Feather River Whitewater Boating Opportunity Feasibility Study

Volume 2: Phase 2 Concept Evaluation

Final

Oroville Facilities
FERC Project No. 2100

California Department of Water Resources
Oroville Field Division
FERC License Coordination Branch
Recreation and Land Use Section

December 2009

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State of California
The Resources Agency
Department of Water Resources

FEATHER RIVER WHITEWATER BOATING OPPORTUNITY FEASIBILITY STUDY

VOLUME 2: PHASE 2 CONCEPT EVALUATION

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REPORT SUMMARY

This Feather River Whitewater Boating Opportunity Feasibility Study Phase 2 Report describes opportunities and constraints related to several candidate whitewater park sites in the Oroville area. The report also describes several general types and sizes of whitewater parks that may be suitable for the Oroville area, referred to as park "concepts," based on an investigation of numerous existing and proposed parks in the U.S. This information is then used to support an evaluation and comparison of three whitewater park concepts deemed most suitable for three of those candidate sites. The Supplemental Benefits Fund (SBF) Steering Committee recommended each of the three candidate site for evaluation in a July 2009 letter to the California Department of Water Resources (DWR).

This report follows on the Phase 1 Background Report, which was completed in February 2009. The Phase 1 report provides information on regional whitewater boating supply and demand, and whitewater park information drawn from across the U.S., to support the Phase 2 analyses and conclusions.

The three candidate whitewater park sites and concepts that are evaluated and compared in this Phase 2 report are:

1. Small instream whitewater park at Bedrock Park
2. Large artificial channel whitewater park at Fish Barrier Pool
3. Large artificial channel whitewater park at Riverbend Canyon

The criteria applied in the evaluations are derived from a Study Plan developed by DWR with input from the SBF Steering Committee and finalized in 2008. Additional questions related to opportunities and constraints at the three sites listed above and related to other whitewater park development needs and potential challenges at the three sites are also preliminarily addressed. These additional questions were brought into the study process at the request of the SBF Steering Committee via the July 2009 letter to DWR, referenced above.

<u>Bedrock Park – Small Instream Whitewater Park Concept</u>

At Bedrock Park, relatively few constraints are apparent for development of a small instream whitewater park at the site of the existing swim lagoon. However, additional data are needed on biological and cultural resources, and potential impacts on anadromous fish require additional analysis. A conflict may also exist with the potential installation of a Fish Segregation Weir being considered by DWR for this area of the Feather River.

This park concept would be relatively inexpensive to implement, possibly costing less than $300,000. It would primarily serve local novice-level boaters, and as such would not be expected to provide significant economic benefit to the community. (The concept has been proposed by the Feather River Recreation and Park District as a "second

facility" to supplement a larger whitewater park to be built elsewhere in the Oroville area.)

Fish Barrier Pool – Large Artificial Channel Whitewater Park Concept

The City of Oroville and Oroville Redevelopment Agency have previously highlighted the good potential of this site, which lies entirely within the Project boundary, for whitewater park development, as exemplified by the conceptual whitewater park design for the site presented in their 2004 Protection, Mitigation, & Enhancement (PM&E) form during the Oroville Facilities relicensing process. With the possible exception of cultural resources, this site presents few major potential constraints on whitewater park development, and it appears that most potential impacts would be avoided. Subsequent design-specific studies would need to address needs and options for avoiding or mitigating potential cultural resource impacts.

Parking and vehicle access to the site may present challenges for whitewater park development. The narrow, steep site provides limited parking options, and the only road onto the site is a private gated road. Potential use of the road for a whitewater park, with improvements, would need to be agreed upon with the current private and DWR users of the road.

Updated construction cost estimates for the conceptual park design originally developed in 2003 by a whitewater park design consultant for the City of Oroville suggest that this park concept could cost $30-35 million to implement.

The site is well located to provide linkages to other existing and proposed recreation facilities, and this park concept provides the best potential among the three evaluated for providing economic benefits to the community due to these linkages and its central location. The cost of power foregone by diverting water that now flows through the Diversion Dam Power Plant to a whitewater park is an important consideration that needs to be weighed against potential economic benefits. Finally, the implications of the requirement for DWR to obtain a Project license amendment from the Federal Energy Regulatory Commission (FERC) to allow a whitewater park to be developed also need to be considered.

Riverbend Canyon – Large Artificial Channel Whitewater Park Concept

The Riverbend Canyon site provides some unique advantages among the three sites for potential whitewater park development. These include ample topographical gradient and a large area, which may provide a range of options for the design and location of a whitewater park channel on the site. It also has the advantage of easy access and good visibility from State Highway 70. The site is not as accessible from central Oroville or as well located relative to the historic downtown of Oroville as the Fish Barrier Pool site, yet this concept appears to provide good potential for a significant economic benefit to the community. Future residential and recreation facility development that

has been proposed for the north bank of the Feather River near this site could enhance both access to and potential economic benefits of a park at this site.

However, several potentially significant constraints on whitewater park development at the site are also apparent. Foremost among these are the challenges involved in bringing water to the site. Consideration is given in this report to construction of a pipeline to bring water from the Power Canal, 1 mile to the north, or from the Feather River Fish Hatchery, three-fourths of a mile to the east. Each of these potential pipelines would represent a large and potentially costly project in addition to development of a whitewater park on the site itself. A pipeline from the Power Canal large enough to supply pass-through flow to a whitewater park on the site would carry the greatest cost and may result in fishery resource impacts on the Feather River where the water would be returned. Such a diversion of water would also impose substantial costs for power foregone at the Thermalito Pumping-Generating Plant. A smaller pipeline to supply a recirculating pumped-flow type of park could provide a more practical and less costly option to a large pipeline, but with the disadvantage of substantial operating costs to pump the water through the park.

If either potential pipeline to bring water to the site were included in a whitewater park design, the implications of the requirement for DWR to obtain a Project license amendment from the FERC to allow modification of a part of the FERC-licensed facilities (Power Canal or Fish Hatchery) would also need to be considered.

Other likely challenges associated with potential whitewater park development at this site include the absence of appropriate vehicle access and utility infrastructure, the provision of which would likely be complicated by the steep topography of the canyon and low elevation of much of the site relative to surrounding developed areas. Additional data are needed on the biological and cultural resources present on the site to more fully evaluate potential whitewater park development constraints related to those resources.

Based on the cost estimates for the conceptual park design developed for the Fish Barrier Pool site, construction costs for existing artificial channel whitewater parks built elsewhere in the U.S., and construction-related site constraints, it is estimated that this park concept could cost more than $40 million to implement. This cost does not include any pipeline project that may be required to bring water to the site, which, depending on pipeline size, could add up to $7 million to the overall cost. In addition, a pipeline from the Power Canal would require an inlet and gate structure on the canal, the cost of which may be similar to the cost of the pipeline itself.

Non-park Options for Enhancement of Whitewater Opportunities

This Phase 2 report describes several regional whitewater runs that might benefit from enhancement of boater access, and provides several examples of primarily low-cost enhancements that have been considered by the hydropower project operator and boaters for the North Fork Feather River, and the costs associated with those

enhancements. Although those enhancements would not be expected to provide significant economic benefits to the Oroville area, they could enrich the number and range of accessible whitewater boating opportunities in the area, and in doing so expand the overall whitewater boating population and potential market for both park and non-park whitewater boating.

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ACRONYMS AND ABBREVIATIONS

ASCI	Adventure Sport Center International
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
Caltrans	California Department of Transportation
CESA	California Endangered Species Act
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
DFG	California Department of Fish and Game
DPR	California Department of Parks and Recreation
DWR	California Department of Water Resources
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
fpm	feet per mile
FRFH	Feather River Fish Hatchery
FRRPD	Feather River Recreation and Park District
GIS	geographic information system
HDPE	high-density polyethylene
HPMP	Historic Properties Management Plan
NMFS	National Marine Fisheries Service
OWA	Oroville Wildlife Area
PG&E	Pacific Gas and Electric Company
PM&E	Protection, Mitigation, and Enhancement
RSWG	Recreation and Socioeconomic Work Group
RWQCB	Regional Water Quality Control Board
SBF	Supplemental Benefits Fund
SFWPA	South Feather Water and Power Agency
SHPO	State Historic Preservation Office
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNWC	U.S. National Whitewater Center
VELB	valley elderberry longhorn beetle
WPI	Whitewater Parks International

1.0 INTRODUCTION

This study is being conducted to implement Section B101 of the Settlement Agreement for Relicensing of the Oroville Facilities, signed March 2006 (DWR 2006a). Under the terms specified in Section B101, the Licensee is to conduct and fund a whitewater boating opportunity and recreation feasibility study to assist the Project Supplemental Benefits Fund (SBF) Steering Committee in determining whether existing whitewater recreation opportunities could potentially be enhanced (referred to in Section B101(b) as "non-park options"), and the feasibility of the construction and operation of a whitewater boating project (referred to in Section B101(b) as "park options") in the Project area or region. The results of this study will assist the SBF Steering Committee in determining whether to fund the construction and operation of such a project, or cost-share on such a project somewhere in the region, pursuant to their funding criteria.

1.1 BACKGROUND INFORMATION

Community interest in exploring the potential for the development of a whitewater boating facility in the vicinity of Oroville emerged during the Federal Energy Regulatory Commission (FERC) relicensing process, which was initiated by the California Department of Water Resources (DWR) in 2000. The Recreation and Socioeconomic Work Group (RSWG) functioned within the Oroville Facilities Relicensing Collaborative for several years and, as part of its activities, discussed potential Protection, Mitigation, and Enhancement (PM&E) measures submitted for consideration by members of the collaborative. The City of Oroville and the Oroville Redevelopment Agency submitted a Resource Action (PM&E) Identification Form for a whitewater park to be located in Oroville on the west side of the Fish Barrier Pool, between the Thermalito Diversion Dam and the Fish Barrier Dam, referred to in this report as the City of Oroville's PM&E form (City of Oroville and the Oroville Redevelopment Agency 2004). This conceptual design was described in some detail, and several alternative whitewater facilities at other sites in the Oroville vicinity were also briefly described. The form also highlighted the proponents' objectives associated with the proposed facility, which included making Oroville a destination for whitewater paddlers and adventure sport enthusiasts, and enhancing the local economy, a goal consistent with resource goals established by the RSWG for the Oroville Facilities Relicensing.

The RSWG and DWR determined that this Resource Action was outside the scope of DWR's relicensing or operational obligations, and thus better addressed outside the realm of the FERC license. As a result, evaluation of the feasibility of a whitewater park in the Oroville region was addressed within Appendix B of the Settlement Agreement, as described above. (Appendix B includes measures agreed to among the parties to the Settlement Agreement, but that are to be implemented outside the FERC Project boundary, or are without a direct nexus to the Project, and therefore are not to be included in the new Project license.)

More recently, DWR has conducted a Reconnaissance Study of Potential Future Facility Modifications (DWR 2006b). The local whitewater boating community has expressed

interest in also evaluating the potential for the facility modifications described in the Reconnaissance Study to support whitewater boating facilities or use.

As described in more detail in Section 2.0, this study is being conducted in two phases. Phase 1 included an assessment of whitewater supply and demand, as well as a compilation of information about existing and proposed parks in the United States. The Phase 1 Background Report was completed in February 2009 (DWR 2009). Phase 2 (this report) includes an evaluation and comparison of whitewater park concepts and potential sites within the Project area and an evaluation of non-park whitewater enhancement options for the Project area or region. The Phase 1 and Phase 2 reports will later be unified into a Final Study Report.

1.2 STUDY AREA

The scoping process for this study defined the geographic scope of the study as the Project area or region (Section B101 defined the region as "Northern California, Northern Nevada, other nearby western states, or other appropriate analogs if possible"). However, different geographic scopes are necessary to best address the tasks contained in each phase of the study.

For the demand and supply assessments presented in the Phase 1 Background Report, the study area was regional in scope, focusing on Northern California and Northern Nevada. Additional information related to demand at the state, multi-state regional, and national level was also reviewed for general indications that the data might contain relative to the more local area of interest. Given the low number of developed whitewater boating facilities in the region as defined in Section B101 of the Settlement Agreement, the review of constructed and proposed whitewater boating facilities was extended to include other western states and other parts of the country.

For this Phase 2 Concept Evaluation report, the study area encompasses a more limited geographic region, containing and surrounding the Oroville Facilities. This geographic scope relates primarily to evaluating and reviewing potential whitewater boating facilities and sites. However, as in the Phase 1 investigation, data on whitewater parks across the U.S. were also used. Information on the physical attributes of those parks, and on the communities in which they are situated, was used to describe the key attributes of whitewater parks and potential whitewater park sites. Information on the operation and the numbers and types of paddlers using the parks, and on the construction costs and financial performance of parks, was used to evaluate potential Oroville-area park concepts in terms of social, financial, and economic criteria.

2.0 STUDY PHASES AND OBJECTIVES

The Study Plan for the Feather River Whitewater Boating Opportunity Feasibility Study (see Appendix F of the Phase 1 report) describes a two-phase approach to this assessment. Phase 1, encompassing three major tasks as described in the Study Plan, was focused on development of the study scope; collecting, compiling, and analyzing information on supply of and demand for whitewater boating opportunities in Northern California and Northern Nevada; and collecting and compiling information on representative whitewater parks (both existing and proposed) in the United States.

All of the information gathering during Phase 1 was intended to meet the information needs prerequisite to the Phase 2 tasks. Phase 2 is focused on identifying viable potential park and non-park concepts and evaluating potential sites to host a viable whitewater boating park concept in the Project area or region, and determining the general feasibility of those options.

Three study objectives were identified for Phase 1 of the study:

- Determine the necessary content and geographic scope of the study, consistent with the intent of Settlement Agreement Section B101 (addressed by Study Plan Task 1).
- Assess the existing supply and existing and future demand for whitewater boating in the Project area and region to help define the market that could potentially be served by enhanced or new whitewater boating opportunities (addressed by Study Plan Tasks 2A and B).
- Gain an understanding of key aspects of the recreational use and operational characteristics of existing and proposed whitewater facilities that could be relevant to and inform the development of potential park concepts for the Project area or region (addressed by Study Plan Task 3).

The information gathered during Phase 1, along with additional, generally more site-specific information gathered during Phase 2, will contribute toward meeting the overall objective of this study: to determine the feasibility of constructing and operating whitewater boating (park and non-park) facilities and/or cost sharing such a project in the Project area or region.

Specific Phase 2 objectives to achieve this purpose are to:

- Identify three to five viable whitewater park concepts, and viable sites that could accommodate those concepts, in the Project area or region (addressed by Study Plan Tasks 4A and B).
- Identify three to five viable non-park concepts in the Project area or region (addressed by Study Plan Task 5); specific sites would be inherent in the concepts, each to be associated with existing whitewater runs.
- Evaluate and compare the three to five viable park and non-park concepts and provide conclusions regarding the feasibility of constructing and operating

whitewater boating (park or non-park) facilities in the Project area or region (addressed by Study Plan Task 6).

3.0 METHODOLOGY

Information for Phase 2 of this study was gathered from several sources, including paddle sport industry studies, numerous internet sources describing existing and proposed instream and artificial channel whitewater parks, feasibility studies for proposed instream and artificial channel whitewater parks at several locations in the U.S., Oroville Facilities relicensing study reports and geographic information system (GIS) data, DWR State Water Project operations data, Butte County parcel maps, City of Oroville General Plan (City of Oroville 2008) and other Planning Department maps, aerial images of candidate whitewater park sites, and site visits. Sections 3.1 through 3.4 describe the methods and sources used for the analysis and assessment tasks, the results of which are reported in Section 4.0. These tasks include:

- Identification of viable whitewater park concepts
- Identification of viable whitewater park sites
- Identification of viable non-park concepts
- Evaluation and comparison of whitewater park concepts

3.1 IDENTIFICATION OF VIABLE WHITEWATER PARK CONCEPTS

The task of identifying viable whitewater park concepts was approached in two steps. First, an investigation of numerous existing and proposed U.S. whitewater parks was used to develop an understanding of the basic components required to create a viable whitewater park. The investigation included the 10 parks described in the Phase 1 Background Report, and about 20 additional parks. Second, a set of viable whitewater park concepts for consideration in the Oroville area was developed based on the understanding gained of the attributes of viable parks, and the range of park sizes and construction costs found among existing and proposed parks across the U.S.

During Phase 1 of this study, an internet-based search was used to collect information on the 10 whitewater boating parks specified in the Study Plan (five instream parks and five artificial channel parks). The information for each park included opening date, type of park (public vs. commercial), course layout and length of run or runs, types of boating use supported, flow levels, whitewater difficulty class or classes, construction cost, other (non-boating) amenities provided, seasonal availability, and fee structure. Other information such as amount of use, user characteristics, events held at the facility, or other management information was also recorded when available.

Telephone interviews with course operators or managers were conducted to obtain missing information, or more detailed information, on park use levels and user characteristics. Some user and financial characteristics of existing parks specified in the Study Plan were generally found to be unavailable from existing articles, studies, and research of other public information, such as public agency meeting and financial reports. This information was obtained for only a few parks during the supplemental telephone interviews, and additional requests for these data made during Phase 2 were not successful in obtaining additional information.

Phase 2 included additional research on existing and proposed instream parks in the U.S. This was done because research of the five instream parks examined in Phase 1 did not provide information on the full range of potential instream park concepts (e.g., no examples were included of moderate-scale and moderate-cost parks). Also, several of the instream and artificial channel parks researched in Phase 1 can be considered unique in some aspects of their setting and design (e.g., an instream park created by modifying existing dams, large pumped-flow courses) and so may be of limited use in defining viable whitewater park concepts for the Oroville area. The research was also expanded to include an additional example of an artificial channel whitewater park constructed in an existing channel, only one of which was investigated in Phase 1.

The attention during the additional research was focused on the physical characteristics of the park sites (e.g., stream flow and gradient), park design (e.g., size and number of features), and construction cost. This additional research provided a more robust pool of information to outline the characteristics of a viable instream or artificial channel whitewater park. It also was useful in developing meaningful categories of whitewater park "concepts" to consider based on a range of size, complexity, and cost factors for both instream and artificial channel park types that accurately represent the range of whitewater park possibilities, a purpose of Subtask A of Task 4 as described in the Study Plan (see Appendix F of the Phase 1 report).

3.2 IDENTIFICATION OF VIABLE WHITEWATER PARK SITES

Candidate sites were evaluated against a set of general siting criteria, referred to as "preliminary evaluative criteria" in the Study Plan. A total of eight physical, environmental, and economic criteria were used in this first-pass fatal flaw evaluation.

As specified in the Study Plan, input was solicited from the SBF Steering Committee regarding potential refinement of the criteria; however, no revisions to the list provided in the Study Plan were requested by the committee. The sites that were not eliminated in the initial screening were to be carried forward to a more detailed secondary evaluation, which is essentially a pre-design assessment. However, subsequent input by the committee led to several of the sites that had not been eliminated in the initial screening to be dropped from further consideration, and two new sites were recommended for consideration instead. The secondary evaluation included consideration of several additional physical and environmental criteria, described below.

3.2.1 Preliminary Evaluation of Candidate Whitewater Park Sites

The preliminary evaluative criteria used to screen the list of candidate park sites are as follows:

Category	Criteria	Specific Requirement for Criteria
Physical	- Flow of water	- Flow is adequate and not excessive
	- Gradient	- Adequate natural gradient is available
	- Land ownership	- Little or no private property ownership

Category	Criteria	Specific Requirement for Criteria
Environmental	- Special status species	- Little or no presence of special status species or protected habitat
	- Fish passage/river habitat	- Little or no conflict with fish passage or river habitat
	- Flooding risk	- Little or no flooding potential
	- Cultural resources	- Little or no impacts on cultural resources
Economic	- Site acquisition costs	- Reasonable site acquisition costs

Sources used to compile information on these criteria at the candidate whitewater park sites include the following (see Appendix A, Table A-1 for a more detailed listing):

- Study reports completed during the Oroville Facilities Relicensing program addressing land use, recreation, fisheries, and terrestrial resources;
- Stream flow data from DWR monthly reports on State Water Project operations, and from U.S. Geological Survey (USGS) Feather River stream gauges;
- Butte County Assessor parcel data, providing ownership (public/private), zoning, and flood risk data; and
- City of Oroville online downloadable maps and General Plan update maps, providing ownership (public/private), zoning, flood risk, utility infrastructure, and vernal pool area data.

In addition, topographical data were used to determine stream gradient in the vicinity of the candidate park sites, and GIS data layers compiled during the Oroville Facilities Relicensing program were used to identify more site-specific occurrences of special-status species and habitat, as well as public lands and state public land jurisdiction, and land uses.

Special-status species observations and habitat data were also obtained from the California Natural Diversity Database (CNDDB), which provides a frequently updated database of GIS-mapped locations of special status plants and animals in California.

Cultural resource surveys and studies were conducted as part of the relicensing program. Limited areas below the Diversion Pool were intensively surveyed, but only cursory (sample) surveys were conducted in many areas, and some areas were not surveyed. Areas outside the FERC Project boundary were also not surveyed. One cultural resources study report (McCarthy et al. 2004) provided a generalized map indicating the location of several Native American villages and fishing camps and other archeological sites along the Feather River downstream of Lake Oroville. Maps depicting cultural resource survey results for the candidate park sites within the Oroville Facilities Project area were also available for review. (To protect the confidentiality of cultural sites, these data are not publicly available, and specific cultural resource sites are not identified in this report.)

3.2.2 Secondary Evaluation of Candidate Whitewater Park Sites Remaining

The secondary evaluation of candidate whitewater park sites applied a total of 25 evaluative criteria to each park site carried forward from the preliminary evaluation. In this step, each site was assigned a rating of "good," "fair," or "poor" for each criterion. The definitions used for these ratings in relation to each of the criteria are provided in Section 4.2.

The 25 criteria included nine physical criteria, five Oroville Facilities operational criteria, two whitewater park operational criteria, six environmental constraint criteria, and federal, state and local permitting considerations.

Physical criteria included:

a) Gradient (general adequacy was addressed in preliminary screening)
b) Flow (general adequacy was addressed in preliminary screening)
c) Land ownership/use (extent of private ownership of sites was addressed in preliminary screening)
d) Parking/access
e) Available infrastructure (potable water, sanitary sewer, electricity, telephone)
f) Potential length of run(s)
g) Available space for spectating, optional amenities
h) Aesthetics
i) Safety/security

Operational requirements criteria, which related to the potential impacts of whitewater park development on the operations of the Oroville Facilities, included:

a) Security
b) Regulatory flow and temperature requirements
c) Power generation
d) Water supply
e) Flood control operations

Typical whitewater park operational criteria, which related to potential constraints on the daily and seasonal operation of a whitewater park at a site, included:

a) Diurnal (potential constraints on daily operation)
b) Seasonal (potential constraints on seasonal operation)

Environmental constraints criteria included:

a) Flooding potential (addressed in preliminary screening; sites with little or no flooding potential carried forward)
b) Special status species/habitat (addressed in preliminary screening; sites with little or no presence of special status species or protected habitat carried forward)
c) Fish passage/river habitat (addressed in preliminary screening; sites with little or no conflict with fish passage or river habitat carried forward)
d) Water temperature
e) Other potential water quality/quantity impacts

f) Cultural resources (addressed in preliminary screening; sites with little or no impacts on cultural resources carried forward).

Finally, permitting and approval considerations associated with each candidate site were evaluated, including:

a) Federal permits and approvals
b) State permits and approvals
c) Local permits and approvals

Sources used to compile information on these criteria at the candidate whitewater park sites include the sources listed above for the preliminary criteria, as well as the following (see Appendix A, Table A-2 for a more detailed listing):

- City of Oroville General Plan (2030 Update), including land use and utility infrastructure sections and related maps, and City of Oroville website map files; and
- Developmental Analysis section of the Final Environmental Impact Statement (EIS) for the Oroville Facilities (FERC 2007) addressing hydropower generation values and costs.

Federal and state agency and environmental non-profit group guidance on environmental permitting authorities and processes (e.g., U.S. Army Corps of Engineers Sacramento District Regulatory Program, Sacramento River Watershed Program) was used to assess federal and state permitting and approval considerations, in the context of instream versus artificial channel park concepts, and known presence of special status species and protected habitats and cultural resources.

Visual assessment based on internet aerial image sources such as Google Maps and site visits was used to support analysis of available space for development, potential safety and security issues, access, and aesthetics at candidate sites

3.3 IDENTIFICATION OF VIABLE NON-PARK CONCEPTS

Viable non-park options for enhancing whitewater boating opportunities in the Oroville area were drawn from actions arising from the Oroville Facilities Relicensing process, and discussions arising from other FERC relicensing activity for projects upstream on the North Fork Feather River, owned and operated by Pacific Gas & Electric Company (PG&E). Examples include the recently established on-water shuttle to serve the whitewater run that is occasionally available in the North Fork Feather area of Lake Oroville, and an assessment of potential river access improvements on the Rock Creek and Cresta whitewater runs on the North Fork Feather River upstream of Lake Oroville. These provided examples of current access improvement needs as well as examples of actions that could be applied to enhance access to other local whitewater runs on other Lake Oroville tributaries.

3.4 EVALUATION AND COMPARISON OF WHITEWATER PARK CONCEPTS

The final step of Phase 2 of this study applied social, financial, and economic criteria to the specific whitewater parks concepts (among the types identified in Section 4.1) at the three candidate whitewater park sites that were the focus of the secondary site screening based on several criteria (as described in Section 4.2). This provided the most comprehensive perspective on the feasibility of each whitewater park concept and site, building upon the site- and concept-specific information compiled during the preceding study steps.

The social criteria used in the final assessment include numbers and types of boaters who would visit a park as well as potential spectator visitation, and potential negative influences on park use, including competing natural and artificial whitewater opportunities, and competing or conflicting recreation uses at the candidate site.

Estimates of potential annual visits by paddlers (kayakers and rafters) to an Oroville area whitewater park were developed by adapting methods used for estimating potential use of proposed parks elsewhere in the U.S. The estimates used recent and readily available population data for the counties in a market area composed of 22 Northern California counties, and data on paddlesports participation by residents within that 22-county area. The estimates also relied on assumptions about the proportion of whitewater boaters who would visit such a park in a given year, and how often those boaters would visit. Those assumptions were supported by regional, state, and national paddlesports participation data summarized in the Phase 1 Background Report. Additional details on the methodology used for the use estimates for an Oroville area whitewater park are provided in Appendix E.

Potential spectator visitation was assessed in a more general fashion, given the lack of reliable examples of non-event spectator attendance and the several factors that may influence spectator numbers. Each park site and concept was rated as having low, moderate, or high potential for spectator visitation.

The evaluation of competing natural and artificial whitewater opportunities was based on research on existing local natural whitewater runs and regional whitewater parks conducted for Phase 1 and prior Phase 2 study steps. This information was used to characterize similarities and differences between potential whitewater park concepts in the Oroville area, and the types and availability of existing whitewater opportunities in the region.

The financial and economic criteria used in the final assessment include estimated conceptual costs for the whitewater park concepts, based on detailed cost estimates that were developed as part of the conceptual proposal for one of the artificial channel park concepts and cost estimates for numerous existing parks across the U.S. Estimates of revenue generation potential were based on information on the existing park's fee structures, combined with the park use estimates described above. These two criteria are key inputs into the assessment of potential impacts of each park concept on the local economy and on local economic development, along with a third criteria

addressed, linkages with the local community and other recreation opportunities or venues. Lastly, whitewater park ownership, management, and financing options for whitewater parks are described based on the examples of whitewater park development at various locations across the U.S.

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4.0 RESULTS

Section 4.0 presents the results of a process to identify viable whitewater park concepts, evaluation of several candidate whitewater park sites in the Oroville area, and further evaluation of specific concepts deemed viable for specific candidate sites, applying a wider range of social and related financial and economic criteria. In concert with the Phase 1 Background Report (DWR 2009), which evaluated whitewater boating supply and demand, as well as the characteristics of a potential whitewater park and users of such a park, these assessments will aid the SBF Steering Committee in determining the feasibility of constructing and operating whitewater boating facilities (park and non-park) and/or cost sharing such a project in the Project area or region.

Section 4.1 identifies and describes viable whitewater park concepts, based on an investigation of instream and artificial channel parks that have been built or proposed in the United States.

Section 4.2 identifies viable whitewater park sites in the Oroville area. During this process, seven potential sites were first evaluated against a set of initial screening criteria to identify fatal flaws; three of the sites were eliminated from further consideration in this process. The four remaining sites were then to be evaluated against a second set of more detailed screening criteria to more fully characterize the opportunities and constraints inherent in each site. However, input provided by the SBF Steering Committee during this process led to three of those four initial sites that had not been eliminated in the initial screening to be dropped from consideration, largely because of a lack of connectivity to and distance from the downtown Oroville area, and thus were judged to be unlikely to provide desired economic benefits to the community. At the same time, the SBF Steering Committee recommended two additional sites for consideration, each of which the committee had subjected to a screening process similar to the initial screening applied in this study.

Section 4.3 identifies several non-park concepts for providing whitewater boating enhancement in the Oroville area, with actions meant to enhance access to existing local natural runs.

Section 4.4 reports on the evaluation and comparison of an instream or artificial channel whitewater park concept at three sites: the one candidate whitewater park site that was not eliminated from consideration during the initial screening, and the two additional sites initially screened and recommended by the SBF Steering Committee.

4.1 IDENTIFICATION OF VIABLE WHITEWATER PARK CONCEPTS

Many factors play a role in whether a particular type and size of whitewater park with specific features and at a specific site is likely to be a viable facility. The term “viable” indicates that the park will successfully serve the boating and non-boating purposes for which is it is intended. Among those factors, the survey of existing and proposed parks conducted for this study suggests several characteristics or attributes that are essential to the viability of a park. The survey of existing and proposed parks also suggests a

range of park sizes and complexity within the basic categories of instream and artificial channel parks that can be used to define a range of general whitewater park concepts to consider for the Oroville area.

4.1.1 Characteristics of a Viable Whitewater Park

The survey of existing and proposed parks supports the following conclusions regarding five key attributes of a viable whitewater park.

- **River and Park Access:** A viable whitewater park provides safe and convenient access to the water for boaters and, in the case of an instream park, protects the riverbank from adverse impacts of use (i.e. erosion, excess debris, vegetation impacts, etc.). Viability is enhanced if streamside paths and viewing locations are provided for spectators. Safe and convenient access also includes adequate parking to meet the park's intended uses.

- **Available Flow and Gradient:** A viable whitewater park can be designed to function at a range of flows, from a few hundred cubic feet per second (cfs) to several thousand cfs. Judging by existing courses surveyed, the ideal gradient for an instream course appears to be in the range of 35 to 50 feet per mile (fpm), although parks have been built on streams with gradients as low as 10 fpm. The gradient designed into artificial courses may be somewhat steeper than instream courses, up to about 80 fpm. A viable park dependent on variable river flows (natural or dam-controlled) will have hydraulic features that function at most flow levels (low, moderate, and high flows), although the type of experience provided will change with changes in flow.

- **Proximity to Population Centers and Urban Development:** A viable whitewater park is typically situated close to population centers large enough to supply an ample population of potential local park users, or, if not situated near any population centers, is in a community that attracts a significant population of non-local recreation visitors. A park's viability is increased by a larger local population, a portion of whom might use the park regularly, and by proximity to developed residential and commercial areas that increase the convenience and visibility of the park, as well as providing opportunities for a greater impact on the local economy.

- **Types and Levels of Difficulty of Boating Supported:** At a minimum, a viable whitewater park provides for several types of kayaking and in most cases will be enhanced if rafting is also accommodated. Rafting is particularly important at most artificial channel parks, where fees are charged, in that it accounts for the greatest number of paying park users. A viable whitewater park should be usable by novice and/or intermediate level paddlers. A park that provides challenging features for advanced paddlers and a slalom course meeting competition standards will increase its viability by expanding the range of users and providing the potential for training and competitive events.

- **Length of Runs/Number of Whitewater Features:** A viable whitewater park may provide only one hydraulic feature, but one that accommodates several boaters at once. Multiple features increase the viability of a park by providing a more varied boating experience, and by accommodating more boaters and a greater range of boater types and skill levels, increasing the park's ability to hold boaters' interest over the long term. A longer run increases the viability of a park by increasing the number of features that can be designed into the park, and by providing a longer ride for rafters and river-running kayakers and canoers for parks intended to provide that type of experience (e.g., more than a "playpark" experience).

Appendix H provides a more detailed description of these key components of viable whitewater parks in each park type category, supported by an analysis of numerous existing and proposed parks in the U.S.

4.1.2 Summary Description of Viable Whitewater Park Concepts

The following section describes the set of viable park concepts represented by the range of existing and proposed parks, broadly categorized into size/cost classifications in the instream and artificial channel park categories.

The analysis of existing and proposed whitewater parks suggests five whitewater park concepts (i.e., various scales of parks within each of the two categories) to consider. Each park concept presented below is a composite of what characterizes the typical instream and artificial channel parks of various sizes (small, medium, and large) in the U.S. Small, medium, and large classifications are used to represent practical categories based on overall park size and complexity, which loosely correlate to the number and length of whitewater channels or runs and to the number of constructed hydraulic whitewater features. In general, the cost to construct the parks corresponds to the size and complexity of each type of park and can be categorized as low, moderate, and high.

Although a medium-sized artificial channel park may be possible to envision and to construct, the available information suggests that artificial channel parks can be placed into just two disparate categories: smaller, lower cost parks, sometimes developed within an existing artificial channel, and much more complex and higher cost parks, generally developed with specially designed and built artificial channels, and with several prominent recently built examples using a recirculating pumped-flow design. Therefore, for the purposes of this study, medium and large artificial channel parks are considered as a single concept and just two artificial channel park categories are used.

Within each of the five park type and size categories (i.e., concepts) described below, one or more existing or proposed parks are listed as examples. These examples provide a real-world basis for the concepts presented for consideration in the Oroville area. Further examination of these parks may be useful as part of a more detailed development of a potentially feasible park concept at a site in the Oroville area, particularly for park siting and design considerations and solutions to site constraints or challenges.

The following describes the five general whitewater park concepts to be considered in this phase of the study.

Concept 1: Small Instream Whitewater Park

Typical park description: One or a few play features (may be several if in a small stream); may include slalom gates; no or modest streamside improvements.

Approximate construction cost range: $100,000 - $500,000

Existing and proposed examples:

Park Location	Approx. Length	Number of Features	Construction Cost[1]
Lyons, CO	1/4 mile	8	$130K
Gunnison, CO	1/4 mile	3	$200K
Vail, CO	<500 feet	1	$240K
Missoula, MT	<500 feet	1	$300K
Salida, CO	1/4 mile	2	$307K
Golden, CO	1/3 mile[2]	12, with slalom course	$380K[3]
Cascade, ID (proposed)	1/4 mile	3, short slalom channel	$500K

1. *Actual costs as stated in source documents, not adjusted for inflation.*
2. *Length includes initial instream improvements and downstream additions, each occupying about 800 feet of the creek (based on visual inspection of aerial images).*
3. *Total construction costs include $165K for initial improvements and $225K for later additions. Additional funds have been expended on bridge and streamside improvements such as paved paths (The Shimoda Group 2007).*

Concept 2: Medium-Sized Instream Whitewater Park

Typical park description: Longer run or runs than small parks, and usually several play features; often includes substantial streamside improvements such as rock terracing; may include non-boating improvements (parking, toilets, pedestrian paths, picnic sites, etc.) as part of overall whitewater park development.

Approximate construction cost range: $500,000-$2,000,000

Existing and proposed examples:

Park Location	Approx. Length	Number of Features	Construction Cost[1]
Durango, CO (proposed enhancements)	1/4 mile	5	$550K[2]
Riggins, ID (proposed)	1/2 mile	3[3]	$550K
Buena Vista, CO (enhancements)	1/2 mile	5	$625K[4]
Sparks, NV	1/4 mile	5	$900K
Glenwood Springs, CO	<500 ft	1[4]	$900K[5]
Dallas, TX (proposed)	<500 ft	2	$1.0M[6]
Spokane, WA (proposed)	Not available	2	$1.2M[7]
Casper, WY	1/2 mile	4	$2.0M[8]

1. *Actual costs as stated in source documents, not adjusted for inflation.*
2. *Construction cost includes improvements to two existing instream features (Durango Telegraph 2009).*
3. *Conceptual plan also calls for 1,400 cubic yards of boulder flow deflectors and 100 large random boulders.*
4. *Construction cost is for improvements to three existing features and two new features, plus bank improvements, trails, and signage. Breakdown of instream portion of park enhancements was not available, but was assumed to exceed $500,000.*
5. *This park is unique among the examples listed in that it consists of a single large, multi-feature wave-structure. The relatively high construction cost for a single structure may be because the park was built in the Colorado River, a larger, higher flow river than other park sites in this category.*
6. *The proposed park would consist of two standing wave features with streamside terracing, parking, a trail from parking lot to the river, and landscaping. The conceptual design budget suggests that instream work would account for about half the total construction cost.*
7. *Construction cost estimate includes visitor center, parking, and landscaping. Construction cost of the instream portion of the work was not available but was assumed to exceed $500,000 (about 40% of the total).*
8. *Construction cost includes clean-up and remediation work at old refinery site; a breakdown of instream and other whitewater construction costs and non-whitewater construction costs was not available.*

Concept 3: Large Instream Whitewater Park

Typical park description: Longer run or runs than a typical medium or small park and/or with a higher number of features; extensive streamside terracing; overall park design often includes paved pathways and other non-boating amenities/improvements.

Approximate construction cost range: $2,000,000 - $10,000,000

Existing and proposed examples:

Park Location	Approx. Length	Number of Features	Construction Cost[1]
Reno, NV	1/2 mile (2 channels)	11	$2.8M[2]
Boise, ID (proposed)	1/2 mile	6[3]	$6.5M[4]
Copperhill, TN	1/3 mile	Numerous[5]	$7.7M[6]

1. *Actual costs as stated in source documents, not adjusted for inflation.*
2. *Total construction cost includes instream enhancements ($1.5M) and streamside enhancements ($1.3M); some significant potential costs were minimized by a free supply and transportation of large rock from a source of residential construction spoils.*
3. *Phase 1 of the proposed River Recreation Park would consist of an adjustable park-and-play feature at the site of an existing diversion dam; Phase 2 would include 4-5 additional fixed features (drop/wave structures and flow deflectors) located downstream.*
4. *Total estimated construction cost for proposed River Recreation Park including instream features and enhancements to riverside pathway, and development of a 56-acre community park on adjacent land. Breakdown of whitewater park and non-whitewater construction costs was not available.*
5. *The number of hydraulic features is not provided in available data sources.*
6. *Instream enhancements only; total project construction cost of $25 million includes 7,200 sq. ft. visitor's center/gift shop, streamside pathways, a pedestrian bridge, and other improvements.*

Concept 4: Small Artificial Channel Whitewater Park

Typical park description: Often constructed in an existing channel that is modified to create whitewater features; no or minor improvements outside channel.

Approximate construction cost range: $1,000,000-$5,000,000

Existing examples:

Park Location	Number/Length of Channels	Construction Cost[1]
South Bend, IN (existing mill race channel)	1 (1,900 ft)	$5.0M
Dickerson, MD (existing power plant channel)[2]	1 (900 ft)	unknown[3]

1. *Actual costs as stated in source documents, not adjusted for inflation.*
2. *Technically, may be considered a pumped-flow course, as water is pumped from a power plant cooling system; however, the park is in a gravity-flow outlet channel more similar to a diversion channel, and the flow does not recirculate like at existing pumped-flow courses.*
3. *Built for Olympic training with volunteer effort and donated services.*

Concept 5: Medium/Large Artificial Channel Whitewater Park

Typical park description: Several whitewater features within single or multiple specially designed channels with sections of varying difficulty; whitewater features are often planned within a larger park concept, with accommodations for spectators and linkages to other nearby park amenities. May be constructed on a channel diverting water from a natural source or may be a pumped-flow course that is not dependent on a natural stream.

Approximate construction cost range: $15,000,000 - $40,000,000

Existing and proposed examples:

Park Location	Number/Length of Channels	Construction Cost[1]
Dallas, TX (proposed pumped flow)[2]	2 (~2,000 ft)[3]	$20M
McHenry, MD (pumped-flow)	1 (1,700 ft)	$24M
Minneapolis, MN (proposed diversion channel)	1 (~2,000 ft)	$26M[4]
Charlotte, NC (pumped-flow)	2 (3,750 ft)[5]	$38M

1. *Actual costs as stated in source documents, not adjusted for inflation.*
2. *Park conceptual design includes diversion from an artificial lake/reservoir and pumps to return flow from terminal pool back to reservoir.*
3. *Park conceptual design includes a channel with play and intermediate sections and a competition channel.*
4. *Construction cost estimate is about 10 years old and may be low; park plan is undergoing redesign.*
5. *Park includes two main channels, one of which splits into "freestyle" and "instruction" channels for a stretch before rejoining to form a" big water" channel.*

4.2 IDENTIFICATION OF VIABLE WHITEWATER PARK SITES

Subtask B of Task 4 of the Study Plan is to identify viable whitewater park sites in the Project area or region. Seven candidate whitewater park sites were identified, drawn from several sources produced during the Oroville Facilities Relicensing process. The seven identified sites and the relevant sources for each site are listed in Table 4.2-1; brief descriptions of the sites follow the table. Figure 4.2-1 depicts the locations of the candidate sites.

Given that the original sources for many of the sites were several years old, input was solicited in February 2009 from the SBF Steering Committee regarding this initial list of candidate sites to provide an opportunity to add, delete, or refine the listed sites. No changes to the list of sites to be evaluated were requested prior to the completion of the preliminary screening of the seven candidate sites in May 2009. However, input received from the Steering Committee via their July 2009 letter to DWR (included as Appendix I) was used to further reduce the list of "viable sites" beyond those determined to be appropriate to carry forward to secondary site screening. In particular, sites that

were not in or adjacent to the community of Oroville were eliminated from consideration, based on the limited potential for economic benefit to the community of a park at those sites. Additional discussion of the Steering Committee input and how it was used in this study in relation to preliminary and secondary screening of candidate sites is provided at the conclusion of Section 4.2.1 and start of Section 4.2.2.

Table 4.2-1. Candidate whitewater park sites in the Oroville area.

Candidate Site	Sources	Ownership (Public/Private)	Inside FERC Project Boundary?
Artificial Channel Park Option			
1. Fish Barrier Pool	PM&E Form[1], R-16 Focus Group[2]	Public	Yes
2. Forebay Power Plant Area[3]	PM&E Form[1], R-16 Focus Group[2]	Public	Yes
3. Afterbay Diversion Canal	DWR Reconnaissance Study of Facility Modifictions[4]	Primarily private	Partially
4. Alternate Afterbay Outlet Channel	DWR Reconnaissance Study of Facility Modifictions[4]	Public	Yes
Instream Park Option			
5. Below Fish Barrier Dam[5]	R-16 Focus Group[2]	Public	Yes
6. Low Flow Channel near Bedrock Park	PM&E Form[1], R-16 Focus Group[2]	Public	No
7. Afterbay Outlet Discharge Area[6]	PM&E Form[1]	Public	Yes

1. *City of Oroville Waterfront Redevelopment Resource Action (PM&E) Identification Form, prepared May 2003, revised January 2004 (City of Oroville and Oroville Redevelopment Agency 2004); submittal details seven proposed resource actions for the Feather River near downtown Oroville, one of which is a whitewater park. An artificial channel park on the Fish Barrier Pool is the primary whitewater park resource action; the three other sites listed here are briefly described in the PM&E form as alternative potential resource actions.*
2. *The focus group, with 11 participants and composed primarily of local whitewater boaters, was convened in May 2003 as part of data collection efforts for Study R-16: Whitewater and River Boating (DWR 2004b). Participants completed a survey that asked for input on a proposed whitewater park in the Oroville area.*
3. *This site was not described in detail in the PM&E form or by the focus group; for the purposes of this study, the site was defined as the area bounded by the power plant operations area and the tailwater canal to the north and west and by the South Forebay Day Use Area entrance road and Grand Avenue to the east and south.*
4. *Reconnaissance Study of Potential Future Facilities Modifications (DWR 2006b), published as preliminary reconnaissance level information for Settlement Agreement purposes. The local boating community expressed interest in this study evaluating the feasibility of incorporating a whitewater park into structures conceptually described in the Reconnaissance Study.*
5. *This site was not described in detail by the focus group; for the purposes of this study, the site was defined as the area between the Table Mountain Blvd. bridge and the Fish Barrier Dam.*
6. *This site was not described in detail in the PM&E form; for the purposes of this study, the site was defined as the area of the Feather River from below the pool at the Afterbay Outlet structure to a point about 1.3 miles downstream, all within the Oroville Wildlife Area (OWA). Most of this river reach is divided into east and west channels by a mile-long narrow island; the candidate site was limited to the west channel due to the presence of fewer identified anadromous fish spawning areas as compared to the east channel.*

Diversion Pool
Diversion Pool Day Use Area
North Forebay Boat Ramp / Day Use Area / Aquatic Center
Diversion Dam
Power Canal
Table Mountain Blvd
1
Fish Barrier Dam
Fish Hatchery
5
6
Montgomery St.
Nelson Ave.
Thermalito Forebay
Thermalito Forebay Dam & Power Plant
Wilbur Rd.
Tres Vias Rd.
Grand Ave.
South Thermalito Forebay Boat Ramp / Day Use Area
2
Tail Channel
Riverbend Park
Bedrock Park
Downtown Oroville
Wilbur Rd Boat Ramp
Oroville Dam Blvd -- West
162
OWA HQ
Monument Hill Boat Ramp / Day Use Area
Airport
Larkin Rd.
3
Clay Pit SVRA
Oroville
Rabe Road Shooting Range
Feather River
Larkin Road Car-top Boat Ramp / Day Use Area
Larkin Rd.
Thermalito Afterbay
Afterbay Outlet
Outlet Camp Area / Boat Ramp
Pacific Heights Entrance
East Hamilton Rd.
Wildlife Area
7
99
Vance Ave Entrance
Larkin Rd.
70
Camp Area G
Hwy 70 Entrance
4
Palm Ave Entrance
Paradise
Lake Oroville
Thermalito Forebay
Oroville
Thermalito Afterbay
Gridley
MAP WINDOW
0 5 10 20 Miles

Candidate Whitewater Park Sites

Whitewater Park Options

Artificial Channel

1. Fish Barrier Pool
2. Forebay Power Plant Area
3. Afterbay Diversion Canal
4. Alternate Afterbay Outlet Channel

Instream

5. Below Fish Barrier Dam
6. Low Flow Channel near Bedrock Park
7. Afterbay Outlet Discharge Area

Jurisdictions

FERC Boundary

City of Oroville

Source: Aerial Imagery: NAIP 2005 // Map prepared by EDAW 2008

1 0 1 2 Miles

Scale 1 : 15,840
1" = 0.25 mile
1"= 1320 ft
[reduced to 33% when plotted at 11x17]

Whitewater Boating Feasibility Study
Prepared for SBF Steering Committee

FIGURE 4.2-1

Candidate Whitewater Park Sites

Prepared by: PJ -- EDAW, Inc.

Date 12/09

P:\2000\0s016.gis\arcmap\ww_sites-proposed_33x51.mxd

Back of 11x17 figure; intentionally blank

- **Site 1: Fish Barrier Pool:** This site consists of more than 26 acres of State-owned land, all within the FERC Project boundary, on the west bank of the Feather River between the Diversion Dam and Power Canal to the north and the Fish Barrier Dam to the south. The site is characterized by exposed bedrock outcroppings close to the Fish Barrier Pool and steeply sloped oak and foothill pine woodland mixed with more open grassy areas above. At its northern end, near the Power Canal, the site rises as much as 100 feet above the elevation of the Fish Barrier Pool. A privately maintained and gated unpaved road (Golden Feather Drive) enters the site from the south and follows the west boundary of the site to a private homestead occupying a 3-acre parcel adjacent to the State lands. DWR also maintains a gate on this road, which is used to access the site for official purposes. An underground pipeline supplying water to the Feather River Fish Hatchery from the Diversion Pool crosses the site, and a dirt road runs parallel to the pipeline route. A high-voltage electricity transmission line crosses the middle of the site and the Fish Barrier Pool from east to west, with one transmission line tower on the site. On the adjacent private land to the west, a residential subdivision is under development and may eventually occupy all of the adjoining land.

- **Site 2: Forebay Power Plant Area:** This approximately 38-acre site abuts the Thermalito Power Plant (more formally known as the Thermalito Pumping-Generating Plant) operations area on the east and south, and occupies an open grassland area between the Thermalito Forebay and the power plant tailrace. The South Thermalito Forebay Recreation Area, a day use site used by anglers, picnickers, swimmers, and boaters, is immediately to the east, on the Forebay shoreline. The entire site consists of State-owned land, all within the FERC Project boundary.

- **Site 3: Afterbay Diversion Canal:** This candidate site is less precisely defined than those described above because it includes the entire 3-mile long conceptual alignment of a new Afterbay Diversion Canal. A potential whitewater park would occupy only a portion of that alignment or an adjacent area, depending on how whitewater features were designed in conjunction with this potential water temperature control project. The conceptual canal alignment extends between the northeast Thermalito Afterbay at the Wilbur Road crossing to the west bank of the Feather River about 1 mile upstream of the existing Afterbay Outlet. The route passes between the Afterbay and the Oroville Airport. The upper and lower ends of the conceptual alignment are on State lands within the FERC Project boundary, but most of the alignment crosses private agricultural and rural-residential lands.

- **Site 4: Alternate Afterbay Outlet Channel:** Similar to Site 3, this candidate site is less precisely defined than Sites 1 and 2 because it includes the entire 4.6-mile long conceptual alignment of a new Afterbay Outlet Channel. As with Site 3, a potential whitewater park would occupy only a portion of that alignment or an adjacent area, depending on how whitewater features were designed in conjunction with this potential water temperature control project. The conceptual channel alignment extends along the west bank of the Feather River between the existing Afterbay

Outlet and the south boundary of the Oroville Wildlife Area (OWA). The entire conceptual alignment, with the possible exception of a small area near the north end, is on State lands within the OWA and within the FERC Project boundary. Most of the alignment crosses gravel spoil piles.

- **Site 5: Below Fish Barrier Dam:** This site includes the upstream-most segment of the low flow channel of the Feather River, between the Fish Barrier Dam and the Table Mountain Boulevard Bridge. The several-hundred foot segment of the river is between the DWR Feather River Fish Hatchery day use area (with public parking and fish ladder viewing facilities) on the west bank and the City of Oroville's Nature Center Park on the east bank. The riverbank on both sides is characterized by exposed bedrock, and large rocks and bedrock islands are in the channel. This portion of the river is within the FERC Project boundary.

- **Site 6: Low Flow Channel near Bedrock Park:** This site is about one-half mile downstream of Site 5, and includes the segment of the low flow channel of the Feather River adjacent to Bedrock Park (jointly owned by the Feather River Recreation and Park District and the City of Oroville), and the areas immediately upstream and downstream. This quarter-mile segment of the river is between the FERC Project boundary, which crosses the river near the downstream end of the Feather River Fish Hatchery, and the State Highway 70 bridge over the river. The entire site is outside the FERC Project boundary. The south riverbank is occupied by Bedrock Park and the peninsula that forms the park's swim lagoon, and more steeply sloped areas upstream and downstream of the park. The paved Feather River bike and pedestrian trail follows the south riverbank. The steeply sloped north riverbank is in State ownership and is adjacent to large privately owned undeveloped parcels. Those parcels are largely situated below the main river bluff and are not accessible to the general public, although informal off-road vehicle use occurs.

- **Site 7: Afterbay Outlet Discharge Area:** This site includes a 1.2-mile stretch of the Feather River below the Afterbay Outlet and is entirely within the OWA and within the FERC Project boundary. The segment begins about 1,000 feet downstream of the Afterbay Outlet, where the river splits into east and west channels, and encompasses the length of the west channel. A narrow mid-channel island comprises the east boundary of the site, and the west bank of the river comprises the west boundary. The site terminates a short distance beyond the island, at a point parallel with the north end of One-Mile Pond in the OWA. The entire reach is accessible from the OWA, with gravel roads providing vehicle access to the riverbank at several locations. The OWA lands and the midstream island are both primarily composed of gravel spoil piles, with scattered ponds and riparian woodland vegetation.

4.2.1 Preliminary Screening of Candidate Whitewater Park Sites

The following summarizes the information obtained related to the evaluative criteria at each of the seven candidate whitewater park sites, as well as the general conclusions regarding each criterion. This is followed by a summary of all seven sites using a rating

of “good,” “fair”, or “poor” for each criterion, indicating which sites will be dropped from further consideration in this study because to poor (or fatal flaw) ratings for one or more criteria.

Site 1: Fish Barrier Pool

Criteria	Result	Data Summary
Flow of water	Adequate	Several thousand cfs available for diversion from Power Canal, which carries flow released from Lake Oroville minus flow released to low flow channel (600-700 cfs) and diversion to Fish Hatchery (100-120 cfs).
Gradient	Adequate	Natural riverbank provides about 68 feet of elevation difference between Power Canal and Fish Barrier Pool, where the diverted water would be returned and the whitewater channel would terminate. Gradient of channel depicted in conceptual park design is 50-80 fpm.
Land ownership	Public	State lands under the jurisdiction of DWR (two parcels).
Special status species	None	No special-status species or protected habitats were identified in the area during relicensing studies.
Fish passage/river habitat	None	Off-stream site.
Flooding risk	Low potential	Only margins of parcels are within the Federal Emergency Management Agency (FEMA) 100-year flood zone.
Cultural resources	Possible impacts	Intensive surveys of parcels identified several cultural sites, including most of the Fish Barrier Pool banks. A portion of the site is likely highly disturbed due to Oroville Facilities construction (Diversion Dam and Power Canal).
Site acquisition costs	None	Public lands.

Site 2: Forebay Power Plant Area

Criteria	Result	Data Summary
Flow of water	Adequate	Several thousand cfs available for diversion from Forebay in lieu of passing through power plant.
Gradient	Adequate	Site south of power plant provides about 63 feet of elevation difference between the Forebay surface and the top of the levee above the power plant tailwater canal, where diverted water would be returned.[1]
Land ownership	Public	State lands under the jurisdiction of the Department of Parks and Recreation (DPR) (presumed park site in area south of power plant operations zone); the power plant, canal, and surrounding levees are under the jurisdiction of DWR.
ESA special status species	None	No special-status species or protected habitats were identified in the area during relicensing studies (vernal pools found in the vicinity are all to the east of the candidate site, mainly east of the South Forebay Day Use Area entrance road).
Fish passage/river habitat	None	Off-stream site.
Flooding risk	None	Off-stream site.
Cultural resources	No impact likely	No cultural sites identified during intensive surveys of this entire area. Land is likely highly disturbed due to Oroville Facilities construction (power plant and canal).
Site acquisition costs	None	Public lands.

1. *Because the power plant tailwater canal lies in a deep, steep-sided cut between levees, it was assumed that any artificial whitewater channel constructed at this site would terminate near the top of the canal levee rather than at the level of the canal itself, with the flow then conducted to the canal by a channel or tunnel/pipe not used for whitewater purposes.*

ESA = Endangered Species Act.

Site 3: Afterbay Diversion Canal (Conceptual Alignment)

Criteria	Result	Data Summary
Flow of water	Excessive	Canal would carry entire Afterbay release to Feather River, up to 8,000 cfs.[1]
Gradient	Low	Average gradient of about 8 fpm (28-foot drop over 3.5-mile conceptual canal route) between the power plant canal and the point on the Feather River where the Reconnaissance Study indicates the canal would terminate.[2]
Land ownership	Mostly private lands	Majority of the conceptual canal alignment (between Hwy. 162 and Larkin Road) crosses private lands; the City of Oroville is the owner of parcels southwest of the airport (a runway approach area).
Special status species	Possible Impacts/ Unknown	Most of the private and city land along the conceptual canal alignment probably has not been surveyed; the general area is identified in the City of Oroville General Plan (City of Oroville 2008) as a potential vernal pool area. CNDDB data indicate the presence of burrowing owl and vernal pool fairy shrimp in the vicinity. Scattered vernal pools have been identified at the north end of the conceptual alignment. At the south end of the conceptual alignment, within the OWA, there is the potential presence of the valley elderberry longhorn beetle (VELB), and several species of concern.
Fish passage/river habitat	None	Off-stream site.
Flooding risk	None	Off-stream site.
Cultural resources	Unknown	Only limited areas near the upper and lower ends of the conceptual canal alignment were surveyed during the relicensing program. Most of the land along the conceptual canal alignment has not been surveyed (private and city-owned land). Dredge spoil areas at the south end of the conceptual canal alignment, within the OWA, have been identified as cultural sites and are under consideration for listing on the National Register of Historic Places.
Site acquisition costs	High	Most of the conceptual canal alignment is on private lands, and most of those lands are within the approved Oro Bay planned unit development. Whitewater channel and associated parking and other amenities would require acquisition of substantial additional lands beyond those required for temperature control project.

1. *Due to this high flow, it is assumed for the purposes of this evaluation that any whitewater opportunity developed in conjunction with this facility modification would be required to make use of a separate diversion channel carrying a portion of the total canal flow.*
2. *For the purposes of this evaluation, it is assumed that a whitewater diversion channel up to 2,000 feet in length could be located anywhere along the conceptual canal alignment but would have the same or less gradient as the parallel canal segment, and the gradient of the canal would be consistent along its length.*

Site 4: Alternate Afterbay Outlet Channel (Conceptual Alignment)

Criteria	Result	Data Summary
Flow of water	Excessive	Channel would carry from minimum Feather River high flow channel flow of 1,000 to 2,500 cfs up to 4,000 cfs.[1]
Gradient	Adequate	Average gradient of about 11.7 fpm (54-foot drop over 4.6-mile conceptual channel route) between the channel inlet on the Afterbay to the point on the Feather River where the channel would terminate.[2] (Most of the drop occurs at the upper end of the conceptual route, between the Afterbay and the riverbank area below the existing outlet.)
Land ownership	Public	Entire conceptual canal route is within the OWA on State lands under the jurisdiction of Department of Fish and Game (DFG).
Special status species	Possible impacts	Conceptual channel route is primarily through dredger spoil piles with few special-status species present; however, there are numerous elderberry plants (host plant for VELB) near the river, and giant garter snake habitat surrounds One-Mile Pond in the vicinity of the conceptual canal route. Also, several birds on species of concern lists may be present in the vicinity.[3]
Fish passage/river habitat	None	Off-stream site.
Flooding risk	Moderate risk	Most of the OWA between the Afterbay Outlet and One-Mile Pond is within the FEMA 100-year flood zone.[3]
Cultural resources	Possible impacts	Dredge spoil areas are present along most of the conceptual channel alignment within the OWA; these have been identified as cultural sites and are under consideration for listing on the National Register of Historic Places.[3]
Site acquisition costs	None	Public lands.

1. *Due to this high flow, it is assumed for the purposes of this evaluation that any whitewater opportunity developed in conjunction with this facility modification would be required to make use of a separate diversion channel carrying a portion of the total canal flow.*
2. *For the purposes of this evaluation, it is assumed that the whitewater diversion channel, which is assumed to be up to 2,000 feet in length, could be located anywhere along the conceptual canal alignment but would have the same or less gradient as the parallel canal segment, and the gradient of the canal would be consistent along its length.*
3. *Although impacts on special-status species and cultural resources and flooding risk may all represent constraints to whitewater park development at this site, it is assumed that these constraints would be addressed in the context of development of the conceptual canal, and thus may not be considered fatal flaws for this site regarding potential for whitewater park development.*

Site 5: Below Fish Barrier Dam

Criteria	Result	Data Summary
Flow of water	Low	600-700 cfs at most times.[1]
Gradient	Adequate	Approximately 100 fpm.
Land ownership	Public	West bank: State property under DWR jurisdiction (fish ladder public viewing area); East bank: area immediately downstream of the Fish Barrier Dam is State property under DWR jurisdiction (used for access to Sewim Bo trail and day use sites, and Diversion Dam Power Plant service road); adjacent land downstream, where access from city streets is located, is occupied by the City of Oroville's Nature Center park.
ESA special status species	Low likelihood of presence	West bank is occupied by developed recreation site (fish ladder viewing area), and no special status species or protected habitat were found on the east bank within the FERC Project boundary; City of Oroville property at Nature Center park was not surveyed, but relicensing study data suggest low likelihood of special-status species being present.
Fish passage/river habitat	High potential conflict	This area of the low flow channel is an important holding area for Chinook salmon and steelhead, which spawn just downstream and enter the hatchery fish ladder immediately below the Fish Barrier Dam on the west bank.
Flooding risk	Moderate risk	Much of the City of Oroville Nature Center park is within the FEMA 100-year flood zone.[2]
Cultural resources	Possible impacts	Intensive surveys on much of this area identified several cultural sites; the west bank is occupied by the Feather River Fish Hatchery fish ladder viewing area; the City of Oroville describes the Nature Center on the east bank as the site of a Native American fishing village, but this has been the site of public recreation use for many years.[3]
Site acquisition costs	None	Public lands.

1. *Oroville Facilities Settlement Agreement Article A108.1 proposes that the minimum flow within the low flow channel be increased to 700-800 cfs. Nevertheless, the 200-250 foot width of the river at this location would require the flow to be constricted to be adequate for whitewater use. Existing instream whitewater parks with similar flows are generally in narrower streams (e.g., Clear Creek in Golden, Colorado, at the site of the whitewater park is about 75 feet wide).*
2. *Little additional development outside of the river channel would be required for an instream whitewater park at this location, given that parking and river access exist on both sides of the river; therefore, this should not be regarded as a fatal flaw.*
3. *As noted above, little additional development outside of the river channel would be required for an instream whitewater park at this location; therefore, the likelihood of cultural resource impacts would be low.*

ESA = Endangered Species Act.

Site 6: Low Flow Channel near Bedrock Park

Criteria	Result	Data Summary
Flow of water	Low	600-700 cfs at most times.[1]
Gradient	Adequate	Approximately 14 fpm.
Land ownership	Public lands	On the south bank, Bedrock Park is on Feather River Recreation and Park District and City of Oroville property; on the north bank, State lands extend a short distance upslope from the riverbank.[2]
Special status species	Unknown	Probable low likelihood of presence; little data are available since this site is outside the FERC Project boundary; however, relicensing study data suggest low likelihood of special-status species being present.
Fish passage/river habitat	High potential conflict	The low flow channel in this vicinity is an important spawning area for Chinook salmon and steelhead. Several Chinook spawning sites have been specifically identified in the river adjacent to Bedrock Park.
Flooding risk	Moderate risk	Much of Bedrock Park and the State-owned land on the opposite bank is within the FEMA 100-year flood zone.[3]
Cultural resources	Unknown	No survey data are available. Bedrock Park is a developed recreation facility and has been the site of public recreation use for many years; the State-owned north riverbank appears to be a highly disturbed site composed of leveled dredge tailings.
Site acquisition costs	None	Public lands.

1. *Oroville Facilities Settlement Agreement Article A108.1 proposes that the minimum flow within the low flow channel be increased to 700-800 cfs. Nevertheless, the 200-250 foot width of the river at this location would require the flow to be constricted to be adequate for whitewater uses. Existing instream whitewater parks with similar flows are generally in narrower streams (e.g., Clear Creek in Golden, Colorado, at the site of the whitewater park is about 75 feet wide).*
2. *The lands upslope from the State lands along the riverbank are private property, approved for a residential subdivision, which includes lands above and below the river bluff. Access to the riverbank would require crossing the private parcels. An existing gated gravel road connects the parcels to the paved city road on the bluff.*
3. *Little additional development outside of the river channel would be required for an instream whitewater park at this location, given that parking and river access exists at Bedrock Park; therefore, this should not be regarded as a fatal flaw.*

Site 7: Afterbay Outlet Discharge Area

Criteria	Result	Data Summary
Flow of water	Adequate	Minimum instream flows below the Afterbay Outlet are 1,000 cfs April-September; 1,700 cfs October-March (less during dry years); flows during the summer and fall are typically between 2,000 and 5,000 cfs; much higher flows can occur during the rare occasions when Lake Oroville is spilling water; maximum flow of 2,500 cfs October 15-November 30.[1]
Gradient	Low	Approximately 3.3 fpm.
Land ownership	Public lands	All lands in this area are State property within the OWA, under the jurisdiction of DFG.
Special status species	Moderate likelihood of presence	Numerous elderberry plants (VELB host plant) in vicinity; several birds on species of concern lists may be present in the vicinity.[2]
Fish passage/river habitat	Potential conflict	Fisheries studies indicate a low concentration of anadromous fish spawning activity in this stretch of the river relative to the low flow channel, and few spawning areas in the west channel (several were identified in the east channel).
Flooding risk	Moderate risk	Most of the OWA between the Afterbay Outlet and One-Mile Pond is within the FEMA 100-year flood zone.[2]
Cultural resources	Possible impacts	Dredge spoil areas predominate along this reach of the river and include the midstream island; these have been identified as cultural sites and are under consideration for listing on the National Register of Historic Places.[2]
Site acquisition costs	None	Public lands.

1. *The Alternate Afterbay Outlet and Channel described in the Reconnaissance Study of Potential Future Facilities Modifications would reduce flows at this site to the level of the low flow channel, potentially resulting in flows inadequate for whitewater uses.*
2. *Little additional development outside of the river channel would be required for an instream whitewater park at this location, given that informal parking and river access exist within the OWA; therefore, this should not be regarded as a fatal flaw.*

4.2.1.1 Summary of Results of Preliminary Screening of Candidate Whitewater Park Sites

The following summarizes the results of the application of the evaluative criteria to the seven candidate whitewater park sites. Conclusions of "good," "fair," and "poor" express whether each criterion was found to be a positive, neutral, or negative factor in the potential of the site to host a whitewater park. Criteria that were determined to be negative factors can be understood as a fatal flaw for that site and grounds for not carrying that site forward into the more detailed secondary evaluation. Results are summarized in Table 4.2-2.

Table 4.2-2. Results of preliminary screening of candidate whitewater park sites.

Candidate Whitewater Park Site	Flow of Water	Gradient	Land Ownership	Special-Status Species	Fish Passage/ River Habitat	Flooding Risk	Cultural Resources	Site Acquisition Costs
Artificial Channel Park Sites								
1. Fish Barrier Pool	+	+	+	+	+	+	o	+
2. Forebay Power Plant Area	+	+	+	+	+	+	+	+
3. Afterbay Diversion Canal	o	o	o	o	+	+	o	o
4. Alternate Afterbay Outlet Channel	o	+	+	o	+	o	o	+
Instream Park Sites								
5. Below Fish Barrier Dam	-	+	+	+	-	o	o	+
6. Low Flow Channel near Bedrock Park	-	+	+	+	-	o	o	+
7. Afterbay Outlet Discharge Area	+	o	+	o	o	o	o	+

Key:
+ = "good" (no or few apparent constraints related to this criterion).
o = "fair" (possible constraints related to this criterion, but may not be fatal flaw; data may be lacking).
- = "poor" (significant constraints apparent related to this criterion; probable fatal flaw).

4.2.1.2 Preliminary Screening Conclusions for Candidate Whitewater Park Sites

The following describes the preliminary screening conclusion for each candidate whitewater park site, as supported by the site information related to the screening criteria and the interpretation of that information as positive, neutral, or negative factors in the potential for the site to host a whitewater park. In several instances, a fair rating for a factor was due to uncertainly resulting from a lack of available data. Numerous neutral factors due to uncertainty were also considered a "fatal flaw" due to the constraint this lack of data would place on site development without considerable investment in obtaining the information needed to fully evaluate potential constraints.

Of the seven sites, four were identified as suitable to be carried forward into the more detailed secondary evaluation (described in Section 4.4). However, as described in the introduction to Section 4.2, the SBF Steering Committee's input eliminated three of those four sites from further consideration. Thus, only Site 1 (Fish Barrier Pool), which was among the sites recommended by the committee for further consideration, was carried forward into the more detailed secondary evaluation.

Site 1. Fish Barrier Pool

This site appears to have few constraints related to the preliminary screening criteria, all of which were judged to be positive factors in the potential of the site to host a whitewater park (with the exception of a fair rating for cultural resources).

Site 2. Forebay Power Plant Area

This site appears to have few constraints related to the preliminary screening criteria, all of which were judged to be positive factors in the potential of the site to host a whitewater park.

Site 4. Alternate Afterbay Outlet Channel (Conceptual Alignment)

This site appears to have a few positive factors in the potential of the site to host a whitewater park. In addition, ample resource data are available from relicensing and post-relicensing studies, and land ownership and acquisition costs are not constraints. However, the evaluation of several of the preliminary criteria, including flooding risk, is made more difficult and speculative by not having a prior determination of where in the vicinity of the several-mile long conceptual channel route a whitewater facility might be constructed, since it is likely that a whitewater facility would parallel just a portion of that route. (There is an assumed requirement for a parallel whitewater channel due to the excessive flows that would be carried in the channel.) Thus, there are several potential positive factors associated with this site, along with several unknown factors. Perhaps most important among the unknown factors, although not directly tied to the Study Plan criteria, is whether this temperature control project will be selected for implementation, which is necessary to support any potential whitewater boating facility.

Site 7. Afterbay Outlet Discharge Area

This site on the Feather River below the Afterbay Outlet appears to have a few positive factors enhancing the potential of the site to host an instream whitewater park. (A potential instream facility appears to be best sited within the 1.25 miles of river between the downstream end of the deep pool at the Afterbay outlet and a point parallel to One-Mile Pond, to take best advantage of OWA and river access.) Land ownership is public, and there would be no site acquisition costs. Flow is good and although gradient is low, it may be possible to design a whitewater feature or features constructed in one of the parallel channels that would function at a low gradient, as has been done on low-gradient streams elsewhere in the U.S. (see Appendix B for details on these and other U.S. parks). Flooding risk appears to be low as the instream whitewater structures would not impede high flows. Potential cultural and special-status species impacts appear to be low, assuming that little or no disturbance would occur outside the channel itself, given the location of this site within the OWA. Potential fish passage and river habitat impacts may be a constraint, but fisheries studies indicate that spawning areas are few and are concentrated in the east channel, suggesting it may be possible to avoid or minimize these impacts by placing whitewater features only in the west channel. Whitewater features can be designed to facilitate fish passage and enhance fish habitat (Frink, T. 2007, Harvey, M. 2007, REP 2005).

The apparent or potential constraints on the following three sites representing fatal flaws, or a significant level of uncertainty involving several screening criteria, eliminated the sites from further consideration, and these were not carried forward into the more detailed secondary evaluation.

Site 3. Afterbay Diversion Canal (Conceptual Alignment)

Like the preceding site derived from the DWR Reconnaissance Study, this site appears to have a few positive factors in its potential to host a whitewater park. However, little biological or cultural resource data are available for much of the land crossed by the conceptual canal route. Because of these data gaps, it is not possible to determine the likelihood of potential impacts that would represent fatal flaw biological or cultural resource constraints. CNDDB data indicate the possible presence of several special status species, but this has not been confirmed by studies.

Also, regarding land ownership and site acquisition costs, it is not possible to determine whether they would be fatal flaw constraints without prior determination of how land acquisition would occur to allow construction of the potential canal. Further, it is not known how much additional land acquisition might be necessary for a whitewater facility, and how much additional potential biological or cultural resource impacts might occur, due to the assumed requirement for a parallel whitewater channel to avoid excessive flows (and presumably related safety issues) in the canal.

Finally, evaluation of several of the preliminary criteria is made more difficult and speculative by not having a prior determination of where in the vicinity of the several-mile long conceptual canal route a whitewater facility might be constructed, since it is likely that a whitewater facility would parallel just a portion (half mile or less) of that route. Thus, although there is a lack of clear fatal flaws associated with this site, there are also are numerous unknown factors and fewer potential positive factors than the similar Site 4, given that most of the site is on private lands.

Site 5. Below Fish Barrier Dam

Low flow appears to be a negative factor in the potential of this site to host a whitewater park without substantial constriction and similar modifications to the riverbed. Such modifications would likely exacerbate possible conflicts with fish passage and river habitat at this site, which is an important area of the river for the anadromous fish (Chinook salmon and steelhead) that concentrate here because of the proximity of the Fish Barrier Dam.

Site 6. Low Flow Channel near Bedrock Park

Like the preceding site on the low flow channel, low flow appears to be a negative factor in the potential of this site to host a whitewater park without substantial constriction and similar modifications to the riverbed. Such modifications would likely exacerbate possible conflicts with fish passage and river habitat at this site, which is an important area of the river for anadromous fish (Chinook salmon and steelhead), which spawn in high concentrations in the vicinity. There is also the potential for future actions to enhance and increase spawning habitat in this area of the river, which would further conflict with potential whitewater park development and whitewater boating uses.

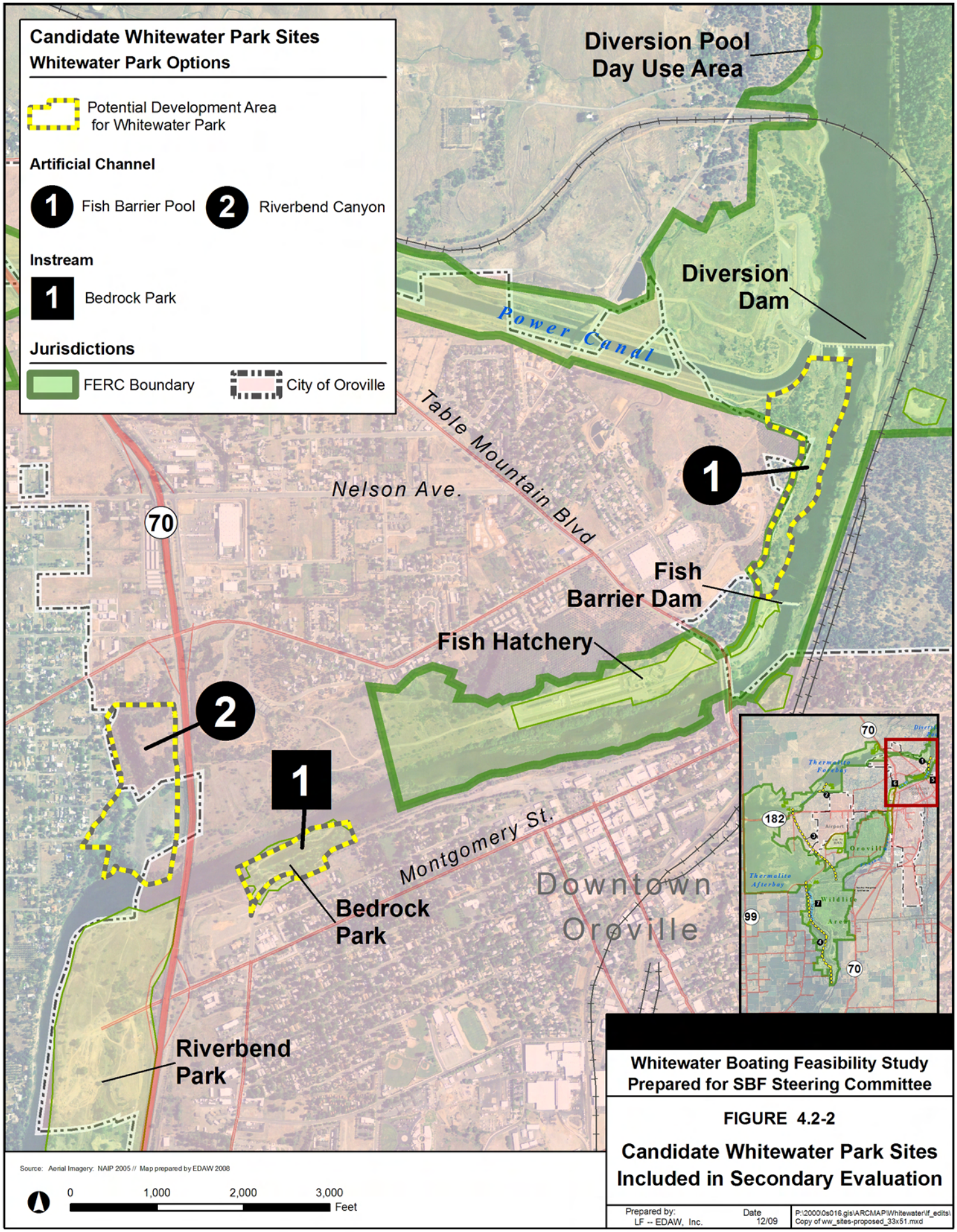
4.2.2 Secondary Evaluation of Candidate Whitewater Park Sites

As described in the preceding section, one of the seven initial candidate whitewater park sites (Fish Barrier Pool) was carried forward to the more detailed secondary evaluation. Three of the seven sites (Alternate Diversion Canal, Below Fish Barrier Dam, and Low Flow Channel near Bedrock Park) were eliminated by the initial screening conducted for this study, and three additional sites (Forebay Power Plant Area, Alternate Afterbay Outlet Channel, and Afterbay Outlet Discharge Area) were eliminated in response to the SBF Steering Committee's input, provided via a July 2009 letter to DWR (Appendix I). In addition, one instream park site (Bedrock Park) and one artificial channel whitewater park site (Riverbend Canyon) were introduced into the evaluation process by the SBF Steering Committee, both of which the committee subjected to their own preliminary screening before recommending the sites for further evaluation. The Fish Barrier Pool site, included in the initial screening above, was also recommended for further evaluation by the Steering Committee. The two "new" sites are described briefly here, and the Fish Barrier Pool site is reintroduced, focusing on the conceptual whitewater park design for that site developed by the City of Oroville, and included in their PM&E form. Figure 4.2-2 depicts the locations of the candidate sites that were the subject of the secondary evaluation.

As listed in the Study Plan, the secondary evaluation applied a total of 25 criteria in several categories to provide a more substantive comparison of candidate sites and, in the final step, park concepts judged to be appropriate at the candidate sites. Several of the physical and environmental criteria applied in the initial screening were re-applied in this secondary evaluation, along with additional physical and environmental criteria, and criteria related to Oroville Facilities operational requirements, typical whitewater park operational needs, and permitting/approval considerations. The final evaluation step, addressed in Section 4.4, reintroduces economic criteria.

Instream Park Site: Bedrock Park

Bedrock Park is situated on the south bank of the low flow channel of the Feather River within the City of Oroville, about 1 mile downstream from the Fish Barrier Dam. The 13.1-acre park includes about 8.4 acres owned by the City of Oroville and about 4.7 acres owned by the Feather River Recreation and Park District (FRRPD). The FRRPD operates and maintains the park. The park includes a swim lagoon created by a small flash board dam constructed between the riverbank and a large gravel bar in the river. (This is a separate and distinct site from Site 6: Low Flow Channel near Bedrock Park addressed in the Section 4.2.1. That site included a portion of the low flow channel adjacent to Bedrock Park but excluded Bedrock Park itself, including the swim lagoon.) The shallow lagoon is about 1,000 feet long and 100 feet wide at its widest point. A turf-covered slope overlooks the lagoon, and above this slope the park provides a large day use area shaded by mature trees, an amphitheatre, flush toilets and potable water, and two parking lots. The Feather River Parkway bike path traverses the park. The site is outside the FERC Project boundary. Figure 4.2-3 provides several photos of the swim lagoon area of Bedrock Park. Figure 4.2-4 is a conceptual site plan of a whitewater facility, which would consist of a channel constructed in the location of the existing lagoon, as proposed and depicted in the FRRPD 2020 Master Plan (April 2009).



Whitewater Boating Feasibility Study
Prepared for SBF Steering Committee

FIGURE 4.2-2

Candidate Whitewater Park Sites Included in Secondary Evaluation

Prepared by:	Date	
LF -- EDAW, Inc.	12/09	P:\2000\0s016.gis\ARCMAP\Whitewater\lf_edits\Copy of ww_sites-proposed_33x51.mxd

	
Photo 1: Inlet of swim lagoon, looking upstream.	Photo 2: View of length of Bedrock Park lagoon (dam is at far end).
	
Photo 3: Lower lagoon and flashboard dam.	Photo 4: Outlet of lagoon to low flow channel of Feather River.

Figure 4.2-3. Bedrock Park site photos.

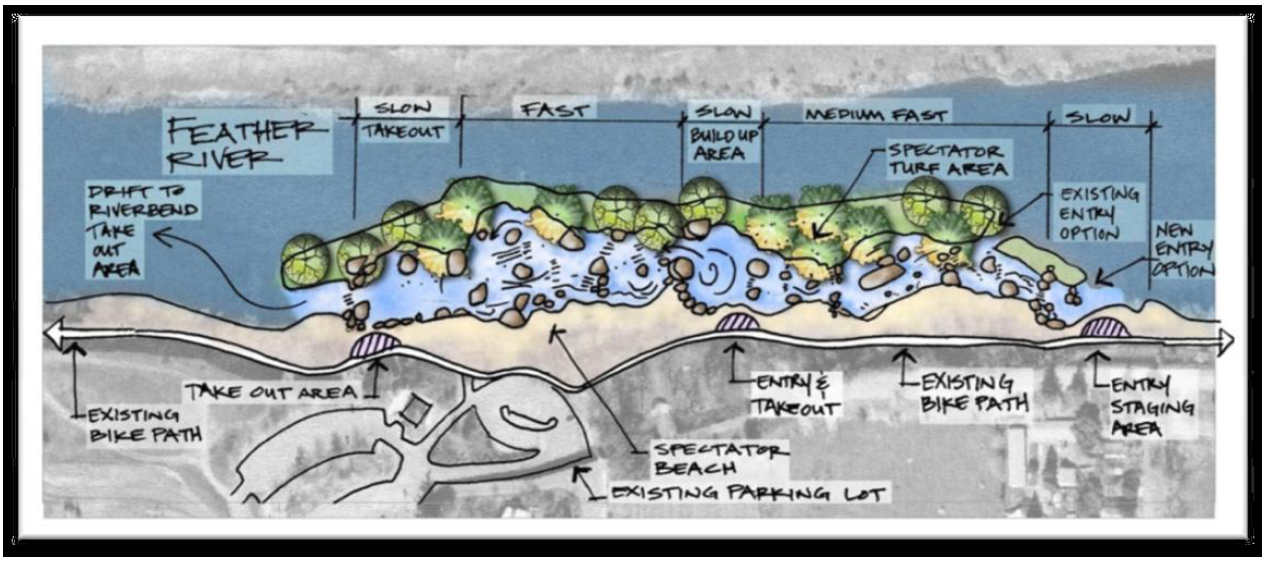


Figure 4.2-4. Bedrock Park whitewater facility conceptual site plan presented in the FRRPD 2020 Master Plan.

The Master Plan refers to this proposed facility as "a second whitewater facility to cater to youths and beginning kayakers" and as "a small, slow-flow whitewater park." According to the Master Plan, this park would not, by itself, satisfy community interest in a whitewater facility along the Feather River corridor, but would complement a larger park constructed nearby.

Artificial Channel Park Site 1: Fish Barrier Pool

As described at the beginning of Section 4.2, this site consists of more than 26 acres of State-owned land, all within the FERC Project boundary, on the west bank of the Feather River between the Diversion Dam and Power Canal to the north and the Fish Barrier Dam to the south. Figure 4.2-5 provides several photos of the site.

The conceptual whitewater park design developed by the City of Oroville, and reproduced below (Figure 4.2-6), includes a winding artificial channel over 4,000 feet in length, beginning at the north end of the site and extending to the south end before reversing direction and outletting into the upstream end of the Fish Barrier Pool. Between 400 and 600 cfs of flow would be diverted into the channel via a tunnel from the Power Canal. A second short and steep channel with 50-100 cfs of flow would also outlet into the upper Fish Barrier Pool. The two channels would provide a combination of novice, intermediate, and expert-level paddling opportunities. The conceptual design also includes trails and pedestrian bridges to allow movement of paddlers and spectators on the site and to connect the site to the east side of the Fish Barrier Pool and to adjacent recreation facilities north of the Power Canal. (Additional proposed resource actions contained in the City of Oroville's PM&E form include a "flexible event staging/group camping area" on the north side of the Power Canal and "equestrian event staging/group camping area" east of the Fish Barrier Pool.) Terraced seating and observation areas would also be provided for spectators.

	
Photo 1: Rocky slopes and pines at the north end of site.	Photo 2: Inlet, brushy slopes, and service road at south end of site.
	
Photo 3: Gated entrance to Golden Feather Drive at south boundary of site.	Photo 4: Dirt service road extending from the end of Golden Feather Drive.

Figure 4.2-5. Fish Barrier Pool site photos.

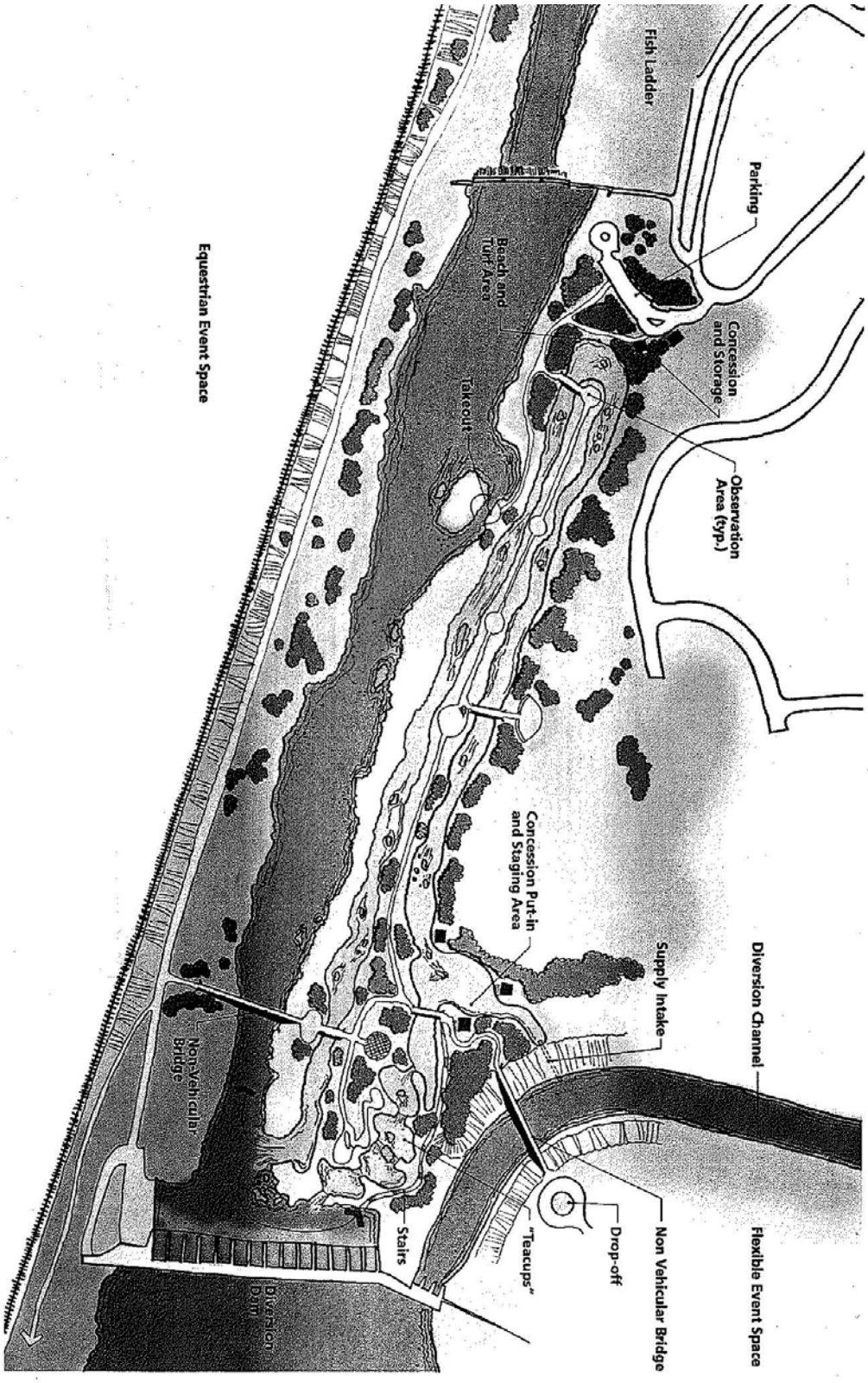


Figure 4.2-6. Conceptual whitewater park design for the Fish Barrier Pool site submitted with the City of Oroville's PM&E form (2003).

Artificial Channel Park Site 2: Riverbend Canyon

This site consists of about 36 acres of primarily privately owned land on the north bank of the low flow channel of the Feather River, about 1.5 miles downstream from the Fish Barrier Dam. State Highway 70 runs along the east boundary of the site, and a wooded ravine (the "canyon" referred to in the site name) occupies the north and west sides of the site. The topography of the site is varied, and substantial differences in elevation delineate the upper and lower portions of the site. The maximum elevation is about 244 feet and the minimum elevation, at the riverbank, is about 135 feet, a difference of about 109 feet.

The upper (north) portion of the site consists of an isolated river bluff plateau overlooking State Highway 70 to the east and Riverbend Canyon to the north and west, with an open field on the fairly level top and steep wooded sides. The lower (south) portion of the site consists of a mostly open sparsely vegetated area, with three small and widely spaced ponds. Most of this lower area sits 20-25 feet above the elevation of the river, which defines the south boundary of the site, and the surface consists of gravel and cobbles deposited during historical dredge mining of the river. The ponds occupy small depressions in these deposits and are surrounded by riparian forest. The stream bed within the upper canyon appears to contain water only intermittently, and the dredge spoils deposited in the lower canyon fill the former stream channel, so that the channel does not reach the river. The southwest corner of the site drops steeply down into a riparian forested area and then to the river.

Only a small portion of the site appears to be publicly owned (a less than 2-acre FRRPD parcel on the river bank). A dirt four-wheel drive trail drops down into the canyon from a residential street to the west of the site, and off-road vehicle use of the site (presumably unauthorized) is evident from the trails that have developed on the lower portion of the site. This use was also observed during a site visit. The northern portion and the southeast corner of the site is within the City of Oroville, while most of the southern portion is outside the city boundary and within Butte County jurisdiction. The site is outside the FERC Project boundary. Figure 4.2-7 provides several photos of the site.

4.2.2.1 Site Criteria Rating (Good, Fair, Poor) Definitions

Similar to the initial screening, the intent in this step is to evaluate each site regarding each of the 25 criteria, using the best available information appropriate to a reconnaissance-level evaluation, and assign a rating of "good," "fair," or "poor" to each site on that criterion. The definitions of these ratings, shown in Table 4.2-3, are necessarily somewhat more precise than the more general definitions used for the initial fatal flaw screening criteria. Once again, the good/fair/poor ratings can be interpreted as being positive, neutral, or negative factors in the overall constraints and opportunities presented by a site. Stated in terms of constraints, this means criteria rated as good do not appear to be a constraint, those rated fair appear to be a possible minor constraint, and those rated poor appear to be a probable major constraint on whitewater park use of the site.

	
Photo 1: Open, sparsely vegetated area on southern half of site.	Photo 2: Largest of three ponds on site.
	
Photo 3: Open grassland plateau on northern half of site.	Photo 4: Four-wheel drive trail off 5th Street providing vehicle access to site.

Figure 4.2-7. Riverbend Canyon site photos.

Table 4.2-3. Definitions for good, fair, and poor ratings assigned to sites for evaluative criteria.

Evaluative Criteria	Assigned Rating and Definition		
	GOOD	**FAIR**	**POOR**
1. Physical Criteria			
a) Gradient	adequate gradient (20-80 fpm)	low gradient (<20 fpm)	excessive gradient (>80 fpm)
b) Flow	adequate flow (500-2,000 cfs)	low flow (<500 cfs)	excessive flow (>2,000 cfs)
c) Land ownership/use	public and undeveloped land	mixed public and private land	private and/or developed land
d) Parking/access	parking available on site or nearby, good access to site/river	parking and/or access to site/river may be limited	little or no space for parking, poor access to site/river
e) Available infrastructure (potable water / sanitary sewer / electricity / telephone)	most utilities available on site or adjacent	some utilities may not be available or are not adjacent	utilities not available nearby; difficult or impossible to provide
f) Potential length of run(s)	space for up to half-mile instream run or artificial channel	space for at least 800-ft instream run or artificial channel	space for only short instream run or artificial channel (<800 ft)
g) Available space for spectating, optional amenities	ample space for spectating, optional amenities	adequate space for spectating, optional amenities	limited space for spectating, optional amenities
h) Aesthetics	generally attractive setting (vegetation, viewshed, etc.)	attractive and unattractive aspects of setting	generally unattractive setting (vegetation, viewshed, etc.)
i) Safety/security	provides safe access and is generally free of major hazards	may present potential hazards to visitors that may be mitigated	does not provide safe access and/or contains major difficult to mitigate hazards
2. Operational Requirements Criteria			
a) Security	no impact likely - site does not include or abut secure operations areas (powerhouse, canal, dam, etc.)	potential minor impact - site abuts secure operations areas (powerhouse, canal, dam, etc.), will require exclusion of public	potential major impact - site includes or abuts secure operations areas (powerhouse, canal, dam, etc.), will require exclusion of public
b) Regulatory flow and temperature requirements	no impact likely - no change to flow or temperature anticipated	potential minor impact - small and insignificant changes to flow or temperature may occur	potential major impact - significant changes to flow or temperature may occur

Table 4.2-3. Definitions for good, fair, and poor ratings assigned to sites for evaluative criteria.

Evaluative Criteria	Assigned Rating and Definition		
	GOOD	**FAIR**	**POOR**
c) Power generation	no impact likely - no effect on power generation	potential minor impact - small potential loss of power generation	potential major impact - substantial potential loss of power generation
d) Water supply	no impact likely - no change to flow that could affect ability to meet water supply commitments	potential minor impact - potential small change to flow that could affect ability to meet water supply commitments	potential major impact - potential large change to flow that could affect ability to meet water supply commitments
e) Flood control operations	no impact likely - no change in flow or storage that could affect flood control operations	potential minor impact - potential small change in flow or storage that could affect flood control operations	potential major impact - potential large change in flow or storage that could affect flood control operations
3. Typical Whitewater Park Operational Criteria			
a) Diurnal park operations considerations	no constraints to daily operations anticipated	minor constraints to daily operations anticipated	major constraints to daily operations anticipated
b) Seasonal park operations considerations	no constraints to seasonal operations anticipated	minor constraints to seasonal operations anticipated	major constraints to seasonal operations anticipated
4. Environmental Constraints Criteria			
a) Flooding potential	no or low potential - not in 100-year flood zone	moderate potential - minor portion of site in 100-year flood zone	high potential - most or all of site in 100-year flood zone
b) Special status species/ habitat [1]	no impact likely - no known special status species or habitat	potential minor impact - no federal or state listed species known; sensitive species may be present	potential major impact - federal or state listed species may be present
c) Fish passage/river habitat	no impact likely - no impact on fish passage or river habitat anticipated	potential minor impact - potential impact only on non-anadromous fish passage/habitat	potential major impact - potential impact on anadromous fish (salmon, steelhead) passage/habitat
d) Water temperature (cold water effects on boaters)	no impact likely - no effect of cold water temperature anticipated	potential minor impact - small potential effect of cold water temperature	potential major impact - substantial potential effect of cold water temperature
e) Other potential water quality/quantity impacts	no impact likely - no effects on water quality/quantity anticipated	potential minor impact - small potential effects on water quality/quantity	potential major impact - substantial potential effects on water quality/quantity

Table 4.2-3. Definitions for good, fair, and poor ratings assigned to sites for evaluative criteria.

Evaluative Criteria	Assigned Rating and Definition		
	GOOD	**FAIR**	**POOR**
f) Cultural resources	no impact likely - no known cultural resources in vicinity	potential minor impact - cultural resources known or may be present but impacts appear unlikely	potential major impact - cultural resources known or may be present, potential for impacts
5. Permitting/Approval Considerations Criteria			
a) Federal	Permits/approvals process not considered significant; no major delays anticipated	Some issues to address; some delay anticipated	Some issues to address; outcome for timely approval uncertain
b) State	Permits/approvals process not considered significant; no major delays anticipated	Some issues to address; some delay anticipated	Some issues to address; outcome for timely approval uncertain
c) Local	Permits/approvals process not considered significant; no major delays anticipated	Some issues to address; some delay anticipated	Some issues to address; outcome for timely approval uncertain

1. *Special status species/habitat evaluation focused on terrestrial and non-fish aquatic species. Potential constraints related to special status fish species were evaluated under 4c) Fish passage/river habitat.*

Key to site ratings:
GOOD: positive factor, not a constraint on whitewater park use of site.
FAIR: neutral factor, possible minor constraint on whitewater park use of site.
POOR: negative factor, possible/probable major constraint on whitewater park use of site.

An individual poor rating does not make a site infeasible; however, such a rating does reflect a possible barrier that would need to be overcome or mitigated to make the site feasible. Subsequent sections of this report focus on placing these criteria rankings for each site side by side, so that sites can more easily be compared in terms of what types of barriers they have in common and how many barriers each site may have relative to other candidate sites.

4.2.2.2 Results of Evaluation of Candidate Whitewater Park Sites Based on 25 Evaluative Criteria

Applying the definitions described above, each candidate whitewater park site was evaluated against each criterion. Figures 4.2-8 through 4.2-10 depict each of the three candidate sites (i.e., Bedrock Park, Fish Barrier Pool, and Riverbend Canyon) with information related to several physical and environmental criteria. Table 4.2-4 present the results for each site for each of the 25 criteria (Appendix C provides a brief synopsis of the rationale used to determine the rating assigned to each site for each criteria;

Appendix A, Table A-2, lists the major sources of information used in making these assessments). Where appropriate, the evaluative term used in the definition (such as "low," "adequate," or "excessive" gradient) is used in this table, along with the "good," "fair," and "poor" ratings assigned to each site for all criteria.

Table 4.2-4. Ratings assigned to candidate whitewater park sites based on evaluative criteria.

Evaluative Criteria	Instream Park Site	Artificial Channel Park Sites	
	Bedrock Park	**Fish Barrier Pool**	**Riverbend Canyon**
1. Physical Criteria			
a) Gradient	Low (Fair)	Adequate (Good)	Adequate (Good)
b) Flow	Low (Fair)	Adequate (Good)	Adequate (Good)
c) Land ownership/use	Public (Good)	Public (Good)	Primarily Private (Poor)
d) Parking/access	Good	Fair	Fair
e) Available infrastructure (water/sewer/elect/phone)	Good	Good	Fair
f) Potential length of run(s)	Fair	Good	Good
g) Available space for spectating, optional amenities	Good	Fair	Good
h) Aesthetics	Good	Good	Good
i) Safety/security	Good	Fair	Good
2. Operational Requirements Criteria			
a) Security	No Impact Likely (Good)	No Impact Likely (Good)	No Impact Likely (Good)
b) Regulatory flow and temperature requirements	Potential Minor Impact (Fair)	No Impact Likely (Good)	Potential Major Impact (Poor) **
c) Power generation	No Impact Likely (Good)	Potential Major Impact (Poor)	No Impact Likely (Good) **
d) Water supply	No Impact Likely (Good)	No Impact Likely (Good)	No Impact Likely (Good)
e) Flood control operations	No Impact Likely (Good)	No Impact Likely (Good)	No Impact Likely (Good)
3. Typical Whitewater Park Operational Criteria			
a) Diurnal park operations considerations	Good	Fair	Fair
b) Seasonal park operations considerations	Fair	Fair	Fair

Table 4.2-4. Ratings assigned to candidate whitewater park sites based on evaluative criteria.

Evaluative Criteria	Instream Park Site	Artificial Channel Park Sites	
	Bedrock Park	**Fish Barrier Pool**	**Riverbend Canyon**
4. Environmental Constraints			
a) Flooding potential	No Flooding Potential (Good)	No Flooding Potential (Good)	Moderate Flooding Potential (Fair)
b) Special status species/ habitat [1]	No Impact Likely (Good) *	No Impact Likely (Good)	Potential Minor Impact (Fair) *
c) Fish passage/river habitat	No Impact Likely (Good)	No Impact Likely (Good)	No Impact Likely (Good)
d) Water temperature (cold water effects on boaters)	Potential Minor Impact (Fair)	Potential Minor Impact (Fair)	Potential Minor Impact (Fair)
e) Other potential water quality/quantity impacts	No Impacts Likely (Good)	No Impacts Likely (Good)	No Impacts Likely (Good)
f) Cultural resources	No Impacts Likely (Good) *	Potential Major Impacts (Poor)	Potential Impacts Unknown (Poor) *
5. Permitting/Approval Considerations Criteria			
a) Federal			
USACE - Sec 404 Clean Water Act permit	Permit required	Permit may be required	Permit may be required (if jurisdictional)
NMFS - ESA consultation/ "take" authorization (anadromous fish)	Formal Consultation/ Permit required	Informal consultation/ No permit required	Informal consultation/ Permit not likely required **
USFWS - ESA consultation/ "take" authorization	Informal consultation/ Permit may be required *	Informal consultation/ No permit required	Informal consultation/ Permit may be required *
FERC – Oroville Facilities License Amendment	License amendment may be required	License amendment required	License amendment likely required
b) State[2]			
DFG - Sec 1602 Streambed Alteration Agreement	Agreement required	Agreement not likely required	Agreement may be required
DFG - CESA consultation/ Incidental Take Permit	Consultation/ permit required *	No consultation/ No permit required	Consultation/ Permit may be required *
RWQCB - Section 401 Clean Water Act certification	Certification required	Certification may be required (if 404 permit required)	Certification may be required (if 404 permit required)
SHPO review (potential effects on heritage resources)	Review required *	Review required, through Oroville Project HPMP implementation	Review required *
Central Valley Flood Protection Board - Encroachment permit	Permit required	No permit required	Permit not likely required

Table 4.2-4. Ratings assigned to candidate whitewater park sites based on evaluative criteria.

Evaluative Criteria	Instream Park Site	Artificial Channel Park Sites	
	Bedrock Park	Fish Barrier Pool	Riverbend Canyon
c) Local			
Butte County	No permit or zoning issues anticipated (City jurisdiction)	No complex permit or zoning issues anticipated	Potentially complex zoning/permit issues anticipated
City of Oroville	No permit or zoning issues anticipated	No permit or zoning issues anticipated (County jurisdiction)	Potentially complex zoning/permit issues anticipated

1. *Special status species/habitat evaluation focused on terrestrial and non-fish aquatic species. Potential constraints related to special status fish species were evaluated under 4c) Fish passage/river habitat.*
2. *Does not include separate agreements with DWR that may be necessary to implement whitewater park concepts.*

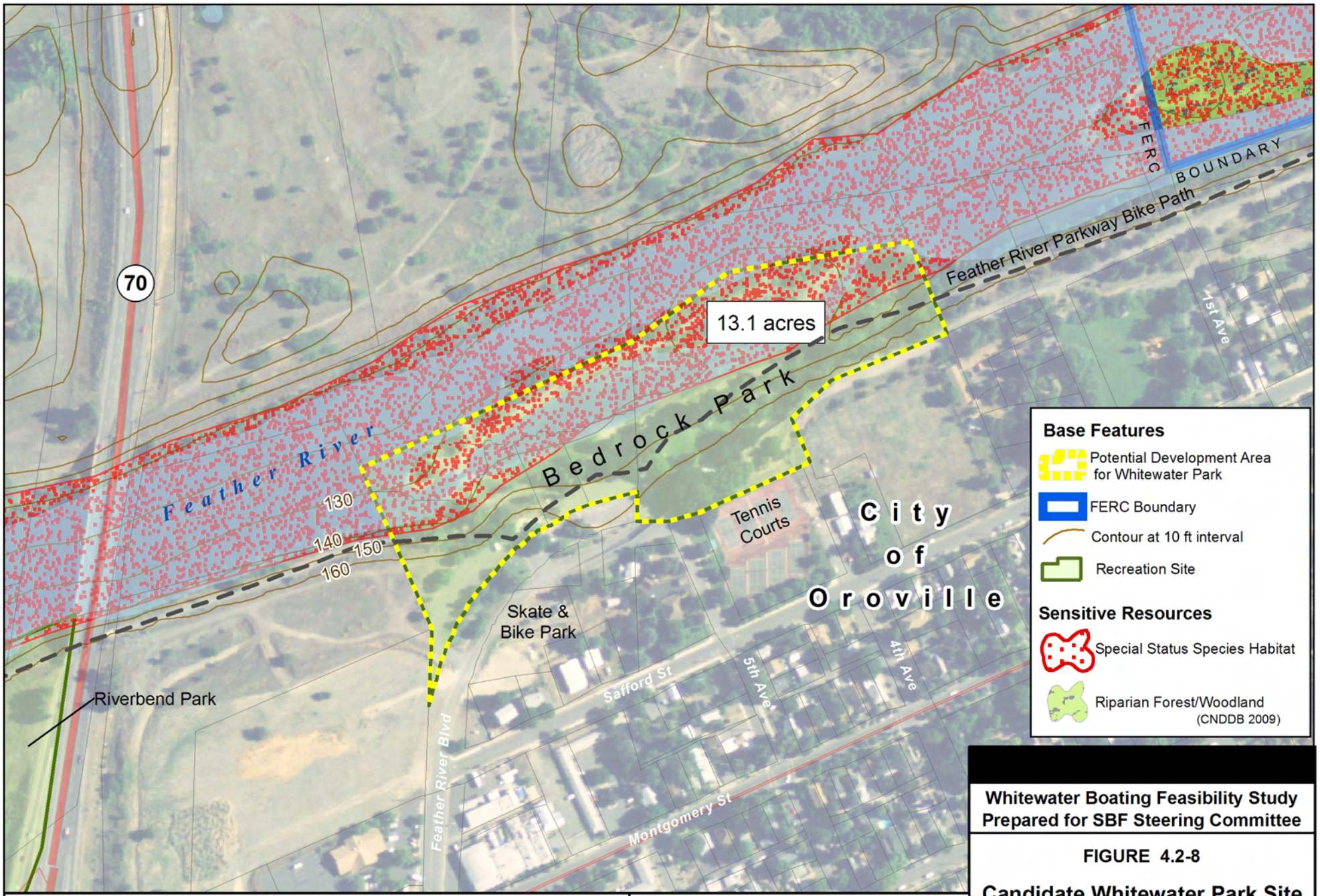
Key: "" = resource data are lacking; additional study is needed to confirm this preliminary determination based on the best available information; "**" = potential constraint is design-dependent, i.e., potential use of retention pond or ponds for course, and potential release of water from park to river.*

ESA = Endangered Species Act; HPMP = Historic Properties Management Plan; SHPO = State Historic Preservation Office; RWQCB = Regional Water Quality Control Board; USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service; NMFS = National Marine Fisheries Service; CESA = California Endangered Species Act.

Note that in the permitting/approval considerations category, a good, fair, or poor rating was not applied in reference to the individual federal, state, and local agency permitting or approval that may be required. The need or lack of a need for a particular permit or consultation was not judged to be, by itself, a constraint or positive or negative factor for a site. Instead, the need at each site for several federal, state, or local permits, consultation, or approvals was viewed in sum, and good, fair, and poor ratings applied according to the definitions shown in Table 4.2-3. These definitions take into account both the number of permits, consultations, or approvals needed, and whether impacts/issues are anticipated that could make the permitting, consultation, or approval process complex and more difficult and time-consuming.

4.2.2.3 Summary of Results of Evaluation of Candidate Whitewater Park Sites Based on 25 Evaluative Criteria

Table 4.2-5 summarizes the results for each site for each of the 25 criteria, using a more readily compared "+/0/-" format and color coding to represent good, fair, and poor site ratings. Numerical scores for each site based on the sum of these ratings are provided at the bottom of the table. These cumulative scores represent an attempt to quantify to results of the secondary evaluation to facilitate comparison across candidate sites. However, these cumulative scores should not be taken as definitive or precise representations of the potential of each site for whitewater park development. Weighting factors for each criteria (e.g., 1 = not important, 2 = somewhat important, 3 = important, 4 = essential), based on additional analysis of local whitewater park needs and preferences, could be used in subsequent site analysis to more definitively place a value on the development potential of a focused set of candidate sites.



Source: DWR 2007 / Map prepared by EDAW 2009

300 150 0 300 Feet

Scale 1 : 3600
1" = 300 ft

NOTES for CANDIDATE SITE:

- No cultural resource surveys completed.
- Site is under FRRPD jurisdiction.

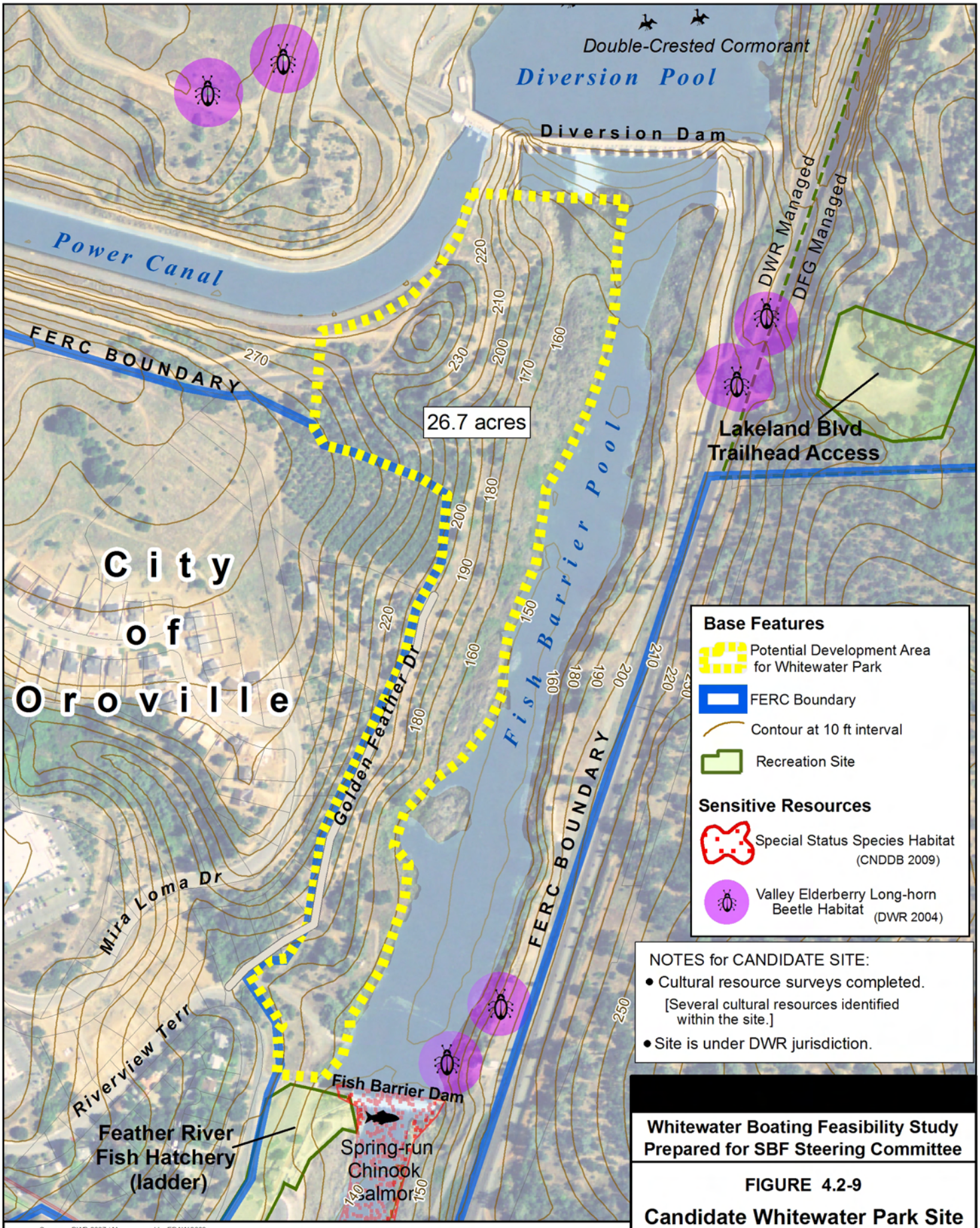
Whitewater Boating Feasibility Study
Prepared for SBF Steering Committee

FIGURE 4.2-8

Candidate Whitewater Park Site

Bedrock Park

Prepared by: EP -- EDAW, Inc.
Date 12/09
P:\2000\0s016.gis\arcmap\whitewater\ww_ProposedSite_BedrockPark_11x8.mxd



Whitewater Boating Feasibility Study
Prepared for SBF Steering Committee

FIGURE 4.2-9

Candidate Whitewater Park Site

Fish Barrier Pool

[City of Oroville PM&E]

Prepared by:	Date	
PJ -- EDAW, Inc.	12/09	P:\2000\0s016.gis\arcmap\whitewater\ww_ProposedSite_#4FishBarrierPool_8x11.mxd

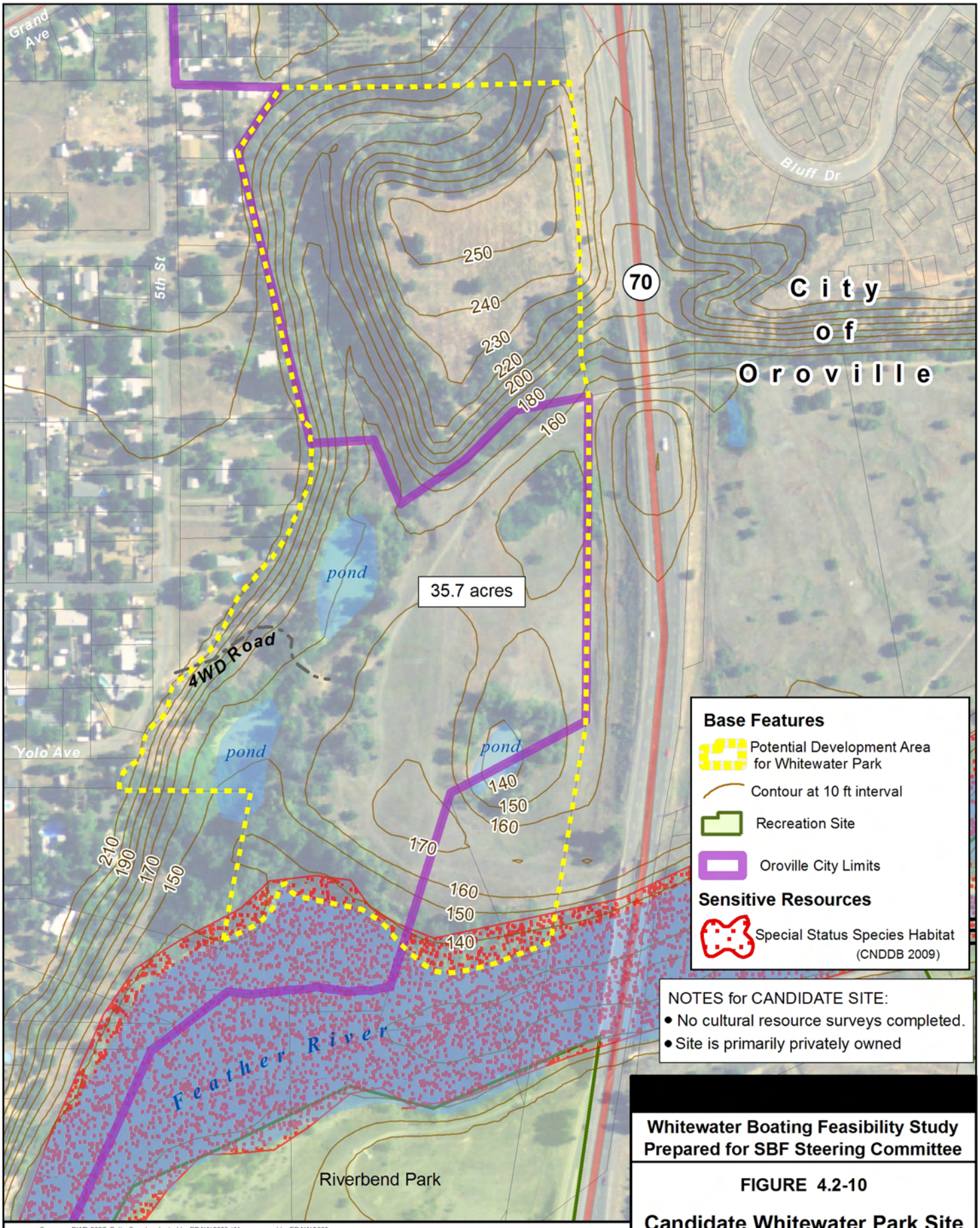

Grand Ave
5th St
Bluff Dr
70
City of Oroville
250
240
230
220
200
180
160
pond
35.7 acres
4WD Road
Yolo Ave
pond
pond
140
150
160
170
210
190
170
150
160
150
140
Feather River
Riverbend Park
Base Features
Potential Development Area for Whitewater Park
Contour at 10 ft interval
Recreation Site
Oroville City Limits
Sensitive Resources
Special Status Species Habitat (CNDDB 2009)
NOTES for CANDIDATE SITE:
• No cultural resource surveys completed.
• Site is primarily privately owned
Source: DWR 2007, Butte County adapted by EDAW 2009 / Map prepared by EDAW 2009
300 150 0 300 Feet
Scale 1 : 3600
1" = 300 ft
Whitewater Boating Feasibility Study
Prepared for SBF Steering Committee
FIGURE 4.2-10
Candidate Whitewater Park Site
Riverbend Canyon
Prepared by: EP -- EDAW, Inc.
Date 12/09
P:\2000\0s016.gis\arcmap\whitewater\ww_ProposedSite_RiverbendCanyon_8x11.mxd

Table 4.2-5. Summary of ratings given to candidate whitewater park sites for evaluative site criteria.

Evaluative Criteria	Instream Park Site	Artificial Channel Park Sites	
	Bedrock Park	Fish Barrier Pool	Riverbend Canyon
1. Physical Criteria			
a) Gradient	0	+	+
b) Flow	0	+	+
c) Land ownership/use	+	+	-
d) Parking/access	+	0	0
e) Available infrastructure (potable water / sanitary sewer / electricity / telephone)	+	+	0
f) Potential length of run(s)	0	+	+
g) Available space for spectating, optional amenities	+	0	+
h) Aesthetics	+	+	+
i) Safety/security	+	0	+
2. Operational Requirements Criteria			
a) Security	+	+	+
b) Regulatory flow and temperature req.	0	+	-
c) Power generation	+	-	+
d) Water supply	+	+	+
e) Flood control operations	+	+	+
3. Typical Whitewater Park Operational Criteria			
a) Diurnal considerations (potential constraints on daily operations at site)	+	0	0
b) Seasonal considerations (potential seasonal constraints on operations at site)	0	0	0
4. Environmental Constraints Criteria			
a) Flooding potential	+	+	0
b) Special status species/habitat [1]	+	+	0
c) Fish passage/river habitat	+	+	+
d) Water temperature (cold water effects on boaters)	0	0	0
e) Other potential water quality/quantity impacts	+	+	+

Table 4.2-5. Summary of ratings given to candidate whitewater park sites for evaluative site criteria.

Evaluative Criteria	Instream Park Site	Artificial Channel Park Sites	
	Bedrock Park	Fish Barrier Pool	Riverbend Canyon
f) Cultural resources	+	-	+
5. Permitting/Approval Considerations Criteria			
a) Federal	-	0	0
b) State	-	0	0
c) Local	+	+	-
Summary of Site Ratings and Cumulative Scores			
Good ratings (positive factors)	17	15	13
Fair ratings (neutral factors)	6	8	9
Poor ratings (negative factors)	2	2	3
Cumulative Score (+ = 1, 0 = 0, - = -1)	15	13	10

1. *Special status species/habitat evaluation focused on terrestrial and non-fish aquatic species. Potential constraints related to special status fish species were evaluated under 4c) Fish passage/river habitat.*

Key to site ratings:
+ = GOOD (green cell shading): positive factor, not a constraint on whitewater park use of site.
0 = FAIR (yellow cell shading): neutral factor, possible minor constraint on whitewater park use of site.
- = POOR (red cell shading): negative factor, possible/probable major constraint on whitewater park use of site.

4.2.2.4 Conclusions Drawn from the Evaluation of Candidate Whitewater Park Sites Based on 25 Evaluative Criteria

The following conclusions can be drawn regarding the viability of the three candidate whitewater park sites based on the criteria enumerated in the Study Plan. It is important to note the provisional nature of these conclusions, which are based on a reconnaissance-level screening using the best available information; a more rigorous evaluation, which may be appropriate for a site or sites chosen to move forward in a whitewater park development process, may reveal new constraints. In particular, certain environmental constraints would require more intensive, site-specific analysis using tools not available here to fully understand potential impacts. An example is potential effects of an artificial whitewater channels at the Fish Barrier Pool on water temperature, where small increases may have adverse effects on fisheries. Water temperature modeling tools could be applied to fully investigate this potential constraint.

Positive factors in the viability of the three sites, based on the lack of apparent constraints, can be summarized as follows:

- The Fish Barrier Pool and Bedrock Park sites were rated “good” on most of the criteria, and the number of criteria judged to be a positive factor (not a constraint)

in the viability of the sites is similar between those two sites (15 and 17 criteria rated "good"). In contrast, the Riverbend Canyon site was assigned a good rating for only 13 of the 25 criteria, and therefore appears to be a somewhat less favorable site, with numerous potential minor and major constraints.

Neutral factors in the viability of the three sites, based on apparent potential minor constraints, can be summarized as follows:

- All of the sites were rated fair on several criteria. In some cases, the degree to which the criterion would be a constraint on the viability of the site was not entirely clear or certain, but the constraint in those cases did not appear to be a major constraint that would potentially make the site not viable. An example is the effect of cold water temperatures (generally less than 60 degrees F) that would potentially limit fall, winter, and spring use of a whitewater park at any of the three sites. The uncertainty is based on the likelihood that whitewater park use would be low during most cool-weather months at any site and the potential for kayakers and rafters to wear gear (dry suits) that would reduce the effects of cold water and perhaps extend off-season use (see Appendix C, Table C-1, row 4d).

- The physical criteria rated "fair" at the Bedrock Park site include low flow and gradient and relatively short potential run length. However, these constraints may not be major concerns if the intent would be to provide a "stand-alone mini venue" (the SBF Steering Committee's recommendation) or, as similarly described in the FRRPD Master Plan, a "second whitewater facility to cater to youths and beginning kayakers."

- Other criteria for which sites were rated "fair" point out physical challenges inherent in the sites that would need to be addressed in any whitewater facility design for the sites. Examples include the lack of level ground for parking at the Fish Barrier Pool site and lack of access onto the Riverbend Canyon site. Preliminary design work could help further define the severity of these types of constraints, as well as options for addressing them at a particular site.

- The requirement, or possible requirement, for several federal and state permits, certification, or other environmental approvals at both the Fish Barrier Pool and Riverbend Canyon sites led to a "fair" rating for federal and state permitting for both sites. These permitting requirements could impose delays, and additional costs, on potential whitewater park development at those sites.

Negative factors in the viability of the three sites, based on possible or probable major constraints, can be summarized as follows:

- Each of the candidate park sites was rated "poor" on at least two criteria, and the Riverbend Canyon site on three criteria. These criteria may present the greatest challenges to potential whitewater park development at the sites. Some of these,

such as the predominantly private land ownership at Riverbend Canyon and the loss of power generation output associated with the Fish Barrier Pool site (and potentially Riverbend Canyon, if the Power Canal is the source of water for a park, as addressed below), suggest significant potential costs to develop and operate a whitewater facility at the sites that need to be considered. Others, such as potential impacts on biological or cultural resources, would need to be eliminated or reduced to the satisfaction of the permitting and regulatory agencies for a site to be viable.

Finally, it should be understood that "fair" and "poor" ratings do not necessarily indicate that development of a whitewater facility at a site is not feasible. Constraints may be reduced or eliminated by specific features incorporated into the design or operation of the park. Also, on-site or off-site mitigation may be developed in response to adverse effects of whitewater park development.

In comparing the viability of the three sites, the following conclusions can be drawn:

Instream Park Site - Bedrock Park:

- The instream park site on the Feather River at Bedrock Park (recommended in the SBF Steering Committee letter to DWR of July 7, 2009) appears to have less potential constraints than the two artificial channel park sites, although the number of potential minor and major constraints at the Fish Barrier Pool site is similar.

- There do not appear to be any major physical, operational (for the Oroville Facilities or the potential whitewater facility), or environmental constraints at this site. However, the location of this site in the low flow channel of the river, where anadromous fisheries issues and related water temperature and flow concerns are of vital importance, is likely to result in several federal and state permitting requirements. Also, the area of the river in the vicinity of Bedrock Park is being considered by DWR as a potential site for the Fish Segregation Weir, which would be used to separate spring-run and fall-run Chinook salmon. (The weir is a component of the Lower Feather River Habitat Improvement Plan, as per Settlement Agreement Articles A101 and A105.)

- It is important to note, once again, the lack of biological (non-aquatic) and cultural resource data for the site, which are needed to confirm the anticipated low likelihood of impacts on special status species and cultural resources.

- The potential permitting requirements may represent the greatest challenge to whitewater park development at this site. However, additional investigation is needed to determine the likely fishery and water temperature and flow impacts of converting the existing lagoon into a whitewater channel. The effects may be small yet still significant given the anadromous fish needs and regulatory requirements. Beneficial effects are possible. The influence of an increase in the minimum flow in the low flow channel, as stipulated in the Settlement Agreement, would need to be considered in this investigation.

Artificial Channel Park Site 1 – Fish Barrier Pool:

- The Fish Barrier Pool site, described in the City of Oroville's PM&E form as the preferred whitewater park site (City of Oroville and Oroville Redevelopment Agency 2004), appears to have few major physical, operational (for the Oroville Facilities or the potential whitewater facility), or environmental constraints. In addition, the size, aesthetics, topography, and public ownership of the site, and the accessible location adjacent to existing infrastructure are all positive factors in the viability of this site.

- Access and parking needs may present constraints for whitewater park development at this site as the site is surrounded by residential development and may provide few parking options. (The conceptual park design contained in the PM&E form includes a 20-30 space parking lot at the south end of the site.) Also, the capacity of existing adjacent water and wastewater infrastructure may not be adequate to serve a large whitewater park. Therefore, there may be off-site infrastructure improvement and parking construction costs associated with this site.

- The presence of the Diversion Dam and Power Plant outflow at the upstream end of this site and the Fish Barrier Dam at the downstream end present potential hazards for recreational users of this site. These would be of particularly concern regarding whitewater paddlers who would exit from the whitewater channel to the Fish Barrier Pool at the end of a run (as depicted on the PM&E form conceptual park design). It would be necessary to ensure that paddlers and spectators are kept a safe distance from these hazards.

- Development of a whitewater park at this site, which would involve major disturbance across the length of the site, may be constrained by the presence of cultural resources in several locations across the site. Further investigation would be needed to determine the necessity of and options for avoiding impacts on specific cultural resources present.

- Because this entire site is within the FERC Project boundary, and because diversion of water from the Power Canal would require modification of part of the FERC-licensed facilities, a license amendment from FERC would be required.

- Finally, the loss of potentially substantial amounts of power generation due to the diversion of water that now flows through the Diversion Dam Power Plant is an important operational cost consideration at this site.

Artificial Channel Park Site 2 – Riverbend Canyon:

- The Riverbend Canyon site (recommended in the SBF Steering Committee letter to DWR of July 7, 2009) appears to have several positive factors in support of the viability of the site. These include the large size of the site and ample gradient (even if only the lower elevation portion of the site was used for a whitewater channel), along with good aesthetics and probable low potential for biological or cultural

resource impacts. However, biological and cultural resource data for this site are needed to confirm the anticipated low likelihood of impacts.

- A potential major constraint at Riverbend Canyon is the potential warming of water released from a whitewater park to the river. Water held in a retention pond for use in a whitewater channel (after being pumped from the river or piped from off site) could warm such that water temperature requirements in the low flow channel are violated. Pumping or diversion of water directly into a whitewater channel followed by immediate release of the water to the river would reduce the potential for warming.

- Several features of this site would present challenges in providing for public use that would need to be addressed in facility design. Although the site is adjacent to developed residential and commercial areas, the lack of non-four wheel drive vehicle access onto the site and the topographic constraints imposed by the steep-sided canyon that wraps around two sides of the site would limit options for providing vehicle access and water/wastewater infrastructure, and would also be likely to substantially increase construction costs. The capacity of existing adjacent water and wastewater infrastructure may not be adequate to serve a large whitewater park. Therefore, there may also be off-site infrastructure improvement costs associated with this site.

- Residential development of the riverside parcels on the east side of State Highway 70 was proposed by the City of Oroville and the Oroville Redevelopment Agency in the *Oroville Waterfront Redevelopment Concept Plan*, as depicted in the PM&E form that also proposes a whitewater park at the Fish Barrier Pool or an alternative site. This potential future development, referred to as the "North Bank Residential Neighborhood" in the *Concept Plan,* may provide more access and utility infrastructure options, since the sites are linked via a highway underpass.

- The *Oroville Waterfront Redevelopment Concept Plan* also proposes several new recreational amenities on both sides of the river between the Feather River Fish Hatchery/Table Mountain Blvd. bridge and the State Highway 70 bridge. These include a "waterfront linear park" providing new public open space and a trail on the north bank of the river and two pedestrian bridges over the river providing connections to the existing trail on the south river levee. The proposals also include an "aquatic center/swim complex" in the vicinity of the existing Bedrock Park, and a "gateway park" on both sides of the river in the vicinity of the State Highway 70 bridge. If the City of Oroville and the Oroville Redevelopment Agency are successful in implementing these or similar potential future recreation developments, a whitewater park at the Riverbend Canyon site could both contribute to and benefit from the synergy created by multiple linked recreation opportunities in proximity to each other. The proposed trail and pedestrian bridge linkages would also substantially enhance the connection of this site to central Oroville residential areas and the downtown area, which could potentially increase park usage and the potential contribution of a park to local economic development.

- Among the potential major constraints of this site is the predominant private ownership. This constraint is unique to this site and was considered a potential "fatal flaw" for other candidate sites subjected to initial site screening, in relation to the criterion of "reasonable site acquisition costs." This site was not evaluated for this criterion in initial screening due to its later introduction by the SBF Steering Committee via their July 2009 letter to DWR. Site acquisition costs are not known and would require a real estate assessment to determine, but are assumed to be substantial given the size of the site and the nearly total private ownership.

- Because diversion of water from the Power Canal or Feather River Fish Hatchery would require modification of part of the FERC-licensed facilities, a license amendment from FERC would be required if either of these options for supplying water to the site were included in the whitewater park design.

- Mixed city and county jurisdiction of the site is likely to be a constraint, and impose challenges for local permitting and approvals, unless action is taken to annex the main lower parcel to the City of Oroville and thus bring all five parcels within the site under city jurisdiction. Alternatively, limiting whitewater park development to the main 10-acre lower parcel, which is under Butte County jurisdiction, would avoid the need to reconcile city and county jurisdictions.

4.2.2.5 Additional SBF Steering Committee Questions Related to Viability of Candidate Whitewater Park Sites

In its July 2009 letter to DWR, the SBF Steering Committee requested that several questions be investigated regarding each of the three sites recommended by the committee. Some of these questions relate to potential physical constraints of the sites that were addressed previously in this report; these potential constraints were among the secondary site evaluative criteria included in the Study Plan. These are addressed once again below, with any additional information found with further investigation. Other questions relate to the feasibility and costs of certain site modifications and off-site pipelines to support whitewater park use, which would provide a water supply or store water for a whitewater channel on the site. These are essentially site design and engineering issues, which would be expected to be addressed in detailed facility designs for sites where the SBF Steering Committee may elect to continue to pursue potential whitewater park development, and are beyond the original intent of this study. However, an attempt has been made to develop preliminary responses to each of these questions based on available information, and thus provide an indication if these issues are likely to represent significant obstacles to whitewater park development or use at the sites.

Riverbend Canyon Site

1. What is the cost of getting water to this site via the existing power canal or from the fish hatchery?

Several factors affect the cost of a pipeline of a given length and size: the type of pipe, the length of the pipeline, the diameter of pipe, environment, and terrain. Environment and terrain factors include topography, soils, presence of natural obstacles such as bedrock and waterways, and presence of residential or commercial development and roadways on the route. Because of these and other factors, planning for a pipeline is very site-specific.

The reconnaissance-level (preliminary) cost estimate provided here is intended to support only rough comparison, screening, and evaluation of potential pipeline projects. The several levels of precision in construction cost estimates correspond to the typical phases of the project design and development process and are considered standards within the construction industry. A Level 1 estimate, also termed a “reconnaissance” or “feasibility” estimate, is an order of magnitude estimate intended to facilitate budgetary and feasibility determinations. It is typically prepared to develop a project budget and is based on historical information related to similar projects, with adjustments made for specific project conditions. Project information for estimates at this level usually include a general functional description of the project and intended use, significant features and components, a sketch or schematic layout (if available), the geographic location, size of the site to be developed, and number of people intended to be served by the facility. Because this type of estimate is an order of magnitude estimate, a typical degree of accuracy assigned to the estimate is plus or minus 40 percent (USACE 2008, DOE 1997, Manfredonia, B., et al. 2009).

a. Power Canal Pipeline Option

Supplying water to the site via the Power Canal would require a pipeline (or similar conveyance) approximately 1 mile long. To avoid the added complexity and expense of crossing State Highway 70, the most practical route would be entirely to the west of the highway. Therefore, the pipeline would run from an intake at the west end of the Power Canal or the east end of the Thermalito Forebay, following as direct a route as practical south to the north end of the site.

For this reconnaissance-level purpose, the likely approximate route appears to have few major obstacles in terms of topography or natural barriers, as the land is fairly level and the route crosses generally open ground and no waterways. However, the Nelson Park complex (operated by the FRRPD), several residential and commercial properties, and several road crossings are along the route.

Major elements of pipeline costs can be subdivided into construction costs, which include both material and labor costs for pipeline installation, and other project costs that are not directly associated with construction activities including engineering and

surveying, project management, environmental assessments and permitting, and right-of-way or easement acquisition (Menon 2004). A right-of-way or easements 50 to 75 feet in width would be needed for all properties along the route to this site.

Regarding pipeline size, rough estimates of the flow capacity of standard unpressurized concrete, corrugated metal, and corrugated plastic pipe (materials commonly used for stormwater drainage, for example) indicate that a large pipeline, possibly 8 feet or larger in diameter, would be required to bring the 400-600 cfs flow required if the water were to be directly diverted into a large artificial channel whitewater park.[1]

Conceptual water pipeline cost estimates were developed by civil engineers at MWH, Inc., lead consultant for the Oroville Facilities License Implementation. The estimates indicated a cost of about $6.0 to $7.0 million for a 96-inch pipeline 1 mile in length, assuming the approximate pipeline location described above. This preliminary estimate includes contractor overhead and profit, mobilization and demobilization, and contingency costs, with assumptions of one valve per mile, and a 65-foot right-of-way. The preliminary estimate includes labor and material components of construction costs, but does not include engineering, permitting, land acquisition, or other non-construction costs. Additional park design information is needed to estimate the cost of an intake and gate on the Power Canal. However, the cost of this necessary component may be similar to the cost of the pipeline itself.

This pipeline and intake project would be a major undertaking in addition to development of the whitewater facility itself, and would require additional environmental documentation and permitting, with associated additional costs. Bureau of Reclamation records related to pipeline projects and industry standards suggest that these and other non-construction costs might add 25 percent to the project cost (BOR 2006).

It is important to note that the flow from this pipeline would need to be released to the low flow channel after passing through the whitewater park channel, and that this outflow could have adverse effects on special status anadromous fish. (This issue is addressed further under question 3 below.) The basic park design would be a diversion channel park, of which the proposed Mississippi Whitewater Park is an example, although that park would divert water directly from the river rather than using a pipeline. (See the Phase 1 Background Report for details and conceptual illustrations of the Mississippi Whitewater Park.)

A more practical and cost-effective option for supplying water to this site from the Power Canal may be a smaller pipeline that would supply a retention pond at the upstream end of the course, rather than supplying a greater flow to be diverted directly into a

[1] Flow estimates obtained using an online hydraulic flow calculator (FlowSizer.com 2009) indicate that an 8-ft diameter concrete pipe, with 0.25% slope (13.2 ft/mile), would provide about 240 cfs at half-full flow (which is often used as a design parameter), and about 500 cfs at full flow. A pipe made from corrugated metal or high-density polyethylene (HDPE), due to a rougher interior surface, would have a substantially lower flow capacity. Appendix G, Table G-1 provides a range of flow capacity estimates for finished concrete and steel pipe.

whitewater channel. Water would flow from the retention pond into the whitewater channel, and would need to be pumped back up to the top of the course, presumably from a second retention pond at the bottom of the course. This is the basic design of the two large artificial channel whitewater courses built in Maryland and North Carolina in the past few years, as described in the Phase 1 Background Report.[2]

A 36-inch (or smaller) pipeline could potentially be suitable to supply a retention pond at the Riverbend Canyon site. A 36-inch pipeline (applying the same assumptions for pipe material and slope as above) would have a capacity of about 18 cfs at half-full flow and 37 cfs at full flow (Oregon State University 2009, FlowSizer.com 2009). These flows correspond to 11.7 and 23.9 million gallons per day.[3] Given that the large pumped flow parks described in the Phase 1 Background Report contain 12-13 million gallons of water in their ponds and channels, a 36-inch pipeline would require from one-half day to a full day to supply all of the water needed for a whitewater park of a similar size.

The preliminary cost estimate for a 36-inch pipeline 1 mile in length provided by MWH, Inc., assuming the same approximate pipeline location, is $2.0 to $2.5 million. As would be the case for the larger pipeline, additional costs for an intake and gate on the Power Canal may be similar to the cost of the pipeline itself. Again, such a pipeline and intake project would be a major undertaking in addition to the development of the whitewater facility itself, with requirements for additional environmental documentation and permitting, with associated additional costs.

b. Feather River Fish Hatchery Pipeline Option

Another option to supply water to a whitewater park at this site is the use of water from the Feather River Fish Hatchery. The hatchery diverts approximately 90 to 110 cfs from the Diversion Dam year round via a 54-inch pipe, but discharges approximately 35 to 70 cfs of that flow directly back into the Feather River (Cramer Fish Sciences 2009). The excess gravity-fed flow is necessary to maintain sufficient water pressure; thus, it is assumed that this flow will continue to be available for potential off-site use.

This 35 to 70 cfs flow would not be sufficient flow for an artificial channel whitewater park. But the potential may exist to divert this unused water from the Feather River Fish Hatchery via a pipeline to a retention pond at the Riverbend Canyon site, from which water would be pumped to supply a whitewater channel. Again, this is the basic design of the Maryland and North Carolina artificial channel parks built in recent years.

[2] Further analysis could provide a comparison of costs for a large pipeline, with the cost of a smaller pipeline to supply retention ponds and the added cost of pumping the water to the top of the course. The USNWC pumps up to 1,200 cfs through the course at a cost of over $200 per hour (Smith 2006). This equates to more than $430,000 for 12 hours of operation per day for a 6-month season. A large artificial channel park at this site may require less than half this flow of water. However, average retail energy prices for commercial customers are nearly twice as high in California ($0.15/kWh) as in North Carolina ($0.08/kWh)(Energy Information Administration 2009). Therefore, pumping costs may be similar.

[3] 1 cfs = 646,317 gallons per day.

A pipeline constructed for this purpose would need to transport the water at least 4,000 feet (three-quarters of mile), from the downstream end of the hatchery to the east side of the Riverbend Canyon site. The existing State Highway 70 underpass could potentially provide a convenient route for the pipeline to enter the site without the need to tunnel beneath the highway. Using the same pipeline slope and material assumptions as above, a pipeline about 42 inches in diameter would be sufficient to carry most of the available unused water from the hatchery (pipe capacity would be about 63 cfs at full flow, and about 32 cfs at half-full flow (Oregon State University 2009, FlowSizer.com 2009).

A conceptual construction cost of $1.0 to $1.5 million was estimated for a pipeline of that size and length, taking into account likely cost savings due to the unobstructed route across undeveloped land with no roads or waterways to cross. If a smaller pipeline with less flow capacity were determined to be adequate, construction costs could be substantially reduced. As with the Power Canal pipeline option, these costs do not include engineering, permitting, land acquisition, or other non-construction costs. Therefore, the total cost to bring water to the site would likely exceed the estimate above.

An additional issue for this pipeline is the potential for adverse impact on the Hatchery Ditch, a side channel of the low flow channel adjacent to the Feather River Fish Hatchery which provides critical habitat for special status fish species. The Hatchery Ditch is primarily dependent for flow on the same discharge of excess hatchery water that would be diverted for whitewater park use under this pipeline option. Any such diversion would need to avoid or mitigate any potential adverse effects on special status fish species and habitat in Hatchery Ditch.

c. Summary

Table 4.2-6 summarizes the responses to this question as described above. Appendix G, Table G-2, provides additional pipeline cost estimates for pipe diameters between 3 and 8 feet.

Table 4.2-6. Options and preliminary costs for a pipeline to supply an artificial channel whitewater park at the Riverbend Canyon site.

Pipe Option and Purpose	Approx. Pipe Size and Length	Preliminary Pipeline Construction Cost[1]	Assumptions Regarding Park Design and Related Constraints
Power Canal Supply Option			
Pipeline to divert sufficient flow for a whitewater channel (up to 500 cfs)	96-inch (8-foot) diameter pipe, 1 mile long	$6.0-7.0 million	• Would need to release water to low flow channel, which may have adverse effects on anadromous fish • Would result in substantial lost power generation at Thermalito Pumping-Generating Plant

Table 4.2-6. Options and preliminary costs for a pipeline to supply an artificial channel whitewater park at the Riverbend Canyon site.

Pipe Option and Purpose	Approx. Pipe Size and Length	Preliminary Pipeline Construction Cost[1]	Assumptions Regarding Park Design and Related Constraints
Pipeline to divert sufficient flow for retention pond from which water would be released into a whitewater channel and recirculated	36-inch diameter pipe[2], 1 mile long	$2.0-2.5 million	• Would need to construct a retention pond at the top of the whitewater channel to receive and store water for use in the channel • Would need to pump water from a retention pond at the bottom of the whitewater channel to the top of the channel, which would result in substantial operating costs
Fish Hatchery Supply Option			
Pipeline to divert sufficient flow for retention pond from which water would be pumped into a whitewater channel and recirculated	42-inch diameter pipe[3], 4,000 feet long	$1.0-1.5 million	• Would need to construct a retention pond to receive and store water for use in the whitewater channel • Would need to pump water from a retention pond to the top of the whitewater channel, which would result in substantial operating costs

1. *Cost does not include non-construction costs such as engineering, surveying, environmental studies and permitting, or land acquisition/easements. These are estimated to add 25% to project costs. Also does not include the costs of an intake/gate on the Power Canal, or any necessary pumps. Additional park design information is needed to estimate these costs; however, the costs of these projects may be similar to the cost of the pipeline itself.*
2. *A 36-inch pipe could divert up to 37 cfs. A smaller diameter pipe may provide sufficient flow for whitewater park needs, depending on park design and other factors.*
3. *A 42-inch pipe could divert up to 63 cfs, which is close to the maximum available flow from the hatchery; a smaller diameter pipe may provide sufficient flow for park needs, depending on park design and other factors.*

2. What is the feasibility (and) storage capacity potential of a reservoir situated at the upper end of Riverbend Canyon?

Two factors were examined to assess the feasibility of a reservoir at the upper end of Riverbend Canyon: the difference in elevation between the upper canyon and the lower portion of the site, and the suitability of the soils present to construct a dam for the reservoir and to hold water behind a dam or embankment. The question of potential capacity was assessed by estimating the space available relative to the space required for the type of retaining ponds typically used in pumped flow whitewater courses.

The elevation at the bottom of the upper end of the Riverbend Canyon (which would be the approximate bottom elevation of a reservoir built there) is about 200 feet. The elevation in the vicinity of the smaller of the two ponds in the lower canyon is about 150 feet. (The lower parcel drops an additional 20-30 feet down to the river at the

downstream end of the canyon.) This 50-foot elevation difference provides more than ample gradient between the upper and lower canyon in which to develop a whitewater channel.

However, a whitewater channel would not likely extend the entire length of the canyon, but would begin at a lower point, since the 50-foot elevation difference would require a very long channel with switchbacks to avoid an excessive gradient. The large pumped-flow whitewater parks in Maryland and North Carolina have a total drop of 24 and 21 feet, respectively, with channels as long as 1,700 feet. The Riverbend Canyon, from the north end of the site to a point between the two ponds is about 1,600 feet long. Therefore, a 15-20 foot drop would provide a desirable 50-65 feet per mile gradient. Alternatively, a more winding channel lengthened to 2,000 feet with a 20-25 foot drop would provide a similar gradient.

The soil survey for Butte County (NRCS 2006) indicates that the native material at the upper portion of the site (including the upper canyon) is within the Thompson Flat/Oroville complex of fine sandy loams. The complex includes Thompson Flat fine sandy loam (50 percent of the map unit covered by the report) and Oroville gravelly fine sandy loam (40 percent of the map unit covered by the report); the two soils are not mapped individually.

The soil survey report cites several limitations for Oroville soils for constructing embankments, dikes, or levees; thus, non-native material may be needed to construct a reservoir in the upper canyon. The Thompson Flat soils do not have these limitations. The Oroville soils are also reported to have limitations for reservoirs/ponds due to “depth to pan” (an impermeable layer), but this does not appear to be of concern in this case, since this limitation appears to be related to ponds constructed by excavation rather than by damming a canyon. Neither soil type is limited for ponds/reservoir due to permeability.

An additional concern with the placement of a reservoir in the upper canyon is the need to provide for the existing drainage into the canyon. The upper reaches of the canyon extend across State Highway 70. That area and additional areas to the north are drained by the City of Oroville stormwater collection system into the upper canyon on the site via a culvert that passes under the highway (City of Oroville 1996).

Regarding potential storage capacity of a reservoir in the upper canyon, the upper canyon provides about 500 feet of length and more than 200 feet of width, from the north to south lips of the canyon (an area of about 2.3 acres). These dimensions suggest that sufficient space exists in the upper canyon to construct a reservoir to supply a whitewater run. The upper canyon has a depth of about 40 feet, presumably only a portion of which would be used to construct a reservoir of sufficient size to supply a whitewater channel.

The retention ponds at existing pumped-flow whitewater parks provide a good indication of the necessary size of the retention ponds and confirm that the above dimensions at

Riverbend Canyon are adequate. Based on measurements taken from aerial imagery, the upper pond at the Adventure Sports Center International (ASCI) whitewater park measures about 230 by 150 feet (0.8 acres) while the larger lower pond measures about 500 by 300 feet (3.4 acres). Similar measurements of the ponds at the U.S. National Whitewater Center (USNWC) indicate that the facility's upper pond measures about 300 by 260 feet (1.8 acres) and the lower pond measures about 400 by 330 feet (3.0 acres). The channels in these parks, and most likely the ponds, average 5 feet deep; at that depth, the lower ponds have a volume of about 5.0-5.5 million gallons (15-17 acre-feet). As a point of reference, at each of the parks, the pumps circulate at total of 12-13 million gallons of water (37 acre-feet) through the whitewater channel(s).

3. Would there be issues surrounding returning water back to the low flow channel?

There are two potential aquatic resource issues associated with returning water back to the low flow channel from a whitewater park at this site. First, there is the potential to increase water temperatures in the low flow channel, downstream of the point of water return, due to increasing the residence time of water being stored and/or travelling through the whitewater park as compared to that water entering the low flow channel directly from the Diversion Pool. Second, there is the potential creation of attraction flows in the low flow channel at the point of the water return, which could function as an attractive nuisance for fish and result in migration and spawning delays (Fitzer 2009). Relicensing Study F10 describes the existence of such attraction flows for steelhead in the vicinity of the "Hatchery Ditch" caused by source flows from the Feather River Fish Hatchery settling ponds.

Increased water temperatures, even if the changes are small, could conflict with water temperature requirements for the low flow channel to benefit Chinook salmon and steelhead (DWR is required to maintain a water temperature at Feather River mile 61.6 less than or equal to 65°F on a daily average from June 1 through September 30 [DWR 2004a]) and future actions to further reduce water temperatures (Settlement Agreement Article A108.1) includes additional measures to further reduce temperatures in the low flow channel [DWR 2006a]). Further study of potential water temperature and fish attraction effects of a whitewater park, based on certain park design assumptions related to how water is to be used, stored, and released, is needed to address these issues with greater specificity and precision.

Diversion of sufficient flow for a whitewater channel (up to 500 cfs) from the Power Canal and release of that flow to the low flow channel would result in daily, or potentially more frequent, variations in flows in the low flow channel. The potential resource impacts of these variations in flows have not been identified. However, maximum allowable ramp-down requirements for water released to the river (currently 300 cfs per 24 hours for low flow channel releases less than 2,500 cfs [NMFS 2004]), designed to protect salmonids and other aquatic organisms, would need to be incorporated into park operations.

4. What is the feasibility of allowing water to be captured and allowed to percolate back into the ground?

The feasibility of water from a whitewater park at this site percolating into the ground is presumed to be of interest as an alternative to outletting the water directly into the river, which may have significant adverse effects on water quality and anadromous fish. This issue was assessed by, once again, examining the soils data provided by the soil survey report for Butte County (NRCS 2006). The soil type present on the lower parcel and lower canyon (below the line of the river bluff) is identified as "Xerorthents, tailings." These soils are described as highly permeable with permeability greater than 6 inches per hour in the top 2-5 feet of soil, and are described as "somewhat excessively drained." The high permeability appears to favor the feasibility of percolating water from a whitewater channel back into the ground. The Feather River Fish Hatchery, located one-half mile upstream on similar soils, uses settling basins to percolate water used in the hatchery into the Feather River (DFG 2009).

However, it does not appear likely that this degree of permeability would be sufficient to allow this method of releasing water from a whitewater channel at the site. (A more precise assessment of permeability would require on-site testing.) The volume of water passed through a large artificial channel whitewater park is typically 400-500 cfs and potentially up to 700 cfs, as in the USNWC "competition channel." The 500 cfs is equivalent to 323 million gallons, or nearly 1,000 acre-feet, per day.[4] In comparison, the Feather River Fish Hatchery percolates a maximum of 47.3 million gallons per day back to the river from two settling basins (each approximately 300 feet long by 30 feet wide and 15 feet deep) (DFG 2009). Therefore, capturing and percolating into the ground this large volume of water (six to seven times as much water as flows through the fish hatchery settling basins) possibly will make this type of design infeasible for the large scale park envisioned for this site.

Because percolation may not be feasible and direct return of water to the river may have adverse environmental effects, it would likely be necessary to construct a pond in the lower canyon from which water would be recirculated. Also, as described under question 1 above, a recirculating park would avoid the need to divert all of the needed 400-600 cfs flow from the Power Canal and returns that flow to the river. However, the soils data indicate that the soils present more limitations for a pond at the lower canyon than the upper canyon. The Xerorthents soils and tailings have high limitations for embankments, dikes, and levees because of seepage and high limitations for reservoirs/ponds due to permeability. Therefore, it appears that a lower pond would need to be lined to prevent infiltration, unless infiltration was deemed to be desirable or acceptable, and lost water could be replaced via the pipe diverting water from the Power Canal.

[4] 1 cfs over 24 hours = 1.983 acre-feet.

Bedrock Park Site

1. How much water can be diverted to the park area?

This issue is addressed in part in the secondary evaluation of this site, which includes evaluation of available flow, among other physical criteria (see Section 4.2.2.3 and Appendix C). From a fisheries standpoint, it may not be acceptable to the resource agencies to divert a substantial amount of water from the low flow channel due to potential effects on fish habitat and the regulatory requirement for a minimum flow of 600 cfs (Fitzer 2009).

However, the Settlement Agreement includes a measure to increase the minimum flow in the low flow channel by 100-200 cfs (DWR 2006a). This measure would take effect upon license issuance and has the purpose of expanding the amount of spawning, rearing, and adult holding habitat for anadromous fish (Chinook salmon and steelhead). A portion of this increased flow could potentially be diverted to the whitewater channel, although the approximate 1,000 feet of the river channel adjacent to the lagoon would therefore not fully benefit from the increased flows. This could provide sufficient water for a "beginner-level" park, while all remaining portions of the low flow channel would benefit from increased flows. Also, the whitewater channel could be designed to provide fish habitat functions, which could compensate for the temporary diversion of increased flow to the whitewater park rather than to the main channel in that area. (Appendix D provides more information and sources regarding potential fish benefits of instream whitewater structures.) Additional analysis of this potential issue and consultation with the resource agencies would be necessary.

2. Is there enough gradient to create a wave feature at this location?

Wave features have been created or are planned on very low gradient streams. However, these have been created on or are planned for the full width of the streams, which is not being considered for the Feather River at Bedrock Park. Also, flow at these other locations is generally higher than the flow likely to be available for diversion at Bedrock Park. Therefore, the feasibility of a wave feature in the relatively small and low flow side-channel such as is being considered for Bedrock Park is not certain.

Examples of wave features planned or created on low-gradient streams, and the available flows at those locations, include the following:

Trinity River, Dallas, Texas:

- Planned "standing wave" feature (REP 2005)
- Approximate gradient on reach = 7-10 fpm (at the upstream Fort Worth whitewater park on the Clear Fork) (American Whitewater 2008a)
- Flow = 800-1,500 cfs in spring and early summer, 400-800 early June, 300-400 cfs mid June through Sept, but with short duration peak flows of 1,000-3,000 cfs common after heavy rains (USGS 2009)

Gunnison River, Gunnison, Colorado:

- Instream whitewater park with several play features (Eddyflower.com 2009)
- Approximate gradient on reach = 11 fpm (Eddyflower.com 2009)
- Flow = 800-2,500 cfs in summer (USGS 2009)

North Platte River, Casper, Wyoming:

- Instream whitewater park with several play features (Eddyflower.com 2009)
- Approximate gradient on reach = 10 fpm (Eddyflower.com 2009)
- Flow = 1,500-2,000 cfs May through September (at gauge 15 miles downstream) (USGS 2009)

3. Are water temperatures at this location acceptable for contact water recreation?

The water temperature in a whitewater channel would be colder than the present lagoon temperature due to increased flow and presumably would be similar to existing temperatures in the low flow channel. The water temperature in the low flow channel is generally in the range of 60-65 degrees F during the summer months, and 45-60 degrees F the remainder of the year (DWR 2004a). The Settlement Agreement includes measures designed to further reduce water temperature in the low flow channel for the benefit of anadromous fish (DWR 2006a).

These temperatures are lower than ideal for contact water recreation. However, this fact does not differentiate the acceptability of Bedrock Park for whitewater paddling from the other two sites, since all would be using cold water from the Diversion Pool/Power Canal, or the low flow channel.

As a point of comparison, river temperatures on the popular Rock Creek and Cresta runs upstream of Lake Oroville on the North Fork Feather River are not quite as cold as the low flow channel, with a daily average maximum water temperature during the summer of 68-72 degrees F (PG&E 2009).

It is worthwhile to note that paddlers who have made an investment in whitewater activities with the purchase of a boat and other gear are generally prepared for cold water temperatures with specialized cold-water paddling clothing, such as a wetsuit or drysuit. Such clothing is commonly seen in use on the Rock Creek and Cresta runs. The American Whitewater Safety Code recommends a wetsuit or drysuit if the water temperature is <50 degrees F (American Whitewater 2005), although this recommendation appears to be intended to protect paddlers who may be flushed out of the boat and end up swimming. This seems less of a concern for a relatively low-flow beginner channel at Bedrock Park. American Canoe Association guidelines for cold-water paddling include wearing of protective clothing when both air and water temperature are below 60 degrees F, or if the paddler expects to be repeatedly exposed to cool (65-70 degrees F or less) water in cool or mild weather (American Canoe Association 2009).

These guidelines suggest that wearing of protective clothing by paddlers may be advisable or desirable at a Bedrock Park whitewater facility, particularly in cool weather.

Fish Barrier Pool Site

1. Are there issues associated with having this site reside partially in the flood channel?

This issue is addressed in part in the secondary evaluation of this site, which includes an evaluation of flooding potential, among other environmental constraint criteria (see Section 4.2.2.3 and Appendix C). Only a small portion of the site along the margin of the Fish Barrier Pool is in the FEMA 100-year flood zone (City of Oroville 2009), and none of the area above Fish Barrier Dam is in the Central Valley Flood Protection Board-designated floodway (Central Valley Flood Protection Board 1971). It does not appear likely that the lower portion of a run outletting to the Fish Barrier Pool (as depicted in the City of Oroville's PM&E form) and thus constructed in the flood zone would be a significant constraint. The channel would not impede flood flows. However, for safety reasons, the park most likely would not be able to operate during those rare occasions when flood flows are present.

2. Are water temperatures in this location acceptable for contact water recreation?

The water temperature in the Power Canal is generally in the range of 55-60 degrees F during the summer months, and 45-55 degrees F the remainder of the year (DWR 2004a). As described above in relation to the Bedrock Park site, these temperatures are lower than ideal for contact water recreation. However, this fact does not differentiate the acceptability of the Fish Barrier Pool site for whitewater paddling from the other two sites, since all would be using cold water from the Diversion Pool/Power Canal, or the low flow channel.

3. What is the potential cost of forgone power generation at this site?

This issue is addressed in part in the secondary evaluation of this site, which includes an evaluation of power generation constraints, among other Oroville Facilities operational requirement criteria (see Section 4.2.2.3 and Appendix C). The amount and potential cost of power foregone at this site depends on the value of the power foregone, the duration of the diversion of water that would otherwise pass through the Diversion Dam Power Plant (e.g., number of hours per day and number of months per year), and the timing of diversions, since energy values differ by time of day (i.e., on-peak and off-peak hours). Based on the conceptual design contained in the City of Oroville's PM&E form, the whitewater park would divert 400-750 cfs. This represents all or nearly all of the flow that now passes through the Diversion Dam Power Plant, which has a capacity of 615 cfs (DWR 2007).

Based on values provided in the Developmental Analysis section of the Oroville Facilities Final EIS (FERC 2007), the value of the power generated at the Oroville

Facilities is about $0.035/kWh for on-peak generation and $0.028/kWh for off-peak generation. Given that 82 percent of the lost energy generation associated with the Final EIS Proposed Action is on-peak generation (FERC 2007), the on-peak generation value may be more relevant for this assessment. DWR Bulletin 132-06 (DWR 2007) states that, in a median water year, the Diversion Dam Power Plant generates 24 million kWh of energy per year. Multiplying the 24 million kWh annual production of the Diversion Dam Power Plant by $0.035/kWh produces an annual energy value of $840,000. If this is converted to a per hour value, the value of the on-peak power generation at the Diversion Dam Power Plant is about $96 per hour.

The actual value of the energy foregone by diverting water to a whitewater park at this site would likely be less than $840,000 since the facility would probably not divert water from the power plant 24 hours per day or for the entire year. Nevertheless, if the facility would operate only 6 months of the year and 12 hours per day, the annual cost of power foregone could still be in the range of $200,000. Further reducing park operations to weekends only would reduce the cost of power foregone by about 70 percent, to about $60,000.

4. What is the feasibility and cost of accessing water from the existing power canal?

It appears to be feasible to construct a tunnel or pipeline given the short distance (300 feet) between the canal and where the whitewater course would begin (based on the design included in the City of Oroville's PM&E form), the existence of water conveyance at the site in the form of the 54-inch fish hatchery pipeline, and lack of obvious barriers to creating a tunnel or pipeline (or open conveyance).

Factors such as size, shape, slope, and interior surface (lined or unlined) determine the flow capacity of an unpressurized tunnel. However, an approximation of the size of tunnel that would be needed to convey up to 600 cfs can be obtained by considering examples of several unlined and unpressurized diversion tunnels incorporated in other California hydroelectric projects. These examples suggest that a large tunnel would be required.

The South Feather Power Project, upstream of Lake Oroville, provides several examples of tunnels with flow capacities that correspond to the desired upper flow limit of 600 cfs for this site. The South Fork Diversion Tunnel is an 11-foot-diameter concrete-lined and unlined unpressurized tunnel that diverts up to 600 cfs of water from the South Fork Diversion Dam to Sly Creek Reservoir. The Slate Creek Diversion Tunnel is an 11- foot-diameter, concrete-lined and unlined unpressurized tunnel that diverts up to a maximum flow capacity of 848 cfs of water from the Slate Creek Diversion Dam to Sly Creek Reservoir (FERC 2009).

At the lower end of the desired range of flow, an example can be found in the Plumas County Water Agency's Duncan Creek diversion tunnel, part of the Middle Fork American River Project. This is a 9-foot by 10-foot horseshoe-shaped tunnel, with a

capacity of 400 cfs (PCWA 2007). This is comparable to the lower end of the flow intended for the whitewater park at this site, in the conceptual design contained in the PM&E form.

The City of Oroville's PM&E form estimates the cost of a "control structure and inlet tunnel (gravity fed from Power Canal)" at $2.88 million, based on the conceptual park design. This probable cost, developed for the city by a firm that specializes in whitewater park design, can be assumed to be an acceptable estimate at this time. An update of this cost estimate to 2009 dollars, based on U.S. Army Corps of Engineers cost indices for diversion structures (USACE 2009), provides an estimate of $3.86 million.

5. Could an alternate access entrance/exit be found?

The best potential access to this site appears to be Golden Feather Drive, which enters the site from the south and roughly follows its western boundary. According to the Butte County Road List available on the county website (Butte County 2009), the road is private (i.e., not under county or city jurisdiction). It is a dead-end road connected to Riverview Terrace, which is a city residential street that visitors currently use when leaving the Feather River Fish Hatchery's fish ladder visitor area. Riverview Terrace is a two-lane road but is a wide street, which may enhance its suitability for use by increased recreational traffic that would be associated with a whitewater park.

The advantages of this potential access road are that it would provide an existing route at edge of site, but provide access to the middle of the site, with dirt service roads extending the route to the full length of site. However, the road is currently used by both a private homeowner (the only residence on Golden Feather Drive) and DWR. A whitewater park design for this site using this road for access would need to consider the presumed necessity of maintaining access for those purposes, and the necessity for agreements regarding road usage that would need to be approved by both the adjacent resident and DWR.

The adjacent Feather River Fish Hatchery's fish ladder visitor parking area could possibly be linked for pedestrian use with this whitewater park site and thus could meet a portion of parking needs. Completion of the adjoining subdivision that is currently under development could provide additional access options, as the road network on the adjacent lands is completed. However, these potential alternate access roads would have the disadvantage of bringing additional traffic deeper into the residential area and on more narrow roads than Riverview Terrace.

4.3 IDENTIFICATION OF VIABLE NON-PARK CONCEPTS

Study Plan Task 5 is to identify viable non-park concepts in the Project area or region. Non-park concepts were defined to include both physical and programmatic actions to enhance access to existing whitewater runs. Physical enhancement could include constructing or improving river access sites where boaters put-in and take-out; constructing or improving boater parking, staging areas, or shuttle operation sites; and

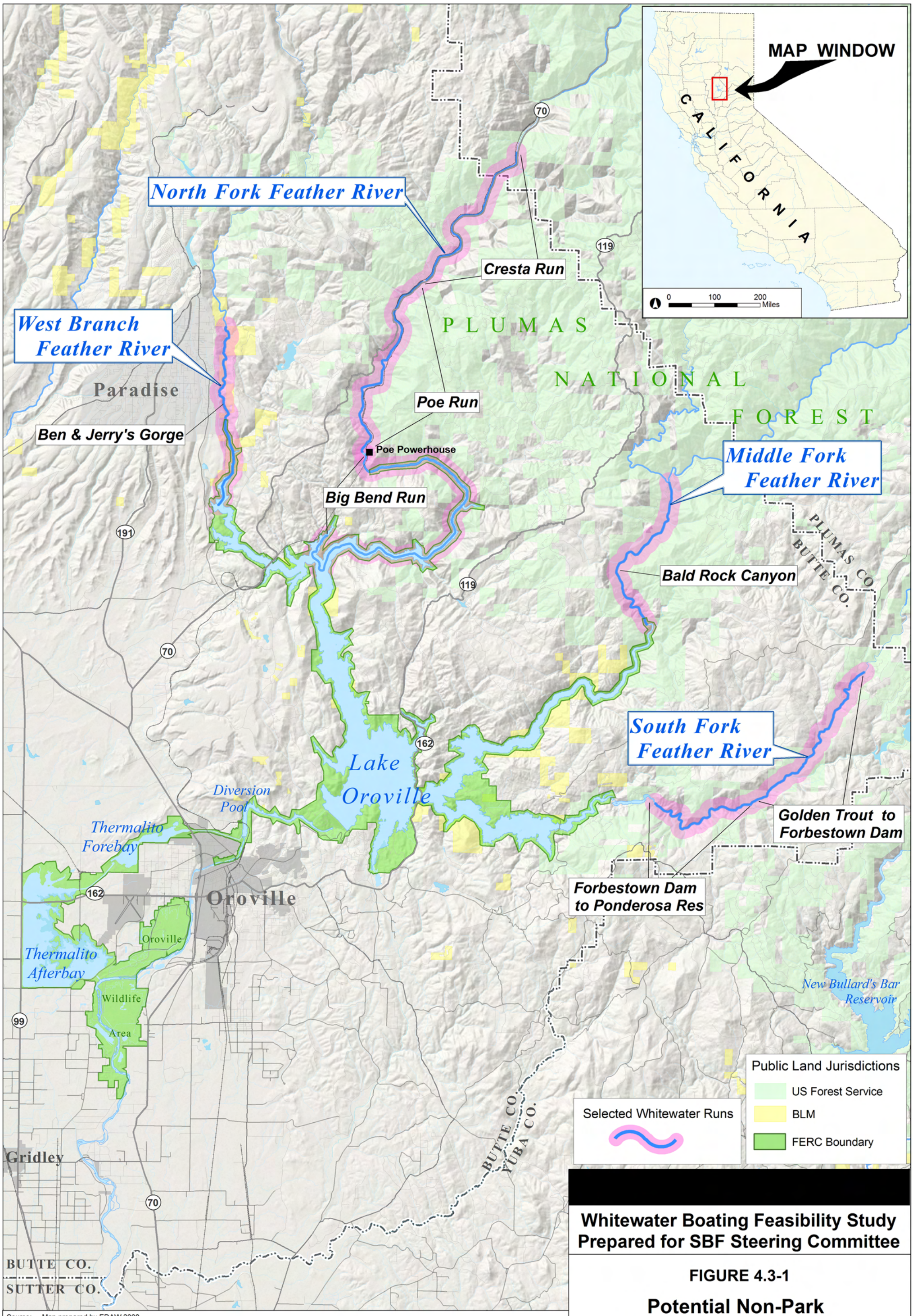
improvements such as toilets and riverside campsites to be used by paddlers. Programmatic actions could include arrangements for shuttle services to carry boaters and gear between parking areas and put-in sites, or on-water shuttles to carry boaters from the end of the whitewater runs that terminate on Lake Oroville to boat ramps or marinas, where vehicle shuttles to parking areas or put-ins could be arranged. The geographic area for the enhancement of whitewater boating via non-park actions was defined to include the existing whitewater runs on the four main branches of the Feather River terminating in Lake Oroville: the West Branch, North Fork, Middle Fork, and South Fork, as depicted in Figure 4.3-1. These runs are primarily within Butte County but also extend into Plumas County on the North Fork and South Fork. All are within about 1 hour's travel time of Oroville, providing the greatest potential for benefits to local boaters.

The following sections describe the existing local whitewater runs that could be the focus of enhancement if the SBF Steering Committee chooses to implement the non-park whitewater boating enhancement option, the current access conditions for those runs, potential access improvements, and rough cost estimates for those improvements.

4.3.1 Existing Local Whitewater Runs and Present Access Conditions

Each of the tributaries flowing into Lake Oroville provides whitewater runs, and the lowest runs on each tributary terminate in the reservoir, requiring a flat-water paddle to a take-out location. (The exception is the lowest South Fork Feather River run, which terminates at Ponderosa Reservoir, immediately upstream of Lake Oroville.) As summarized in Table 4.3-1, the runs vary in difficulty and accessibility. The runs on the North Fork Feather are the most popular, with use having increased over the past several years in association with scheduled summer and fall recreation flow releases. These runs are also popular because of the intermediate difficulty (Class III) of several sections and generally good access in proximity to State Highway 70, although several access improvements are under consideration as part of the FERC license requirements for the PG&E Rock Creek-Cresta Hydroelectric Project.

The Ben and Jerry's run on the West Branch has relatively easy walk-in access to the put-in from a public road in the Paradise/Magalia area, but it is a high-difficulty (Class V) run. (The run immediately upstream is somewhat less challenging and is accessible from a bridge crossing.) Most of the runs on the Middle Fork and South Fork are relatively difficult to access, with no formal recreation development; paddlers access the river via informal trails off unpaved USFS roads, and most of the runs are in the higher difficulty classes (Classes IV and V). Based on shuttle route descriptions provided by whitewater boaters in the boating community, most of these runs also require a considerable amount of driving to shuttle between put-in and take-out locations.



Whitewater Boating Feasibility Study
Prepared for SBF Steering Committee

FIGURE 4.3-1

Potential Non-Park Whitewater Opportunities to be Enhanced

Prepared by:	Date	
PJ -- EDAW, Inc.	12/09	P:\2000\0s016.gis\arcmap\ww_opport_non-park_33x51.mxd

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Table 4.3-1. Local whitewater runs and access conditions.

Whitewater Run Name	Description	Access Conditions and Ownership
Ben and Jerry's Gorge (West Branch Feather)	• 7 miles • Class V • Likely low use	• Put-in via steep informal trail across flume (BLM ownership) • No access to run within the gorge • Long paddle to take-out on lake at Nelson Bar boat ramp
Cresta Run (North Fork Feather)[1]	• 6.5 miles • Class III-IV • Scheduled flow releases during summer and fall	• Several regularly used informal access sites along State Highway 70 (PG&E and USFS ownership) • PG&E involved in cooperative efforts to improve access as part of Rock Creek-Cresta Project FERC license requirements
Poe Run (North Fork Feather)	• 7.6 miles • Class III (lower) - Class V (upper) • Run benefits from upstream scheduled flow releases	• Good access to put-in off State Highway 70 at Sandy Beach (USFS ownership) • Rough road access to Bardee's Bar, put-in for lower portion run (PG&E ownership) • Good access to take-out at Poe Powerhouse (PG&E ownership) • Access improvements considered as part of FERC license process for Poe Project
Bald Rock Canyon (Middle Fork Feather)	• 6.7 miles • Class V • Likely low use	• Put-in (informal) near USFS campground at Milsap Bar bridge • No access possible within the canyon • Long paddle to take-out on the reservoir near Bidwell Bar bridge
South Fork Diversion Dam to Golden Trout Crossing (South Fork Feather)[2]	• 4.3 miles • Class II-IV • Likely low use, recent increase[3]	• Put-in (informal) below South Fork Diversion Dam (SFWPA) • Take-out (informal) at Golden Trout Crossing near USFS primitive camping area, accessed by rough road
Forbestown Diversion Dam to Ponderosa Reservoir (South Fork Feather)	• 5.4 miles • Class V • Likely low use, recent increase[3]	• Put-in (informal) via steep bank below Forbestown Diversion Dam (SFWPA) • Take-out at Ponderosa Reservoir (SFWPA)

BLM = Bureau of Land Management; SFWPA = South Feather Water and Power Agency; USFS = U.S. Forest Service.

1. *Scheduled flow releases occur on the Cresta and the upstream Rock Creek run on the same weekends; therefore, it is reasonable to also consider access enhancements for the Rock Creek run, which has similar constraints at existing informal access sites along State Highway 70.*
2. *This run replaced the downstream Golden Trout Crossing to Forbestown Diversion Dam run in this assessment, which SFWPA has determined to have a steep gradient and "limited whitewater boating opportunities" (FERC 2009).*
3. *Whitewater recreation on the South Fork Feather River has been assessed as part of the South Feather Power Project FERC relicensing process. SFWPA has proposed supplemental spring flow releases during wet years for recreational boating (FERC 2009). Fall releases are scheduled in cooperation with American Whitewater (American Whitewater 2008b).*

4.3.2 Potential Access Improvements

The following describes in general terms the types of access improvements that could be viable at individual access sites described above; the information is summarized in Table 4.3-1. The popularity and broader range of users (intermediate and more expert paddlers) of the North Fork runs suggest that access improvements there may be the logical priority among the runs on the four tributaries; however, discussions with the boating community would need to occur to prioritize sites for improvement.

PG&E and boaters have assessed and prioritized potential access improvements and services on the Rock Creek and Cresta runs (PG&E 2003), but sufficient funds have not been identified to implement those improvements.

- Put-in/Take-out Development or Improvement. These sites are intended to provide safe and convenient locations where kayakers and rafters can launch and retrieve boats, appropriately located in relation to the upper and lower ends of the whitewater runs. The space required depends on the amount and types of use a run receives, but sufficient room is needed for vehicles, boaters, and gear, with rafts requiring more space than kayaks. Put-ins or take-outs served by a shuttle may require only minimal parking space in which the shuttle can safely operate. Steep or high riverbanks at desired put-in locations may require more elaborate access to the riverbank such as stairs or slides for rafts. Heavily used sites would benefit from amenities like potable water and restrooms, although these are not required.

- Parking Area Development or Improvement. A parking area, distinct from a put-in or take-out, may serve primarily as a location for boaters to park and stage their equipment before using a shuttle vehicle to reach a put-in location. Also, parking improvements may be associated with a nearby put-in or take-out, accessed by trail and not to be improved, to provide secure and legal parking where it is lacking (for example, boaters may park inappropriately along roadsides, at road gates, or at road ends near put-in or take-out locations).

- Shuttle Services (Road Shuttles, Boat Shuttles). Road shuttles provide a safe means to move boaters and equipment from parking and staging areas to and from put-ins or take-outs when safe parking is not possible or is insufficient at the put-in or take-out sites. For several years, American Whitewater and paddler volunteers have coordinated such a shuttle service for the North Fork Feather Rock Creek and Cresta runs on weekends when recreational flow releases are scheduled (California Creeks 2006). On the South Fork American River, Eldorado County and the river boating community have recently collaborated to operate a shuttle service for kayakers and rafters, funded by shuttle fees and state grants (Oakland Tribune 2009).

  Downstream from the Poe run on the North Fork Feather is the Big Bend Run, a substantial part of which is available only when Lake Oroville is drawn down more than 170 feet (DWR 2004b). This occurs only occasionally, generally

during the fall of dry years. As part of the Settlement Agreement (DWR 2006a), DPR and American Whitewater have negotiated a shuttle service operated from the Lime Saddle marina to be available to boaters using the Big Bend run (American Whitewater 2008c, DPR 2009). Presumably, boaters using the Ben and Jerry's run on the West Branch could also use this service. Similarly, the recently completed contract for operation of the Bidwell Canyon Marina requires that the concessionaire provide a shuttle service on the Middle Fork arm of the lake (DPR 2009), which would benefit paddlers using the Bald Rock run. Each of these shuttles allows paddlers, who pay a fee for the service, to avoid a long flat-water paddle to a take-out.

Any access site improvements would need to be coordinated with several entities, as well as the boating community. These entities include the public or private land owners at the sites considered for improvement. The USFS and the Bureau of Land Management (BLM) are the landowners at several access sites on the West Branch and North Fork; these agencies might also be the owners at other sites on the Middle and South Fork runs (where ownership was not confirmed). Private landowners of access sites on the tributaries appear to be primarily two utilities (PG&E on the North Fork and the South Feather Water and Power Agency [SFWPA] on the South Fork), but timber companies and other private landowners may also own access sites or new sites that may be considered for access development.

Traffic and pedestrian safety considerations require coordination with the California Department of Transportation (Caltrans) if access sites considered for improvement are on state highways (such as State Highway 70 along the North Fork Feather River), with county road departments if access sites are on county roads (such as Bardee's Bar Road), and with the USFS if access sites are on USFS roads (such as several roads in the vicinity of the Middle Fork and South Fork access sites).

If improvements at access sites have the potential to affect protected plants, animals, or fish, additional coordination and approvals from federal and state wildlife agencies may be required.

4.3.3 Cost Estimates for Access Improvements

PG&E's Rock Creek Cresta River Access Management Plan (PG&E 2003), prepared as part of a FERC license requirement to improve river access within the Rock Creek-Cresta project area, includes preliminary site improvement layouts and cost estimates for the identified improvements. This plan provides a relatively recent and local source on which to base estimates for similar improvements that might be considered at other sites on the North Fork or on the West Branch, Middle Fork, and South Fork. Although actual costs for access site improvement are highly dependent on site-specific needs and constraints, the several examples for improving sites on the North Fork provide a rough gauge of likely costs.

Four of the North Fork sites have been considered for development of new loop roads and parking (Table 4.3-2). Three of these are established unpaved sites that already

receive boater use, including parking, staging, and even informal camping, while a fourth is marginally accessible and receives only light walk-in use. Additionally, creation or improvement of the access roads has been considered for three of the four sites, which greatly inflates the cost. At two of the three sites where access road improvements were considered, the cost of constructing or improving the access roads greatly exceeded the other improvement costs, because of the high cost of imported fill and/or construction of a concrete retaining wall. As a result, total costs associated with these access road improvements may not be representative of typical access site improvements. Not including the creation or improvement of access roads, access site improvement costs (updated to 2009 dollar values to account for inflation) ranged between about $45,000 and $133,000, and averaged about $92,000.

Table 4.3-2. Cost estimates[1] for North Fork Feather River access improvements.

Access Site	Access Road Estimated Improvement Costs[2]	Other Site Improvement Estimated Costs[3]
Rock Creek Dam Bench (undeveloped site)	$536,000	$123,000 (loop road and parking)
Tobin Vista (existing unpaved site)	$91,000	$66,000 (loop road and parking)
Rock Creek Inlet (existing unpaved site)	NA	$45,000 (paving)
Cresta Powerhouse (existing unpaved site)	$1,788,000[4]	$133,000 (loop road and parking)
Average cost	*$806,000*	*$92,000*

Source: PG&E 2003.

1. *Cost figures have been adjusted to 2009 dollar values to account for inflation, based on the California Department of Transportation Price Index for Selected California Construction Items (Caltrans 2009). Figures have been rounded to nearest $1,000.*
2. *All access road estimates include the following construction costs: mobilization and clearing, imported fill compacted in place, aggregate base, asphalt concrete paving, and guardrail. Added to construction costs are engineering and construction management, and contingency (each 20% of construction costs).*
3. *All other site improvement estimates include the following construction costs: rough grading, aggregate base, asphalt concrete paving. Added to construction costs are engineering and construction management, and contingency (each 20% of construction costs).*
4. *This estimate includes two additional construction costs: rebar and concrete for a 270 foot long x 32 foot maximum height retaining wall. These two items account for 48% of the estimated cost.*

4.4 EVALUATION AND COMPARISON OF WHITEWATER PARK AND NON-PARK WHITEWATER BOATING ENHANCEMENT CONCEPTS

The preceding sections of this report have identified viable whitewater park concepts (independent of specific sites) and evaluated the viability of several candidate Oroville area whitewater park sites. This section brings the consideration of whitewater park concepts and sites together, by identifying viable park concepts for the candidate park sites, and by introducing additional social, financial, and economic evaluative criteria that are applied to these specific concepts at specific sites.

The preceding sections have also identified potential actions to implement a non-park option for enhancing whitewater boating opportunities in the Project area or region. Most of the social and economic evaluative criteria that are applied to the whitewater park concepts at specific candidate park sites in this section are not relevant to the non-park option. The potential non-park access enhancements are not likely to result in the level of boating activity that a whitewater park near Oroville could attract, as most of these runs are used only by boaters with a high level of expertise, and several are fairly remote wilderness runs. Even the most popular of these runs, on the North Fork Feather River, receive use by no more than a few hundred boaters per year. These factors lead to the conclusion that there is not likely to be a significant level of economic impact or benefit in the Oroville area related to the use of these natural runs.

4.4.1 Viable Whitewater Park Concepts at the Candidate Whitewater Park Sites

As described in Section 4.1.2, a range of what is defined as small, medium, and large instream whitewater park concepts is possible at appropriate sites, and several examples of each size instream park exist. Similarly, small and large artificial channel parks were described and existing and proposed examples listed, including two sub-groups of large artificial channel parks (those that use a diversion channel and pumped-flow parks not dependent on flow diverted from a natural waterway).

Based on their original sources within the City of Oroville's PM&E form (City of Oroville and Oroville Redevelopment Agency 2004) and the July 2009 SBF Steering Committee letter to DWR, the candidate whitewater park sites in the Oroville area were associated from the outset with either instream or artificial channel park concepts. With consideration given to the scale of development needed to create an artificial channel park, and the space limitations inherent in the sole instream site, only one instream or artificial channel concept is judged to be viable at each site, as depicted in Table 4.4-1.

Development of an artificial channel park at the two artificial channel park sites (i.e., the Fish Barrier Pool and Riverbend Canyon) would require substantial modification of the sites and would entail large and complex projects. Essentially, any park built on these sites would be a large-scale project, particularly if the park were to match the vision of the City of Oroville as described on the PM&E form, with a range of boating opportunities and spectator amenities. Therefore, the type of smaller-scale artificial channel park that has been built at a few locations in the U.S., generally within an existing channel and without a large investment in other amenities, is not viable for these sites.

Table 4.4-1. Viable whitewater park concepts for candidate whitewater park sites.

Site	Viable Concepts	Rationale	Similar Existing/Proposed Parks
Instream Park Site			
Bedrock Park	☒ Small instream park ☐ Medium instream park ☐ Large instream park	• Bedrock Park swim lagoon location limits potential size of whitewater run to area of existing lagoon. • Creating a whitewater channel outside the area of the existing lagoon would likely involve impacts on anadromous fish habitat that would make a park in this location infeasible.	Small instream parks in the U.S. include[1]: • Lyons, Colorado • Gunnison, Colorado • Salida, Colorado • Golden, Colorado • Missoula, Montana
Artificial Channel Park Sites			
Fish Barrier Pool	☐ Small diversion channel park ☒ Large diversion channel park ☐ Large pumped flow park	• Park would be a large and complex project, with the construction of several thousand feet of artificial channel and associated access and amenities. • Water would be diverted through the park from the Power Canal to the Fish Barrier Pool, with no pumping required.	Mississippi River Whitewater Park, Minneapolis, Minnesota: • A proposed large park that would divert flow from the river. • Would be located adjacent to existing industrial and residential areas and power plant.
Riverbend Canyon	☐ Small diversion channel park ☒ Large diversion channel park ☒ Large pumped flow park	• As at the Fish Barrier Pool, the park would be a large and complex project, with the potential construction of several thousand feet of artificial channel and associated access and amenities.[2] • Assumption is that water would be pumped from the river at the south boundary of the site to the top of the course and returned to the river after passing through the course.[3] • Alternatively, water could be recirculated through the course, with water pumped from a retention pond at the end of the course to a pond at the start of the course (a pumped flow park).[4]	Mississippi River Whitewater Park, Minneapolis, Minnesota: • see description in cell above ASCI, McHenry, Maryland: • A large pumped flow park that takes advantage of topography of mountaintop location to provide course gradient. • Water is pumped between ponds at start and end of course (recirculating flow).

Table 4.4-1. Viable whitewater park concepts for candidate whitewater park sites.

1. *Most of these and similar parks were developed adjacent to existing city parks and riverside trails and/or with enhancement of these existing recreation amenities; thus, these examples have several similarities to the Bedrock Park site.*
2. *Because this site was proposed by the SBF Steering Committee as an alternative site to the Fish Barrier Pool, the assumption is that a similar-sized park would be built at this site, to meet similar boating and spectating purposes.*
3. *The SBF Steering Committee also expressed interest in evaluating the feasibility of bringing water to the site via a pipeline from the Power Canal, 1 mile to the north, or from the Feather River Fish Hatchery, one-half mile to the east. These water source options are addressed elsewhere in this report. Although none of these options would provide what is typically described as a diversion channel park, where no pumping or pipeline is required (such as the proposed Mississippi Whitewater Park), in other respects these options would be similar to existing and proposed diversion channel parks.*
4. *The potential for constructing reservoirs (ponds) that would be necessary for a pumped flow course are also addressed elsewhere in this report.*

4.4.2 Social Criteria

This section addresses four social criteria for evaluating the viability of three whitewater park concepts at the three candidate sites: potential user types and numbers, potential non-boater (spectator) visitation, competing natural and artificial whitewater opportunities, and competing or conflicting recreation uses. For the purposes of this evaluation, the concepts of a large diversion channel and a large pumped flow park at Riverbend Canyon are treated as one, since there would be no difference in terms of social criteria between the two concepts.

4.4.2.1 Potential User Types and Numbers

Table 4.4-2 provides a summary of the use estimates for the three viable whitewater park concepts at the three candidate sites in the Oroville area, as described above. The estimates of total park use are based on a market area consisting of 22 Northern California counties. The market area is divided into the local market (residents within about a 1-hour drive from Oroville), which is further divided into Butte County and surrounding counties, and the non-local market (residents within about a 1- to 3-hour drive of Oroville), which includes all of the remaining counties in the market area.

Table 4.4-2. Annual use estimates for the Oroville area whitewater park concepts.

Whitewater Park Site and Concept	Local Market		Non-Local Market	Estimated Total Use[1]
	Butte County	Surrounding Counties		
Fish Barrier Pool (large artificial channel park)	11,400	7,400	18,680	37,500
Riverbend Canyon (large artificial channel park)	8,550	5,550	14,010	28,100
Bedrock Park (small instream park)	3,050	1,970	0[2]	5,000

1. *Estimates do not include potential event attendance.*
2. *Non-local market use of a "beginner" park at Bedrock Park may not actually be zero, but would be expected to be a very small number and insignificant portion of park use.*

The initial use estimate developed was for the concept of an artificial channel park on the Fish Barrier Pool, the concept and site deemed likely to attract the highest number of users. Appendix E provides details on the methodology and sources used in developing this use estimate, and tables providing more detailed breakdown of the estimate by county and type of use.

The use estimate for the concept of a large artificial channel park at the Riverbend Canyon site was derived by deducting 25 percent from the use estimate for the similar park concept at the Fish Barrier Pool site. This adjustment was based on disadvantages of the Riverbend Canyon site, as compared to the Fish Barrier Pool site, of being less connected to the residential and commercial development of central Oroville, greater distance from downtown Oroville, and lack of connections to other existing or planned recreation sites. In contrast, a park at the Fish Barrier Pool site

would be adjacent to the Feather River Fish Hatchery fish ladder viewing area and could connect via a pedestrian bridge to recreation facilities on the north side of the Power Canal at the Diversion Pool. (Enhancements are proposed for day use facilities at the Diversion Pool within the Oroville Facilities Recreation Management Plan (DWR 2005), to be implemented upon license issuance, per Settlement Agreement Article A127.)

(The City of Oroville Redevelopment Agency has proposed residential and recreation development for the north riverbank parcels on the opposite side of State Highway 70, as part of the City of Oroville *Waterfront Redevelopment Concept Plan*, of which the whitewater park at the Fish Barrier Pool is a part. The proposals are depicted in the City of Oroville's PM&E form. Further, the City of Oroville has approved two Tentative Subdivision Maps for residential development on the riverbank parcels and on the river bluff above, totaling 216 lots (City of Oroville 2009). The riverbank parcels are connected to the Riverbend Canyon site via a highway underpass, which could provide a vehicle and pedestrian linkage in the future.)

A use estimate for an instream park at Bedrock Park was also developed by making several downward adjustments to the estimate for the Fish Barrier Pool artificial channel park. Rafting use was deleted from the estimate, since the prerequisites for rafting use based on assessment of existing parks (established commercial rafting operations, run length size or number of features attractive to private rafters) are not present. Because the type of small instream park proposed by the FRRPD and SBF Steering Committee would not provide the full range of novice, intermediate, and expert kayaking provided by a park at the Fish Barrier Pool, estimates of the proportion of Butte County kayakers who would use the park were also adjusted downward by 50 percent. Because the park would be intended to serve local paddlers and youth (including people encouraged to try the sport for the first time by the availability of a beginner facility), and the park would not be expected to attract a significant number of non-local visitors, the frequency of use by visitors from the local market but outside Butte County was adjusted downward by 50 percent and use by visitors from the non-local market area was deleted.

Table 4.4-3 summarizes the rationale behind each of the whitewater park use estimates and provides comparisons to use levels or use projections at similar artificial channel or instream parks in the U.S. for which reliable use estimates are available, to provide a point of reference for the Oroville park estimates.

4.4.2.2 Potential Non-Boater (Spectator) Visitation

Investigation of existing and proposed whitewater parks suggested several factors that provide the best opportunities to attract a significant number of spectators to a whitewater park on a regular basis (outside of planned events): a location of the park in-town versus on the edge of town or in a rural or remote location; and a location close to parks, trails, and commercial and/or residential areas. The Reno, Nevada, and Golden, Colorado, instream parks are examples of parks with such locations conducive to attracting spectators.

Table 4.4-3. Rationale and comparables for Oroville area whitewater park use estimates.

Whitewater Park Site and Concept	Estimated Annual Total Use	Rationale for Estimate	Comparison with Use at Similar Whitewater Parks
Fish Barrier Pool (large artificial channel park)	37,500	Highest potential use: • in-town location. • kayaking and guided-rafting use. • novice to expert experience. • linked to other recreation sites. • includes non-paddling amenities.	• 50 percent lower than USNWC use and 25 percent lower than Mississippi River park projections; both are larger parks and/or in much larger cities than Oroville. • 2X use level at ASCI, which is a large park but in a rural resort area, with few full-time local residents, and larger cities more distant than Sacramento.
Riverbend Canyon (large artificial channel park)	28,100	25 percent lower estimated potential use than a similar facility at the Fish Barrier Pool due to location: • At the edge of Oroville and opposite State Highway 70 from town center. • Less linkage to other recreation sites (although this may change if additional recreational development occurs on that side of the river, or if pedestrian connections are provided to the south side of the river and central Oroville).	• 65 percent lower than USNWC use and 25 percent lower than Mississippi River park projections; both are larger parks and/or in much larger cities than Oroville. • 1.5X use level at ASCI, which is a large park but in a rural resort area, with few full-time local residents, and larger cities more distant than Sacramento.
Bedrock Park (small instream park)	5,000	• Beginner kayaking use only (incidental tubing use might also occur but is not part of the use estimate). • Shorter run/fewer features than artificial channel parks. • Intended primarily for local use and not intended to attract non-local visitors, thus non-local market was not included in the estimate.	• 65 percent lower than estimated use of Golden, Colorado, instream park, which is a longer run with numerous features and provides more challenging paddling. • 65 percent lower than non-event projected use of Reno, Nevada, instream park, which is a larger park, also in-town but in a much larger city, with draw of nearby casinos.

The large artificial channel parks at McHenry, Maryland (ASCI) and Charlotte, North Carolina (USNWC) do not meet most of these criteria, but both are examples of parks designed to provide good viewing opportunities for spectators, with course-side paved paths and special viewing spots. Specific estimates of spectator numbers at existing parks are scarce, but the available information suggests that spectators may outnumber boaters at an advantageously located and designed park.

Regarding the three Oroville area park concepts, artificial channel parks at the Fish Barrier Pool or Riverbend Canyon would provide the best potential for attracting spectators, including those who might come from out-of-town. The Fish Barrier Pool site is at a central, in-town location, close to existing recreation attractions such as the fish ladder viewing area of the Feather River Fish Hatchery, with the potential for linkage to existing and planned trails and recreation facilities. Also, the conceptual design includes special features for spectators. Together, these factors suggest a high potential for spectator visitation, although the site is not very visible from local roads or other vantage points. The Riverbend Canyon site is somewhat less centrally located to the community but is a very visible location from State Highway 70.

Spectator visitation is probably less of a concern at the Bedrock Park site, as the intended facility would not provide for the higher skill-level types of uses and events most likely to attract spectators. Therefore, there would be a low potential for spectator visitation. (Nonetheless, local residents might be expected to have some interest in observing paddling at Bedrock Park, and the existing grassy park slopes and shaded day use areas would provide ample space for those spectators.)

4.4.2.3 Competing Natural Whitewater and Whitewater Park Opportunities

The three viable whitewater park concepts at the three candidate sites in the Oroville area, if built, would each be competing for users with existing natural whitewater and whitewater park paddling opportunities. In particular, whitewater boaters in Northern California have many and varied boating opportunities available on natural runs. The Phase 1 Background Report documents 70 whitewater runs in the Northern Sierra region, stretching from the Sacramento River and Battle Creek south and east of Redding to the American River and its tributaries east of Sacramento. Closer to Oroville and Chico, within Butte and Plumas counties, 14 runs are available on the various Feather River tributaries, and two additional runs are available on Butte Creek east of Chico.

The availability of local runs has increased in recent years because of scheduled recreational flow releases on the Rock Creek and Cresta North Fork Feather runs, negotiated during FERC hydroelectric project relicensing proceedings. Other ongoing FERC license proceedings may result in similar flow agreements and access improvements on other North Fork Feather runs, on Butte Creek, and on the South Fork Feather River. As described above, as a result of the Settlement Agreement, a shuttle service operated out of the Lake Oroville Marina (Lime Saddle Recreation Area) is now available to paddlers using the Big Bend run during periods when Lake Oroville drawdown and North Fork flows make the run available. The new marina concession contract recently awarded for the Bidwell Marina provides a similar shuttle pick-up service for users of Middle Fork whitewater runs that terminate at Lake Oroville (DPR 2009).

The Sacramento area has a large population (more than 2 million residents in the metro area), and it is anticipated that paddlers from the Sacramento area could contribute a substantial portion of visitors to a whitewater park in the Oroville area (these potential

visitors were included among the non-local visitors in the preceding use estimates for an Oroville area whitewater park). However, paddlers in the Sacramento area have nearly two dozen natural whitewater runs to choose from on the American River and its tributaries, including some of the most popular runs served by commercial rafting outfitters. Also, the Truckee River Whitewater Park in Reno, Nevada, is within a 2-hour drive for most Sacramento area residents, only about a half-hour more driving than required to visit Oroville.

Competition from other whitewater parks would be low in that the Reno facility is the only whitewater park in the region. However, a 2007 channel restoration project on the North Fork American River, east of Sacramento, was designed to provide whitewater boating opportunities. DPR is proceeding with plans to provide direct access to that river segment, which lies within the Auburn State Recreation Area but can now only be reached by floating down from a put-in location several miles upstream (DPR 2007).

The foregoing establishes that there are ample and increasing whitewater boating opportunities on natural runs, and a few whitewater park-type opportunities, that may compete with an Oroville-area whitewater park for boaters' interest. Further comparison of these competing opportunities with the types of opportunities likely to be provided by an instream or artificial channel park in the Oroville area will help define the degree of potential competition. Accordingly, the following sections compare the Oroville area park concepts and existing whitewater opportunities in terms of types of boating, level of difficulty, and availability of the opportunities to paddlers.

Table 4.4-4 summarizes and compares the whitewater opportunities that may be provided by instream and artificial channel park concepts in the Oroville area, and competing local natural runs and regional whitewater parks.

Comparison by Type of Whitewater Boating Opportunity

The artificial channel park concepts at the Fish Barrier Pool and Riverbend Canyon could provide a rafting opportunity, possibly using rafting guides as at other artificial channel parks (e.g., ASCI, USNWC). Few rafting opportunities are available in the local area. Although commercial rafters have offered trips on the North Fork Feather River runs, the popular commercially run rivers are outside the local area, mainly east of Sacramento on the American River tributaries and to the northwest of Redding (e.g., on the California Salmon, Trinity, and Klamath rivers), with additional popular runs in the central and south Sierra (e.g., on the Tuolumne, Merced, Kings, and Kern rivers). Although two rafting outfitters have city permits to use the Reno whitewater park (City of Reno 2007), most whitewater rafting on the Truckee River occurs upstream, between Lake Tahoe and the California state line.

The conceptual park design for the Fish Barrier Pool site as presented in the City of Oroville's PM&E form includes an artificial channel more than 4,000 feet long, divided into an 1,800-foot upper reach with an 80 fpm gradient and drops of up to 3 feet, followed by a 2,300-foot lower reach with a 50 fpm gradient and drops of up to 2 feet. This channel length would provide a river-running type kayaking experience.

Table 4.4-4. Comparison of whitewater park concepts and competing natural whitewater runs and whitewater parks.

Attributes	Oroville Area Whitewater Park Concepts		Existing Whitewater Opportunities	
	Instream Park Concept	Artificial Channel Park Concepts	Local Natural Runs [1]	Regional Whitewater Parks [2]
1. Types of Boating				
Rafting (commercial)		X		X
Kayaking				
River running		X	X	
Playboat kayaking	X	X	X	X
Slalom/Competition kayaking		X		
2. Level of Difficulty				
Novice (Class II-III)	X	X	Few [3]	X
Intermediate (Class III-IV)		X	Few [4]	X
Expert (Class IV-V)		X	Many [5]	
3. Availability to Paddlers				
Ease of access	X	X	Few [6]	X
Proximity to local paddlers	X	X	Few [7]	
Seasonal availability				
Available year-round	X	X		X
Available spring			Most	
Available summer			Few	
Available fall-winter			Few	

1. *Local runs include approximately 14 runs on the Feather River tributaries (North Fork, West Branch, Middle Fork, and South Fork) and two runs on Butte Creek, most of which are entirely or partially in Butte County (North Fork, Middle Fork, and South Fork runs extend upstream into Plumas County).*
2. *Regional whitewater parks include just one facility: the Truckee River Whitewater Park in Reno, Nevada. In late 2007, a stretch of the North Fork American River at the Auburn dam site (above Folsom Lake) was restored, with Class III whitewater features and a concrete portage trail. Paddlers cannot yet access this facility directly, but it is possible to put in upstream and float down to it.*
3. *Examples of local Class II-III runs include Butte Creek below Centerville, and the Sloat Run on the Middle Fork.*
4. *Examples of local Class III-IV runs include the popular and accessible Rock Creek and Cresta runs on the North Fork Feather River.*
5. *Examples of local Class IV-V runs include Butte Creek above Centerville, most of the Middle Fork and all of the South Fork and West Branch Feather runs, and the upper portion of the Poe run on the North Fork Feather River.*
6. *Among the few runs that provide ease of access are the lower Butte Creek run, and the Rock Creek and Cresta runs on the North Fork, both made easily accessible by riverside roadways and road crossings.*
7. *The lower Butte Creek run, and the Rock Creek, Cresta, and Poe runs on the North Fork are quickly reached by paved roads from Chico and Oroville; reaching most other local runs requires several miles of travel on unpaved roads, and some require and additional hike into the put-in location.*

In addition, the PM&E form describes “modular, movable features” that would provide the types of hydraulics preferred for playboat or freestyle kayaking. The lower reach would be designed for competitive slalom events. In comparison, a small instream park downstream of the Afterbay Outlet discharge area would provide only playboat kayaking

opportunities. Similar park-and-play opportunities are the focus of most instream whitewater parks, including the Reno whitewater park, where kayakers spend most of their time on the water using individual hydraulic features, rather than moving through the course.

Local whitewater runs primarily provide river running opportunities for kayakers, who travel down the several miles of river encompassed by each run with a variety of rapids, drops, and similar natural features. Some local runs also may provide playboating opportunities at a few locations, although accessible park-and-play spots appear to be rare.

Comparison by Level of Difficulty of Whitewater Boating

Novice and intermediate difficulty whitewater runs are relatively scarce in the Oroville and surrounding areas, and some of these (such as the Butte Creek below Centerville run) are better known for tubing opportunities than kayaking or rafting. Both the instream and artificial channel park concepts would provide novice and intermediate level opportunities, as do most whitewater parks in the U.S.

As described above, the conceptual park design for the Fish Barrier Pool site as presented in the City of Oroville's PM&E form includes a short and steep expert-level channel with larger drops; presumably, a similar design would be desired for the alternate Riverbend Canyon site. Although several expert-level runs are available on local rivers, a whitewater park can provide a more controlled and safer expert-level opportunity and one that is easy to access and closer to most paddlers' homes, and not constrained by seasonably variable flows. The Reno whitewater park, with relatively low gradient and small drops, does not provide for expert-level paddling, although freestyle kayak competitions are held there.

Comparison by Availability of Whitewater Boating Opportunities

Both instream and artificial channel whitewater park concepts for the Oroville area would provide paddling opportunities with the advantages of relative ease of access and proximity, being in and near the developed urban area of Oroville, and close to major roadways. This is in contrast to local natural whitewater runs, most of which require considerably more driving to reach, and several of which require miles of driving on rural foothill and mountain roads, some unpaved. Relatively few local natural whitewater runs, such as those on the North Fork Feather River accessed from State Highway 70 that follows the river up the canyon, can be described as easily accessible.

Lastly, both instream and artificial channel park concepts for a whitewater park in the Oroville area would provide potential paddling opportunities year round, based on the year-round availability of flows, although cold water temperatures would be expected to limit use during cool weather seasons. The whitewater park at Reno is also available year round, with a design that accommodates the low flows that commonly occur during the late summer and fall. In contrast, most of the local natural whitewater runs are available primarily during spring high flows. Relatively few runs remain usable during the summer, fall, or winter (before high flows return). Among the few local runs

available in the summer and fall are those on the North Fork Feather River made available by scheduled recreation flow releases from the PG&E reservoirs in the canyon.

Conclusions Regarding Competing Whitewater Opportunities

The preceding comparisons of whitewater park concepts for the Oroville area, local whitewater runs, and whitewater park opportunities corroborate the park use estimates presented previously that project the highest potential park use for the artificial channel park concepts. Those concepts provide the broadest range of uses, levels of difficulty, and availability to local paddlers. The instream park would also have advantages for paddlers in availability, but with a more limited range of uses and difficulty. Both types of parks have the potential to draw paddlers who may also use natural runs, because they can provide more beginner and intermediate level experiences, with greater convenience, and with year-round availability.

4.4.2.4 Competing or Conflicting Recreational Uses at Whitewater Park Sites

The two candidate artificial channel whitewater park sites (Fish Barrier Pool and Riverbend Canyon) have few or no recreational uses that would compete or conflict with whitewater park use of the sites. The west side of the Fish Barrier Pool is undeveloped and essentially inaccessible in its current state. The only recreational activity that occurs in the vicinity of the Fish Barrier Pool is use of the Sewim Bo trail and associated picnic sites on the river bank opposite the candidate whitewater site. No boating activity occurs on the Fish Barrier Pool. Similarly, the Riverbend Canyon site is undeveloped and does not currently support authorized recreational use, although the site is used by off-road vehicles (presumably without authorization).

An instream park on the low flow channel at Bedrock Park could conflict with angling activity on the river, given that some paddlers would continue down the river from the park to take-out at Riverbend Park. (The conceptual drawing of the park as proposed in the FRRPD Master Plan indicates that the existing flash board dam would be removed, permitting paddlers to continue downstream.) However, these potential conflicts would be expected to be minor because angling activity is concentrated in the main channel parallel to and upstream of the existing Bedrock Park lagoon. These potential conflicts may not be significant unless paddlers continued downstream to areas where anglers frequently fish. Little angling activity appears to occur within the lagoon itself.

4.4.3 Financial and Economic Criteria

Application of financial and economic factors for evaluating the feasibility of the whitewater concepts and sites first considers a set of individual evaluation factors. These factors, which correspond to social concerns addressed above and additional economic concerns identified in the Study Plan, are evaluated and then considered in combination to develop three composite evaluative criteria that are used to evaluate the final concepts and sites. The composite evaluative criteria were developed for consistency with other previously identified and applied criteria.

4.4.3.1 Individual Evaluation Factors

The following six individual factors incorporate the social considerations described above, and address related financial and economic considerations for developing a whitewater park in the Oroville area.

Potential User Types and Numbers and Potential Spectators

The foremost social impact of a whitewater park lies in its contribution toward a higher quality of life for users and visitors to the park. A whitewater park can provide variety to the array of opportunities available to paddlers and better or more convenient whitewater paddling opportunities than existing natural runs or other parks. Flows in most natural whitewater runs within Northern California are low most of the summer and fall months, and only one whitewater park has been built in the region. Non-paddling visitors may be drawn to a whitewater park by the opportunity to observe an exciting outdoor activity or sporting event in a setting more accessible and convenient than most natural runs. At a whitewater park suitable for beginners, as most artificial channel parks are designed to be, non-paddlers may be inspired to give rafting or kayaking a try and so become park users.

For purposes of evaluating financial and economic criteria, four types of potential park visitors are considered: kayakers, rafters, spectators, and other park visitors. Each of these user types has different implications for potential revenue generation. Instream parks are assumed to attract mainly kayakers; instream parks used by rafters are generally found only on rivers with established commercial rafting operations. Small instream and artificial channel parks may have minimal accommodations for spectators and other park visitors, particularly if the whitewater features are not built near an existing public park or in conjunction with a new park development. At such small parks, it is assumed that support facilities would not be adequate to host events with significant numbers of spectators. Large instream and artificial channel parks, on the other hand, are typically capable of attracting all four types of park visitors, although spectators and other users may not be willing to pay entrance fees except possibly for special events.

The Oroville-area park use and spectator estimates presented above considered these factors affecting potential visitation and the estimates are a key input in the revenue generation potential and economic impact conclusions presented later in this section.

Ownership, Management, and Financing Options

Most whitewater parks in the U.S. are owned by public entities, but public, private, or non-profit entities operate the parks. As viewed by Whitewater Parks International (WPI), the organizational philosophy of the entity pursuing whitewater park development is critical to defining the financial, social, environmental, and operational outcomes of the park (Felton and Campbell 2006). According to WPI, consensus must be built among the organizational members (the SBF Steering Committee and other interested parties) committed to facility development to clarify a position concerning financing, community access, and types of users to be accommodated. For example, key philosophical questions include: does the organization want to require that the facility

only cover its operating costs or will it need to generate revenue to cover debt service and provide a return on investment (i.e., turn a profit), and what level of community access is desirable for the facility? The philosophies underlying these questions help frame key decisions concerning facility ownership and management.

In terms of capital financing, a variety of options are available, including having the owner (public, private, or non-profit) provide all of the capital, using a combination of capital and debt, using debt/equity partnerships, or pursuing funding from local, state, or federal sources, loans, grants, bonds, private contributions, and corporate sponsorships. Whatever mix of funding is pursued, experience at other parks, especially the larger parks, shows that capital repayment arrangements should be structured so as not to negatively affect ongoing facility operations.

Estimated Conceptual Costs

Construction Costs

As documented in the Phase 1 Background Report and summarized in Appendix F, construction costs for previously built whitewater parks vary widely. Because instream whitewater parks typically are created by placing artificial structures within an existing natural channel, construction costs tend to be less for instream parks, although the Ocoee Whitewater Park in Copperhill, Tennessee, is an exception, with a construction cost of $7.7 million ($10.9 million in 2009 dollars) for instream features. As shown in Appendix F, construction costs for the instream parks evaluated in Phase 1 range from $150,000 to $7.7 million ($172,000 to $10.9 million in 2009 dollars), which represent the extremes within the range of potential costs. Section 4.1.2 of this report provides additional cost information for different sizes of instream parks, indicating that the approximate cost of the smallest instream parks is in the range of $100,000 to $500,000; the cost of medium-sized parks is in the range of $500,000 to $2 million; and the cost of the largest instream parks is in the range of $2 million to over $10 million (accounting for inflation since the largest parks were built).

Artificial channel whitewater parks can be constructed in an existing canal or flume, in an artificial channel created adjacent to a natural or existing artificial channel, or with an artificial channel unconnected to a natural channel. Because of construction complexities, construction costs for artificial channel parks are higher, ranging from $20 million to $40 million for large artificial channel parks. Less construction cost information is available for smaller artificial channel parks, typically built by modifying an existing channel for whitewater use; cost information is available only for the East Race Waterway in South Bend, Indiana. The $5 million cost of that park may be low as a current estimate since that park was built in the early 1980s, and inflation and other factors can be assumed to have substantially escalated costs since that time. (The Bureau of Labor Statistics' Consumer Price Index indicates 115 percent inflation between 1983 and 2009 [U.S. Bureau of Labor Statistics 2009].)

Estimated probable costs for the artificial channel whitewater park on the Fish Barrier Pool proposed by the City of Oroville as part of its Waterfront Redevelopment Concept

Plan were included in the PM&E form (City of Oroville and Oroville Redevelopment Agency 2004). The total estimated cost, updated to 2009 dollars, was $31.7 million, $19.8 million (62 percent) of which was for construction costs. These estimated costs provide a cost basis for the candidate whitewater concept for the Fish Barrier Pool, and the similar candidate concept for the Riverbend Canyon site, identified and evaluated in this feasibility study. The construction estimate for the Riverbend Canyon site is also based on costs associated with similar existing parks (particularly large pumped flow parks), as is the cost estimate for the instream park concept at Bedrock Park. All of these estimates took into account construction-related site constraints (a subset of the site constraints evaluated in Section 4.2.2).

Operating Costs

Information on operating costs for whitewater parks is limited. The USNWC park outside of Charlotte, North Carolina, is an exception. The financial challenges of this park since beginning operations in 2006 have been well documented. As shown in Appendix F, the 2007 annual operating budget for the center was $10.1 million. The five largest expenses, including interest on debt, recreational operations and maintenance (O&M), salaries, depreciation, and utilities, accounted for 75 percent of the total expenses. Although information on operating costs at other whitewater facilities is limited, annual expenses for the center would appear not to be representative of other facilities but more reflective of the high operating expenses associated with the wide range of services offered there, including restaurant and retail services. However, 2007 recreational operations expenses alone were more than $2.1 million. This total does not include other O&M expenses, portions of which are associated with recreational operations, such as salaries and payroll taxes ($1.4 million), utilities ($844,000), and repairs ($132,000) (Mecklenburg County 2008).

It should be mentioned that the USNWC entered into service agreements with several local city and county governments to provide park services. In exchange for providing these services, the city and county entities agreed to pay an annual service fee of up to $1.7 million for 7 years. Payments must be made if annual revenues do not offset expenses. Because revenues fell short of expenses each of the first two years that USNWC had been in operation, the government entities were required to make these payments in 2008 and 2009 (Mecklenburg County 2008, 2009).

Information also is available for projected operating expenses at the proposed Mississippi Whitewater Park in Minneapolis, Minnesota. This information is based on operating expenses for the East Race Waterway in South Bend, Indiana, where annual operating expenses are estimated to be about $81,000. As shown in Appendix F, annual operating expenses for the proposed Mississippi Whitewater Park are projected to be about $510,000 per year, with $400,000 dedicated to staff salaries. This proposed $25 million facility is expected to operate year round with a projected 50,000 paying visitors (kayakers and rafters) and five to ten times that number of spectators and other users (Minnesota Department of Natural Resources 1999).

Little information is available on operating expenses for instream parks, as most are operated as part of the host community's overall park and trail system; whatever additional costs attributable to the whitewater improvements are not distinguished from other costs. However, the available evidence suggests that typical day-to-day expenses are low and may be limited to covering such activities as occasional removal of logs or other debris from the whitewater feature, and general maintenance of riverbank areas used by whitewater boaters. Therefore, a range of $25,000 to $50,000 is suggested as a reasonable annual operating expense. It is worth noting that several instream parks in the U.S. have incurred additional costs after initial development of the park for repairs or adjustment to whitewater features after floods or other normal high-water events caused the installed features to shift, making the whitewater less safe or less effective in providing the water conditions desired by boaters (e.g., good play waves).

Revenue Generation Potential

Operating revenues for whitewater parks come primarily from user fees, although it appears that some facilities rely to a limited extent on concessionaire revenues and grant funds (e.g., USNWC). At most whitewater parks, fees are structured to cover operating expenses. As shown in Appendix F, fees vary widely by type of facility and associated amenities. Most instream parks, which are typically public facilities adjacent to and accessed through free municipal parks (i.e., with open access), do not charge fees for access to or use of the facility. The Ocoee Whitewater Center is an exception in that boaters who access the whitewater course from the center directly are charged for parking. However, rafters typically enter the river upstream of the center and do not pay a fee to use the park (although the rafting outfitters pay USFS permit fees).

Fees at artificial channel parks also differ by activity. Most facilities charge different fees for rafting (which generally includes raft rental and a guide) and kayaking (most kayakers bring their own boats). As previously indicated, the decision whether to charge user fees should reflect the organizational philosophy underlying park operation. If the underlying philosophy is that the park should primarily serve local needs, consideration should be given to waiving user fees, if financially feasible. Because local governments, in general, are increasingly relying on user fees to cover parks and recreation operating expenses as more traditional general funding sources become less available, it may be necessary to charge user fees, even to local residents, to provide this type of park and recreation service.

In setting fees, the extent to which external funding sources (e.g., corporate sponsorships, private donations, and cost-sharing grants) may be available needs to be considered. Funds from certain external sources, however, are often limited to construction and are not available for operating expenses.

Impacts on the Local Economy/Economic Development Benefits

An important benefit of developing a whitewater park is the positive economic impact that parks can have on the local economy. The community that would most benefit from the candidate park concepts is the City of Oroville. Forming the commercial nucleus of

the greater Oroville area, the City of Oroville serves as the commercial hub for the study area.

By attracting visitors from outside the local area, whitewater parks can directly contribute to the overall level of economic activity in the city. This economic activity can be traced from the provision of recreation services at the park to the generation of employment and income opportunities, both at the park and in support businesses throughout the community. The development of a whitewater park would likely increase overall levels of local tourism, which in turn would increase levels of spending by visitors in the community. Visitors from outside the region spend money on accommodations, restaurant meals, fuel, and other services in the vicinity of the park. This spending directly supports jobs and generates earnings in many business sectors, and indirectly generates jobs and earnings in other sectors of the economy as the directly affected businesses and their employees spend in the local economy. In addition, special events at the park can produce temporary influxes of local merchant sales and needs for short-term employment. Lastly, local construction jobs also would be associated with developing a whitewater park.

Experience at whitewater parks in other communities has shown that generally between 20 and 40 percent of visitors to the parks come from outside the local area. Park scale and level of amenities, in combination with the relative population of the local area, affect this rate, with facilities featuring more amenities tending to attract more visitors from outside areas. Tourism effects are important because they bring new dollars to the local economy. Although whitewater parks serve an important role in meeting the recreation needs of local residents, the park's contribution to generating new tourism dollars has vital importance for local economic development.

At present, tourism plays a relatively minor role in Oroville's greater retail mix; however, stable businesses that operate at profitable levels may enjoy significant marginal benefits in response to increases in recreation-related activity associated with a whitewater park. Consequently, any increase in tourism may be reflected directly in a merchant's profitability and convey the benefits of increased economic activity (MWH/EDAW Team 2004).

The development of whitewater parks also generates potential indirect benefits. Whitewater parks with ongoing operations and programs, including the hosting of special events, can affect investment in the surrounding area. Special events at venues like whitewater parks often influence the number of visitors to a community long after the events have occurred. These effects relate to overall local economic development goals. Developing whitewater parks can serve as a key attraction for an area targeting economic development. This in turn can lead to rising property values and public improvements of existing infrastructure. The East Race Waterway course in South Bend, Indiana, and the Truckee River Whitewater Park in Reno, Nevada are examples where park development has reportedly led to downtown revitalization by attracting private sector investment in the area (Mississippi Whitewater Park Development Corporation 2003, Canoekayak.com 2008).

Spin-off impacts can be expected in the immediate neighborhood of a park and throughout the city. If developed in an area targeted for redevelopment, a whitewater park could help provide a unique element to the city's identity. In addition, by presumably introducing more people to whitewater sports, a whitewater park could help stimulate interest in whitewater boating in other parts of the region.

According to the City of Oroville's PM&E form, a whitewater facility in proximity to the downtown area would address certain resource goals established by the RSWG for the Oroville Facilities Hydroelectric Project area, including:

- Encourage recreation improvements, programs, and public-private partnerships that have a high economic return to the local economy.
- Enhance the local economy.
- Provide recreation that supports and promotes development of public event venues.
- Provide recreation development for diverse user groups.
- Provide recreation opportunities complementary to the diversity of the Oroville community and surrounding sphere of influence.

Local Community Linkages

Development of a whitewater park in the Oroville area could strengthen ties to existing recreation venues and other community attractions. The potential role that a whitewater park could play in the development of the city's downtown and riverfront area was addressed above. Other important ties include the relationship to recreation facilities and opportunities within the Lake Oroville State Recreation Area, including Lake Oroville, Thermalito Forebay and Afterbay, and the OWA. Proximity to these and other recreation attractions in the region offers opportunities for creating synergies for providing a regional recreation experience.

4.4.3.2 Composite Evaluative Criteria

Because some of the individual social, financial, and economic factors described above have both negative and positive effects (for example, high construction costs have positive effects on job creation but have corresponding negative effects related to capital formation), they are combined into composite evaluative criteria in this section for purposes of evaluating the concepts/site options. Applying composite evaluative criteria is considered more meaningful for assessing project feasibility, as well as being consistent with other criteria previously applied.

Three composite evaluative criteria were developed by combining the relevant individual social, financial, and economic factors described above. Two of the three composite

evaluative criteria (capital investment requirements and net operating expenses) address financial risk, and one criterion addresses potential local economic development benefits. These composite evaluative criteria are intended to balance both the positive and negative considerations of individual factors.

Capital Requirements

This evaluative criterion addresses the relative construction cost of the three concepts/site options, summarized in Table 4.4-5. It is intended to identify the relative challenges in obtaining capital for construction, as well as providing a measure of risk associated with potential debt requirements. Good information is available on the range of costs for small instream parks, as proposed by FRRPD for Bedrock Park (see Section 4.2.2). The estimated probable costs for the artificial channel whitewater park on the Fish Barrier Pool proposed by the City of Oroville as part of its Waterfront Redevelopment Concept Plan provides a detailed source for that concept's cost. Probable costs for the artificial channel park concept at the Riverbend Canyon site takes into account the likely development cost of that concept, including adjustments made to account for more site constraints than at the Fish Barrier Pool site.

The reconnaissance-level (preliminary) cost estimates provided here are intended to support only rough comparison, screening, and evaluation of potential projects. Future phases of feasibility analysis for specific conceptual or preliminary whitewater park designs would include topographical surveys, geologic investigations, assessment of sensitive biological and cultural resources, and similar factors to assess the feasibility of any proposed whitewater park project. As described above in relation to potential pipeline projects to supply the Riverbend Canyon site (Section 4.2.2.5), these park concept construction cost estimates are best characterized as level-of-magnitude estimates with a degree of accuracy of plus or minus 40 percent.

Table 4.4-5 summarizes the capital requirements associated with the three Oroville area whitewater park concepts.

Table 4.4-5. Whitewater park concept estimated capital requirements.

	Instream Park Concept	Artificial Channel Park Concepts	
	Bedrock Park	**Fish Barrier Pool**	**Riverbend Canyon**
CONSTRUCTION RELATED SITE CONSTRAINTS			
1. Physical Constraints[1]			
c) Land ownership/use	+	+	-
d) Parking/access	+	0	0
e) Available infrastructure	+	+	0
g) Available space for spectating, optional amenities	+	0	+

Table 4.4-5. Whitewater park concept estimated capital requirements.

	Instream Park Concept	Artificial Channel Park Concepts	
	Bedrock Park	**Fish Barrier Pool**	**Riverbend Canyon**
2. Environmental Constraints			
a) Flooding potential	+	+	0
b) Special status species /habitat	+	+	0
c) Fish passage/river habitat	+	+	+
e) Other potential water quality/quantity impacts	+	+	+
f) Cultural resources	+	-	+
3. Permitting/Approval Considerations			
a) Federal	-	0	0
b) State	-	0	0
c) Local	+	+	-
Cumulative Score (+ = 1, 0 = 0, - = -1)	8	6	2
CONSTRUCTION COST ESTIMATES BASED ON SIMILAR FACILITY COSTS AND CONSIDERATION OF SITE CONSTRAINTS ABOVE			
Total Facility Construction Costs (cost range: small instream park, <$0.5 million; large artificial channel park, $20-35+ million)	**$200,000-300,000** (mid-range of costs documented for existing similar parks, accounting for construction-related site constraints)	**$30-35 million** (large facility with fewer construction-related site constraints than Riverbend Canyon site)	**$40-50 million** (large facility similar to Fish Barrier Pool site but with more construction-related site constraints, and no opportunity for direct diversion of water to course, necessitating pipeline and/or pumping)

Key to ratings:
+ = GOOD (green cell shading): positive factor, not a constraint on whitewater park use of site and minor effect on construction costs.
0 = FAIR (yellow shading): neutral factor, possible minor constraint in whitewater park use of site and moderate effect on construction costs.
- = POOR (red shading): negative factor, possible/probable major constraint on whitewater park use of site and substantial effect on construction costs.

Net Operating Costs

This evaluative criterion considers operating and maintenance expenses and revenues of the three concepts/site options. It is intended to evaluate the potential for generating sufficient revenues to meet operating and maintenance expenses (and potentially for paying down construction-related debt). An operating revenue/expense ratio is used to gauge this potential. The evaluation considers the type and projected number of visitors, user fees, and average per-visitor operating expenditures, based on information

from existing whitewater parks, to estimate and compare operating revenues and expenses. For the assessment, paying visitors are assumed to include kayakers and rafters only, and it is assumed that there would be no charge for parking. The calculation of operating revenues and expenses is intended to approximate values for the first few years of operations. The resulting ratio is best characterized as a first-order approximation.

Table 4.4-6 summarizes the estimated net operating costs for the whitewater park, based on the potential revenues and operating expenses associated with the three Oroville area whitewater park concepts.

Table 4.4-6. Whitewater park concept estimated annual revenues and operating expenses.

	Instream Park Concept	**Artificial Channel Park Concepts**	
	Bedrock Park	**Fish Barrier Pool**	**Riverbend Canyon**
Potential revenues (assumptions: 60% of kayakers and rafters are adults; adult kayakers pay $12 per day and youth kayakers pay $6 per day; rafters pay $4 per trip and are assumed to take, on average, two trips per day based on fees charged at East Race Waterway)	No fee	12,000 adult kayakers @ $12 per person; 8,000 youth kayakers @ $6 per person; revenues = $192,000; 17,500 rafters (adult and youth) @ $8 per person; revenues = $140,000; total revenues = **$332,000**	9,000 adult kayakers @ $12 per person; 6,000 youth kayakers @ $6 per person; revenues = $144,000; 13,125 rafters (adult and youth) @ $8 per person; revenues = $105,000; total revenues = **$249,000**
Estimated operating and maintenance expenses (for artificial channel parks, based on average operating costs per visitor estimated for the proposed Mississippi Whitewater Park)[1]	Low; assume extra maintenance costs, potential additional park staffing needs = **$25,000-$30,000**	37,500 visitors at average operating cost per visitor of $10.20; annual operating expense = **$382,500**	28,100 visitors at average operating cost per visitor of $10.20; annual operating expense = **$286,620**[2]
Revenue/Expense Ratio	**NA**	**0.87**	**0.87**

1. *Expenses included in the Mississippi Whitewater Park estimate are on-site staff, administrative overhead, food and beverage concession, and maintenance/security. A $100,000 annual contribution to a capital improvements reserve was also recommended, but is not included in the operating costs.*
2. *Does not include potential pumping costs to supply water from the Power Canal, Feather River Fish Hatchery, or river into a whitewater channel, or pumping for a recirculating pumped flow course.*

Benefits to the Local Economy

This evaluative criterion addresses local economic impacts of the concepts/site options. It identifies the potential for generating tourism-related spending and for contributing to

downtown economic development in the City of Oroville. The evaluation estimates the amount of local spending (i.e., within the City of Oroville) associated with each concept/site by park visitors who live outside Butte County and are presumed to not otherwise be spending in the Oroville area. Average per-day spending estimates of $27.08 for out-of-area visitors, as derived from surveys of visitors to the Feather River – Diversion Pool area for the Oroville Relicensing studies and adjusted to 2009 dollars, were used in the calculations. Matching the results of the park use estimates described above, it is assumed that 70 percent of visitors to the park would be out-of-area visitors and 30 percent would be local residents. Of the 70 percent of out-of-area visitors, it is further assumed that only 50 percent would not otherwise be spending in the Oroville area. These percentages are similar to use estimates for a proposed whitewater park in upstate New York (Crane Associates Inc. 2008), which was used as a model for the use estimates for the potential Oroville-area whitewater parks. This criterion also considers the potential contribution to local economic development based primarily on proximity of the sites to designated economic development areas.

Table 4.4-7 summarizes the potential benefits to the local economy of the three Oroville area whitewater park concepts, based on potential increases in local tourism spending and potential contributions to local economic development.

Table 4.4-7. Whitewater park concept benefits to the local economy (City of Oroville).

	Instream Park Concept	**Artificial Channel Park Concepts**	
	Bedrock Park	**Fish Barrier Pool**	**Riverbend Canyon**
Increase in local tourism spending	**Very low** (primarily would serve local novice-level paddlers and new paddlers/youth from City of Oroville and local area, with few out-of-area visitors)	13,125 out-of-area visitors @ $27.08 per visitor; annual tourism-related spending of **$355,425**	9,835 out-of-area visitors @ $27.08 per visitor; annual tourism-related spending of **$266,332**
Potential contribution to local economic development	**Low** (good proximity for contributing to downtown riverfront but very limited draw for visitors from outside the local market)	**High** (very good location for contributing to downtown riverfront development; highest number of out-of-area visitors expected; strong geographical relationship to downtown)	**Moderate** (will attract a relatively high number of out-of-area visitors who access from State Hwy 70 and other roads in proximity to downtown Oroville; less strong geographical relationship to downtown)

4.4.3.3 Conclusions Regarding Financial and Economic Criteria

Table 4.4-8 summarizes the foregoing evaluation of the three Oroville area whitewater park concepts based on financial and economic criteria, ranking each concept/site for each criterion using a high/moderate/low scale.

Considering first the instream park concept at Bedrock Park, this concept can be described as having low financial risk due to both low construction and operating costs, but it also has low benefits to the local economy due to a low potential to increase local tourism spending and a low potential to contribute to local economic development.

The concept of an artificial channel park at the Fish Barrier Pool is estimated to have high construction costs and operating expenses relative to the other concepts/sites, but it also has the highest revenue potential and the highest potential for benefitting the local economy. The concept of an artificial channel park at the Riverbend Canyon site would have similarly high (or higher) construction costs, and perhaps only slightly lower operating expenses (based on user demands associated with lower attendance), but the lower attendance would also result in lower revenue. Compared to the similar park concept at the Fish Barrier Pool site, potential benefits to the local economy are moderate, primarily due to the less central location, at some distance from the core of the community.

Table 4.4-8. Summary of financial and economic evaluation of Oroville area whitewater park concepts.

	Instream Park Concept	**Artificial Channel Park Concepts**	
	Bedrock Park	**Fish Barrier Pool**	**Riverbend Canyon**
Financial Risk			
Construction cost	Low	High	High
Operating expenses	Low	High	Moderate–High[1]
Revenue	None	High	Moderate
Benefits to Local Economy			
Increase in local tourism spending	Very Low	High	Moderate
Potential contribution to local economic development	Low	High	Moderate

1. *Does not include potential pumping costs to supply water from the Power Canal, Feather River Fish Hatchery, or river into a whitewater channel, or pumping for a recirculating pumped flow course.*

5.0 SUMMARY & CONCLUSIONS

The initial screening of seven candidate whitewater park sites in the Oroville area eliminated three of the seven sites from further consideration, as reported in Section 4.2.1, due to fatal flaw constraints inherent in those sites. In its July 2009 letter to DWR, the SBF Steering Committee indicated that three of the remaining four sites were not among sites the committee had an interest in, primarily because of the sites' low potential for contributing to local economic development due to their remoteness from downtown Oroville. However, the committee recommended two new sites for further consideration based on their own initial screening. The resulting three sites were subject to a more detailed evaluation, as reported in Section 4.2.2, resulting in each site receiving good, fair, or poor ratings on 25 physical, environmental, and operational criteria. In addition, preliminary answers were developed in response to several questions submitted by the SBF Steering Committee in their letter regarding each of the three candidate sites.

Potential park concepts (small, medium, or large instream park; small or large artificial channel park) were then identified for each of the three sites, and a final evaluation step focused on social, financial, and economic factors was completed. This final step, chiefly built upon the prior site-based evaluations, provides the most complete reconnaissance-level assessment of specific park concepts at individual sites to guide the SBF Steering Committee in their decisions regarding funding for development of a whitewater park in the Oroville area. Information is also provided to guide the SBF Steering Committee's consideration of non-park alternatives for enhancing whitewater boating in the Oroville area.

5.1 FEASIBILITY OF CANDIDATE WHITEWATER PARK SITES BASED ON PHYSICAL, ENVIRONMENTAL, AND OPERATIONAL CRITERIA

Although each of the three sites carried forward from the initial screening was identified as an instream or artificial channel park site, the sites were not evaluated against any specific whitewater park concept. This evaluation did not result in any of the candidate sites being found infeasible, but did identify constraints or challenges associated with each site, thus allowing the sites to be compared in terms of greater and lesser constraints.

The artificial channel park site at Riverbend Canyon is clearly the site with the greatest constraints, with a score of 10 out a maximum of 25 points (25 points is equivalent to a good rating assigned to a site for all 25 criteria). As a result, this site can be considered the least feasible. The site was rated "fair" or "poor" on more than half of the criteria.

Conversely, the artificial channel site at the Fish Barrier Pool and the instream park site at Bedrock Park each has considerably fewer constraints; each of the sites was assigned a "fair" rating for several criteria but a "poor" rating for only two or three criteria, and so can be considered the most feasible sites. The low number of "poor" ratings indicates that neither site can be considered infeasible at this point, although challenges exist for each. The difference in scores between the two sites was due to a

minor difference of one additional ”fair” rating (neutral factor with zero points assigned) and one less “good” rating for the Fish Barrier Pool site. The “fair” ratings are less definitive in determining the feasibility of a site than poor ratings, in that they reflect uncertainty about potential impacts in some cases.

An important distinguishing feature of the Fish Barrier Pool site is that it is entirely within the FERC Project boundary. As such, any changes to the site (and to Project operations) such as would occur with the development of a whitewater park would require an amendment to the Project license in order for park development to proceed. DWR would be required to submit a license amendment application to FERC, which would conduct an environmental analysis of the changes proposed in the amendment application. (Depending on park design at Riverbend Canyon and construction methods at Bedrock Park, similar approval or license amendments may also be required from FERC for whitewater park development to proceed at those sites.) Summary scores for the three sites are presented in Table 5.1-1.

Table 5.1-1. Summary of evaluation of three Oroville area whitewater park concepts.

	Instream Park Concept	**Artificial Channel Park Concepts**	
	Bedrock Park	**Fish Barrier Pool**	**Riverbend Canyon**
Site Opportunities and Constraints (25 criteria total)			
“Good” ratings	17	15	13
“Fair” ratings	6	8	9
“Poor” ratings	2	2	3
Financial and Economic Criteria			
Financial Risk	Low	High	High
Benefits to Local Economy	Low	High	Moderate

5.2 ADDITIONAL INFORMATION REGARDING FEASIBILITY OF CANDIDATE WHITEWATER PARK SITES DEVELOPED IN RESPONSE TO SBF STEERING COMMITTEE QUESTIONS

The responses developed to the SBF Steering Committee’s questions, given time and budget constraints of this study, are preliminary and could be revised or supplemented with additional investigation. However, the responses provide a considerable amount of information related to each candidate whitewater park site, beyond that obtained for the specific site evaluation criteria enumerated in the Study Plan. This additional information helps to further characterize the feasibility of whitewater park development

at each site. The following subsections summarize the additional information developed for each site.

5.2.1 Riverbend Canyon Artificial Channel Park Site

Although the lower portion of this site is adjacent to the low flow channel, this site does not have an adjacent source of water to supply a whitewater channel from above or upstream, such as exists at the Fish Barrier Pool site with the adjacent Power Canal. Therefore, it is likely that water for a whitewater channel would need to be brought to the site via a pipeline. The SBF Steering Committee's question regarding the cost of getting water to the site suggests both the Power Canal and the Feather River Fish Hatchery as sources.

It is estimated that diverting sufficient flow directly into a gravity-fed whitewater channel from the Power Canal would require a 1-mile-long pipeline of 8 feet or greater in diameter. Preliminary construction costs for such a pipeline were estimated to be approximately $6 to $7 million. Alternatively, a smaller pipeline from the Power Canal could supply sufficient flow to a retention pond on the site from which a recirculating pumped-flow park would draw water. Preliminary construction costs for this pipeline, sized at 36 inches in diameter, were estimated to be approximately $2.0 to $2.5 million. Intakes/gates for these pipelines would also be complex projects with similar additional costs. Excess Feather River Fish Hatchery water up to about 70 cfs could also be conveyed via a 4,000-foot pipeline to the site, at the lowest estimated cost among the three options, approximately $1.0 to $1.5 million.

Each of these options has implications for the type of artificial channel park that could be developed on the site (i.e., a diversion channel park, or a pumped flow park). Each type of park would use the diverted water differently and thus would have different potential environmental impacts, particularly on anadromous fish (habitat and water temperatures) in the low flow channel. Of particular concern would be the return of water from a diversion channel park to the river.

The option of bringing only sufficient water to the site to supply a pumped-flow park would require retention ponds at the upper and lower ends of the whitewater channel, such as exist at several parks of this type in Maryland and North Carolina. Water would be recirculated through the park by pumping water from the lower pond to the upper pond. There is sufficient space within the Riverbend Canyon and on the lower portion of the site for ponds of adequate size. However, the soils present at each portion of the site have varying constraints for construction of ponds and embankments such as would be required for this purpose. These constraints indicate that material would need to be brought to the site for embankments, and that the lower reservoir would need to be lined to compensate for the high permeability of the soils (existing parks of this type use cement ponds).

The option of a pumped-flow park brings with it the cost of pumping the water through the park, which is likely substantial. Investigation of pumping costs at the USNWC

pumped-flow park in North Carolina and comparison of retail energy prices for commercial customers suggest costs as high as $200 per hour of operation.

The SBF Steering Committee inquired about the feasibility of percolating water captured from a whitewater park at this site into the ground, and potential issues surrounding returning water back to the low flow channel. Although the permeability of the soil on the lower portion of the site is high, it does not appear likely that the high volume of water that would be used in a whitewater park could be percolated into the soil rather than released directly to the river. Returning water directly to the low flow channel from a whitewater park, which would be necessary if water were directly diverted into a diversion channel type park, may have adverse impacts on anadromous fish. One concern is increased water temperature in the low flow channel due to warming of the water while it is diverted to and used in a whitewater park. Another concern is the potential to create attraction flows that would cause Chinook salmon and steelhead to delay their migration or spawning.

5.2.2 Bedrock Park Instream Park Site

The current minimal flow within the Bedrock Park swim lagoon is not sufficient for a whitewater park. Due to potential effects on fish habitat and the regulatory flow requirement for the low flow channel, it is unlikely to be acceptable to the resource agencies (DFG, NMFS) to divert a substantial amount of water to a whitewater channel, given existing flows. However, Settlement Agreement measures to increase flows in the low flow channel by 100 to 200 cfs may provide an opportunity to support some portion of that increased flow into a whitewater channel without depriving most of the low flow channel of the benefits of the full 100 to 200 cfs increase in flows.

The approximate 15 fpm gradient at this site is low for whitewater park use. However, whitewater play features (“waves”) and multiple-feature instream whitewater parks are proposed and have been built on streams with similarly low gradients. The fact that only a portion of the river channel would be available for a wave feature or whitewater channel and the comparatively low flow that would be possible at this site result in additional constraints on the creation of a whitewater feature. Also, this location is being considered by DWR as a potential site for a Fish Segregation Weir which, if constructed, would likely conflict with potential whitewater park development.

The water temperature at this site is lower than ideal for water contact recreation, but the temperature does not differ substantially from what would exist at the two artificial channel sites. The water temperature is cooler than some popular local whitewater runs. However, many paddlers are equipped with specialized protective clothing for use in cold water.

5.2.3 Fish Barrier Pool Site

Concerns expressed by the SBF Steering Committee about this site being partially in a flood channel do not appear to be substantiated. Only a small portion at the fringe of the site is within the FEMA 100-year flood zone, and the entire site is outside the Central Valley Flood Protection Board designated floodway. The conceptual park

design submitted by the City of Oroville with their PM&E form suggests that conflict of the park with flood flows would not be a concern. All but the downstream-most ends of the two whitewater channels depicted in the conceptual park design are well above the elevation of flood flow, and the park would presumably not operate while flood flows were being passed through the Fish Barrier Pool.

Power foregone at the Diversion Dam Power Plant may be a substantial cost associated with whitewater park development at this site. Assuming that all or nearly all of the flow now passed through the power plant would be diverted (per the conceptual park design), diversion of water from the Power Canal would result in a power foregone cost of at least $60,000 to $200,000. These values are based on a 6-month park operating season, and the park operating 12 hours per day, on weekends only (lower figure) or on both weekends and weekdays (upper figure).

Given that water is currently diverted at this site via a 54-inch pipeline to the Feather River Fish Hatchery and given the short distance that water would need to be conveyed from the Power Canal, access to water from the Power Canal is likely feasible. An update of the cost estimate for a control structure and inlet tunnel provided in the City of Oroville's PM&E form from 2003 to 2009 dollars, based on USACE cost indices for diversion structures (USACE 2009), provides an estimate of $3.86 million.

The best potential access to this site appears to be provided by the existing Golden Feather Drive, a private unpaved road that follows the west boundary of the site. However, the road would need to be improved and issues of shared use with the current private and DWR staff users of the road would need to be addressed. New options for road access to the site may become available as the development of the adjacent residential subdivision is completed, but with potential additional constraints related to conflicts with residential traffic.

5.3 FEASIBILITY OF WHITEWATER PARK CONCEPTS AT CANDIDATE SITES BASED ON SOCIAL CRITERIA

The results of the evaluation based on social criteria indicate that the artificial channel park concepts have the potential to attract whitewater paddlers currently using natural runs and the lone existing whitewater park in the region, in Reno, Nevada. A park that provides opportunities for beginner-level paddling and possibly guided rafting, where no experience is required, can also attract new paddlers to the park.

Although the overall supply of local natural whitewater boating opportunities is large (as documented in the Phase 1 Background Report), the artificial channel park concepts can fill gaps in the availability of local whitewater opportunities for beginning and intermediate paddlers and in the availability of runs in the summer and fall seasons, and are designed to provide for easy and quick access to paddling as compared to most natural runs in the local area. The instream park concept at Bedrock Park could also expand seasonal access to whitewater boating, and expand beginner-level paddling opportunities, particularly if linked to instructional boating at the Chico State Aquatic Center, at Thermalito Forebay.

The concept of a large artificial channel park at the Fish Barrier Pool site, as described in the City of Oroville's PM&E form, has the potential to draw the greatest number of park users, and is also best situated to draw spectators to observe paddlers in action at the park. The other artificial channel park concept at Riverbend Canyon is constrained by a less central location and fewer linkages to other recreation sites that could complement whitewater use and spectating, but would benefit from good visibility from State Highway 70. The instream park concept for Bedrock Park would attract the least number of paddlers, because it would support the most limited range of uses and difficulty, but this is the expressed intent for this concept, which local proponents envision as complementary to a large-scale whitewater park.

An artificial channel park at the Fish Barrier Pool or Riverbend Canyon would be best situated to host events, which can attract out-of-town spectators. Both are convenient locations for visitors to access, with available space on the sites and nearby supporting infrastructure.

Competition or conflicts with other recreation uses does not appear to be a major issue for any of the park concepts at the three sites.

5.4 FEASIBILITY OF WHITEWATER PARK CONCEPTS AT CANDIDATE SITES BASED ON FINANCIAL AND ECONOMIC CRITERIA

The concept of a large artificial channel park at the Fish Barrier Pool site (identified by the City of Oroville in their PM&E form as the preferred park site) clearly rises to the top in feasibility, being the most desirable site with the fewest major constraints, providing the best opportunity for gaining revenue to support operation of a park and the best opportunity to provide the desired economic impact for the community.

It is important to note that none of the park concepts would be expected to turn a profit, as has been found to be true for artificial channel parks across the U.S.[5] However, the results indicate that the concept of a large artificial channel park at the Fish Barrier Pool site can come nearest to covering operational costs, in addition to providing indirect economic benefits to the community. The difference in potential indirect economic benefits between this concept, and the similar concept at Riverbend Canyon, is probably small.

While the reconnaissance-level evaluation presented in this report indicates that artificial channel whitewater park development at the Fish Barrier Pool site is the most feasible, when social, financial, and economic criteria are taken into account, potential

[5] The potential for a small profit after the first year of operation is claimed for the proposed Mississippi Whitewater Park in Minneapolis, Minnesota; however, this is based on a steadily increasing number of park visitors each year with only slowly increasing O&M costs (Minnesota Department of Natural Resources 1999). USNWC claimed to achieve an operating profit during its first full year of operation; however, this calculation includes revenue in the form of a $1.7 million "service fee" paid by local governments, which accounted for 20 percent of revenues, and it does not include interest on debt, which accounted for 25 percent of expenses (Mecklenburg County 2008).

constraints would need to be addressed, including potential impacts on cultural resources. Additional study is needed to establish the significance of the potential impacts and resulting mitigation challenges. Development of a park at the Fish Barrier Pool would result in lost power generation that could cost up to $800,000 per year, depending on the number of days per week and hours per day the park would operate and the length of the operating season, which needs to be considered against the potential economic benefits of the park.

5.5 POTENTIAL FOR NON-PARK WHITEWATER ENHANCEMENTS

A variety of whitewater run access improvements are possible on local whitewater runs upstream of Lake Oroville. Many of these improvements have been described and evaluated by boaters and the agencies that operate the hydropower projects on these river reaches, and some funding has been committed for these improvements.

Construction cost estimates developed by PG&E for such improvements on the North Fork Feather River suggest that the improvements that do not involve major construction, such as new access roads, can be accomplished for relatively modest cost (generally $50,000-$130,000). More substantial improvements may cost $500,000-$1,500,000, or more.

Unlike whitewater park development in and near Oroville, these access improvements on more distant natural whitewater runs would not be expected to provide measurable benefits to the local economy.

5.6 CONCLUSIONS

A whitewater park in the immediate Oroville vicinity would likely provide economic benefits to the community through direct means (park visitors) and indirect means (increased tourism). The Oroville Facilities provide a continuous flow of water within the Feather River below Oroville Dam, and there are potential synergisms for whitewater boating opportunities. However, the potential economic viability and environmental constraints need to be well understood before any of the concepts described in this report move forward. Any proposal to implement one of the whitewater park concepts needs to be carefully evaluated to determine the potential project costs and environmental impacts.

Based on the information presented in this study, there is likely justification for a limited number of conceptual park alternatives to be further analyzed to determine if potential funding sources are available and whether the known physical, operational, and environmental constraints (particularly anadromous fish habitat and water temperatures) could be mitigated. Additional data on biological resources at the Bedrock Park site, and on biological and cultural resources at the Riverbend Canyon site, are needed to support further analysis. Development of a conceptual whitewater park design (or several alternatives) for the Riverbend Canyon site, similar to what has been developed by the City of Oroville for the Fish Barrier Pool site, would greatly facilitate further analysis. Future analysis should be based on a conceptual design that establishes in preliminary form some essential aspects of the whitewater park design, such as whether

a diverted flow or pumped-flow course would be constructed, and how water would be brought to and handled on the site.

With the completion of this study, DWR has met its obligations under Oroville Facilities Settlement Agreement Section B101 to conduct a Feather River Whitewater Boating Opportunity Feasibility Study.

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APPENDIX A

Sources of Data Used During Screening of Candidate Whitewater Park Sites

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Sources of Data Used During Screening of Candidate Whitewater Park Sites

Table A-1. Sources of data used during initial screening of candidate whitewater park sites.

Criteria	Sources
Flow	DWR State Water Project Operations Data, Monthly Reports: Tables 5 and 6 (available through 2006) provide flow data for low-flow channel, Power Canal, and Forebay Power Plant tailwater channel; data was used to estimate flows that would be carried in proposed Afterbay Diversion Canal and Alternate Outlet and Channel.
	DWR Reconnaissance Study of Potential Facility Modifications (Dec 2006): discusses flow that would be carried by proposed Afterbay Diversion Canal and Alternate Afterbay Outlet and Channel.
	USGS flow gauge data: Feather River at Oroville (site #11407000) provides flow data for Feather River below Diversion Dam (low-flow channel); Diversion to Feather River Fish Hatchery (site #11406930) provides flow data for hatchery diversion from Diversion Pool/Power Canal.
Natural Gradient	Topographic data in GIS database compiled during Oroville Facilities relicensing process (See note below table for additional GIS based sources).
Private Property Ownership	Relicensing Study L1 – Land Use: Section 5.2.1.4, Fig. 5.2-1a depicts private lands surrounding project area (covers 1/4 mile from FERC boundary) as well as ownership and jurisdiction of public lands within the project boundary.
	Butte County assessor parcel data: Available on County website (Street Knowledge GIS interface); public parcels are identified by zoning designation PQ ("Public, Quasi-Public").
	City of Oroville website: Downloadable maps depict zoning (updated July 2005), and approved development on parcels in "area of influence" (June 2008)
Special-Status Species/Protected Habitat	Relicensing Study T2: Project Effects on Special Status Species - Report provides data on habitat and populations of 9 protected species within the project area, including Forebay, Afterbay and Feather River; also provides maps of vernal pools in Forebay and Afterbay areas, and observations regarding 26 "species of concern."
	City of Oroville website - Downloadable maps from General Plan Update: Map Fig. OPS-3 depicts vernal pool areas (including the area between Forebay and Afterbay).
	California Natural Diversity Database (CNDDB) provided frequently updated data, compatible with GIS mapping, on observations of special status animal and plant species and habitat.

Table A-1. Sources of data used during initial screening of candidate whitewater park sites.

Criteria	Sources
Fish Passage/River Habitat	Relicensing Study F10 - Task 2B: Evaluation of Potential Effects of Oroville Facilities Operation on Spawning Chinook Salmon - Report provides maps of Chinook salmon and steelhead spawning densities on Feather River; Appendix C provides maps of spawning areas.
	Relicensing Study F10 - Task 3A: Distribution and Habitat Use of Steelhead and Other Fishes in the Lower Feather River - Report provides maps of steelhead and other fish species observations in the Feather River.
Flooding Potential	Butte County assessor parcel data, available on County website (Street Knowledge GIS interface): Can map 100 yr. floodplain in relation to specific parcels within County jurisdiction.
	Butte County Development Services Department, GIS Division: FEMA flood zones maps (available on website)
	City of Oroville General Plan Update : Fig 4.7-1 depicts 100-Year FEMA Flood Zones within city and area of influence.
	DWR "best available data" floodplain maps: Maps covering Oroville area and depicting 100 and 200-year floodplains are available on DWR website.
Cultural Resources	Relicensing Study C-1 - Konkow Maidu Ethnographic Report: lists and maps a number of village and fishing sites on the low-flow channel.
	Relicensing Study R-15 - Suitability Study: Report provides map depicting density of known archeological sites within the project area.
Site Acquisition Costs	Butte County land for sale data: Sale information available on several real estate websites provides an indication of current per acre land values.
	City of Oroville website: Downloadable map of "Unconstructed Development" depicts approved residential developments for several sites near proposed whitewater park sites and on conceptual Afterbay Diversion Canal route (subdivided land is assumed to be more costly to acquire than other undeveloped land).

Note: Additional data was available within GIS data layers compiled during the relicensing process for the Oroville Facilities; previously mapped data utilized include:

- wildlife habitat types
- special status species habitat (giant garter snake, vernal pools, valley elderberry longhorn beetle)
- cultural resources (areas survey intensively and cursorily, and identified cultural sites)
- public land ownership and jurisdiction
- land use

Table A-2. Sources of data used during secondary evaluative screening of candidate whitewater park sites.

Evaluative Criteria	Sources
1. Physical Criteria	
a) Gradient	see Table A-1
b) Flow	see Table A-1
c) Land ownership/use	see Table A-1
d) Parking/access	Relicensing Studies R1 - Vehicular Access, R10-Recreation Facility Inventory and Condition
e) Available infrastructure (potable water / sanitary sewer / electricity / telephone)	Oroville General Plan: Fig. PUB-3. Sewer Infrastructure; Fig LU-1. Existing Land Use (residential or commercial develop indication that utilities are available nearby); Section 4.13 Utilities and Infrastructure, describes water, wastewater, electric services in Oroville and Thermalito areas.
	City of Oroville: website map files, utility districts map (sewer, water, power); sanitary sewer and storm drain master maps.
f) Potential length of run(s)	GIS used to determine acreage available, length of instream site
g) Available space for spectating, optional amenities	Visual assessment based on aerial maps and site visits
h) Aesthetics	Visual assessment based on aerial maps and site visits
i) Safety/security	Visual assessment based on aerial maps and site visits
2. Operational Requirements	
a) Security	Visual assessment based on aerial maps and site visits
b) Regulatory flow and temperature requirements	Evaluation of water source and likelihood of temp affects [no impacts to temperature anticipated at most sites, given short duration of diversions; more precise evaluation would require additional analysis using specialized expertise and water temperature models]
c) Power generation	Evaluation of water source and likelihood of power generation affects within City of Oroville PM&E form proposing whitewater park
	Cost of lost power generation based on information on energy values in FERC EIS, Section 4, Developmental Analysis (loss of 8,500 MWh for 100-200 cfs increase in low flow channel, equates to a cost of about 3 cents/KWh = $255,000).
d) Water supply	NA [no effect at any site - diversion of current flows only]
e) Flood control operations	NA [no effect at any site - diversion only of current flows, no special releases for whitewater purposed are assumed]

Table A-2. Sources of data used during secondary evaluative screening of candidate whitewater park sites.

Evaluative Criteria	Sources
3. Typical Whitewater Park Operational Criteria	
a) Diurnal considerations (potential constraints on daily operations at site)	Review of adjacent land uses and development for possible conflicts with whitewater park use
b) Seasonal consideration (potential seasonal constraints on operations at site)	Review of seasonal variability and availability of flows, seasonal water temperature and access to site that may affect operations
4. Environmental Constraints	
a) Flooding potential	see Table A-1
b) Special status species/habitat	see Table A-1
c) Fish passage/river habitat	see Table A-1
d) Water temperature (cold water effects on boaters)	Relicensing Study W-6 - Project Effects on Temperature Regime: provides year-round data on temperatures at numerous locations downstream of Oroville Dam.
e) Other potential water quality/quantity impacts	NA [no impacts anticipated, given non-contact use, and use that is similar to current instream uses; more precise evaluation would require additional analysis using specialized expertise]
f) Cultural resources	see Table A-1
5. Permitting/Approval Considerations	
a) Federal	
ACOE – CWA Sec 404 permit/ Rivers and Harbors Act Sec 10 permit	ACOE - Sacramento District Regulatory Program webpage; California Wetlands Information System - Rivers and Harbors Act summary webpage; FEMA - Clean Water Act, Section 10 Rivers and Harbors Act webpage; Sacramento River Watershed Program *(applicable if project will include placing structures in a streambed or will effect jurisdictional wetlands)*
NMFS - ESA consultation/ take permit	USFWS and NMFS, Endangered Species Consultation Handbook (March 1998), Sacramento River Watershed Program *(applicable if project may affect federally-protected fish)*
USFWS - ESA consultation / take permit	USFWS and NMFS, Endangered Species Consultation Handbook (March 1998); USFWS, Endangered Species Program, “No Surprises” Questions and Answers webpage; Sacramento River Watershed Program *(applicable if project may affect federally-protected terrestrial plants or animals or habitat)*
b) State	
DFG - Sec 1602 Streambed Alteration Permit	DFG website – Lake and Streambed Alteration Program; Sacramento River Watershed Program *(applicable if project will modify a natural streambed)*

Table A-2. Sources of data used during secondary evaluative screening of candidate whitewater park sites.

Evaluative Criteria	Sources
DFG - Incidental Take Permit	DFG website – California Endangered Species Act (CESA), Incidental Take Permit Process; Sacramento River Watershed Program *(applicable if project may affect state-protected plants or animals or habitat)*
RWQCB - Section 401 permit	State Water Resources Control Board website – Dredge/Fill (401) and Wetlands Program; Sacramento River Watershed Program *(tied in with COE Sec 404 permit and related to placement of structures in streambed)*
SHPO - Sec 106 NHPA review/ California Public Resources Code Sec 5024	California State Parks, Office of Historic Preservation website – Project Review; Sacramento River Watershed Program; Steve Heipel (EDAW), Janis Offerman (DWR) *(applicable in most circumstances and for all projects on state lands; review as to whether any Native American or other cultural resources may be affected by project)*
Central Valley Flood Protection Board - Encroachment permit	Central Valley Flood Protection Board webpage – provided information on permits, designated floodway maps. Sacramento River Watershed Program *(applicable if project will modify levees or floodway)*
c) Local	
Butte County	Butte County on-line parcel data (zoning, allowable uses) and General Plan; Flood Hazard Prevention Ordinance (No. 3598) describing permit requirements and criteria for development in flood zones/
City of Oroville	City of Oroville parcel data (zoning, allowable uses) and General Plan

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APPENDIX B

Whitewater Park Profiles

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Instream Whitewater Parks

Park Name: Truckee River Whitewater Park at Wingfield
Location: Reno, Nevada
Owner: City of Reno
Public or Commercial: Public
Year opened: 2003

1. Physical and Hydrologic Characteristics

Length of run(s)	1,200 ft and 1,400 ft. (north and south channels)
Number of features	5 drop structures; 6 drop structures (11 total features)
Average flow - Peak season (April-early June) - Shoulder seasons (March; late June-July) - Off-season (August-March)	 700-1,500 cfs 400-700 cfs 200-400 cfs
Gradient	35-50 fpm

2. Boating Use

Types of uses	Rafting, kayaking, canoeing, tubing
Difficulty	Class II-III
Slalom course (Yes or No)	Yes
Amount of use	50,000/year projected use (Reno Gazette 8/6/2003)

3. Park Setting

Urban or in-town / near town / rural	Urban, within commercial district
Population of home community	215,000
Regional population center(s) and population	Sacramento, CA (2 hrs); 480,000
Tourism-based economy?	Yes (casinos are primary draw)
In existing park or new dry-land park?	Rehabilitation of existing Wingfield Park on island between 2 channels
Trail linkages to residential areas or parks?	No

4. Other Recreational Amenities

Non-boating activities supported	Swimming, wading during low water periods
Food services	None (available nearby and at park during events)
Competitions supported	Park hosts annual 3-day river festival with >35,000 attendees

5. Financial Information

Park use fees	none
Cost to build whitewater facility/features	$1.5 million
Total construction cost (with non-boating amenities)	$4.5 million (includes additional $1.3 million for streamside enhancements and $1.7 million for improvements to Wingfield Park)

Park Name: Clear Creek Whitewater Park
Location: Golden, Colorado
Owner: City of Golden
Public or Commercial: Public
Year opened: Initial improvements: 1998; Additions: 2002

1. Physical and Hydrologic Characteristics

Length of run(s)	¼ mile (competition course 800 ft.)
Number of features	6 drops in addition to competition slalom course; additional drops downstream
Average flow - Peak season (May- June) - Shoulder seasons - Off-season	 600-800 cfs 300-500 cfs 50-100 cfs
Gradient	40 fpm (some sources say 45 fpm)

2. Boating Use

Types of uses	Rafting, kayaking, canoeing, tubing
Difficulty	Class II+
Slalom course (Yes or No)	Yes
Amount of use	14,000/year (2000)

3. Park Setting

Urban or in-town / near town / rural	In-town, adjacent to residential and commercial districts
Population of home community	18,000 (college town)
Regional population center(s) and population	Denver, CO (suburbs 10 miles); Boulder, CO (20 miles); 100,000
Tourism-based economy?	No
In existing park or new park?	Adjacent to city parks on both sides of river
Trail linkages to residential areas or parks?	Paved paths on both sides of river; linkage to bike routes

4. Other Recreational Amenities

Non-boating activities supported	Swimming, wading during low water periods
Food services	None (available nearby and at park during events)
Competitions supported	Park has hosted several competitive events and festivals

5. Financial Information

Park use fees	none
Cost to build whitewater facility/features	$390,000 ($165K for initial improvements; $225K for 2002 instream additions) (Source: Shimoda 2007 ppt Waller Creek)
Total construction cost (with non-boating amenities)	NA (additional streamside and bridge improvements have been completed)

Park Name: Arkansas Whitewater Park and Greenway
Location: Salida, Colorado
Owner: City of Salida
Public or Commercial: Public
Year opened: Initial improvements: 2001, Phase 2: 2003

1. Physical and Hydrologic Characteristics

Length of run(s)/park	1,000 ft.
Number of features	2 playhole structures
Average flow - Peak season - Shoulder seasons - Off-season	 1,000-2,000 cfs (May-July) 500-1,000 cfs 200-500 cfs
Gradient	45 fpm (whitewater park section); 23 fpm (entire 19-mile run containing park)

2. Boating Use

Types of uses	Rafting, kayaking, canoeing
Difficulty	Class II+-III
Slalom course (Yes or No)	Yes (Source: Eddy Flower webpage "99")
Amount of use	No data

3. Park Setting

Urban or in-town / near town / rural	In-town (adjacent to commercial district)
Population of home community	5,000 (mountain valley town)
Regional population center(s) and population	None
Tourism-based economy?	Yes, river rafting and mountain recreation are primary summer draws
In existing park or new park?	Greenway improvements linked whitewater park to existing city park
Trail linkages to residential areas or parks?	No

4. Other Recreational Amenities

Non-boating activities supported	Swimming, wading during low water periods
Food services	None (available nearby and at park during events)
Competitions supported	Park hosts annual FIBArk Festival

5. Financial Information

Park use fees	None
Cost to build whitewater facility/features	unknown
Total construction cost (with non-boating amenities)	$307,000 (includes bank restoration and access improvements, restroom)

Park Name: Ocoee Whitewater Center
Location: Near Ducktown, Tennessee
Owner: U.S. Forest Service
Public or Commercial: Public
Year opened: 1996

1. Physical and Hydrologic Characteristics

Length of run(s)/park	1,640 ft.
Number of features	Several drops, ledges, rapids
Average flow (dependent on TVA dam releases) - 34 dam release days, May-September - Non-release days	 1,400 cfs (normal release) unknown (low - tributary inflows only)
Gradient	50 fpm (average for entire 3.5 mile Upper Ocoee run, including OWC)

2. Boating Use

Types of uses	Rafting, kayaking, canoeing
Difficulty	Class III-IV
Slalom course (Yes or No)	No (gates have been removed)
Amount of use	Boating use unknown; 300,000 visitors annually to OWC (most are not whitewater boaters)

3. Park Setting

Urban or in-town / near town / rural	Rural (7 miles to nearest town)
Population of home community	<1,000 (in each of 2 nearest towns)
Regional population center(s) and population	Chattanooga, TN (60 miles), 500,000; Atlanta, GA (100 miles), 5 million
Tourism-based economy?	Yes; river rafting and Cherokee National Forest are primary summer draws
In existing park or new park?	Development of OWC included visitors center, and several other improvements
Trail linkages to residential areas or parks?	OWC linked to 30-mile trail system on USFS lands and to USFS campground

4. Other Recreational Amenities

Non-boating activities supported	Swimming, wading during low water periods; popular site for spectators
Food services	Concession stand in visitors center
Competitions supported	Hosted 1996 Olympics, other competitions held annually

5. Financial Information

Park use fees	None (USFS charges $3 parking fee)
Cost to build whitewater facility/features	$7.7 million
Total construction cost (with non-boating amenities)	$25 million (includes 7,200 sq. ft. visitor center, pathways and pedestrian bridge over river, other day use improvements)

Park Name: Trinity Park Whitewater Course
Location: Fort Worth, Texas
Owner: City of Fort Worth
Public or Commercial: Public
Year opened: 2004

1. Physical and Hydrologic Characteristics

Length of run(s)/park	½ mile (section of stream with whitewater enhancements)
Number of features	3 chutes added to existing low dams
Average flow - Peak season (summer and fall) - Following rain events (summer and fall) - Off-season	 <100-250 cfs 750-3,000 cfs (usually short duration) <20 cfs
Gradient	7 fpm

2. Boating Use

Types of uses	Rafting, kayaking, canoeing
Difficulty	Class II-III (depending on flow)
Slalom course (Yes or No)	No
Amount of use	Unknown

3. Park Setting

Urban or in-town / near town / rural	Urban
Population of home community	700,000
Regional population center(s) and population	Dallas-Ft. Worth metro area: 7 million
Tourism-based economy?	No
In existing park or new park?	Facility is within a city park
Trail linkages to residential areas or parks	Paved trails along river levees link to other city parks, bike routes

4. Other Recreational Amenities

Non-boating activities supported	None (cement channel)
Food services	None
Competitions supported	None

5. Financial Information

Park use fees	None
Cost to build whitewater facility/features	$150,000 (additional cost for whitewater enhancements created during dam repair project)
Total construction cost (with non-boating enhancements)	NA

Artificial Channel Whitewater Parks

Park Name: East Race Waterway
Location: South Bend, Indiana
Owner: City of South Bend
Public or Commercial: Public
Year opened: 1984

1. Physical and Hydrologic Characteristics

Length of run(s)/park	1,900 ft.
Number of features	Unknown (several)
Average flow	450-500 cfs
Gradient	33 fpm

2. Boating Use

Types of uses	Rafting, kayaking, competition
Difficulty	Class II-III
Slalom course (Yes or No)	Yes (during competitions)
Amount of use	14,000 year

3. Park Setting

Urban or in-town / near town / rural	In-town
Population of home community	100,000 (315,000 in metro area)
Regional population center(s) and population	Chicago, IL metro area: 9 million
Tourism-based economy?	No
In existing park or new park?	Riverwalk park system along course
Trail linkages to residential areas or parks	Riverwalk parallels entire course, provides linkage to other parks, commercial district

4. Other Recreational Amenities

Non-boating activities supported	None
Food services	None
Competitions supported	Has hosted slalom competition in the past

5. Financial Information

Park use fees	Rafting (rental): $4 per person/trip Kayaking (private boats): $12 /day
Cost to build whitewater facility	$5 million

Park Name: U.S. National Whitewater Center
Location: Charlotte, North Carolina
Owner: UNNWC non-profit organization
Public or Commercial: Commercial
Year opened: 2006

1. Physical and Hydrologic Characteristics

Length of run(s)/park	1,670 feet and 1,370 feet in 2 main channels (total of 3,750 feet), 700 ft. side channel
Number of features	Numerous
Average flow	700 cfs average (variable); max 1,250 cfs
Gradient	65 fpm and 80 fpm (completion channel)

2. Boating Use

Types of uses	Rafting (guided), kayaking (playboating, river running, slalom)
Difficulty	Class II, III, IV
Slalom course (Yes or No)	Yes
Amount of use	80,000 (2008); unknown how many of these were boaters, spectators, others

3. Park Setting

Urban or in-town / near town / rural	Near town (semi-rural area at edge of city)
Population of home community	700,000
Regional population center(s) and population	Metro area population: 1.7 million
Tourism-based economy?	No
In existing park or new park?	In existing undeveloped county park, new park amenities and improvement (i.e., trails, river access) included in project
Trail linkages to residential areas or parks	None

4. Other Recreational Amenities

Non-boating activities supported	Climbing (artificial rock towers); ropes course, zip lines, mountain biking on trails; flat-water boating access to river
Food services	Yes (course-side restaurant)
Competitions supported	Yes (slalom and freestyle)

5. Financial Information

Park use fees	$5 per vehicle parking fee; rafting fee: $40-65 per person, depending on day of week and season; kayaking: $20 per day; fees for climbing, ropes course, zip lines.
Cost to build whitewater facility	38 million

Park Name: Adventure Sport Center International (ASCI)
Location: McHenry, Maryland
Owner: ASCI non-profit organization
Public or Commercial: Commercial
Year opened: 2007

1. Physical and Hydrologic Characteristics

Length of run(s)/park	1,700 ft.
Number of features	Numerous (includes 6 variable wave shapers)
Average flow	550 cfs
Gradient	75 fpm

2. Boating Use

Types of uses	Rafting (guided), play boat, river running, slalom kayaking; inflatable kayak (rental)
Difficulty	Class II, III, IV
Slalom course (Yes or No)	Yes
Amount of use	Projected 18,000 on-water customers

3. Park Setting

Urban or in-town / near town / rural	Rural (small resort community)
Population of home community	5,000
Regional population center(s) and population	Washington, D.C. (5.3 million) Pittsburgh, PA (2.4 million)
Tourism-based economy?	Yes (winter and summer resort area)
In existing park or new park?	Part of existing resort development
Trail linkages to residential areas or parks	No

4. Other Recreational Amenities

Non-boating activities supported	500 acre recreation area with rock climbing, mountain biking, hiking
Food services	No
Competitions supported	Yes (slalom, freestyle)

5. Financial Information

Park use fees	Rafting fee: $75 per person, depending on day of week and season; kayaking: $15-20 per half day, $25/full day; inflatable kayak rental: $40 / 2 hrs.
Cost to build whitewater facility	$24 million

Park Name: Mississippi Whitewater Park (proposed)
Location: Minneapolis, Minnesota
Owner: Unknown (may be public entity, or non-profit)
Public or Commercial: Public
Year opened: NA

1. Physical and Hydrologic Characteristics

Length of run(s)/park	2,000 ft.
Number of features	Several
Average flow	800-1,000 cfs
Gradient	49 fpm

2. Boating Use

Types of uses	Rafting, kayaking, whitewater canoeing
Difficulty	Beginner/intermediate and expert segments proposed
Slalom course (Yes or No)	Yes
Amount of use	50,000 (“conservative estimate”)

3. Park Setting

Urban or in-town / near town / rural	Urban
Population of home community	375,000
Regional population center(s) and population	Minneapolis-St. Paul (3.5 million)
Tourism-based economy?	No
In existing park or new park?	New park would be developed at site
Trail linkages to residential areas or parks	Potential for trail linkages

4. Other Recreational Amenities

Non-boating activities supported	None proposed
Food services	Proposed to be included in design
Competitions supported	Slalom and freestyle proposed

5. Financial Information

Park use fees	Proposed daily fees are $12 for adults and $6 for youth; season passes would be $300
Cost to build whitewater facility	$26 million (2006 estimate)

Park Name: Trinity River Whitewater Course
Location: Dallas, Texas
Owner: Unknown (would be in public parkway)
Public or Commercial: Public
Year opened: NA

1. Physical and Hydrologic Characteristics

Length of run(s)/park	2,000 ft.
Number of features	Several
Average flow	Unknown
Gradient	37 fpm

2. Boating Use

Types of uses	Rafting, slalom and playboat kayaking
Difficulty	Intermediate and completion channels
Slalom course (Yes or No)	Yes
Amount of use	No projection available

3. Park Setting

Urban or in-town / near town / rural	Urban
Population of home community	1.3 million
Regional population center(s) and population	Dallas-Ft. Worth metro area: 6.3 million
Tourism-based economy?	No
In existing park or new park?	New park development as part of 20 mile river corridor improvement project
Trail linkages to residential areas or parks	Yes (proposed trails in parkway)

4. Other Recreational Amenities

Non-boating activities supported	None proposed
Food services	Unknown
Competitions supported	“Competition” and “play” channels (slalom, freestyle)

5. Financial Information

Park use fees	Unknown
Cost to build whitewater facility	$20.2 million (2006 estimate)

APPENDIX C

Results of Secondary Evaluation of Candidate Whitewater Park Sites

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Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
1. Physical Criteria			
a) Gradient	LOW (FAIR). Lagoon weir is about 3 ft high. 3 ft drop in elevation over 1,000- foot length of lagoon provides a gradient of about 15 fpm. This is a relatively low gradient but may be adequate for "beginner" type whitewater park use.	ADEQUATE (GOOD). About 68 feet of elevation difference exists between the Power Canal where water would be diverted and the Fish Barrier Pool. This provides an opportunity to construct an artificial channel with switchback that would have a 50 fpm gradient, according to the conceptual park design depicted in the City of Oroville's PM&E form.	ADEQUATE (GOOD). The west side of lower parcel drops about 20 feet into the lower canyon, and the river is at about 135 ft elevation, providing about 25-30 feet drop from lower parcel, which would provide ample gradient for a whitewater channel. (Assumption is that channel would terminate in a pond, not directly in river, to allow paddlers to return to start of the run.) The upper parcel may be best considered for location of a water supply pond only rather than a whitewater channel, as the gradient would be excessive for whitewater channel use.
b) Flow	LOW (FAIR). LFC flow is 600-700 cfs, a minor portion of which is diverted into the swim lagoon.[1] Flow during site visit was estimated to be <10 cfs. Investigation of existing small instream whitewater parks suggest that 50-100 cfs would be needed for a "beginner" whitewater channel. Increased LFC flows stipulated by the Settlement Agreement may provide opportunity for increased flows through this site for whitewater use.	ADEQUATE (GOOD). Several 1,000 cfs available for diversion from Power Canal, which carries most of the water released from Lake Oroville to the Forebay (minus 600-700 cfs passed through Diversion Dam Power Plant and released to LFC and fish hatchery intake).	ADEQUATE (GOOD). Would need to pipe water from Power Canal (1 mile north), where ample flow is available, or pipe water from the Feather River Hatchery (3/4 mile east), where up to 70 cfs is available, or pump water from river at south edge of site (600-700 cfs flow in LFC) and return that flow to the river to meet regulatory LFC flow requirements. Further development of potential whitewater park design (i.e., source and use of water for channel) is needed to further define this potential constraint. Excess hatchery flows are not sufficient for direct diversion to a whitewater channel.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
c) Land ownership/use	PUBLIC (GOOD). 13 acre Bedrock Park is operated by the FRRPD. About 1/3 of the park is owned by FRRPD and about 2/3, including most of the lagoon, is owned by the City of Oroville. Current park use includes swimming in the lagoon, although poor water quality and algae growth apparently discourage this use. Other uses of park include picnicking, relaxing, walking and biking (paved bike path traverses the park), and fishing.	PUBLIC (GOOD). Entire proposed site is on state-owned land not currently used by the public, but adjacent to the public fish ladder viewing area of the Feather River Fish Hatchery. Residential use of adjacent area would require consideration of potential conflicts (e.g., traffic, noise, light, public safety) and means to minimize these.	PRIMARILY PRIVATE (POOR). Primarily privately-owned vacant land; FRRPD owns a small parcel on the riverbank. Lower 20 acre parcel is currently used by off-road vehicles, which gain access via a steep 4WD road/trail connecting to 5th Street and adjacent residential area to the west of the site.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
d) Parking/access	GOOD. Access and parking available at Bedrock Park. Parking is also available along adjacent areas of Arlin Rhine Drive, on the city levee.	FAIR. City streets provide access to south end of site, off Riverview Terrace; future development of roads for adjacent residential subdivision may provide options for access to the north side of the site, but would bring visitors through a residential area. A gated private gravel road (Golden Feather Drive) follows the west boundary of the site, and is used by an adjacent resident and by DWR staff. This road may provide the best access if improved. The narrow and steep site may limit parking options; it may be possible to make use of underutilized parking (100 spaces) at Feather River Fish Hatchery public fish ladder viewing area; conceptual design submitted with PM&E form includes a pedestrian bridge over the Power Canal, which could link the site to potential parking areas on the north side of the canal. Construction of off-site parking would impose additional cost for whitewater park development.	FAIR. Access to site is limited. Park access would need to be provided from the north or west, although both options present challenges. A 4WD road/trail currently provides access to the lower parcel from 5th street to the west, and provides the most feasible route for a future access road. From the north, access off Grand Avenue may be feasible, but private land occupied by a commercial stone supply operation is situated between Grand Ave and the north boundary of the site, and any access road would have to cross a ravine to reach the upper parcel. Large site would provide plentiful space for parking.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
e) Available infrastructure (potable water / sanitary sewer / electricity / telephone)	GOOD. Park has potable water, restrooms, electricity service. Telephone service is nearby. All services available within the City of Oroville (water = California Water Services Company, wastewater = City of Oroville).	GOOD. Site is adjacent to infrastructure associated with residential and recreation development within the City of Oroville, and adjacent to Thermalito Irrigation District service area (water and wastewater). If existing adjacent infrastructure is insufficient to meet the needs of a large whitewater park, if may be necessary to expand the capacity of off-site infrastructure, which would impose additional costs for whitewater park development.	FAIR. No infrastructure currently on site. May be sanitary sewer constraints due to canyon topography and low elevation of lower parcel relative to surrounding developed areas. Upper parcels are within boundary of Thermalito Irrigation District service area, but lower parcels are excluded, perhaps due to location in floodplain and low elevation. Nearest City of Oroville sanitary sewer line is at Grand Ave. If existing adjacent infrastructure is insufficient to meet the needs of a large whitewater park, if may be necessary to expand the capacity of off-site infrastructure, which would impose additional costs for whitewater park development. Electricity and phone service could be extended from surrounding developed areas to the upper parcel from the north and to lower parcel from the west.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
f) Potential length of run(s)	FAIR. Lagoon is over 1,000 feet in length, which would permit sufficient length for a short whitewater run. Length may be more suitable for a "play wave" oriented park with several play features rather than a park designed to be "run."	GOOD. Long narrow site along length of 1/2 mile-long Fish Barrier Pool provides opportunity for a switchback channel that takes advantages of substantial slope of site, with upper and lower reaches from 1,800-2,300 ft in length (according to conceptual design provided with City of Oroville PM&E form).	GOOD. Large site (over 30 acres and extending about 2000 ft. from North to South and about 600 ft from East to West) would allow a long run, potentially over 2000 ft. if turns or switchbacks are used; lower parcel is about 20 acres and may provide sufficient room for a whitewater channel, leaving upper parcel for water storage or other facility components.
g) Available space for spectating, optional amenities	GOOD. Park is about 13 acres and contains ample room for spectating on sloping shoreline with turf. Amenities could be added to park as part of whitewater park enhancements and could be complementary to adjacent tennis courts and skate and bike park.	FAIR. Long narrow site along length of 1/2 mile-long Fish Barrier Pool, provides limited space for pathways and spectating locations alongside switchback channels (according to conceptual design provided with City of Oroville PM&E form).	GOOD. Large site would provide ample room for spectating and optional amenities.
h) Aesthetics	GOOD. Attractive river side setting with existing park featuring large turf areas and numerous large shade trees. Gravel bar separating the lagoon from the main river channel provides natural riparian vegetation (trees and shrubs).	GOOD. Upper portion of site has mixed oak and foothill pine vegetation; remnant olive orchard adjacent; area where channel would be built is predominantly bare rock. Site provides elevated view of Fish Barrier Pool and opposite bank of river.	GOOD. Site contains large flat open areas with sparse grass cover, with canyon and hillside slopes wooded with mature oaks and foothill pines. Upper parcel is perched above Hwy. 70, while lower parcel is 10-15 feet below the highway, in each case providing some visual separation from the road. On the lower parcel, several ponds surrounded by riparian trees (cottonwoods, willows) provide visual interest.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
i) Safety/security	GOOD. No issues apparent and site is free of major hazards; park provides good access to law enforcement (park is patrolled by City of Oroville Police Department) and emergency vehicles.	FAIR. Safe access is available to site via existing city roads. Site is close to public facilities, with good access for law enforcement and emergency vehicles. However, the Diversion Dam and power plant outflow and the Fish Barrier Dam present potential hazards; it would be necessary to ensure that park visitors and boaters exiting from the whitewater channel to the Fish Barrier Pool are kept a safe distance from the dams and power plant.	GOOD. No issues or major hazards apparent. Whitewater park would need to provide adequate access for law enforcement and emergency vehicles to ensure public safety. Presumably, this access would be provided along with the necessary public access.
2. Operational Requirements			
a) Security	NO IMPACT LIKELY (GOOD). No operational facilities in this area.	NO IMPACT LIKELY (GOOD). Adjacent to Diversion Dam and Power Canal on north end and Fish Barrier Dam on south end; Separation of whitewater facility users from dams and DWR access to dams would need to be maintained.	NO IMPACT LIKELY (GOOD). No operational facilities in this area.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
b) Regulatory flow and temperature requirements	POTENTIAL MINOR IMPACT (FAIR). Current flow into lagoon is not adequate for whitewater park use. Investigation of existing small instream parks suggest at least 50-100 cfs may be needed for whitewater use. Increasing the amount of water diverted from LFC may have impacts on flow and temperature requirements for LFC within the parallel section of river. However, no impacts would be expected downstream of the park, as the diverted water would be quickly returned to the main channel. Also, Settlement Agreement Article A108.1 calls for increasing the minimum LFC flow 100-200 cfs, which could provide the additional flow needed for the whitewater park while some increase in flow in the parallel section of river.	NO IMPACT LIKELY (GOOD). No effects on water flow as park would divert flow currently routed through the Diversion Dam power plant. Potential effects on temperature are not known, but short duration of diversion would be expected to minimize warming.	POTENTIAL MAJOR IMPACT (POOR). There is a potential conflict with LFC water temperature requirements (65oF average daily temp at Robinson Riffle) if water is held in a retention pond for use in a whitewater channel (after being pumped from the river or piped from the Power Canal or Fish Hatchery), causing temperature to increase, before being released to the river. No conflict with LFC minimum flow requirement (600 cfs), whether water is pumped from and returned to river at site or diverted via pipe from the Power Canal or Fish Hatchery and released to river below site. NOTE: Settlement Agreement A108.1 calls for increasing minimum LFC flow 100-200 cfs, thus increased flow in the LFC is expected to occur upon license issuance. Any flow diverted from the Power Canal would be in addition to these Settlement Agreement flows. Release of water diverted from the Power Canal through a whitewater channel would result in daily, or potentially more frequent, variations in flow in the LFC, which may cause additional impacts. Ramping rates for these releases would need to meet regulatory requirements (max. 300 cfs decrease per 24 hours).

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
c) Power generation	NO IMPACT LIKELY (GOOD). No change to flows would occur at the Thermalito Diversion Dam Power Plant or Thermalito Pumping-Generating Plant, therefore there would be no effect on power generation.	POTENTIAL MAJOR IMPACT (POOR). Whitewater park would divert a portion or all of flow (400-600 cfs) used to generate power at the Diversion Dam Power Plant; Study E-3 states that the power plant generates about 24 million kWh/yr; FEIS places value of power generated at $35 mills/kWh (peak) and $28 mill/kWh (off-peak); thus the potential lost power generation could be valued at several hundred thousand dollars per year.[2]	NO IMPACT LIKELY (GOOD). This assessment is based on an assumption that a modest flow of water would be piped from the Power Canal or Fish Hatchery in an amount sufficient only to supply a retention pond at the site from which water would be recirculated. If water was piped from the Fish Hatchery, there would be no effect on power generation because all generation facilities are upstream. If sufficient water only to supply a retention pond on the site were piped from the Power Canal, the impact on power generation would be small. NOTE: If sufficient flow to divert directly into a whitewater channel (400-600 cfs) is piped from the Power Canal, the park would divert a portion of the flow used to generate power at the Thermalito Pumping-Generating Plant, and the impact would be similar to the potential major impact described for the Fish Barrier Pool site. However, the relative impact per unit of water diverted would be greater due to the greater head at the Thermalito Pumping-Generation Plant as compared to the Diversion Pool Power Plant.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
d) Water supply	NO IMPACT LIKELY (GOOD). Not a consumptive use and water deliveries would be unaffected.	NO IMPACT LIKELY (GOOD). Not a consumptive use and water deliveries would be unaffected.	NO IMPACT LIKELY (GOOD). Not a consumptive use and water deliveries would be unaffected.
e) Flood control operations	NO IMPACT LIKELY (GOOD). No changes would occur in water stored in or released from Lake Oroville for flood control purposes in association with an instream whitewater park at this site; therefore, no effect on flood control operations would occur.	NO IMPACT LIKELY (GOOD). No changes would occur in water stored in or released from Lake Oroville for flood control purposes in association with diversion of water at this site for whitewater park; therefore, no effect on flood control operations would occur.[3]	NO IMPACT LIKELY (GOOD). No changes would occur in water stored in or released from Lake Oroville for flood control purposes in association with diversion of water at this site for whitewater park; therefore, no effect on flood control operations would occur.
3. Typical Whitewater Park Operational Criteria			
a) Diurnal (potential constraints on daily operations at site)	GOOD. No constraints on daily operations appear likely. Access to park is available during daylight hours year-round. River flows in LFC are consistent at all times of day. Also, whitewater use would be complementary to existing park uses, and Bedrock Park has been identified as a suitable location for this use by the FRRPD.	FAIR. No formal public access to the site exists at present, but public road access would be available year-round; flow is available for diversion at all times of day. However, consideration would need to be given to potential effects of daily whitewater park operation (lights, noise, traffic, etc.) on adjacent residential area.	FAIR. Public road access would be available to site from the west year-round; flow is available for diversion at all times of day. Site is buffered somewhat from residential area to the west by wooded ravine/canyon. However, consideration would need to be given to potential effects of daily whitewater park operation (lights, noise, traffic, etc.) on adjacent residential area. Relatively high elevation of upper parcel may increase noise and light concerns if development occurred there, since development and activity would be more visible and perhaps more audible from the adjacent neighborhood.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
b) Seasonal (potential seasonal constraints on operations at site)	FAIR. No major seasonal constraints apparent. Access to park is available during daylight hours year-round. River flows are adequate during all seasons. However, cold water temperatures (<60oF and as low as 45^{o}F) during the fall, winter and spring would be expected to limit potential use of a whitewater park during those seasons. Potential exists for conflict with anglers downstream of site during late summer and fall peak fishing season. However, angling activity is concentrated within the main channel near and upstream of Bedrock Park.	FAIR. No major seasonal constraints apparent. Access would be available during daylight hours year-round via adjacent public roads. Flows available for diversion are adequate during all seasons. However, cold water temperatures (<60^{o}F) would be expected to limit potential use of a whitewater park during the fall, winter and spring.	FAIR. No major seasonal constraints apparent. Flows available for diversion are adequate during all seasons. However, cold water temperatures (<60oF and as low as 45^{o}F) during the fall, winter and spring would be expected to limit potential use of a whitewater park during those seasons. Access is available during daylight hours year-round.
4. Environmental Constraints			
a) Flooding potential	NO/LOW POTENTIAL (GOOD). Although the swim lagoon and most of Bedrock Park are within the FEMA 100-year flood zone, a whitewater channel would not impede flood flows. As compared to the existing lagoon, whitewater development with removal of the flashboard dam would be expected to eliminate a constraint to flood flow. Instream whitewater parks have been developed in many locations that experience high spring runoff.	NO/LOW FLOODING POTENTIAL (GOOD). Most of the river bank above the Fish Barrier Pool is above the FEMA 100-year flood zone. It would be necessary to close the park during those rare occasions when high flows were being passed through the Fish Barrier Pool.	MODERATE POTENTIAL (FAIR). Lower canyon and adjacent portions of site are within FEMA 100-year flood zone (approximately 1/4 of site in total). However, most of lower parcel is 20-30 feet higher in elevation than the river at normal flow, thus park development on those areas are unlikely to flood. Also, development within the canyon appears unlikely to impede flood flows since it would be well outside the main river channel.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
b) Special status species /habitat NOTE: Potential impacts on special status fish species (e.g., Chinook salmon, steelhead) /habitat are addressed under 4c. Fish passage/river habitat	NO IMPACT LIKELY (GOOD). [Site is outside FERC project boundary - not surveyed]. Existing data for the project area suggest riparian forest and scrub vegetation on river side of lagoon may provide habitat for special status species. Swainson's hawk nest and several species of concern (e.g., snowy egret, osprey, western pond turtle) were observed downstream along river and within OWA. However, riparian habitat is confined to small area and park development could be limited to riverbank side of lagoon and existing developed park, with no necessity to disturb riparian areas.	NO IMPACT LIKELY (GOOD). Relicensing studies indicated that no special status species or habitat were present at this site.	POTENTIAL MINOR IMPACT (FAIR). [Site is outside FERC project boundary - not surveyed.] Existing data for the project area suggests that riparian forest and small ponds at this site may be provide habitat for special status species, based on similar habitat and special status species observations within the OWA (e.g., giant garter snake, Swainson's hawk, snowy egret, osprey, western pond turtle); may also be elderberry plants on the site, based on location of plants documented upstream and downstream. However, whitewater park development could potentially avoid these limited portions of the site, thus any potential adverse effects might be avoided.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
c) Fish passage/river habitat	NO IMPACT LIKELY (GOOD). The upper 3 miles of the LFC are critical holding and spawning habitat for anadromous Chinook salmon and steelhead and spawning areas were identified for these species near Bedrock Park. Other fish species are also present in the river. However, hydraulic whitewater park features can be designed to ensure fish passage and to improve habitat conditions (see Appendix D). NOTE: This site is in the area of the river being considered by DWR for a Fish Segregation Weir, per Settlement Agreement Articles A101 and A105. If constructed, this weir would likely conflict with whitewater park development.	NO IMPACT LIKELY (GOOD). Not in waterway, and upstream of Fish Barrier Dam, thus upstream movement of anadromous fish in created channel in not a concern.	NO IMPACT LIKELY (GOOD). Off-channel site and no perennial streams present; stream in canyon upstream of the largest pond appears to be carry only seasonal flow, with no surface flow at most times; there does not appear to be any surface flow connection to Feather River. NOTE: This assessment is based on an assumption that water would be piped from the Power Canal or Fish Hatchery in an amount sufficient only to supply a retention pond at the site from which water would be recirculated. The diversion of higher flows from the Power Canal directly to a whitewater channel and thence released to the river could have adverse effects on anadromous fish.
d) Water temperature (cold water effects on boaters)	POTENTIAL MINOR IMPACT (FAIR). Cold water (maximum temperature of river is 60-65oF in summer and as low as 45oF in winter) would be expected to reduce use by boaters. However, kayakers frequently wear specialized clothing to protect against cold water, thus impact of cold water would be reduced for those with appropriate gear.	POTENTIAL MINOR IMPACT (FAIR). Cold water (maximum temperature of Power Canal is 60oF in summer and as low as 45oF in winter) would be expected to reduce use by boaters. However, kayakers frequently wear specialized clothing to protect against cold water, thus impact of cold water would be reduced for those with appropriate gear.	POTENTIAL MINOR IMPACT (FAIR). Cold water (maximum temperature of Power Canal and river is 60-65oF in summer and as low as 45oF in winter) would be expected to reduce use by boaters. However, kayakers frequently wear specialized clothing to protect against cold water, thus impact of cold water would be reduced for those with appropriate gear.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
e) Other potential water quality/quantity impacts	NO IMPACTS LIKELY (GOOD). Instream hydraulic features and boating activity would not be expected to increase turbidity. Incidental immersion contact with water would not be expected to increase bacteria. Development of whitewater channel could provide water quality benefits if the flow is increased as compared to existing low flow in lagoon (relicensing studies indicated that the lagoon has been affected by high bacteria levels and algae growth).	NO IMPACT LIKELY (GOOD). Short-term diversion of a portion of the water released to the Fish Barrier Pool into an artificial channel for boating use and boating activity is not anticipated to cause adverse water quality impacts. Incidental immersion contact with water would not be expected to increase bacteria.	NO IMPACT LIKELY (GOOD). Short-term diversion of a portion of the water released normally flowing to the Thermalito Forebay or pumping of water from the river into an artificial channel for boating use and boating activity is not anticipated to cause adverse water quality impacts. Incidental immersion contact with water would not be expected to increase bacteria.[4]

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
f) Cultural resources	NO IMPACT LIKELY (GOOD). No disturbance in areas outside the river channel is anticipated. Site is on the river, where Native American cultural sites are known to exist. However, the presence of intact archeological sites is unlikely given that the river and its banks in this area were disturbed by historic dredger mining and development of the levee and existing Bedrock Park and swim lagoon.	POTENTIAL MAJOR IMPACTS (POOR). Intensive surveys of site for relicensing studies identified several cultural sites, which include most of the Fish Barrier Pool banks. Several Native American habitation and fishing sites are known to exist along the river near Oroville. Although portions of the site are likely to have been disturbed during Oroville Facilities construction (Diversion Dam and Power Canal), construction of artificial whitewater channels have the potential to cause impacts. However, the area is covered within the HPMP which would provide structured approach to mitigation.	POTENTIAL IMPACTS UNKNOWN (POOR). Cultural resource inventory and evaluation data is lacking for both the upper "plateau" area, above the river bluff line, and the lower area. The upper portions of this site appear to have the potential to contain relatively intact and significant prehistoric and/or historic-era archeological sites. Project-related activities involving ground disturbance in this area could adversely affect important cultural resources. The leveled dredge spoils that cover the lower parcel are not anticipated to be potentially eligible for the National Register of Historic Places (unlike relatively undisturbed spoil fields downstream within the OWA). The presence of intact archeological sites is unlikely given that the lower portion of the site was disturbed by historic dredger mining and gravel spoil disposal.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
5. Permitting/ Approval Considerations			
a) Federal			
ACOE – CWA Section 404 permit for activity resulting in placement of fill materials into river or jurisdictional wetland; RHA Sec 10 permit for placement of structures in river.	PERMIT REQUIRED. Development of whitewater features in swim lagoon may result in fill/excavation in waters of the United States in which case a CWA Section 404 permit would be required; development of whitewater features would involve placing structures in a navigable waterway and so would require Rivers and Harbors Act (RHA) Section 10 permit (permits for activities regulated under both CWA and RHA are processed simultaneously by ACOE).	PERMIT MAY BE REQUIRED. Permit may be required if installation of whitewater channel terminating in the waterway, as depicted in conceptual park design, would impact the waterway below the ordinary high water mark (OHWM). No wetlands would be affected. Also may require CWA Section 401 and RHA Section 10 permits.	PERMIT MAY BE REQUIRED. Permit may be required if development of a whitewater park would impact the several ponds or any other potentially jurisdictional waters of the United States (e.g. intermittent/ephemeral streams, wetlands) present; wetland delineation/consultation with ACOE needed to determine if ponds, ephemeral streams or other potentially jurisdictional features constitute jurisdictional wetlands or non-wetland waters of the United States (three ponds are within 500 feet of Feather River). Also, water outfall pipe and/or outfall installation on Feather River, if required, may require CWA Section 401 and RHA Section 10 permits.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
NMFS - ESA consultation/ "take" authorization: federally protected anadromous fish, and essential fish habitat [5]	FORMAL CONSULTATION/PERMIT REQUIRED. Potential for adverse effects on Chinook salmon and steelhead in LFC suggests formal consultation and incidental take authorization would be required, unless NMFS concurs park development is "not likely to adversely affect" listed species or critical habitat. ACOE would be federal lead agency through CWA 404/RHA 10 permitting process. Additional study is needed to determine whether creation of a whitewater channel in place of the lagoon could have potential adverse impacts on fish. May be potential for beneficial impacts, with renewed fish passage following removal of flashboard dam and better habitat conditions with improved flow and introduction of boulders and other structures in channel.	INFORMAL CONSULTATION/NO PERMIT REQUIRED. No protected anadromous or other special status fish species are present upstream of Diversion Dam.	INFORMAL CONSULTATION/ PERMIT NOT LIKELY REQUIRED. Park would be outside the river channel, thus there would be no potential for direct impacts on Chinook salmon or steelhead. Assume that park can be designed to avoid indirect adverse effects on fish. However, permit requirements depend on park design regarding how water is provided and used at the park and how water is released to the river. Potential impacts to anadromous fish due to release of warmer water back to river and fish attraction flows that may be created by release of water would need to be addressed in park design phase. If these potential adverse effects are not eliminated, formal consultation would be required.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
USFWS - ESA consultation/ "take" authorization: federally protected plants, terrestrial animals, freshwater aquatic animals; may also make recommendations on migratory bird species and non-listed fish and wildlife species [5]	INFORMAL CONSULTATION/ PERMIT MAY BE REQUIRED. Available information (CNDDB, relicensing studies) suggests presence of federally protected plant or animals is unlikely. Assume work to create whitewater channel would occur solely within the existing lagoon, and riparian vegetation on gravel bar would be undisturbed, thus any potential adverse effects can be avoided. NOTE: Need data on presence of species/habitat, particularly in relation to riparian areas on gravel bar. This information would be gathered as part of "informal consultation" with USFWS during which a determination is made whether species/critical habitat is present and may be affected by proposed action.	INFORMAL CONSULTATION/NO PERMIT REQUIRED. Relicensing studies indicated that no protected species or habitat were present.	INFORMAL CONSULTATION/ PERMIT MAY BE REQUIRED. Available information (CNDDB, relicensing studies) suggests presence of federally protected plant or animals is unlikely. However, riparian areas and ponds may be potential giant garter snake habitat, and elderberry plants (VELB habitat) may be present. Whitewater park development could potentially avoid these limited portions of the site, thus any potential adverse effects might be avoided. NOTE: Need data on presence of species/habitat. This information would be gathered as part of "informal consultation" with USFWS during which a determination is made whether species/critical habitat is present and may be affected by proposed action.
FERC – Oroville Facilities License Amendment	LICENSE AMENDMENT MAY BE REQUIRED. Although this site is outside the current FERC Project boundary, temporary flow impacts, depending on how the potential park would be constructed, may require a license amendment or FERC approval. This is due to potential temporary effects on flow in the Feather River downstream of the site and within the FERC Project boundary.	LICENSE AMENDMENT REQUIRED. Because the site would impact flows within the FERC Project boundary, and diversion of water from the Power Canal would require modification of a part of the FERC-licensed facilities, a license amendment would be required from FERC.	LICENSE AMENDMENT LIKELY REQUIRED. Diversion of water via a pipeline from the Power Canal or from the Feather River Fish Hatchery would require modification of a part of the FERC-licensed facilities. Therefore, a license amendment would be required from FERC if either of those options were part of the whitewater park design.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
b) State[6]			
DFG - Sec 1602 Streambed Alteration Agreement: alteration or modification of bed, bank, or channel of stream	AGREEMENT REQUIRED. Whitewater park development would alter riverbed with construction of hydraulic features (boulders or other means to constrict and direct flow) in existing swim lagoon.	AGREEMENT NOT LIKELY REQUIRED. Whitewater park development would not occur in a waterway or riparian zone; no streams present on site. NOTE: Consultation with DFG is needed to confirm that construction of whitewater channel terminating in waterway, as depicted in conceptual park design, will not require agreement.	AGREEMENT MAY BE REQUIRED. No alteration or modification of a streambed or adjacent riparian zone would occur with whitewater park development. NOTE: Consultation with DFG is needed to confirm that presence of intermittent stream in upper canyon, which does not appear to carry flow to Feather River, but terminates at a pond, will not require agreement. A potential whitewater channel seems most likely to impact the lower canyon, occupied by two ponds created by gravel spoils deposition.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
DFG - CESA consultation/ Incidental Take Permit: state listed animal species; consistency determination for any dually-listed (federal and state) species that are addressed through a federal ESA consultation	CONSULTATION/PERMIT REQUIRED. Presence of spring-run Chinook salmon in river will require consultation and incidental take permit. Other state-listed species/habitat may also be present. NOTE: Biological information for terrestrial species is lacking; this area was not surveyed as part of relicensing studies; surveys needed for State-listed species, particularly those known to be present in the project area; Swainson's hawk nest and several species of concern (e.g., snowy egret, osprey, and western pond turtle) were documented downriver within OWA.	NO CONSULTATION /NO PERMIT REQUIRED. Relicensing studies indicated that no protected species were present at this site.	CONSULTATION/PERMIT MAY BE REQUIRED. Available information (CNDDB, relicensing studies) suggests presence of State-listed plants or animals is unlikely. NOTE: Biological information for terrestrial species is lacking; this area was not surveyed as part of relicensing studies; surveys needed for State-listed species, particularly those known to be present in the project area; Swainson's hawk nest and several species of concern (e.g., snowy egret, osprey, and western pond turtle) were documented downriver within OWA.
RWQCB – CWA Section 401 Water Quality Certification: activity resulting in placement of structures or fill materials into river [7]	CERTIFICATION REQUIRED. Discharge of fill material (boulders or other means to constrict and direct flow) would occur in the whitewater channel created within the existing lagoon. CWA Section 401 water quality certification is required for issuance of CWA 404 permit by ACOE; Review would coincide with ACOE Section 404 process.	CERTIFICATION MAY BE REQUIRED. 401 Certification would be required if Section 404 permit is required. SWQCB will conduct 401 review of project if a Section 404 permit is needed. Review would coincide with ACOE Section 404 process.	CERTIFICATION MAY BE REQUIRED. 401 Certification would be required if Section 404 permit is required. SWQCB will conduct 401 review of project if a Section 404 permit is needed. Review would coincide with ACOE Section 404 process.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
SHPO - Review under Sec 106 of NHPA: potential effects on heritage resources, including Native American sites and Traditional Cultural Properties, and historic properties.	CONSULTATION REQUIRED. CWA Sec 404 ACOE permit process will include cultural resource consultation under Sec 106 of NHPA; although this site is outside the FERC project boundary, the Historic Properties Management Plan (HPMP) developed for the Oroville Facilities, as required by FERC, may be used as a guide for meeting cultural resource management and protection requirements in advance of construction.	CONSULTATION REQUIRED. Development of a whitewater park within the Project boundary would need to conform to the Historic Properties Management Plan (HPMP) developed for the Oroville Facilities, as required by FERC. The HPMP requires Sec 106 consultation and treatment of cultural resource effects prior to project construction.	CONSULTATION REQUIRED. If a CWA Sec 404 permit is required, the ACOE permit process will include cultural resource consultation under Sec 106 of NHPA; although this site is outside the FERC project boundary, the Historic Properties Management Plan (HPMP) developed for the Oroville Facilities, as required by FERC, may be used as a guide for meeting cultural resource management and protection requirements.
Central Valley Flood Protection Board - Encroachment permit	PERMIT REQUIRED - NO IMPACTS LIKELY. Entire site is within the designated floodway of the Feather River. However, the instream park envisioned would not impede flood flows, and no new structures outside the whitewater channel would be proposed within the floodway.	NO PERMIT REQUIRED. Site is not within a designated floodway (Feather River floodway terminates at the Fish Barrier Dam) and whitewater park development would not impede flood flows.	PERMIT NOT LIKELY REQUIRED. Only the south margin of the site, at the lower portion of the high riverbank, is within the designated floodway. Construction in the floodway, with the possible exception of a water outflow pipe or outfall structure, would not be required for whitewater park development. Whitewater park development on the site above floodway would not impede flood flows.

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
c) Local			
Butte County	NO PERMITS OR REZONING REQUIRED. Entire site is within City of Oroville jurisdiction.	PERMITS OR REZONING NOT LIKELY REQUIRED. Site parcels are zoned "public", recreational use is compatible with code and are also compatible with "public" zoning of adjacent parcels within County jurisdiction to north of Power Canal. However, west boundary of site is adjacent to a single homestead on a 3 acre lot, within County jurisdiction. Consideration should be given to potential effects on this residence.	PERMITS/REZONING REQUIRED - COMPLEX. Potentially complex issues: 20 acre lower parcel is in Butte County jurisdiction; zoning is Agricultural-Residential, "public and quasi-public uses" are permitted subject to a use permit. However, General Plan designation is Low-Density Residential. Also, special requirements are imposed by the County for new development within flood hazard zones, which includes the portions of this site within the FEMA 100 year flood zone "A". [8]

Table C-1. Results of secondary evaluation of proposed whitewater park sites and rationale for ratings.

	Instream Park Site	Artificial Channel Park Site	
Criteria/Constraint	**Bedrock Park**	**Fish Barrier Pool**	**Riverbend Canyon**
City of Oroville	NO OR MINOR PERMIT REQUIREMENTS / NO REZONING REQUIRED. Whitewater park development would be consistent with current park use, and the majority of the site is city-owned (8.44 of 13.10 acres within Bedrock Park are owned by City. FRRPD owns the two parcels on the west side of park, totaling 4.66 acres, and maintains the park.) Entire site is zoned "Open Space." Minimal land disturbance and lack of new construction on land would be expected to minimize applications, permits and fees which may be required from City Building, Planning, and Engineering Departments.	NO OR MINOR PERMIT REQUIREMENTS / NO REZONING REQUIRED. The site is outside the city boundary. However, it is adjacent to a residential subdivision under construction within the city boundary, and may have effects on local residents (noise, lights, traffic, etc.). Therefore, coordination with city Planning Department may be required. Also, permits may be required if impacts to city streets or other infrastructure could occur during construction.	PERMITS/REZONING REQUIRED - COMPLEX. Several permits may be required by County Building, Planning, and Code Enforcement Departments for this type of large development. Potentially complex issues: rezoning may be needed. The 10 acre upper “plateau” parcel, 4 acre upper canyon parcel, and two small parcels totaling 3.5 acres on the river near the Hwy 70 bridge are within the city boundary. Upper parcels are zoned R1, Single Family Residential, and General Plan designation is Residential High Density. Both of the small parcels (may not be needed to use site) are zoned "Open Space". In the General Plan, the parcel furthest from the bridge is designated for park use (relicensing data indicates is FRRPD jurisdiction/ownership) and parcel nearest bridge for Residential High Density use. Site is adjacent to residential areas within the city boundary (to the northwest, along Grand Ave. and 5th St.); park development may have effects on local residents (noise, lights, traffic, etc.).

Notes:

1. No information was available on current flow through the lagoon (this information was requested from FRRPD). Field visit observation indicates flow is <50 cfs.
2. 1 mill = $0.001, thus $35 mill/kWh = $0.035/kWh. Based on peak price, annual generation of 24 million kWh would be valued at $840,000. Whitewater park impacts on power generation, and associated cost, would depend on the amount of water diverted as well as the proportion of time that water was diverted to the park, and the timing of those diversions relative to peak and off-peak generation.
3. It would probably be necessary to close the park during flood control operations, when high flows released from Lake Oroville pass over Diversion Dam and through the Fish Barrier Pool.
4. Potential for dissolved oxygen impacts depends in part on park design. Dissolved oxygen may be reduced if water is held in a pond before being released to the whitewater channel and then released to river. A closed-cycle pumped-flow park, where water is pumped from a pond at the end of the whitewater channel back to the starting pond, would avoid this.
5. If no federal permit or funding is required, ESA compliance would be achieved through ESA Section 10 (Habitat Conservation Plan); if a federal nexus exists, ESA compliance would be achieved through ESA Section 7 (Consultation).
6. Does not include separate agreements with DWR that may be necessary to implement whitewater park concepts.
7. Whitewater park construction at artificial channel park sites may also require a CWA Section 402 National Pollution Discharge Elimination System (NPDES) permit for storm water discharge; the permit would require development and implementation of a storm water pollution prevention plan (SWPPP).
8. It may be useful to consider City of Oroville annexation of the lower parcels if whitewater park development plans for this site proceed, to provide consistent local jurisdiction and zoning.

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APPENDIX D

Fishery Benefits Associated with Instream Whitewater Parks

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Fishery Benefits Associated with Instream Whitewater Parks

Information is available to document fish habitat benefits of several instream whitewater parks in the western U.S., primarily through the creation of pool habitat that provide cold-water refuge for fish (Table D-1). Additional information, summarized below the table, is available that provides a more general documentation of potential fishery benefits and that provides examples and guidelines for incorporating fishery needs into instream park design and construction.

Table D-1. Fishery benefits claimed for U.S. instream whitewater parks.

Park Location	River	Benefits Claimed
Pueblo, Colorado	Arkansas River	• Park was designed as part of a habitat restoration project on 9 miles of the river, with the whitewater park in the lower half-mile of that reach • Goal was to provide protection for fish (stocked trout and naturally occurring species) year-round • Park created deep pool structures connected by currents meant to serve as fish passageways between the pools • Expected to dramatically enhance angling opportunities in the river reach
Reno, Nevada	Truckee River	• Deep pools created by park instream structures should enhance fish habitat • 2003-2006 Nevada Division of Wildlife fish population inventories at park indicate: o Normal distribution of fish species before and after in North Channel, with slight improvements o Created habitat in South Channel o Created low flow "holding water"
Missoula, Montana	Clark Fork River	• Better fish habitat for native trout: improved oxygenation, cover, deep cool pool for fish to take refuge in during hot summer months

Sources

Arkansas River:

Images Pueblo. 2009b. Arkansas River Project Restores Fish Habitat. Accessed 4/24/2009. Available at: http://imagespueblo.com/index.php/site/articles/ Arkansas_river_project_restores_fish_habitat.

Truckee River:

Harvey, Mike. 2007. Truckee River Whitewater Park, Reno, Nevada. PowerPoint presentation at the Whitewater Courses and Parks conference, April 18-20, 2007, McHenry, Maryland. Recreation Engineering and Planning.

Clark Fork River:

NewWest.Net. 2006. *Brennan's Wave Begins to Take Shape*. Author: Dylan Tucker. Accessed 4/24/2009. Available at: http://www.newwest.net/main/print/5594.

Additional sources relating to potential fish habitat benefits of parks

Recreation Engineering and Planning, Inc.:

- "Trinity Whitewater Briefing," presented to the River Committee of the Dallas City Council, 3/7/2005:
    - Designed several fish passage structures
    - Worked with fish biologists to tailor specific designs for specific species
    - Studies have shown increased fish populations in parks

- Design Analysis for the Pagosa Whitewater Park and Fish Habitat Improvements, prepared for the Town of Pagosa Springs, Colorado, December 2005.
    - Report was prepared in support of the Town's Section 404 permit, in response to an information request from the Army Corps of Engineers.
    - Project has "dual objectives of both improving instream habitat as well as creating recreational improvements…"
    - Provides detailed analysis of potential improvements "tailored to provide for both high instream recreation as well as improvements to the existing instream and riparian habitat to allow for improved fishing, promote a healthy riparian corridor, protect against unwarranted erosion and enhance the aquatic environment."

American Rivers:

- Presentation by Quinn McKew, "Whitewater Parks and the Environment: Looking Up and Downstream," 2007 Whitewater Parks Conference, McHenry, Maryland.
    - Under the topic of River Restoration, states that "whitewater parks can have beneficial impacts on degraded streams and provide fish habitat"
    - Several recommendations relating to instream parks are offered:
        - Limit the use of grout and other permanent in-channel modifications
        - Accommodate the needs of all native species in the design, construction, and maintenance of instream features
        - Use native materials in the construction
        - Use vegetation rather than rock for bank stabilization
        - Respect the need for undergoing environmental permits

APPENDIX E

Oroville Whitewater Park Use Estimation Methods and Data Sources, and Use Estimates by Market Area and County

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Oroville Whitewater Park Use Estimation Methods, Data Sources, and Use Estimates by Market Area and County

The following describes the formula and sources used for estimating paddler use of the potential Oroville area whitewater parks evaluated in this report, and briefly describes available information for estimating spectator and event attendance. This use estimation methodology is based on the methodology used in an economic impact analysis study for a proposed whitewater park on the Sacandaga River in New York (Crane Associates, Inc. 2008). Sources for individual inputs within the use estimate formula are enumerated below.

Formula used for park use estimates:

A	Population >= 16 years old for each county in the market area
	X
B	Percentage of population participating in kayaking and rafting
	X
C	Estimate of the average percentage of kayakers and rafters in each county that would visit the park in a given year
	X
D	Estimate of the average number of visits kayakers and rafters in each county would make to the park in a given year
	=
Total estimated annual visits	

Park use estimates required 3 data inputs based on existing sources:

1. Market area (defined by counties) and submarkets (defined by distance from Oroville) which provides “local” and “non-local” visitor groups (some non-locals may stay overnight, and so may have a greater economic impact).
2. Population 16 years and older (the age group that corresponds with USFS paddlesports participation data) within the market area counties.
3. Paddlesports (kayaking and rafting) participation, which is multiplied by the population >16 years old in each county to arrive at the paddlesport participant population for market area and submarkets.

Park use estimates also required the following foregoing estimates as inputs:

4. Estimates of the percentage of paddlers in each submarket that would come to an Oroville park in a given year.
5. Estimates of the number of visits paddlers in each submarket would make to an Oroville park per year.

Rationale and sources for each input:

1) Market area and submarkets

a) As a proxy for the market area, the estimates applied the Tahoe National Forest "local area" as defined by the U.S. Forest Service for National Survey on Recreation and the Environment (NSRE) participation data analysis; this market area includes 22 Northern California counties (including Butte County) and 5 Nevada counties.

b) Because proximity is an important factor in how often people are likely to visit a recreation facility, submarkets based on distance also need to be considered; these estimates used as a guide the estimates for a proposed Sacandaga River, New York whitewater park, which used 3 submarkets :
   i) Residents of area within 1 hour drive (estimated to account for 45% of visits)
   ii) Residents of area within 4 hour drive (estimated to account for 45% of visits); this "regional" group was further divided into short distance travelers (1-2 hrs), long-distance travelers (2-4 hrs) with no overnight stay, and long-distance travelers with an overnight stay.
   iii) Event/competition attendance (estimated to account for 10% of attendance)

c) Applying similar submarkets to Oroville, potential visitors were separated into the following groups:
   i) "Local" park users (within 1 hour drive): Butte and surrounding counties, which accounted for 2/3 of visitors surveyed in 2003 relicensing study
   ii) "Non-local" park users (>1 to 3 hour drive): All remaining counties in market area
   iii) Event attendance based on attendance at other whitewater parks' events, the annual Oroville Feather River event, or on estimates for event attendance at other proposed parks (see note below).

2) Population

a) California Department of Finance Table E-4, available on-line, provided the most recent (January 1, 2009) population estimates for the market area counties.

b) The California Department of Health Services web site provides county population data by age group for 2007; this was used to deduct people <16 years old, with the assumption that the percentage of people below 16 years old in each county has not changed significantly since 2007.

3) Paddlesports participation

a) Used NSRE participation data for the Tahoe National Forest "local area", which includes most of the Northern California counties in the market area; this does not include some of the area included in the supply of whitewater opportunities analysis, including the coastal counties, Siskiyou and Trinity counties, and Bay Area counties of Napa, Contra Costa, and Alameda; however, except for the Bay Area counties, these counties have low populations, and none would be expected to contribute a large portion of visitors due to distance from Oroville area and/or available natural whitewater opportunities in closer proximity.

b) Rafting participation = 11.4% for Tahoe National Forest local area; since this figure includes “tubing” and “floating” participation, it was necessary to adjust the percentage downward; based on regional and national data presented in the Phase 1 report, we estimated that about 1 in 4 of these were participants in whitewater rafting, and therefore used a 3% participation rate for whitewater rafting.
c) Kayaking participation (all types) = 8.0% for Tahoe National Forest local area; since NSRE data for California indicates only about 1 in 5 (21.4%) of kayakers/canoers participate in whitewater forms of the activities, whitewater kayaking participation was estimated to be 1.7% (8.0% x 0.214 = 1.7%). This is a substantially higher rate than the national percentage of 1%.

4) Percentage of paddlesports participants who might come to an Oroville area whitewater park in a given year

a) It is unlikely that every paddler or even most paddlers will use the park or those who do will visit every year, particularly those who do not live in Butte or surrounding counties. Therefore, a reasonable estimate has to be made as to what percentage might come to the park, although there is little data available to base this on.
b) An assumption was made that those in Butte County, which is known to have an active core group of paddlers centered in the Chico area, would be the most active in their use of the park, with an estimate of 50% of paddlers using the park in a given year.
c) An assumption was made that paddlers not in Butte County but still within a reasonably short drive (within an hour or so) would be somewhat less active in their use (but more active than those living further away). Therefore, an estimate of 25% of paddlers using the park in a given year was applied to counties surrounding Butte County.
d) Finally, an assumption was made that paddlers from more distant parts of the market area (the non-local market) would be the least active users of the park, with an estimate of 10% of paddlers using the park in a given year, recognizing that most have other closer-to-home whitewater options (including the Reno Whitewater Park for some), but some paddlers will be willing to occasionally drive 2-3 hours to a whitewater park in the Oroville area.

5) Visits to whitewater park per year

a) 1994-95 NSRE data for California indicates an average of 8.5 days of kayaking per year, but that about 40% participated only 1 day; rafting/tubing/floating participation averaged about 5.5 days per year, but with 20-25% reporting only 1 day of participation. Also, 2000-01 national NSRE data indicates 45-58% participating in “freshwater” kayaking/canoeing/rafting “1-2 days” per year.
b) Using the NSRE “days per year” data as a guide, we estimated an average of 4 days of whitewater park use per year for potential “local” kayakers and 2 days of use per year for whitewater rafters, noting that most rafting use as represented by participation sources is likely to be non-whitewater tubing and floating.

c) These participation rates were halved for non-locals (both kayakers and rafters), with the expectation that not all of those paddlers' whitewater activity would occur at the Oroville park, but would also continue to include natural runs, many of which are closer to their homes.

Other Attendance Estimates

Spectators: Sources indicate parks may have 8-10 times the number of spectators as actual park users, but this is likely the high end of the range and highly dependent on ease of access and proximity to other amenities, trail/foot path access, an in-town (vs. edge of town or rural) location, etc. Non-event spectators are likely to be most numerous at parks that are highly visible and accessible and close to commercial districts, residential areas and/or other recreation facilities.

Events: The ability to host events and likely attendance is dependent on the location of the park and park design that supports both challenging events and event spectators. A park that can host event provides a potential additional means of bringing in visitors to the park and increasing economic impact. Available sources provide rough estimates of the range of possible event attendance, with examples of low attendance in the low hundreds and examples of high attendance as many as several thousand over 2-3 days.

Event attendance is not specifically included in the park use estimates. However, events are addressed more generally in the report as a potential additional means of bringing in visitors and increasing economic impact. There is some indication that events at a whitewater park would draw visitors: as reported in relicensing Study R-15, about 20-25% of household survey respondents said they would be motivated to visit the Oroville area for the first time or more often by canoe/kayak events.

Table E-1. Use estimate for an artificial channel whitewater park at the Fish Barrier Pool.
(kayaking and rafting use, local and non-local markets)

	A			B		C		D		
County	Pop. (1/1/09)	Pop. % > 16 years old	Pop. >=16 years old	Total # Kayak Partici-pants [1]	Total # Raft Partici-pants [2]	Kayaking Visitors[3]	Rafting Visitors[3]	Annual Visits by Kayaking Partici-pants[4]	Annual Visits by Rafting Partici-pants[5]	Total # Kayaker and Rafter Visits per Year
LOCAL MARKET										
Butte	**220,748**	**81%**	**179,247**	**3,047**	**5,377**	**1,524**	**2,689**	**6,094**	**5,377**	**11,472**
Sutter	96,554	73%	70,871	1,205	2,126	301	532	1,205	1,063	2,268
Yuba	72,900	74%	53,873	916	1,616	229	404	916	808	1,724
Tehama	62,836	80%	50,269	855	1,508	214	377	855	754	1,609
Glenn	29,239	76%	22,280	379	668	95	167	379	334	713
Colusa	21,997	75%	16,498	280	495	70	124	280	247	528
Plumas	20,632	84%	17,434	296	523	74	131	296	262	558
SUB-TOTALS	*524,906*		*410,472*	*6,978*	*12,314*	*2,506*	*4,423*	*10,025*	*8,846*	*18,871*
NON-LOCAL MARKET										
Sacramento	1,433,187	76%	1,089,222	18,517	32,677	1,852	3,268	3,703	3,268	6,971
San Joaquin	689,480	71%	489,531	8,322	14,686	832	1,469	1,664	1,469	3,133
Solano	426,729	88%	332,849	5,658	9,985	566	999	1,132	999	2,130
Placer	339,577	88%	264,870	4,503	7,946	450	795	901	795	1,695
Yolo	200,709	79%	158,560	2,696	4,757	270	476	539	476	1,015
Shasta	183,023	80%	146,418	2,489	4,393	249	439	498	439	937
El Dorado	180,185	81%	145,950	2,481	4,378	248	438	496	438	934
Nevada	98,718	84%	82,923	1,410	2,488	141	249	282	249	531
Lake	64,025	83%	53,141	903	1,594	90	159	181	159	340
Tuolumne	56,335	86%	48,448	824	1,453	82	145	165	145	310
Calaveras	45,987	85%	39,089	665	1,173	66	117	133	117	250
Amador	38,080	87%	33,130	563	994	56	99	113	99	212
Lassen	35,550	84%	29,862	508	896	51	90	102	90	191

County	A			B		C		D		Total # Kayaker and Rafter Visits per Year
	Pop. (1/1/09)	Pop. % > 16 years old	Pop. >=16 years old	Total # Kayak Partici-pants [1]	Total # Raft Partici-pants [2]	Kayaking Visitors[3]	Rafting Visitors[3]	Annual Visits by Kayaking Partici-pants[4]	Annual Visits by Rafting Partici-pants[5]	
Sierra	3,358	86%	2,888	49	87	5	9	10	9	18
Alpine	1,201	85%	1,021	17	31	2	3	3	3	7
SUB-TOTALS	*3,796,144*		*2,917,901*	*49,604*	*87,537*	*4,960*	*8,754*	*9,921*	*8,754*	*18,675*
GRAND TOTAL										**37,546**

1. *Estimate based on participation rate of 1.7% of county population >=16 years old for all counties.*
2. *Estimate based on participation rate of 3.0% of county population >=16 years old for all counties.*
3. *Estimate based on 50% use rate for Butte County and 25% use rate for all other local counties, 10% use rate for non-local counties.*
4. *Estimate based on 4 visits per year for all local counties, 2 visits per year for all non-local counties*
5. *Estimate based on 2 visits per year for all local counties, 1 visit per year for all non-local counties.*

Table E-2. Use estimate for an instream whitewater park at Bedrock Park.
(kayaking use only, local market use only)

	A			B	C	D
County	**Population (1/1/09)**	**Population % > 16 years old**	**Population >=16 years old**	**Total # Kayaking Participants [1]**	**Kayaking Visitors in a given year [2]**	**Annual Visits by Kayaking Participants [3]**
LOCAL MARKET						
Butte	**220,748**	**81%**	**179,247**	**3,047**	**762**	**3,047**
Sutter	96,554	73%	70,871	1,205	301	602
Yuba	72,900	74%	53,873	916	229	458
Tehama	62,836	80%	50,269	855	214	427
Glenn	29,239	76%	22,280	379	95	189
Colusa	21,997	75%	16,498	280	70	140
Plumas	20,632	84%	17,434	296	74	148
SUB-TOTALS	*524,906*		*410,472*	*6,978*	*1,745*	
GRAND TOTAL						**5,013**

1. Estimate based on participation rate of 1.7% of county population >=16 years old for all counties.
2. Estimate based on 25% annual use rate for all counties.
3. Estimate based on 4 visits per year for Butte County and 2 visits per year for all other counties.

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APPENDIX F

Summary of Financial Information from Existing and Proposed Whitewater Parks

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Table F-1. Summary of financial information from existing and proposed whitewater parks.

Park Name and Location	Ownership, Management and Funding	Construction Costs	Operating Costs	Fees
Instream Parks				
Truckee River Whitewater Park (Reno, NV)	The City of Reno owns the park, and the State of Nevada manages the river bottom and banks; construction of the park was funded by statewide bonds approved by voters.	This public park includes a year-round course that cost $1.5 million to construct; total cost of improvements including a grassy park with an amphitheater and facilities for concerts, festivals, picnics, and outdoor sports was $4.5 million. Built in 2003.	No information available	Public park; use of the park is free of charge
Clear Creek Whitewater Park (Golden, CO)	City of Golden	$342,000 (constructed in 1998)	No information available	Public park; use of the park is free of charge.
Arkansas Whitewater Park and Greenbelt (Salida, CO)	Ownership and management by City of Salida & Arkansas River Trust; funding by the City and the Trust, several local agencies, foundations, and businesses, and the state, including $108,000 grant from Great Outdoor Colorado (state lottery funds)	The initial phase of improvements was accomplished with donated materials and labor. Phase 2 improvements were funded with $50,000 from the City of Salida and nearly $30,000 in private donations. Constructed in 2001.	No information available	Public park; use of the park is free of charge.

Table F-1. Summary of financial information from existing and proposed whitewater parks.

Park Name and Location	Ownership, Management and Funding	Construction Costs	Operating Costs	Fees
Ocoee Whitewater Center (Copperhill, TN)	U.S. Forest Service	$25 million ($7.7 million for river alterations) - built in 1995	$52,000 (based on information in the Mississippi Whitewater Park Feasibility Study) - although open year-round, flows for whitewater only occur on 34 weekend days per year	There is a $3.00 all-day user fee for parking at the center and access to the picnicking sites and trails on adjacent USFS property.
Trinity River Whitewater Course (Fort Worth, TX)	City of Ft. Worth	$150,000 (constructed in 2004)	No information available	There is no fee to use the course, which is accessed via a public park and riverside trails.
Artificial Channel Parks				
East Race Waterway (South Bend, IN)	Owned by the City of South Bend and operated by the Parks and Recreation Department. The course was financed with a grant and local bonds	$5 million (built in 1984)	$81,000 (based on information in the Mississippi Whitewater Park Feasibility Study)	The parks department rents inflatable kayaks and 2, 4, and 6-person rafts for a fee of $4 per person per trip. Private kayakers and canoers who pass a brief water test (to ensure they have the basic skills to use the course safely) are also permitted on the course and pay a daily $12 fee.

Table F-1. Summary of financial information from existing and proposed whitewater parks.

Park Name and Location	Ownership, Management and Funding	Construction Costs	Operating Costs	Fees
U.S. National Whitewater Center (Charlotte, NC)	The USNWC was built as a public/private/nonprofit partnership and is operated by a nonprofit organization. The center is managed by an Executive Director and staff, with the oversight of the USNWC Board of Directors. Local government entities have agreed to pay USNWC an annual service fee of up to $1.7 million for a 7-year period, with payments reduced if annual revenues exceed expenses. The Center had a commitment for a grant of $198,400 from the U.S. Department of Housing and Urban Development for the purchase of furniture and equipment, which it received in January 2008.	$38 million (built in 2006)	For the 2007 Fiscal Year, total operating expenses were estimated at $10.1 million. The five largest expenses were Interest ($2.3 million), Recreational Operations ($2.1 million), Salaries ($1.3 million), Depreciation ($1.0 million), and Utilities ($844,200). These five expenses accounted for 75% of total expenses. The next five expense categories are Restaurant Operations ($616,000), Retail Operations ($334,700), In-Kind Land Lease ($324,000), Insurance ($248,000), and Credit Card and Other Fees ($159,020). In total, these 10 expense items account for about 92 percent of the total expenses.	Fees vary by activity. There is a $5 per vehicle parking fee, but use of the paths around the whitewater runs and the hiking and biking trails is free of charge. Whitewater rafting fees vary by season and day of the week and are in the range of $39-65 per person during the May 1 to September 30 peak season. Rates are discounted on weekdays and during the October through April off-season. Kayakers and canoers may purchase a $20 day pass, with 10-day and monthly passes also available.

Table F-1. Summary of financial information from existing and proposed whitewater parks.

Park Name and Location	Ownership, Management and Funding	Construction Costs	Operating Costs	Fees
Adventure Sports Center International (McHenry, MD)	ASCI is operated by a nonprofit group with a volunteer board of directors. The nonprofit was formed to develop the center, which was built through a multi-year collaboration between ASCI, the State of Maryland and local governments, a local college, and the site's landowner and real estate developer. The real estate developer donated more than 550 acres of property for the whitewater course and other recreational uses, and has pledged an annual cash contribution for 10 years.	$24 million (built in 2007)	No information available	Fees vary by activity, season, day of the week, and age of the participant. Guided rafting during summer weekends is $75 per adult, while a 6-person raft can be reserved for $425. The daily fee for private boaters is $15-20 for one half-day session or $25 for all day. Inflatable kayaks can be rented for $40 for 2 hours. Weekly and season passes are available for private boaters for $100 and $400, respectively, and season passes are available for guided rafting for $600.

Table F-1. Summary of financial information from existing and proposed whitewater parks.

Park Name and Location	Ownership, Management and Funding	Construction Costs	Operating Costs	Fees
Mississippi Whitewater Park (Minneapolis, MN) - Proposed	Under a cost-share agreement, two-thirds of the funding would come from federal sources and one-third from state sources. MDNR funded the original park feasibility study and is working with project partners on the redesign, while exploring other options for potential park owners and managers.	Original construction cost estimated at $15 million (with $7 million in capital costs), but a more recent estimate for total project cost is $26 million.	Based on information for the East Race Waterway, the following operating costs were estimated by consultants for this proposed facility: $400,000 for staff salaries, $80,000 for administrative overhead, $16,000 for food and beverage concessionaires, and $14,000 for maintenance and security. In addition, $100,000 is set aside annually as a Capital Improvement reserve.	According to feasibility studies, daily fees are estimated to be $12 for adults and $6 for youth; season passes would be $300

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APPENDIX G

Water Pipeline Capacity and Construction Cost Estimates

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Water Pipeline Capacity and Construction Cost Estimates

Water Pipeline Capacity Estimates

These pipeline capacity estimates were obtained using flow calculators available online (Oregon State University 2009, Flowsizer.com 2009). These calculators are designed to demonstrate the approximate flow capacities of various types and sizes of natural and constructed open channels and pipes. The calculators use Manning's equation, an equation commonly used for hydraulic engineering purposes, such as the design of drainage systems. The calculators use data inputs on pipeline diameter, slope, and roughness coefficient (Manning's n, which quantifies the roughness of the interior of the pipe, which has a negative effect on flow), and depth of flow, and provide output (a table or graph) depicting the pipe's flow capacity. Manning's n values for various pipe materials were supplied by several sources (Oregon State University 2009, LMNO Engineering, Research, and Software, Ltd. 2000).

The flow capacity data in the table below is derived from the calculator outputs. A relatively flat slope of 0.25 percent (3 inches drop in pipe elevation per 100 feet) was used for all calculations. This was selected as an appropriate slope given the relatively level topography of the potential pipeline route and the elevations of the potential intake location at the Power Canal and the potential outflow location in the Riverbend Canyon.

Table G-1. Approximate pipeline flow capacities for concrete or steel pipe.

Pipe Diameter (inches)	Pipe Slope[1] (%)	Approximate Pipe Capacity[2]	
		Half-full Flow (cfs)	Full Flow (cfs)
36	0.25	18	37
48	0.25	39	81
60	0.25	69	150
72	0.25	110	230
84	0.25	173	330
96	0.25	240	500

Sources: Oregon State University 2009, FlowSizer.com 2009, LMNO Engineering, Research, and Software, Ltd. 2000.

1. *Slope of 0.25% = 3 inches/100 feet = 13.2 feet/mile.*
2. *Capacities are for steel or finished concrete pipe. The roughness coefficient (Manning's n) used in the flow equation varies by pipe material. An n value of 0.012 was used for these calculations, which corresponds to the approximate n value for steel and finished concrete pipe. The higher n values for other common pipe materials (corrugated metal or plastic (HDPE) pipe with 3 x1 inch corrugation = 0.022; corrugated metal pipe with 6 x 2 inch corrugation = 0.032) result in substantially lower flow capacities.*

Water Pipeline Construction Cost Estimates

These conceptual-level pipeline cost estimates are based on analyses conducted by MWH, Inc. engineers applying the results of a review of existing estimates for comparable projects and professional judgment. The estimates cover a range of pipeline sizes and both rural and suburban environments. (The assumed potential pipeline route between the Power Canal and Riverbend Canyon site may be midway in character between the rural and suburban settings, therefore estimates for each are provided.) These estimates do not include engineering, permitting, or land acquisition costs or any other non-construction costs.

Table G-2. Approximate pipeline construction costs in rural and suburban environments.

Pipe Diameter (inches)	Pipe Material	Construction Cost [1]			
		Rural[2] ($/lf)	Suburban[3] ($/lf)	Rural[2] ($/mile x $1M)	Suburban[3] ($/mile x $1M)
24	PVC	$240	$300	$1.27	$1.58
36	Ductile Iron	$425	$507	$2.24	$2.68
48	Ductile Iron	$519	$614	$2.74	$3.24
60	Steel	$735	$859	$3.88	$4.54
72	Steel	$989	$1,146	$5.22	$6.05
84	Steel	$1,136	$1,310	$6.00	$6.92
96	Steel	$1,284	$1,478	$6.78	$7.80

Source: MWH Inc. 2009.

1. *Costs include materials (e.g., pipe material, backfill, pipe bedding), labor and site work (e.g., reseeding or resodding, pavement replacement) and the following markups and assumptions:*
   - *Contractor overhead and profit, mobilization and demobilization (10%)*
   - *Construction contingency (20%)*
   - *One valve per mile*
   - *65 foot right-of-way (30 foot for pipe diameters < 30 inches)*
2. *Rural = 85% of right-of-way is sodded, 15% is pavement/road crossings.*
3. *Suburban = 60% of right-of-way is sodded, 40% is pavement/road crossings.*

References

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APPENDIX H

Characteristics of a Viable Whitewater Park

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Characteristics of a Viable Whitewater Park

The purpose of this appendix is to provide a more detailed description of five basic physical attributes of a whitewater park and those attributes in relation to existing and proposed whitewater parks in the U.S., and to state some general conclusions regarding those attributes as components of a viable whitewater park. The first three of these are attributes that relate more generally to potential whitewater park sites as well as to actual existing and proposed parks, in that candidate sites may have certain opportunities or constraints related to these attributes:

- Access to river and potential park
- Available flow and gradient (hydrology)
- Proximity to population centers and urban development

Two additional physical attributes are also related to potential park sites, but can be influenced by whitewater park design as applied at a specific site:

- Types and level of difficulty of boating supported
- Length of run(s) and number of whitewater features

Although these two attributes are related to the physical attributes of potential whitewater park sites, a broad range of potential park sites might support the desired level of these attributes given the appropriate park design.

The information presented here is based on the research on 10 existing and proposed parks presented in the Phase 1 Background Report; research on additional aspects of those parks' attributes, surroundings, and host communities; and investigation of a number of additional existing and proposed U.S. instream parks, which provided more robust information to better represent the diverse characteristics of U.S. whitewater parks.

This information supports conclusions about what specific attributes help to create a viable park, and helps to define the attributes of a viable whitewater park for the Oroville area, as addressed in the subsequent screening of candidate sites, along with several other physical site criteria, environmental criteria, DWR operations criteria, and permitting considerations.

Park Attribute 1: River and Park Access

A whitewater park must provide safe means for boaters to enter and exit the water. At instream parks, protection of the riverbank and riparian vegetation from damage is also important. Adequate space for vehicle parking to meet the needs of a park's expected level of use is also needed.

Instream Parks

At an instream whitewater park, boaters must be provided streamside access for launching and taking out boats. At some existing parks, access is provided at several locations via streamside paths connected to city parks and parking areas. This is the case at the Clear Creek Whitewater Park in Golden, Colorado (City of Golden 2009), as well as the park in Steamboat Springs, Colorado (City of Steamboat Springs 2009). Several parks have designed boat access into flow constriction or drop structures that allow kayakers to launch boats into the eddy below a play feature from which they can paddle into the whitewater play feature. Examples of this design include the Arkansas River Whitewater Park in Salida, Colorado (Arkansas River Trust 2007), and the Truckee River Whitewater Park in Reno, Nevada (City of Reno 2007).

Because most instream parks built in recent years are intended primarily for what is commonly termed "playboating" and "park and play" kayaking (also referred to in competitions as "freestyle" or "rodeo"), they most often are built in conjunction with streamside improvements, such as rock terraces, that provide easy access to the water. The above-mentioned parks in Salida, Colorado, and Reno, Nevada, have these types of access improvements. Other instream parks in Colorado and other western states were built in conjunction with improvement to or creation of new municipal parks that provide access to the water for boaters and other recreation users, as well as amenities such as restrooms and picnic sites (Colorado Kayak Supply 2009, American Whitewater 2009).

The improved streamside access and adjacent dry-land parks found at many instream parks is also an important feature in allowing those facilities to successfully host large competitive paddling events and river festivals. The parks in Golden, Salida, and Steamboat Springs, Colorado, and Reno, Nevada, all host popular annual events attended by thousands of spectators who use the streamside terraces and adjacent parks (City of Golden 2008, Arkansas River Trust 2007, Friends of the Yampa 2009, Reno River Festival LLC 2009).

Artificial Channel Parks

Safe means for boaters to enter and exit the water is part of the design of artificial channel parks. Also, all three of the existing artificial channel parks described in the Phase 1 Background Report (East Race Waterway in South Bend, Indiana; U.S. National Whitewater Center [USNWC] in Charlotte, North Carolina; and Adventure Sport Center International [ASCI] in McHenry, Maryland) were designed with pathways and numerous places alongside the whitewater channels for spectators to watch the action on the water.

Artificial channel parks are generally designed to handle a larger number of boaters than instream parks, particularly rafters. In addition, most artificial channel parks are designed to offer ample spectator opportunities, non-boating recreation, and host whitewater paddling competitions. Therefore, parking for park users and spectators is a key element of design of most artificial channel parks. An example is USNWC; the park is capable of handling about 50 rafts at once, or 250 paddlers, as well as kayakers, and

offers non-boating adventure sport activities, has a 300-seat restaurant, and hosts competitions drawing many participants and spectators (USNWC 2008). Commensurate with this large capacity for both park users and spectators, USNWC has parking space for several hundred vehicles.

Parking for urban artificial channel parks may be provided on local streets in the vicinity of the park. This is the case for the East Race Waterway (Chicago Area Paddling and Fishing Guide 2008), which is near the downtown area of South Bend. Similarly, the proposed Mississippi River Whitewater Park in Minneapolis, Minnesota, would have only minimal parking on site due to space constraints but would use available parking in the surrounding developed urban area, and remote parking with shuttle services (Minnesota DNR 1999).

Park Attribute 2: Available Flow and Gradient (Hydrology)

The available flow of water and natural gradient are a major determinant of the type and size of park that is possible at a given site, and are primary factors in park design. Like the attributes of park length and number of features, these attributes vary widely at existing parks. Instream and artificial channel (diversion channel type) parks have been built on relatively small, low-flow streams and on major rivers. Instream parks have been built on river reaches with moderate gradients and on river reaches with relatively low gradients. Flow and gradient of artificial channel pumped flow parks appear to be largely a matter of design and engineering rather than site constraints.

Instream Parks

Based on U.S. Geological Survey historical flow data (USGS 2009), the average peak flows of river reaches at whitewater parks are as low as 50-100 cubic feet per second (cfs) and as high as 5,000-10,000 or even 20,000 cfs.[1] This demonstrates that rivers within a wide range of size and flow may provide viable sites for a whitewater park.

At the lower end of the flow range are the several instream parks that have been constructed on small tributary rivers and creeks, with average peak flows of 200-300 cfs or less. These include four Colorado parks: those in Boulder and in Lyons (on Boulder Creek and on St. Vrain Creek, both tributaries to the South Platte River), and in Vail and in Breckenridge (on Gore Creek and on the Blue River, both tributaries to the Colorado River). (The Colorado and South Platte Rivers are among the major rivers flowing from the Rocky Mountain region of Colorado.)

However, the survey of existing parks in this study suggests that most of the instream whitewater parks built in the U.S. have an average peak flow in the range of 1,000 to 2,500 cfs. This includes two of the instream parks assessed in the Phase 1 Background Report, the Truckee River Whitewater Park in Reno, Nevada, and the Arkansas

[1] The flow data indicate that in any given year, peak flows may greatly exceed the historical averages on these rivers; for example, during periods of higher-than-average snowmelt.

Whitewater Park in Salida, Colorado. Several additional instream parks in Colorado are on rivers with similar peak flows.[2]

The Clear Creek Whitewater Park in Golden, Colorado, has average peak flows between these two groups, in the range of 600-800 cfs. At the high end of the flow range are instream whitewater parks built on reaches of large rivers in Colorado and Montana with average peak flows of 10,000 or 20,000 cfs or higher.[3]

Instream whitewater parks have also been built in streams with a range of stream gradients. The park in Casper, Wyoming, is on relatively flat reach with a gradient of about 10 feet per mile (fpm) (Eddyflower.com 2009a), and the park in Gunnison, Colorado, is on a reach with an average gradient of about 20 fpm (Eddyflower.com 2009b). Several parks are on river reaches with gradients of 30 to 50 fpm. The Durango, Colorado, park has a gradient of 30 fpm (Boulder Outdoor Center 2009a) and the parks at Salida, Golden, and Lyons, Colorado, all have gradients of about 45 fpm (Boulder Outdoor Center 2008, 2009c, 2009b). The Upper Ocoee River reach, the site of the Ocoee Whitewater Center, has a gradient of about 50 fpm (American Whitewater 2008), and the park at Boulder, Colorado, is on a stream reach with a slightly higher gradient of 52 fpm (Eddyflower.com 2009c). The two channels of the Reno, Nevada, park are described as having a drop of 2 feet every 200-300 feet (Lautner 2008), which equates to 35-50 fpm.

Artificial Channel Parks

Within artificial channel parks, water flow depends on how much water is diverted into the park (such as at the East Race Waterway) or how much water is pumped through the park (such as at USNWC and ASCI). Determination of how much flow is needed to provide the desired boating experience is a central aspect of park engineering and design, accomplished with the help of computer and physical flow modeling tools. Both the East Race Waterway and ASCI use flows in the range of 450-550 cfs (South Bend Parks and Recreation Dept. 2008, ASCI 2008). USNWC, with wider channels than those parks (averaging 60 feet vs. 35-40 feet at ASCI and 30-35 feet at East Race Waterway), can pump as much as 700 cfs through the “competition” channel (Recreation Management 2007). On both pumped-flow courses, the amount of water pumped through the channel can be adjusted, using lower flows for less challenging paddling and higher flows to increase the level of difficulty (ASCI 2007, Recreation Management 2007).

Like flow, gradient is a primary consideration and aspect of artificial channel whitewater park design. Based on a length of 1,900 feet and a drop in elevation of 12 feet (South Bend Parks and Recreation Dept. 2008), the East Race Waterway, an existing concrete channel converted from industrial use, has a gradient of about 33 fpm. In contrast, at ASCI the 24-foot drop in elevation over the length over the 1,700-foot channel equates

[2] These include parks on the Arkansas River at Buena Vista and Pueblo; on the Animas River at Durango; on the Yampa River at Steamboat Springs; and on the Gunnison River at Gunnison.
[3] Instream parks on other high-flow river reaches are proposed on the Spokane River in Spokane, Washington, and on the Colorado River in Palisade, Colorado.

to a gradient of 75 fpm. The competition channel at USNWC, described as "the world's steepest slalom channel" (Willoughby, S. 2006), drops 21 feet over a length of 1,370 feet (Recreation Management 2007), a gradient of about 80 fpm. The proposed Mississippi Whitewater Park in Minneapolis, Minnesota, would have a length of 1,850 feet and a drop of 17 feet, about 50 fpm; a low-gradient beginner to intermediate section would be followed by a steeper and more challenging expert section, separated by a 100-foot takeout pool (Minnesota DNR 1999).

Park Attribute 3: Proximity to Population Centers and Urban Development

Situating a whitewater park in or near a population center provides a pool of potential local users of the park. Parks that are not near population centers are more dependent on tourists and other visitors from outside the area to provide a consistent user population. Parks that are placed close to commercial and residential areas have several possible advantages including ease of access for residents and visitors, greater visibility to visitors, and more opportunities for synergy with other recreation and commercial facilities and services.

Instream Parks

The survey of instream parks and a review of population statistics for their associated home cities indicate that most of the instream parks built in the U.S., and several additional proposed parks, are situated in smaller cities of less than 20,000 residents. Some of these parks are in cities with small year-round populations (some with less than 5,000 residents) but with a tourism-centered economy and with popular recreation destinations in the vicinity that attract large numbers of tourists, particularly for river-based and other types of outdoor recreation. Examples include parks in Vail, Breckenridge, and Glenwood Springs, Colorado, all of which are Rocky Mountain towns on the Interstate 70 corridor, travelled by millions of tourists each year. Two of the instream parks described in the Phase 1 Background Report, in Salida and Golden, Colorado, are also in small cities. Salida is on the Arkansas River, the most popular rafting destination in the state, which attracts several hundred thousand commercial rafting customers each year (Colorado Rivers Outfitters Association 2009). Golden has a population of about 18,000 but is only about 20 miles from the larger city of Boulder and less than 10 miles from the Denver suburbs.

Several other instream parks are in larger cities, with populations between 50,000 and 100,000 residents. Examples include the parks in Boulder and Pueblo, Colorado; Casper, Wyoming; and Missoula, Montana. These appear to be communities with less economic focus on tourism than the smaller cities described above; thus, the parks may be assumed to be used primarily by local boaters, except during events that attract visitors from outside the area. The park in Reno, Nevada, is located in a city of more than 200,000 residents that also attracts many visitors to the several local casinos and other attractions.

The two other instream parks described in the Phase 1 Background Report illustrate the two extremes in terms of proximity to population centers. The park on the Clear Fork of the Trinity River in Fort Worth, Texas (population 700,000, and within a metro area with

a population of more than 6 million) is the only U.S. instream park built in a large city. At the other extreme is the Ocoee Whitewater Center in the Appalachian Mountains of eastern Tennessee; the two nearest towns, Ducktown and Copperhill, are 7 and 10 miles from the park, respectively, each with less than 1,000 residents. However, the park is on one of the most popular rafting rivers in the eastern U.S. (American Whitewater 2008), is on a federal and state-designated scenic byway, and is surrounded by U.S. Forest Service (USFS) lands that attract many outdoor recreationists (USFS 2009). Chattanooga, Tennessee (population 500,000) is about 60 miles to the west, and the Atlanta, Georgia, metro area, with more than 5 million residents, is about 100 miles to the south.

Artificial Channel Parks

Artificial channel whitewater parks typically cost substantially more to build than instream parks (see Phase 1 Background Report, Section 4.4.2). They also may be expensive to operate, particularly if they rely on pumped flows (the electrical costs for the pumps at USNWC exceed $1.2 million per year [Willoughby, S. 2006]). Therefore, the presence of a substantial local population of potential park users takes on additional importance to justify the larger costs associated with an artificial channel park, particularly if the intent is for the park to produce sufficient revenue to cover its operating costs. (See Section 4.4.3 for additional information on economic issues associated with whitewater parks.)

Three of the five built and proposed artificial channel parks described in the Phase 1 Background Report are located in metropolitan areas with several million residents. USNWC's home city of Charlotte, North Carolina, has a population of about 700,000, and the metro area has a population of 1.7 million. The proposed parks in Dallas, Texas, and Minneapolis, Minnesota, would be in the center of major metropolitan areas with several million residents. East Race Waterway is in the modest-sized college community of South Bend, Indiana, with 100,000 residents, but the Chicago metropolitan area is less than 100 miles away by interstate highway.

ASCI differs from the other artificial channel parks in that it is located in a small resort and vacation home community. The year-round population is small, but the summer population swells with tourists who come to the long-established year-round resort on the mountain where the park is located, as well as for the recreational opportunities on the lake at the base of the mountain and on the nearby Youghiogheny River. The major metropolitan areas of Washington, D.C., and Baltimore, Maryland, are about a 3-hour drive from ASCI, and Pittsburgh, Pennsylvania, is about a 2-hour drive away.

Park Attribute 4: Types and Level of Difficulty of Boating Supported

A whitewater park that is suitable for entry-level and intermediate as well as more advanced paddlers will meet the needs of and attract the widest range of boaters. Similarly, a whitewater park designed to accommodate different types of kayaking (playboating/rodeo boating, slalom boating, river running), as well as rafting will provide

the widest range of boating opportunities and will maximize the use of the park[4]. Play features and slalom courses that can support competitions and training likewise will maximize park use and provide the opportunity to host competitive events.

Instream Parks

Most instream parks are designed to be useable by boaters with a range of skill levels. For example, the Reno, Nevada, park has one channel described as "ideal for a beginners play park" and a steeper, more challenging channel intended "to keep racing kayakers sharp and on their game" (Lautner, W. 2008). Likewise, the Golden, Colorado, park has sections of varying difficulty, including one with "flat, broad, and shallow surf waves" and one with "more extreme surf and wave drops" (City of Golden 2008).

Most instream parks built in recent years are focused on providing opportunities for playboat kayaking. Although those parks are generally not designed primarily for slalom boating[5], some feature slalom gates or are suitable for slalom boating (e.g., the Golden, Boulder, and Durango, Colorado, parks). It may be possible to set up temporary slalom gates (set up only for events) at an instream park by attaching support cables for the gates to streamside trees (Boulder Outdoor Center 2009b).

Parks on rivers used by commercial rafting outfitters, such as the Durango, Colorado, park, may be designed to accommodate and enhance commercial rafting (Durango Telegraph 2006).

Artificial Channel Parks

Rafting is understood to be a key to the economic viability of artificial channel parks like USNWC (Neville, T. 2007, Vogel, J. 2007). It provides a social activity that the widest spectrum of people can participate in (young and old, first timers and inexperienced boaters, families and organized groups) and provides the opportunity for the park to serve the greatest number of customers and thus maximize revenue. The same features that provide exciting rides for rafters running an artificial channel whitewater course can also provide opportunities for playboaters to perform their maneuvers.

Artificial channel parks are generally designed to include slalom boating, which helps to maximize range of potential park users and allow the use of the park for slalom training and competitions. All three of the existing artificial channel parks described in the Phase 1 Background Report (East Race Waterway, USNWC, and ASCI) have hosted slalom competitions (South Bend Parks and Recreation Department 2008, USNWC 2008, Weekend Adventures Magazine 2007), including events featuring the U.S. National Slalom Team.

[4] Although use of open canoes on whitewater is much less popular than use of kayaks, most parks that accommodate kayaks can also accommodate canoes. Some parks also allow the use of inflatable kayaks ("duckies"), and some instream parks are used by tubers and waders when the water level is low.
[5] An older park designed originally for slalom boating is the Wausau, Wisconsin, whitewater course, first opened in 1974. The park now hosts both slalom boating and freestyle kayaking competitions (Wausau Kayak/Canoe Corporation 2008).

Both USNWC and ASCI are designed to provide a range of difficulty. Among its purposes, ASCI is a "venue for beginners and experienced persons and youth" as well as "a competition venue for national and international events" (Yoder, D. 2007), which is accomplished by altering flow levels and with movable wave-shapers. As described in the Phase 1 Background Report, USNWC provides two main channels, a longer, lower gradient channel that is split for part of its length into instruction and freestyle sections, and a shorter, steeper competition channel.

Park Attribute 5: Length of Runs/Number of Whitewater Features

The length of runs and number of features of a whitewater park can vary widely between a small instream park with only one or two hydraulic features that occupy only a few hundred feet of a river, to larger instream and artificial channel parks with 10 or more features on runs up to half a mile long. These attributes are closely tied to the intended use or uses of a park and its intended market. However, larger parks with more and varied features are more likely to attract a greater number of local and non-local users.

Instream Parks

Not including parks with only a single hydraulic feature, most instream parks are between a quarter and a half-mile in length. A few shorter parks are about 600 feet in length. However, because most of the built and proposed instream parks in the U.S. are focused on playboating, the number and quality of the hydraulic play features (drop or wave structures) are of primary interest rather than the length of the run.

The park in Glenwood Springs, Colorado, consists of one large structure with several features: a main wave feature and high-water and low-water features (Glenwood Springs Whitewater Park 2009). The instream park in Salida, Colorado, has two hydraulic features (Arkansas River Trust 2007), while most other instream parks surveyed have four to eight features.

The length of an instream park designed primarily for playboating is a function of how widely the play features are spaced. One whitewater feasibility study indicates that hydraulic features should be placed between 200 and 300 feet apart to provide boaters "the ability to set up prior to entering a hydraulic feature and to recover after exiting a feature and setting up for the next feature" (Southern California Edison 2005). For parks with multiple features, wider spacing can provide for larger eddies below play features, where kayakers can recover after being washed off of a wave. Larger eddies also provide more space for paddlers to rest and to wait their turn to use popular play features, and more safety for paddlers that end up in the water.

An example of a whitewater park with widely spaced features is the Pueblo, Colorado, course which has eight drops spread out along a half-mile of the river, with 200 to 400 feet of water between drops providing large eddies (Images Pueblo 2009). An example of a park with more closely spaced features is the Lyons, Colorado, park, which provides eight features on a quarter-mile bend in the river that wraps around a town

park, which has the advantage of "making it an easy walk for kayakers…from the last takeout back to the start" (Town of Lyons 2009).

Longer runs allow more play features to be included in the park. An example of this is the park in Reno, Nevada; the 1,200- and 1,400-foot channels on each side of an island provide room for a total of 11 drop pools (City of Reno 2007). Also, play features spread out over a longer segment of river channel help to distribute use and lessen crowding and conflict on the water. Several instream parks surveyed are about a half-mile in length but have sizeable flat water segments between features rather than continuous whitewater.

The length of the run is of interest for those using a slalom course, particularly for competitive training. Competition slalom courses that meet International Canoe Federation rules have from 18 to 25 gates spaced over about 800 to 1,300 feet of river (ICF 2009). An example is the competition slalom course at the Clear Creek Whitewater Park in Golden, Colorado, which is 800 feet in length (City of Golden 2008). Lastly, longer runs are desirable for kayakers interested in the river-running style of paddling rather than play boating, and to rafters and canoers running the river, as a longer run equates to a longer ride through the created whitewater features.

Artificial Channel Parks

Existing and proposed artificial channel parks provide runs of 1,400-2,000 feet. For example, the two main channels at USNWC are nearly 1,400 and 1,700 feet long (USNWC 2008), the single channel at ASCI is 1,700 feet long (ASCI 2007), and the East Race Waterway is 1,900 feet long (South Bend Parks and Recreation Dept. 2008). The proposed artificial channel parks at Dallas, Texas, and Minneapolis, Minnesota, described in the Phase 1 Background Report could offer runs up to 2,000 feet in length (Recreation Engineering and Planning 2005, Minnesota DNR 1999).

As is the case with instream parks, artificial channel parks with longer runs provide a more desirable experience for rafters and canoers, and river-running style kayakers, by allowing a longer ride down the course[6]. Also, longer runs can accommodate more hydraulic features and thereby provide more variety and challenge to boaters.

As described above, standard competitive slalom courses are from 800 to 1,300 feet long; as depicted on a facility map, the competition slalom course at USNWC is installed at the 1,370 foot competition channel (USNWC 2008).

[6] The loop courses at USNWC and ASCI provide an experience more similar to a longer run on a natural river in that boaters can quickly make repeat trips down the course due to the mechanical conveyors that carry them back up to the starting pool.

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APPENDIX I

SBF Steering Committee Letter to DWR, July 13, 2009

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SUPPLEMENTAL BENEFITS FUND

1735 MONTGOMERY STREET -- OROVILLE, CA 95965-4897
(530) 538-2518 Fax (530) 538-2468

July 13, 2009

Kevin Dossey, Chief
Recreation and Land Use Section
Bill Cochran, Chief
License Coordination Branch
Oroville Field Division
460 Glen Drive
Oroville, CA 95966

COPY

Re: Feather River Whitewater Boating Opportunity Feasibility Study

Dear Mr. Dossey & Mr. Cochran,

The Supplemental Benefits Fund Steering Committee at its April 9, 2009 meeting established an Ad hoc Committee for the specific purpose of reviewing and prioritizing five (5) potential Whitewater Park sites. Those five potential sites were previously narrowed down from eleven (11) sites provided by DWR and expanded by the SBF Steering Committee on March 13, 2009.

The Ad hoc Committee had representation from the Steering Committee, SBF Advisors, and the general public with a total of fifteen participants (regular members and alternates). The SBF Coordinator, Bob Marciniak facilitated each of these meetings. The committee met on a regular basis initially refining the criterion that DWR had previously provided, as well as accomplishing an extensive visit of each of the five sites.

The purpose of this summary letter is to provide DWR specific direction as to which sites to include in the Feather River Whitewater Boating Opportunity Feasibility Study that DWR is preparing as a requirement of the Lake Oroville Settlement Agreement, Appendix B (b-13-c) which states; "*Except as provided in the Project Supplemental Benefits Fund, the Licensee's financial obligation under this provision does not extend beyond this feasibility study. Study cost contribution by the Licensee will be a maximum of $250,000. The study scoping process, including any necessary contracting efforts, will commence within 90 days of the execution of this Settlement Agreement. Target study completion will be within 15 months of execution of this Settlement Agreement.*"

Prior to the summary, the Steering Committee wishes to call several items to DWR's attention. These comments are not recommended to be included in the study, but are brought forward as future concerns for areas not within the sites selected by the Steering Committee.

- DWR Site 6: a potential new channel between the Wilbur Road Boat Ramp and the Outlet Camp Area Boat Ramp. If this site is developed as a future channel by DWR the Steering Committee requests that planning include provisions that would make this accessible to the public for water activities such as kayaking, tubing, equestrian, bicycle, or walking trails.

- Any expansion, or revision to existing channels, as appropriate, to include public accessibility.

- Site(s) include a provision for alternative energy generation, either for the venue and to provide an income source for the SBF; or to provide an offset to lost hydro-generation from water diversions.

- Educational opportunities related to salmon rehabilitation.

- Keeping on track with details of the Settlement Agreement Recreation Management Plan dated March 2006 for improvements along the river channel, the downtown area, and the lake.

Site Evaluation Criterion used by the Whitewater Ad hoc Committee:

1. *Available Infrastructure*
   - Parking
   - Restrooms
   - Power
   - Accessibility

2. *Constraints*
   - Cultural resource impacts
   - Water quality
   - Gradient & flow
   - Fish/habitant issues
   - Seasonal availability
   - Regulatory flow & water temperatures
   - Noise factors
   - Hours of operation
   - Lighting at night

3. *Economic Potential*
   - Proximity to Historic Downtown
   - Growth/expansion opportunities
   - Room for spectators

4. *Aesthetics*
   - Views
   - Surroundings
   - Visibility
   - Public Acceptance
   - Blends in with current use/synergy
   - Would it blend in with potential future uses

5. *Green Aspects*
   - Solar or wind potential
   - Sustainability

Specific Findings of the Ad hoc Whitewater Committee:

Not Recommended:

- **Riverbend Park:** This site was considered as an out of river channel. It is not recommended to be included in the final study due to water pumping issues, interference of fish habitats, and the approved passive nature of the existing park.

- **North Forebay:** This site was considered because of visibility and the proximity of water, however it is not recommended to be included in the final study due to the lack of connectivity and distance to the Historic Downtown.

Recommended:

- **Riverbend Canyon:** West of Hwy 70/below the bluff & north of Riverbend Park. This site is highly recommended as it provides most of the attributes that a large Whitewater Park requires. It has a mature natural setting, a secluded canyon, ample gradient, and spectator accessibility, excellent visibility from Hwy 70 and connectivity to Riverbend Park, Bedrock Park, and the Historic Downtown as well as the planned City of Oroville Gateway project. This location would be a welcoming and visual statement to recreational opportunities of the region. It also may compliment salmon rehabilitation efforts currently underway. Limitations include water sourcing, however consideration should be given to tapping the Thermalito Diversion Cannel, or the Feather River. The site, because of its size, also could allow a series of reservoirs to either store, capture

or re-circulate water. The gradient possibilities for this site are excellent based on the topographical maps provided by the City of Oroville. A straight run or circular run with an ultimate possibility of dropping into the Feather River exists. (see attachment 1 for topographical information)

Questions pertaining to the Riverbend Canyon Site:

1. What is the cost of getting water to this site via the existing power canal or from the fish hatchery?
2. What is the feasibility of storage capacity potential of a reservoir situated at the upper end of Riverbend Canyon?
3. Would there be issues surrounding returning water back to the low flow channel?
4. What is the feasibility of allowing water to be captured and allowed to perk back into the ground?

- **Bedrock Park:** Envisioned starting in the existing side channel of the Feather River and continuing to just east of the Hwy 70 over-crossing this would be a smaller, family oriented venue. The park has existing site improvements including parking, an amphitheater, restrooms and mature landscaping as well as, excellent visibility from Hwy 70. This site offers an opportunity as a "stand-alone" mini venue, however its proximity to either of the other two sites allows for a complimentary park, low impact training and a minimal start-up and construction expenditure. It offers connectivity to Riverbend Park, Riverbend Canyon, the Historic Downtown and the City of Oroville Gateway project. This site however appears to have the least gradient based on the topographical information provided by the City of Oroville. (see attachment 2 for topographical information)

Questions pertaining to the Bedrock Park Site:

1. How much water can be diverted into the park area?
2. Is there enough gradient to create a wave feature at this location?
3. Are water temperatures at this location acceptable for contact water recreation?

- **Diversion Dam to the Fish Barrier:** The site is located to the northwest of the Feather River on a combination of private and publicly owned property. This site has ample gradient, accessibility to water from the existing power channel. It provides a natural setting and offers connectivity to the Historic Downtown and Fish Hatchery facilities. Concerns include, it is completely within the FERC boundary, has sensitive Native American artifact sites, limited road visibility and a complicated ingress and egress pattern. The preliminary layout from the previously prepared study by the City of Oroville reflects excellent gradient possibilities. (see attachment 3 for topographical information)

Note: The City of Oroville in 2007 issued the Oroville Waterfront Concept Plan & General Plan Amendment that had a Whitewater Park study as part of it. It is recommended that information should be taken into consideration when this site is evaluated.

Questions pertaining to the Diversion Dam Site:

1. Are there issues associated with having this site reside partially in the flood channel?
2. Are water temperatures at this location acceptable for contact water recreation?
3. What is the potential cost of forgone power generation at this site?
4. What is the feasibility and cost of accessing water from the existing power canal?
5. Could an alternate access entrance/exit be found?

Please let us know if additional information, or clarification, of the three sites in the SBF identification process is needed. There currently is a high level of community interest in pursuing a Whitewater Park and to keep the momentum going a completed DWR report by the next SBF Steering Committee Meeting on October 7, 2009 would be desirable.

The SBF Steering Committee appreciates the opportunity to interface with the California Department of Water Resources in completing the Feather River Whitewater Boating Opportunity Feasibility Study.

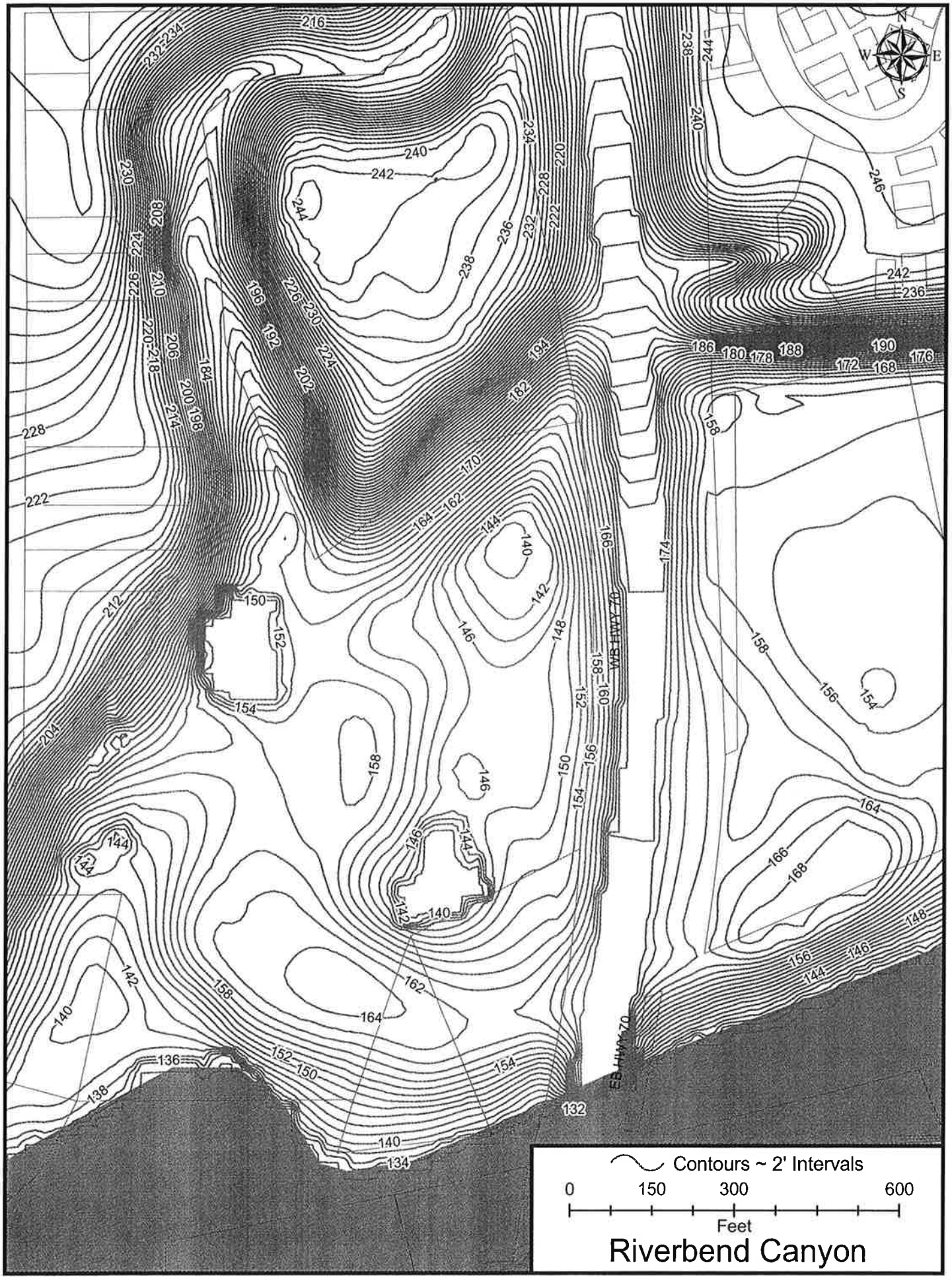
Sincerely,

Loren Gill

Loren Gill, Chairperson
SBF Steering Committee

Cc: SBF Steering Committee Members
Whitewater Ad hoc Committee Members

Attachments: Six Topographical Maps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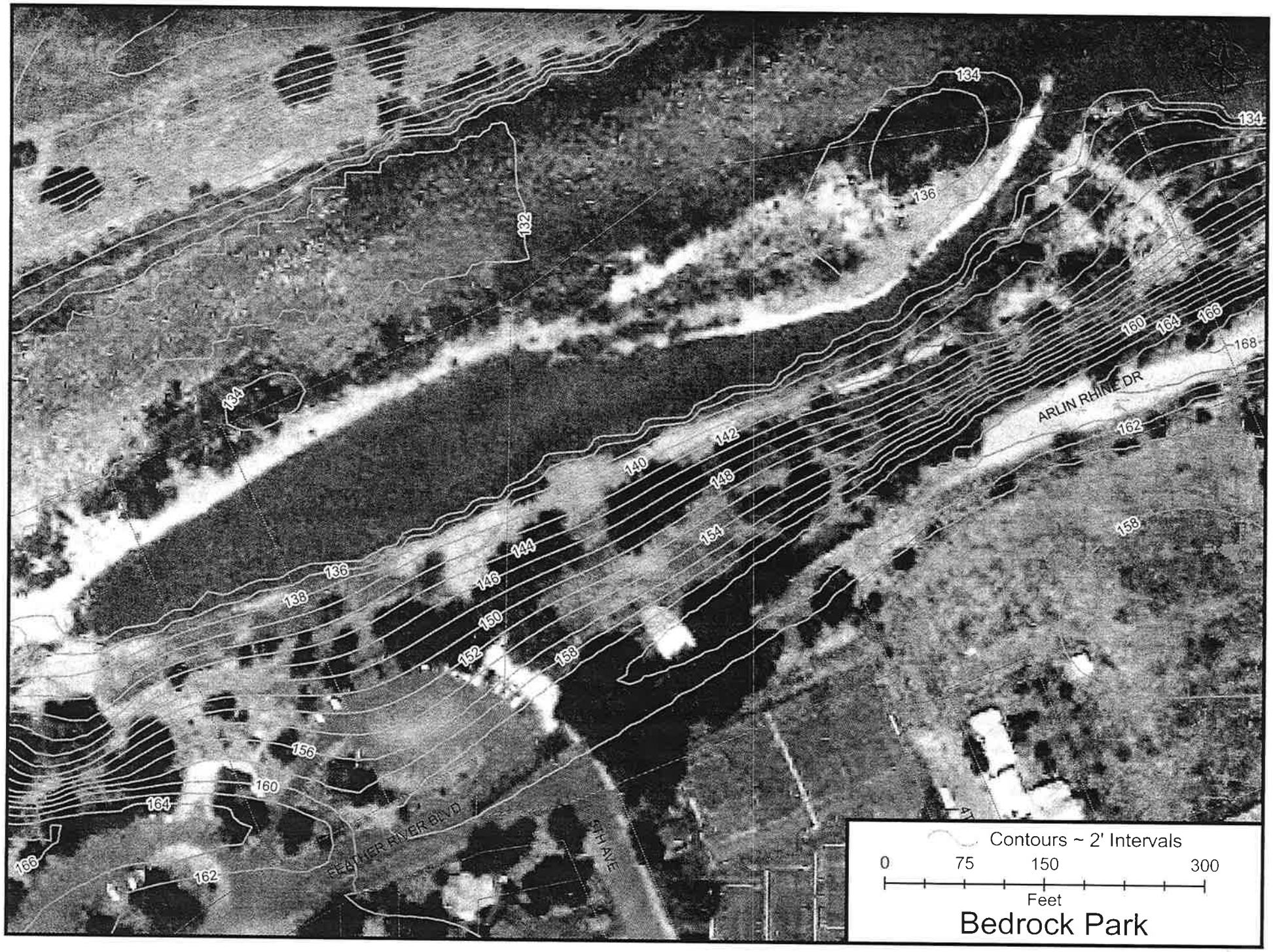
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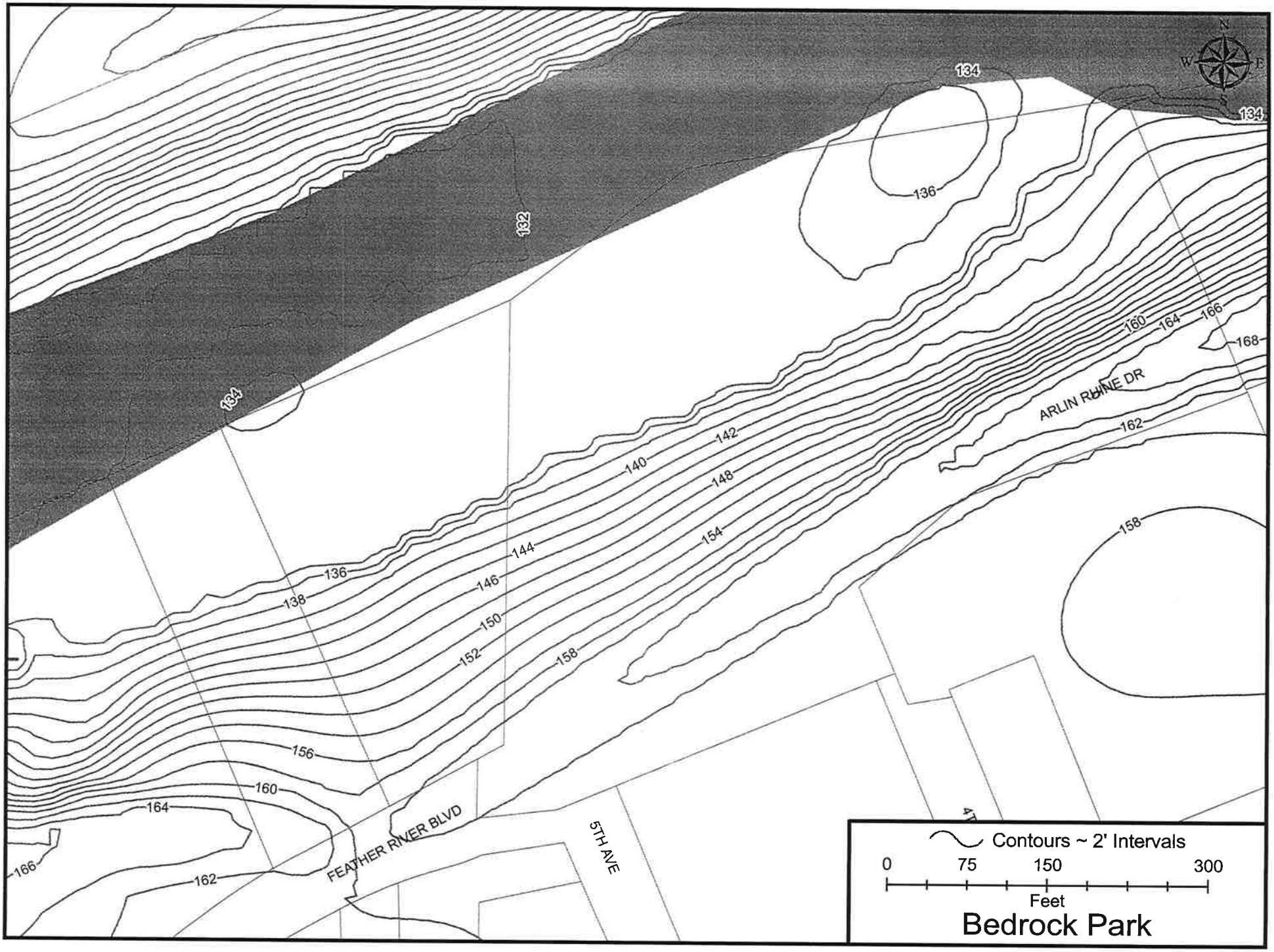
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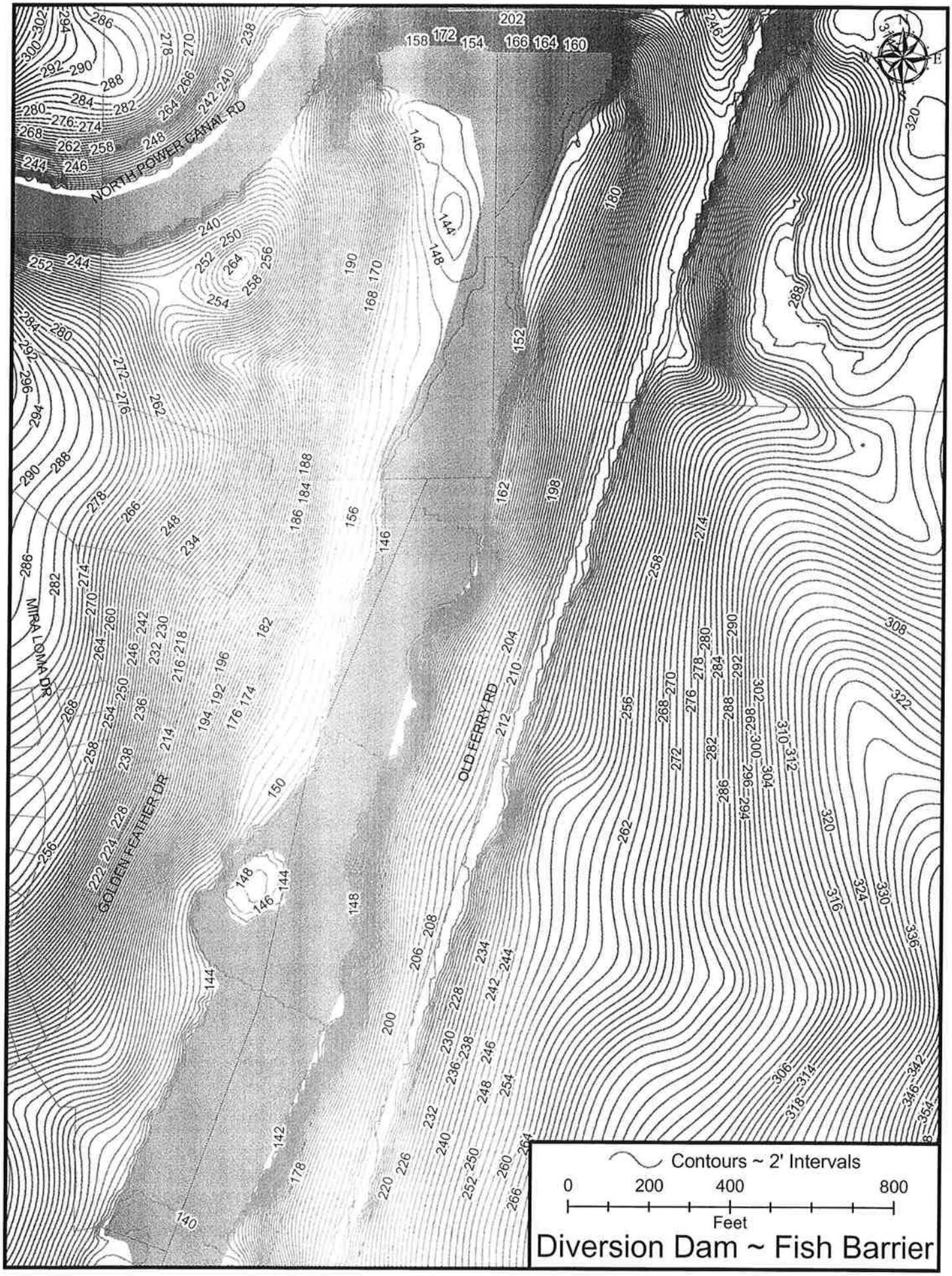
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