Eagle County Fairgrounds

Whitewater Park

Site Evaluation

Prepared by:

McLaughlin Whitewater design group

December 2005

McLaughlin Whitewater
design group

December 14, 2005

Eagle Board of County Commissioners
Eagle County
P.O. Box 850
Eagle, Colorado 81631-0850

RE: SITING EVALUATION FOR A WHITEWATER PARK

Commissioners:

We have completed our identification of sites for whitewater features on the Eagle River adjacent to the Eagle County Fairgrounds. A number of good sites were found during the course of this study. While this effort was intended to identify locations for a whitewater park, it can also be used for long-term planning, if multiple projects or whitewater improvements are ultimately desired.

We have identified four sites that could support a range of whitewater park options. Two of the sites could readily provide for courses of a world-class caliber. In addition, individual features at various locations could provide a series of whitewater attractions throughout the Eagle County Fairgrounds Reach.

Following is a summary of our analysis, findings, and supporting figures.

Very truly yours,
McLaughlin Whitewater Design Group

Richard E. McLaughlin, P.E.

Jay Kincaid

2300 15th Street, Suite 220 • Denver, Colorado 80202
T 303.964.3333 F 303.964.3355 • www.mclaughlinwhitewater.com

TABLE OF CONTENTS

I. BACKGROUND

Eagle County is interested in developing a whitewater park on the Eagle River in a reach extending about 1.5 miles adjacent to the Eagle County Fairgrounds. To investigate this further, the County has commissioned this site investigation to determine locations within the reach that are suitable for a whitewater park or whitewater features.

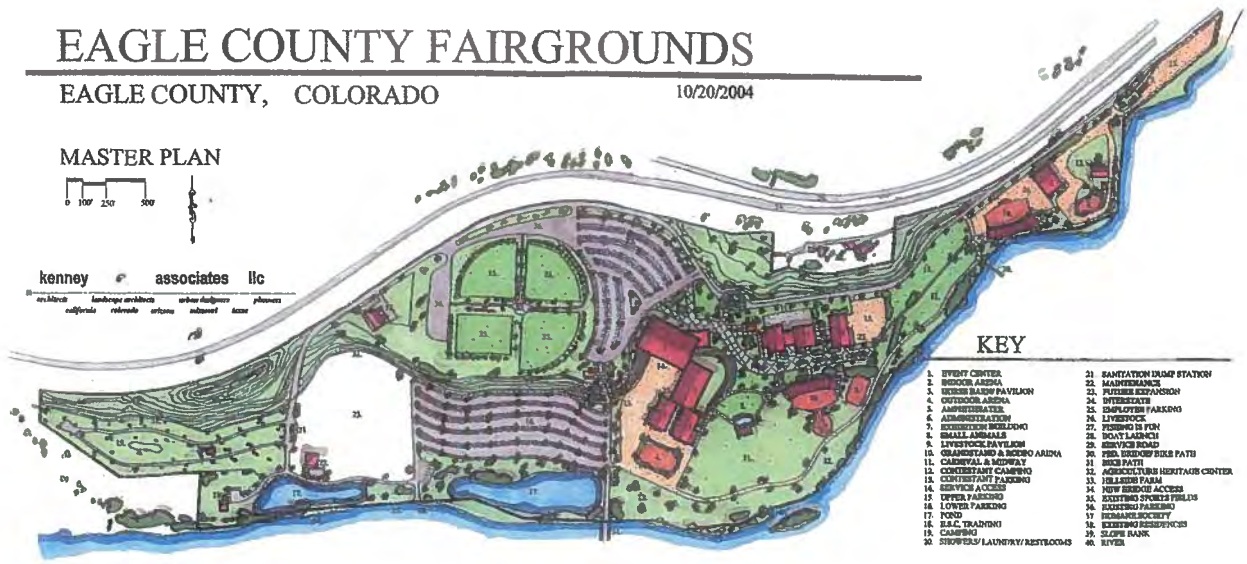


Figure 1. The Current Masterplan for the Eagle County Fairgrounds

Approach

Several field investigations, review of available information, and an evaluation of river characteristics were conducted to identify and evaluate potential sites for a whitewater park within the "Eagle County Fairgrounds Reach" shown on Figure 1.

Site Factors

The quality and costs of man-made whitewater parks can vary substantially. Three "site" factors that impact the quality of a whitewater park and related costs are:

1. Available Flow - measured in cubic feet per second (cfs)
2. Hydraulic Drop - available fall or drop in the water surface across a site (feet)
3. Access - for boaters, spectators, and parking.

These site factors are described and evaluated later in this report. The quality of these site factors determines the overall potential of the site. However, with a given potential, various qualities of whitewater parks and recreational experiences are possible based upon design and funding. The site factors of available flow and hydraulic drop relate to the performance of the whitewater "course", while access is a measure of the convenience of the surrounding "park" to

"course" users. The quality of recreational experiences and the related whitewater park can be rated or ranked in various manners. For this site investigation study, we will rank them as:

1. Local Merit
2. Regional Merit
3. National Merit

Local Merit. A whitewater park of local merit would be used by local residents, providing convenient boating, but not of a caliber to routinely draw recreational boaters from distant populated areas such as Denver.

Regional Merit. A whitewater park of regional significance would attract recreational users from the Front Range and Grand Junction, as well as nearby states. It could also host national-level events if aggressively promoted and sponsored, such as the Teva Games in Vail, but would not necessarily have world-class hydraulic features.

Figure 2. Whitewater Park in Vail

National Merit. A nationally significant whitewater park would provide a high level whitewater course consisting of recreational and competitive features that would routinely draw users from across the nation. It would be known nationally for reliably providing a high quality experience and would easily attract national competitions. Note that national and international whitewater events are awarded by sports governing bodies to the most deserving whitewater sites after review of several competing proposals.

> *Sites that can support a whitewater park of regional or national merit are considered in this site evaluation.*

Course and Park Users

Users of whitewater parks include kayakers, rafters, and almost as importantly - spectators. Some successful parks have been noted to draw more spectators or land-based recreationalists than actual in-river users. Access for both in-river and land-based recreationalists are considered in this siting study.

This reach is navigated by kayakers, rafters, and other types of whitewater craft. Therefore this site evaluation focuses on these uses, and not non-whitewater craft. There are a number of different types of whitewater enthusiasts. The sport of freestyle kayaking involves performing various maneuvers or "tricks" at a specific hole or wave feature. Slalom kayaking or canoeing, on the other hand, is an Olympic sport and involves navigation of kayaks and canoes through a series of gates which are suspended over the river. A course in this reach would support freestyle kayaking and could potentially host slalom, provided that it is appropriately designed and the selected site has adequate length. If the County proceeds with development of one of the sites, stakeholder input would help the designers provide the type of features conducive to the intended user groups. However, a high-quality whitewater park site that supports a wide variety of users can be identified and evaluated based upon the existing site characteristics.

In addition to the site characteristics listed above, good design, construction, and promotion are critical to yield high quality whitewater parks. The emphasis of this evaluation is on the potential of sites to develop the three site factors conducive to a great whitewater park – flow, hydraulic drop, and access. This site investigation also considers other issues specific to this reach of the Eagle River. These issues include land ownership and the planned improvements to the County's Neilson Pump Line Diversion.

Reviewed Documentation

To evaluate potential sites within this reach, various available documents and data regarding this reach and its environs were collected and reviewed. These included:

1. The Floodplain Information Report (FIR), August 22, 2003.
2. The HEC-RAS hydraulic model used in the FIR
3. 1998 aerial photography
4. Updated 2003 aerial photography
5. Field surveys by County and MWDG staff
6. Flow data from three USGS gage stations
7. A proposed diversion replacement plan for the Nielson Pump Line Ditch Diversion Structure.

In addition to these documents, several field observations were conducted by the McLaughlin Whitewater Design Group (MWDG) personnel, including World Freestyle Champion, Jay Kincaid. Hydraulic drop at various existing rapids and riffles were surveyed by County and MWDG staff on November 2, 2005.

II. ANALYSIS

The Eagle County Fairgrounds reach has an average gradient of about 0.9 percent with several steeper man-made drops located at two irrigation diversions. This reach of the Eagle River is generally incised with a single-thread having an alluvial bed composed of gravels, rounded cobbles, and small boulders. This reach is comprised of long uniform sections, small riffles, and intermediate pools. From a whitewater perspective, the riffles are relatively wide and lack the depth, velocities, and focused currents that are typical on steeper whitewater streams. The upper portion of the reach just below the County's Neilson Pump Line Ditch Diversion appears to be the only portion of the river that is not in its native channel. During the construction of I-70, the river was relocated to its present channel. This portion of the Eagle River channel appears to be somewhat unstable in that the existing gradient is steeper than shown in the previous floodplain study and subsidence in the adjacent overbank area is evident.

Hydrology

A review of the hydrology was made to evaluate the available flow. Flood hydrology is available from the recent Floodplain Information Report. The reported 10-year and 100-year flood flows are 4,530 cfs and 7,060 cfs respectively. While these flow rates are important for future design efforts, flow rates of interest in the planning of a whitewater park relate to the average daily or monthly flow rates that occur during the intended period of use. For boating in the Eagle area, the spring, summer, and fall are the seasons of primary boating interest. Because there are no major tributaries that enter the Eagle River within this reach, the hydrology is assumed to be relatively consistent for the study area.

The USGS operates and maintains a network of stream gages throughout the United States. Unfortunately there is no operating gage near this reach. There was a stream gage at Eagle but it only operated prior to 1924. The nearest upstream gage is in Avon and the nearest downstream gage is in Gypsum, with the Gypsum gage having a much longer period of operation. For the purposes of this site investigation, the average monthly flows between the gages were weighted according the drainage areas. This weighted average was then plotted on the following Figure 4.

County	Location	USGS Designation	Years of Operation	Drainage Area in square Miles
Eagle County, Colorado	At Eagle	09067500	1911- 1924	629
Eagle County, Colorado	Below Gypsum	09070000	1946-2004	944
Eagle County, Colorado	At Avon	09067020	1988 -1999	402

Figure 3. USGS Gage Stations on the Eagle River In the Vicinity of the Town of Eagle

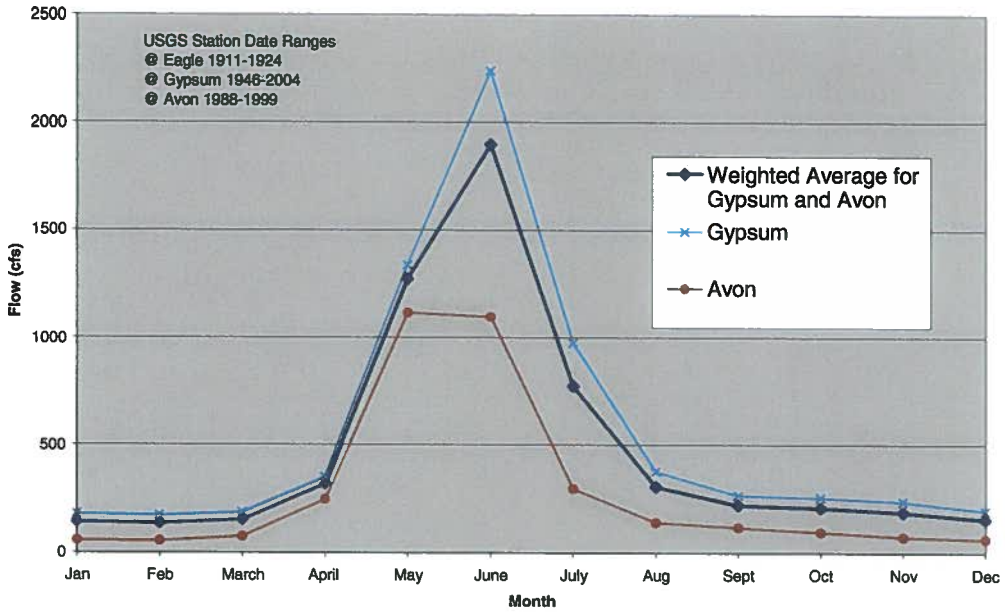


Figure 4. Monthly Median Stream Flow Data – Eagle River From the USGS Gages at Avon and Gypsum Colorado

Median flows during the spring, summer and fall indicate that this reach is quite suitable for a high quality, seasonal whitewater park. Given adequate hydraulic drop, and access (discussed below), design of a whitewater park of national significance is possible within this reach.

Hydraulic Drop

The second site factor outlined in the approach described above is hydraulic drop. This is the difference in the elevation of the water surface downstream of a particular site subtracted from the elevation of the water surface at the upstream end. In other words it is the vertical distance that the water drops or "falls" in that reach of the river, and is measured in feet. The hydraulic drop is a critical component in the performance of a whitewater course. The hydraulic drop multiplied by the flow rate correlates to the power of the river and resulting excitement of the course.

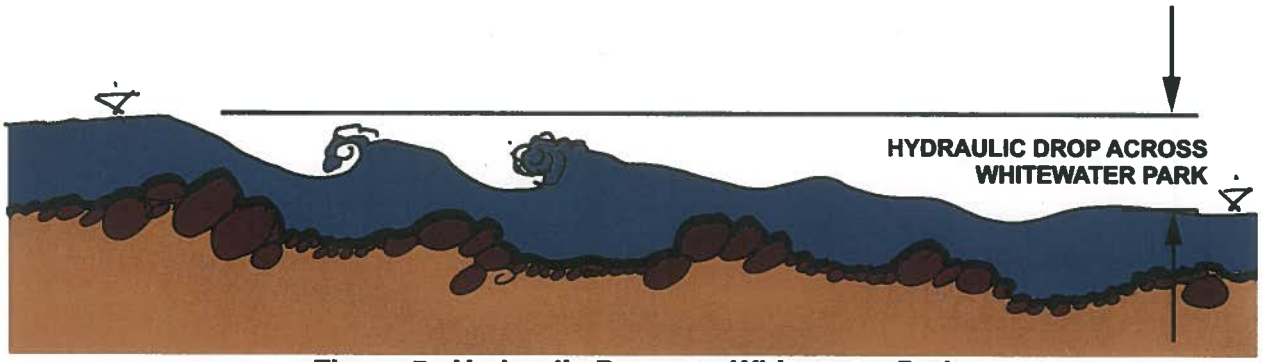


Figure 5. Hydraulic Drop at a Whitewater Park

While the flow throughout this reach remains the same for any potential site, the concentration of hydraulic drop, or gradient varies throughout the study reach. Therefore, the primary focus of this siting study is to identify sites where adequate hydraulic drop exists, or where it can be reasonably developed and concentrated.

Because of the local geology and alluvial nature of this reach of the Eagle River, large natural rapids, i.e. areas of concentrated natural hydraulic drop, are not present. (Two man-made rapids exist within this reach but were created by construction of other projects.) There are two approaches to developing hydraulic drop in this reach for a whitewater course.

The first is to use existing hydraulic drop that is naturally occurring – in a riffle, or that occurs at an existing structure – such as a diversion.

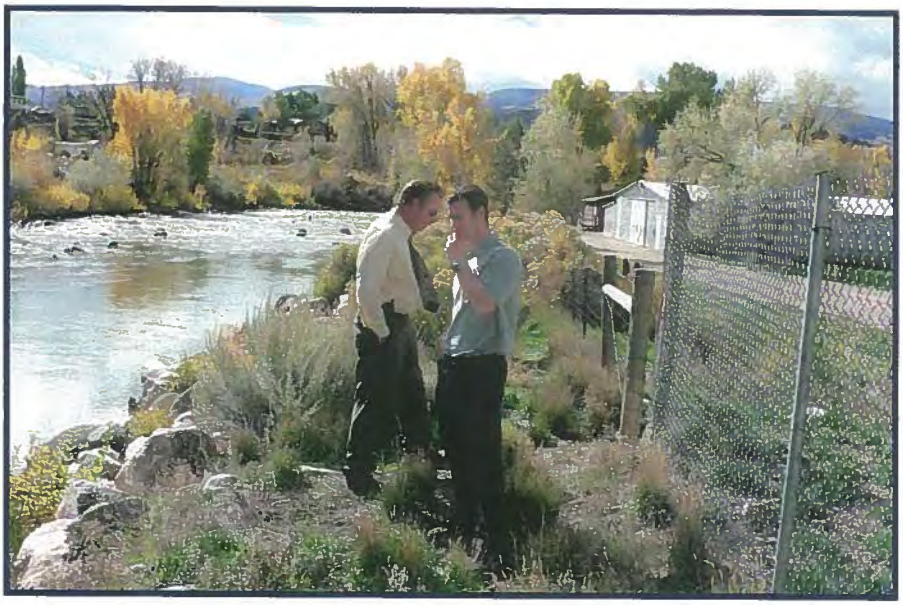


Figure 6. Floodplain impacts need to be addressed carefully. The finished floor of this building (background) is only 3.5 feet above the river (at low flow).

The second method is to create drop and mitigate any floodplain issues. A man-made whitewater park that creates adequate hydraulic drop could conceivably be placed anywhere within this reach. Functionally, such a course would create adequate hydraulic drop by "backing up" the river just as accomplished by the two diversion dams within this reach. Such structures however, can increase the upstream floodplain elevations and can cause aggradation (raising) of the streambed. This aggradation can cause additional increases in floodplain elevations and deposition in whitewater features, rendering them less effective. Practical considerations regarding floodplain related impacts to upstream and adjacent properties need to be made. Additionally, floodplain regulatory issues are also a consideration in developing hydraulic drop. If proposed improvements elevate the floodplain but do not cause any harm, significant regulatory hurdles still need to be crossed. As a result of the difficulties in creating hydraulic drop at a site, the first method of using the existing hydraulic drop within a site is preferred.

Figure 7. Hydraulic at Existing Riffle can be used by concentrating the drop (and flow) at one larger feature.

This site investigation focused on evaluating the existing hydraulic drop that occurs at potential whitewater park sites. The amount of drop that has been used to create whitewater parks has varied dramatically. Recent parks in Colorado such as the ones at Steamboat and Gunnison have been created with four to five feet of drop. Other courses have been created with drops up to 30 feet, such as the Ocoee Whitewater Course used for the 1996 Olympics. For this site evaluation, hydraulic drops in excess of four feet are considered.

Access

The third site factor that is considered in this site evaluation of a whitewater park study is access. There are a number of types of access including:

- Parking for boaters and spectators
- Ingress and egress access to where the boater can enter ("put-in") and exit ("take out off") the river or visually evaluate the course prior to use.
- A portage route. A way to carry around the course for those who do not wish to run it. A trail for boaters to return to the upstream put-in so that they can run the whitewater course again.
- Access along one or both of the banks adjacent to the whitewater course so that boaters can exit the course if needed.
- Access for viewing of the course and its users by spectators, and judges if the course is used for competitions.
- Construction access and staging

If other site factors such as hydraulic drop and flow are nearly equal, access and compatibility with surrounding land uses could be a deciding factor.

Parking, ingress/egress, viewing, and construction access within this reach are primarily provided from the Eagle County Fairgrounds (north) side of the river. Based upon a review of land ownership by County Staff, the south side of the river (and river bed) is privately owned. Furthermore, the topography along much of the southern bank is steep and less favorable than the more open and accessible northern bank. Future or site specific improvements along the south bank could enhance a particular site; however, improvements would more than likely be secondary to the access provided by the fairgrounds. The fairgrounds provide opportunities for excellent parking, ingress/egress, and viewing. The eastern portions of the fairgrounds reach are developed with nearby vehicular access and parking. The western portions of the site are undeveloped and all types of access could be incorporated into the existing masterplan. Considering the size, recreational nature, and adjacent location of the fairgrounds, access along this reach is very good for a whitewater park. Evaluation of access and parking related to other uses of the fairgrounds may need to be completed if a site is selected or if particular concerns arise in the site selection process.

III. IDENTIFIED SITES

There were four sites identified along the County Fairgrounds reach which exhibit sufficient hydraulic drop for development of a whitewater park. These sites are shown on the attached drawings numbered 1 through 5. These sites are each described below. The referenced centerline river stationing shown on the drawings was obtained from the Floodplain Information Report.

Site 1. Station 844+00 to Station 851+00

This 700 foot-long site is at the most upstream portion of the reach. As shown on Drawing Number 2, and on Drawing Number 5 (the hydraulic profile), it begins at the existing Neilson Pump Line Diversion and continues downstream through an existing rapid. The hydraulic drop at the site is derived from the existing diversion and the existing rapid. This rapid is known by some local boaters as Rodeo Rapid.

The diversion must maintain an upstream water surface elevation sufficient to divert flow into the existing intake pipe. The diversion formerly consisted of two loose (non-grouted) boulder drops. The lower drop is no longer in existence, but is reported by County staff to have been located approximately 100 feet downstream of the existing drop. Portions of the remaining existing boulder drop have partially failed, leaving the upstream water surface elevation below what is needed to divert flow into the intake pipe at low river flows. The County is planning on replacing the diversion drop structures and it is evident that an integrated project that improves the existing diversion and creates a whitewater park may be advantageous. These types of projects which include a utilitarian function, such as the diversion, and a recreational whitewater course are called multi-use. Multi-use whitewater/diversion projects have been constructed and successfully operated for over 30 years, with the first one in the United States being Confluence Park in Denver, Colorado.

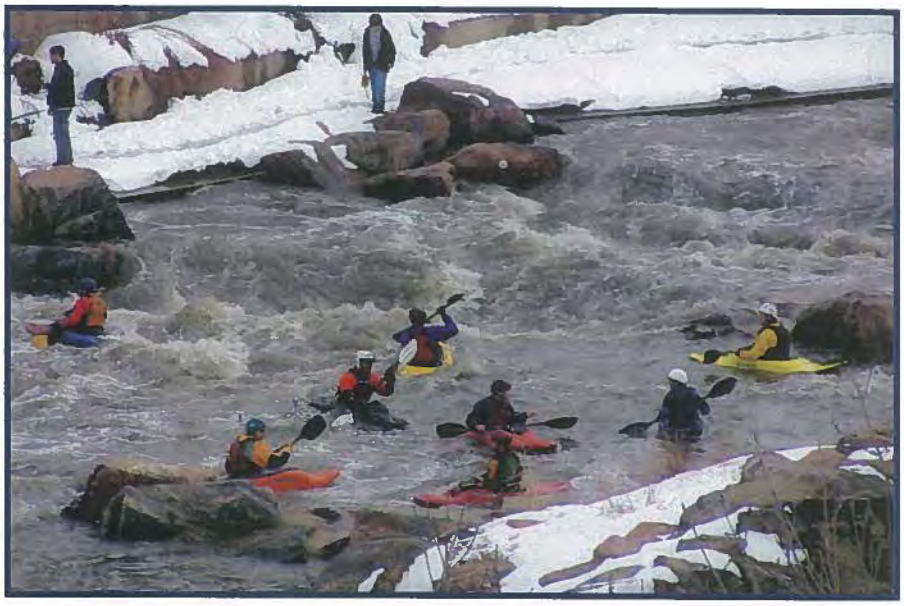


Figure 8. Confluence Park in Denver, and other projects designed by the authors, act as diversion structures as well as whitewater courses.

There are obvious cost-saving implications afforded by combining the two projects into one. The boulder drops needed for a whitewater course can readily be tailored to support the Neilson Pump Line Diversion.

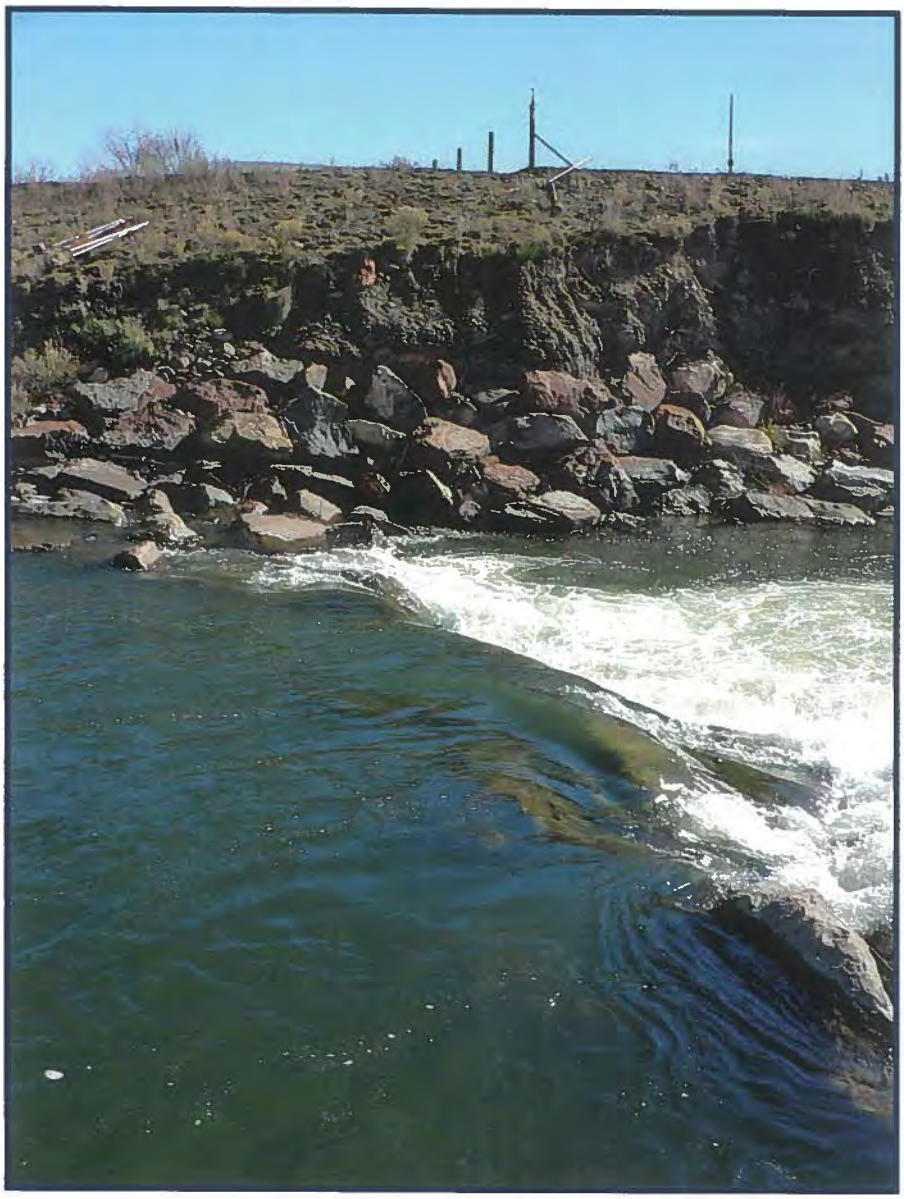


Figure 9: Upper drop of the Neilson Pump Line Diversion has partially failed and creates an undesirable hydraulic condition to boaters at some flows.

Hydraulic Drop

Another benefit of combining a whitewater course into the diversion is that the course can utilize the same hydraulic drop that is created by the diversion. As a result, impacts to the river from construction of a whitewater course are minimized. The existing hydraulic drop across the remaining portion of the diversion was measured at about 2.5 feet during lower flow conditions. To create a diversion with enough upstream depth to reliably divert, this hydraulic drop will need to be increased to approximately 5.2 feet.

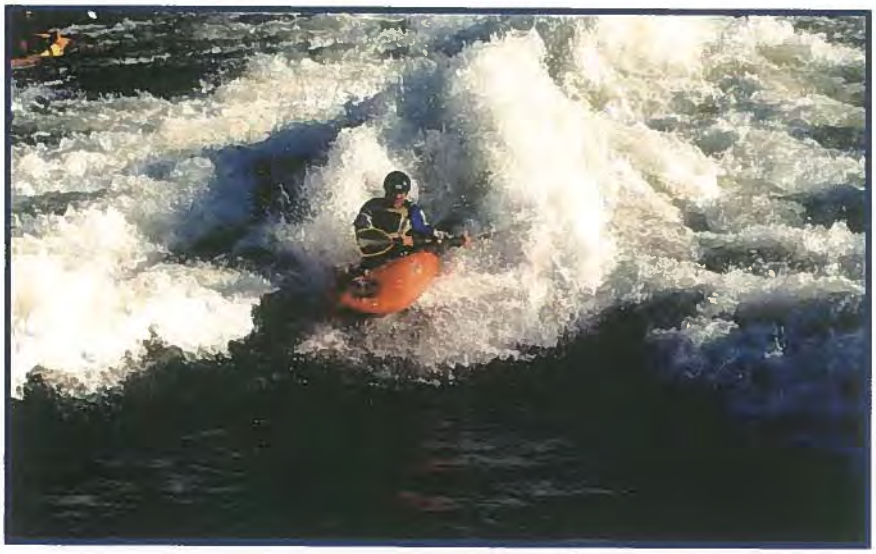


Figure 10: The availability of hydraulic drop at Site 1 is sufficient to produce the big waves that are desired by freestyle kayakers and rafters.

Approximately 300 feet downstream of the existing boulder drop at the diversion is the entrance to the only existing rapid within the entire Fairgrounds Reach. The measured hydraulic drop (at low flow) across this existing rapid is 6.3 feet. Therefore the total hydraulic drop of this rapid when combined with the repaired diversion is 11.5 feet.

Figure 11. Path of the Eagle River Prior to Construction of Interstate 70.

River Instability

The downstream rapid is not naturally occurring, as the original path of the river extended across Interstate I-70. As a part of construction of the Interstate, the Eagle River was rerouted to its current location, which is a shorter and consequently steeper path. This rapid and the intervening upstream river through the diversion are not in their native channel and exhibit signs of instability. The southern banks of the river are undercut, and there is depression in the northern over-bank downstream of the diversion.

Figure 12. Undercut banks along the southern side of the river.

Comparisons of the surveyed profiles shown on Drawing Number 5 also indicate that invert of the river may have degraded. In comparing the surveyed water surface profile to the profile of the river bed from the hydraulic model, it can be observed that this reach of the river is much steeper than shown by the existing hydraulic model. County Staff familiar with the diversion also do not recall such a significant rapid in this location. The concern is that this rapid may move vertically or horizontally in the future. If the riverbed at this rapid lowers, it would further threaten the stability of diversion's boulder drops. If it moves horizontally or vertically it could cause degradation of either river bank.

Proposed Whitewater Course Improvements

Due to the concurrent investigation into the diversion improvements, the potential for instability of this reach, and complexities with integration of the diversion and a whitewater course, this site was investigated further than the other identified sites. Drawing Number 2 shows locations of drops that could create a whitewater course at this site. These are shown schematically, and the location, number, and size will vary depending upon further design efforts. The configuration shown has two drops which replace the existing/previous boulder diversion drops. These drops would act to maintain and repair the existing diversion and provide a high-quality whitewater course. A series of drops are located in the vicinity of the existing rapid downstream of the diversion drops. In addition to forming an additional portion of the whitewater course, these lower drops act to stabilize the river and protect the diversion.

The drops on Drawing 2 are shown in two phases. From either a whitewater course or diversion perspective, these drops could be built at once or in the two phases shown. If constructed in

two phases, degradation of the downstream rapid could necessitate the construction of the lower drops (second phase) to protect the diversion and whitewater course Therefore interim monitoring of the rapid for signs of degradation or movement would be needed.

Access

Access to the site is as generally described in the Analysis Section of this report. The site is located on a curve within the Eagle County Fairgrounds and resulting access is on the inside of the curve. This provides a superb location of near-river viewing as shown on Drawing 2. Existing access and viewing at the upstream and downstream ends of the course is somewhat limited; however, grading and terracing on the northern bank could readily allow for ingress/egress and viewing throughout the length of the course.

Whitewater Park Potential

Site 1 has sufficient site characteristics - hydraulic drop, length, flow, and access - to create a whitewater course that could be used for:

- Freestyle Competitions
- Competitive Slalom/Canoeing Events
- Recreational Playboating
- Slalom Kayaking/Canoeing Training
- Whitewater Rafting
- Personal Whitewater Craft

The site characteristics support a course that could attain a ranking of national merit for both freestyle and slalom competitive events and training. If the intent of the course was to include hosting slalom events, the length would need to be increased an additional 100 – 200 feet from what is shown on Drawing Number 2, and additional features, other than those shown, would need to be added.

Land Ownership

Land ownership and easements as provided by County staff are shown on Drawing Number 2. Note that the locations of the boundaries and easements are shown only as approximate. Field and legal surveys are needed to establish the location of the existing diversion and proposed improvements in relationship to the easement and property boundaries. Based upon the approximate locations, it is apparent that portions of the improvements are located on land owned by CDOT, and private owners. However, most if not all of the proposed in-river improvements are located within existing CDOT permanent easements. Review of easement conditions and discussions with CDOT would be needed if this site is selected. Land acquisition or acquirement of easements from private owners may also be needed depending upon further review. It should be noted that the utilitarian functions of the improvements including stabilization and maintenance of the diversion and channel may fall under the existing easement provisions.

Site 2. Station 841+00 to Station 826+00

This site is approximately 1,500 feet in length and extends from 300 feet downstream of the footbridge though the grandstand and rodeo arena. This site is shown on the attached Drawing Number 3. The Eagle River at this site consists of a series of small riffles, pools, and milder gradient sections.

Figure 13. The existing footbridge located near the downstream end of Site 2 would integrate nicely into whitewater features within this reach.

Hydraulic Drop

The total hydraulic drop at this site is about 15 feet, but because the drop at this site is spread out over such a long section of river, the features would need to be distributed over its distance. In other words, the overall 1 percent gradient of the stream would need to be maintained to avoid impacting the floodplain impacts and/or needing to elevate the regulatory floodplain.

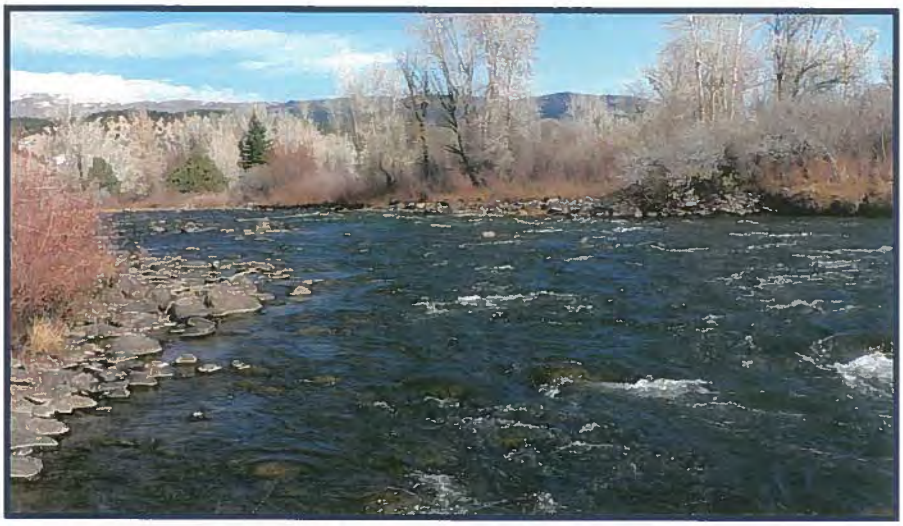


Figure 14. Riffle upstream of the pipe crossing. A feature in this reach would focus the flow and the drop at this riffle.

In addition to a more distributed arrangement of the whitewater park, the size of the drops would need to be kept smaller so as to avoid floodplain impacts and avoid aggradation of the streambed. The size of the drops could vary but would probably be on the order of 6 to 18-inches depending upon final hydraulic modeling.

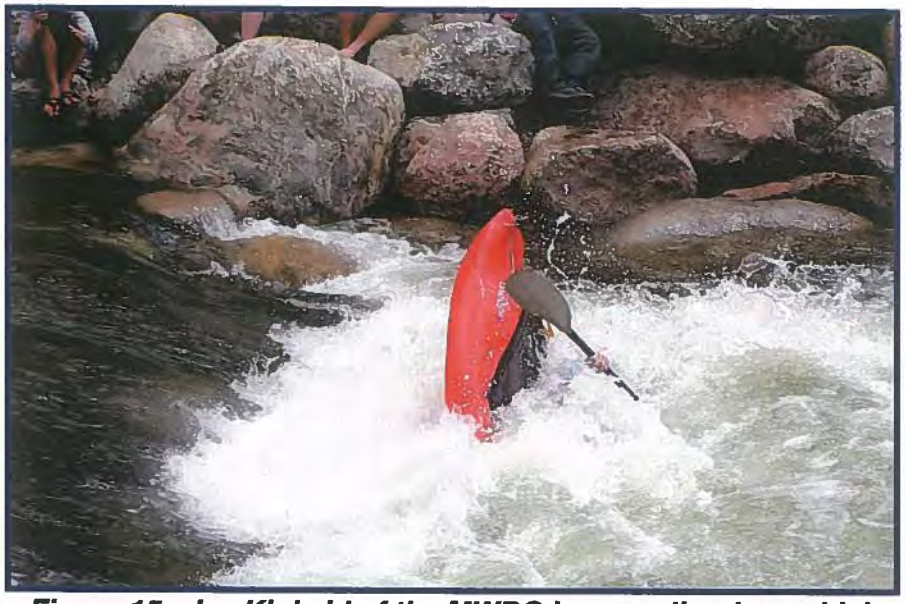


Figure 15. Jay Kinkaid of the MWDG in a smaller drop which could be similar to those at this Site.

Proposed Whitewater Course Improvements

This site could be developed with upwards of five smaller drops or other whitewater features or optionally, only a few of the drops could be constructed if a smaller project or phased approach is desired. Drawing Number 3 shows one spacing arrangement of drops that could create a whitewater course at this site. These are shown schematically, and the location, number, and size will vary depending upon further design efforts.

Figure 16. A series of smaller drops would be used by rafters boating through most of the Eagle County Fairgrounds reach.

Access

The majority of this site is located adjacent to the developed (eastern) area of the Eagle County Fairgrounds. Access at this site is as generally described in the Analysis Section of this report. Primary access will be provided along the northern bank due to private land ownership and steep banks on the southern river bank. Ingress and egress access is available throughout the length of the fairgrounds with only minor grading/terracing. Removal of fencing or addition of gates to the existing fencing would also be necessary.

Figure 17. The Andy Gerard Park and footbridge are two existing amenities that would integrate nicely with access of whitewater improvements at Site 2.

In the developed upstream and midsection of this site, the grandstand and rodeo arena and other existing facilities "back-up" to the river. In these areas, access (especially viewing) may be limited or require modification to the landscaping and parking. Adjustment of the location of drops based upon access and viewing may be beneficial to the planning and design of this site.

Whitewater Park Potential

The smaller and more dispersed features of Site 2 limits the site's potential uses. World Class or features of national merit would not be attainable at this site. The site could however support:

- Recreational Playboating
- Slalom Kayaking/Canoeing Training
- Whitewater Rafting
- Personal Whitewater Craft

The site characteristics support a course that could attain a ranking of regional merit for both freestyle and slalom competitive events and training.

Land Ownership

As with the majority of the Eagle County Fairgrounds reach, the County only owns the northern bank of the river. While this is adequate for primary access, acquisition of land or easements in the bottom of the river as well as a portion of the southern bank would be necessary for structures, construction, and perhaps limited bank access by users.

Site 3. Station 818+00 to Station 823+00

This relatively short site is approximately 500 feet in length and centers on a riffle that appears to be created partly by an island located within the reach. This site is shown on the attached Drawing Number 3 and starts 300 feet downstream of Site 2.

Figure 18. Site 3 is located at the only island within the Eagle County Fairgrounds reach.

Hydraulic Drop

The hydraulic drop across Site 3 is approximately 6 feet, providing an average gradient of approximately 1.2%.

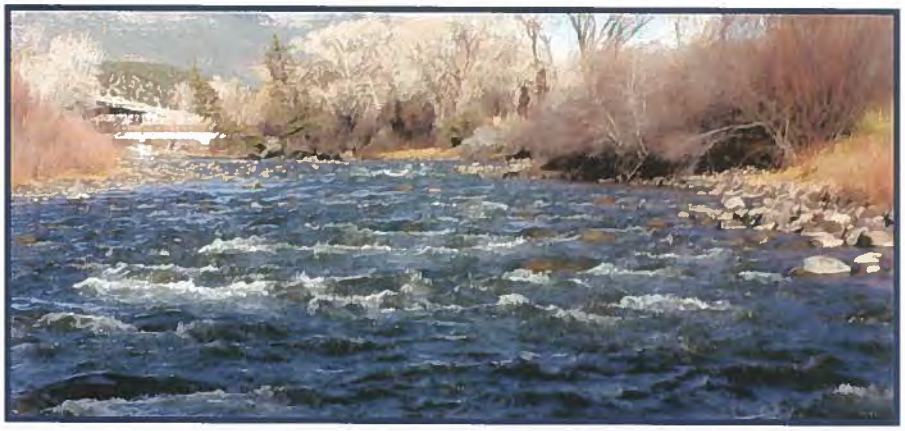


Figure 19. The existing riffle is one of the steepest in the Eagle County Fairgrounds reach.

Proposed Whitewater Course Improvements

With 6 feet of drop located over the 500 foot-long site, two or three moderate or large drops are possible. The drops would need to extend across the island and abut into both banks. This is necessary so that during high flows, the river would not wash out the island or "cut" around the course and create a larger channel on the north side of the river. Because of the width of the river and resulting drops, it would be desirable to keep the number of drops to a minimum.

Access

This site lies within the undeveloped portion of the fairgrounds and therefore has good potential in developing high quality access that is well integrated into future development. As with Site 2, the southern bank is of limited use due to private land ownership and steep banks. Ingress/egress and close-up viewing access is optimal throughout the length of the southern bank due to its low elevation. Because of the undisturbed and remote nature of the site, the whitewater park could offer a somewhat unique experience to both the in-river users and spectators. In addition, the fairground masterplan calls for an indoor and an outdoor arena (with related parking) within 900 feet of this site.

Whitewater Park Potential

Due to the 6 feet of hydraulic drop, the course could create large waves or holes that would attract freestyle kayakers. World-class freestyle features of national merit would be attainable at this site. Due to the short length of the course however, a venue that would host slalom events would not be practical.

In summary, Site 3 could support:

- Freestyle Competitions
- Recreational Playboating
- Slalom Kayaking/Canoeing Training
- Whitewater Rafting
- Personal Whitewater Craft

The site characteristics support a course that could attain a ranking of national merit for freestyle competitive events, playboating, and freestyle training.

Land Ownership

As with the majority of the Eagle County Fairgrounds reach, the County only owns the northern bank of the river. While this is adequate for the primary access, acquisition of land or easements in the bottom of the river as well as a portion of the southern bank would be necessary for structures, construction, and perhaps limited bank access by users.

Site 4. Station 799+50 to Station 812+00

The most downstream site identified in this study begins at the second irrigation diversion within the Eagle County Fairgrounds reach. As with most diversions, the Shumm Ditch No.1 Diversion entails drop structures that impound the upstream water so that it can be routed into an intake pipe. If the existing drop structures are replaced or modified to provide a whitewater course, then they can provide multi-purpose functions. The primary advantage for the siting of a whitewater course at this site is that this hydraulic drop already exists with no impact to the regulatory floodplain.

Figure 20. Looking downstream at Shumm Ditch No.1 Diversion.

Unlike the Neilson Pump Line Diversion, it is not evident that the drop structures have failed or are in need of repair. However the diversion does not appear to function efficiently. There is a large buildup of sediment upstream of the intake pipe or "head gate." In addition, a large pile of debris has accumulated in the side channel that leads to the head gate.

Figure 21. The head gate to the Shumm Ditch No.1 Diversion has an upstream buildup of sediment .

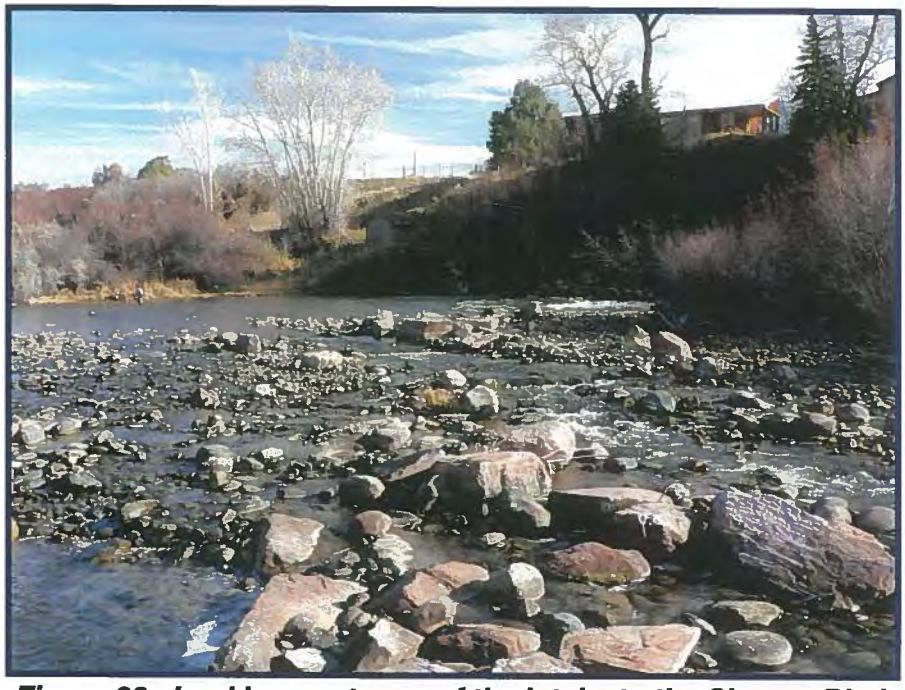


Figure 22. Looking upstream of the intake to the Shumm Ditch No.1 Diversion. Maintenance issues are created because the head gate is on this side channel located on the inside of a curve within the river.

Because of these issues, the construction of a well integrated whitewater course into this diversion could benefit the diversion owner/operator and make this site a viable option.

A riffle located approximately 1,000 feet downstream of this diversion is also included within this site. It is included because of its proximity to the diversion and due to a number of advantages of moving the drop upstream closer to the diversion. This 240 foot-long riffle is located between river stations 799+80 and 802+20. It is adjacent to an auto salvage yard and advantages of relocating the drop upstream include:

1. Improvement to the aesthetics of the site,
2. Inclusion of the hydraulic drop with that of the diversion for recreational reasons, and
3. Stabilization of the diversion structures.

Hydraulic Drop

The hydraulic drop across Site 4 is approximately 12.5 feet with 7.5 feet occurring at the diversion. However if the lower riffle is located upstream, the useable hydraulic drop for a whitewater course would be somewhat less – maybe on the order of 10 feet.

Figure 23. Looking upstream at the riffle located across from the auto salvage yard.

Proposed Whitewater Course Improvements

There are many options for a whitewater course located at this site. The key factors that would help refine the options include:

1. The willingness and motivation of the owner/operator of the diversion to include a whitewater course within the site.
2. The perceived value by the diversion owner/operator of resulting improvements to reducing maintenance to the diversion.
3. The desired size and scope of the whitewater course.

This site could be developed in one initial phase or in two phases with the first phase resulting in a moderately sized whitewater course such as described at Site 3. In this configuration the site could have two or three large drops. If the site were to be fully developed – utilizing all the available drop – the course could consist of a number of large and small drops with other obstacles and whitewater features.

Access

This site lies within the undeveloped portion of the fairgrounds and therefore, may afford high quality access to the site that is well integrated into future development. The current Eagle County Fairgrounds Masterplan would need to be modified as a lake is proposed in the area adjacent to this site. The southern bank is of limited use due to private land ownership and steep banks. Ingress/egress and close-up viewing access would require grading and a foot bridge to span the diversion channel in the upper portions of the course. The access downstream of the diversion would need to include improvements to cross the irrigation ditch.

Whitewater Park Potential

As with Site 1, Site 4 has sufficient site characteristics - hydraulic drop, length, flow, and access - to create a whitewater course that could be used for:

- Freestyle Competitions
- Competitive Slalom/Canoeing Events
- Recreational Playboating
- Slalom Kayaking/Canoeing Training
- Whitewater Rafting
- Personal Whitewater Craft

The site characteristics support a course that could attain a ranking of national merit for freestyle if just a portion of the site is developed into a whitewater course. The entire site would need to be used for the whitewater course if the course is to support competitive slalom racing.

Land Ownership

As with the majority of the Eagle County Fairgrounds reach, the County only owns the northern bank of the river. While this is adequate for the primary access, acquisition of land or easements in the bottom of the river as well as along the southern bank would be necessary for structures, construction, and limited bank access by users. Review of land or easement ownership related to the diversion was not conducted.

IV. CONCLUSIONS

The four identified sites offer viable options for the siting of a whitewater park. Selection of one of the sites may be influenced by a number of factors. These include:

Land Availability

The difficulty and/or costs in attaining land may direct the selection of sites. Sites 2 through 4 will require acquisition of lands and/or easements to construct and use a whitewater park. The land and easements needed include the bottom of the river and a portion of the southern bank. Site 1 may require acquisition of land and/or easements based upon the scope of improvements made, review of existing easements requirements, and discussions or agreements with CDOT.

Integration with the Fairgrounds Masterplan

Development of a whitewater park will entail roads to the site and parking. In addition, integration of terraces and grading, buildings, changing rooms and toilets, and other support facilities with improvements planned in the masterplan may impact the site selection.

Planned Maintenance of the Neilson Pump Line Ditch Diversion Structure

Repairs to the County's diversion will require significant construction including grouted boulder drops - if the structures are intended to reliably resist strong river currents and pass in-river recreational users. In addition, the potential downstream instability of the channel could also mandate additional grouted boulder structures – regardless of the development of a whitewater park at this site. If the County decides to pursue reliable and long-term maintenance efforts on the diversion, then integration of a whitewater course at this site seems to be advantageous.

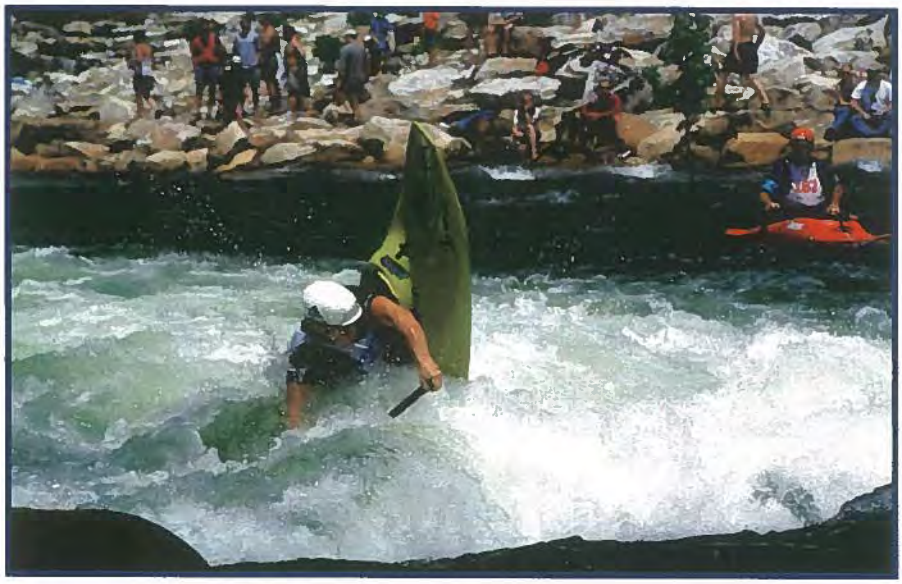


Figure24. Large freestyle features popular to the majority of today's boaters are possible at all of the sites except Site 2.

The Size and Scope of a Whitewater Course

Sites 1 and 4 offer the County the option to develop the whitewater park, either initially or in the future, to a large course of national merit. Optionally, both of these sites could support a smaller course that would still provide world-class freestyle kayaking features. Site 3 could also support a smaller whitewater park with world-class freestyle kayaking features, but this site could not be developed into a large whitewater park as provided by Sites 1 and 4. Site 2 supports a whitewater park that is different from the other sites. Because of the distributed river gradient, these features would be smaller with relatively long distances between them. This is somewhat less conducive to viewing and would not provide for big waves and holes popular with freestyle kayakers and whitewater rafters.

Number	Revision Description	By	Date

EAGLE RIVER
EAGLE COUNTY, COLORADO

WHITEWATER PARK SITE INVESTIGATION

OVERALL SITE PLAN

McLaughlin Whitewater design group

DESIGN: REM
DETAIL: LNS
DATE: NOV.2005

Drawing Number:
1

P/EAGLE COUNTY /BASE.DWG / DECEMBER 14, 2005 /

LOOKING DOWNSTREAM AT THE NEILSON PUMP LINE DIVERSION

CDOT HAS A PERMANENT EASEMENT

OWNER: PHYLLIS JOHNSON AND HARLAN D. HOUSE

OWNER: EVERETT L. CASE

EXCAVATED POOL (TYP)

WHITEWATER PARK PARKING

OWNER: EAGLE COUNTY

CDOT

VIEWING/ STAGING AREA

ACCESS TO RIVER

TERRACED BANKS AND PATHS AT UPSTREAM AND DOWNSTREAM ENDS OF COURSE

ROCK STRUCTURE (TYP)

851+00

850+00

849+00

848+00

847+00

846+00

845+00

844+00

843+00

S1

PHASE I
RODEO RAPID
LARGE WAVE DROPS
W/ DIVERSION REPLACEMENT
CONFIGURATION SHOWN
DROP = 5.2' +/-

CDOT PERMANENT EASEMENT

SITE I
TOTAL DROP= 11.5'

PHASE II
RODEO RAPID
HELPS TO STABILIZE
RIVER CHANNEL
DROP = 6.3' +/-

NOTES:
1. LAND OWNERSHIP BOUNDARIES ARE APPROXIMATE AND SHOWN FOR ILLUSTRATIVE PURPOSES ONLY
2. LOCATION OF DROPS ARE SCHEMATIC

30 0 30 60

Number	Revision Description	By	Date

EAGLE RIVER
EAGLE COUNTY, COLORADO

WHITEWATER PARK SITE INVESTIGATION

SITE I
STA 844+00 - STA 851+00

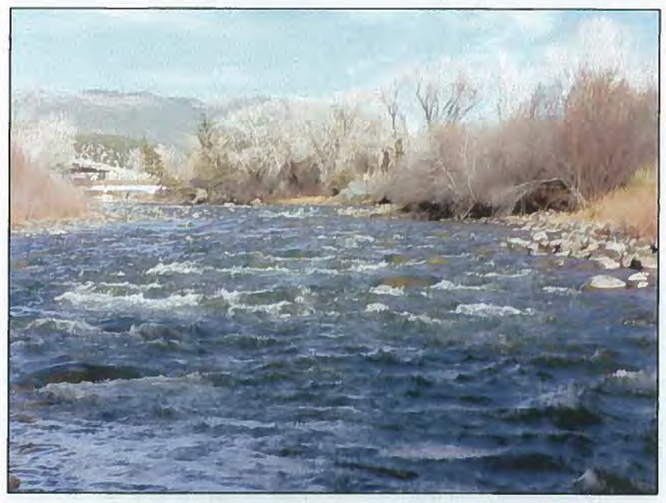
Laughlin Whitewater

DESIGN: REM
DETAIL: LNS

DATE: NOV.2005

Drawing Number:
2

AN EXISTING RIFFLE WITHIN SITE 2



LOOKING UPSTREAM AT THE EXISTING RIFFLE AT SITE 3

NOTES:
1. LOCATION OF DROPS ARE SCHEMATIC
2. AERIAL PHOTOGRAPH IS NOT RECTIFIED WITH CONTOURS

Number	Revision Description	By	Date

EAGLE RIVER
EAGLE COUNTY, COLORADO

WHITEWATER PARK SITE INVESTIGATION

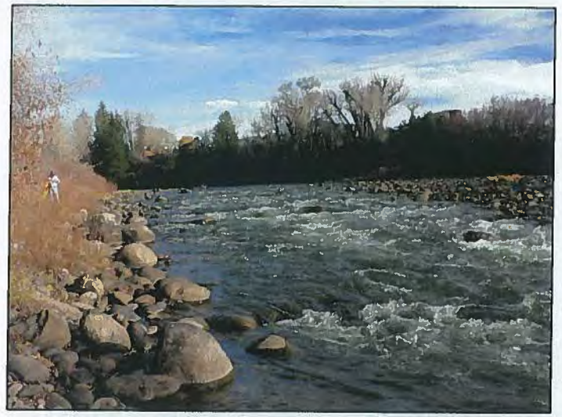
SITE 2: STA 841+00 - 825+50
SITE 3: STA 823+00 - 818+00

McLaughlin Whitewater Design Group

DESIGN: REM
DETAIL: LNS
DATE: NOV 2005

Drawing Number: 3

/EAGLE COUNTY /BASE.DWG / DECEMBER 14, 2005 /



LOOKING UPSTREAM AT THE RIFFLE AT STATION 800+00

ACCESS TO THE CHANNEL DIVIDER AREA IS NEEDED IF THE UPSTREAM PORTIONS OF THE SITE ARE DEVELOPED

INTEGRATE DIVERSION IMPROVEMENTS WITH PROJECT

ACCESS & VIEWING THIS SIDE OF THE RIVER

SERIES OF DROPS AND WHITEWATER COURSE LOCATION AND CONFIGURATION DEPEND UPON FINAL DESIGN

LARGE DROPS COULD BE CONSTRUCTED IN THIS AREA OR CHANNEL COULD BE EXCAVATED AND DROPS CONSTRUCTED UPSTREAM.

SITE 4 -
SCHUMM DITCH NO. 1 DIVERSION TO JUNK YARD
TOTAL DROP = 10' +/-
HIGH QUALITY PARK WITH LARGE DROPS POSSIBLE.
INTEGRATE COURSE W/DIVERSION IMPROVEMENTS

LOOKING UPSTREAM AT THE SCHUMM DIVERSION NEAR STATION 809+00

50 0 50 100

NOTES:
1. AERIAL PHOTOGRAPH IS NOT RECTIFIED WITH CONTOURS

Number	Revision Description	By	Date

EAGLE RIVER
EAGLE COUNTY, COLORADO

WHITEWATER PARK SITE INVESTIGATION

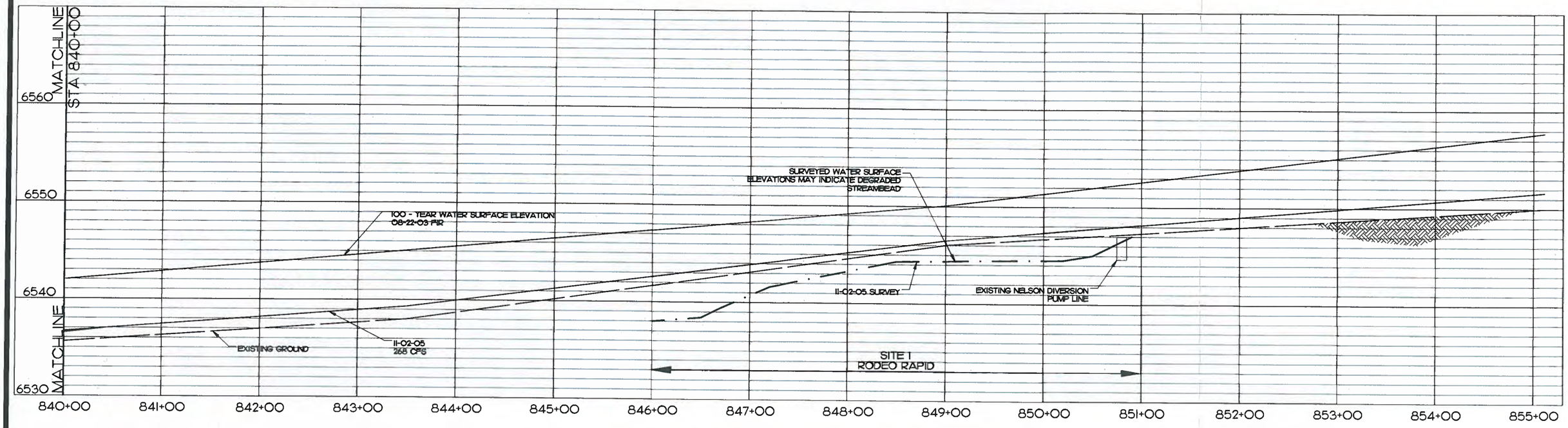
SITE 4: STA 812+00 - 799+50

McLaughlin Whitewater design group

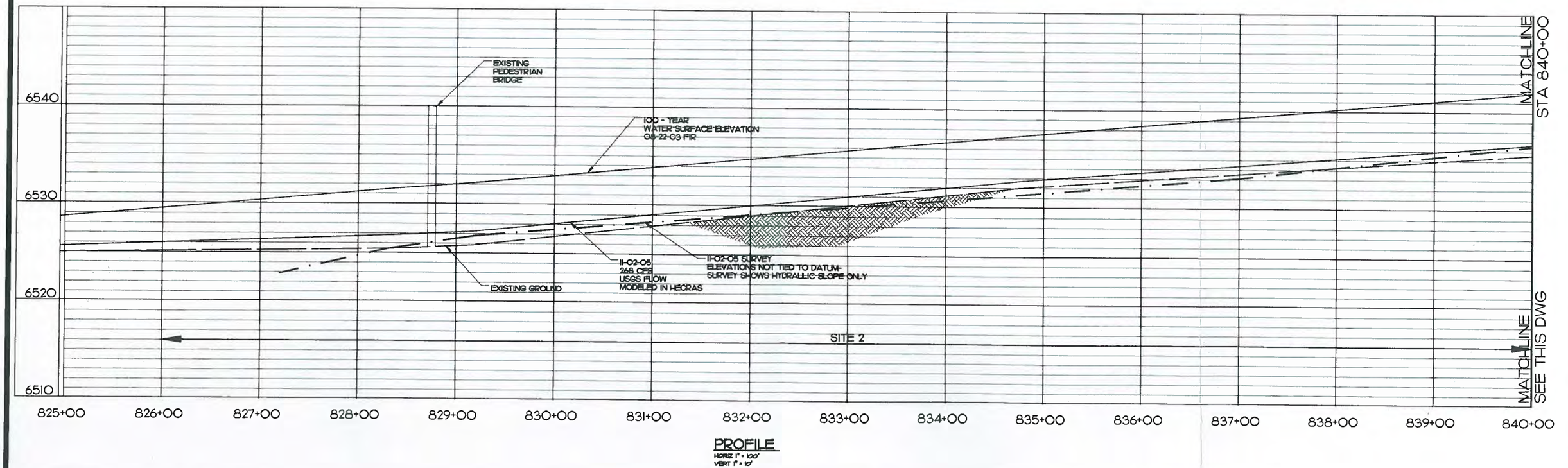
DESIGN: REM
DETAIL: LNS
DATE: NOV.2005

Drawing Number: 4

/EAGLE COUNTY /BASE.DWG / DECEMBER 14, 2005 /



PROFILE
HORIZ 1" = 100'
VERT 1" = 10'



PROFILE
HORIZ 1" = 100'
VERT 1" = 10'

Number	Revision Description	By	Date
13XXX	14XXX	15XXX	16XXX

EAGLE RIVER
EAGLE COUNTY, COLORADO

WHITEWATER PARK SITE INVESTIGATION

WATER SURFACE PROFILES

McLaughlin Whitewater design group

DESIGN: REM
DETAIL: LNS
DATE: NOV 2005

Drawing Number: 5

EAGLE COUNTY /MP/ PROFILE.DWG: / DECEMBER 13, 2005 /