Letter NGO22

FRIENDS OF THE RIVER

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April 29, 2005

Ms. Mary Marshall
Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825

Mr. Jim Canaday
State Water Resources Control Board
1001 "I" Street
Sacramento, CA 95814

Re: Comments on Battle Creek Restoration Project SEIS/REIR

Dear Ms. Marshall and Mr. Canaday:

Friends of the River strongly supports full restoration of Battle Creek's threatened and endangered salmon and steelhead. Battle Creek represents the best opportunity to restore salmon and steelhead habitat in the entire Sacramento River watershed. However, we cannot support the preferred alternative (MOU Alternative) identified in the Battle Creek SEIS/REIR. The MOU Alternative is too costly and its potential for success in fully restoring salmon and steelhead is simply too uncertain. NGO22-1

Although we do not question the integrity of the agencies and individuals promoting The MOU Alternative, their claims must be compared to the government's failed promises in the past to avoid damage to salmon and steelhead and even to enhance these fisheries through water development. The Trinity Division of the CVP and the Red Bluff Diversion Dam are just two examples. In addition, the Battle Creek Restoration Project has its own history of poor project administration, grossly underestimated costs, and failure to identify all environmental impacts early in the process. NGO22-2

Perhaps the most egregious aspect of this project is the proponents continued insistence that no other alternative is acceptable. Essentially, the agencies claim that the Memorandum of Understanding (MOU) signed with PG&E in 1999 excludes adoption of any other alternative. This premise is flawed and violates both NEPA and CEQA by limiting real consideration of other alternatives and restricting the ability of the public to participate meaningfully in the environmental review. It has also led the MOU agencies to go to great lengths to justify The MOU Alternative in the face of significant evidence that other alternatives provide a higher and more reliable level of restoration. NGO22-3

A review of the project by the California Hydropower Reform Coalition in 2004 conclusively shows that the alternative to remove all eight PG&E dams below Battle Creek's natural fish barriers (Alt. B) is: NGO22-4

- Economically competitive, if not cheaper than the MOU Alternative, due to the extreme cost of constructing fish ladders, screens, bypass facilities, tailrace connectors, new or improved access roads for the three dams retained under the MOU Alternative.
- Does not require costly mitigation to reduce the chance of spreading of infectious fish disease that is required under the MOU Alternative.

- More durable and less prone to mechanical failure, flood events, maintenance demands, future budget cuts, regime changes, energy market fluctuations and other uncertainties than The MOU Alternative.

- Most closely restores Battle Creek to natural conditions in regard to fish habitat, fish passage, flows, and water temperature. It most closely achieves the habitat conditions in Eagle Canyon needed to establish a second population of endangered winter run chinook salmon, as well as for threatened spring run chinook salmon and steelhead in both forks.

- Provides a higher level of population and habitat restoration for threatened and endangered salmon and steelhead, as required by federal and state law (ESA, CESA).

- Best meets temperature and other water quality standards established in the Central Valley Basin Plan.

NGO22-4 cont

The SEIS/REIR goes to considerable lengths to justify the MOU Alternative in comparison to Alternative B. But every argument in the SEIS/REIR against Alternative B can be reasonably questioned or rebutted. For example, the SEIS/REIR conclusively states that Alternative B is more expensive than the MOU Alternative (pg. 11), and is therefore rejected. But later in the document, it is shown that the low and high range cost estimates for Alternative B are in fact, lower than the range estimated for the MOU Alternative (Table 3-8). It appears that the document disputes its own conclusions.

NGO22-5

The SEIS/REIR completely ignores factors beyond Battle Creek that will significantly affect the potential for restoration success. These factors include:

- (a) The Bureau of Reclamation's decision to eliminate the cold water pool behind Shasta Dam and not meet temperature standards for endangered winter run salmon downstream of Balls Ferry. This means that winter run fish migrating to and from Battle Creek will be subject to lethally high water temperatures in the Sacramento River.

- (b) The Bureau of Reclamation's decision to apparently shelve the Red Bluff Diversion Dam Fish Passage Improvement Project. The current operation of this dam affects the migration of as much as 70% of all threatened spring run salmon that spawn upstream of Red Bluff (USFWS, July 2004), including the spring run fish that would be potentially restored to Battle Creek. A draft proposal to permanently raise the gates of this dam 12 months/year would have increased spring run passage past the Red Bluff Diversion Dam by 91% (TCCA, Aug. 2002). But the Bureau has apparently unilaterally shelved any further consideration of this plan.

- (c) The National Marine Fisheries Service's tentative conclusion to downgrade the endangered status of the winter run to threatened, in part due to the unproven premise that the Battle Creek Restoration Project will establish a much needed second population of the winter run. This will allow for increased incidental take of the winter run and less protection overall for a species that many believe still lingers on the brink of extinction.

The Battle Creek Restoration Project cannot truly succeed unless steps are taken immediately to resolve these additional issues in a manner that assures full protection of the target restoration species.

NGO22-6

In conclusion, Friends of the River supports adoption of Alternative B, which removes all PG&E dams below Battle Creek's natural fish barriers. This alternative ensures the highest level of salmon recovery and is a smarter, more efficient use of public dollars than the MOU

NGO22-7

Alternative. In addition, we believe that Alternative B will ultimately save public money by reducing costs for mitigation, project operation, and adaptive management.

We hereby incorporate by reference our original comments to the DEIS/DEIR (dated 10/16/03) and the following attachments:

NGO22-7 cont

- Economic Review of the Battle Creek Project by G&G Associates (3/8/04)
- Analysis of Dam Removal Alternative B (CHRC, April 2004)
- CHRC Comments on the Administrative Draft (August 2004)
- Comparison of Battle Creek Alternatives (D. Carney, April 2004)

Thank you for your consideration.

Sincerely,

Steven L. Evans
Conservation Director

Review Of Proposed Eight Dam Removal Scenario

Battle Creek Dam Removal

March 8, 2004

Mr. Stephen Wald, Director
California Hydropower Reform Coalition
2140 Shattuck Avenue, Suite 500
Berkeley, CA 94704

RE: *Final Report on Review of Battle Creek 8 Dam Removal Concept*

Dear Mr. Wald,

As you requested, I have conducted a review of cost estimates prepared by the Bureau of Reclamation and PG&E for the various options for dam removal and upgrades to fish passage on the Battle Creek Project. Much of my time on this project was involved with discussing issues as they arose and investigating costs. My findings from this investigation are discussed below.

Cost Savings

Specific cost comments regarding the details of the basis for The Bureau's and PG&E's costs were provided to you in a memo via email on January 12, 2004.

Further cost savings may also be realized for the 8 dam removal scenario by re-sizing facilities to meet flow criteria for this rather than the current Cal-Fed proposal. While reviewing the project for Cal-Fed I was never made aware of specific design parameters for each element of the project so I cannot specifically compare the relative design flow capacities to the 8 dam removal. However, listed below are some of the areas that could be investigated to reduce the cost of the 8 dam project. These comments assume that the 8 dam removal project would use and convey less water than the other options. For this analysis I assumed that the conveyance system would need to be sized for at least 145 cfs.

1. Use a smaller pipe for the connection between Inskip Powerhouse and the Coleman Canal. It is currently shown as being an 84-inch diameter pipe.

Rough calculations suggest that this size pipe would allow a flow of approximately 500 cfs. The size of this pipe could be substantially reduced if water diverted from Inskip Dam and North Battle Creek Feeder were not included in the flow. My rough estimate suggests that a 4 foot diameter pipe would suffice for a flow of a projected flow of 145 cfs.

2. The by-pass system used for diverting flow so that power production can continue while maintenance operations occur on the Inskip Powerhouse penstock could be downsized also. Since this is a relatively large and very expensive element of the project that operates only on a very limited basis, it could also be considered for elimination entirely.

   Several alternatives could replace the bypass system. The easiest would be to stop power production entirely and divert water from the canal at it origin into North Battle Creek during the repairs to Inskip penstock. The cost for lost power production would need to be weighed against the cost of construction of the bypass system over the life of the system to determine cost savings. Otherwise, except for emergencies, repairs and maintenance of the penstock could occur when similar repairs occur at other power production units keeping lost power generation at a minimum.

   As an alternative to lost power production in emergency situations, water could be spilled into the South Fork. Although as the system operates now before the improvements water is spilled into South Battle Creek, Bureau response to the Technical Committee questions about the need for the bypass suggests that (unspecified) environmental issues also were part of the consideration to build the bypass system. With lower flows environmental concerns may be reduced.

   This approach would of course, violate the fisheries criteria temporarily. However, it appears that this option of spilling North Fork water into the South Fork is possible at South Powerhouse. The Bureau drawing number OA-60-109, for instance clearly shows a culvert through the dike which separates north and south fork waters. Further, the response to questions about this issue by the Technical Panel acknowledges that some mixing is inevitable. It appears that the question is one of cost versus benefit for this element of the project in the 8 dam configuration.

3. At South Powerhouse a new 1,200 foot long tunnel is proposed to divert water from the powerhouse and canal to the Inskip Canal. The hydraulic properties listed in the plans state that the design flow is 165 cfs. At this facility the lower flow of approximately 135 cfs (reduced to account for the inclusion of the overland flow addition of 10 cfs between South and Inskip powerhouses) would reduce the cost of the tunnel by approximately 20%.

4. The cost for appurtenances, such as head walls and concrete liners, associated with all of the above elements would also be decreased. I do not have a detailed cost break out for the elements listed above so I can not provide a detailed comparison of the cost savings. One of the comments I made in the Cal-Fed process was that cost were bundled together so that individual costs could not be determined.

Maintenance Issues

I do not have a detailed break out of maintenance costs. However, it is safe to say that screens and ladders are not maintenance free. The spreadsheet comparison for all the alternatives includes $600,000 for maintenance for the life of the project. This would appear to cover the labor of one person assigned 15% of the time to maintenance of screens and ladders. It is difficult to estimate the actual cost of maintenance without specific costs for a similar installation on similar rain fed high gradient stream. However, screens and ladders routinely need maintenance on streams in the northwest. Freshets can dislodge elements of the facility, make it inoperable, or in the worst case destroy elements of the facility.

Structurally, these the support elements which are made of reinforced concrete, are very strong, which accounts for some of high costs. Without specific knowledge of materials in the basin I cannot comment on the resistance of the screens to damage. High flows in confined canyons similar to North Battle Creek move objects such as trees and rocks that can damage these screens and could break concrete. It would be prudent to include some replacement costs in the maintenance to account for this. It is not apparent that the cost included in the spreadsheet is sufficient to include maintenance and *repair* of structures.

Sincerely,

Dennis Gathard, P.E.

Analysis of Dam Removal Alternative B
Battle Creek Salmon and Steelhead Restoration Project

California Hydropower Reform Coalition

April 12, 2004
<u>Revised April 23, 2004</u>

2140 Shattuck Ave, Suite 500
Berkeley, CA 94704

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On March 25, agencies and PG&E informed the California Bay Delta Authority (CBDA) of their decision to reject Alternative B and seek the additional funding necessary to implement the original MOU.

PG&E and the agencies provided two primary reasons why they ultimately rejected Alternative B. They believe that the incremental environmental benefits of Alternative B are minor, compared to the MOU alternative. Furthermore, consideration of any alternative other than the MOU would require potentially lengthy renegotiation of the MOU.

The original restoration plan is a voluntary agreement between the MOU signatories. Any amendment to the MOU would need to be acceptable to these parties and then be approved by FERC and other agencies with regulatory jurisdiction. We are grateful that considerable efforts have also been made to secure the support of local landowners and other stakeholders. For an alternative to be feasible, it must provide greater environmental benefits at an equal or lesser total cost; be supported by the agencies, PG&E, and a critical mass of stakeholders; and not cause significant delays in project implementation. After several months of review, CHRC finds that Alternative B meets these criteria, with the exception of MOU signatory support. This paper outlines the bases for this conclusion.

Project Description

A detailed description of the MOU project and Alternative B is beyond the scope of this paper, but is provided elsewhere. Briefly, on the North Fork, the MOU would remove Wildcat dam and install screens and ladders on Eagle Canyon and North Battle Creek Feeder dams. On the South Fork, Coleman and South dams would be removed, with screens and ladders installed at Inskip dam. Alternative B would remove the three dams retrofitted with screens and ladders under the MOU. Both alternatives install "tailrace connectors" to reduce or eliminate mixing of North Fork water with South Fork water (discussed further below under "water quality"). The MOU, and presumably any satisfactory amendment to it, includes dedication of water rights to the environment and funding for monitoring and adaptive management.

Ecological Benefits of Alternative B

Fish biologists and river ecologists have long recognized that unimpaired, free flowing, naturally functioning river systems provide the best habitat for native riverine species. The agency signatories to the MOU affirmed this in their 1999 report, *Battle Creek Salmon and Steelhead Restoration Plan* (Kier and Ward, 1999). That report cites Cairns (1990), who suggested that "ecosystem restoration should be based on restoring ecosystem function as closely as possible to original conditions, and should not be based on experimental systems subject to mechanical failures and uncertain biological responses."

On page 49 of that report, the agencies state these principles definitively:

Analysis of Dam Removal Alternative B
Battle Creek Salmon and Steelhead Restoration Project

Summary
The Battle Creek Salmon and Steelhead Restoration Project, a high priority for resource agencies and stakeholders alike, has been subject to significant cost overruns. In this analysis, we present biological and economic information that demonstrates that removing eight dams on Battle Creek will likely result in more effective restoration of the anadromous fish habitat at equal or less total cost than the current restoration plan. The California Hydropower Reform Coalition (CHRC)[1] recommends that Memorandum of Understanding (MOU) signatories amend the current project accordingly, to increase its biological effectiveness, and to ensure efficient use of scarce public and ratepayer funds.

Background
Battle Creek is widely recognized to be the best opportunity to restore salmon habitat in the Sacramento watershed, particularly for the unique but endangered winter run chinook salmon. In 1999, after several years of negotiation, state and federal agencies and PG&E forged a landmark agreement to restore Battle Creek for threatened and endangered anadromous fish. In an MOU, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, NOAA Fisheries, California Department of Fish and Game, and PG&E agreed to remove five of eight small hydropower dams, construct screens and ladders on the remaining three dams, and undertake complex engineering measures to prevent the mixing of North and South Fork waters.

As approved by CALFED in 1999, the Battle Creek Salmon and Steelhead Restoration Project was to cost roughly $50 million ($27 million from taxpayers for construction and implementation, $20 million from ratepayers in the form of foregone power, $3 million from the Packard Foundation). Project managers proceeded to refine and finalize engineering and design plans, and pursue environmental and other regulatory approvals. Cost estimates for the MOU project have subsequently increased to $108 million or more ($65 million construction, $43 million in forgone power). This significant cost increase led supporters of the Battle Creek project to explore the feasibility of cost effective alternatives to the MOU project.

In the fall of 2003, PG&E, US Bureau of Reclamation, Metropolitan Water District, and California Hydropower Reform Coalition conducted a cost review that identified an equal cost alternative. This new alternative, Alternative B, would remove the three remaining dams on the anadromous reaches of Battle Creek and retain project powerhouses. Since January 2004, agencies and stakeholders have explored biological, economic, and procedural issues raised by Alternative B, and held a public forum in Red Bluff March 15.

[1] The California Hydropower Reform Coalition (CHRC), founded in 1997, consists of fishing, river recreation, and river conservation organizations that work to balance hydropower production with the protection and restoration of California's rivers and streams. The ultimate success of the Battle Creek Restoration Project is a high priority for CHRC's members because of the perilous status of winter run and other chinook in the Sacramento River watershed.

Kier/Ward Table 9. Biological principles that the USFWS, NMFS, CDFG, and USBR consider essential for salmonid restoration and a necessary component of any negotiated settlement with PG&E.

Biological Effectiveness – Restoration actions must incorporate the most biologically effective remedies that provide the highest certainty to successfully restore ecosystem functions and self-sustaining populations of native fish in a timely manner. **Restoring Natural Processes** – Restoration actions must incorporate measures that mimic the hydrologic conditions under which Battle Creek anadromous fish resources evolved by increasing baseflows and eliminating mixing of North Fork and South Fork waters. **Biological Certainty** – Restoration actions must provide maximum long-term effectiveness by minimizing long-term dependence on the integrity of man-made restoration actions and the cooperation of future project owners and operators.

Alternative B better meets these principles than does the MOU. As detailed below, Alternative B provides a suite of benefits that together provide greater assurance that ecosystem functions and fish populations will be restored. Stream channel dynamics, streamflows, and water temperatures more closely approach the natural condition of Battle Creek under Alternative B. Alternative B provides a restoration strategy that does not rely on imprecise, controversial habitat prediction models and the long-term maintenance and continuous performance of engineered structures. It returns the mainstem and the anadromous reaches of both forks of Battle Creek to a more natural state, allowing the natural variability of the river to repair and maintain, over time, the mosaic of habitats that support salmonids and other aquatic and riparian species. Alternative B is not only cheaper in the short term, it delivers greater potential for success in the long term. Thirty years from now, screens and ladders installed under the MOU will have aged and may need to be replaced. Battle Creek, under Alternative B, would continuously maintain itself, at little or no cost.

Alternative B also allows substantially more water to stay in the stream channel. Many of the biological differences between the two alternatives stem from these flow differences. When evaluating the relative merits of alternative flow regimes, the Instream Flow Council (2002) recommends analyzing hydrology, water quality, biology, geomorphology, and connectivity. The agencies and CHRC examined each of these, but came to different conclusions as to the relative importance of the differences documented.

1. Hydrology

Alternative B would provide stream flows in Battle Creek that more closely approximate the natural (unimpaired) flow. Restoration ecologists have increasingly turned to the unimpaired flow as a reference point for investigating the impacts of altered flows, and as a target for prescribing controlled flow regimes most likely to sustain natural ecosystem processes and species recovery (Stanford, 1996; Poff 1997; Richter 1997; Trush 2000). Under this paradigm, the unimpaired regime itself is not typically feasible for developed river systems. Battle Creek is a rare exception, because unimpaired flow is approachable at an equal or reduced cost from an alternative that already has agency, licensee, and public support.

The Instream Flow Council (2002) recommends that "instream flow prescriptions should provide intra-annually and interannually variable flow patterns that mimic the natural hydrograph (magnitude, frequency, duration, timing, rate of change) to maintain or restore processes that sustain natural riverine characteristics." (Instream Flow Council, 2002, p. 93). There are measurable differences between the MOU and Alt B for each of these hydrograph components. These differences are graphically depicted in the appended figures and discussed in detail below.

- **Magnitude.** Figures S-1 through S-6 compare unimpaired, MOU and Alt B synthetic water years using the 10th, 30th, 50th, 70th, and 90th percentile daily flows from the years 1962-2002 (1997 was excluded due to an incomplete record).. While winter storm events are generally comparable for all alternatives, Alt B streamflows in spring, summer, and fall are significantly higher than MOU flows for all reaches and water year types: 50-55% more over the course of the year, and 80-130% more in summer. Unimpaired and Alt B flows show significant interannual changes in late summer/early fall low flow periods, whereas the MOU falls to the same, substantially lower flow for each reach and year type. Interannual baseflow variability under Alt B would cause physical habitat, temperature, and passage conditions to vary somewhat from year to year, allowing fish to exploit outstanding habitat conditions on a recurring basis.
- **Frequency.** Comparative analysis of Figures H-1 to H-4 (hydrographs of water years 1962-2002) shows that low to mid level pulses are more frequent in the late fall and early spring under Alt B. The geomorphic discussion below outlines how Alt B may provide flows capable of mobilizing sediment more frequently than the MOU.
- **Duration.** Clear differences in the duration of flows are illustrated in Figures E-1 to E-6, comparative flow exceedence curves for the mainstem, Eagle Canyon, and Inskip reaches. For example, if flows below 50 cfs were found to form a natural barrier in Eagle Canyon, Figure E-5 shows MOU flows would exceed that amount in summer 20% of the time (24 days), based on the 1962-2002 period of record. Alt B flows would exceed 50 cfs 97% of the time (118 days).
- **Timing.** Figures S-4 to S-6 illustrate a significant difference in the descending limb of the hydrograph, the transition from the winter (high) to summer (low) flow season. The onset of lower and less variable baseflows under the MOU is also substantially earlier (30-60 days). This effect also shows up each and every year on Figures H-1 to H-4. This particular feature of the hydrograph is important for anadromous fish for at least two reasons. First, outmigrating smolts ride the descending limb of the hydrograph. Second, higher flows extending farther into the summer months serve as a buffer to thermal stress for all species and life stages. The gradual, seasonal transition from higher to lower flows also plays a key role in the life histories of many other aquatic and riparian species.
- **Rate of change.** At least three issues arise related to rate of change. First, smaller peak events have a much more abrupt interface with the baseflow under the MOU than under Alt B or unimpaired (Figures H-1 to H-4), possibly causing fish stranding. Second, under unimpaired and Alt B flow regimes, the transition from the winter (high) to summer (low) flow season is long and gradual. The onset of lower, stable baseflows under the MOU is much earlier, and more abrupt. Finally, on the South Fork, for most year types, the transition between the summer and winter flow releases below Inksip dam (40 and 86 cfs, respectively) does not occur at the more gradual rate seen under unimpaired and Alt B.

2. Water Quality

- **Temperature**

Water temperature is a key factor in Battle Creek's restoration potential for salmon, especially the endangered winter run chinook. Figures T-1 to T-8 are longitudinal temperature profiles developed for Battle Creek by PG&E in 2001 (SNTEMP). The MOU, Alternative B, and an unimpaired alternative are presented for Jun-Sep, for normal and dry/warm year types. For the purposes of this analysis, Alternative B was constructed from a "hybrid" of two pre-existing SNTEMP alternatives – a full decommissioning alternative (SNTEMP Alt 6) for the South Fork, and a 6 dam removal alternative for the North Fork and Mainstem (SNTEMP Alt 4). The full modeling assumptions for SNTEMP are beyond the scope of this paper, but can be reviewed at www.calhrc.org/battlecreek.htm.

Figures T-1 to T-8 show that Alternative B is predicted to provide cooler water than the MOU in the North Fork, South Fork, and mainstem Battle Creek in all months, for both normal and warm/dry years. Various life stages of four races of chinook salmon and steelhead utilize Battle Creek each month of the year. Assuming temperature thresholds of 66°F for juveniles, 62°F for prespawning adults, and 58°F for incubating eggs (Armour, 1991), in an average June, Alternative B provides an additional 8.7 miles of rearing habitat in the mainstem and South Fork, and an additional 2.5 miles of adult holding habitat in the forks of Battle Creek. In September, Alternative B provides an additional 8.5 miles of adult holding habitat in the mainstem and South Fork Battle Creek and 1.3 miles of egg incubating habitat in the North Fork.

These results are conservative. As described in detail in the following paragraphs, limitations presented by the "hybrid" approach to modeling Alt B, and the flow assumptions of SNTEMP itself combine to significantly understate the temperature benefits of the 8 dam removal alternative. Corrected, SNTEMP would show even greater temperature benefits to Alternative B.

Figures C-1 through C-3 compare RMI/Navigant median monthly streamflows to the SNTEMP modeled flows in the North Fork (Eagle Canyon), South Fork (Inskip) and Mainstem (above Coleman PH), for each alternative. RMI/Navigant median flows are shown with braces denoting the 10th and 90th percentile flows for water years 1962-2002 for that month.

While the flows used in the SNTEMP model for the most part approximate the median flows for the unimpaired and MOU alternatives, they are consistently less than median flows of Alt B. This is especially true on the mainstem (Figure C-1), where SNTEMP normal and dry year flows for Alt B are both less than the 10% synthetic dry year. Further, as discussed above (i.e., hydrology discussion), Alt B maintains considerably more variability from year to year throughout the descending limb of the hydrograph (June and July) and the low flow period (August and September), as shown in Figures S-4 to S-6, and in the 10th/90th braces in Figures C-1 to C-3.

In many year types, Alt B flows approach and equal the volume of flow in the unimpaired alternative modeled by SNTEMP. Interannual variability in the Alt B hydrograph could provide recurring optimal temperatures in the forks and mainstem of Battle Creek. Other than June, the MOU alternative does not share this characteristic. A careful comparison of

Figures C-1 to C-3 to SNTEMP suggests that, corrected for flow, SNTEMP would show substantial temperature benefits for Alt B relative to the MOU.

There is an additional consideration with the SNTEMP mainstem temperatures. According to the validation and calibration sections of SNTEMP, the model is not very accurate for predicting mainstem temperatures.

> ...[V]alidation showed that, except for the Mainstem, the updated TRPA-SNTEMP model achieved the same level of accuracy as in the calibration phase. Figures 2–7 compare the model's predictions with the observed daily average temperature at six stations in various reaches. Good agreement is evident. In Figure 7, however, there is a noticeably large discrepancy for the Mainstem just above the Coleman Powerhouse. This large discrepancy also occurred during the 1989 calibration. Because the main objective of the present project is to predict temperature characteristics for upper Battle Creek in the North Fork and the South Fork river channels, the larger discrepancy predicted in the Mainstem is not a major concern. Therefore, no attempt was made to adjust the model. (SNTEMP 2001, Sec.3, pp. 3-4.)

SNTEMP Figure -7. Validation for Mainstem Battle Creek

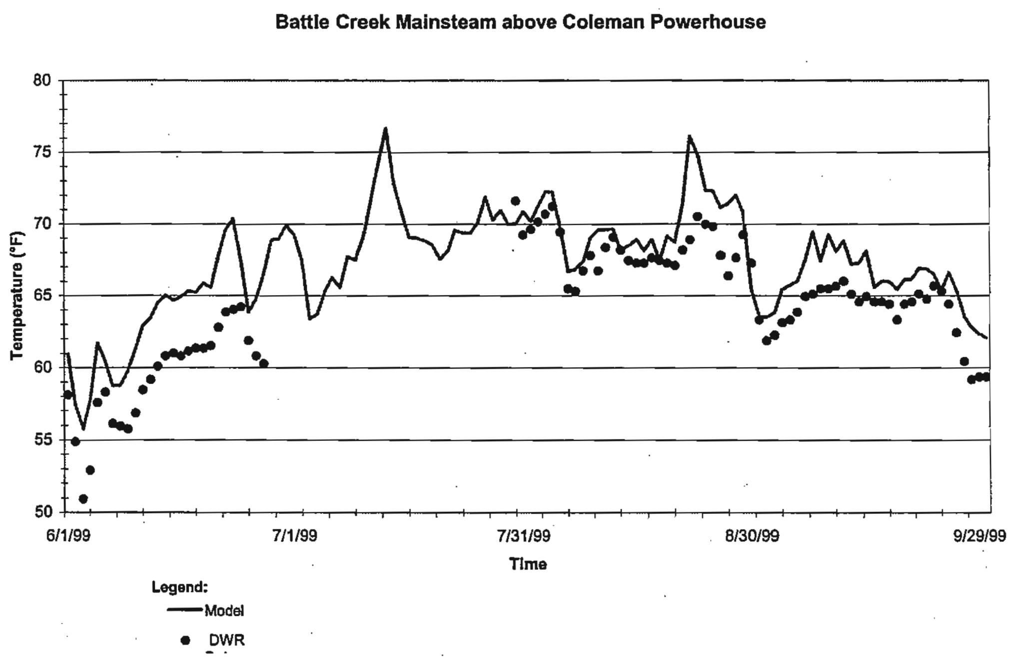

Figure 7. Model validation test for Mainstem Reach, 1999 daily average water temperature.

The 1999 validation test shows SNTEMP overestimated mainstem temperatures by 3-5°F in June, and 1-4°F in September. Figures T-1 to T-8 show the mainstem often at or above the upper limits for many life stages of target species. Accounting for the SNTEMP modeling error (which would affect all alternatives), the underestimate of Alt B "normal" flows, and the interannual variability of Alt B flows, would show substantially more viable habitat in the mainstem of Battle Creek under Alt B. Because these uncertainties bear materially on the temperatures attainable by the Battle Creek Restoration Project, project proponents and reviewers should recalibrate SNTEMP mainstem based on 2000-2003 recorded temperature data, and run Alt B with corrected flow estimates.

The following two tables compare river miles below temperature thresholds for the MOU and Alt B under SNTEMP as shown in figures T-1 and T-4, and under a conservatively corrected SNTEMP. Marginal mileage *is not* inclusive of optimal mileage. For example, SNTEMP shows the MOU provides 2.4 miles of habitat below 57.2°F (optimal) and 20.2 miles of habitat between 57.2°F and 66°F (marginal) for juvenile chinook salmon in a normal June. Alt B provides 8.7 miles of additional marginal habitat.

Table 1. June temperature/river miles relationship for various life stages. SNTEMP shown as published in 2001, and conservatively adjusted for the errors described above (1°F cooler on mainstem for all alternatives, additional 1°F for Alt B mainstem). Optimal and marginal temperature thresholds from CDFG/USFWS.

June	Steelhead Smolts		Chinook Embryos		Chinook Juveniles		Chinook Smolts		Adult Chinook	
	<56.4°F	<59°F	<59.5°F	<61°F	<57.2°F	<66°F	<62.6°F	<68°F	<60°F	<66°F
SNTEMP	Opt.	Mar.	Opt.	Mar.	Opt.	Mar.	Opt.	Mar.	Opt.	Mar.
MOU (mi.)	0.0	7.9	9.4	3.1	2.4	20.2	15.8	15.6	10.8	11.8
Alt B (mi.)	0.0	7.7	9.5	4.8	2.4	28.9	18.0	14.1	11.2	20.1
Difference	0.0	-0.2	0.1	1.7	0.0	8.7	2.2	-1.5	0.4	8.3
SNTEMP Adjusted										
MOU (mi.)	0.0	7.9	9.4	3.1	2.4	22.9	15.8	16.3	10.8	14.5
Alt B (mi.)	0.0	7.7	9.5	4.8	2.4	29.7	22.3	9.8	11.2	20.9
Difference	0.0	-0.2	0.1	1.7	0.0	6.8	6.5	-6.5	0.4	6.4

River miles below NBCF and South Dams for the NF and SF, respectively.

Table 2. September temperature/river miles relationship for various life stages. SNTEMP is shown as published in 2001, and adjusted for modeling error described above (1°F cooler on mainstem for all alternatives). Optimal and marginal temperature thresholds from CDFG/USFWS.

September	Steelhead Smolts		Chinook Embryos		Chinook Juveniles		Chinook Smolts		Adult Chinook	
	<56.4°F	<59°F	<59.5°F	<61°F	<57.2°F	<66°F	<62.6°F	<68°F	<60°F	<66°F
SNTEMP	Opt.	Mar.	Opt.	Mar.	Opt.	Mar.	Opt.	Mar.	Opt.	Mar.
MOU (mi.)	6.8	7.3	15.4	2.1	9.2	22.9	22.2	9.9	16.2	15.9
Alt B (mi.)	7.1	8.1	16.0	4.7	10.0	22.1	28.9	3.2	16.7	15.4
Difference	0.3	0.8	0.6	2.6	0.8	-0.8	6.7	-6.7	0.5	-0.5
SNTEMP Adjusted										
MOU (mi.)	6.8	7.3	15.4	3.0	9.2	22.9	25.1	7.0	16.2	15.9
Alt B (mi.)	7.1	8.1	16.8	7.0	10.0	22.1	30.8	1.3	19.2	12.9
Difference	0.3	0.8	1.4	4.0	0.8	-0.8	5.7	-5.7	3.0	-3.0

River miles below NBCF and South Dams for the NF and SF, respectively.

Alternative B provides equal or greater optimal thermal habitat for each life stage.

- **Mixing of North and South Fork waters**

A major purpose of the Battle Creek project is to prevent the mixing of water from the North and South Forks. The tailrace connectors being constructed for this purpose total $13.7 million, or 28% of the total construction cost of the project. However, mixing will still occur under the MOU project during routine maintenance and other planned outages on the South Fork. Planned annual outages are estimated at four days each for the South, Inskip, and Coleman powerhouses. Concerns have been raised about the possibility of resident juveniles imprinting on the North Fork water during these periods.

Under Alternative B, shutting down any powerhouse on the South Fork requires shutting down all powerhouses and not diverting at Volta, eliminating 12 days of planned mixing per year. Under Alt B, the only cause of North Fork water entering the South Fork would be emergency shutdowns, and in that event, there would be substantially less water in the power system to mix.

Table 3. Mixing of North and South Fork Waters. Flow estimates from RMI/Navigant power model.

MOU	Median powerhouse flow (cfs)	Maximum powerhouse flow (cfs)	Days of mixing/year
South PH	71	150	4 + unplanned
Inskip PH	132	284	4 + unplanned
Coleman PH	151	380	4 + unplanned
Alt B			
South PH	71	128	Unplanned only
Inskip PH	71	128	Unplanned only
Coleman PH	71	128	Unplanned only

3. Biology

- **Habitat**

The MOU alternative makes use of 1988 PHABSIM data to prescribe "biologically optimum" flows that are just a fraction of naturally occurring flows in Battle Creek. For example, the MOU summer minimum flow in Eagle Canyon is 35 cfs, which is 73% less than the median unimpaired summer low flow, and 35% less than the modeled driest day on record (Oct 27, 1993). Scientists have criticized PHABSIM generally (Castleberry, 1996), as well as the types of approaches used in the Battle Creek study. PHABSIM is considered an especially poor predictor of hydraulic conditions for channels with the complexity and gradients that characterize much of Battle Creek. For a project of this size and importance to listed species, it is surprising that so much weight was given to the hydraulic habitat analysis, and that it does not incorporate better methodologies. The Battle Creek PHABSIM study does not include transects in two dimensions, it does not include confidence intervals, it does not incorporate temperature in Weighted Useable Area, and it has not been validated, despite the fact that interim flows based upon it began in 1995 (Williams, 1995; Ghanem, 1996; Kondolf, 2000; Payne, 2003).

Despite these shortcomings, the physical habitat predicted through PHABSIM was the primary basis for selecting "optimum" flows for the MOU restoration project. Responding to comments to the draft 1999 Kier/Ward report, the authors state (p. 140), "...[T]he original, stated intent of the Biological Team process was to use an IFIM/WUA based approach to determine appropriate flows for fish in Battle Creek. The SNTEMP was to be a check to make sure that temperatures were not too high ... [M]anaging flows based primarily on temperature was never a primary objective of the Biological Team." Given the importance of temperature to recovery of Battle Creek salmonids and the relatively marginal temperatures attained under MOU flows, project proponents may reconsider this approach.

Because the MOU minimum flow releases approach the WUA maxima, project proponents have claimed that the MOU project restores "90-95% of the habitat" of Battle Creek. Some have used this claim to argue against Alt B because it is assumed that the best that can be achieved through Alt B over the MOU is an additional 5% habitat. The hydrological and temperature benefits of Alt B alone show this not to be the case (80-130% more water in summer, and a conservative 3-7 miles (8-18%) more optimal thermal habitat in critical months).

- **Ecosystem vs. single species approach**

Much of the attention and planned investment in Battle Creek is focused on a very narrow list of species. This is appropriate given the enormous social and regulatory mandate to recover endangered salmon. The single-species approach to river management has not always yielded long-term success, however. An ecosystem approach strives to maintain overall ecosystem complexity, recognizing a community of native species has adapted to a dynamic range of disturbance and stability. The variable flows, temperatures, and physical habitat provided under Alt B most closely approximate the conditions that occurred prior to construction of the hydropower project on Battle Creek. These are the conditions most likely to sustain the processes and biotic communities that promote recovery for the target species, and most likely to support a functioning ecosystem.

4. Geomorphology

The Nature Conservancy prepared a geomorphic analysis that compares the MOU and Alt B (Roberts 2004). It concludes that, since the three remaining dams in the MOU project do not significantly alter high flow events, and the dams themselves are not sediment traps, the MOU does not impair geomorphic stream function. The TNC report identifies 2250 cfs as the 1.5 return flow for Eagle Canyon, and 3250 cfs for the Inskip reach. The RMI/Navigant model, modified to utilize the USGS record of average daily flows at Coleman (USGS 11376550), projects those flows occurring far less frequently, and in the Inskip case, not in the period of record (1962-2002). The differences between the models could be due to different partitioning fractions, or use of instantaneous peak flow rather than average daily peak flow.

The following analysis applies the TNC methodology to the RMI/Navigant flow model output. We determined a 1.5 year return flow by ranking the unimpaired peak daily flow for water years 1962-2002 (1997 excepted) and selecting the 27th ranked flow (Weibull method). For the mainstem, Eagle Canyon, and Inskip reaches, respectively, those flows were 2390 cfs, 1246 cfs, and 590 cfs. Adopting the assumption that sediment movement initiates at 60% to 80% of the 1.5 year recurrence flow, we determined the number years

(1962-2002, 1997 excepted) in which average daily flows exceeded threshold flows for two or more days under the unimpaired, Alt B, and MOU alternatives. We also note the total number of days that thresholds would be exceeded over the same period.

Table 4. Battle Creek Geomorphology

Battle Creek Reach (geomorphic threshold flows, 0.6-0.8 of 1.5 return flow)	Number of years with two or more days at or above threshold flow, 1962-2002 (total number of days)					
	Unimpaired		Alt B		MOU	
	0.6	0.8	0.6	0.8	0.6	0.8
Mainstem (1434-1912 cfs)	29 (452)	24 (249)	28 (373)	23 (218)	27 (295)	21 (174)
Eagle (748-997 cfs)	29 (452)	24 (249)	28 (325)	23 (194)	24 (256)	20 (160)
Inskip (354-472 cfs)	29 (452)	24 (249)	29 (452)	24 (249)	27 (306)	22 (184)

The Weibull recurrence interval for sediment threshold flows of two or more days is 1.4-1.7 for Unimpaired, 1.4-1.8 for Alt B, and 1.5-2.1 for the MOU. These results show Alternative B mobilizes sediment more frequently than the MOU alternative, and for more total days, using simulated historic hydrology. Periodic sediment mobility plays an important role in the morphology and composition of the stream channel and substrate, and ensures spawning gravels are clean and well distributed.

The effect of diverting approximately half of the summer flow at Eagle Canyon (56%) and Inskip dams (46%) on fine suspended sediment, fine organic particles, and drifting aquatic macroinvertebrates was not analyzed.

5. Connectivity

Concerns have been raised elsewhere at length and in detail about the risk of long-term reliance on fish screens and ladders to pass fish over dams on Battle Creek. Exchanges between the Battle Creek project managers and peer reviewers on technical aspects of screen and ladder design demonstrate that "the state of the art" is controversial and always changing. Removing three additional dams would reduce uncertainty of upstream and downstream passage at dam sites for all life stages of salmonids and for other species, and yield considerable cost savings immediately and over time. Alt B would also avoid considerable construction impacts and costs, including permanent roads and parking lots in the riparian corridor. These MOU project features have ecological, geomorphic, and aesthetic consequences.

There is also concern about fish passage at natural barriers under the flow regime prescribed by the preferred (MOU) alternative. Monitoring activities have identified a natural barrier on the North Fork for adult spring chinook at interim flows (USFWS, 2004, public comments to Battle Creek Working Group). Specifically, adults and redds have been seen below this barrier, but not above it. MOU minimum flows at Eagle Canyon dam are 35 cfs during the low flow season. Figures I-1 and I-2 show that interim flows on the North Fork in 2002 and 2003 are similar to what can be expected under the MOU. Alternative B baseflows are consistently and significantly higher, and vary from year to year, both of which would tend to reduce passage uncertainty at this and other potential barriers on Battle Creek.

Adaptive Management

Many, but not all, of the flow related issues described above could be addressed with a robust and flexible adaptive management program. The MOU provides for a $3 million Water Acquisition Fund (WAF) and $3 million Adaptive Management Fund (AMF) to be used to purchase additional flow. How much water does this buy, and how flexible is the program?

The MOU, as amended in the Adaptive Management Plan, spells out specific procedures for purchasing flows through the WAF and AMF. The first ten years of purchases would be paid at the real-time cost of the actual power forgone. In year 11, any remaining funds can be used to purchase flows through the end of the license term (2026) at the net present value of the estimated future power cost of such flows. If the WAF and AMF are depleted and flows are still needed, PG&E could provide up to an additional $6 million in adaptive management costs (flow and facility modifications). The agencies agreed to support the flow rates in effect in 2026 in the next license.

At the request of the resource agencies, Navigant consulting estimated the purchasing power of the two funds to be 8,000 AF ($3 million WAF) and 14,000 AF ($6 million WAF+AMF) per year, respectively, assuming the following:

- <u>No flow purchases until 2014.</u>
- $50/mWh replacement cost of power throughout the year, 2.5 % inflation, 9.53% discount rate
- No objection by PG&E to the flow increase. PG&E reserves the right to oppose any flow purchase, but it agrees to implement the first $3 million of flow purchases even if it disagrees while parties pursue dispute resolution. The second $3 million cannot be used for flow unless PG&E concurs or FERC so orders.

Any of the following would reduce the purchasing power of the two funds.

- Flow purchases prior to 2014, for example, to ensure passage at natural barriers in Eagle Canyon.
- Power prices above $50/mWh – overall, or for the months, days, or hours in which flow is purchased. Power prices are above their average annual rate during summer months, when flow purchases are most likely to be made. For the first ten years, flow purchases would be sensitive to possibly extreme prices on high demand, hot days.
- Increase in the inflation rate
- Reduction in the applicable discount rate

Figures A-1 to A-3 show annual flows expressed in acre feet for three alternatives (MOU, Alt B, Unimpaired) across 5 synthetic year types, plus the mean. For the mainstem and Eagle Canyon, the MOU provides roughly half the flow of Alt B, and a third of the unimpaired flow. MOU flows are relatively higher on the South Fork but are still substantially lower than Alt B flows. Annual acre feet flows are also shown for the MOU alternative plus the two adaptive management flow funds. For illustration purposes, it is assumed the fund is applied equally across both forks. Figures A-4 to A-6 show summer months only, and assume adaptive management purchases would occur only in June through September, again equally in both forks.

For nearly all reaches and year types, Alt B provides more flow than can be achieved through the adaptive management funds. In a median summer, Alt B provides 80% more flow in the mainstem than the MOU, and 25% more than the MOU plus the WAF and AMF. In Eagle Canyon, Alt B provides 127% more flow than the MOU in a median summer, and 32% more than the MOU plus the WAF and AMF. For the Inskip reach, Alt B provides 86% more flow than the MOU in a median summer, and 9% more than the MOU plus the WAF and AMF. These flow benefits would be provided without the 5-8 year delay, $6 million cost, or considerable uncertainty associated with the flow purchase procedures provided in the MOU.

Table 5. Median summer flows (Jun-Sep), by reach.

Reach	Alt B	MOU	MOU+$3m	MOU+$6m
	AF	% of Alt B	% of Alt B	% of Alt B
Mainstem	57,951	56	69	80
Eagle	22,112	44	62	75
Inskip	18,382	54	75	92

Economic Considerations

As noted above, in the Fall of 2003, PG&E, US Bureau of Reclamation, Metropolitan Water District, and California Hydropower Reform Coalition updated the cost estimates of the Battle Creek project, including the MOU, the NEPA/CEQA alternatives, and three new alternatives that included the removal of additional dams. Alternative B arose out of that effort, when it was shown to be $2 million less expensive than the MOU alternative.

Since presenting those findings to the California Bay Delta Authority in January, 2004, CHRC worked with David Marcus, an economist and energy policy analyst, to further refine the cost differential between the MOU and Alternative B. Marcus's findings, revised and annotated to reflect the April 11, 2004 draft cost estimates, are attached as Appendix II, however his conclusions bear emphasis. **Under all scenarios, it appears that costs under Alternative B are such that, if CBDA funds are held constant, PG&E could be compensated for the net present value of 50 years of renewable replacement power.**

Process and Schedule Considerations

At the March 15 public meeting, the MOU signatories estimated it would take an additional 3 years to pursue Alternative B rather than the MOU. This estimate is a best-case scenario for the MOU alternative (assuming expedited and uncontested approvals by FERC and other agencies with regulatory jurisdiction) and a worst-case scenario for Alternative B (namely, two year negotiation of a MOU amendment and publication of a supplement to the DEIS/R). While we agree that a three year delay would warrant careful balancing of the considerable ecological benefits and risk reduction provided under Alt B against the cost, funding, and species recovery risk of additional delay, we do not believe a three year delay is a reasonable estimate. With willing parties, it would be feasible to bring Alternative B to the point where construction may commence by the end of 2005. Specifically, the CBDA would conditionally approve funding this summer for the MOU alternative or Alternative B, depending on which receives final regulatory approvals. The draft DEIS/R would be supplemented to incorporate Alternative B and would be published for further public comment, after which the lead agencies would finalize the document. If Alternative B were the preferred alternative, the MOU would be amended to the limited extent necessary to implement Alternative B.

The regulatory approval process for the Battle Creek project, prior to construction, is necessarily complex, even for the MOU alternative. CBDA must review and approve the project for additional funding. NOAA Fisheries must undertake formal consultation under the Endangered Species Act section 7(a)(2). The State Water Resources Control Board must certify the project complies with the Clean Water Act section 401(a)(1). The Army Corps of Engineers must issue a Clean Water Act section 404 permit. PG&E must complete a California Public Utilities Commission Section 851 proceeding to divest or encumber a utility asset. FERC must approve a license amendment. All of these approvals are subject to public comment, administrative appeal, and judicial review. Voluntary adoption of Alt B by parties would likely ease and even expedite these approvals. For example:

- Section 401(a) of the Clean Water Act requires a project to attain all beneficial uses and other water quality standards, to the extent controllable. The record developed here and elsewhere demonstrates that Alt B is a feasible alternative that is more likely to comply with applicable water quality standards, including the designated beneficial use of coldwater fish and the anti-degradation policy (which prohibits an adverse impact on the coldwater fishery as it existed in 1967).
- NOAA Fisheries will issue an incidental take statement under the Endangered Species Act. With no screens or ladders, lower temperatures, more natural hydrograph, and better passage at natural barriers, it is likely Alt B results in less take than the MOU.
- The California Public Utilities Commission must find the Battle Creek project is reasonable and prudent use of ratepayer funds. In the current MOU, PG&E's ratepayers will pay $43 million in forgone power costs. In Alt B, PG&E's ratepayers would bear the same burden, but in return get a completely restored river, 80% more water instream (mainstem), no ongoing responsibility for operation and maintenance, including repair and eventual replacement of screens and ladders, and no $6 million adaptive management duty.
- If the Battle Creek Project is to become a reality, the CBDA must approve supplemental funding. Assuming action this summer, CBDA will necessarily condition any funding approval on subsequent regulatory approvals, whether for the MOU or Alternative B. In the face of large cost increases, project managers can demonstrate flexibility and adaptive management by amending the project to realize greater project benefits at no additional cost.

In addition to the regulatory and funding processes, there has been a long and extensive public outreach process for the Battle Creek Project. Many stakeholders, including and especially local stakeholders in the watershed, have attended meetings and coordinated with project managers and proponents for many years. Not all are in agreement with the MOU project, nor can it be assumed that all would support Alt B. However, stakeholder support is a necessary component of any Battle Creek project, regardless of the alternative.

Conclusion

To sum up the advantages of Alternative B as compared to the MOU restoration project, we reaffirm and restate the original principals laid out by the resource agencies in their 1999 report (Kier/Ward 1999):

- **Biological Effectiveness** – Alternative B incorporates the most biologically effective remedies that provide the highest certainty to successfully restore ecosystem functions and self-sustaining populations of native fish in a timely manner.
- **Restoring Natural Processes** – Alternative B incorporates measures that more closely mimic the hydrologic conditions under which Battle Creek anadromous fish resources evolved, by increasing baseflows, restoring flow variability, reducing temperature, and reducing, to a greater extent than the MOU, the mixing of North Fork and South Fork waters.
- **Biological Certainty** – Alternative B provides maximum long-term effectiveness by minimizing long-term dependence on the integrity of man-made restoration actions and the cooperation of future project owners and operators.

Our analysis has shown that the hydrograph under Alt B – in particular its descending limb in spring, and interannual variability during the low summer flow season – provides better conditions for the recovery of threatened and endangered salmon, steelhead, and other aquatic species. Temperature models reveal some of the cooling benefits of Alt B, and would show more with appropriate adjustments. Finally, in areas such as fish passage at natural barriers, and adaptive management of flows, Alt B provides a greater degree of benefit, up front and over the long term, than does the MOU.

The restoration of Battle Creek is a critical priority for agencies, PG&E, and stakeholders alike. The scarcity and value of the natural resources of Battle Creek, and the public resources necessary to restore them, demand of all of us an extra measure of reflection, flexibility, and innovation. The emergence of an alternative that provides a greater degree of restoration for equal or less cost is a rare opportunity. We respectfully encourage project supporters to consider these findings, and to act on them.

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Appendix I

Figures

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Figure S-2. Synthetic Water Year Comparison, Eagle Canyon, NF Battle Creek
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Figure S-4. Synthetic Water Year Comparison, Mainstem Battle Creek, Jun - Sep
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Figure E-1. Flow Exceedence Curve, Mainstem Battle Creek
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Figure E-6. Flow Exceedence Curve, Inskip, SF Battle Creek, Jun-Sep

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Figure I-1. North Fork Battle Creek Natural Fish Barrier Flows, 2003
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Figure A-1. Acre Feet/Year Comparison, Mainstem Battle Creek
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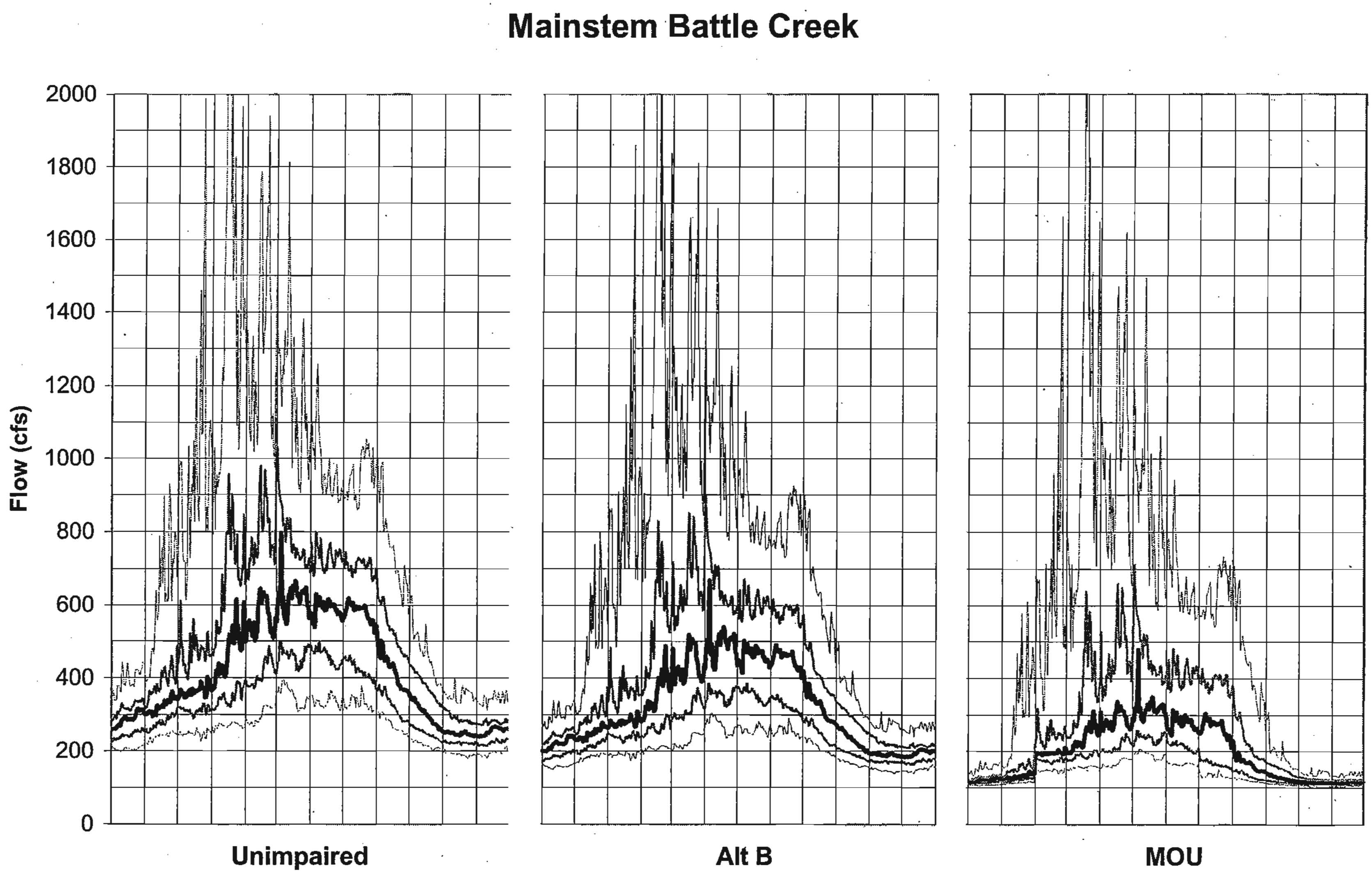
Figure A-6. Acre Feet/Jun-Sep Comparison, Inskip, SF Battle Creek

Figure S-1, Mainstem

Synthetic Water Year Comparison

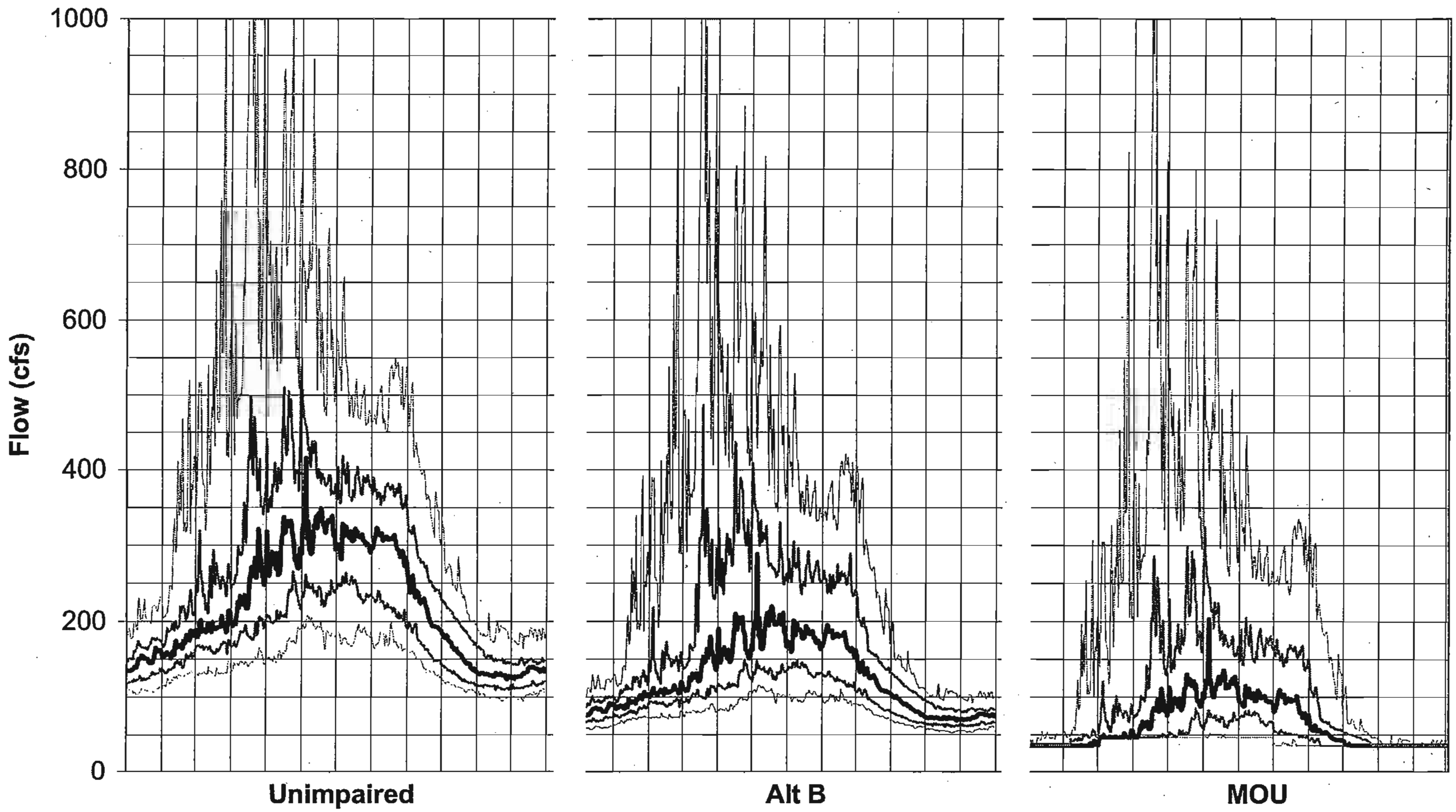


WY 1962-2002 daily flow data from USGS 11376550 and modified RMI/Navigant model. 10%, 30%, 50% (BOLD), 70%, and 90% percentile flow for Oct 1 -Sep 30 in the period of record. 1997 data excluded.

Figure S-2, Eagle Canyon

Synthetic Water Year Comparison

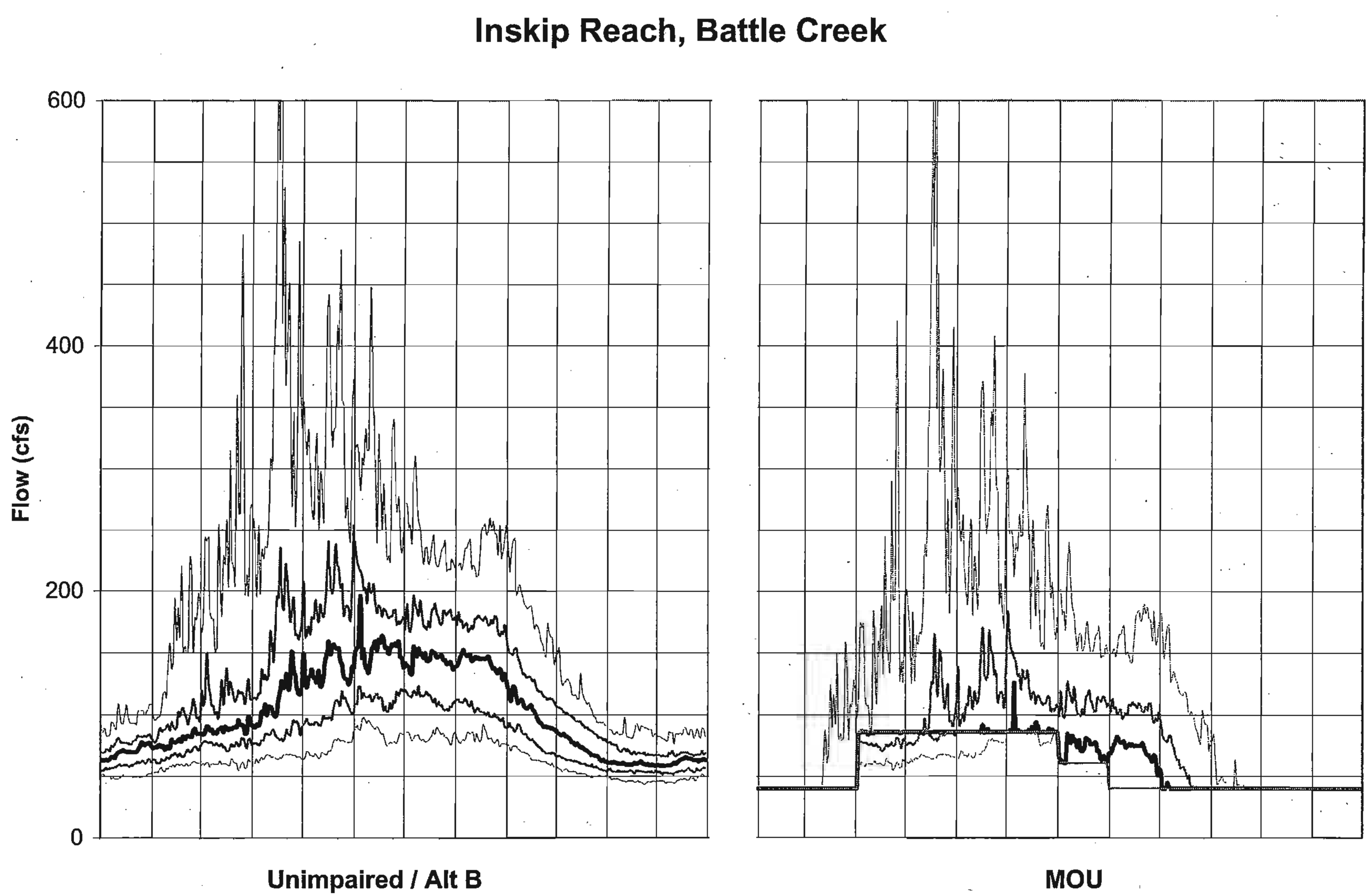
Eagle Canyon, Battle Creek



WY 1962-2002 daily flow data from USGS 11376550 and modified RMI/Navigant model. 10%, 30%, 50% (BOLD), 70%, and 90% percentile flow for each day in the period of record. 1997 data excluded.

Figure S-3, Inskip Reach

Synthetic Water Year Comparison

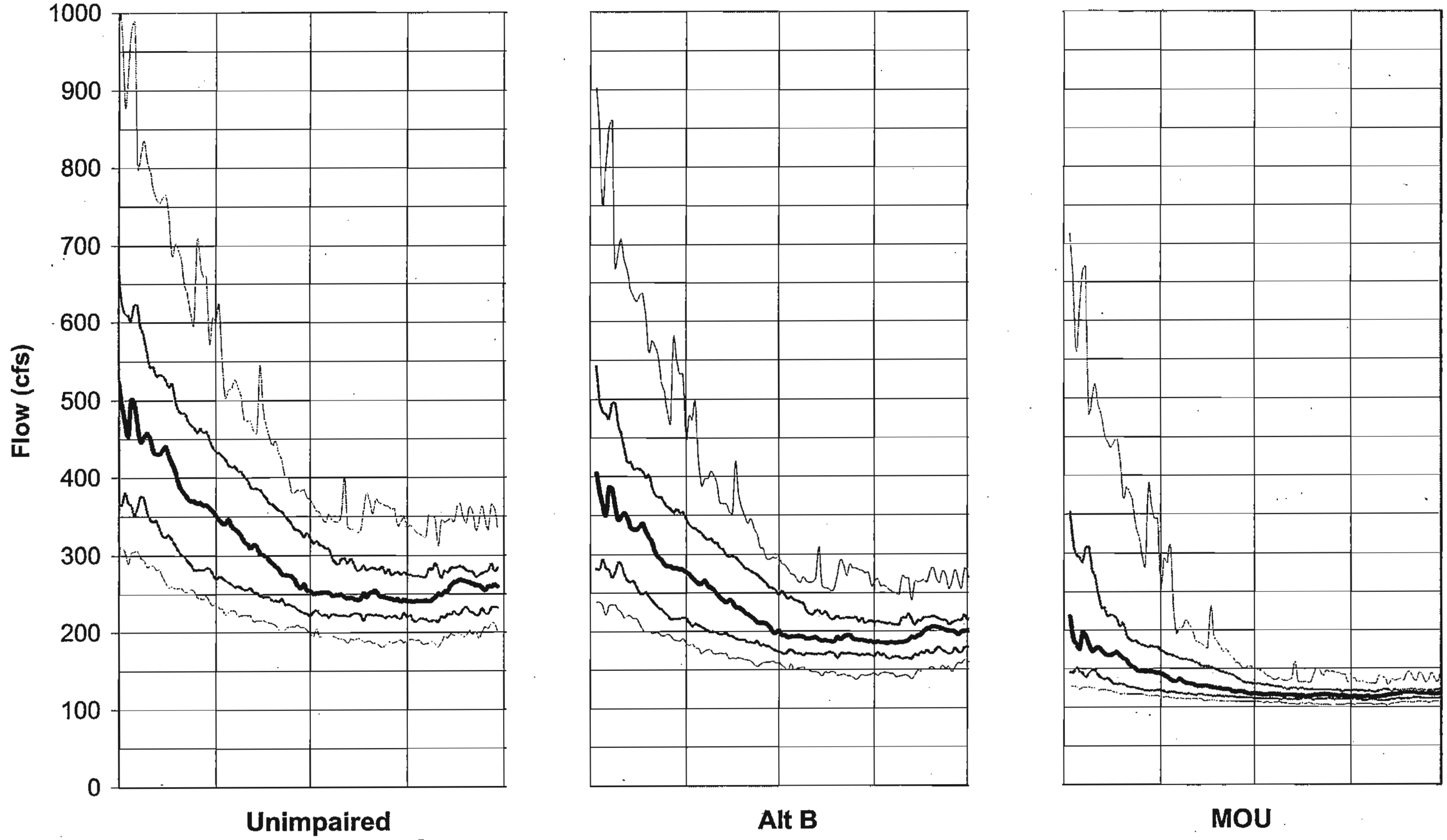


WY 1962-2002 daily flow data from USGS 11376550 and modified RMI/Navigant model. 10%, 30%, 50% (**BOLD**), 70%, and 90% percentile flow for each day in the period of record. 1997 data excluded.

Figure S-4, Mainstem Summer

Synthetic Water Year Comparison

Mainstem Battle Creek, Jun - Sep

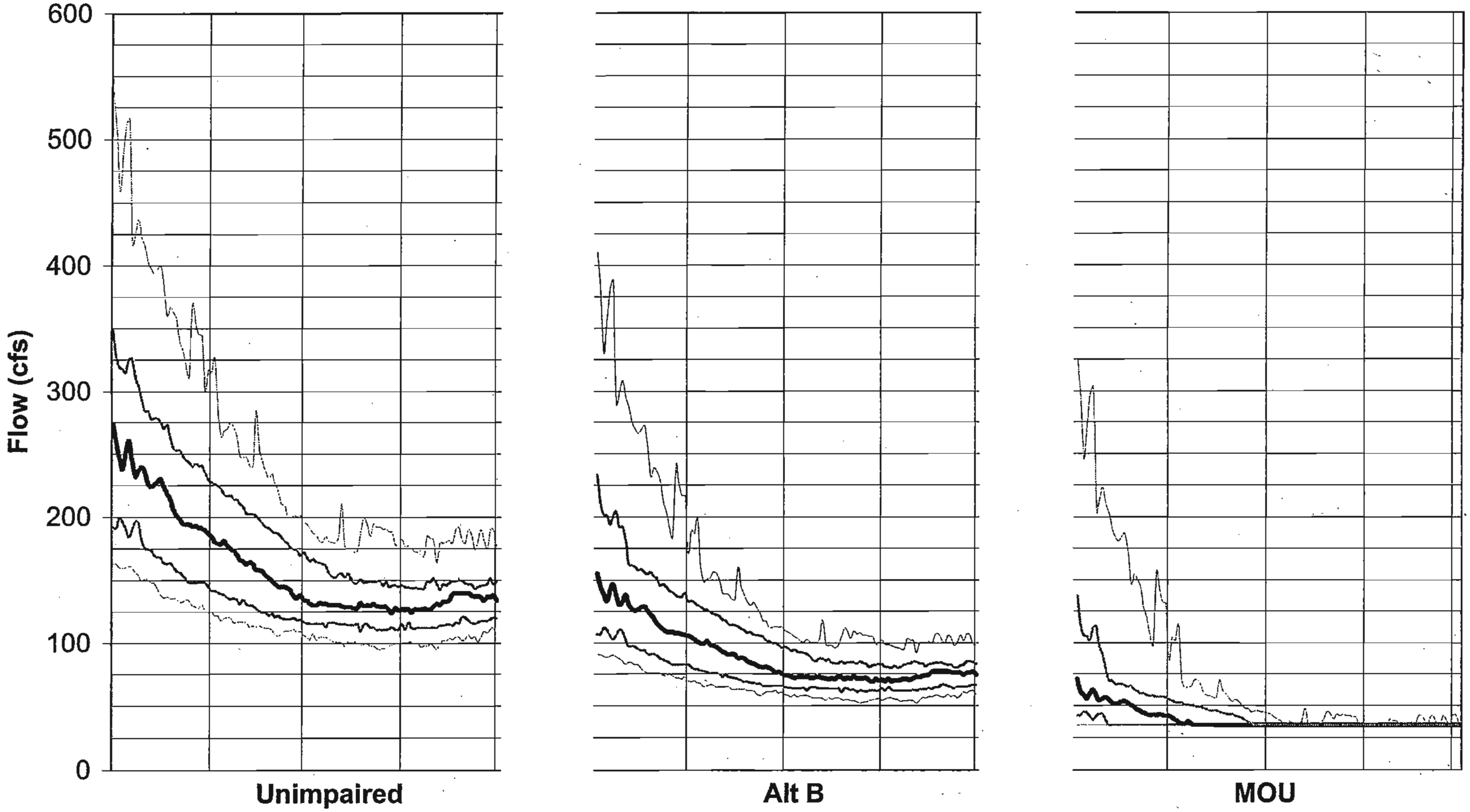


WY 1962-2002 daily flow data from USGS 11376550 and modified RMI/Navigant model. 10%, 30%, 50% (median), 70%, and 90% percentile flow for Jun-Sep in the period of record. 1997 data excluded.

Figure S-5, Eagle Canyon Summer

Synthetic Water Year Comparison

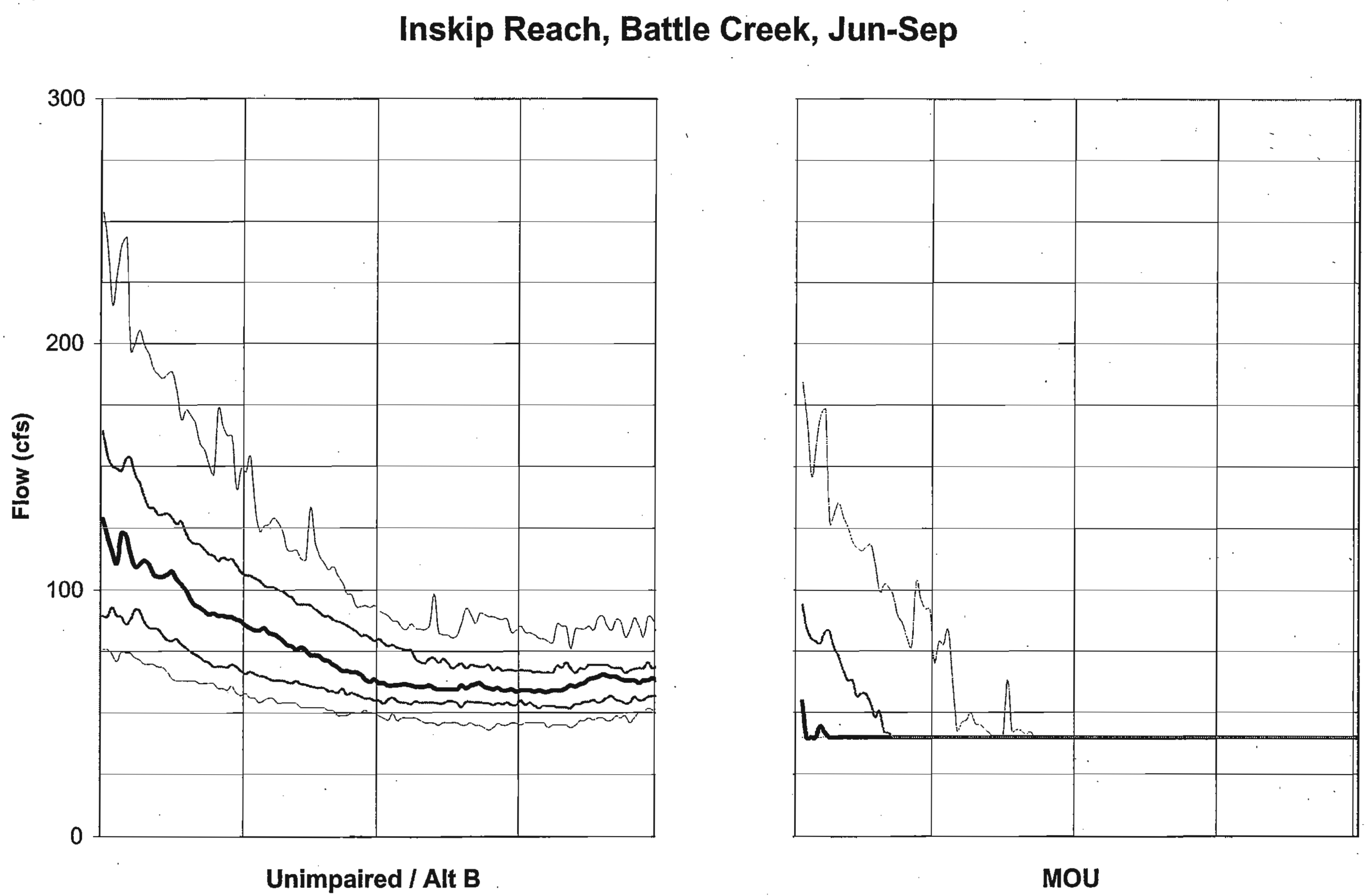
Eagle Canyon, Battle Creek, Jun-Sep



WY 1962-2002 daily flow data from USGS 11376550 and modified RMI/Navigant model. 10%, 30%, 50% (BOLD), 70%, and 90% percentile flow for Jun-Sep in the period of record. 1997 data excluded.

Figure S-6, Inskip Reach Summer

Synthetic Water Year Comparison

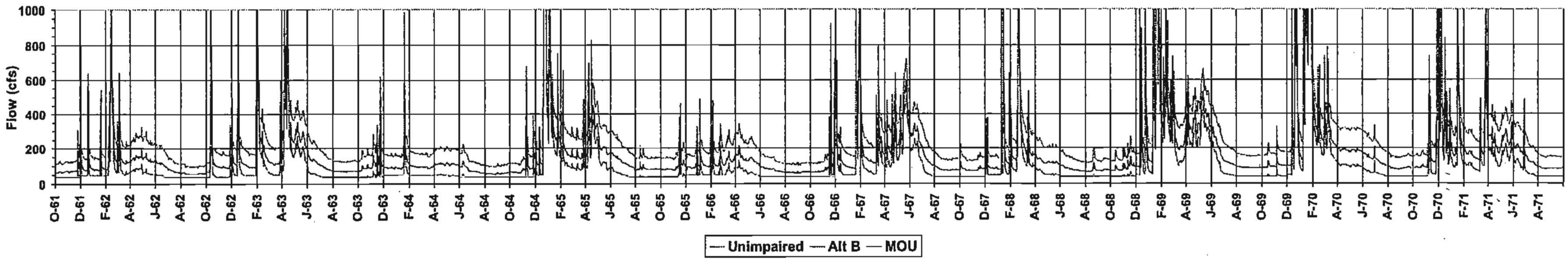


WY 1962-2002 daily flow data from USGS 11376550 and modified RMI/Navigant model. 10%, 30%, 50% (BOLD), 70%, and 90% percentile flow for Jun-Sep in the period of record. 1997 data excluded.

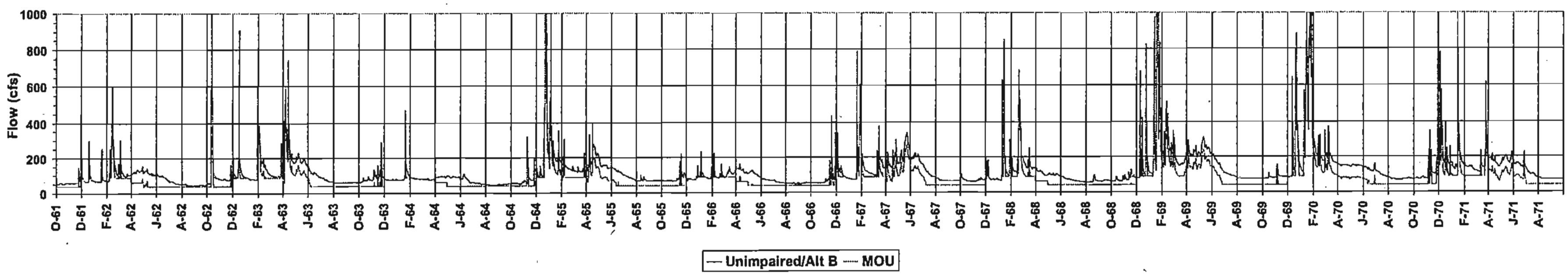
Figure H-1, Comparative Hydrographs

WY 1962-1971

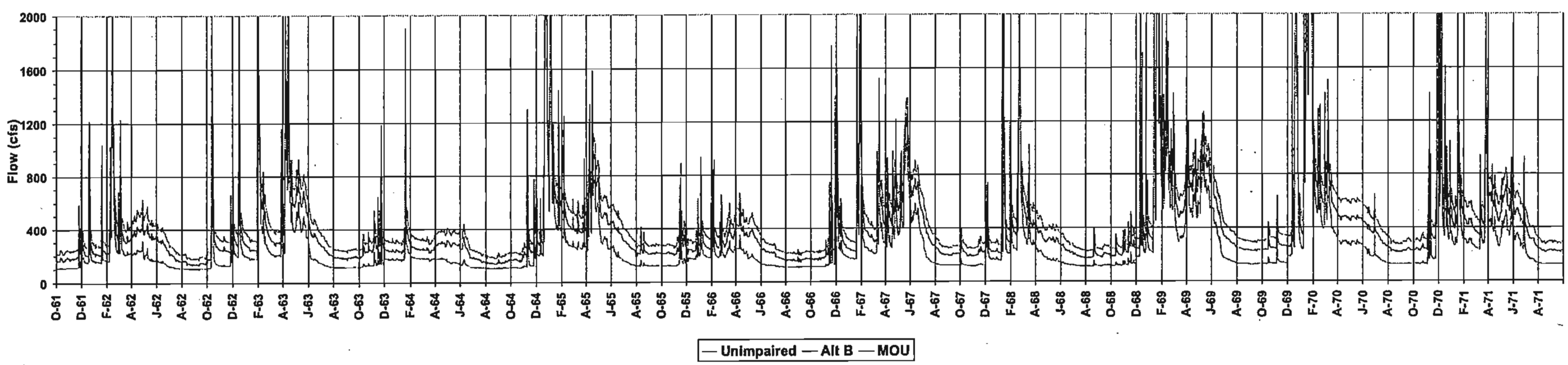
Eagle Canyon, North Fork Battle Creek



Inskip Reach, South Fork Battle Creek



Mainstem Battle Creek, Above Coleman PH

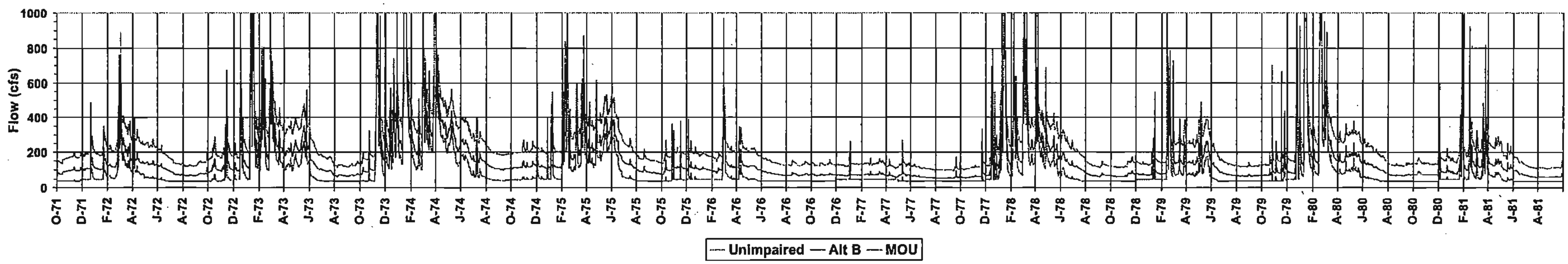


Flow data from modified RMI/Navigant daily flow model using USGS 11376550

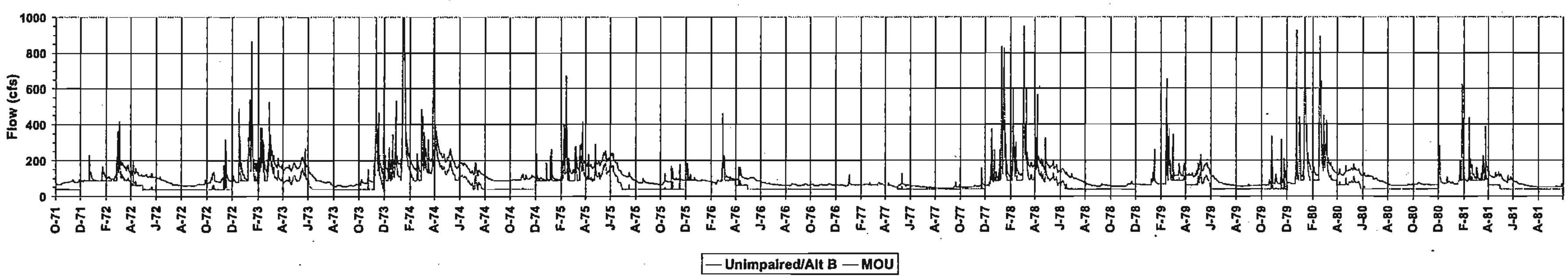
Figure H-2, Comparative Hydrographs

WY 1972-1981

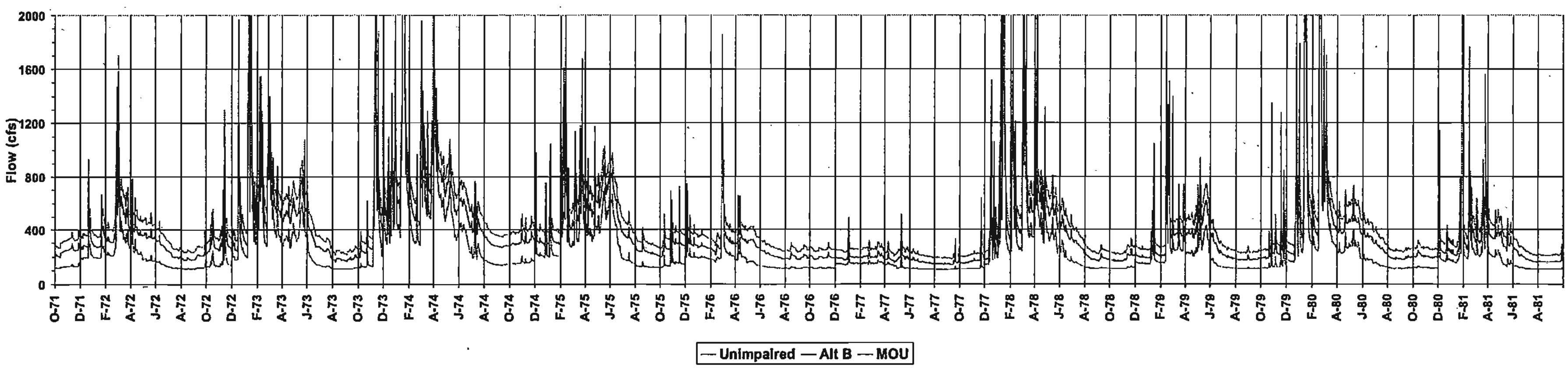
Eagle Canyon, North Fork Battle Creek



Inskip Reach, South Fork Battle Creek

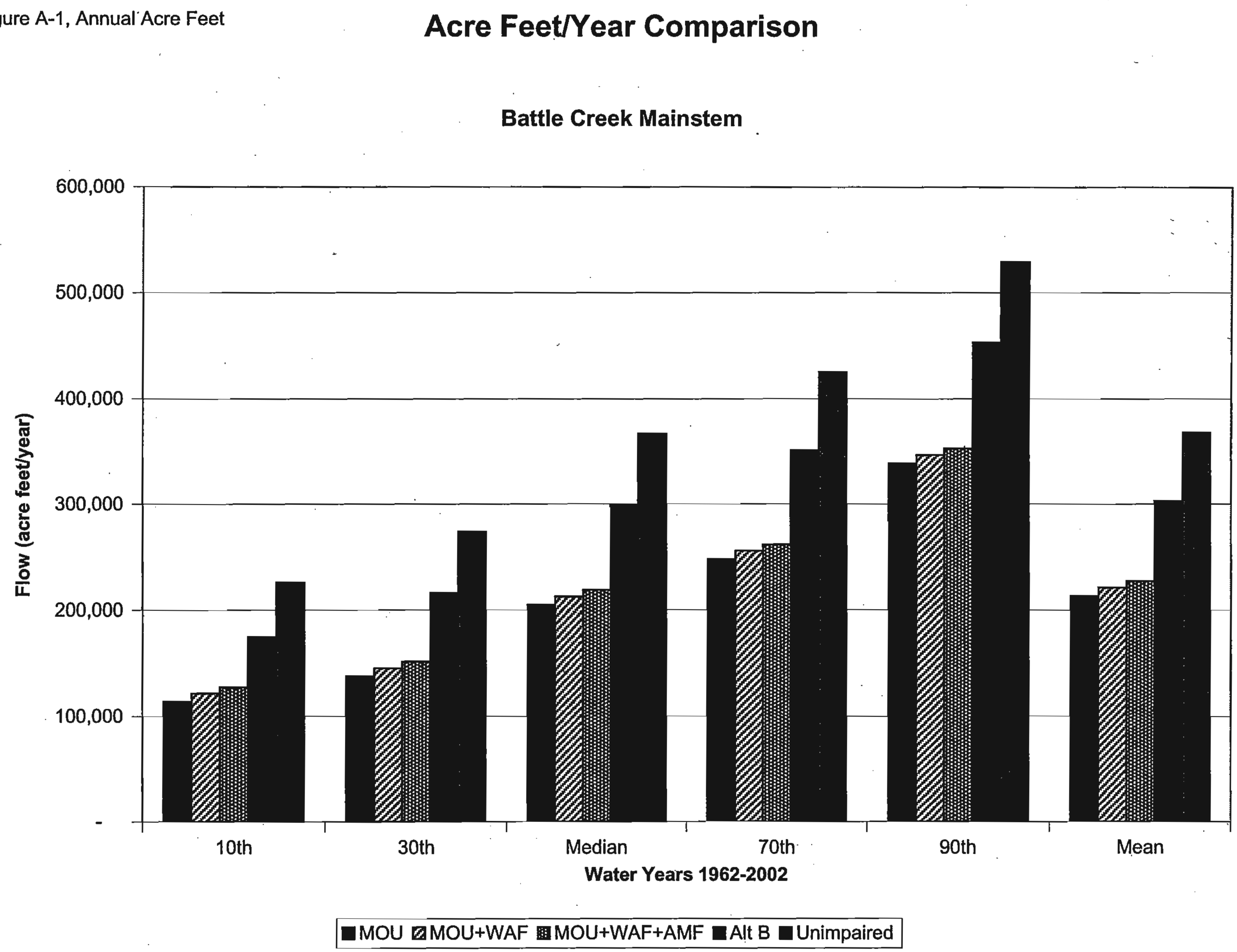


Mainstem Battle Creek, Above Coleman PH



Flow data from modified RMI/Navigant daily flow model using USGS 11376550

Figure A-1, Annual Acre Feet



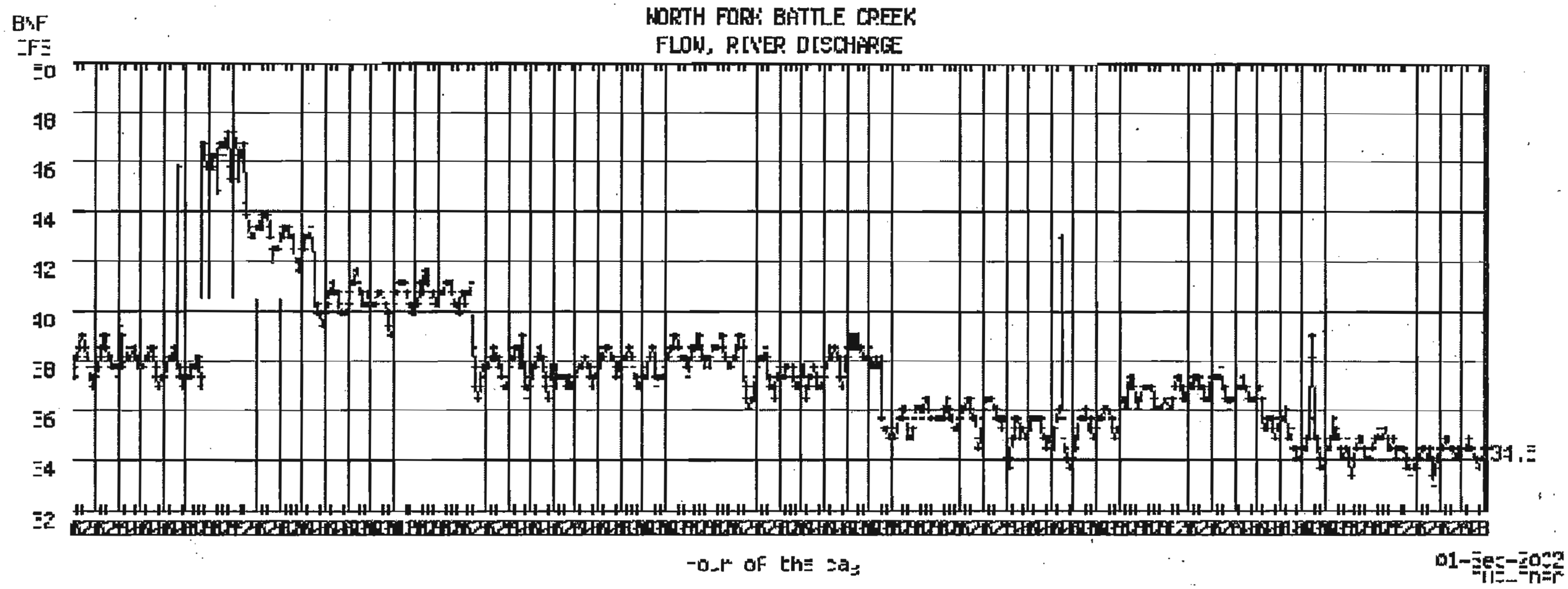
1962-2002 annual flows derived from modified RVI/Navigant model. 10% - 90% and mean annual flows shown. WAF ($3 mil): ~8000 AF. AMF ($3 mil): ~6000 AF. $50/mWh, 2.5% inflation, 9.53% discount rate, no purchase until 2014.

Figure I-2. North Fork Battle Creek Fish Barrier Flow

NORTH FORK BATTLE CREEK *(BNF)*

Elevation 998' · SACRAMENTO R basin · Operator: CA Dept of Water Resources
Sensor ID number 3484

Plot generated Wednesday at 12:50:23



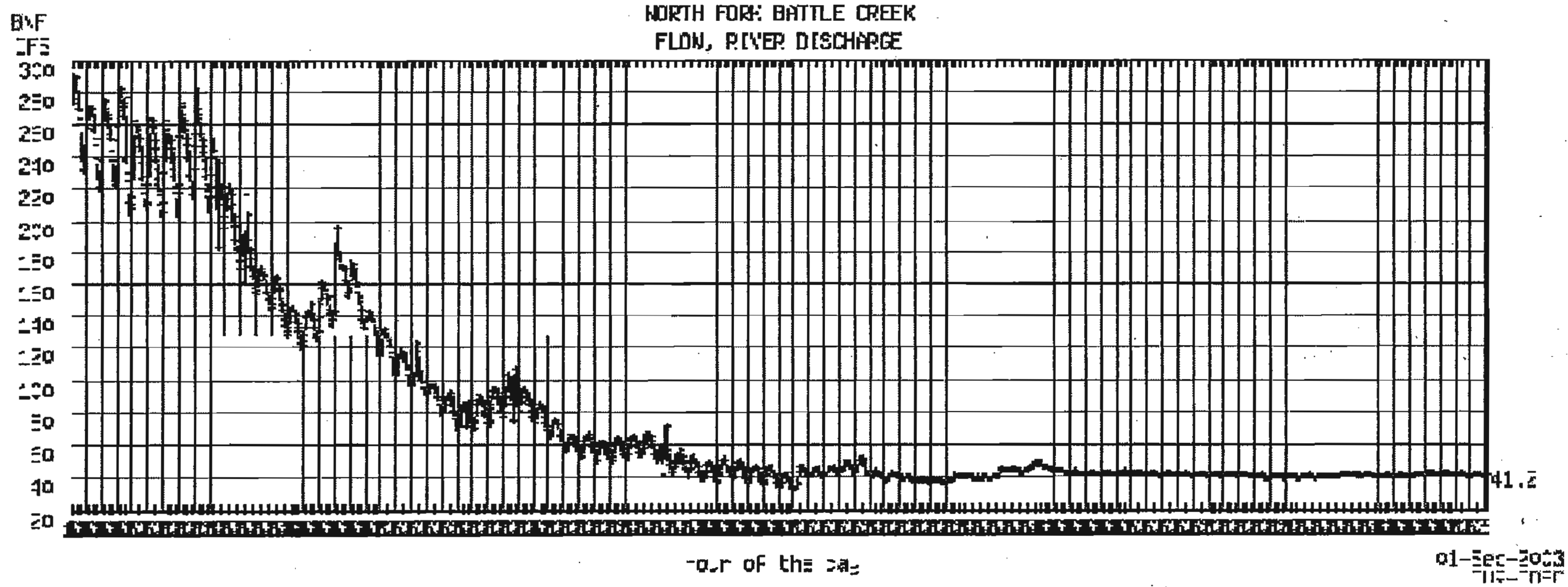
Data from 06/01/2002 00:00 through 09/01/2002 00:00 · Duration: 92days
Max of period: 47.18 · Min of period 32.98

Figure I-1. North Fork Battle Creek Fish Barrier Flow

NORTH FORK BATTLE CREEK *(BNF)*

Elevation 998' · SACRAMENTO R basin · Operator: CA Dept of Water Resources
Sensor ID number 9484

Plot generated Wednesday at 12:32:12

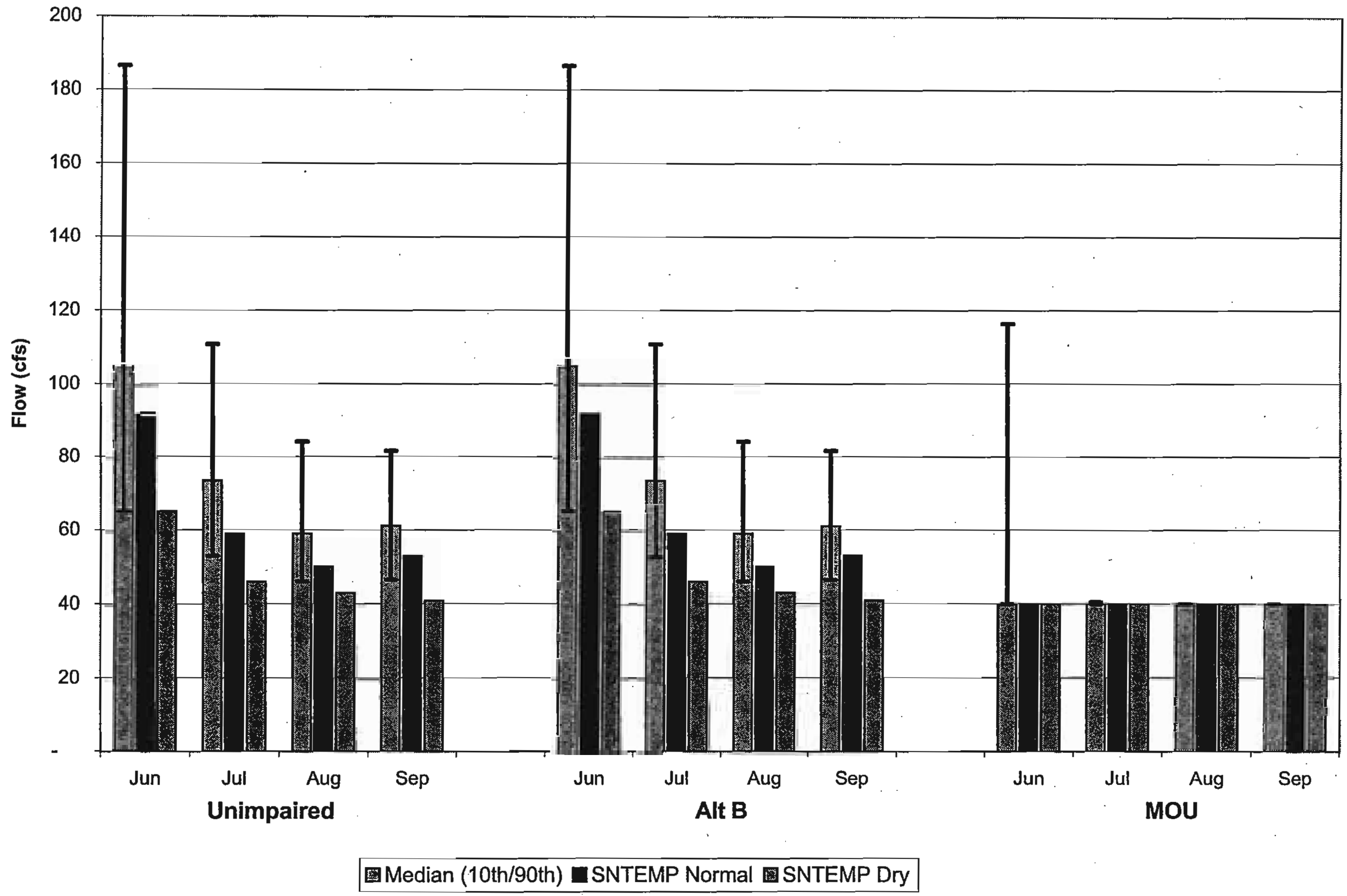


Data from 06/01/2003 00:00 through 09/01/2003 00:00 · Duration: 92days
Max of period: 291 · Min of period: 32.6

Figure C-3, SNTEMP Flow Comparison

Battle Creek, Inskip Reach

Unimpaired, Alt B, MOU Flow vs. SNTEMP Flow

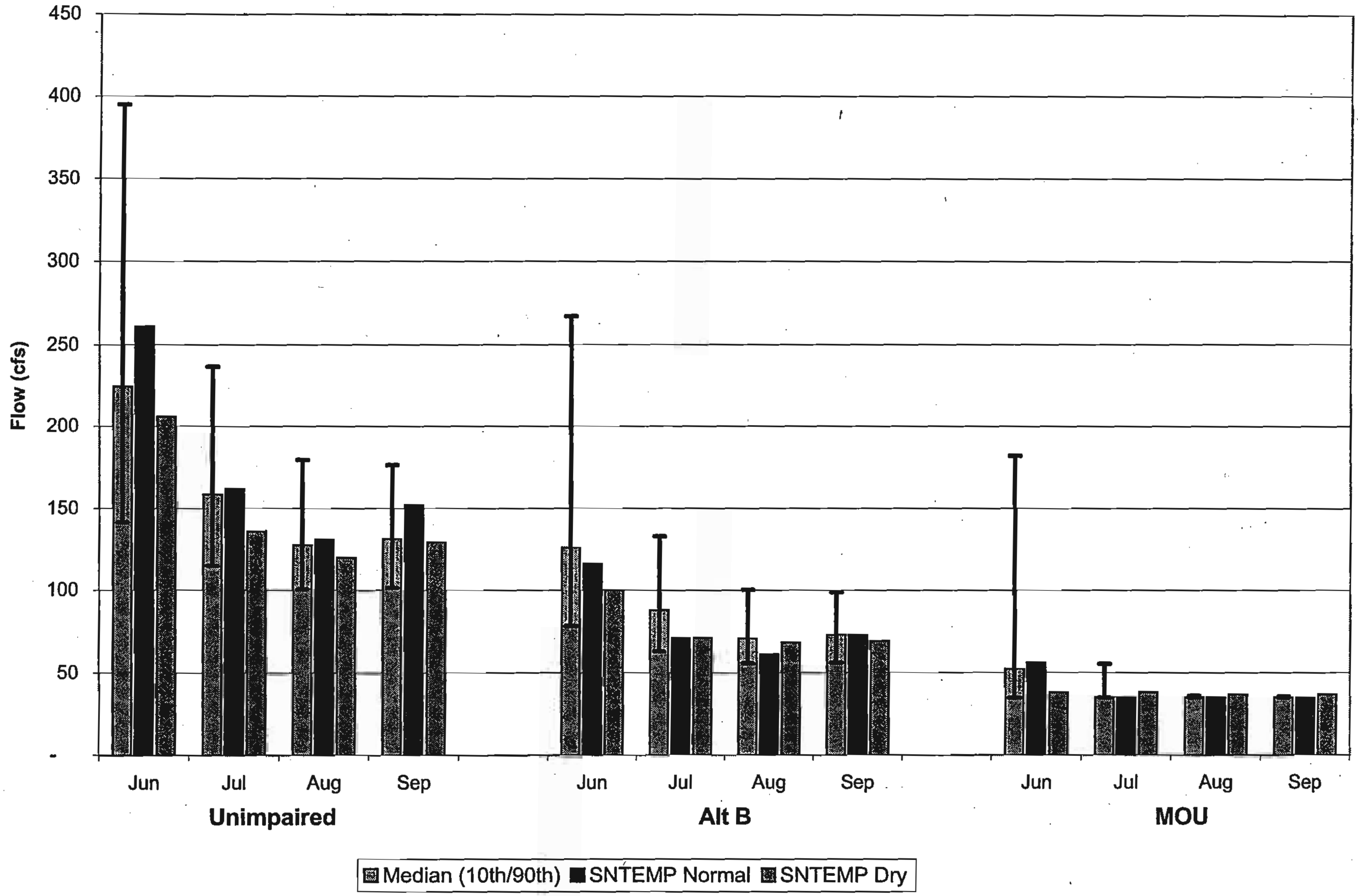


WY 1962-2002 median monthly flows plus 10th and 90th percentile range for Unimpaired, Alt B, MOU: RMI/Navigant flow model. SNTEMP normal and dry flows from Scott Tu, PG&E.

Figure C-2, SNTEMP Flow Comparsion

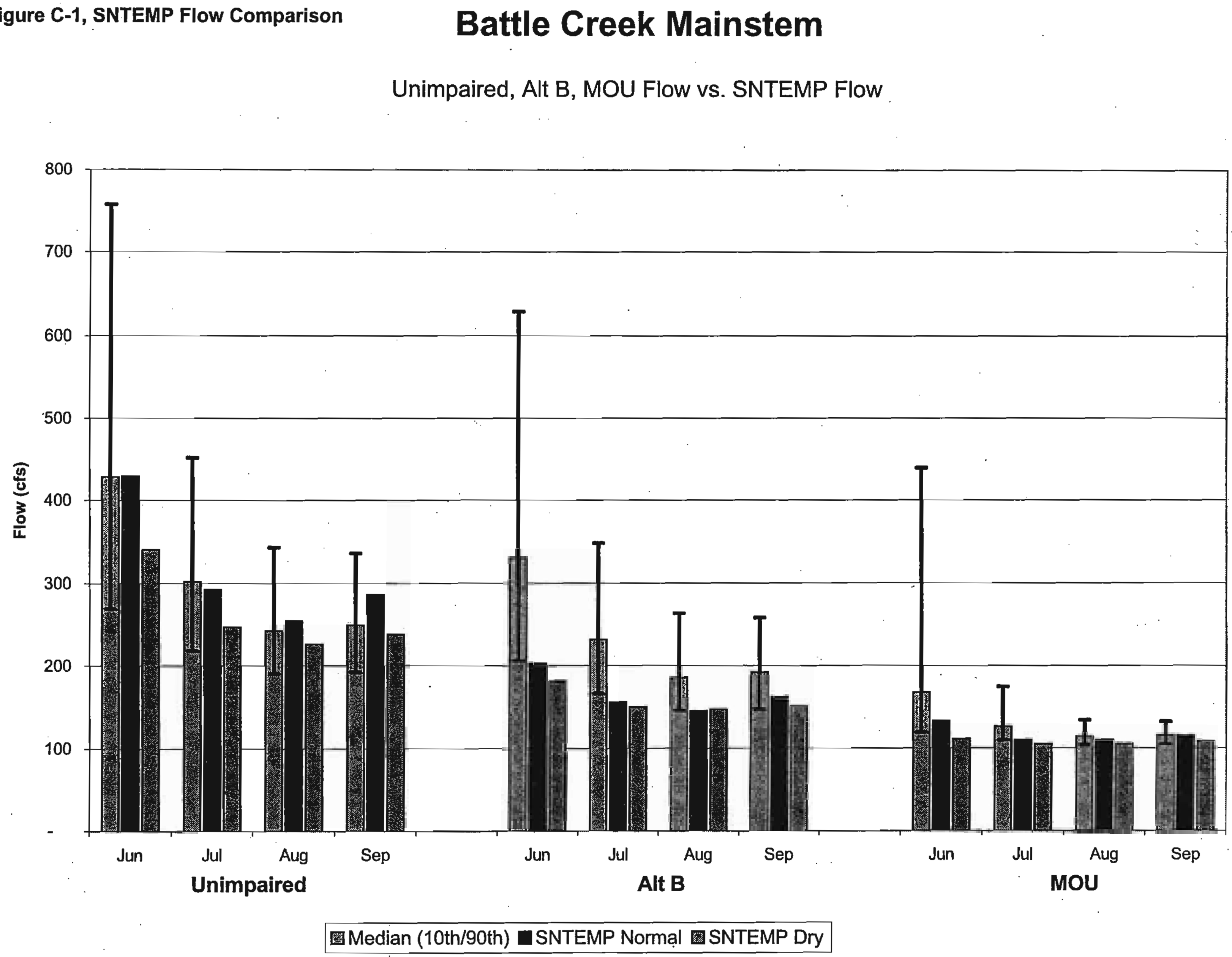
Battle Creek, Eagle Canyon Reach

Unimpaired, Alt B, MOU Flow vs. SNTEMP Flow



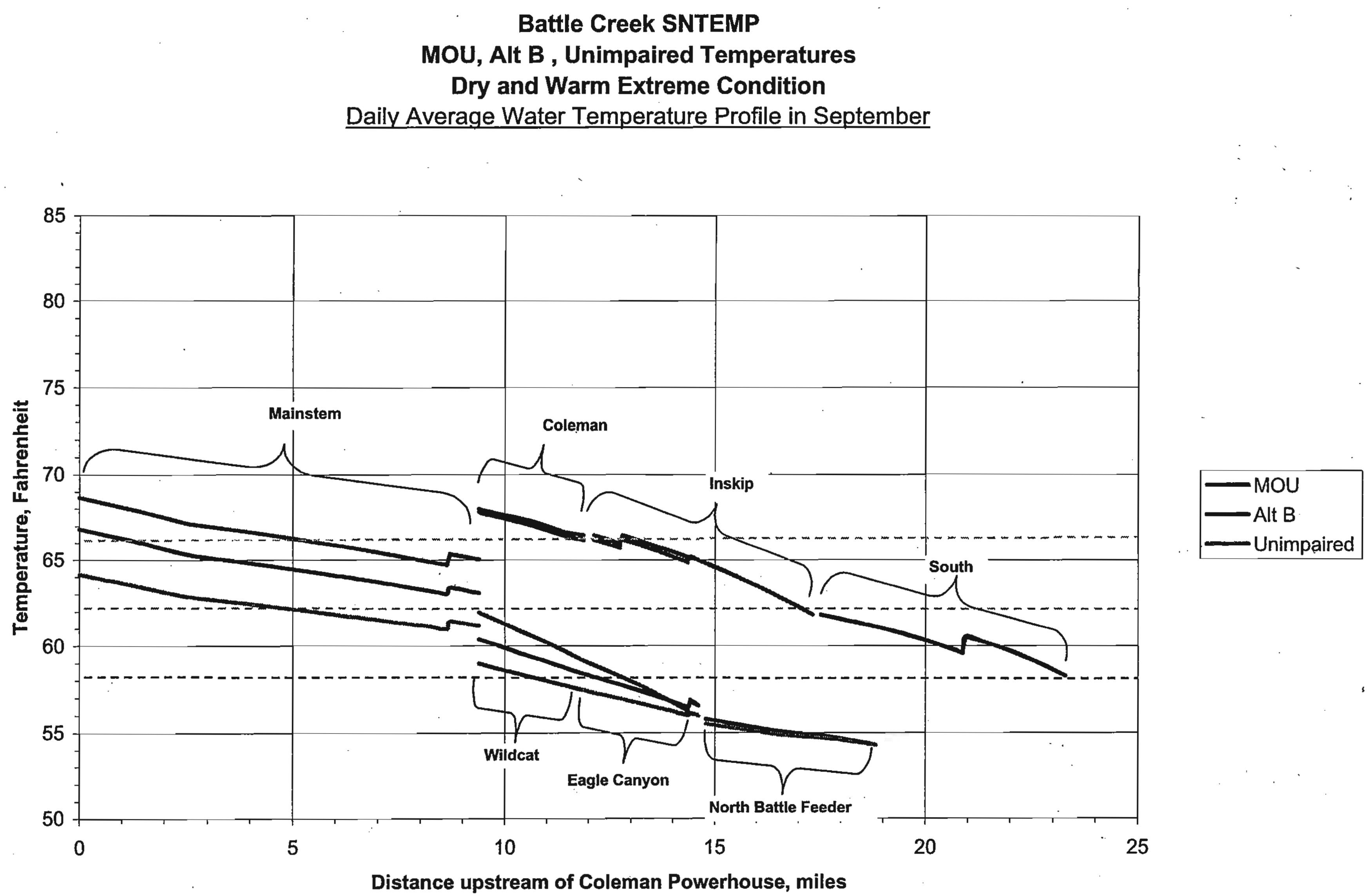
WY 1962-2002 median monthly flows plus 10th and 90th percentile range for Unimpaired, Alt B, MOU: RMI/Navigant flow model. SNTEMP normal and dry flows from Scott Tu, PG&E.

Figure C-1, SNTEMP Flow Comparison



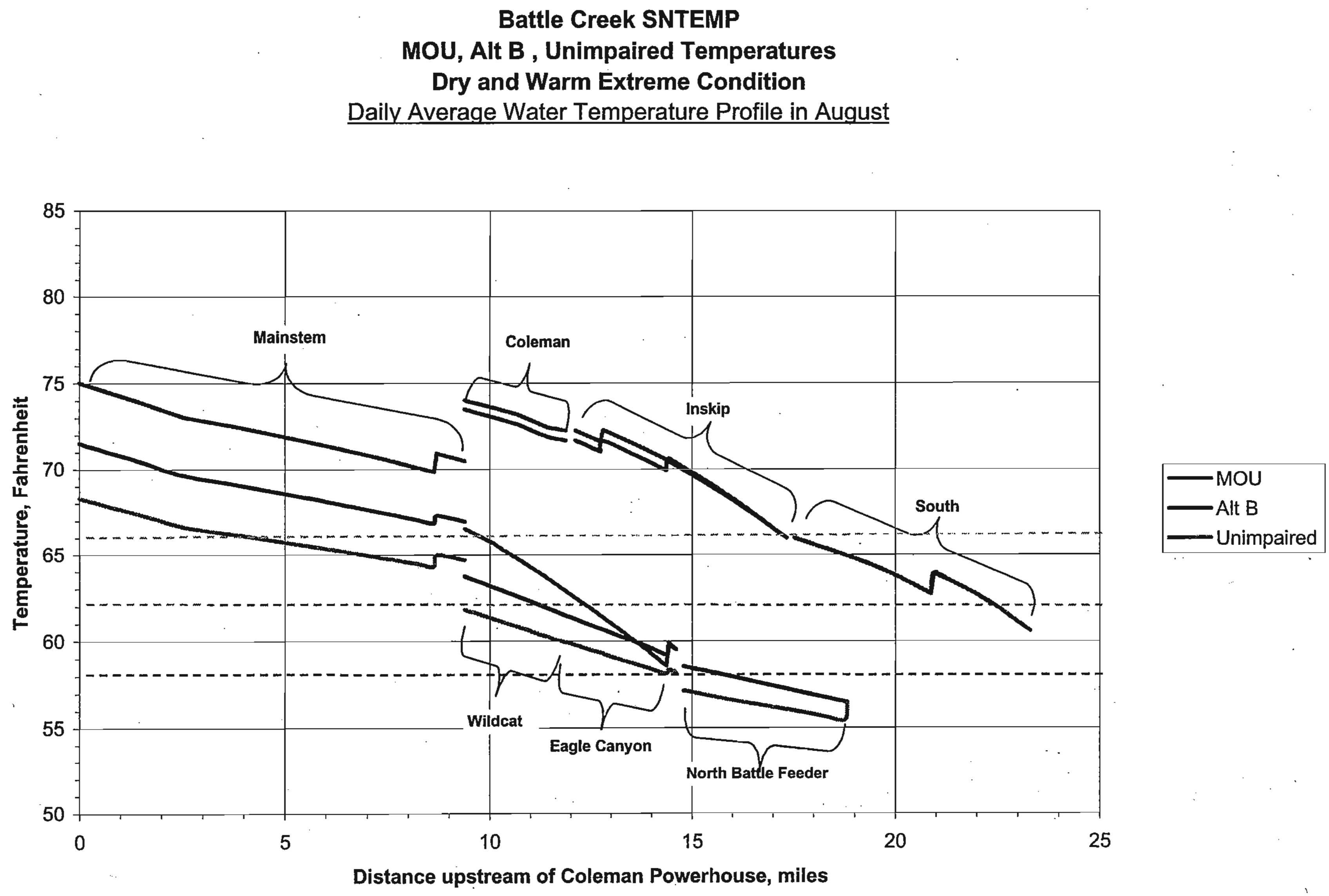
WY 1962-2002 median monthly flows plus 10th and 90th percentile range for Unimpaired, Alt B, MOU: RMI/Navigant flow model. SNTEMP normal and dry flows from Scott Tu, PG&E.

Figure T-8, DryWarm-Sep



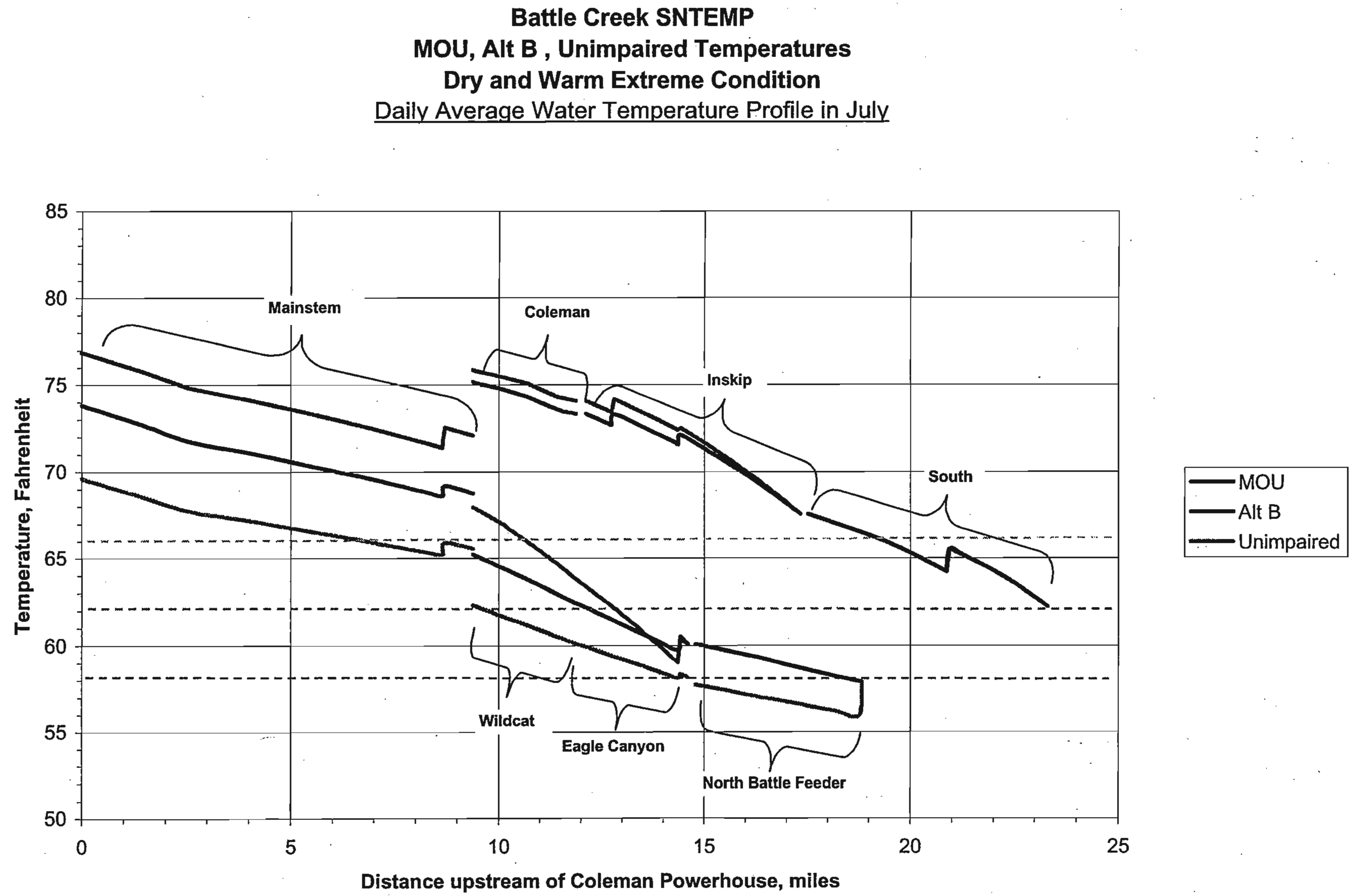
MOU Temp: SNTEMP Alt 3
Alt B Temp: North Fork and Mainstem, SNTEMP Alt 4; South Fork, SNTEMP Alt 6. **Alt B Mainstem does not account for SF cooling.**
Unimpaired: SNTEMP Alt 6 (no facilities below Volta)

Figure T-7, DryWarm-Aug



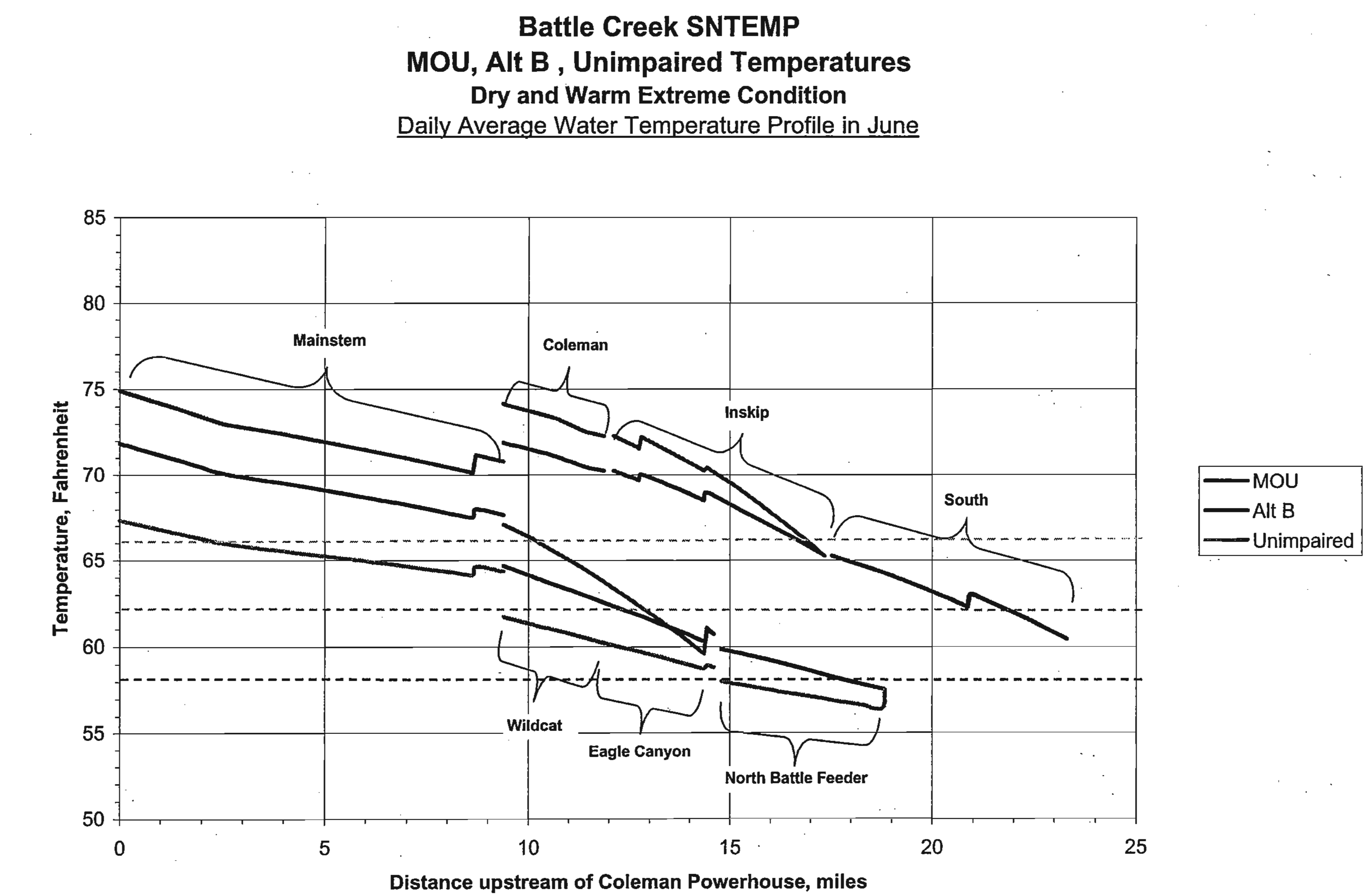
MOU Temp: SNTEMP Alt 3
Alt B Temp: North Fork and Mainstem, SNTEMP Alt 4; South Fork, SNTEMP Alt 6. **Alt B Mainstem does not account for SF cooling.**
Unimpaired: SNTEMP Alt 6 (no facilities below Volta)

Figure T-6, DryWarm-July



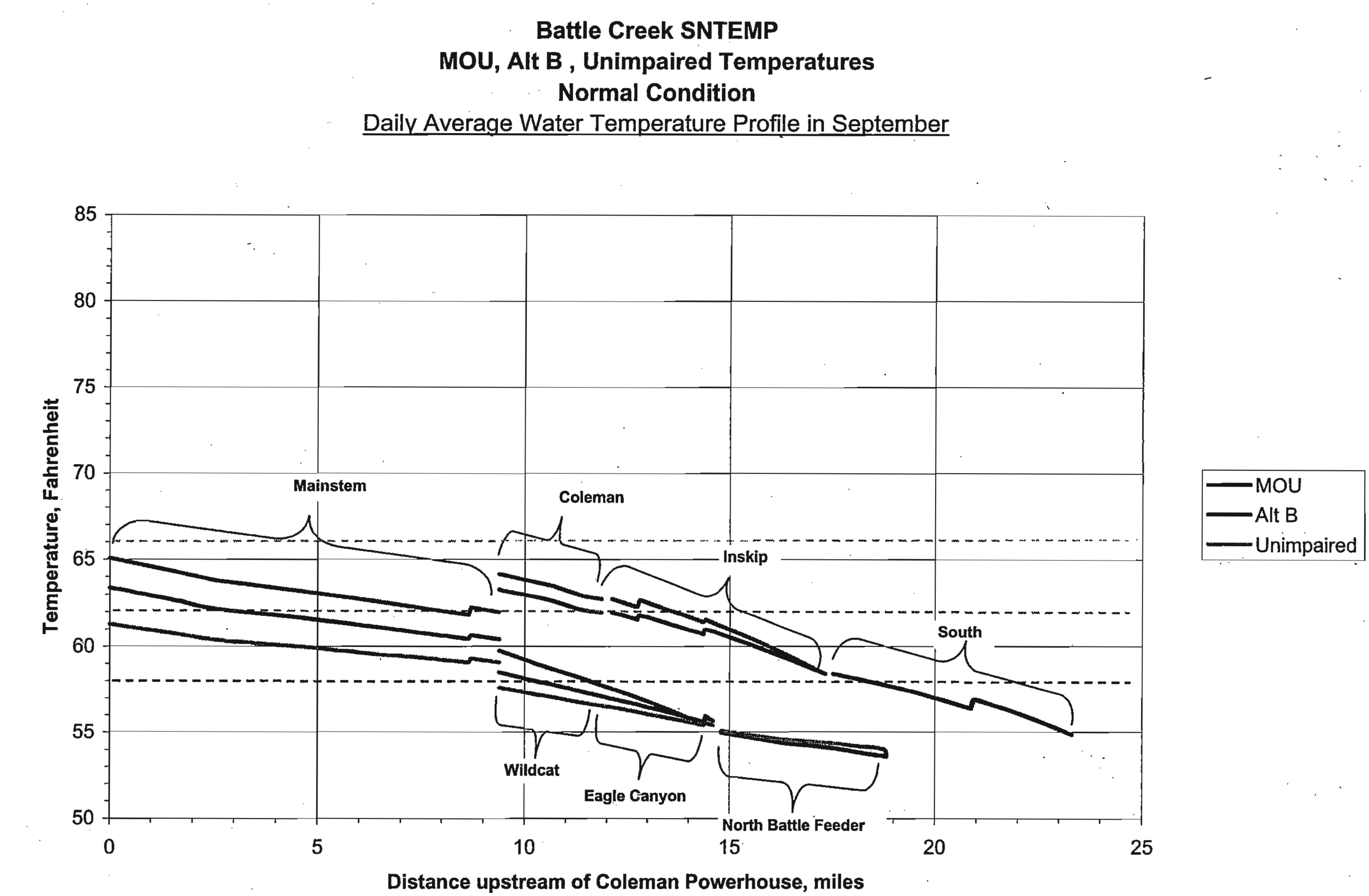
MOU Temp: SNTEMP Alt 3
Alt B Temp: North Fork and Mainstem, SNTEMP Alt 4; South Fork, SNTEMP Alt 6. **Alt B Mainstem does not account for SF cooling.**
Unimpaired: SNTEMP Alt 6 (no facilities below Volta)

Figure T-5, DryWarm-June



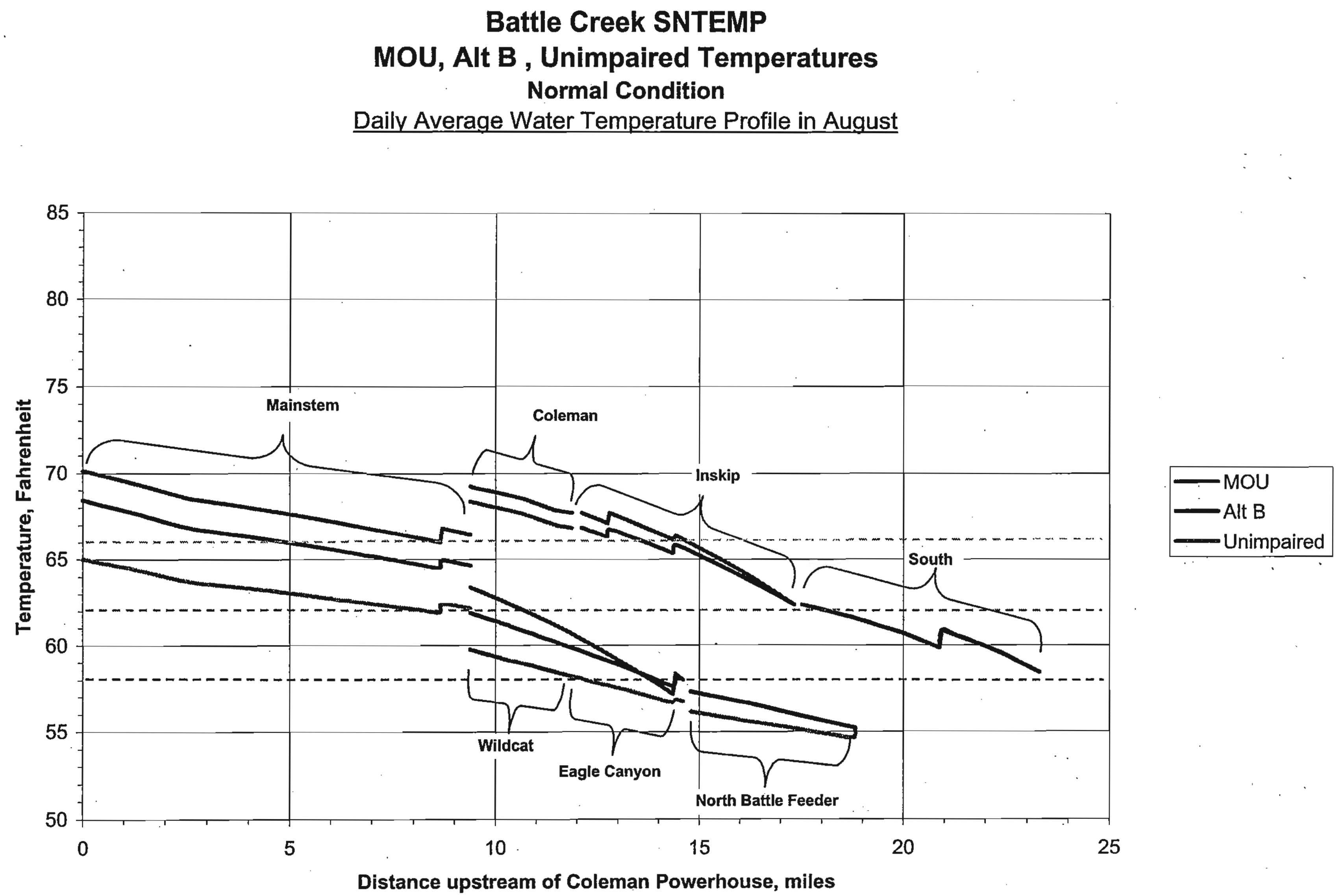
MOU Temp: SNTEMP Alt 3
Alt B Temp: North Fork and Mainstem, SNTEMP Alt 4; South Fork, SNTEMP Alt 6. **Alt B Mainstem does not account for SF cooling.**
Unimpaired: SNTEMP Alt 6 (no facilities below Volta)

Figure T-4, Avg-Sep



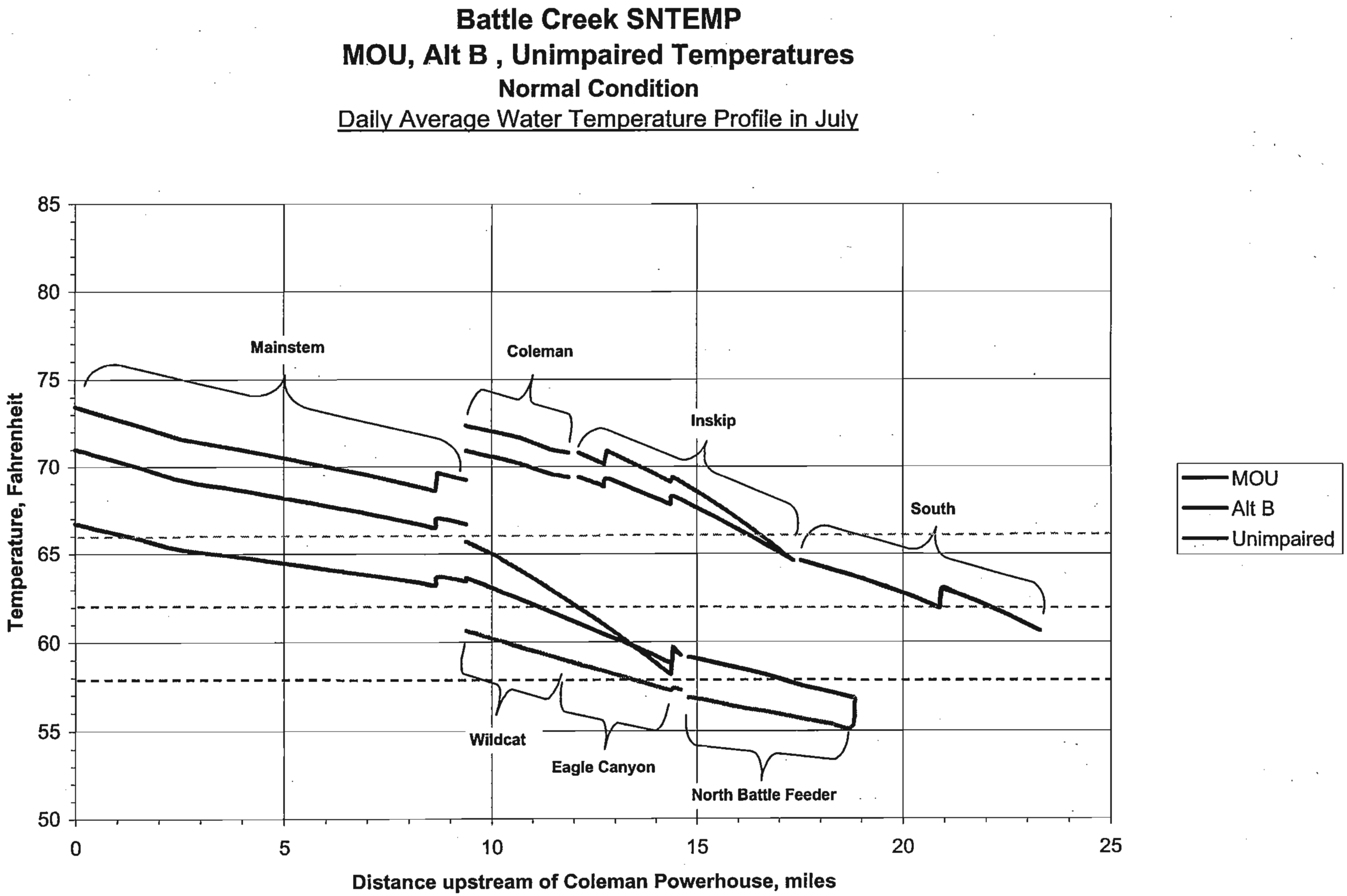
MOU Temp: SNTEMP Alt 3
Alt B Temp: North Fork and Mainstem, SNTEMP Alt 4; South Fork, SNTEMP Alt 6. **Alt B Mainstem does not account for SF cooling.**
Unimpaired: SNTEMP Alt 6 (no facilities below Volta)

Figure T-3, Avg-Aug



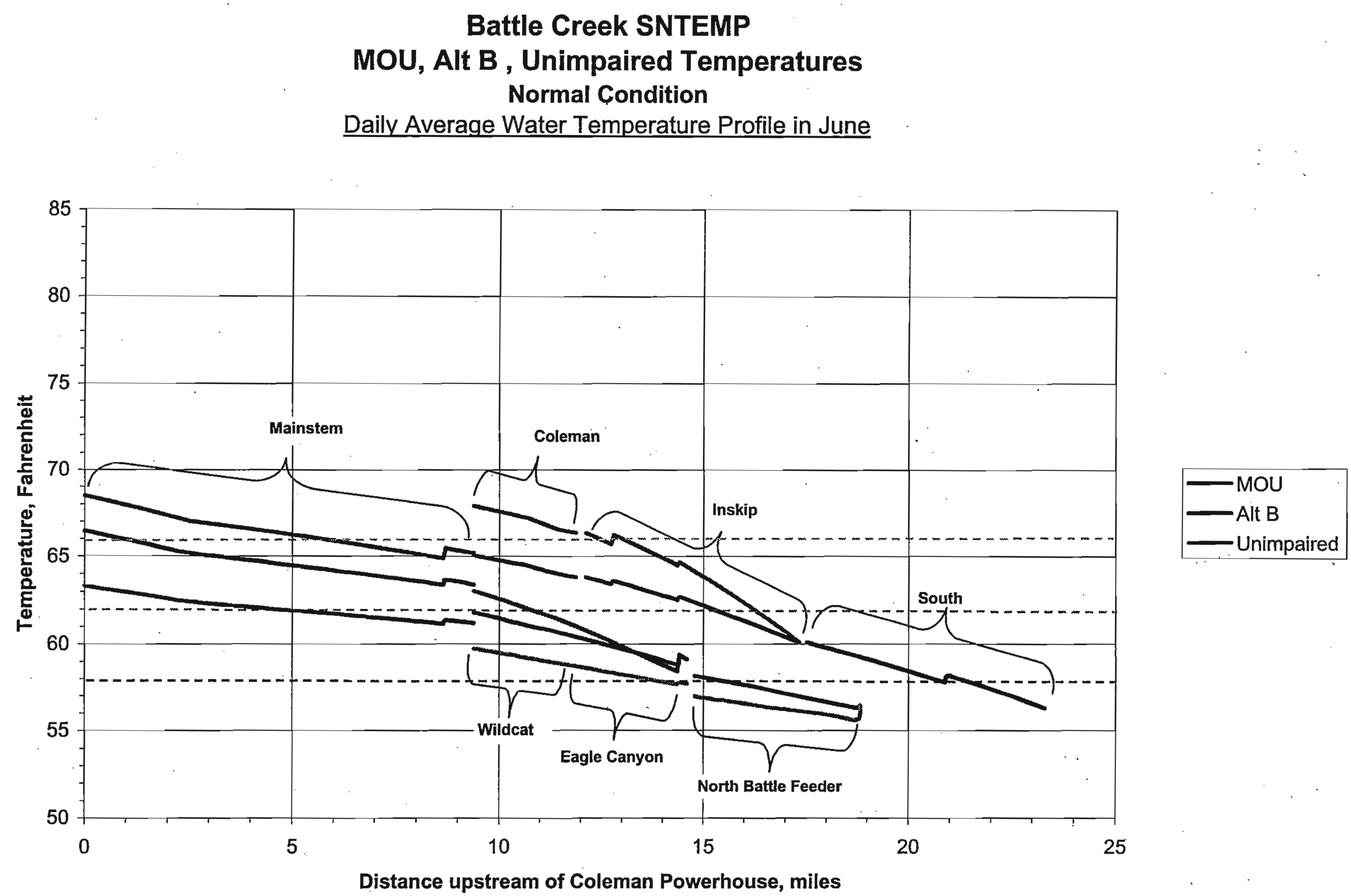
MOU Temp: SNTEMP Alt 3
Alt B Temp: North Fork and Mainstem, SNTEMP Alt 4; South Fork, SNTEMP Alt 6. **Alt B Mainstem does not account for SF cooling.**
Unimpaired: SNTEMP Alt 6 (no facilities below Volta)

Figure T-2, Avg-July



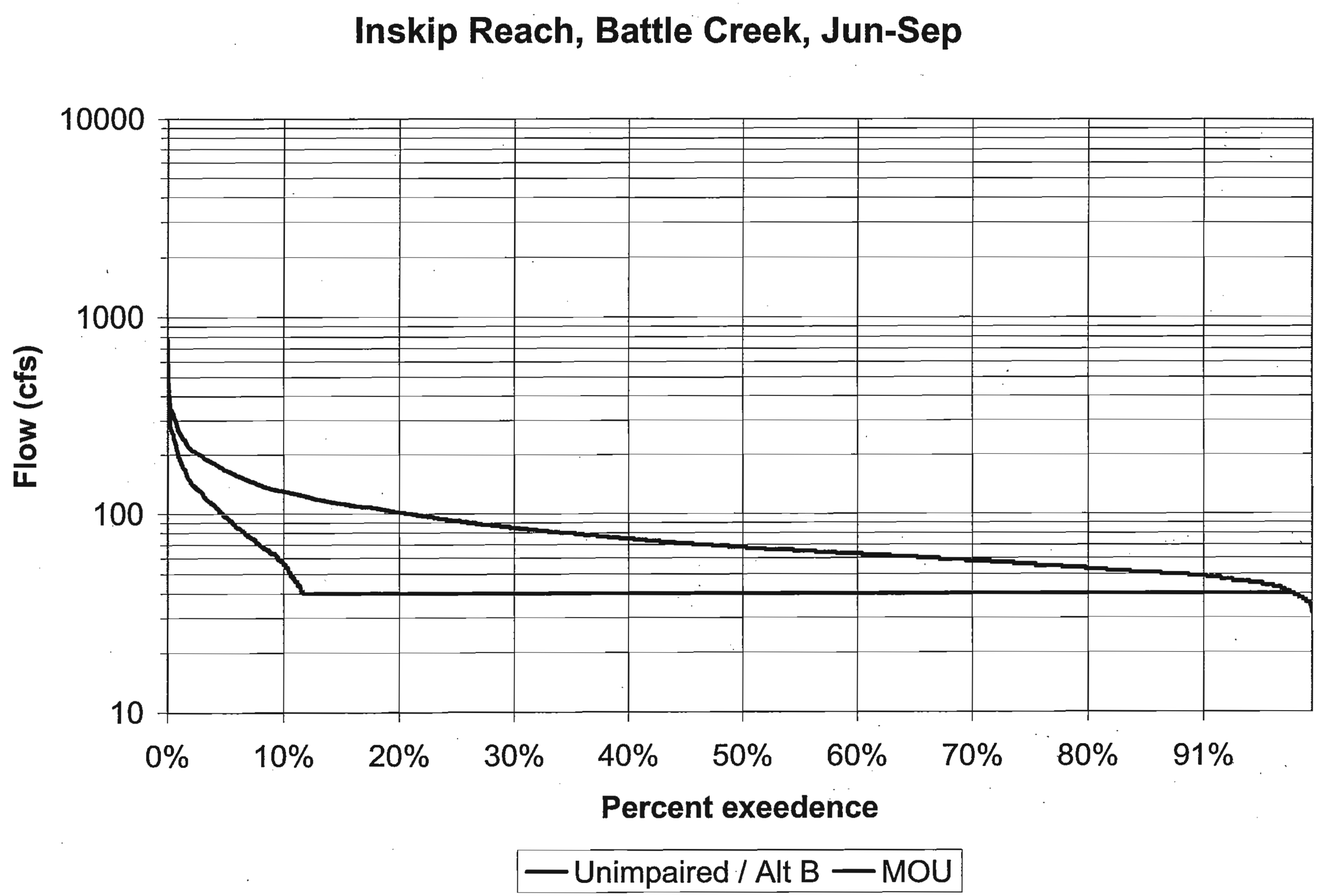
MOU Temp: SNTEMP Alt 3
Alt B Temp: North Fork and Mainstem, SNTEMP Alt 4; South Fork, SNTEMP Alt 6. **Alt B Mainstem does not account for SF cooling.**
Unimpaired: SNTEMP Alt 6 (no facilities below Volta)

Figure T-1, Avg-June



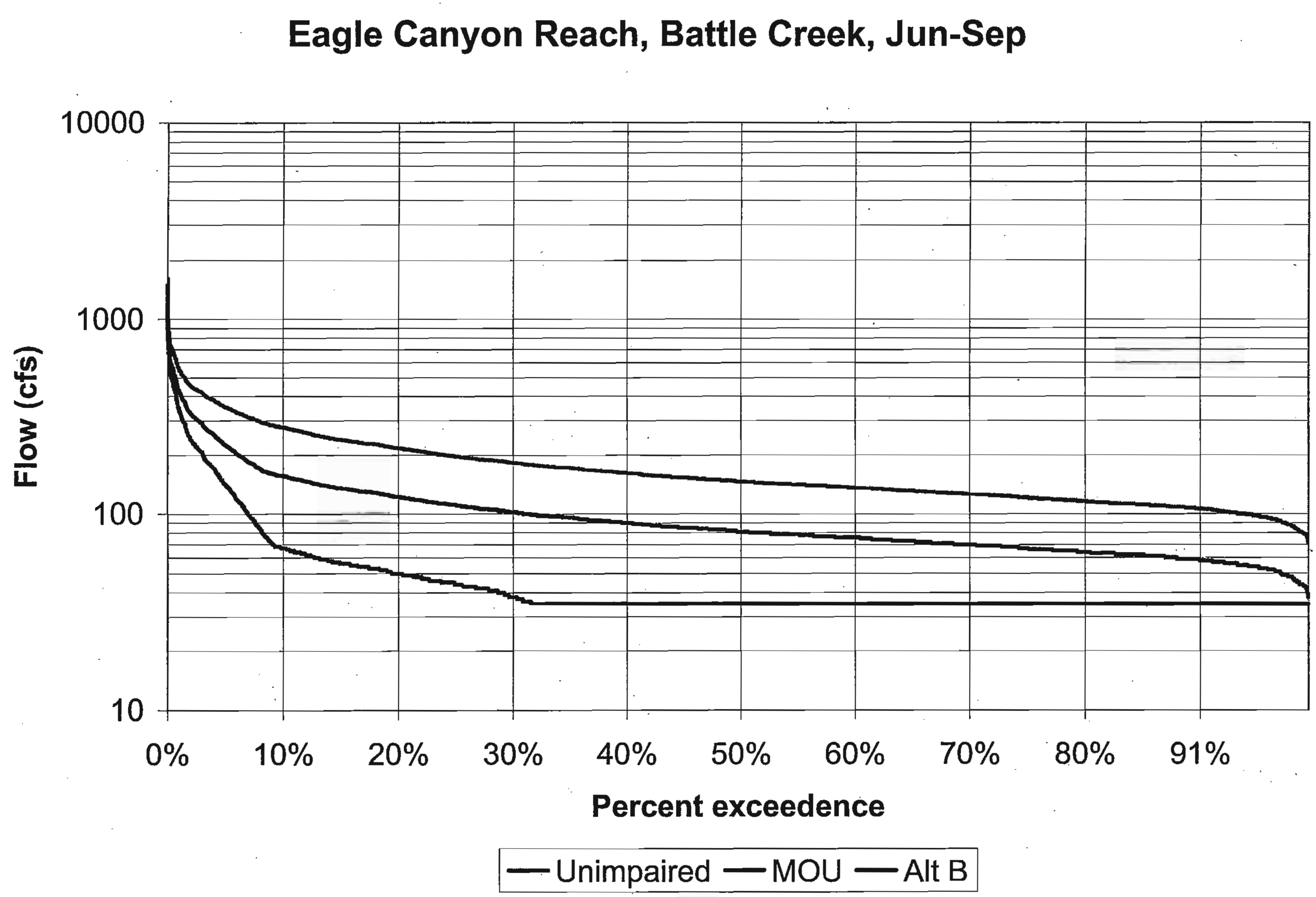
MOU Temp: SNTEMP Alt 3
Alt B Temp: North Fork and Mainstem, SNTEMP Alt 4; South Fork, SNTEMP Alt 6. **Alt B Mainstem does not account for SF cooling.**
Unimpaired: SNTEMP Alt 6 (no facilities below Volta)

Figure E-6, Flow Exceedence Curve, Inskip Reach, Summer



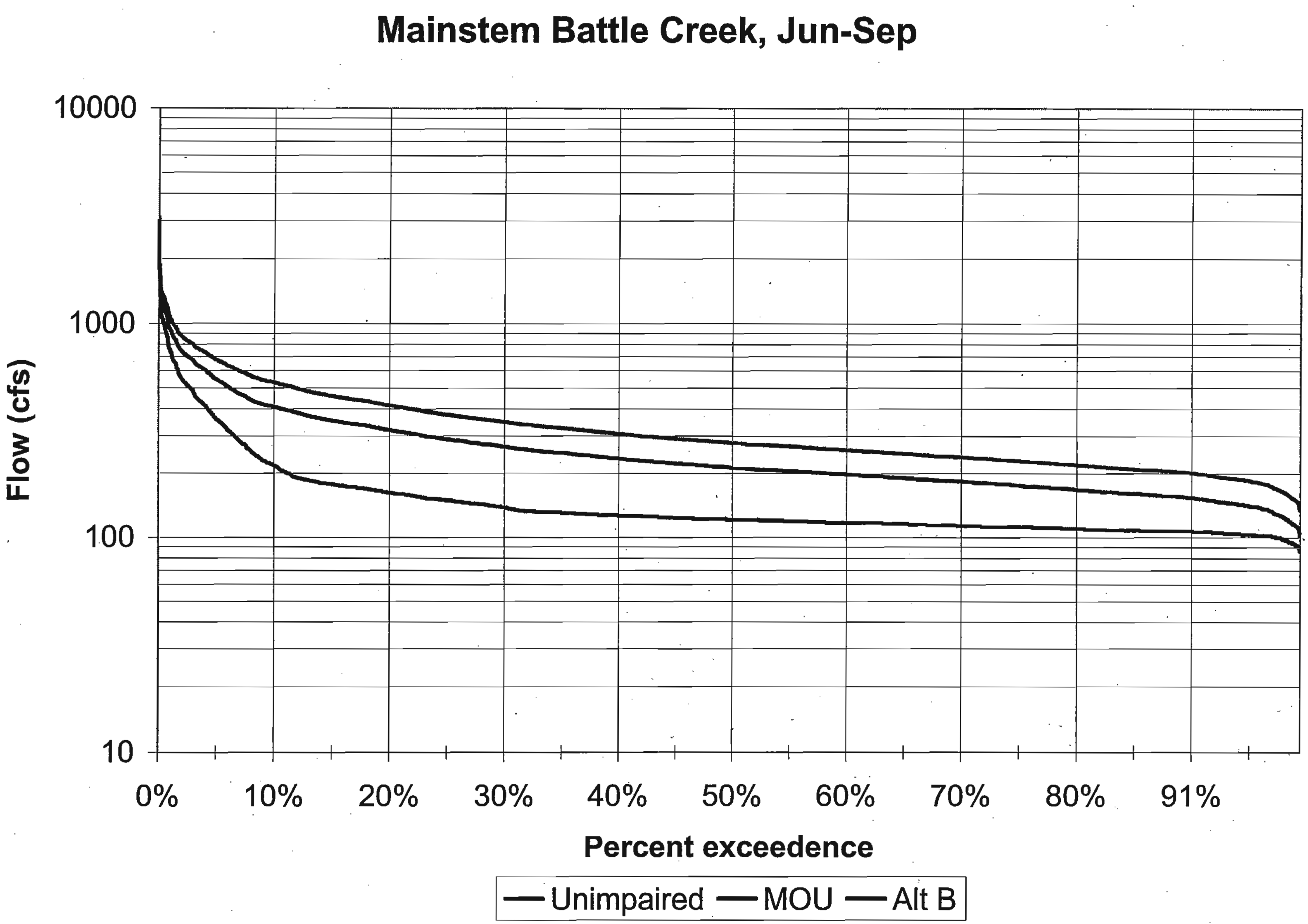
Water years 1962-2002, using daily flow model adopted from RMI/Navigant flow/econ model. 1997 data excluded.

Figure E-5, Flow Exceedence Curve, Eagle Canyon Reach, Summer



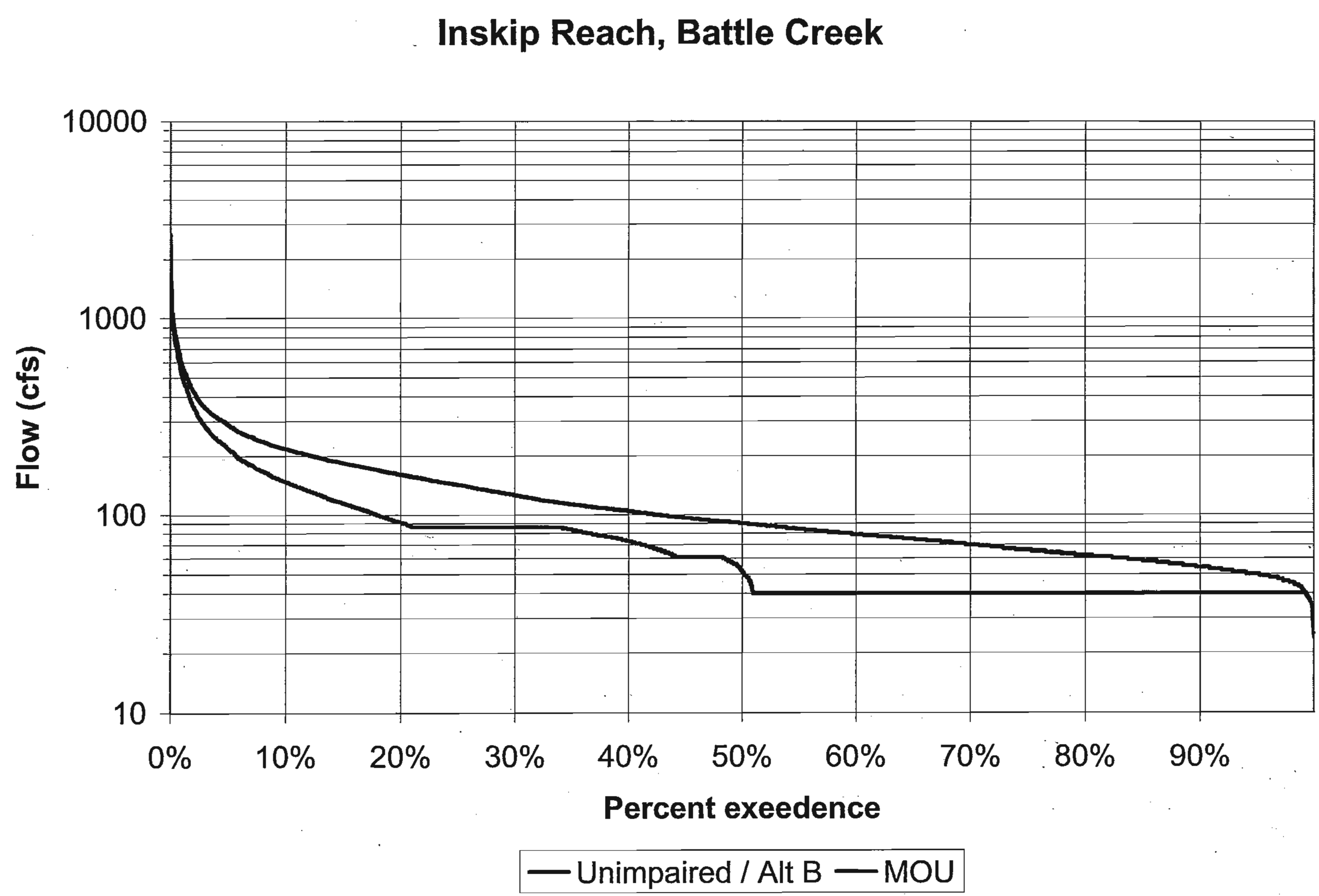
Water years 1962-2002, using daily flow model adopted from RMI/Navigant flow/econ model. 1997 data excluded.

Figure E-4. Flow Exceedence Curve, Mainstem Battle Creek, Summer



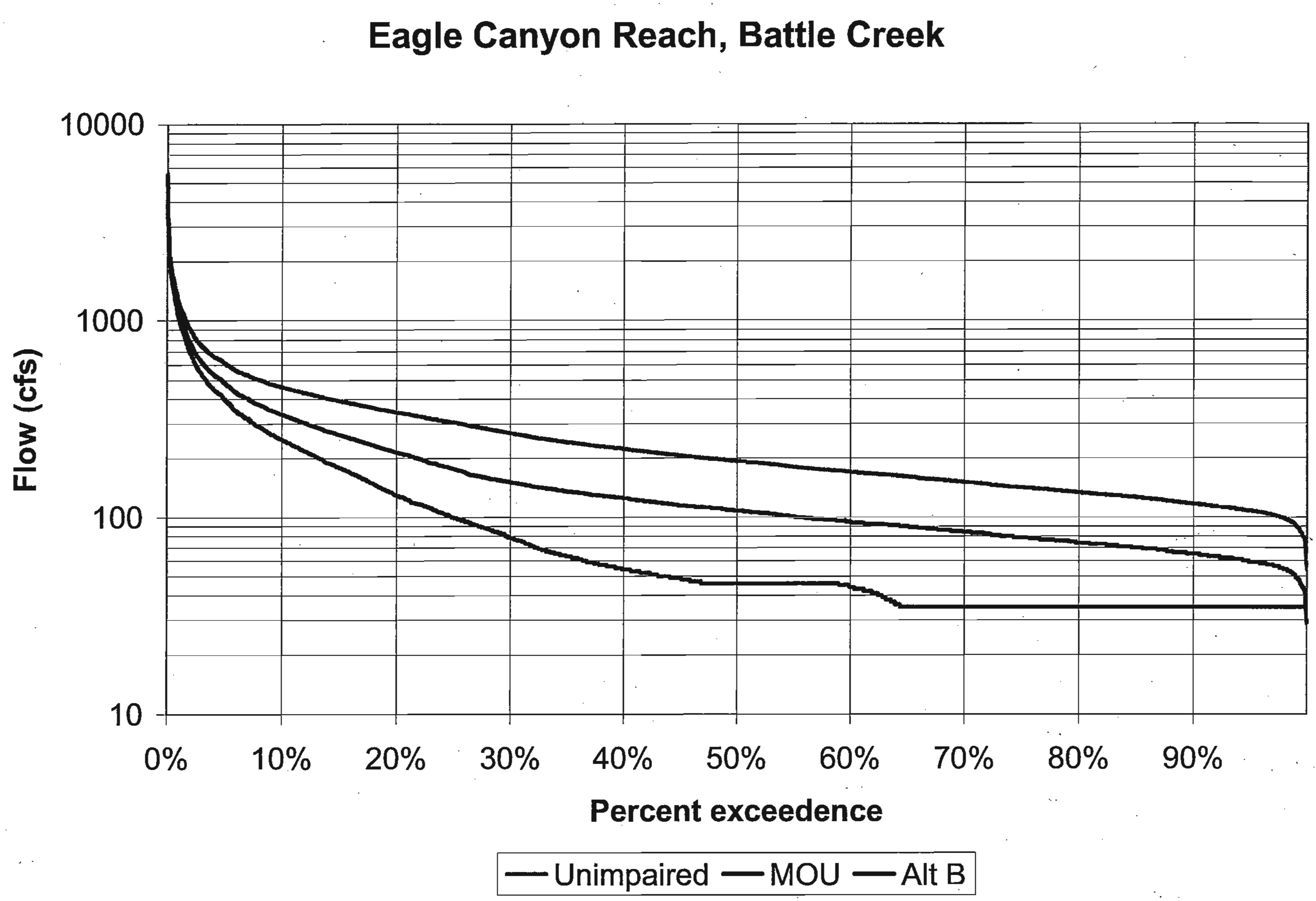
Water years 1962-2002, using daily flow model adopted from RMI/Navigant flow/econ model. 1997 data excluded.

Figure E-3, Flow Exceedence Curve, Inskip Reach, Battle Creek



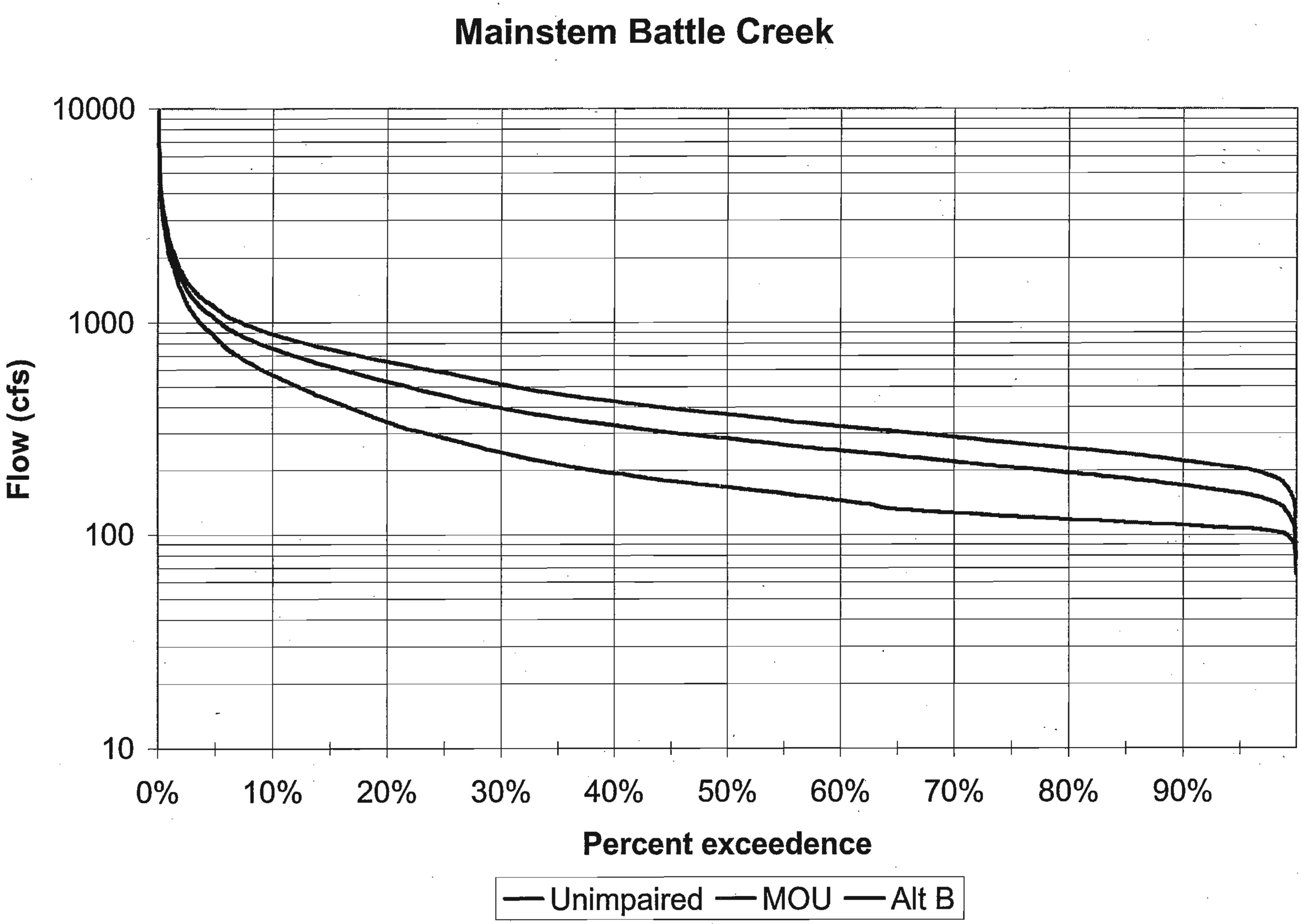
Water years 1962-2002, using daily flow model adopted from RMI/Navigant flow/econ model. 1997 data excluded.

Figure E-2, Flow Exceedence Curve, Eagle Canyon Reach, Battle Creek



Water years 1962-2002, using daily flow model adopted from RMI/Navigant flow/econ model. 1997 data excluded.

Figure E-1. Flow Exceedence Curve, Mainstem Battle Creek

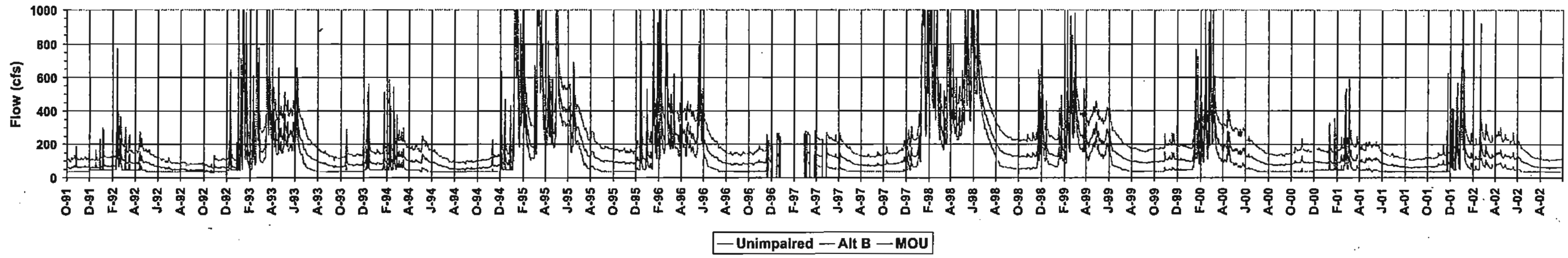


Water years 1962-2002, using daily flow model adopted from RMI/Navigant flow/econ model. 1997 data excluded.

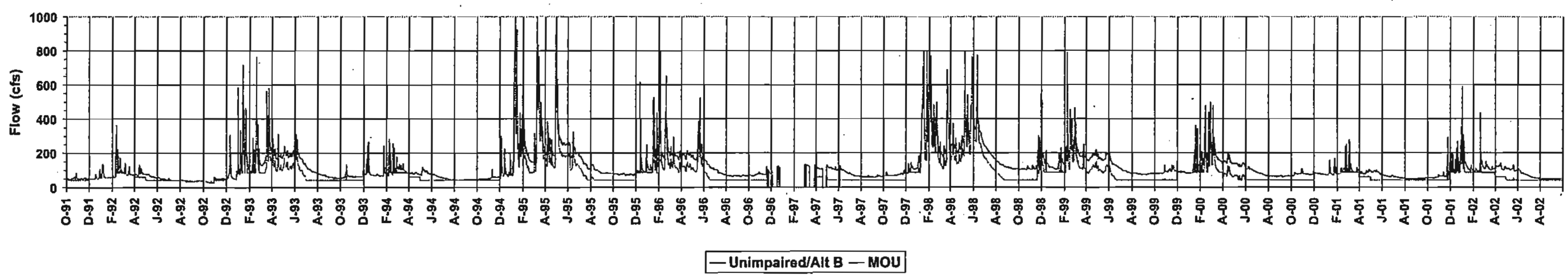
Figure H-4, Comparative Hydrographs

WY 1992-2002

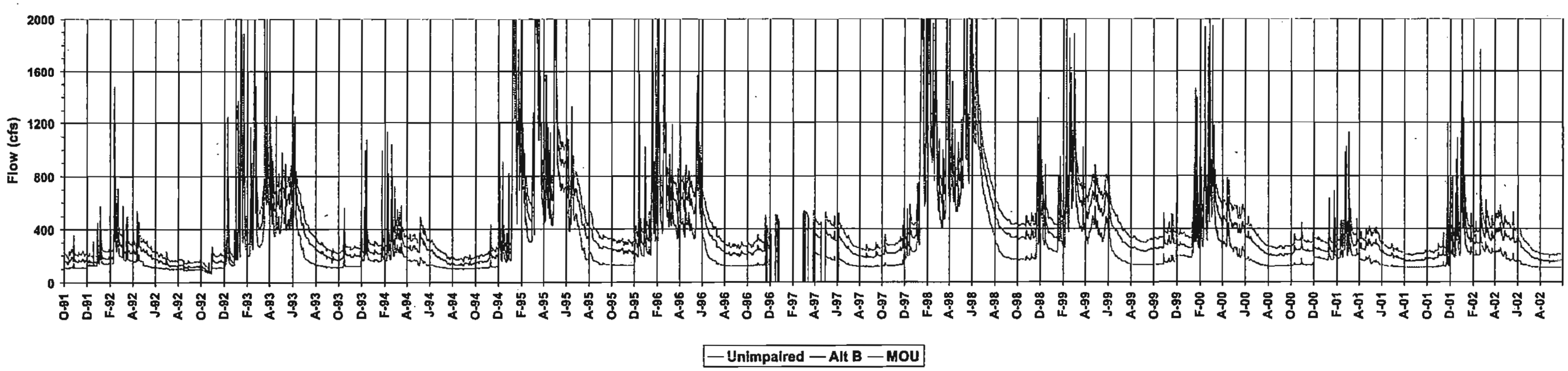
Eagle Canyon, North Fork Battle Creek



Inskip Reach, South Fork Battle Creek



Mainstem Battle Creek, Above Coleman PH

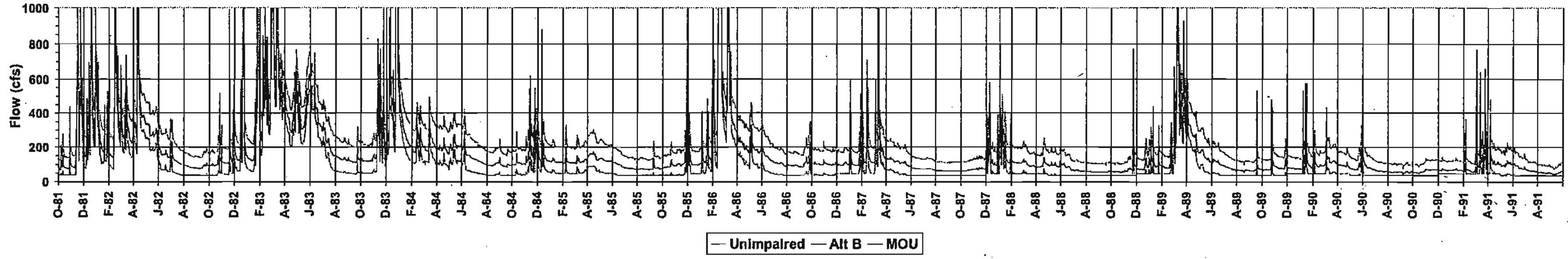


Flow data from modified RMI/Navigant daily flow model using USGS 11376550

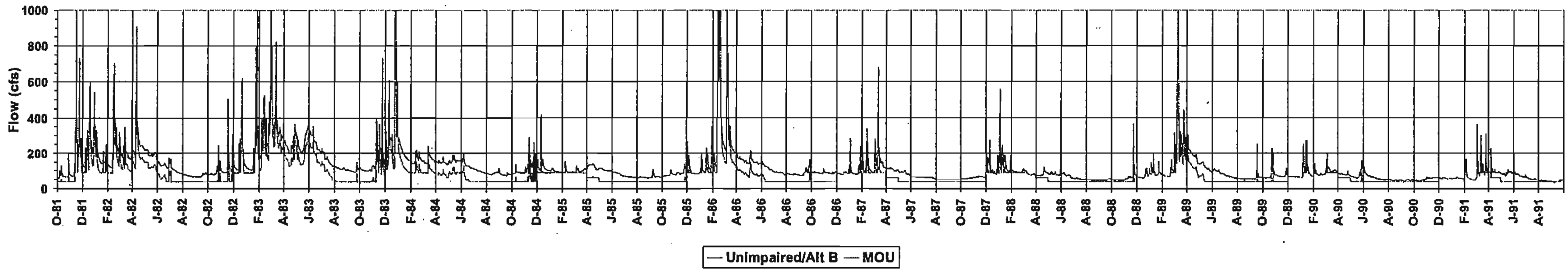
Figure H-3, Comparative Hydrographs

WY 1982-1991

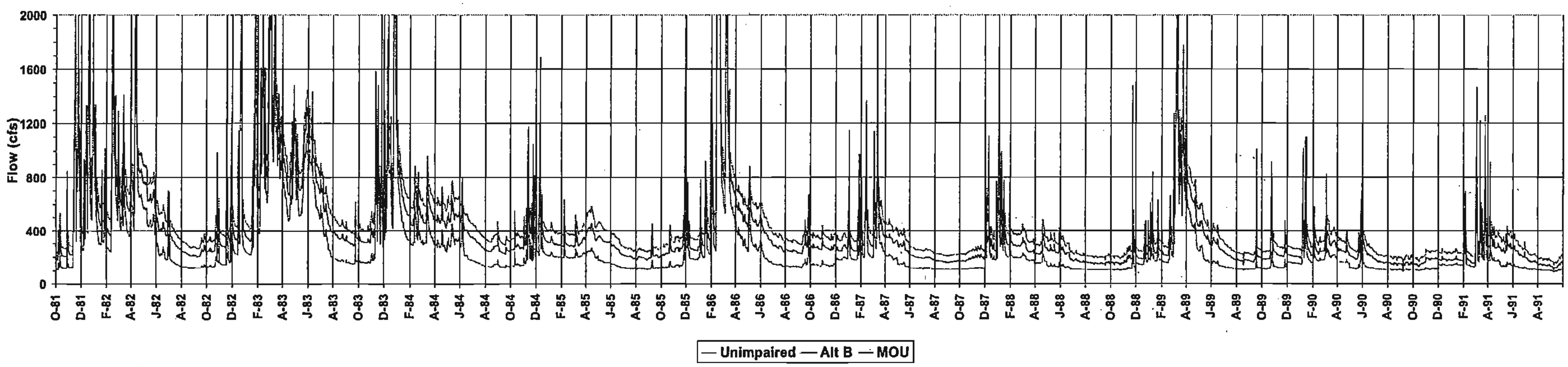
Eagle Canyon, North Fork Battle Creek



Inskip Reach, South Fork Battle Creek



Mainstem Battle Creek, Above Coleman PH

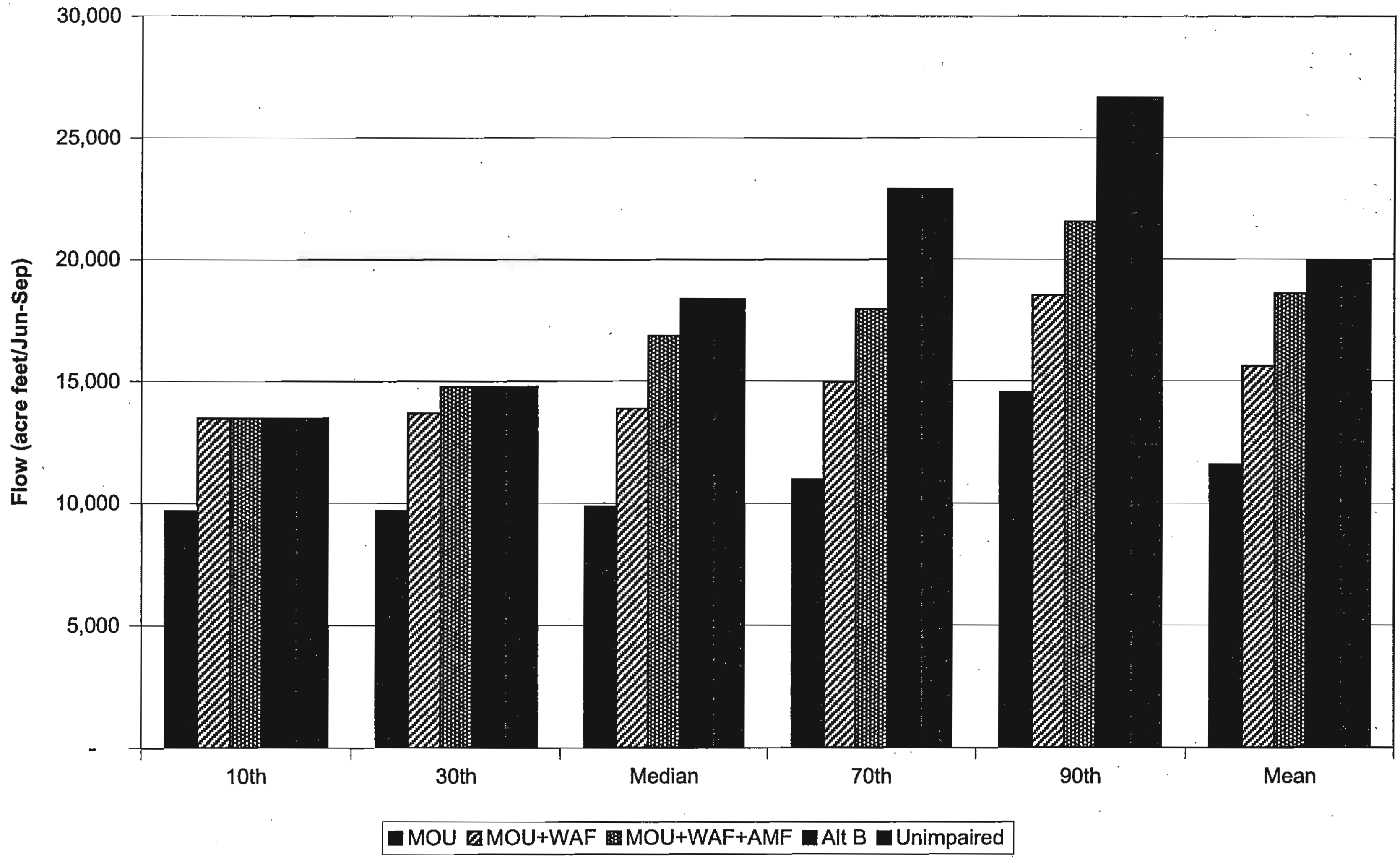


Flow data from modified RMI/Navigant daily flow model using USGS 11376550

Figure A-6, Summer Acre Feet

Acre Feet/Jun-Sep Comparison

Inskip Reach, Battle Creek



1962-2002 Jun-Sep flows derived from modified RVI/Navigant model. 10% - 90% and mean summer flows shown. WAF ($1.5 mil): ~4000 AF. AMF ($1.5 mil): ~3000 AF. $50/mWh, 2.5% inflation, 9.53% discount rate, post 2014, summer only, equal NF/SF.

Appendix II

Battle Creek Economics Memoranda

Revised April 11, 2004 to reflect April 10 revised project costs.
All references can be downloaded at www.calhrc.org/battlecreek.htm.

March 11, 2004

TO: CHRC

FROM: David Marcus

SUBJECT: Economic reasonableness of 8-dam removal option for Battle Creek hydroelectric projects

I. Introduction

PG&E and others have agreed through an MOU to a 5-dam removal option for the Battle Creek hydroelectric projects, with fish passage facilities to be built at the other three dams. Recent increases in the estimated cost of those fish passage facilities has led to renewed interest in the option of removing all 8 dams, thereby avoiding the cost of constructing and maintaining new fish passage facilities. This memo gives a brief review of the economic reasonableness of such an option.

II. Differences between the two cases

Under the MOU alternative, the average annual generation of the Battle Creek projects is 162.17 gwh per year.[1] With 8-dam removal, the average annual generation is 124.25 gwh per year.[2] Thus the 8 dam case requires an average of 37.92 gwh per year of replacement energy. On the other hand, the MOU case has capital costs which are $17.64 million higher than the 8-dam case, in June 2003 dollars.[3] It also has O&M costs which are $577 thousand higher each year, in 2003 dollars.[4] The NPV of the O&M costs differential, over the period 2005-2026, inclusive, is $6.64 million[5] using an inflation rate of 3% and a discount rate of 9%,[6] or 11.55 times the annual differential in 2003 dollars.[7] There are various other small differences between the two cases which offset one another.[8] Finally, there are future capital addition costs, where the MOU case will cost $120 thousand per year more than the 8 dam case, in 2003 dollars.[9] When grossed up for the income tax effects and return on rate base, this $120 thousand per year cost difference corresponds to a ratepayer difference of $171 thousand per year.[10] Using the same 11.55 factor to convert annual 2003

[1] Battle Creek Economics.xls, "Economic Summary" tab, cell D6.
[2] Battle Creek Economics.xls, "Economic Summary" tab, cell I6.
[3] Battle Creek Economics.xls, "Economic Summary" tab, cell D7 minus cell I7.
[4] Battle Creek Economics.xls, "Economic Summary" tab, cells D27 and D28 minus cells I27 and I28.
[5] Battle Creek Economics.xls, "Economic Summary" tab, cell D54 minus cell I54.
[6] Battle Creek Economics.xls, "Economic Summary" tab, cells A47, A48.
[7] Battle Creek Economics.xls, "Economic Summary" tab, 1000 times cell C120 divided by cell C22.
[8] One-time Screen/Ladder repairs, construction outage costs, FERC license amendment costs. See Battle Creek Economics.xls, "Economic Summary" tab, cells D30 and D35 and D36, minus cells I30 and I35 and I36.
[9] Battle Creek Economics.xls, "Economic Summary" tab, cell D10 minus cell I10.
[10] Battle Creek Economics.xls, "Economic Summary" tab, cell D26 minus cell I26.

costs into 2005-2026 NPV costs, the future capital additions of the MOU case will be $2.0 million higher than the future capital costs of the 8-dam case.

Putting all the cost numbers together, the 8-dam case saves $17.6 + $6.7 + $2.0 = $26.3 million dollars compared to the MOU case, in year 2003 NPV terms. The question is whether this savings is more or less than the cost of replacing the average 37.92 gwh per year of generation which would be lost under the 8-dam case.

III. Cost of replacement generation

The Battle Creek Economics spreadsheet uses an energy value of $51.1 per Mwh, or 5.16 cents per kwh, for 2003,[11] and then escalates that price at 3 percent per year.[12] Using that price, the NPV of 2005-2026 replacement energy purchases would be $51.1/Mwh x 1000 Mwh/gwh x 37.92 gwh/year x 11.55 NPV conversion factor = $22.4 million. This is $3.9 million less than the capital and operating cost penalty associated with the MOU case, and suggests that the 8-dam case is economically preferable by this amount.[13]

However, $51.1 per Mwh may not be the appropriate number to use. The intention of both CHRC and PG&E is that if the 8-dam case is to be adopted, then replacement energy for the decrease in Battle Creek generation should come from renewable resources. Renewable resource generation may have higher costs than the general market prices used in the Battle Creek Economics spreadsheet.

The California Energy Commission, in its October 2003 "Electricity and Natural Gas Assessment Report," CEC publication P100-03-014, estimates the levelized cost of wind generation, in 2002 dollars.[14] The CEC estimates are thus structured the same way as the prices in the Battle Creek Economics spreadsheet, with an initial year price that escalates each year thereafter at the rate of inflation. The CEC cost estimate for wind generation is 4.93 cents per kwh.[15] Adding 3 percent for inflation from 2002 to 2003, the CEC number corresponds to a 2003 price for wind of $50.8 per Mwh, extremely close to (and slightly lower than) the $51.1/Mwh price in the Battle Creek Economics spreadsheet for energy in 2003. Thus it is reasonable to use the Battle Creek Economics values to compare the MOU to the 8-dam alternative.

Alternatively, one can calculate what price for replacement energy would eliminate the $3.9 million cost advantage held by the 8-dam case over the MOU case when replacement energy is priced at $51.1/Mwh in 2003 dollars. To make the two cases equal, the NPV of replacement energy must be equal to $26.3 million, as shown in the previous section. Based on an 11.55 NPV conversion factor, that corresponds to an annual replacement energy cost of $26.3/11.55 = $2.27 million in 2003 dollars. Since the average quantity of replacement energy is 37.92 gwh per year, or 37,920 Mwh per year, the breakeven price for replacement energy would be $2.27 million/37,920 Mwh = $60.65/Mwh in 2003 dollars. Escalating forward to 2004 dollars, the breakeven price would be $61.78 per Mwh. This is well above the CEC's price for wind energy.

[11] Battle Creek Economics.xls, "Economic Summary" tab, cell C22 divided by cell C6.
[12] Battle Creek Economics.xls, "Economic Summary" tab, cell A47.
[13] Battle Creek Economics.xls, "Economic Summary" tab, comparing cells D55 and I55, shows a $2.2 million NPV advantage for the 8-dam case. However, cells D55 and I55 do not refelect the $2.0 million NPV advantage of the 8-dam case over the MOU case with respect to future capital additions, discussed above.
[14] CEC, Electricity and Natural Gas Assessment Report," CEC publication P100-03-014, p. B-2.
[15] CEC, Electricity and Natural Gas Assessment Report," CEC publication P100-03-014, p. B-3.

IV. Other issues

A. Discount rate

The Battle Creek Economics spreadsheet uses a discount rate of 9 percent per year. Elsewhere, a discount rate of 9.53 percent per year has been used as more representative of the PG&E rate of return.[16] Using a higher discount rate will increase the cost advantage of the 8-dam case over the MOU case. With a 9.53% discount rate instead of a 9% discount rate, the NPV conversion factor would be 11.00 instead of 11.55. Holding all other assumptions constant, the $3.9 million cost advantage of the 8-dam case over the MOU case would increase to $4.55 million.[17]

B. Inflation rate

The Battle Creek Economics spreadsheet uses an inflation rate of 3 percent per year. Elsewhere, an inflation rate of 2.5 percent per year has been used for both O&M and energy prices when evaluating the Battle Creek projects.[18] Lower inflation rate assumptions increase the cost advantage of the 8-dam case over the MOU case. With a 2.5% inflation rate instead of a 3% inflation rate, the NPV conversion factor would be 11.00 instead of 11.55.With a 2.5 percent inflation rate, the $3.9 million cost advantage of the 8-dam case over the MOU case would increase to $4.55 million.[19]

C. Combined effect of changing inflation rate and discount rate assumptions

If both the discount rate and inflation rate assumptions are changed to match those in the Navigant spreadsheet, the NPV conversion factor would be 10.47 instead of 11.55. The $3.9 million cost advantage of the 8-dam case over the MOU case would increase to $5.2 million.[20]

D. Replacing capacity

The Battle Creek projects provide a small amount of reliable capacity in dry years. Looking at 1977 hydrology, in the months of July and August when PG&E's annual peak normally occurs (these are the months for which PG&E's reserve planning was typically done, historically), the difference between the MOU and 8-dam cases is 1553-1774 Mwh per month.[21] This corresponds to an output difference of 2.1-2.4 Mw. If the 38 gwh difference between the cases were replaced with wind generation from wind farms with an annual capacity factor of 30 percent, it would take 14.4 Mw of wind generation to produce 38 gwh per year.[22] In order for 14.4 Mw of installed wind capacity to produce 2.1-2.4 Mw

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[16] Navigant spreadsheet, "Proforma Analysis" tab, cell B9.
[17] $17.6 for capital costs, $6.3 million for O&M, $1.9 million for capital adjustments, offset by $21.3 million for replacement power costs.
[18] Navigant spreadsheet, "Proforma Analysis" tab, rows 7 and 8.
[19] $17.9 for capital costs, $6.3 million for O&M, $1.9 million for capital adjustments, offset by $21.3 million for replacement power costs.
[20] $17.9 for capital costs, $6.1 million for O&M, $1.8 million for capital adjustments, offset by $20.3 million for replacement power costs.
[21] Navigant spreadsheets for MOU and 8-dam cases, "Tier 1" tab," cells M117 and N117.
[22] 14.4 Mw x 8760 hours/year x 30% capacity factor x 1 gwh/1000 Mwh.

of firm capacity, the wind generation would have to have a firm capacity rating equal to 15-17 percent of its installed capacity, a quite small fraction. In the extreme case where wind generation produced no firm capacity at all (the wind never blew on summer afternoons), the economic cost to replace 2.1-2.4 Mw of firm hydro capacity would be small. At current prices of under $100/kw-year for year-round capacity, 2.4 Mw would cost under $240 thousand per year. Using an 11.55 NPV conversion factor, as discussed above, the NPV cost of replacement capacity would be under $2.8 million, not enough to offset the $3.9 million cost advantage of the 8-dam case. If PG&E only bought summer replacement capacity, the costs would be significantly less.

From: David Marcus [dmarcus2@mindspring.com]
Sent: Friday, March 12, 2004 11:43 AM **(UPDATED April 22 to reflect new costs)**
To: Stephen Wald
Subject: Re: foregone power memo

Steve,

After our conversation with PG&E, I have revisited my Battle Creek analysis in light of issues raised by PG&E. I checked PG&E's current rate of return on capital and found it to be 9.24%. I believe this is the correct number to use in comparing cost streams over different time periods, whether from a ratepayer or stockholder point of view. I incorporated this number into the "Battle Creek Economic Summary" spreadsheet (cell A49). I then modified the spreadsheet in several ways:

1. I added a line to show, and allow the user to vary, the assumed 2004 energy price (cell A48).

2. I modified the summary line entitled "Screen, Ladder Decommissioning Costs" (row 53 in the modified spreadsheet; previously row 52) to put it in 2004 dollars, consistent with the title of the section on row 51 (row 53 was previously in 2003 dollars, a point I had not noticed before today). This makes the 8-dam alternative more attractive by $0.5 million.

3. I modified the summary line entitled "Increased O&M" (row 55 in the modified spreadsheet; row 54 in the original spreadsheet) so that future capital additions (row 26) are accounted for in the summary.

4. I extended the replacement power calculations to include the years 2027-2035 (new rows 121-129), per PG&E's concern that it get post-relicensing replacement power.

5. I changed the expected implementation period to be 2006-2035 instead of 2005-2026 (see rows 130-131), per PG&E's suggestion. This change affects both "Replacement Power Costs" (new row 54) and "Increased O&M" (new row 55). The deferred start of the implementation reduces the NPV of both the replacement power costs and the O&M costs, while the longer time period increases them. The net effect is a small increase, $2 million, in the NPV of the difference between the MOU and Alt. B (cell D129 minus cell I129, versus cell D130 minus cell I130), a difference which is itself about 1/3 offset by the effect of the different implementation period on O&M cost savings (the difference is the percentage difference between cells C129 and C130, times the dollar difference between cells D55 and I55). So the net impact of changing the implementation period is only about $1.3 million in NPV terms.

6. I added note 4 (rows 89-91) which points out that if the implementation delay to 2006 affects Alt. B but not the MOU case, then the MOU case will have $3.2 million in NPV costs in 2005 for replacement power costs and O&M costs that are not accounted for elsewhere in the modeling.

7. I then set the 2004 energy price to the level which would make the "Expected Case" costs of the MOU and Alt. B be the same. This price turns out to be $57.5 per Mwh. As my previous memo indicated, the CEC believes that wind energy can be procured for well under $57 per Mwh.

I have attached the modified spreadsheet. You will find that if you change the inflation rate to 2.5% from 3% (cell A47), the breakeven energy price for replacement energy changes to $59.5/Mwh. If you change the discount rate to 7.85% the breakeven 2004 energy price changes to $52/Mwh. If you change both the inflation rate and the discount rate, the breakeven 2004 energy price changes to $53.7/Mwh. All of these prices are in the range of prices that I believe is attainable for long-term wind contracts. Please call if you have any questions.

April 23, 2004

TO: File
FROM: Stephen Wald, CHRC
SUBJECT: Battle Creek Incremental Forgone Power Under Alt B

On April 22, 2004, PG&E informed CHRC that they wanted to change their estimate of the increment of power lost going from the MOU to Alt B, from 38 annual gigawatt hours to 50 gwh, based on the Navigant power model. PG&E said the Navigant model was more accurate and more sophisticated than their prior internal calculations.

However, the original Navigant model to which PG&E referred uses average monthly hydrology that does not match current USGS data from its website[1]. Corrected, the Navigant model shows the increment of power lost under Alt B to be 33 gwh in 1989, the selected average year.[2]

Using the Battle Creek Economic Summary spreadsheet, modified as described in David Marcus's March 12 email memo to CHRC, and the following assumptions: 33 gwh power differential, 3% inflation, and 9.24% discount rate (PG&E's weighted average cost of capital), PG&E could be compensated for 30 years of forgone power under Alt B at $64.7/mwh at the same total cost to the Bay Delta Authority.[3]

PG&E has also asked the question, even if we were compensated for 30 years, what happens in year 31? The breakeven price for 50 years of forgone power, using the same assumptions above, is $59.5/mwh.

Including $3 million in private foundation funding for Alt B, the 30 and 50 year breakeven power prices would be $71.6 and $65.5 per mwh, respectively.

These values are well above the projected price of power, and within the range of public estimates of renewable power, as well: $46.25 wind (CEC 2003), $45.31 geothermal (CEC 2003), $29-67 biomass (Oregon DOE 2004).

[1] Compare the Coleman Fish Hatchery Flows tab on the original Navigant model (http://www.calhrc.org/2003-09-22 Current Restoration Project.xls - 2.5 MB) with http://nwis.waterdata.usgs.gov/nwis/monthly/?site_no=11376550&agency_cd=USGS.

[2] Corrected Navigant model, http://www.calhrc.org/2004-03-09 Current Restoration Project.xls. MOU case on tab "Tier 1", Alt B case on tab "Tier 2".

[3] http://www.calhrc.org/Battle Creek Economic Summary - 30 years. This table is shown on the following two pages, with the input assumption of $50/mwh power prices for 2004. Alt B yields $28.1 million in NPV savings over the MOU that can be applied to the increment of forgone power.

BATTLE CREEK SALMON RESTORATION ECONOMIC SUMMARY USING FERC'S CURRENT COST METHOD

		30-Oct-03					added alts Oct03	added alts Oct03	added alts Nov03
		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8
		Resume existing FERC License conditions	MOU, with cost sharing	Install screens and ladders at diversions, ...	MOU plus decommission Eagle Canyon	MOU plus decommission Eagle Canyon; w/o South Lower Ripley and Soap decommissioning	Decommission Entire Battle Creek Hydro Project	Decommission all diversion downstream of Natural Barriers	Decommission all facilities downstream of Natural Barriers
		No Action Alternative	Five Dam Removal Alternative	No Dam Removal Alternative	Six Dam Removal Alternative	Three Dam Removal Alternative	Complete Removal Alternative	Remove downstream diversions	Remove downstream diversions
ln 1	**Average Annual Energy, GWh**	257.63	183.4	190.56	137.05	159.57	0	149.73	59.3
ln 2	**Total construction costs + ln15 (USBR June '03), $millions**		$65,334	$62,443	$61,076	$63,980	$93,990	$47,697	$54,525
	One-Time and Annually Recurring Cost Descriptions ($1,000's)								
ln 3	Unrecovered Sunk Costs, or Net Book Value	$34,600	$34,600	$34,600	$34,600	$34,600	$34,600	$34,600	$34,600
ln 4	Future Capital Additions (per year)	$300	$300	$300	$300	$300	$0	$180	$150
ln 5	Operation and Maintenance (per year)	$1,700	$1,783	$1,880	$1,750	$1,947	$0	$1,360	$1,020
ln 6	Storm repairs (every 10 years)	$500	$950	$1,400	$800	$800	$0	$400	$300
ln 7	Construct Screens & Ladders, w/ connectors/byp	$0	$29,033	$47,424	$23,160	$30,135	$0	$0	$0
ln 8	One-time Screen/Ladder repairs	$0	$600	$1,200	$400	$600	$0	$0	$0
ln 9	Decommissioning costs, w/ connectors/bypass	$0	$19,145	$0	$22,897	$18,826	$70,800	$36,007	$33,335
ln 10	Envir Compliance, Montr & Mitgtn	$0	$9,690	$9,690	$9,690	$9,690	$23,190	$11,690	$21,190
ln 11	MLFT Pathogen Problem Resolution	$0	$2,329	$2,329	$2,329	$2,329	$0	$0	$0
ln 12	Future Water Acquisition	$0	$3,000	$3,000	$3,000	$3,000	$0	$0	$0
ln 13	Construction outage costs	$0	$1,259	$955	$841	$790	$0	$841	$0
ln 14	FERC License Amendment/EIS/EIR	$0	$4,750	$4,750	$4,750	$4,750	$9,500	$5,700	$5,700
ln 15	Reimbursed Foregone Power (net present value)	$0	$2,137	$0	$0	$0	$0	$0	$0
ln 16	2003 Power Benefits (per year)	$12,506	$8,903	$9,250	$6,653	$7,746	$0	$7,268	$2,879
	FERC Current Cost Method (Annual cost in 2003 dollars, $1,000's/yr)								
ln 17	Unrecovered Sunk Costs, or Net Book Value	$4,844	$4,844	$4,844	$4,844	$4,844	$4,844	$4,844	$4,844
ln 18	Future Capital Additions	$427	$427	$427	$427	$427	$0	$256	$213
ln 19	Operation and Maintenance	$1,700	$1,783	$1,880	$1,750	$1,947	$0	$1,360	$1,020
ln 20	Storm repairs	$140	$266	$392	$224	$224	$0	$112	$84
ln 21	Construct Screens & Ladders	$0	$4,065	$6,639	$3,242	$4,219	$0	$0	$0
ln 22	One-time Screen/Ladder repairs	$0	$84	$168	$56	$84	$0	$0	$0
ln 23	Decommissioning costs	$0	$2,680	$0	$3,206	$2,636	$9,912	$5,041	$4,667
ln 24	Envir Compliance, Montr & Mitgtn	$0	$1,357	$1,357	$1,357	$1,357	$3,247	$1,637	$2,967
ln 25	MLFT Pathogen Problem Resolution	$0	$326	$326	$326	$326	$0	$0	$0
ln 26	Future Water Acquisition	$0	$420	$420	$420	$420	$0	$0	$0
ln 27	Construction outage costs	$0	$122	$93	$82	$77	$0	$82	$0
ln 28	FERC License Amendment	$0	$665	$665	$665	$665	$1,330	$798	$798
ln 29	Reimbursed Foregone Power	$0	$207	$0	$0	$0	$0	$0	$0
ln 30	2003 Power Benefits	$12,506	$8,903	$9,250	$6,653	$7,746	$0	$7,268	$2,879
ln 31	**Total Cost of Project Power**	$7,111	$16,831	$17,211	$16,598	$17,225	$19,333	$14,129	$14,593
ln 32	**Going-forward Cost of Project Power**	$2,267	$11,987	$12,367	$11,754	$12,381	$14,489	$9,285	$9,749
ln 33	**Total Net benefits (including NBV)**	$5,395	-$7,928	-$7,960	-$9,946	-$9,479	-$19,333	-$6,861	-$11,714
ln 34	**Net benefits on a going-forward basis (excluding NBV)**	$10,239	-$3,084	-$3,116	-$5,102	-$4,635	-$14,489	-$2,017	-$6,870

[redacted]

3.0% Escalation rate
$50.0 2004 energy price, $/Mwh
9.24% Discount Rate

SENSITIVITY ANALYSES	Alt 2 MOU, with cost sharing	Alt 3 Install screens and ladders at diversions, ...	Alt 4 MOU plus decommission Eagle Canyon	Alt 5 MOU plus decommission Eagle Canyon; w/o South Lower Ripley and Soap decommissioning	Alt 6 Decommission Entire Battle Creek Hydro Project	Alt 7 Decommission all diversion downstream of Natural Barriers	Alt 8 Decommission all facilities downstream of Natural Barriers
	Net Present Value cost in 2004 dollars, $millions						
I. EXPECTED CASE							
Screen, Ladder, Decommissioning Costs	$67.3	$64.3	$62.9	$65.9	$96.8	$49.1	$56.2
Replacement Power Costs	$47.9	$43.3	$77.8	$63.2	$166.1	$69.6	$128
Increased O&M	$2.8	$5.7	$1.8	$4.4	($30.1)	($7.2)	($12.6)
Total	$117.9	$113.3	$142.5	$133.5	$232.8	$111.6	$171.5
II. POWER VALUE UNCERTAINTY							
A. 4 cent power values (in 2004 $)							
Screen, Ladder, Decommissioning Costs	$67.3	$64.3	$62.9	$65.9	$96.8	$49.1	$56.2
Replacement Power Costs	$38.3	$34.6	$62.2	$50.6	$132.9	$55.7	$102.3
Increased O&M	$2.8	$5.7	$1.8	$4.4	($30.1)	($7.2)	($12.6)
Total	$108.4	$104.7	$126.9	$120.9	$199.6	$97.6	$145.9
B. 6 cent power values (in 2004 $)							
Screen, Ladder, Decommissioning Costs	$67.3	$64.3	$62.9	$65.9	$96.8	$49.1	$56.2
Replacement Power Costs	$57.4	$51.9	$93.3	$75.9	$199.4	$83.5	$153.5
Increased O&M	$2.8	$5.7	$1.8	$4.4	($30.1)	($7.2)	($12.6)
Total	$127.5	$122.0	$158.0	$146.2	$266.1	$125.5	$197.0
III. CONSTRUCTION COST UNCERTAINTY							
A. Construction costs 10% less than expected							
Screen, Ladder, Decommissioning Costs	$60.6	$57.9	$56.6	$59.3	$87.1	$44.2	$50.5
Replacement Power Costs	$47.9	$43.3	$77.8	$63.2	$166.1	$69.6	$127.9
Increased O&M	$2.8	$5.7	$1.8	$4.4	($30.1)	($7.2)	($12.6)
Total	$111.2	$106.9	$136.2	$127.0	$223.2	$106.6	$165.8
B. Construction costs 25% more than expected							
Screen, Ladder, Decommissioning Costs	$84.1	$80.4	$78.6	$82.4	$121.0	$61.4	$70.2
Replacement Power Costs	$47.9	$43.3	$77.8	$63.2	$166.1	$69.6	$127.9
Increased O&M	$2.8	$5.7	$1.8	$4.4	($30.1)	($7.2)	($12.6)
Total	$134.8	$129.4	$158.2	$150.0	$257.0	$123.8	$185.5

NOTES:

1 Forced outages and routine maintanance outages would increase with the number of added screen and ladders. The replacement power costs associated with these changes are expected to be minor, but are not included in the analysis.
2 The reduced energy production due to the Salmon Restoration would most likely need to be replaced by a renewable resource. The replacement power cost for renewable electricity could be about 6.5 cents/kWh.
A scenario analysis to reflect this increased renewable replacement power cost is not included.
3 The measures to eliminate mixing of the north fork and south fork waters would reduce the operational flexibility of the hydrosystem. This loss of flexibility has not been included in the economic analysis.
4
or 68.72 gwh. At a market price in 2005 of $50/Mwh, 68.72 gwh would cost $3.44 million, which would equal $3.1 million in 2004 NPV terms. Implementing the MOU 1 year sooner than other options would also increase its costs by $0.1 million because of increased O&M costs in 2005 (difference between cells C11 and D11).

Appendix III

Methods

Hydrology

RMI/Navigant prepared a flow and economic model[1] for Battle Creek designed to use average monthly flow data from USGS gage 11376550. CHRC updated the model to reflect current monthly flow data from the USGS website[2]. CHRC further modified the model[3] to use average daily data from the same gage[4]. Navigant model flow partitions, spring inputs, and project facility flow capacities are as follows:

Based on Area Method			
	Drainage Area		
Measurement Point	**Sq. Mi.**	**Percent**	**Source**
Coleman Fish Hatchery	357.0	100.00%	USGS
Al Smith Diversion	65.0	18.21%	Estimate of N. Fork at Confluence with Deer Creek (Payne, Table 4).
Keswick Diversion	80.0	22.41%	Estimate of N. Fork above Bailey Creek (Payne, Table 4)
NBCF Diversion	133.0	37.25%	USGS
Eagle Canyon Diversion	186.0	52.10%	USGS
Wildcat Diversion	189.0	52.94%	USGS
South Diversion	66.7	18.68%	USGS
Inskip Diversion	88.3	24.73%	USGS
Coleman Diversion	102.0	28.57%	USGS
Baldwin Creek	14.0	3.92%	Estimate of Baldwin Creek at Mouth (Payne, Table 4)

Battle Creek Watershed Spring Flows		
Spring	**Flow (cfs)**	**Inflow Point**
High North Fork Springs	20.0	Above Al Smith Diversion
Upper Eagle Canyon Springs	15.0	Above Eagle Canyon Diversion
Lower Eagle Canyon Springs	0.0	Above Wildcat Diversion
Baldwin Creek Springs	15.0	Above Pacific Power Diversion
Upper Ripley Creek Springs	2.0	Into South Diversion
Lower Ripley Creek Springs	3.0	Into South Diversion
Soap Creek Springs	10.0	Into South Diversion

Flow Capacities (In cfs) of Battle Creek Project Facilities	
Powerhouses	
Volta I	128
Volta II	128
South	222
Inskip	283
Coleman	380
Diversions	
Al Smith Canal	64
Keswick Canal	64
N. Battle Feeder Canal	50
Cross-Country Canal	150
Eagle Canyon Canal	64
Wildcat Canal	18
Pacific Power Canal	15
Asbury Pipe	35
Minimum Requirement in South	0
South Canal	100
Union Canal	222
Inskip Canal	220
Upper Coleman Canal	340
Lower Coleman Canal	380

Figures S-1 to S-6. From Navigant daily data for water years 1962-2002 (1997 excepted), 10%, 30%, 50% (median), 70%, and 90% percentile flows over the 40 year record for each day.

Figures E-1 to E-6. Flow exceedence curves were produced with ranked daily flows for each reach for the noted timeframe (overall and Jun-Sep) over the period of record.

[1] http://www.calhrc.org/2003-09-22 Current Restoration Project.xls – 2.5 MB
[2] http://nwis.waterdata.usgs.gov/nwis/monthly/?site_no=11376550&agency_cd=USGS
[3] http://www.calhrc.org/Battle%20Creek%20daily.xls – 8 MB
[4] http://nwis.waterdata.usgs.gov/nwis/discharge/?site_no=11376550&agency_cd=USGS.

Temperature
Figures T-1 to T-8. Comparative SNTEMP data for Unimpaired, Alt B, and MOU was compiled from existing SNTEMP alternatives 6, 6/4 hybrid as described in the text, and 3, respectively[5]. Dashed lines are shown at Armour (1991) thresholds for egg incubation (58°F), adult holding (62°F), and juvenile rearing (66°F).

Figures C-1 to C-3. SNTEMP flow input comparison contrasts median Navigant monthly flows (derived from daily data set) with SNTEMP normal and dry flows provided by PG&E (Scott Tu). Expected range of flows indicated by braces at the median 90% and 10% percentile daily flows for Jun-Sep.

Conservative flow-based temperature correction estimate of 1°F for Alt B mainstem, June is based upon Figure C-1, which shows SNTEMP Alt B normal flow is at the 10% Navigant flow level. Navigant median Alt B June flow is closer to SNTEMP unimpaired June, which is 4-5°F cooler in Figure T-1. However, the additional Navigant Alt B flow volume is composed of both NF and SF water, whereas the flow in excess of SNTEMP Alt B in unimpaired SNTEMP is entirely NF water (from Volta), and presumably colder.

Conservative validation temperature correction estimate of 1°F for mainstem June and September (all alternatives) is based on SNTEMP Figure 7, which shows model predictions in 1999 consistently exceeded measured temperatures in the mainstem. SNTEMP Table 1[6] states that the 1999 validation study showed a mean error of 2.52°F and a probable error of ±2.16°F for the mainstem. Notes to SNTEMP Table 1 cite a lack of cloud cover data for 1999, but this did not affect the accuracy of model predictions for other stream reaches. An additional note cites a lack of accretion flow data for the mainstem, but this note's meaning and effect could not be determined.

Tables 1 and 2. River mile/temperature estimates. Unimpaired, Alt B, and MOU temperature profiles for each reach in Figures T-1 and T-4 were converted into linear equations (y=mx+b) using MS Excel LINEST function. R-squared values averaged 0.97 for June, 0.98 for September. River miles below temperature thresholds were recorded in 0.1°F increments for each alternative, with and without conservative corrections noted above[7].

Adaptive Management
Navigant estimate of acre feet purchasing power was adopted, rounded to nearest thousand. Acre feet for MOU, Alt B, and Unimpaired were calculated from converted daily cfs data for the applicable period (annual, Jun-Sep).

[5] http://www.calhrc.org/026_11-00_256.doc, http://www.calhrc.org/ProfileAlt3.xls, http://www.calhrc.org/ProfileAlt4.xls, http://www.calhrc.org/ProfileAlt6.xls.
[6] http://www.calhrc.org/026_11-00_256.xls
[7] http://www.calhrc.org/SNTEMP mileage model.xls – 2 MB.

A Comparison of the Battle Creek Five Dam Removal Alternative to the Eight Dam Removal alternative with respect to potential for salmonid restoration success.

By D. Carney
April 29, 2004

The goal of this paper is to compare the Battle Creek Salmon and Steelhead Restoration Project preferred Five Dam Removal alternative with the Eight Dam Removal alternative with respect to the risks of achieving the restoration goals and the potential for its success. Specifically, I examine the scientific literature regarding the impact of dams and their diversions on salmonid populations and the use of Instream Flow Incremental Methodology (IFIM) and Physical Habitat Simulation (PHABSIM) as a reliable model for establishing instream flows to maximize salmonid habitat.

The maintenance and artificial manipulation of three remaining dams in the Battle Creek system and the use of IFIM/PHABSIM to determine flow regimes that maximize salmon habitat are two central features and weaknesses of the Five Dam Removal alternative. The scientific literature shows that dams and their diversions are a primary cause of salmonid declines and that breaching dams is the surest way to restore degraded populations. Dams cause direct mortality to salmonids, affect migration rates and potentially spawning, as well as degrade the biodiversity of the species and induce artificial selective pressures on the genetic make-up of populations. The literature also shows that the IFIM/PHABSIM methodologies cannot model the instream needs of salmonids for many reasons, but, primarily because they cannot predict and replicate the complex interactions of a river's hydrology and ecology with which the species evolved and upon which they depend.

In contrast the Eight Dam Removal alternative offers complete ecological and hydrological restoration of the South Fork Battle Creek system through the removal of all of its dams; and a reduction of detrimental effects of dams and diversions through the removal of Wildcat, Eagle Canyon, and North Battle Creek Feeder Diversion Dams on the North Fork. This alternative will, undoubtedly, be more successful at meeting the primary objective of restoring ... "self-sustaining populations of chinook salmon and steelhead by restoring their habitat in the Battle Creek watershed..." than the Five Dam Removal alternative which relies on artificial diversions and on-going manipulation of instream flows. The Eight Dam Removal alternative also provides an extraordinary and scientifically valuable opportunity to compare salmonid restoration in the completely restored South Fork with that of the still manipulated North Fork.

Meffe (1992) calls for management of salmonid fisheries based upon a clear understanding and acceptance of their evolutionary history. The measures should work within the constraints of that history. In an indictment of humankind's belief that what technology has put asunder, technology (and enough money) can repair, he writes,

> "We know that salmonids must have both healthy riverine and marine systems to complete their life cycles. We know that free passage for adults returning upstream and juveniles migrating downstream is essential...We know that spawning site fidelity is high, and that changes in river odors may disrupt navigational abilities...These and many other life history facts are the result of thousands to millions of generations of evolutionary history and cannot be easily molded to the needs of man without seriously disrupting the system."

Impetus for the project was the continuing decline of several species of these salmonid populations that resulted in their listing under the federal Endangered Species Act and the California Endangered Species Act as endangered or threatened. A primary cause of these declines was the significant loss of habitat with the building of the Central Valley Project's Shasta-Keswick complex: 100 percent of the winter-run habitat (save for possible remnants in upper Battle Creek); 100 percent of spring-run habitat (except for some occupancy in higher elevations on several downstream tributaries); 15 percent of fall-run upriver habitat; and 90 percent of steelhead habitat (Black 1997).

Battle Creek has long been recognized as an extraordinary salmon stream because of its abundant, cold, spring-fed water that runs year-round. Historically, the quality and quantity of its salmon runs were extolled in documents from the turn of the century through the 1920's (Stone 1897, Rutter 1902, Clark 1929 *In* Thomas R. Payne & Associates 1996). Historically, all four runs were present and thriving in an intricate partitioning of habitat and forage use over time and space.

Currently all four salmon runs in Battle Creek have dwindled from historical numbers and winter and spring runs have plummeted to critically low levels (Fisher 1994, Hedrick et al. 2000). Hedrick and others (1995) cautioned that if more fish are lost from the extremely low winter runs, reestablishment of healthy runs will be even more difficult. Even more ominous to the salvage of this run are the predicted periodic high water temperatures in the Sacramento River below the Shasta dam that could be lethal to the last remnant of the winter run population. Their precipitous status makes the Battle Creek restoration particularly critical as the hedge against catastrophic loss of the winter run species (Kier Associates 1999). Consequently, with the goal to restore all four salmon populations now, the alternative with the best likelihood of success is the Eight Dam Removal because it takes an ecological restoration rather than artificial manipulation approach.

An important element vital to the long term success of the Battle Creek Restoration Project is the continued operation of Red Bluff Diversion Dam (RBDD) in its current manner. According to the U.S. Fish and Wildlife Service, (USFWS), 70% of the spring run salmon that migrate past Red Bluff are adversely affected when the RBDD gates are down and the dam is operational from mid-May to mid-September. This includes all of the spring run planned for restoration in Battle Creek. According to the RBDD Fish Passage Improvement Project Draft EIS/EIR (TCCA Aug. 2002), permanently raising the RBDD gates 12 months/year will increase spring run fish passage past the RBDD by 91%. Unfortunately, this critical restoration decision has apparently been unilaterally shelved by the Bureau of Reclamation.

Dams & Their Appurtenances

In a 1999 letter to President Clinton, over 200 scientists, mostly fisheries biologists, argued that the "surest way" to restore salmon populations was to breach dams (Lovett 1999). This solution has been echoed in many other studies (Kareiva et al. 2000, Wilson 2003) and reflects a seemingly obvious correlation between salmon population health and the natural functioning and flow of the rivers in which they evolved.

It is unequivocal, that dams and other hydro-diversions are some of the primary causes of decline of anadromous salmonids. Throughout the west, dams and hydro-power facility development have resulted in subsequent and often catastrophic declines in salmon populations (Fisher 1994, Mann and Plummer 2000, Hedrick et al. 2000, Kareiva, et al. 2000, Levin and Schiewe 2001, Wilson 2003) The crisis of the demise of salmon ranges from Southern California to Canada with 106 populations considered extinct and almost half of those remaining at risk of extinction (Levin and Schiewe 2001). In the Pacific Northwest alone, salmon populations have been extirpated from 40% of their historical habitat and hydropower development clearly has had a damaging effect (Levin and Schiewe 2001).

In California, Moyle (1994) rates the two primary causes of decline for chinook salmon to be water degradation and stream diversions by dams and canals for irrigation and other human uses. Fisher (1994) notes that California's Central Valley chinook salmon populations are a fragment of their former abundance due to water development for hydroelectric production. His data, summarizing Central Valley chinook salmon spawning stock returns from 1967-1992, show consistent declines of all runs with winter and spring runs dropping to critically low numbers. Winter runs have lost nearly all of their historic spawning grounds because of hydroelectric development, plummeting from an estimated population of more than 100,000 in the 1960's to less than 200 individuals in 1991 (Hedrick et al. 2000). They further state that probably the most significant factor to the decline of winter run chinook salmon has been the building of the Shasta Dam on the Sacramento River in the late 30's and early 40's which blocked access to traditional cool-water spawning habitat, and other water diversions which impeded juvenile and adult migration.

Dams continually disrupt salmon populations due to direct mortality and from the more complicated loss of salmon biodiversity. The natural fidelity of salmon to their home stream results in breeding populations that can have a unique genetic signature not only among streams but also within the upper and lower reaches of the same streams (Levin & Schiewe 2001). Significant genetic variation in each of the four runs of Sacramento River chinook salmon, with the winter run exhibiting the greatest genetic divergence, has been determined by Kim et al. (1999) and Banks et al. (2000). While salmon exhibit a strong genetic component reflecting local breeding populations, studies also show they react in complex ways to natural variation in the environment. As a result, human induced changes to their environment will elicit selective forces on them as well (Levin & Schiewe 2001).

Among these forces are the threats to salmon biodiversity. Forced entrainment by dams favors fish that do not migrate with the result that sedentary stocks may dominate over anadromous (Levin & Schiewe 2001). The very engineering fixes designed to protect fish may result in genetic modification. In the Columbia and Snake Rivers, a genetic shift favoring stream-type salmon may occur. Nearly 95% of stream-type salmon are steered away from dam turbines by submersible screens compared to only about 15% of ocean-type salmon who, through idiosyncrasies in their behavior, are less successfully diverted in this way (Levin & Schiewe 2001).

Artificially induced selective pressures may occur for steelhead as well. Over the past six decades the pattern of summer-run steelhead migrations in the Columbia River has changed. Historically, the summer runs were distinctly bimodal (with early and late components) but they have gradually become unimodal (Robards & Quinn 2002). Robards and Quinn (2002) suggest that the change in migration pattern reflects a response to changing temperature and flow of the river as well as the resultant proliferation of hatchery versus wild populations. Steelhead migration may have evolved to get upriver at appropriate natural flows, but now, these flow regimes have been altered by the suite of dams on the river. The coincidental timing of the onset of these changes with the completion of the Bonneville Dam, the lowest on the Columbia River, in 1938, is most likely at least partially causal.

Fish ladders, too, have the potential to impose artificial selection and alter the biodiversity of the species. Where salmon once swam against a naturally flowing current, now they must pass through a series of reservoirs and dams via artificial passageways. Discharge can disorient the fish making it hard to find the ladders which can affect migration rates, and potentially spawning, for salmon (Levin & Schiewe 2001) and steelhead (Robards & Quinn 2002).

While it is understood that the ecological problems associated with dams are widespread (Northwest Power Planning Council 1986 *In* Karieva et al. 2000) and most scientists agree that dam removal will benefit salmon (Marmorek et al. 1998), consideration over their removal has been part of a long-standing problem of weighing the benefits of dams against their costs to depleted fish populations. As part of the decision-making process regarding the potential removal of four hydroelectric dams on the lower Snake River in the Columbia River Basin, Karieva et al. (2000) tested the effectiveness of three past management actions to increase juvenile downstream migration survival rates of Snake River spring/summer (SRSS) Chinook salmon. These actions included reductions of harvest rates, engineering improvements that increased juvenile downstream migration survival rates, and the transportation of juvenile fish from the uppermost to below the lowest dam on the Columbia River. They found that past management actions have reduced in-river mortality but have not reversed population declines. They conclude that dam breaching could improve estuarine survival considerably, eliminate delayed mortality from barging fish, and may increase the physiological vigor of salmon that swim downriver thus improving survival during the estuarine phase. They suggest that dam breaching could reverse the decline of SRSS salmon.

Attempts to restore salmonid populations in the face of hydro development have engaged scientific study and technological means with sometimes massive effort and often at exorbitant expense. Scientists and managers, tasked with maintaining salmon populations, have attempted to devise methodologies and management practices to best conserve the species. These include trucking and barging salmon around dams (Lovett 1999), attempts to provide artificial flow regimes (Bovee 1982, Milhous et al. 1981, 1989), artificial propagation strategies from hatcheries (Meffe 1992, Black 1997) and transplantation, and engineered passage devices--diversions, ladders, screens and the like. All are well intentioned efforts to stave off declining salmonid populations. But our inability to understand, much less manipulate, the complex processes and interactions that make a river, render our techniques and solutions faulty. Salmon continue to decline.

Instream Flow Incremental Methodology & Physical Habitat Simulation

A widely used approach, and the approach used in the Battle Creek Restoration Project preferred Five Dam Removal alternative, to determine flow requirements from hydro developments necessary to maximize salmonid habitat is the Instream Flow Incremental Methodology (IFIM; Bovee 1982). The Five Dam Removal alternative is identified as the preferred alternative, in part because habitat for the target restoration species are maximized under that alternative according to IFIM studies. However, there are many problems with basing critical restoration decisions on IFIM results.

The IFIM is a decision-making tool that includes quantifying the incremental differences in instream habitat that result from alternative instream flow regimes, coupled with the Physical Habitat Simulation (PHABSIM; Milhous et al. 1981, 1989) to relate changes in streamflow to changes in physical habitat necessary for various life stages of salmon or other aquatic species

In a comprehensive review of the IFIM decision-making process and PHABSIM technique for quantifying incremental differences in stream habitat resulting from alternative flow regimes, Hudson et al. (2003) detail specific problems associated with all aspects of these methods. They cite an expert panel convened to consider instream flow standards which concluded that no scientifically defensible method exists for defining the instream flows needed to protect particular species of fish or aquatic ecosystems (Castleberry et al. 1996 *In* Hudson et al. 2003).

The scientifically referenced criticisms include:

1. Statistical and hydraulic methods used by the hydraulic modeling process. PHABSIM are appropriate for only steady, gradually varied, subcritical flows, conditions not met in steep streams, or during hydro-peaking flows or low flows when bedrock is exposed. The spatial and temporal complexity of real flow patterns cannot be simulated by these models. The models cannot predict the importance of boulders, root wads, debris and natural bed formations, etc. that have a vital role in the diversity of periphyton and invertebrates in a stream, the "microcluster refugia" (Briggs et al. 1997 *In* Hudson et al. 2003). Numerous other studies indicate that small features in the hydraulic environment such as velocity gradients over very small scales influence fish population dynamics. They provide as examples studies showing salmonids using a flow separation zone downstream of a boulder as a holding site with minimum tail beats necessary while only millimeters overhead flows are as high as 60-70 cm/s; and brown trout using velocity shelters as refuge areas from which to dart into fast water to feed. The upshot is that there is a major disparity between the scale at which habitat is modeled and the scale at which Habitat Suitability Curves (HSC) have been derived.
2. Sampling problems include the inability to collect habitat use data in an unbiased way or manner that is meaningful to the measurement of fish population size. The results are erroneous preference curves and HSC that cannot relate measures of physical habitat characteristics to instantaneous measure of fish population size because biological responses are slower than flow-related phenomena. Biological consequences cannot be predicted because fish population size is determined by limiting factors that may no longer be in place but were important in the past.
3. Further criticism of the HSC revolves around the necessity that all the variables be statistically independent in order to be correct, and it is known that the two key variables, depth and velocity, are related. In addition, there are no techniques that validate the results of the habitat computations. Particularly damming are citations of two studies where 70% of spawning areas used by chinook salmon were predicted to be unusable, and 87% of areas predicted as useable had never had recorded

use. Another study reported chinook spawning redds to occur in definite clusters even though suitable spawning areas were determined to be widely distributed.

4. PHABSIM does not model significant interactions between species, life stages and the other biological processes that are likely to influence fish movements, migrations, and choices of areas for foraging.
5. Groundwater exchange and its importance in spawning habitat, refugia for surface-dwelling invertebrates, and other critical biotic/abiotic linkages are rarely considered in IFIM.
6. The normal practice of setting minimum flows does not consider the necessary processes that rejuvenate the floodplain and maintain the structural characteristics of a stream through the disturbance of variable stream flows and floods that occur in naturally running streams.
7. Habitat use and preference curves collected at one narrow range of discharges may be inappropriate for assessing potential fish responses at other discharges thus limit the predictive capability of the effects of changes in streamflow on fish habitat.
8. Standard scientific practice and the official policy of the U.S. Fish and Wildlife Service require field verification of model simulations but they have not found a PHABSIM study that has been verified. As one consultant commented "Theoretically, this remarkable lapse from scientific practice is by itself grounds for dismissing the study results."

These and other flaws Hudson et al. (2003) identified for the IFIM/PHABSIM methodology present some question as to the biological relevance of instream flows that have been determined to provide the habitat necessary to restore and enhance Battle Creek chinook salmon and steelhead populations with the Five Dam Removal alternative. They also highlight, once again, the impossibility of modeling the continually changing suite of interacting biotic and abiotic factors that make a river and make it functional for sustaining aquatic species.

Conclusion

The review of existing scientific literature illuminates some of the risks inherent in the salmonid restoration of Battle Creek as it stands with the proposed Five Dam Removal alternative. There will be uncertainty as to the success of restoring salmon and steelhead populations and their habitats with any restoration plan given that humankind has so successfully altered the environment at every scale and almost every locale. But, if the objective is to preserve salmonid populations now, it stands to reason that the alternative which allows the return to the most natural ecology and hydrology of Battle Creek will have the best outcome—the Eight Dam Removal alternative.

> "...people must acknowledge that there is no clear line between sustainability and extinction for salmon, because their populations change so much over time and space. The current quest for a precise definition of how much habitat salmon need, how many can be safely harvested, or how little biological diversity needs to be preserved is not consistent with the needs of the species. For millennia the salmon have "hedged their bets" against major catastrophes, such as ice ages, continental uplifts and volcanic eruptions. They have done so by maintaining a diversity of populations and habitats—in short, they have developed a rich and varied set of genes. Salmon should be allowed to continue pursuing their survival strategy—a strategy that worked before humans arrived on the continent and, if these fish manage to survive, will work long after we are gone." - Gary Meffe

Ms. Carney is a marine and wildlife biologist and researcher who has conducted studies and projects for a variety of state, federal and private organizations.

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September 7, 2004

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Via electronic mail: mmarshall@mp.usbr.gov

Re: CHRC Comments on Chapter 3, Administrative Draft Supplemental EIS/Revised EIR

Dear Ms. Marshall:

Thank you for the opportunity to submit the attached comments on the Administrative Draft Supplemental EIS/Revised EIR of the Battle Creek Salmon and Steelhead Restoration Project, dated August 2004. If you have any questions, please contact Steve Wald at (510) 644-2900 x105 or by email at swald@calhrc.org.

Sincerely,

Laura Norlander
Director

cc: Dan Castleberry, California Bay Delta Authority
Steve Evans, Friends of the River
Richard Roos-Collins, Natural Heritage Institute

Enclosures

Battle Creek Salmon and Steelhead Restoration Project
Comments on the Administrative Draft Supplemental EIS/Revised Draft EIR
(Additional Information on Chapters 3 and 4)
August 2004

Name of individual/agency/organization providing comments: California Hydropower Reform Coalition

Chapter or Section	Page Number	Paragraph & Line(s) within Paragraph	Item/Topic	Comment
Chapter 3, Alternatives Eliminated from Further Consideration	3-2	2nd full para, lines 22-25	Eight Dam Removal Alternative (Alternative B)	"Additionally, the Eight Dam Removal Alternative does not meet an important CALFED Program objective, which requires support from a willing participant. PG&E, the owner of the Hydroelectric Project, does not support the Eight Dam Removal Alternative." While we appreciate lead agencies' willingness to undertake further analysis of the Eight Dam Removal Alternative, we disagree with their decision to eliminate it based, in part, on PG&E's unwillingness to support it. The logic that an alternative can be excluded because the permit applicant opposes it applies equally to all of the alternatives which received detailed consideration: PG&E prefers only the Proposed Action and, under the MOU, cannot be compelled to implement any of the others. This logic, however, is inconsistent with NEPA and CEQA. CEQA directs the state to "Take *all action necessary* to provide the people of this state with clean air and water, enjoyment of aesthetic, natural, scenic, and historic environmental qualities, and freedom from excessive noise." CA Pub. Resources Code § 21001; *see also* 42 U.S.C. § 4331. Nowhere in the statute is this direction qualified by the applicant's willingness to support measures or alternatives that protect the quality of the human environment, yet this is what the EIS/R argues. CEQA mandates that a proposed project not be approved if there are feasible alternatives available which would substantially lessen the

				significant environmental effects of such projects. *See* CA Pub. Resources Code § 21002. Among the factors that may be used to eliminate alternatives from detailed consideration in an EIR are: (i) failure to meet *most* of the basic project objectives, (ii) infeasibility, or (iii) inability to avoid significant environmental impacts." *See* CEQA Guidelines § 15126.6; Goleta, 52 Cal.3d at 569-70. We stand by our previous comments that the Eight Dam Removal Alternative provides the greatest environmental benefits. If PG&E is unwilling to support alternatives and other mitigation measures that minimize the environmental impacts of its project, it may withdraw its application for license.
Table 3-9	3-8		Budget table assumptions	Please provide budget assumptions including the number of years projected, discount rate, price of power for expected case, and other fundamentals. Please provide underlying calculations for planning and implementation costs, replacement power costs, and increased O&M.
	3-6	First full paragraph, lines 6-7		Table 3-9 shows the Eight Dam Removal Alternative expected cost of $116 million, not $120 million.
	3-10	2nd paragraph, lines 1-10		This paragraph purports to summarize the main points of CHRC's report, but paraphrases the agencies' 1998 Kier/Ward report. CHRC's report showed that Alt B substantially increased summer baseflows, restored interannual flow variability in summer, reduced temperatures, and reduced NF/SF mixing. It also emphasized the importance of the descending limb of the hydrograph, problems with the MOU temperature model, and concerns with fish passage at natural barriers at MOU flows.
	3-10		Discussion of habitat	This would be an appropriate place to mention and cite the CBDA peer review document and summarize its conclusions (attached for reference).
Table 3-10	3-10		Habitat and temperature	CHRC report and SNTEMP show Alt B provides significant improvement in predicted temperature regimes, as defined (from less tolerable to more tolerable): See CHRC (2004) Tables 1 and 2, and discussion on page 9: 3-7 more miles optimal thermal habitat, 7-9 more miles marginal habitat than MOU. CHRC report also argued that SNTEMP modeling errors may significantly underestimate the habitat potential of the mainstem, particularly under unimpaired and Alt B flow conditions. See CHRC (2004) pp. 7-9.
Table 3-10	3-11		Hydrology	The draft text is very misleading in that Alt B summer baseflows are

				approximately double the MOU flows in both forks and the mainstem. In addition, Alt B restores interannual flow variability and extends the descending limb of the hydrograph 30 to 60 days – a critical hydrologic feature for anadromous fish.
Table 3-10	3-11		Fish Passage	Given the record, including the TRPA barriers study and USFWS monitoring of interim flows, it is misleading to state in isolation "some areas of Battle Creek that are not barriers at lower flows may act as natural fish barriers at higher flows." If the forks of Battle Creek supported a fishery in their historic condition, fish consistently navigated much higher flows.
	3-12		Replacement power cost	Please cite CPUC proceeding dealing with renewable power, expected schedule for definitive information, and any preliminary, public information available as to price of replacement renewable power.
	3-13		Preferred Voluntary FERC License Amendment Option	See comments above for p. 3-3.
	3-14		Solution principles – reduce conflicts	Text incorrectly states that the eight dam alternative would allocate water to one beneficial use, whereas the Battle Creek project would still produce significant power under Alt B. The Battle Creek project is expected to help recover listed salmonids in the Sacramento River basin. If the MOU project achieves this purpose to a lesser extent than Alt B, then choosing MOU over Alt B for approximately 30 GWH/year *increases* conflicts in the system – between power and other uses of water affected by ESA regulations.
	3-14		Solutions principles – be durable	The text unreasonably assumes Alt B would not include dedication of water rights – a unrealistic assumption. This paragraph turns the key advantage of Alt B over the MOU on its head. It is the MOU, not Alt B, that requires a continuing investment by PG&E ratepayers for operation, maintenance, and eventual replacement of costly screens and ladders for the project benefits to continue.
	3-15		Solution principles – no redirected impacts	The MOU project reduces power production by 30%. Under California law, this power must be replaced by renewable power. Any redirected impact from Alt B replacement power also applies to the replacement of lost MOU power. There is no evidence offered to support the contention that replacing MOU lost power has no impact, but replacing the Alt B increment would harm birds.
	3-15		Solution principles – conclusion	See comments above for p. 3-3.

Comment Letter NGO22—Friends of the River, Friends of the River (April 29, 2005)

Response to Comment NGO22-1

Friends of the River's support for restoration of Chinook salmon and steelhead populations in Battle Creek is appreciated. This comment generally states the belief of Friends of the River that the Proposed Action is too costly to implement and the prospects for restoration success are too uncertain. This comment is presented in detail in subsequent comments presented in this letter and responses are addressed under those comments. Reclamation and the State Water Board understand Friends of the River's position regarding the Proposed Action and will consider this comment as part of the decision-making process for the Restoration Project.

Response to Comment NGO22-2

The EIS/EIR action alternatives are not compared to water development projects, including those cited in this comment, because the Restoration Project is not a water development project. Consequently, there is no basis for comparing impacts of unrelated water development projects on salmon and steelhead to the benefits of the restoration activities proposed under the action alternatives, which are designed specifically to reverse the past effects of water development projects on salmon and steelhead. Furthermore, these projects are located outside of the geographic scope of the Restoration Project and have no effect on the ability to restore habitat in Battle Creek.

> The lead agencies disagree with statements regarding management of Restoration Project planning. The lead agencies acknowledge that estimated costs for implementing the Restoration Project have increased since cost estimates were initially prepared in 1999. Reasons for the increases in project costs are described in detail in the proposal requesting additional funds for the Restoration Project, which was submitted to the CALFED ERP in March 2005 by Reclamation, on behalf of the PMT.

Following is a summary of the main reasons for the increased costs:

- provisions within the MOU, and pursuant to the MOU stipulating certain design requirements;
- the extent of new site data collection necessary to adequately address design and environmental compliance requirements, and the development of additional associated plans, specifications, and documentation;
- incorporation of CALFED ERP Independent TRP recommendations into project plans, specifications and documents; and

- a significant increase in building material costs.

The Restoration Project is in full compliance with NEPA and CEQA requirements. Potential environmental impacts of the Restoration Project were identified based on the best information available in the Draft EIS/EIR in accordance with NEPA and CEQA. Public comments received on the Draft EIS/EIR identified additional potential impacts. Consequently, a Draft SEIS/REIR was prepared that addressed the potential new impacts and released for public review.

Response to Comment NGO22-3

The lead agencies disagree with the assertion that the agencies signatory to the MOU (MOU agencies) claim that the MOU excludes the adoption of any alternative other than the Proposed Action. The MOU specifically states in Section 5.3 of the MOU (EIS/R Appendix A) that:

> The Parties anticipate that activities described in this MOU will be identified in an NEPA/CEQA document as an alternative, but also acknowledge that other alternatives will be considered in the NEPA/CEQA process prior to the time that a final decision or an irreversible commitment of resources or funds is made toward any one alternative.

In addition, the EIS/EIR evaluated three other action alternatives and a No Action Alternative in an equal level of detail and, based on that analysis, identified the Proposed Action as best in achieving the Restoration Project objectives (see EIS/EIR Chapter 2, Volume I). Further, as indicated in the meeting summary prepared for the Restoration Project's March 15, 2004, public meeting (Reclamation and State Water Board 2004), the MOU agencies identified reasons for their support of the Proposed Action, none of which was that the MOU precludes adoption of any other alternative.

This comment further states the commentor's perception that the MOU precludes consideration of alternatives other than the Proposed Action and that the lead agencies have thus restricted the public's ability to meaningfully participate in the environmental review process. The public has been afforded numerous opportunities to participate in the Restoration Project planning and environmental review processes. Public forums have included a public meeting and solicitation of written comments as part project scoping process, monthly Restoration Project team–related meetings that were open to public participation, and public review of the Draft EIS/EIR and Draft SEIS/REIR. Based on subsequent comments in this letter, the concern over the inability to have meaningful public participation appears to be directed toward the lead agencies' consideration of the Eight Dam Alternative. As indicated in Master Response B and by the numerous analyses of the Eight Dam Alternative undertaken at the request of CBDA (Reclamation and State Water Board 2004; California Department of Fish and Game 2004; California Hydropower Reform Coalition 2004; California Bay-Delta Authority 2004), a substantial amount of resources was directed toward investigating the feasibility of this alternative. Additionally, the EIS/EIR evaluated the No Dam Removal, Six Dam Removal, and Three Dam Removal alternatives in an equal level of detail as is required by NEPA. Please also see Master Response B in Chapter 2, Volume III of this Final EIS/EIR.

Response to Comment NGO22-4

This comment identifies the commentor's assessment of the relative attributes of the Eight Dam Removal Alternative compared to the Proposed Action. These attributes, however, are not placed in the context of NEPA and CEQA requirements for evaluating alternatives based on meeting the purpose and need and objectives of the Restoration Project (Chapter 2 in Volume I of this Final EIS/EIR), which include minimizing the loss of clean and renewable energy production by the Hydroelectric Project. The lead agencies have determined that the Five Dam Alternative best meets the purpose and need of the Restoration Project among the action alternatives. The reasons for not including the Eight Dam Removal Alternative as an action alternative are presented under the section titled Alternatives Eliminated from Further Consideration, Eight Dam Removal Alternative, in Chapter 3, Volume I of this Final EIS/EIR and include:

- Incremental habitat benefits of the Eight Dam Removal Alternative would be only marginally better compared to the Five Dam Removal Alternative.
- The cost of replacement energy for the Eight Dam Removal Alternative would be excessive.
- The Five Dam Removal Alternative better achieves a key project objective of minimizing the loss of clean and renewable energy produced by the Hydroelectric Project.
- The Eight Dam Removal Alternative lacks support of a willing participant, as required by the CALFED Program objectives.

The reasons listed above are supported by findings presented in the Restoration Project's March 15, 2004, meeting summary (Reclamation and State Water Board 2004) and in *Further Biological Analyses for Information Presented at the Public Meeting Held in Red Bluff, California, on March 15, 2004, Regarding the Differences between the Five Dam Removal Alternative and the Eight Dam Removal Alternative* prepared by DFG (California Department of Fish and Game 2004). The resource agencies charged with responsibility for management of salmon and steelhead concur with these findings (U.S. Fish and Wildlife Service 2004). In addition, CBDA conducted an independent scientific review of the DFG document (California Department of Fish and Game 2004) and the analysis of the two alternatives cited in this comment conducted by the California Hydropower Reform Coalition (California Hydropower Reform Coalition 2004). The findings of this review (California Bay-Delta Authority 2004) support the position that additional benefits for salmon and steelhead restoration afforded with implementation of the Eight Dam Removal Alternative would be minor. See also Master Response B.

Response to Comment NGO22-5

The statement on page 3-11 of the Draft SEIS/REIR cited in this comment is based on the expected costs of implementing the Restoration Project. These costs have since been updated and are included in Tables 3-8 and 3-9 in Chapter 3, Volume I of this Final EIS/EIR. The updated tables show that the estimated cost as well as the range of costs for the Five Dam Removal Alternative are less than that estimated for the Eight Dam Removal Alternative. The lead agencies acknowledge that disagreement may exist among experts regarding the merits of various alternatives. The Final EIS/EIR is intended to disclose all sides of the project alternatives to ensure that these issues have been considered prior to a decision on the Restoration Project.

Response to Comment NGO22-6

One of the purposes of the Restoration Project is to restore salmon and steelhead habitat along Battle Creek, thus facilitating the establishment of self-sustaining populations in Battle Creek. The ability to restore salmon and steelhead habitat conditions along Battle Creek is independent of the outcome of the policy issues cited in this comment. For example, although the number of salmon and steelhead that may pass through the Red Bluff Diversion Dam may be affected by how the dam is operated, habitat will still be restored and provided for the fish that enter Battle Creek. NEPA and CEQA require disclosure of the impacts of the project. Potential impacts of implementing the project on the environment, including salmon and steelhead, are identified in Chapter 4 of the EIS/EIR. Although not required under NEPA/CEQA, the EIS/EIR also identifies beneficial impacts of the action alternatives on salmon and steelhead. These beneficial impacts are characterized on the basis of how improvement in habitat conditions will likely affect salmon and steelhead that enter Battle Creek. Although the numbers of fish that enter Battle Creek could be affected by such outside factors as the policy issues cited in this comment, the assessment of beneficial impacts is predicated on changes in habitat conditions.

Response to Comment NGO22-7

Please refer to responses to Comments NGO22-1, NGO22-3, NGO22-4, and NGO22-5 regarding the commentor's opinion that removal of all diversion dams on Battle Creek should be selected for the Restoration Project. Additionally, please see Master Response B in Chapter 2, Volume III of this Final EIS/EIR.

PACIFIC COAST FEDERATION of FISHERMEN'S ASSOCIATIONS

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29 April 2005

Ms. Mary Marshall
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Mr. Jim Canaday
State Water Resources Control Board
1001 "I" Street
Sacramento, CA 95814

RE: Comments on Battle Creek Restoration Project SEIS/REIR

Dear Ms. Marshall and Mr. Canaday:

As you may know, the Pacific Coast Federation of Fishermen's Associations was a prime instigator of what has become the Bureau of Reclamation's Battle Creek Restoration Project.
As conceived by the PCFFA's past president and habitat restoration coordinator, the late Nat Bingham; the then-manager of the Central Valley Project Water Association, Jason Peltier; and Metropolitan Water District of Southern California's Steve Hirsch, the project would include the decommissioning of Eagle Canyon Dam in order to optimize access by winter run chinook salmon to the prime habitat potential above that dam. **NGO23-1**

The Bureau of Reclamation's preferred alternative, the "MOU Alternative", does not achieve the principal intended purpose – the decommissioning of Eagle Canyon Dam – for which this project was undertaken. The Bureau of Reclamation's MOU alternative stops well short of optimizing conditions in the Battle Creek watershed for the recovery of winter run chinook salmon – the principal species for which the project was undertaken. Seventy percent of the potential winter run chinook salmon habitat lies above Eagle Canyon Dam. **NGO23-2**

In short, under the Bureau of Reclamation's management these past six years – since the project was handed off to the agencies by the Battle Creek Working Group initiated by Messrs Bingham, Peltier, and Hirsch – the projected costs have increased relentlessly while the potential benefits have diminished steadily. What started out as a $26 million project to restore winter run chinook salmon habitat within a two-year construction project period has become a $72 million project that will doubtless go to $100 million, stretched over a ten year period, for which the principal purpose appears to have been largely lost. **NGO23-3**

The California Hydropower Reform Coalition's 2004 review of the project demonstrated that the removal of eight Battle Creek dams, including Eagle Canyon, rather than the MOU Alternative's five-dam removal effort, would not only cost less than your preferred alternative, but that its **NGO23-4**

Ms. Mary Marshall
Mr. Jim Canady
29 April 2005
Page Two

benefits to fisheries restoration would be far greater. For the Bureau to reject such project analysis and to struggle, as it has in the subject SEIS/REIR, to misrepresent the CHRC's findings makes a mockery of the NEPA/CEQA review process. **NGO23-4 cont**

PG&E made clear mid-way through its negotiations with the agencies in 1999 that it did not want to lose Eagle Canyon Dam. The agencies subsequently entered into a MOU with PG&E that gave equal weight to retaining hydropower production and restoring habitat for winter run chinook salmon.

That was not the intent of the original Battle Creek Working Group partners – <u>including</u> PG&E. The original intent of the Working Group and of the Restoration Project was to optimize habitat opportunities for winter run chinook salmon recovery and then to work out the cost responsibilities between PG&E and the public for doing so. The early indications were that the decommissioning of Eagle Canyon Dam was affordable in view of PG&E's substantial environmental liabilities and the substantial benefit to winter run chinook salmon of removing Eagle Canyon Dam. **NGO23-5**

The MOU Alternative is <u>not</u> the preferred alternative and it comports with neither the letter nor the spirit of the National Environmental Policy Act, California Environmental Quality Act, State and federal clean water acts. The preferred alternative – PG&E's obstreperous position on Eagle Canyon Dam notwithstanding – is <u>clearly</u> that eight dam alternative which was fully analyzed and recommended to you by the CHRP in its 2004 report. **NGO23-6**

Sincerely,

W.F. "Zeke" Grader
Executive Director

Comment Letter NGO23—Pacific Coast Federation of Fishermen’s Associations, W.F. “Zeke” Grader, Jr., Executive Director (April 29, 2005)

Response to Comment NGO23-1

In December 1998, the Four Agencies (Reclamation, NOAA Fisheries, USFWS, and DFG) presented a proposal to PG&E that included removal of Eagle Canyon Diversion Dam. PG&E, as the necessary willing project participant, rejected the original proposal because it would have resulted in too great a loss for the Hydroelectric Project. Subsequently, the Four Agencies through a collaborative process that included negotiations with PG&E, decided that restoration of Battle Creek could be viably achieved only if the project were to incorporate considerations for minimizing effects on hydroelectric power production levels. This included a process whereby the Four Agencies presented several proposals to PG&E, and PG&E presented several counterproposals to the Four Agencies, during confidential negotiations.

The first official document presenting decisions made on the Restoration Project, the Agreement in Principle (signed by Reclamation, NOAA Fisheries, USFWS, DFG, and PG&E), did not include the removal of Eagle Canyon Diversion Dam. This document was attached to the 1999 MOU (signed by the same parties) and is available in Appendix A, Volume III of this Final EIS/EIR. See also Master Response B.

Response to Comment NGO23-2

The purpose of the Restoration Project is not to decommission Eagle Canyon Dam. As described under the Purpose and Need in Chapter 2 in Volume I of this Final EIS/EIR, the purpose of the Restoration Project is to:

> … restore approximately 42 miles of habitat in Battle Creek and an additional 6 miles of habitat in its tributaries while minimizing the loss of clean and renewable energy produced by the Hydroelectric Project.

Although the purpose of the Restoration Project is not to decommission Eagle Canyon Dam, the lead agencies recognize that such decommissioning is one action that could contribute to achieving the purpose and included this action as part of the Six Dam Removal Alternative.

The resource agencies responsible for salmon and steelhead have analyzed the potential benefits of the Proposed Action and the Eight Dam Removal Alternative. Results of that analysis (Reclamation and State Water Board 2004; DFG 2004) indicate the Eight Dam Removal Alternative would likely provide slightly more benefits for Chinook salmon and steelhead than the Proposed Action. As described under the section titled, Alternatives Eliminated from Further Consideration, Eight Dam Removal Alternative, in Chapter 3, Volume I of this Final EIS/EIR (see also Master Response B in Chapter 2, Volume III of this report), the Eight Dam Alternative was not considered further as an action alternative because it does not meet the project objective of minimizing effects on energy production and lacks the support of a willing participant.

Response to Comment NGO23-3

The lead agencies acknowledge that estimated costs of implementing the Restoration Project have increased since cost estimates were initially prepared in 1999. Reasons for the increases in project costs are described in detail in the proposal requesting additional funds for the Restoration Project, which was submitted to CALFED ERP Subcommittee in March 2005 by Reclamation, on behalf of the PMT.

The following summarizes the main reasons for the increased costs:

- provisions within he MOU, and pursuant to the MOU stipulating certain design requirements;
- the extent of new site data collection necessary to adequately address design and environmental compliance requirements, and the development of additional associated plans, specifications, and documentation;
- incorporation of CALFED Ecosystem Restoration Program Independent TRP recommendations into project plans, specifications and documents; and
- a significant increase in building material costs.

Response to Comment NGO23-4

As indicated in Master Response B, information presented in the SEIS/REIR, and substantial analyses of the Eight Dam Removal Alternative (Reclamation and State Water Board 2004; DFG 2004; CHRC 2004; CBDA 2004) were directed toward investigating the feasibility of this alternative. The state and federal resource agencies charged with management of salmon and steelhead have concluded that implementation of the Eight Dam Removal Alternative would likely provide marginally greater, not substantially greater, benefits for these species than the Proposed Action. Additionally, the Eight Dam Removal Alternative does not meet the co-purpose of the Restoration Project, which is to minimize the loss of hydroelectric generation. The reasons for not including the Eight Dam Removal Alternative as an action alternative are presented under the section titled Alternatives Eliminated from Further Consideration, Eight Dam Removal Alternative, in Chapter 3, Volume I of this Final EIS/EIR (see also Master Response B), and include:

- Incremental habitat benefits of the Eight Dam Removal Alternative would be only marginally better compared to the Five Dam Removal Alternative.
- The cost of replacement energy for the Eight Dam Removal Alternative would be excessive.
- The Five Dam Removal Alternative better achieves a key project objective of minimizing the loss of clean and renewable energy produced by the Hydroelectric Project.
- The Eight Dam Removal Alternative lacks support of a willing participant, as required by the CALFED Program objectives.

Response to Comment NGO23-5

Please see the response to Comment NGO23-1. As described in Chapter 2, Volume II of this Final EIS/EIR, the purpose of the Restoration Project is to (1) restore salmon and steelhead habitat in Battle Creek while (2) minimizing reductions in energy production. Accordingly, the EIS/EIR evaluated the relative suitability of each of the alternatives for achieving both of these objectives.

Response to Comment NGO23-6

The Restoration Project EIS/EIR is in compliance with the process and content requirements of NEPA and CEQA. The lead agencies are charged with selecting a preferred alternative based on the ability of an alternative to feasibly achieve the project objectives; with analyzing a reasonable range of feasible alternatives, not all possible alternatives; and providing an explanation of why alternatives are not considered for detailed analysis in the EIS/EIR. See also the response to Comment NGO23-4 and Master Response B for an explanation of why the Eight Dam Removal Alternative was not considered for detailed analysis in the EIS/EIR.

The lead agencies are complying with Sections 404 and 401 of the CWA in a process parallel to the NEPA/CEQA process. The *Preliminary Delineation of Waters of the United States* was submitted to the Corps in March 2005. The lead agencies are currently preparing an application under Section 404 to obtain a permit from the Corps for activities that involve placement of dredged or fill material into waters of the United States. Additionally, the lead agencies are coordinating with the State Water Board to obtain a water quality certification under Section 401 for the Restoration Project.

NGO24

From: Risdon, Angela [ACR1@pge.com]
Sent: Friday, April 29, 2005 11:54 AM
To: Mary Marshall
Cc: Colleen Lingappaiah
Subject: Written comments on Draft SEIS/REIR

Mary:

Attached are PG&E's comments on the Draft SEIS/REIR.

Angela Risdon
Pacific Gas and Electric Company
acr1@pge.com
415-973-6915
<<SEIS-REIR PG&E 42905 comments.doc>>

Battle Creek Salmon and Steelhead Restoration Project
Comments on the Draft Supplemental EIS/Revised Draft EIR
February 2005

Name of individual providing comments: Pacific Gas and Electric Company

Chapter or Section	Page Number	Paragraph & Line(s) within Paragraph[a]	Item/Topic	Comment	
ES		Table ES-5, page 2 of 10	Mitigation for Six Dam Removal Alternative	Delete "Jeffcoat from the mitigation measure. Mitigation at the Jeffcoat mitigation site is not required due to the decommissioning of Eagle Canyon Canal	NGO24-1
ES		Table ES-5, page 2 of 10	Mitigation for Three Dam Removal Alternative	Delete "Jeffcoat from the mitigation measure. Mitigation at the Jeffcoat mitigation site is not required due to the decommissioning of Eagle Canyon Canal	NGO24-2
3	3-4		Asbury Pump Station and Diversion	Need to modify this section to include facility modification to prevent fish passage.	NGO24-3
3	3-7	Para.1, Line 1	Eight Dam Removal Alternative	Suggest revising the sentence to indicate that an "independent consultant model verified the percentages for power production losses for the eight and 5 dam removal alternatives. See para. 1 on page 3-15 where it states that Navigant determined these losses. As written, it looks like just PG&E developed the numbers, when in fact an consultant's model and the entire cost review team confirmed these numbers	NGO24-4
3	3-7	Para. 2, last sentence	Eight Dam Removal Alternative	Angela—suggest inserting the following at the end of the last sentence "due to the higher power production losses and the insignificant increase in habitat benefits"	NGO24-5
3	3-11	Para. 1, line 11	Cost Review of Alternatives	Insert the word "updated" in front of implementation costs.	NGO24-6
4.2 and ES	4-30	Para. 3, numbered items Also see Table ES-5, 3 of 10	Mitigation Measures for Impact 4.2-6	In addition to the measures listed, the following also deserve consideration: • Installation of an exclusion barrier (4ft tall silt fencing or similar) surrounding work sites near potential aquatic habitat to deter CRLF from entering into physical work area. The devise needs to be all	NGO24-7

Chapter or Section	Page Number	Paragraph & Line(s) within Paragraph[a]	Item/Topic	Comment	
				encompassing and maintained throughout construction (surround entire active work area and closed nightly). • Restrict construction to daylight hours • Work sites within 500 ft of breeding /aquatic habitat should have 150 ft buffer area inspected daily by monitor/biologist. • Existing measure #5 should include any and all vehicles/equipment. Also, check beneath vehicles/equipment left on-site overnight for frogs • On-site biologist/monitor during construction at sites with high potential for CRLF occurrence. • Application of appropriate erosion, sediment, hazardous materials management, and material stockpiling best management practices (BMPs) at all sites near aquatic habitat where there is potential to impact water quality.	NGO24-7 cont
7	7-18 through 7-20	Section	Environmentally Preferred Alternative	PG&E disagrees that the environmentally preferred alternative is the Six-Dam Alternative. This section should be revised based on the revised section 4.16.	NGO24-8
7		Table 7.1. page 2 of 10	Six Dam Removal Alternative-Recommended Mitigation Measure	Delete "Jeffcoat from the mitigation measure. Mitigation at the Jeffcoat mitigation site is not required due to the decommissioning of Eagle Canyon Canal.	NGO24-9
7		Table 7.1. page 2 of 10	Three Dam Removal Alternative-Recommended Mitigation Measure	Delete "Jeffcoat from the mitigation measure. Mitigation at the Jeffcoat mitigation site is not required due to the decommissioning of Eagle Canyon Canal.	NGO24-10

Comment Letter NGO24—Pacific Gas and Electric Company, Angela Risdon, License Coordinator (April 29, 2005)

Response to Comment NGO24-1

The mitigation measure as described in Table ES-5 has been updated so as not to include a reference to the mitigation proposed at MLTF's Jeffcoat site.

Response to Comment NGO24-2

The mitigation measure for Impact 4.1-65, "Increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with MLTF and Darrah Springs State Fish Hatchery fish," as described in Table ES-5 has been updated. Because Eagle Canyon Diversion Dam would be removed under the Three Dam Removal Alternative, there would be no need to implement mitigation at the Jeffcoat site.

Response to Comment NGO24-3

The facility modifications at Asbury Diversion Dam are not part of the Restoration Project, but rather are part of the mitigation measure to address the impact on fisheries that could occur as a result of increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with Darrah Springs State Fish Hatchery fish. For this reason, the facility modifications are presented as part of the mitigation measure to address this impact. This information is presented in Section 4.1 under Impact 4.1-8.

Response to Comment NGO24-4

The text in Chapter 3 under the Eight Dam Removal Alternative (Alternative B) has been updated to clarify that a model developed by an independent consultant was used to calculate the percentage of energy loss under the Five Dam and Eight Dam Removal Alternatives.

Response to Comment NGO24-5

The text has been added to the Eight Dam Removal Alternative discussion under Alternatives Eliminated from Further Consideration in Chapter 3 in Volume I of this Final EIS/EIR under the section Eight Dam Removal Alternative (Alternative B) as requested.

Response to Comment NGO24-6

The text has been added to the Eight Dam Removal Alternative discussion under Alternatives Eliminated from Further Consideration in Chapter 3 in Volume I of this Final EIS/EIR under the section Eight Dam Removal Alternative (Alternative B) as requested.

Response to Comment NGO24-7

The additional mitigation measures listed in Comment NGO24-7 have been added to the Mitigation Measure for Impact 4.2-6, "Potential disturbance to California red-legged frogs and their habitat."

Response to Comment NGO24-8

The comment is noted. Because CEQA does not consider impacts on the non-physical environment, the loss of hydropower was not considered when determining the Environmentally Preferred Alternative. Under NEPA, the federal lead agency is not obligated to select the environmentally preferred alternative as the Proposed Action but must identify it in the ROD and should, if possible, identify it in the final EIS. Similarly, CEQA does not require the state lead agency to select the environmentally superior alternative as the Proposed Action in its EIR, as long as the significant impacts of the Proposed Action are otherwise avoided or mitigated without implementation of the environmentally superior alternative.

Response to Comment NGO24-9

The Mitigation Measure for Impact 4.1-45, "Increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with MLTF and Darrah Springs State Fish Hatchery fish," as described in Table 7-1 has been updated. Because Eagle Canyon Diversion Dam would be removed under the Six Dam Removal Alternative, there would be no need to implement mitigation at the Jeffcoat site.

Response to Comment NGO24-10

The mitigation measure for Impact 4.1-65, "Increased risk of a serious or catastrophic fish disease spreading from Battle Creek to fish communities throughout the state through stocking with MLTF and Darrah Springs State Fish Hatchery fish," as described in Table 7-1 has been updated. Because Eagle Canyon Diversion Dam would be removed under the Three Dam Removal Alternative, there would be no need to implement mitigation at the Jeffcoat site.

DHC
5-20-05

Kerry L. Burke
40652 Highway 36 East
Mill Creek, CA 96061

May 18, 2005

Ms. Mary Marshall
Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825

Mr. Jim Canaday
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Subject: Revised comments on the Draft Supplemental Environmental Impact Statement/Environmental Impact Report for the Battle Creek Salmon and Steelhead Restoration Project

Dear Ms. Marshall and Mr. Canaday,

It has come to my attention that I inadvertently omitted some language in my comments of April 28, 2005. I would appreciate if you could include the comments listed below in the Final EIS/EIR documents. I apologize for any inconvenience that this omission has caused you.

The additional language would be inserted after the following paragraph that is located on page 2 of my April 28, 2005 letter.

"We have previously pointed out in our letter of August 5, 2004 the necessity under CEQA and NEPA of tracing economic consequences to see if significant environmental impacts or physical changes will occur which are significant. We provided some of the legal authority for that process. In each of the instances above where we describe the "business losses" or "economic losses" to Oasis Spring Lodge and or Rocky Spring Ranch as we did during the drafting of the Supplement we were attempting to educate the SWRCB and Bureau of Reclamation that the idea that "we will simply pay money for damages and interference done to these properties" is not the purpose of CEQA and NEPA and not compliance with those acts. The purpose of the acts is to identify the significant impacts arising through the chain of economic and social changes and then attempt to identify mitigation measures and if there are no mitigation measures, adopt in the case of CEQA a determination of overriding considerations." NGO 25-1

New Language for Page 3 of letter:

"What is most interesting about this Supplement (and one of the most deficient elements) is that the Supplement fails to allow the decision maker (the SWRCB, the Bureau of Reclamation and other responsible agencies under California law and Federal Law) to in one document identify the significant impacts to the environment arising from "business losses" or "economic damages" and attempt to determine if perhaps aspects of the Project should be deleted or changed or are capable of mitigation. NGO 25-2

The Socioeconomic Section pages 4-54-60 attempts to end the analysis by simply talking about whether revenue losses would be short term or long term. The difficulty is that the economic effects translate into environmental impacts that are significant. If recreational fishing use of this stretch of the stream is ended permanently as a trout fishery, where will recreational trout fishery uses be replaced or will they go unfulfilled? What is the quantification of that use and where are the areas where that recreational use could be replaced? Will trout fishing in other areas be sufficient or are we as part of this project eliminating forever trout fishing for a certain number of users in favor of creating a streambed hatchery for anadromous fish? If so what number of fish can we expect to gain and does that translate into recreational fishing opportunities for anyone or is it simply for the purpose of doing it? If recreational use of streams is to be sacrificed for this project, the decision-makers need to have a means of quantification of the sacrifice and environmental impact. NGO 25-3

By the use of the phrase "business losses" or "economic impacts" the authors attempt to avoid examining the causal chain and to infer that these impacts end with the dollar. Fishing use is done by persons. There are persons who live for trout fishing and their quality of life depends on it. This project may well end trout fishing forever in this stretch of the stream both because of the environmental changes and regulatory changes and all uses of the Oasis Spring Lodge. What the environmental gains to offset those impacts are cannot be divined from this document in terms of recreational use. The means of mitigation are also ignored. In a true and correct CEQA/NEPA process the fishing days would be estimated "before" and "after" and means of mitigation of the reduction in those "recreation day use" figures would be quantified, including suggesting ways in which the recreational experience would be replaced temporarily and permanently at other locations or in this location. NGO 25-4

The authors' prejudice in approaching the project alternatives is more than apparent. It is one of: " Forget what the law requires in regard of CEQA/ NEPA analysis and informing the decision makers of impacts and alternative mitigation measures and quantifying the significant impacts from alternatives, we'll pay whatever it costs." There is a mitigation plan that would maximize recreational use of this stretch of the stream and reduce project impacts while balancing elements of the Preferred Project Alternatives, but the authors only mitigation measure and plan is to notify" as soon as possible and prior to construction activities of the anticipated start date, its duration and type of construction activities." (4.16-6) and keep the dust and noise down. (4.16-11) This is not an examination of significant impacts and alternative mitigation measures and quantification of their effectiveness as required by NEPA/CEQA. NGO 25-5

The authors further have not done sufficient planning and design to determine the approximate physical impacts. The temperature of the water in the South Fork in the area fished for trout currently will be warmer as a result of removal of North Fork Water. However no approximation of that warming and its effect on fishery spawning or habitat is given for any particular periods of time. Further, the sedimentation from the massive cuts and excavations involved in the road construction and parking lot on the North Bank across from the Oasis Springs Lodge and its effect upon the South Fork water quality and therefore fish resources is not given. These soils are highly erodible and located on a steep slope. Without the construction details and estimates of the quantities or surfaces to be disturbed and specification of the soil and sedimentation measures, a conclusion that mitigation measures to reduce sedimentation will render the effect minimal is simply a guess. As Block vs. California 18 FRC 1149(1982) 40 CFR 1508.27(b) and California cases such as County of Inyo v City of Los Angeles (3d Dist 1977) 71 Cal App 3d 185 emphasize, sufficient detail about the construction and plan of works must exist to permit a realistic as opposed to a general analysis of impacts. Here because of budget constraints, the Supplemental EIS/EIR assumes that helping anadromous fish trumps any need to understand and balance NGO 25-6 the impacts of implementing the plan and of getting sufficient detail about the project features into the analysis. That is not a correct understanding of the CEQA/NEPA process."

End of language to be inserted.

If you wish, I can insert the new language into the previous document of April 28, 2005 and send both of you the revised document. Please let me know what is the best approach for your review. If you have any questions regarding this request or the comments, please contact me at 530-595-4470 or via e-mail at BurkeLandUse@aol.com. Thank you for your help in this matter.

Respectfully submitted:

Kerry L. Burke

Cc: Outfitters Properties
L. Johnson, P. O. Box 435, Manton, CA 96059
Paul Minasian,
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P. O. Box 1679, Oroville, CA 95965
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The Chickering Company
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Comment Letter NGO25—Outfitters Properties, Kerry L. Burke (May 18, 2005)

Although the public comment period ended on April 29, 2005, Reclamation and the State Water Board agreed to address the comments provided by Ms. Burke with Outfitter Properties because these comments are directly related to the comments provided by Outfitter Properties on April 28, 2005 (see NGO21 above) on the Draft Supplemental EIS/Revised EIR.

Response to Comment NGO25-1

Please see the response to Comment NGO21-8.

Response to Comment NGO25-2

Please see the response to Comment NGO15-4.

Response to Comment NGO25-3

As indicated in the response to Comment NGO21-186, while the trout-stocking program conducted by the Oasis Springs Lodge clearly provides a recreational resource, the annual stocking of 400 sterile, trophy-sized trout does not produce a viable natural population and is not considered a biological resource. The recreation-related effects of the Proposed Action and alternatives are described in Section 4.14 of this Final EIS/EIR. The socioeconomic effects of the Proposed Action are described in Section 4.16.

Impact 4.14-5 has been added to Section 4.14, Recreation, Volume I of this Final EIS/EIR to address the potential long-term loss of recreational fishery at Oasis Springs Lodge. Impact 4.14-5 states that all agreements that currently allow the artificial stocking of trout in South Fork Battle Creek will be terminated regardless of whether the Proposed Action (or a project alternative) is implemented. Because the existing FERC license requires PG&E to operate and maintain existing ladders, this reach of South Fork Battle Creek will be classified as an “anadromous” stream regardless of which alternative is selected (including the No Action Alternative). DFG policies do not allow artificial trout stocking programs in such streams to reduce competition and predation of the stocked trout with native and locally produced anadromous fish. Therefore, any potential losses of fishing opportunities associated with the elimination of stocking programs are not related to the Proposed Action or project alternatives and would occur under the No Action Alternative.

As also noted in Impact 4.14-5, while certain highly localized fishing opportunities may be decreased, these opportunities make up only a small part of the overall recreation opportunities, including fishing, available in Battle Creek and the surrounding area. Other recreation opportunities will remain and will likely be enhanced through the Restoration Project. Also, natural anadromous fish and trout populations are expected to increase as a result of the Proposed Action, thereby increasing fishing opportunities in South Fork Battle Creek and the general vicinity. This improvement in fish populations will likely at least partially, if not wholly, offset the loss of a very localized and artificially supported fishing opportunity. In addition, the recovery time of the stream is expected to be almost immediate. As noted in the responses to Comment Letter NGO9, additional angling opportunities are expected to be provided and wading is not expected to be adversely affected. For more information, see the response to Comment NGO9-15.

For the reasons described above and in Impact 4.14-5, the lead agencies believe the loss of a localized and artificially supported fishing opportunity is a less-than-significant impact on recreation.

For more information related to the socioeconomic effects of the Restoration Project on the Oasis Springs Lodge, see the response to Comment NGO21-10.

Response to Comment NGO25-4

As indicated previously, fishing regulations will not change as a result of the Restoration Project. Furthermore, as analyzed in Impact 4.14-5 and mentioned in several responses to comments, the potential loss of a recreational fishery at the Oasis Springs Lodge is considered a less-than-significant impact because fishing opportunities will continue to exist after implementation of the Restoration Project and the number of days available for recreational activities are not expected to be different from existing conditions. Because the long-term impact on recreation is less than significant, the replacement of recreational experiences would not be required as a result of this impact. Because no feasible mitigation exists to address the construction-related impacts on recreation at the Oasis Springs Lodge, this impact has been identified as significant and unavoidable as described under Impact 4.14-1.

Response to Comment NGO25-5

The commentor suggests that there is a “mitigation plan that would maximize recreational use of this stretch of stream and reduce project impacts while balancing elements of the Preferred Project Alternatives…” but provides no detail as to what that mitigation might be. As noted above, the artificial trout stocking agreement will be terminated regardless of whether the Proposed Action (or the project alternatives) is implemented. Therefore, this effect is not associated with the Proposed Action or the project alternatives. No significant effects would result from the Proposed Action or alternatives, and no mitigation is necessary or appropriate.

Response to Comment NGO25-6

See Impact 4.14-5 in Section 4.14, Recreation, in Volume I of this Final EIS/EIR, and responses to Comments NGO25-1 through NGO25-5 above. As noted in Impact 4.14-5, temperature effects on native fish are anticipated to be negligible as these fisheries successfully subsisted in this environment prior to the construction of the hydroelectric facilities. Potential effects associated with sedimentation of the stream as a result of project construction are described in Impact 4.4-1 in Section 4.4, Water Quality, in Volume I of this Final EIS/EIR. These effects are described as significant, and mitigation measures are identified that would reduce the effects to a less-than-significant level. There is no evidence to suggest that water quality effects are underestimated or that the mitigation measures would not successfully reduce impacts to less-than-significant levels. The impact discussions and mitigation measures identified throughout the Final EIS/EIR are appropriate and fully comply with the requirements of CEQA and NEPA. For more information regarding the scope of the analysis of the socioeconomic effects on the Oasis Springs Lodge, see the response to Comment NGO21-10.