REC 4 WHITEWATER PLAY-SITE FEASIBILITY STUDY

1.0 EXECUTIVE SUMMARY

This study evaluates the feasibility or potential of developing whitewater boating play-sites (commonly referred to as whitewater parks (parks)) in the Big Creek study area. Two flow-augmented stream reaches in the Big Creek study area have been identified as locations, which could potentially be developed as whitewater parks. These reaches are the Portal tailrace into Huntington Lake, and the Big Creek No. 4 tailrace into Kerckhoff Reservoir. Each site was evaluated to determine if the physical characteristics (gradient, width, and length), hydrology and location at each stream reach were suitable for the development of the site as a whitewater park. This evaluation indicates that both sites have the potential to support a range of development, from minimal alteration up to fully developed whitewater parks. However, fully developed whitewater parks are usually sited in, or near urban areas.

This study also provides a general overview of whitewater parks and a summary of some of the recently developed parks within the country. The term “park” is used because whitewater boating activities are not associated with “running a river.” Instead, the focus is on “playing” at specific locations within a park where a hydraulic feature has been engineered and constructed within the stream channel to support various whitewater “play” or practice activities or maneuvers.

2.0 STUDY OBJECTIVES

Evaluate the potential to develop whitewater play-sites at specific Project locations.

3.0 STUDY IMPLEMENTATION

3.1 STUDY ELEMENTS COMPLETED

- Established criteria required to support whitewater play-sites.
- Using the established criteria, identified Project sites that have the potential for development of whitewater play-sites.
- At each site, determined structural improvements needed to develop site.
- Identified recreational activities that could potentially use the site and identified existing activities and/or resources that may be affected from the development of a whitewater play-site, including angling.

3.2 OUTSTANDING STUDY ELEMENTS

- Identify party(ies) responsible for funding and/or assuming liability for operations of the play-site.

- Determine feasibility and cost of constructing identified improvements.

4.0 STUDY METHODOLOGY

Potential whitewater park locations were identified through consultation with whitewater specialists including representatives from the USDA Forest Service (USDA-FS), San Joaquin Paddlers, American Whitewater Affiliation, Friends of the River, and other interested persons with whitewater boating experience. The sites selected for consideration were evaluated for their physical and hydrological characteristics which included determining the gradient length and width of the stream segment, and a review of historic hydrographic data.

A literature review was completed of publications and case studies on the development of whitewater parks at locations, across the nation. This included web-based research of a number of whitewater parks and organizations at the following websites:

- City of Reno - Whitewater Park at http://www.cityofreno.com/com_service/parks/kayak.html
- Whitewater Parks International - Planning, Design, Development, & Programming of WWParks, Commercial Rafting Facilities & Competition Courses for Freestyle & Slalom at http://www.whitewaterparks.com/
- Susquehanna Whitewater Park Alliance at http://www.swwparkalliance.com/
- Whitewater Parks Worldwide at http://www.whitewaterpark.canoe-kayak.org/whitewater_parks_worldwide.html
- MWPDC Home Page at http://www.whitewaterpark.canoe-kayak.org/
- Arkansas River Trust - Whitewater Park at http://www.arkrivertrust.org/proj_arkwwpark.htm

Whitewater specialists were consulted to identify any other projects and other locations that have been developed specifically as whitewater parks, and to identify experts with experience in the development of whitewater parks. Published data and case studies from other projects were utilized where available to determine the feasibility of developing a whitewater park. Existing literature and case studies of whitewater park development were reviewed, and consultation was conducted to identify if there are established criteria that can be applied when determining the feasibility of whitewater park development. A standardized or established set of criteria for the development of whitewater parks does not exist. Rather, each potential park location has unique physical and hydrological characteristics that must be evaluated independently when considering potential development as a whitewater park. Potential sites are evaluated independently with respect to general location, the degree of stream channel alteration that would be required, and the suitability of streambanks to support and anchor constructed features. Some sites may be remote, or so wide and steep, and/or require extensive streambank stabilization, that the cost of construction is unwarranted, or prohibitive.

Mr. Gary Lacy, an expert with experience in whitewater park development and construction, was consulted to assist in the feasibility analysis. Mr. Lacy is an internationally recognized expert in the design and construction of whitewater parks and has been involved in the design and construction of numerous parks throughout the United States. Consultations with Mr. Lacy where conducted on August 26, and September 2, 2004. Video footage of the Big Creek No. 4 tailrace and the Portal tailrace stream reaches were sent to Mr. Lacy for his review and use in this feasibility analysis. In addition, basic physical characteristics such as length, width, and gradient of each site were developed and provided to Mr. Lacy.

A general overview of the hydrological characteristics of the sites was also provided in the consultations. The hydrology for each site was evaluated by analyzing available 15-minute interval stream flow data collected from the two powerhouse tailraces. Four years of 15-minute flow data was available from the Big Creek No. 4 tailrace (2001 through 2004) and the Portal Powerhouse tailrace (2000 through 2003). The analysis of the hydrologic flow data was focused on the anticipated time frame when a water park would be most used. The time frame analyzed was for the hours between 10 AM to 4 PM and from 4 PM to 8 PM during the summer months of June, July, August and September. Exceedance tables and graphs of the flows within the tailrace reaches were developed from the hydrologic records during these time frames.

Factors which are normally considered in the evaluation of a potential site as a whitewater park include:

- Length of channel
- Width of channel
- General Hydrology
- Bank Structure
- Potential “design elements” for the site
- Location proximity and access to population center
- Construction considerations (access and borrow material)
- General cost to develop the site
- Support facility requirements for the site (parking, restrooms, etc.)
- Staffing requirements and responsibilities (time and expertise) for operation of the site

5.0 STUDY RESULTS

The study results are presented in two sections. The first section provides an overview of whitewater parks and includes a summary of existing parks recently developed within the country. The second section identifies and discusses the two locations within the Big Creek study area that were identified as potential locations for whitewater parks.

5.1 OVERVIEW OF WHITEWATER PARKS

Whitewater parks are gaining popularity and are being developed as components of urban riverfront redevelopment. Whitewater parks have been developed for a variety of reasons including providing convenient venues for whitewater competition and as recreation enhancement measures. Early parks were developed in the 1970s and 1980s. Table REC 4-1 provides a partial list of whitewater parks which have been developed in the country.

The term "park" is used because the whitewater activity is not associated with "running a river." Instead, the focus is on "playing" or practicing at specific locations where features have been engineered and constructed within the stream channel to create hydraulic features that support various whitewater maneuvers. These maneuvers include moves such as front and side surfing, cartwheeling, throwing ends, blunt moves, spoofing and splatting, flat spinning, loops, and front flips.

A park's main purpose is to provide easily accessible whitewater recreation within reasonable driving distance from population centers. Whitewater parks are used for a variety of activities including slalom racing and other river-based competitions, company outings, sports training, and boating instruction. In addition to recreational use, a site can also be used by search and rescue teams as a training facility for river rescue exercises.

A primary design consideration when developing a park is the safety of all potential users. Parks attempt to lower the level of hazard/risk by providing controlled access and egress features and locations. Parks are fairly accessible for rescue or emergency response personnel, and may even be supervised. A primary assumption in the design of a park is that as long as the park does not increase the pre-existing level of hazard there is no increase in liability. However, establishing that there has not been an increase in the level of hazard is a subjective determination. Therefore, it should be assumed that the developer of a park would assume some level of liability risk.

Several design considerations that are evaluated when determining the feasibility to develop a whitewater park are: 1) the proximity of the site to nearby urban centers; 2) access to the site; 3) other support services including parking, trash disposal and restroom facilities; and 4) physical characteristics of the stream channel including channel width and length, gradient, and hydrology. Another consideration is the number of hydraulic features that could be constructed in the stream channel. The overall length of a park would depend on the final design and the number of hydraulic structures that are incorporated into the design. Usually hydraulic features should be placed between 200 and 300 feet apart in the stream channel. This spacing is needed for safety purposes to allow 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.

A number of factors must be considered and evaluated when estimating the cost to develop a whitewater park. These factors include conceptual and engineering design, scoping, permitting, construction access, in-channel construction of hydraulic features, and support facilities (parking, restrooms, boater access trail, put-in and take-out, etc.), and maintenance responsibility. Engineering design costs will vary depending upon the physical characteristics of each site, such as the length or size of the proposed park, and the type of hydraulic features proposed for construction. Scoping costs may include public scoping meetings to introduce the proposed project, determine how the project will be constructed, and how it will be maintained and operated. Permitting costs will include permit applications preparatory for local, state and federal approvals for construction. The permits that may be needed include local use permits, streambed alteration permits, and use permits from federal agencies. The acquisition of these permits may involve an appropriate level of environmental review under the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). Construction access costs will be dependent upon site topography, access to the stream channel and the need to construct temporary access roads for construction equipment, if necessary. It is estimated that in-channel construction costs of hydraulic features may range from $15,000 to $30,000 per feature depending on the channel configuration, anchor points for structures, and the proximity of borrow material needed to build each structure. The cost for support facilities such as parking areas, restrooms, and boater access locations are dependent on the size of a proposed park, the location, and the anticipated level of use. All of these factors must be considered and included in the final cost considerations.

The length of time needed to construct a park is contingent on weather, flow conditions in the stream, the amount and complexity of required permitting, the number of proposed hydraulic features, and the ability to anchor structures in the stream channel. If the stream channel can be dewatered, construction time can be significantly reduced to periods of two to three days for a site with three to four hydraulic structures, provided that good anchor points are available and the material needed to construct the structures is available on or near the site.

5.2 POTENTIAL WHITEWATER PARKS IN THE BIG CREEK STUDY AREA

Two sites within the Big Creek study area were identified as having the potential to support the development of constructed whitewater features. These sites are the tailraces of the Big Creek 4 Powerhouse on the San Joaquin River upstream of Kerckhoff Reservoir and Portal Powerhouse on Rancheria Creek upstream of Huntington Lake. The initial selection of these two sites was based on an evaluation of the general character of the sites which included the width, length, gradient, and that they have dependable flow from powerhouses that is released into the stream channel. After initial selection, the sites were further evaluated to determine the feasibility of development as whitewater parks. From physical and hydrological perspectives, both sites have the potential to support whitewater parks. However, both sites are remote from the nearest sizable city. The Big Creek 4 Powerhouse is a 1 hour drive from Fresno and the Portal Powerhouse is about 1 hours and 45 minutes drive from Fresno. In addition, there is the potential for user conflicts between anglers and whitewater boaters at the Portal Powerhouse site. If the sites were to be fully developed parking and staging areas, restroom and trash disposal facilities would have to be developed at both sites. Management and ownership of the sites likely would be the responsibility of the USDA-FS, a concessionaire, a private developer, or any combination thereof. Management responsibilities would primarily be related to the maintenance of the restrooms and trash disposal facilities. SCE has no interest in owning, managing, or developing such a park. Each site is discussed in more detail below.

Big Creek No. 4 Powerhouse Tailrace

The Big Creek No. 4 Powerhouse Tailrace is located on the western slope of the Sierra Nevada foothills at an elevation of about 1,000 feet above mean sea level (msl) in a steep walled canyon. The tailrace channel has an average width of about 79 feet, is approximately 1,000 to 1,200 feet in length, and has an estimated gradient of approximately 50 feet per mile. These physical characteristics could support the design and construction of a whitewater park. However, the depth and location of the mainstem San Joaquin River at this location could make construction of features difficult and expensive.

The overall length of a park would depend on the final design and the number of hydraulic structures that would be incorporated into the design. Based on a stream length of 1,000 feet and a 200 to 300 feet spacing between hydraulic features, the Big Creek No. 4 tailrace channel could support approximately three or four hydraulic features.

A review of hydrology (15-minute flow data) of the Big Creek No. 4 tailrace from 2001 to 2004 indicate that flows ranged from 3,684 to 0 cfs. The exceedance values for flows in the Big Creek No. 4 tailrace for the summer months of June, July, August and September for the timeframes from 10 AM to 4 PM, and from 4 PM to 8 PM are shown graphically in Figures REC 4-1 and REC 4-2, respectively, and summarized in Table REC 4-2. For the four summer months evaluated, the 50% exceedance flows ranged from 3,535 cfs to 2,894 cfs between 10 AM and 4 PM, and from 3,325 cfs to 2,913 cfs between 4 PM and 8 PM, respectively. Based on a review of the exceedance analysis, the flows in the Big Creek No. 4 tailrace during the four summer months between the hours of 10 AM and 8 PM are generally above 2,500 cfs approximately 60% of the time.

The geography of the site should allow for the development of a park. The high rock wall banks along the channel are favorable in that they provide good anchor material for hydraulic features. The channel width and length of the reach is considered good. A quarry site to provide rock for construction would have to be developed, or rock would have to be brought in from outside sources.

The topography at the Big Creek No. 4 tailrace would limit access to the channel by heavy construction equipment. The high streambanks are primarily comprised of bedrock and the channel is steeply incised along this stream reach. There are no access roads along the banks of the tailrace reach from which construction of instream hydraulic features could take place. Due to the steep topography, construction of a park at this location using heavy construction equipment may require the construction of access points into the stream channel or the construction of an access road along the length of the tailrace reach from which construction equipment could work. While the bedrock channel is good anchor material, the construction access requirements may result in extensive and permanent streambank alteration. Alternatively, construction in this reach could employ methods not dependent on heavy equipment, but rather using portable equipment, which may minimize construction access requirements and permanent streambank alteration.

Current access to the tailrace reach is through a locked gate located at the intersection of County Road 235 and the SCE road leading to Big Creek Powerhouse No. 4. Potential boaters would have to park at the gate and hike approximately 0.25 mile down the powerhouse road to access the stream channel. Potential users may also access the site by paddling upriver from Kerckhoff Reservoir to the park location.

There is very little existing recreational use at the site or in the immediate area and it is anticipated that the potential for user conflict is low. The site is located at a remote area and therefore most of the site use is expected to occur on weekends. Use could increase to both weekday and weekend use during the summer. As the site is at a low elevation (approximately 1,000 feet) and the powerhouse produces fairly dependable year round flows, use of a park at this location could occur year round.

Portal Powerplant Tailrace

The Portal Powerhouse tailrace is near Huntington Lake in the Sierra Nevada at an elevation of approximately 7,000 feet above msl. The tailrace channel below the Portal Powerhouse has an average width of about 37 feet, is approximately 800 feet in length, and has an estimated gradient of approximately 50 feet per mile. These physical characteristics could support the design and construction of a whitewater park.

The overall length of a park would depend on the final design and the number of hydraulic structures that would be incorporated into the design. Based on a stream length of 800 feet and a 200 to 300 feet spacing between hydraulic features, the Big Creek No. 4 tailrace channel could support approximately two to three hydraulic features

A review of hydrology (15-minute flow data) of the Portal Powerhouse tailrace from 2000 to 2003 indicates that flows ranged from 2,003 to 0 cfs. The exceedance values for flows in the Portal Powerhouse tailrace for the summer months of June, July, August and September for the timeframes from 10 AM to 4 PM, and from 4 PM to 8 PM are shown graphically in Figures REC 4-3 and REC 4-4, respectively, and summarized in Table REC 4-3. For the four summer months evaluated, the 50% exceedance flows ranged from 1,172 cfs to 576 cfs and from 1,168 cfs to 564 cfs between 4 PM to 8 PM, respectively. Based on a review of the exceedance analysis, the flows in the Portal Powerhouse tailrace during the four summer months between the hours of 10 AM and 8 PM are generally above 500 cfs approximately 60% of the time.

Construction of a park or play feature at the tailrace may be feasible. The tailrace channel is manmade and the high banks are good for construction but due to the manmade construction of the channel, anchor material for hydraulic features may be questionable. The channel width is good and there appears to be ample rock availability.

Construction access along the tailrace reach is good because Kaiser Pass Road parallels the alignment of the channel on the right bank and access from the left bank is also feasible. The Eastwood Visitor's center is located next to the channel and could provide parking and toilet facilities for potential users.

The site is adjacent to Huntington Lake, which is a prime vacation destination location, with several resorts and summer camps close by the site, and has good surrounding support facilities, but is not near a large population center. There is a high level of existing recreational use at the site during the spring, summer and fall. The primary existing recreational use along the tailrace channel is angling. User conflicts between angling and whitewater would likely occur. Such conflicts would have to be acknowledged and addressed to determine a practical means to combine whitewater feature enhancement while maintaining fisheries resources and habitat.

The site would be inaccessible during the winter due to snow conditions. Most of the use of a whitewater park at this location would be anticipated to occur during the summer and on weekends.

TABLES

Table REC 4-1. Summary of Whitewater Parks Developed within the United States

- Lock 32 - Rochester, New York www.geneseewaterways.com/facil.htm
- Wausau, Wisconsin www.wausauwhitewater.org
- East Race - South Bend, Indiana www.pages.ripco.net/~jwn/southbend.html
- Dickerson, Maryland www.ccadc.org/bce/dickerson
- Clear Creek - Golden, Colorado www.cityofgolden.net/rentals/whitewater/whitewater.htm
- Boulder, Colorado
- Steamboat Springs, Colorado
- Durango, Colorado
- Confluence Park, Colorado www.denver.citysearch.com/profile?id=1822858
- Ogden, Utah www.cc.usu.edu/~uwc/tripsnpics/ogdenww/ogden.html
- Ocoee River, Tennessee
- Salida, Colorado www.arkrivertrust.org
- Williamston, Michigan www.depwh02.mw.mediaone.net/ecarlson54/williamston.html>
- Peduka, Kentucky www.wky.thinkwestkentucky.com/ecotourism/whitewater/report/?N=D
- City of Reno - Whitewater Park http://www.cityofreno.com/com_service/parks/kayak.html

Table REC 4-2
Big Creek No. 4 Tailrace - Flow Exceedances
15-minute flow data, Water Years 2001-2004

Time Frame: 10am to 4pm

Percent	Flow (cfs)			
Exceedance	June	July	August	September
0	3684	3627	3602	3681
5	3643	3569	3552	3549
10	3631	3552	3527	3375
15	3622	3531	3263	3335
20	3616	3457	3245	3247
25	3611	3269	3236	3221
30	3604	3240	3213	3033
35	3598	3221	3089	3021
40	3579	3195	3019	3004
45	3556	3154	3011	2912
50	3535	3127	3005	2894
55	3458	3024	2946	2878
60	3354	3010	2933	1665
65	3275	2995	2920	505
70	3256	2641	2900	291
75	3116	1612	2863	282
80	3008	491	1199	278
85	2745	289	485	262
90	2689	277	286	62
95	1639	166	276	8
100	62	7	34	-2
Average	3207	695	2517	1988
Max	3684	3627	3602	3681
Min	62	7	34	-2

Time Frame: 4pm to 8pm

Percent	Flow (cfs)			
Exceedance	June	July	August	September
0	3671	3647	3662	3663
5	3639	3573	3558	3560
10	3628	3558	3543	3515
15	3622	3545	3494	3362
20	3615	3528	3268	3333
25	3609	3443	3247	3253
30	3604	3286	3237	3231
35	3598	3252	3169	3078
40	3584	3242	3028	3025
45	3562	3225	3020	3013
50	3525	3196	3011	2913
55	3378	3154	3007	2900
60	3324	3136	2998	2893
65	3271	3030	2942	2875
70	3176	3019	2928	1888
75	3112	3009	2914	504
80	3015	2996	2889	301
85	2859	2515	2009	282
90	2701	504	494	264
95	1823	285	288	52
100	302	0	60	0
Average	3231	2881	2755	2305
Max	3671	3647	3662	3663
Min	302	0	60	0

Table REC 4-3
Portal Tailrace - Flow Exceedances
15-minute flow data, Water Years 2000-2003

Time Frame: 10am to 4pm

Percent	Flow (cfs)			
Exceedance	June	July	August	September
0	1777	1497	1491	2003
5	1755	1251	1079	1018
10	1743	1213	991	834
15	1726	1192	970	739
20	1672	1135	946	710
25	1597	1083	936	704
30	1466	1002	900	699
35	1341	915	875	693
40	1292	905	829	665
45	1224	865	791	639
50	1172	804	733	578
55	1141	768	719	524
60	1077	716	715	498
65	995	668	711	481
70	879	580	709	434
75	720	548	704	387
80	710	507	692	225
85	698	430	640	142
90	656	375	558	3
95	531	329	161	2
100	0	0	5	-2000
Average	1170	803	768	496
Max	1777	1497	1491	2003
Min	0	0	5	-2000

Time Frame: 4pm to 8pm

Percent	Flow (cfs)			
Exceedance	June	July	August	September
0	1802	1496	1491	1064
5	1758	1251	1061	1020
10	1739	1213	991	853
15	1720	1196	973	751
20	1656	1136	946	717
25	1538	1087	930	706
30	1473	1037	896	702
35	1338	942	870	698
40	1293	909	809	679
45	1216	886	786	632
50	1168	827	726	564
55	1120	770	717	508
60	1076	719	713	492
65	968	694	711	478
70	885	632	708	423
75	731	559	704	228
80	715	510	683	201
85	703	477	640	103
90	644	379	565	3
95	531	373	162	1
100	0	26	5	-2000
Average	1165	820	764	498
Max	1802	1496	1491	1064
Min	0	26	5	-2000

FIGURES

Figure REC 4-1
Big Creek No. 4 Tailrace - Flow Exceedances
15-minute flow data between 10AM to 4PM during June, July, August and September
Water Years 2001-2004

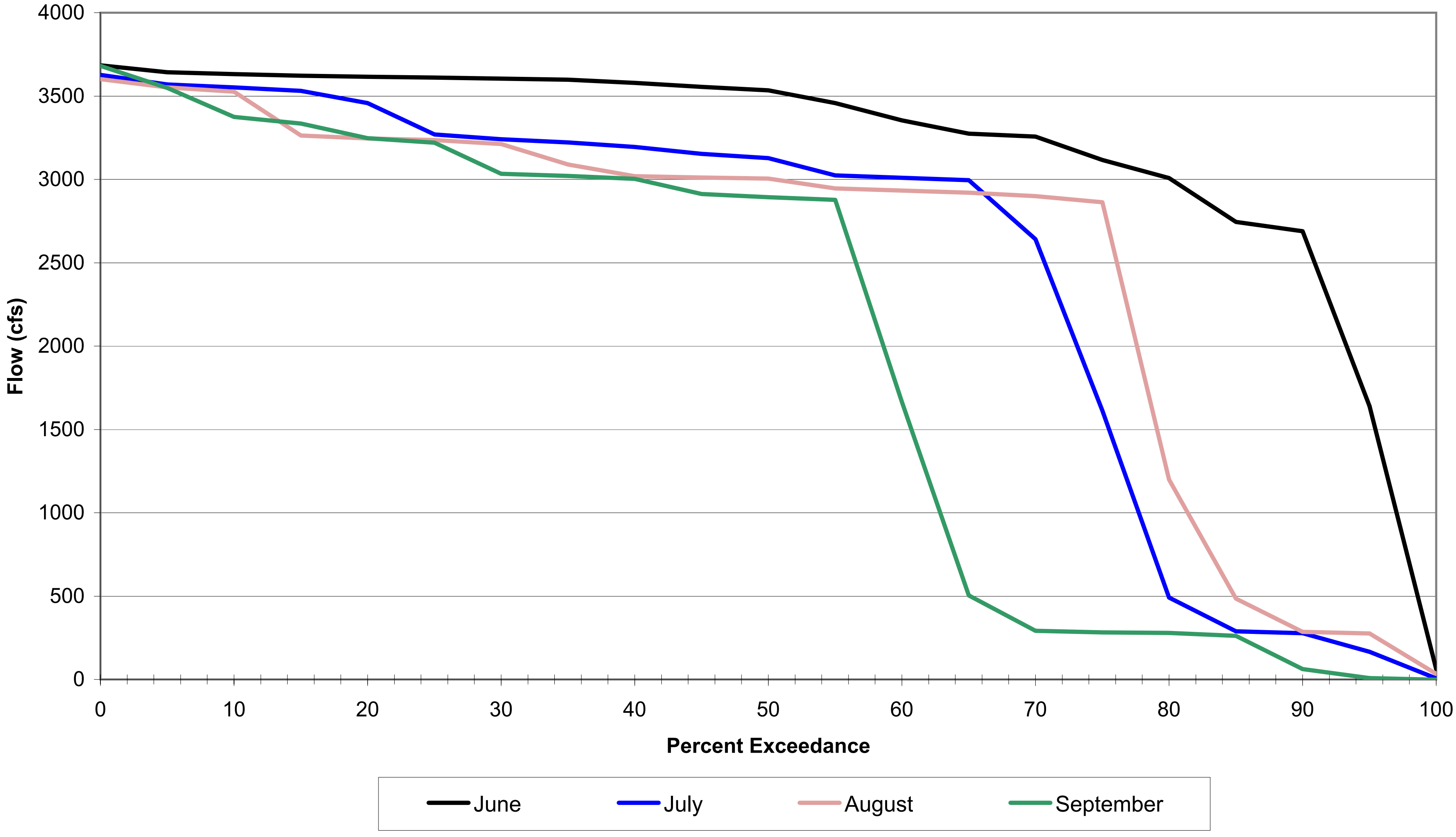

Figure REC 4-2
Big Creek No. 4 Tailrace - Flow Exceedances
15-minute flow data between 4PM to 8PM during June, July, August and September
Water Years 2001-2004

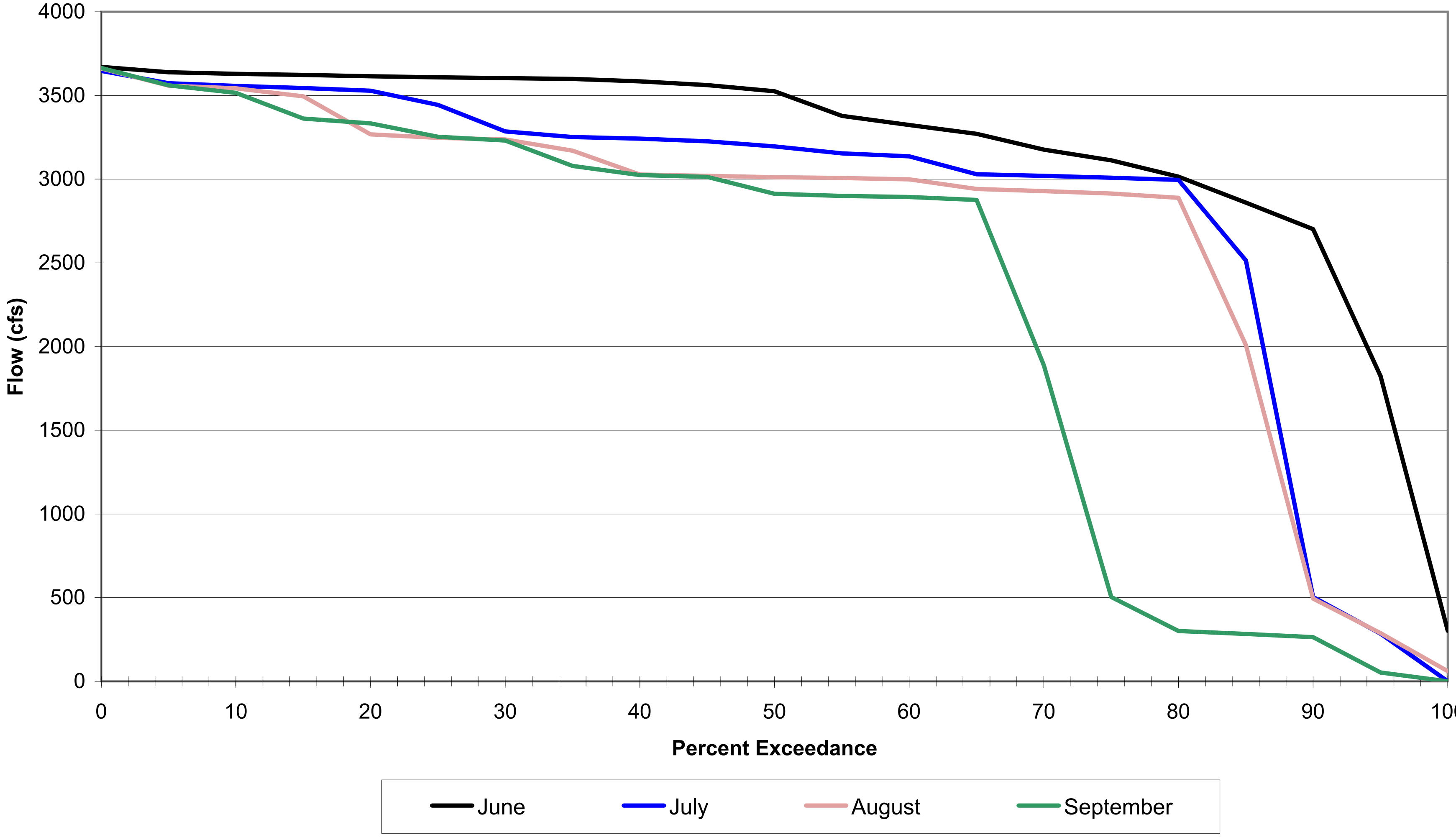

Figure REC 4-3
Portal Tailrace - Flow Exceedances
15-minute flow data between 10AM to 4PM during June, July, August and September
Water Years 2000-2003

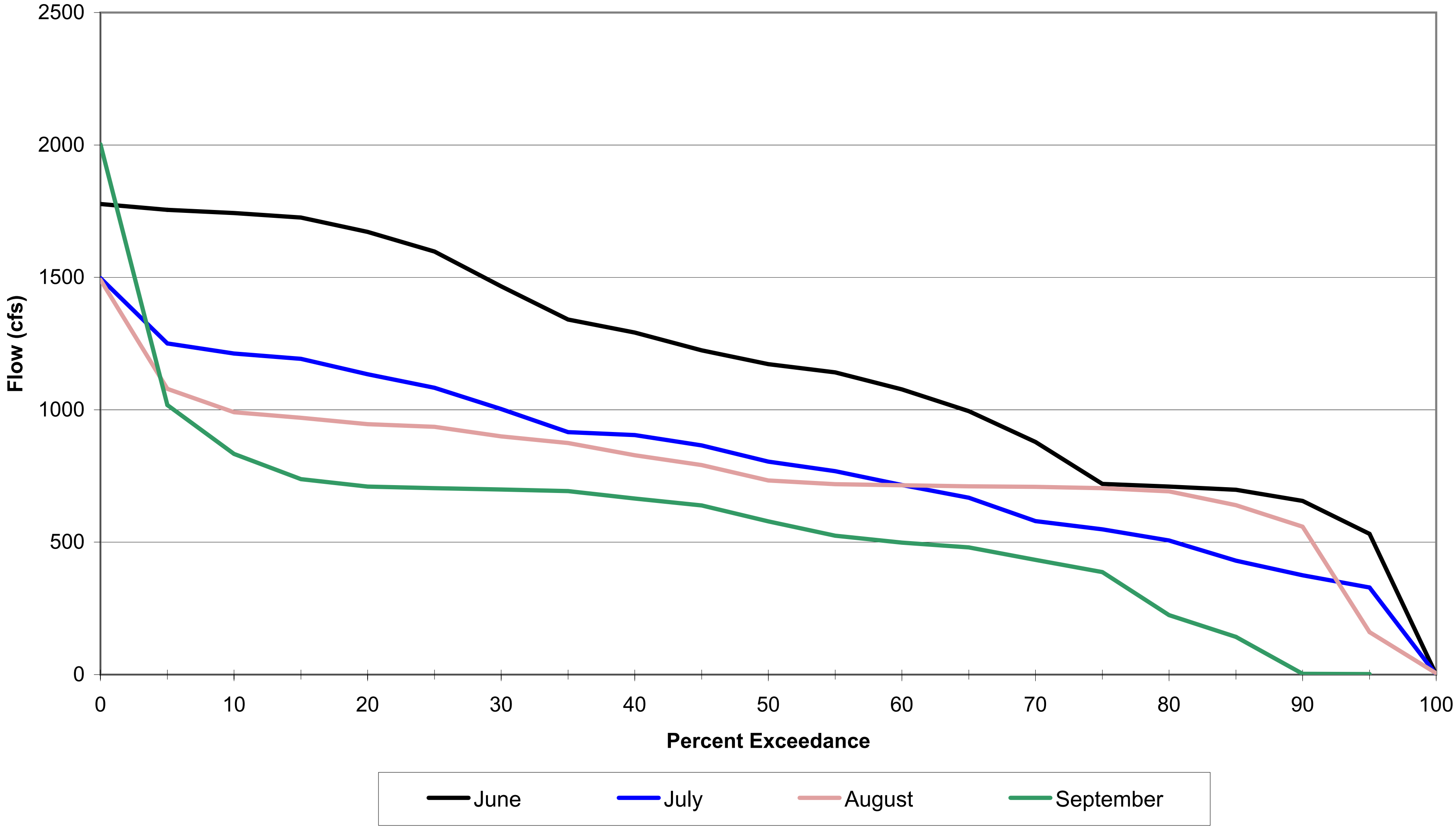

Figure REC 4-4
Portal Tailrace - Flow Exceedances
15-minute flow data between 4PM to 8PM during June, July, August and September
Water Years 2000-2003