLC immediately transfers forebay and canal to Shasta County for recreation
- KC LLC continues work to enhance the steelhead population with Cow Creek community.
- KET board directs studies and habitat enhancement measures
- KC LLC operates the site in experimental/demonstration mode for 5 years during studies. Kilarc Forebay operations very similar to today's conditions.
- KC LLC pays Shasta County for water conveyance, sharing maintenance

⁵ Per process requirements of FERC and NEPA.

⁶ To the satisfaction of the resource agencies and the FERC

- KC LLC shares 33 percent of the profits for enhancements

At the end of 5 years of studies, a determination is made by the resource agencies on what is best for the project. If in their opinion, some of the facilities can be operated under conditions acceptable to KC LLC, these facilities may be licensed by KC LLC. Bonding for remaining facilities will remain in place. Otherwise, the facilities will be decommissioned.

- When/if Kilarc project is declared by KC LLC as non-economic, the bond for facility removal is exercised as needed at that time.
- When/if Environmental Protection Agencies determine that scientific evidence gathered under the proposed study plan indicates that cessation of hydropower operations provides benefits to anadromous fish that outweigh benefits of operations to fish and other stakeholders, the bond for facility removal is exercised as needed at that time.

Specific Benefits of KC-I Alternative to Stakeholders

Sport Fishing Enthusiasts

- The upstream native brown trout remain to be caught in the forebay
- The CDFG put-and-take rainbow trout fishery is maintained

Special Status Fish

- Cold water continues to be delivered downstream via the powerhouse
- Time is created to implement mitigation measures
- Time is created to study relative habitat and habitat use

All Fish

- Evaluation of specific needs of all fish resources in the system
- Community efforts to restore fish are enabled carefully
- Fish intervention measures are enacted in a collaborative mode
- Habitat is created and maintained by KC LLC
- A fish research facility is created and funded with an open mandate

PG&E

- Economy – low removal costs if the facility continues operation
- Staff Savings – less staff and consultant time spent on studies

- Simplicity – work now directed by KET
- Community Relations – no disagreement with community, rather, eliciting community support
- Low Risk – others own the site during continuing operation
- Collaboration – excellent resource agency relations as the best fish solution will be identified
- Uncertainty about future expenditure level can be insured against.

KC LLC

- Opportunity to implement fish restoration and restoration research
- Creation of green power

The Greater Whitmore Community

- Kilarc is saved! The Heart of community remains
- Community recreation area and jobs are maintained
- Water supplies are maintained
- Greater involvement with fish protection with new partner

Western Shasta Resource Conservation District

- Permanent funding partner
- Hands-on engineering assistance
- Dedicated local maintenance staff
- Proposal partner

Fish Affected Downwind of California Fossil Generators

- Less acid rain
- Less heated air across existing habitat

Potential Negative Impacts of Alternative on Anadromous Fish

- May not improve habitat conditions
- May delay an improvement in fish habitat if all enhancements and research fail

- Research may be inconclusive⁷

Roles Changes for Stakeholders

Alternative KC-I changes the role of the signers of the March 2005 Agreement and their consultants from

Supporting the decommissioning (primarily removal) plan assumed in the Agreement

to

independently asking, “What is the best integrated research and restoration plan to help the fish?”

This question is close to the hearts of those mandated to preserve these species. The role of NMFS, USFWS, and CDFG changes from that of regulator/FERC participant to a preferred role of actively contributing to research on how to promote recovery of these special status species. Their input is invaluable as partners rather than regulators over the next few years in determining how to test and implement fish enhancement technologies.

PG&E has multiple goals to pursue with license surrender. PG&E would like to maintain its relations with the fisheries agencies; would like good community relations; would like to reduce costs for its customers; and would like not to impact unduly the natural resources of the area. These goals are often in conflict. The KC-I alternative redefines PG&E’s role from that of destroyer of a community facility to an agent questioning the facility’s remaining best use for the benefit of fish and the community. It places PG&E *with* the community⁸ instead of outside it. It changes the role of PG&E from acting as an agent of the fish agencies to a role of helping the agencies direct the studies and activities proposed by the KET and undertaken by KC LLC.

The community changes from recreating on and living in the shadow of the Kilarc facilities, to being active participants in fish restoration and agents to help solve the anadromous fish problems.

⁷ To avoid disagreements later, exact metrics must be agreed to in advance of acceptance as part of the surrender plan (Tullos). Otherwise, with knowledge gained over the study period, standards for removal may change.

⁸ Clearly there is a spectrum of relations and desires by individual interests. A small number of the community want the facilities removed primarily for reasons of encroachment on their land and privacy.

Finally, under this alternative, KC LLC becomes an active participant in studying and maintaining the health of the river. Davis Hydro, KC LLC's parent company, has learned to take that responsibility very seriously and wishes to carry on that work here.⁹

KC Alternative Activities and Derived Studies

A basic premise of the KC-I Alternative is that KC LLC can study and enact more effective measures for the fish using the Kilarc facilities than by removing them. The only way to know this is through a minimum 5-year study period. It is a major component of this alternative that KC LLC will be active in fostering fish enhancement measures. KC LLC contends that, within 5 years of onsite work and research, it will be doing a better job enhancing the fish resources with Kilarc hydropower resources and community cooperation than will occur by removing the Kilarc facilities.

KC LLC activities will be dictated by the KET Board¹⁰. What exactly will be included in the efforts by KC LLC will evolve over time from inputs from the regulatory and research communities. Below are some of KC LLC's initial ideas on how to proceed. This list is neither a commitment to do these items, nor a limit on the items to be done. As licensee, KC LLC will undertake work in research and intervention on behalf of the fish. KC LLC does not expect to be successful some of the time, but expects improvement in fish habitat in Cow Creek.

The following sample research questions are suggested as part of the transition process from PG&E operating the hydroelectric project to the future disposition of facilities.

- Could the Kilarc Canal be used as a salmonid spawning and rearing habitat and managed in such a way that flows are released in a timely manner so as to improve fish migration conditions?
- Could the upper parts of the German and Abbott ditches, and possibly other ditches be screened off from the fields and used as habitats¹¹?
- Could additional spawning habitat (riffle areas) be created and maintained that would be used by steelhead?

⁹ In Vermont, Davis Hydro is the only hydroelectric project on the Dog River, which is considered the best trout stream in the state.

¹⁰ Who are expected to receive input from affected ranchers, water users, agencies, and NGOs like the Cow Creek Watershed Management Group.

¹¹ In-ditch screens are probably far simpler and less expensive than in-stream screens. Ditches are existing, maintained engineering structures that have many of the features needed for spawning and young juvenile habitat.

- Could additional holding and rearing habitat (deeper runs and pools) be created and maintained that would be used by steelhead?
- Could KC LLC provide technology and manpower to manage the ditches to reduce runoff and pollution of Cow Creek¹²?
- Could steelhead fish fully populate the lower sections of the bypass reach ¹³ with only minor changes in flows?
- Will an increase in flow increase or decrease habitat actually used in the bypass reach?

Recommended Research

Research will be under the direction of the KET, and the initial research items are broken out into: 1) Kilarc site-specific study, 2) detailed fish related research, and 3) generally applicable research to determine how best to manage tributary habitats above Lower Cow Creek to restore anadromous fish populations in the whole Cow Creek Watershed.

Under the direction of the appropriate KET Board, the research would take as its objectives the ideas derived from recent work in this area by the Cow Creek Watershed Management Group, landowners, water rights holders, and agencies. These would include the following references: The Anadromous Fish Restoration Plan by the CDFG, The Cow Creek Watershed Assessment, The Cow Creek Management Plan, Research on this area performed by Dr. Lisa Thompson, and numerous papers and research work done by of the Western Shasta Resource Conservation District¹⁴.

These documents point to several key stressors on the steelhead and salmon populations including habitat loss or modification, unsuitable water temperatures, reduced fish passage (e.g., barriers), entrainment, predation, and degraded water quality. Habitat includes the amount and the conditions of habitat including water temperature, water quality, and stream cover. Barriers

¹² Ditch owners need water to reliably flow in a programmed manner. Supplying this service and remotely monitoring ditches using telemetry meets the needs of the ditch owners and monitors the fish habitat.

¹³ Considerable water flows into the reach of Old Cow Creek between the diversion and the Kilarc Powerhouse from spring-fed flows and from North and South Canyon Creeks even in the summer. These flows are reported to be lower in temperature than the water already in Old Cow Creek because of their close cold underground sources. These cold-water sources upstream from the powerhouse might create a suitable fish habitat upstream of the powerhouse, even in dry years, irrespective of the flows that are left in the natural channel instead of being taken at the Kilarc diversion. It is an interesting question when and where the warmer water upstream of the diversion could best help form fish habitat.

¹⁴ For sources, see the WEB enabled references at the end of this paper, and the Reference section of Kilarc.info. Be aware that many of these references are large, varying between 3 and 25 Megabytes.

can be either natural, such as falls and cascades on the Old Cow Creek or, human-constructed barriers such as dry bypass reaches and dead-end diversion ditches. Predation mortality can be caused by birds, fish, small mammals, and humans. The amount of habitat is related to stream width, substrate characteristics, water temperatures, water quality, and cover or instream structures.

Fish habitat needs depend on the life stage present. Steelhead spawn in riffles and fast moving water up to 4 feet deep (such as most ditches in this area), and require substrate composed of clean gravel approximately 1 to 3 inches in size (a bit large for some ditches). Habitat area is often measured in square area of riffle bottom or deep pools, but also in the ratio of pools to riffle and run habitat. Juveniles require riffles at first and later deeper pools. Water temperatures are important to assess how frequently the system could have unsuitable temperatures to sustain the life stage present.

Kilarc Site Specific Studies

1. Would anadromous fish (steelhead) populations using Old Cow Creek be better served by ceasing or in various ways reducing water diversions for Kilarc hydropower generation?
2. What would be the effect of future Kilarc hydropower operations on steelhead populations in the greater Cow Creek Watershed?

The first question is easier to answer, because it may not be necessary to quantify the population affected. The second question is only halfway answered by measuring effects on Old Cow Creek, as proposed enhancement elsewhere would improve conditions, to compensate for potential negative effects of hydropower operation. The following sections address some aspects of these questions.

Temperature Effects of the Kilarc Powerhouse Operation

“Does the operation of the Kilarc Powerhouse lower the temperature of the stream in drier months and/or years?” Why is this important? It is a contestable hypothesis that the downstream habitat for native fishes including both salmon and trout is improved by lowering water temperature in the summer. Further, for any acceptable temperature regime, by lowering the temperature in the summer, useful habitat however defined by temperature is expanded due to temperature effects on the fish (Thompson). In effect, this hypothesis states that there could

be more habitat in Cow Creek with the Kilarc facility operating than without it due to reduced water temperatures during the warmer months. The testable hypotheses are as follows:

- 1./ By ceasing operation of the Kilarc Powerhouse, quality of downstream habitat that has fish population will be negatively affected.
- 2./ The area of habitat downstream of the powerhouse will incrementally decrease affecting multiple listed species because with higher temperature less area will support target species (Thompson 2006).

Potential Fish Access to Old Cow Creek Bypass Reach

This question is “How many fish would the habitat above various impediments ever be expected to support?” CDFG has gone on record¹⁵ declaring that steelhead can easily pass Whitmore Falls in fall floods¹⁶. It is reported that perhaps no one believes any fish can pass the next barrier about 2.1 miles upstream from the Powerhouse, so it is possible that the bypass habitat that is being discussed is about 2.1 miles long. Just defining what we are talking about is important¹⁷, not only for this reach, but for all streams where this issue exists.

There will clearly be brown trout in this area due to a native upstream brown population. There is likely a resident rainbow trout population from the annual canal purging and occasional overflows from the Kilarc forebay. Juvenile steelhead are impossible to distinguish from juvenile rainbow trout. Conducting a downstream migration study would be one potential way (probably the only) to identify steelhead production in Old Cow Creek.

Habitat Availability above Kilarc Powerhouse

Under the hypothesis that some steelhead pass upstream past the powerhouse, the questions resulting from contemplated removal of project facilities include: 1) “How much habitat is available for steelhead?” 2) “At different flow regimes, what are the relationships between the fish and the stressors within the stream?” 3) “Does limited availability of habitat result in downstream migration?” This third question is important because the amount of

¹⁵ Barry, M. speaking publicly at PG&E’s Public Information Meeting, March 27th, 2007.

¹⁶ An experiment might be conducted *in situ* by placing tagged (or trapping passing) fish of interest below the Whitmore falls and see how many pass the falls in a reasonable period. This could be done at different water stages. The same experiment might be done at the cascade located 2.1 miles upstream to see how effective it is as a barrier.

¹⁷ Tullos discusses this at some length. She indicates that it is necessary for successful restoration for all to agree on definable starting points and metrics for measuring progress and success, or arguments will simply continue.

suitable habitat may dictate in a very non-linear way the number of resident and anadromous fish.

In this case, the number of proximate rainbow trout is not the question. It is the seaward migratory behavior of healthy anadromous individual fish that is desired. Negative aspects of habitat may be critical to induce migration. The opposite interpretation that *adequate high quality habitat induces increased out-migration* seems illogical. The steelhead have evolved a complex set of behaviors such that even in favorable conditions some fish will migrate so as to create a diaspora of individuals across different habitats. This being the case, and ignoring the physical migration impediments momentarily, will more migrants, or fewer, be created by improving habitats? The answer is unlikely to be linear¹⁸.

Detailed Fish-Related Research: Migration Induction Studies

Can migration be induced? If it is true that there are plenty of rainbow trout, the amount of habitat may not limit the behavior desired in this species. Rather, the *stresses on the population in a habitat may induce migration*. Other factors clearly prohibit migration: dams, very high temperature reaches. Can we define an optimal balance between a benign habitat and one that produces the migratory behavior? Assuming we have an individual rainbow trout, what can be done to induce him downstream? This has to be a fertile area of research, and the Cow Creek provides a near perfect experimental set up for testing induction of this behavior.

In most fish studies, *more habitat means more fish*, provided that the species is habitat limited¹⁹. In the case of a fish in which behavior is the major defining characteristic, more habitat may inhibit migration. Put simply, a happy fish may have little inducement to move. A test of this might be to take some rainbow trout in a cordoned off section of habitat and see if they can be made to migrate downstream by stressing them.

Various amounts of stress can be relieved from different small groups of fish to see if they are differentially induced to migrate downstream. Various habitat expansions can be made to see if they stay. This can be done with screening, bottom modifications, and tagging.

¹⁸ A mathematical solution suggests that a large diverse set of geographical areas subjected to a repeated mix of favorable habitat conditions to build population coupled with stressful episodes will produce the most migrants. This solution is subject to free access and migration which is not the case – rather an issue here.

¹⁹ In the case of the Kilarc bypass habitat, this may or may not be the case due to multiple downstream impediments to migration.

Because the facilities are being improved, opportunities²⁰ exist for experimentation; a massive amount of research can be carried out at this facility at modest cost and reasonable probability of getting streambed modification permits.

Generally Applicable Research: Screening Design and Operation

The elaborate fish screen at the PG&E South Cow Creek diversion is in disrepair. The wipers do not touch the screen in places, and many of the bristles are sun-rotted off. It may have been functional when installed, but the basic design is high maintenance. A core element of the KC alternative is that with the operation of Kilarc comes the responsibility to invest in design and testing of new cost effective fish screens, installation, and most important, maintenance.

On commencement, KC LLC intends to work with ranchers, the Cow Creek Watershed Management Group supported by the Western Shasta Resource Conservation District, and local ditch associations to experiment with ideas for enhancing the steelhead habitat and populations. The new lower-tech experimental diversion screening, and habitat expansion designs may provide excellent testing of this and other²¹ technologies. Other projects and interventions undertaken in collaboration with the ditch owners might include:

- Design and operation of diversions and ditches as rearing habitat
- Timed pulse release of year class from ditches to induce both upstream and downstream migration
- In-ditch screening techniques
 - Design and prototyping of different new designs
 - Operation and maintenance considerations
- Radio telemetry of:
 - Diversion control to reduce field flash runoff in the fall
 - Monitoring field runoff to control ditch releases

²⁰ Because these fish are endangered, no additional stress can be put on them – no permit would be granted. However, as improvements in the habitat are made, different amounts of stress can be taken off the fish at different times allowing careful examination of the behavior as conditions improve. This is typically how nutrition intervention studies are carried out on humans, and the approach is applicable here.

²¹ Davis Hydro staff initially came to this area with a fish guidance technology that it wanted to try in the field. It is a fish herding system that is useful for directing fish into spawning channels, toward ladders, or away from inlets. Here, we could use it to drive fish into diversion channels to be returned to the streams.

- Real-time telemetry of diversion screen monitoring, for the detection of any problems, and bypass controls
- Any deviation in adequate water flow for users

KC LLC will work with water diverters to screen diversions²² as permitted. The approach will be on a collaborative basis wherein KC LLC performs the following functions:

- Maintaining good relations with the diverters
- Cleaning and maintaining the diversions
- Instrumenting the diversions so a real-time alarm regarding any decrease inflows is sent to prompt corrective action before a problem becomes serious.

What the KC-I Alternative Does Not Do

In closing, it is fair to consider what KC-I does not do. As in any pro-active adaptive management alternative, the exact actions to be taken evolve as the studies of the plan progress. This plan in particular is dynamic and adaptable in that it will continually evolve for the benefit of the participants and the fish. The plan does not specify in advance exact measures or any detailed engineering to be undertaken in the area. This will evolve with inputs from appropriate stakeholders. We will work to seek permissions to work with ditch associations and farmers to find fish enhancement measures and research venues which are not currently in place. The plan does not specify exact percentages, levels of funding, dollar commitments as many participants in the alternative such as the County, or ditch associations have made no commitments at this time. Nor is it appropriate for them to do so now. This paper solely requests the study of this alternative and subsequently consideration of its approach, implementation, and research agenda.

²² These details are provided here to flesh out the alternative. It is simple to say, “remove the dams”. It is much more difficult to articulate, design, build, and maintain a pro-active alternative. Thus, the detail discussed here not as a prescriptive requirement of the alternative but rather a starting feasible rubric which we all can improve on and one that will provide a framework for analysis as a viable alternative.

Alternative KC-II for South Cow Facilities

This KC-II Alternative is disconnected from the KC-I Alternative except that anadromous fish reach both areas through the same main stem of Lower Cow Creek, and fish habitat enhancement measures proposed for implementation under the KC-I Alternative may actually be best implemented within the KC-II project area.

South Cow Creek has several factors which make its anadromous fish recovery issues quite different from those of Old Cow Creek and the Kilarc diversion. Specifically, South Cow Creek has the following features:

- Major impediments to fish passage independent of the hydro bypassed reach (e.g. the German and Abbott ditch diversions among others.)
- Thermal and nutrient rich Agricultural run-off
- Special status species may be found living in the current tailrace outflow channel
- Water delivery commitments are from the current South Cow Creek Powerhouse tailrace.

On the other hand, South Cow Creek has opportunities that are less prevalent on Old Cow Creek. On South Cow Creek are

- Ranchers willing to consider assisting in fish restoration.
- Larger habitat areas. The Old Cow is predominantly in a gorge-like setting, while South Cow Creek has wider riffle reaches with occasional pools that can be augmented by KC LLC with local cooperation.
- No significant natural barriers to steelhead all through and above the project area.

The PG&E South Cow Creek diversion dam is low and should pose little problems to fish passage especially if the approach pools are cleaned out just below the dam. The diversion canal is long and habitat to a number of animals. The canal supplying the South Cow forebay does not have as good habitat as in the Kilarc canal, but the forebay itself is rich. Furthermore, the California red-legged frog protected under the ESA has been found at times to live in the tailrace. Any habitat change will have to be addressed. By preserving the canal, at least in some form, and the tailrace perhaps at a reduced flow, the needs of these protected species might be best met.

At the same time the South Cow Creek generating facilities are smaller and have less capacity to generate revenue to support a research and intervention agenda. An agent to take

charge of this opportunity has not yet been determined.²³ It is emphasized that in the surrender process an alternative might be to remove some project facilities, while changing or continuing operation of others. South Cow Creek has complex water delivery needs that have been intertwined with hydropower generation. It may be determined that the preferred alternative for South Cow facilities would involve preservation of some facilities for the purpose of water delivery and integration with preservation and enhancement of habitat, and the revenue benefits of hydropower generation do not justify further diversion of water through the facilities that would reduce flows and potentially habitat in the natural channel between the diversion dam and the point where water is discharged from the tailrace back into the creek after passing through the powerhouse.

Specific Actions and Issues

A basic idea in this KC-II is to study when water is low the effects of reducing the base flow of water diverted for hydropower to that needed by the Abbott Ditch and Tetrick ranches, as it is claimed that PG&E must deliver water to these entities. The study would involve analyzing the effects of diverting more water in the months when there is adequate flow to make the hydropower viable. The value derived from the power generated in the old power house, perhaps with smaller turbines, will be used by the agent to mitigate the loss of habitat in the creek. This would need to be monitored. A starting set of actions suggested for the KC-II Alternative are as follows:

- The South Cow Creek diversion dam is left in place, but minor structural modifications would occur and a maintenance program would be enabled and maintained to facilitate fish passage. These could include a pool that would be maintained below the dam.
- Local abutting residents would prefer that the existing diversion be removed. Perhaps a compromise is to have it buried in a 3-4 foot diameter plastic pipe. If the canal is buried in a plastic conduit, habitat will be lost. A study is warranted of how to best balance the request of the residents with habitat requirements of the fish.

²³ KC LLC is willing and interested in participating if there is a modest positive net cash flow, but for the purpose of consideration, the actual agent need not be identified and this project would be organized separately from Kilarc. The reason for this is not the size or return, but rather there are completely different constraints and stake holders in the two projects. We at Davis Hydro, the parent of KC LLC, will work with any other partner willing to take over this more complex, and smaller revenue project.

- The flow in the creek would be increased to meet habitat needs subject to meeting the legal demands of the water rights holders. Additional water would be diverted during fall, winter and spring when sufficient excess water is available. These parameters are part of a 5-year study period.
- Within this study period, KC LLC or an alternative operator would perform the following activities.
 - Working with local ranchers to study how to use pro-active modern ditch management to minimize direct runoff.
 - Controlling ditch diversions to meet needs thus leaving more water in the stream using telemetry, and the services of a paid ditch tender.
 - Designing, constructing, and operating more reliable, less costly, and less intrusive fish screens.
 - Evaluating the upper reaches of ditches to determine presence and usability as a natal and young juvenile rearing habitat.
 - Larger pools and tree stumps could be internally screened and maintained in the stream bed to create pools and cover.

At the end of 5 years of study²⁴, the project will be evaluated. The results anticipated include:

- A different relationship between agencies, ranchers and small hydro operators derived from 5 years of effort at collaboration on habitat restoration
- New technology and strategies for ditches developed with help from the ranchers and residents that is both more efficient for the farmers and better for the fish
- Long term solutions to problems found by the local population and the resource agencies and their biologists working together on ideas and experiments
- New technologies in effective but less costly screening that could be widely applicable to many other irrigation ditches around the world
- A better understanding of the resource and the effect of different fish and fish habitat enhancement measures.

²⁴ Measured from when the studies actually start in the field. A problem in these studies is that study organization and launch often takes longer than the study. This invariably leads to insufficient study time.

- A better balance between local and global concerns, as well as between green power and fish resources.

Benefits of the KC-II Alternative

Potential benefits of the KC-II Alternative include:

- Green power will be generated to reduce downwind acid rain and global warming
- Additional habitat will be created for local and remote fish²⁵
- Local people will be involved in protecting and enhancing their own fish and recreational resources by using the economics and presence of the hydro to create and maintain environmental enhancement measures.
- Water delivery obligations will be met
- PG&E may save some money by not having to remove all its facilities.

Alternative KC-II Management

As with the Kilarc Alternative KC-I, we would expect there to be a South Cow Creek Environmental Trust to oversee the research and enhancement measures. All of the above activities would be under the direction of the Trust's Board, similar in scope to the KET Board²⁶. This board would manage the new South Cow Creek Environmental Trust which might control the funds PG&E would have expended in removing its facilities. It will also contain the profits garnered from the operation of the South Cow hydropower. This trust will be the entity to manage any grant funds and to seek grant funds with other conservation groups. How much money is in the trust, as opposed to how much might be carried by a bond with PG&E is an area for discussion by future trust board members and the recommendations coming out of the study of the KC-II Alternative.

²⁵ Fish is used here as it is commonly used throughout this paper as shorthand for the whole habitat needed to support the fish including water quality, macro-invertebrates, habitat, and opportunities for geographic and genetic diversity.

²⁶ It is unlikely these boards would have the exact same people as the stakeholders other than CDFG and NMFS are different between the creeks.

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