Allison Valley
Master Development Drainage Plan Update

Colorado Springs, Colorado

Prepared for:
Ginger I, LLC
635 West Corona Avenue Suite 216
Pueblo, Colorado 81004

Prepared by:

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Engineering Corporation

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(719) 630-7342

Kiowa Project No. 10051
December 7, 2011

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ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City/County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

Richard N. Wray, P.E.
Registered Engineer #19310
For and on Behalf of Kiowa Engineering Corporation

12/14/11
Date

DEVELOPER'S STATEMENT:

I, the Developer, have read and will comply with all of the requirements specified in this drainage report and plan.

BY: Robert W. Leach
FOR GINGER I

12/8/11
Date

PRINT NAME: ROBERT W. LEACH

ADDRESS: Ginger I, LLC
635 West Corona Avenue Suite 216
Pueblo, Colorado 81004

CITY OF COLORADO SPRINGS:

Filed in accordance with Section 7-7-906 of the code of the City of Colorado Springs, 2001, as amended.

For the City Engineer

12/15/11
Date

Conditions: Prior to approval of the first development plan, the Black Squirrel Creek and Middle Tributary drainage basin planning studies will need to be revised to reflect the improvements contemplated in this MDDP. The MDDP will need to be updated to reflect costs and phasing of the proposed improvements.

I. PROJECT DESCRIPTION

The Allison Valley development is located in northern Colorado Springs and is proposed to be a mixed-use development. The property will be broken into individual filings as phased development occurs. Several filings have already been formed within the overall property. The overall property subject to this master development drainage plan update covers 476 acres. The property is located within portions of Sections 17, 18, 19, and 20, Township 12 South Range 67 West of the 6th Principal Meridian, in Colorado Springs, Colorado. The property is bounded on the south by filings of the Market Place at Interquest, the United States Air Force Academy on the west, on the north by existing land within the Shepard's-McGraw Hill and Compassion International developments, and on the east by Voyager Parkway and land within the Promontory and the Talon Hills developments. The location of the site is shown on Figure 1.

The property has land that lies in three major drainage basins. Portions of the Middle Tributary, Black Squirrel Creek and Elkhorn watersheds all pass through the property in generally an east to west direction. The major drainageways associated with Middle Tributary and Black Squirrel Creek are generally unimproved, however embankments cross these drainageways at several locations. The embankments act to impound runoff that reaches them. The embankments were likely built as part of flood control and the soil conservation efforts within the watershed, possibly by the Soil Conservation Service in cooperation with property owners in the mid 1950's.

II. PROJECT PURPOSE

A development plan was approved for Allison Valley in 2004 and amended in 2008. Along with the development plan approval, a master development drainage plan (MDDP) was prepared in 2004 and subsequently approved in 2006. Since 2008, the property has reverted back to the original property owners prior to the 2004 development plan submittal. The present property owners have concerns with the nature of the major drainageway as proposed in the approved MDDP, the impact upon the natural aesthetic and environmental resource posed by the improvements and their cost. For these reasons this Update to the MDDP is being prepared so that the feasibility of implementing drainageway treatments would act to preserve the existing floodplains and habitat of the Middle Tributary and Black Squirrel creeks as an alternative to the channel configurations proposed in the approved MDDP. Also, the Update to the MDDP focuses on the implementation of

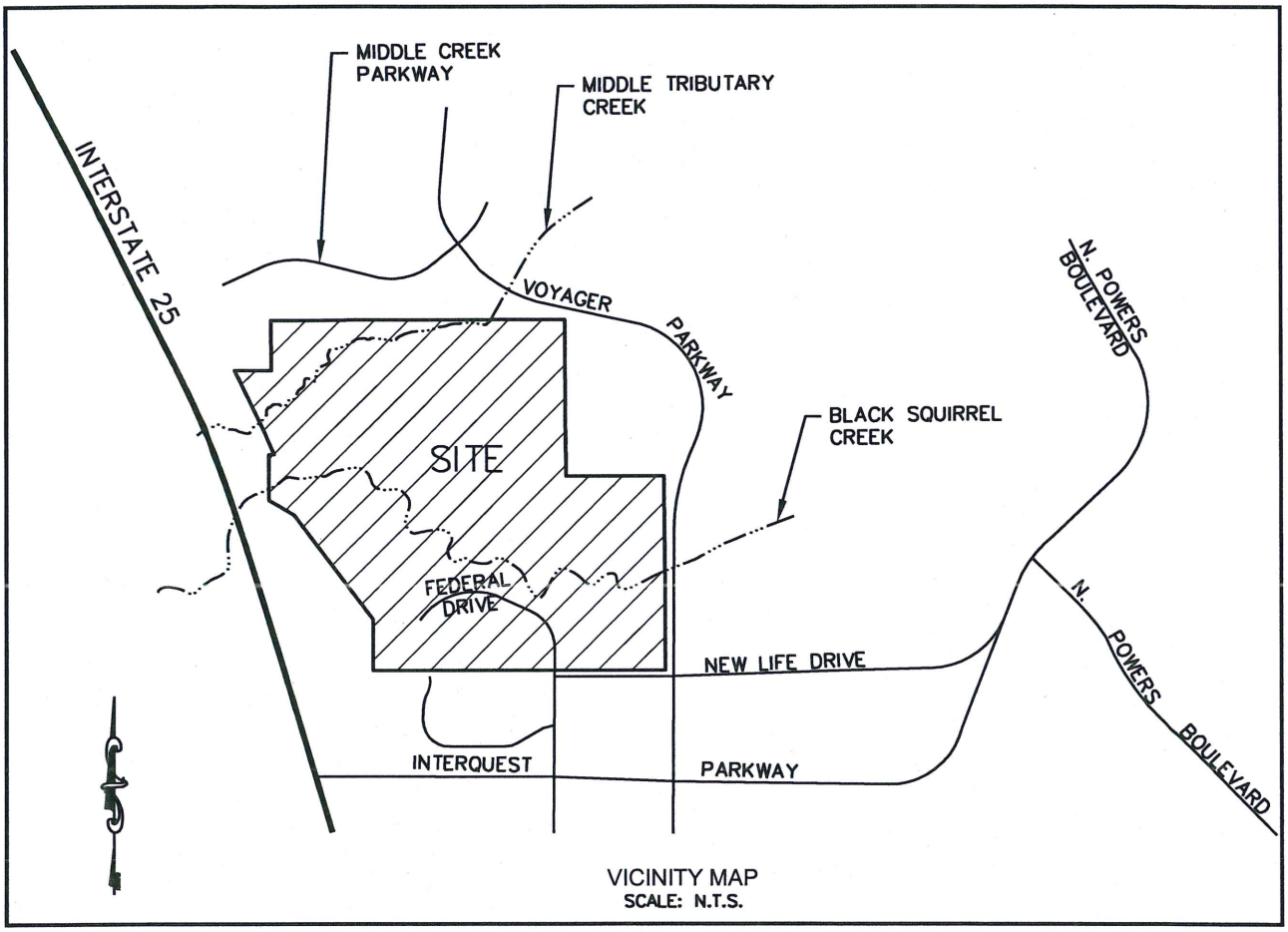

FIGURE 1
VICINITY MAP
ALLISON VALLEY

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Full Spectrum Detention (FSD) to control runoff within those portions of the property that will be developed into residential or commercial land uses.

III. PREVIOUS REPORTS

Following below is a listing of the various reports that were prepared as part of the MDDP and as part of the design process for the major drainageways through the property. The references were reviewed and this review formed the basis from which this Update was prepared. A majority of the information with respect to hydrology and habitat assessments are still valid and usable in the development of the update to the MDDP.

1. Middle Tributary Drainage Basin Planning Study, prepared by URS Corporation, April 1987.
2. Black Squirrel Creek Drainage Basin Planning Study, prepared by URS Corporation, January 1989.
3. Master Development Drainage Plan for Allison Valley, prepared by Classic Consulting Engineers and Surveyors, August 2004, approved February 2006.
4. Final Design Report for Allison Valley On-site Reaches of Black Squirrel Creek and Middle Tributary Channel Improvements, prepared by Classic Consulting Engineers and Surveyors, August 2007, revised September 2008.
5. Preliminary and Final Drainage Report for Allison Valley Filing No. 7, Compassion International Addition, prepared by Classic Consulting Engineers and Surveyors, January 2009, approved February 2009.
6. Preliminary and Final Drainage Report for Compassion International's Northgate Campus Filing No. 1, prepared by JR Engineering Ltd. , March 1999, approved August 1999.
7. Addendum to Preliminary and Final Drainage Report for Compassion International's Northgate Campus Filing No. 1, prepared by JR Engineering Ltd., December 1999, approved January 2000.
8. Master Development Drainage Plan for Marketplace at Interquest and Final Drainage Report for Marketplace at Interquest Filing No. 1 and Filing No. 2, prepared by Classic Consulting Engineers and Surveyors, April 2007, approved August 2007.

9. Request for Verification of Jurisdictional Delineation (letter) for Allison Ranch, Colorado Springs, Colorado, prepared by Walsh Environmental Scientists and Engineers, December 5, 2003.
10. Biological Assessment and Habitat Mitigation Plan for Allison Valley Project, Colorado Springs, Colorado, prepared by Walsh Environmental Scientists and Engineers, 2006.
11. 2007 Addendum to Biological Assessment and Habitat Mitigation Plan for Allison Valley Project, Colorado Springs, Colorado, prepared by Walsh Environmental Scientists and Engineers, May 2007.
12. U. S. Army Individual Permit No. SPA-2004-00017-SCO, Allison Ranch Development, El Paso County, Colorado, November 29, 2007.
13. Request for Authorization of Nationwide Permit #3, Allison Valley Ranch, El Paso County, Colorado, prepared by Walsh Environmental Scientists and Engineers, May 2007.
14. Soil Survey for El Paso County, Colorado, dated June 1981.
15. City of Colorado Springs/El Paso County Drainage Criteria Manual, prepared by City of Colorado Springs, El Paso County, dated May 1987, revised 1996.
16. Flood Insurance Studies for Colorado Springs, and El Paso County, Colorado, prepared by the Federal Emergency Management Agency (FEMA), revised March 1997.

References 1 and 2 established the present or existing condition hydrology for these watersheds. The hydrology produced in these reports was used to determine the location of the 100-year floodplains for Middle Tributary and Black Squirrel creeks. The selected major drainageway plan for these basins called for stormwater detention in developing areas to limit the peak discharges for the 2-, 5-, 10-, 50- and 100-year frequencies to existing conditions. Another major recommendation conclusion reached in these studies was that the embankments across Black Squirrel Creek and Middle Tributary should be removed, primarily because the embankments were not engineered, there is no information as to the materials used to build the embankments and therefore they could not be relied upon to safely store flood runoff.

Reference 3 was prepared as part of the development planning process for Allison Valley. This study recommended that the major drainageways be reconfigured so as to allow for the removal of the various earthen embankments in

accordance with References 1 and 2. Only a conceptual design of the drainageway modifications was put forth in Reference 3. The hydrology from References 1 and 2 was used in the design of the major drainageway facilities. Off-stream detention was proposed for the developing portions of Allison Valley in order to maintain the discharges carried by Middle Tributary and Black Squirrel creeks to preset or existing watershed conditions.

Reference 4 is a detailed design report for the major onsite drainageways within Allison Valley. Final design level plans for Middle Tributary and Black Squirrel creeks were prepared and the technical calculations, environmental surveys and plan and profile drawings were contained in Reference 4. The plans developed in this report formed the basis for the 404 permit made to the USACOE in 2007(reference 12).

References 5 through 7 were all final drainage reports prepared for parcels that have developed north of Allison Valley. Discharge rates from these reports were used to determine the offsite runoff entering Allison Valley.

Reference 8 is the MDDP and final drainage reports for Filings No. 1 and 2 of Marketplace at Interquest. These filings abut the south property line of Allison Valley. Storm water discharge from these filings does not enter the Allison Valley property. Increases in rates of runoff from theses filings were attenuated using onsite detention that released directly to USAFA property.

References 9 through 11 were all environmental reports prepared in anticipation of and as part of applying for a U.S. Army Corps of Engineers (USACOE) permit that would authorize the construction of the major drainageway improvements described in Reference 4. The major outcome of these reports was the establishment of the habitat mitigation areas along the major drainageways needed to offset losses to habitat caused by the removal of the embankments across Middle Tributary and Black Squirrel creeks. The Preble's Mouse habitat boundary was also established in these reports.

Reference 12 is the approved Individual 404 permit associated with the installation of the channel improvements described in Reference 4. With the exception of a sanitary sewer crossing, no construction was ever commenced on this project. The 404 permit, issued November 2007, is effective for five years with the possibility of extensions being granted by the Corps if the work is not completed within the five-year permit period.

Reference 13 is a request to proceed with work associated with repairing the breached dam across Black Squirrel Creek. While authorization to proceed was

granted for this work May 2007, the repair of the breach was never carried out. The emergency authorization for this work has expired.

IV. EXISTING ENVIRONMENTAL RESOURCES

Located at elevations ranging from about 6,600 to 6,800 feet above sea level, the Allison Ranch provides an abundance of ecological habitats varying from open ponderosa pine woodlands, mixed upland shrublands, upland grassland, tree/shrub riparian communities along lakes and streams, wet shrublands, wet meadows and marshes. Habitats are composed of both relic native species along with non-native species whose introduction are a result of a long period of active ranching. Water impoundments and diversions have significantly modified the natural hydrological regime.

Wetlands are found along the two major waterways, historic irrigation ditches, and in large open meadows that were formerly irrigated. The impoundments and irrigation practices have undoubtedly increased wetland areas over time. The riparian fringes located on benches along the waterways are narrow and consist of predominately non-native species such as Russian olive and crack willow.

Per the wetland delineation that took place prior to the 2007 404 permit application, a total of 25.7 acres of jurisdictional wetlands were found to be present along with 6.6 acres of non-jurisdictional wetlands. Both Black Squirrel Creek and the Middle Tributary along with all impoundments are jurisdictional Waters of the U. S. and are subject to regulation by the Corps of Engineers.

Despite being highly modified by man, the Allison Ranch is occupied by the Prebles Meadow Jumping Mouse (PMJM), a threatened species whose habitat is protected by the Endangered Species Act. A 'Mouse Habitat Zone' has been established along the waterways and reflects the areas that are subject to regulation by the U.S. Fish and Wildlife Service. Modifications to the mouse habitat line may be made upon consultation with the Service. Regardless of the location of the mouse habitat line, it should be assumed that the Service will enact stringent habitat conservation efforts for all activities that will take place within the Mouse Habitat Zone in accordance with contemporary conservation methods.

V. EXISTING ONSITE BASIN CONDITIONS

Contained within the map pocket of this report is Exhibit DP1 that displays the major on-site sub-watersheds that lie within the Allison Valley property.

Portions of three major watersheds cross through the property generally from the east to west. These watersheds are the Elkhorn, Black Squirrel and Middle Tributary. All of these watersheds have been analyzed as part of a Drainage Basin Planning Study (DBPS). Hydrology from the Middle Creek and Black Squirrel DBPSs has been used in this Update and in Reference 4 to establish the design discharges for the 10- and 100-year recurrence intervals. Peak discharges for the Black Squirrel and Middle Tributary drainageways are shown on Exhibit DP1.

There are two distinct outfall points for the Allison Valley property both of which are located at the property's west boundary line. The drainageways at the two outfall points are presently in their natural form and no bank linings or grade control exists downstream of the outfall points excepting where the drainageways cross beneath I-25. The 100-year peak discharge for proposed basin conditions for Black Squirrel Creek and for Middle Tributary at the USAFA boundary are 3,956 cubic feet per second and 800 cubic feet per second, respectively.

The existing peak discharges for the 2-, 5-, 10-, 50- and 100-year recurrence intervals as determined at the property's west boundary are required to be maintained at existing levels for the post development condition. Regional detention with staged release structures have been established offsite and upstream of the property in those areas that have developed to date. Regional detention in developments such as Compassion International, Northgate Filing 5 and in watersheds upstream of Voyager Parkway has been constructed as development has occurred and is acting to limit runoff to the levels determined in the respective DBPSs.

Two major drainageways cross through the property. Black Squirrel Creek enters the property via a twin 14-foot by 10-foot concrete box culvert under Voyager Parkway and traverses Allison Valley from the east to west for a distance of approximately 8,500 feet. The average stream gradient is 1.7 percent. However, there is only a short length of the drainageway, 2,000 feet between two of the existing embankments (one is presently breached), that is in it natural course. Its gradient is approximately 2 percent and has a stream sinuosity of 1.1. Most of the drainageway and the floodplain are heavily vegetated with wetland and riparian species. Five embankments (one is presently breached) cross the floodplain of Black Squirrel Creek. The embankments were built along with the historic ranching operations and act to impound runoff that reaches them through either surface or groundwater. With the exception of the breached embankment, the embankments are stable. However, they probably would not meet current State Dam Safety

regulations or guidelines. Each embankment has a low flow outlet and at least a grass-lined spillway. There is no active erosion at any of the embankments and there is little indication of any recent overtopping event that has damaged the embankments. Even though there are no formal riprap spillways, most of the impoundments would overflow into a side channel spillway.

The presence of embankments reduces the effective longitudinal slope of the drainageway to well under the 1.7 percent average. The embankments have been responsible for the development of the wetland and riparian habitats that have formed upstream of them in the inflow channels by causing localized rises in the groundwater table and also detaining groundwater that has day-lighted into the drainageway above each impoundment. In the case of the embankment that breached, the loss of the embankment caused the low channel to drop as much as twenty feet at the breach, and consequently "dry up" the wetland for a distance of approximately 500 feet upstream along the drainageway.

The main stem of Middle Tributary Creek enters the property via an 8-foot by 6-foot concrete box culvert that conveys flow through the Compassion International property and into Allison Valley (design point 5 per the Middle Tributary DBPS). A sub-tributary approximately 2,000 feet west of mainstem's outfall point enters Allison Valley via an unimproved natural swale. All runoff reaching the site have been controlled to existing basin conditions by means of regional detention storage lying upstream of Allison Valley. From design point 5, Middle Tributary Creek traverses the property from northeast to southwest for a distance of approximately 4,000 feet. The average stream gradient is 3.1 percent but there are short reaches where the slope is less than 2 percent. The low flow channel passes through a wetland and riparian vegetated floodplain. One embankment crosses the floodplain of Middle Tributary Creek. This embankment appears to have been overtopped in the past. However, it is still acting to impound groundwater and surface runoff. A good quality wetland and riparian vegetated drainageway is present upstream on the embankment along the drainageway. There is no outlet structure associated with this embankment. Approximately 1,200 feet upstream of the embankment, a head cut has formed and will move upstream if not controlled. Upstream of the head cut, a well-vegetated low flow and floodplain extends to the north property line of Allison Valley.

VI. PROPOSED ONSITE BASIN CONDITIONS

The approved development plan for Allison Valley shows a mixed-use scenario with office and commercial uses proposed south of Black Squirrel Creek and residential uses north of Black Squirrel Creek. A school site is also proposed for the property. The onsite sub-basins shown on Exhibit DP1 have been determined using the topographic base mapping compiled for the property. The basin divides for the proposed conditions have been assumed to remain generally in the same locations as in the present undeveloped condition. The onsite sub-basins were used to determine the stormwater detention volumes that would be needed to control developed runoff to historic conditions before discharging to either Black Squirrel Creek or Middle Tributary Creek. The locations of the off-stream Full Spectrum Detention Basins are also shown on Exhibit DP1 along with the storage volume required to store and route the Excess Urban Runoff Volume (EURV) and storm flows up to and including the 100-year recurrence interval. Agreements reached between the City and the USAFA regarding stormwater management require that runoff for the 2-, 5-, 10-, 50- and 100-year recurrence intervals that reach the USAFA's east boundary must be maintained to existing peak flow conditions.

One of the major differences in this Update compared to the approved MDDP for Allison Valley is that it is proposed to keep the impoundments that occur with the embankments along Black Squirrel Creek and Middle Tributary Creek in place. These impoundments, built in the 1950's, have functioned to store runoff from frequent events and pass the runoff to the major drainageways at a very low rate of flow. Consequently, the banks and invert of the major drainageways for the most part have not had to be stabilized using riprap or by building grade control structures. It is very possible that the embankments were constructed in cooperation with governmental agencies as measures to address flood control and soil conservation. These types of impoundments can be found throughout eastern El Paso and Douglas counties, particularly in the Fountain Creek and Cherry Creek watersheds. Floodplains for Middle Tributary and Black Squirrel Creek are stable and have developed very dense vegetative habitats. Removing the embankments would lower the groundwater table along the drainageways to such a point that it is likely that the wetland and riparian vegetation could not be supported. The lowering of the water table occurred in the vicinity of the Black Squirrel Creek embankment (at cross-section 17 as shown on Exhibit DP1) that was breached. The localized lowering of the water table caused wetland vegetation upstream of the breach to dry up for a distance of approximately 600 feet upstream of the

embankment. Removing the embankments would eliminate important hydrologic effects that the embankments have had on the higher frequency runoff events such as the 2- and 5-year storms.

As with any large land development project, the actual installation of civil infrastructure associated with residential and commercial development will more than likely be phased. As such the infrastructure devoted to the collection and storage of urban runoff will be phased as well. A major advantage of the full spectrum detention is that the size of FSD's are relatively small and therefore can be afforded in the early stage of land development. The FSD's can control runoff for acreages up to 250 acres depending upon the density of the proposed land uses within the watershed tributary to the FSD. A FSD will be required when platting occurs in the sub-regional watershed served by the FSD. The rehabilitation of the impoundments would also be phased according to the size and location of platting activity. Rehabilitation of each embankment will involve the installation of a low flow drain and riser to maintain the water surface as present levels, an outlet structure to control the 5-year discharge from passing over the spillway, a 100-year emergency spillway. Depending upon the results of a geotechnical analysis of each embankment, partial or full reconstruction of the earthen embankments may be necessary.

VII. MAJOR DRAINAGEWAY HYDROLOGY

The peak flow data for Middle Tributary Creek and Black Squirrel Creek from References 1 and 2, respectively, were used to prepare this MDDP Update. The peak flows for these drainageways are shown on Exhibit DP1 where they enter and leave the property. Because Allison Valley lies very low in the each of these watersheds, the peak flows for the 2- through 100-year frequency events are relatively constant through property. The discharges to the major drainageways from the developed areas of Allison Valley will be maintained at historic rates through the implementation of regional stormwater detention. Therefore it is not anticipated that the development of Allison Valley will increase the peak discharges from what was published in References 1 and 2.

In order to assess the hydrologic impact of the storage afforded by each of the embankments along Black Squirrel Creek, additional hydrology modeling was completed. Using the U.S. Army Corps of Engineers (USACOE) HEC-1 Hydrograph Package, the Black Squirrel Creek watershed was modeled at Voyager Parkway (design point 8 of Reference 2). The HEC-1 model was compiled using the curved

number data from Reference 2 and calculating the basin lag time at design point 8. Both the 10- and 100-year peak flows for the 24-hour storm duration obtained using the HEC-1 analysis matched very closely with the hydrology data published in Reference 2 for both peak and volume. Having matched the DBPS hydrology at design point 8, the HEC-1 model was modified to include the storage, stage and discharge relationships for the embankments at cross-sections 2, 5, 20 and 24. It was determined that while these embankments do not create sufficient storage to reduce the 10- or 100-year peak discharges between design points 8 and 9, the peak discharges for the 2- and 5-year storms are reduced substantially. The reason for the reduction in peaks for the 2- and 5-year frequencies is that the volume of runoff for these events can be stored behind each embankment between the mean water level and the spillway crest, and is stored in the natural floodplains and thereby effectively reducing the peak discharges. The breached embankment at cross-section 17 was modeled. The HEC-1 results shown that if the breached embankment at cross-section 17 were restored, the 2- and 5-year peaks would be reduced even further. This is a critical hydrologic impact since the runoff attributable to higher frequency storm events such as the 2- and 5-year, are the events that over time cause the degradation of banks and inverts of urban drainageways. The results of the hydrology analysis are summarized on Table 1.

VIII. FLOODPLAINS

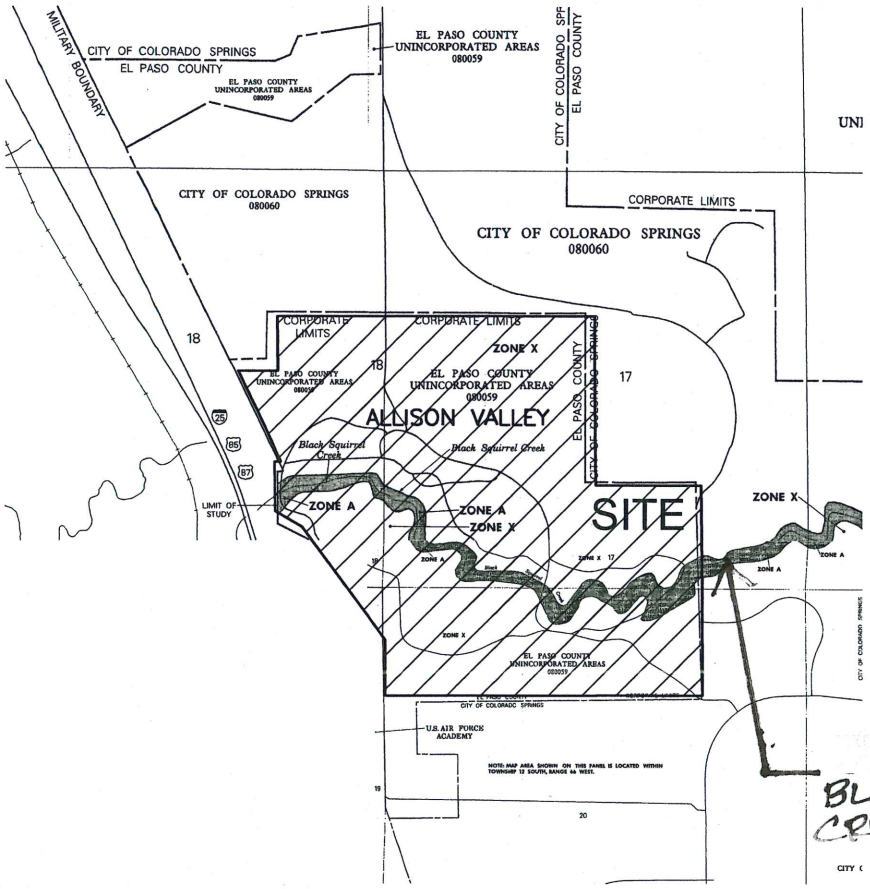
The 100-year floodplain for Black Squirrel Creek and Middle Tributary Creek was determined within Allison Valley. The HEC-RAS modeling program was used to determine the hydraulic profile for each drainageway. Cross-sections used to prepare the hydraulic model were obtained from the two-foot contour interval topographic mapping shown on Exhibit DP1. The location of the 100-year floodplain is also shown on Exhibit DP1.

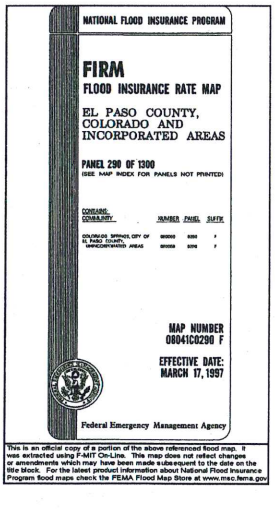
The portion of the Black Squirrel Creek floodplain shown in Reference 16 was determined using approximate methods. As such, the modeling done to compile the 100-year floodplain in this MDDP Update is of higher accuracy and is more reliable in its actual horizontal and vertical locations than the Zone A boundaries published in the 1997 Colorado Springs FIS. The Zone A floodplains as depicted in the Colorado Springs FIS are presented on Figure 2.

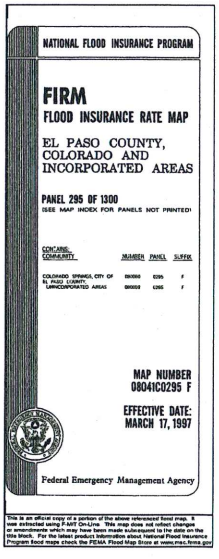
The 100-year velocity for Black Squirrel Creek ranges from 3 to 12 feet per second with the average velocity being around 9 feet per second. For Middle Tributary Creek the 100-year velocity ranges from 4 to 10 feet per second with the

TABLE 1: **COMPARISON OF DISCHARGES**
BLACK SQUIRREL CREEK
ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN UPDATE

HYDROLOGIC CONDITION NUMBER	DESIGN POINT	PEAK DISCHARGE (CFS) 2-YEAR	5-YEAR	10-YEAR	100-YEAR
Present basin conditions per DBPS (no impoundments modeled)	8	NR	NR	1130	4050
	9	NR	NR	1104	3956
Present basin conditions with existing impoundments	8	72	508	1102	4040
	9	23	235	833	3937
Present basin conditions with existing impoundments and impoundment at cross-section 17 restored	8	72	508	1102	4040
	9	5	198	723	3908







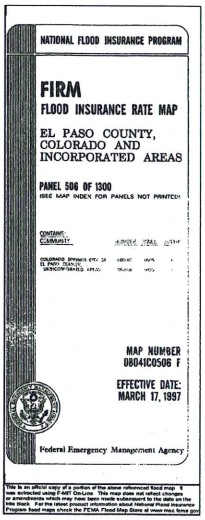


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FIGURE 2
FLOOD INSURANCE RATE MAP
ALLISON VALLEY

average velocity being around 6 feet per second. The depth of the 100-year flow ranges from 2 to 6 feet with less than 4 feet being the average for Black Squirrel Creek. The depth of the 100-year flow ranges from 2 to 5 feet with less than 3 feet being the average for Middle Tributary Creek. The broad nature of the channel's cross-section combined with the dense vegetation along the invert and banks slow the flow velocity considerably. There is presently little evidence of active bank erosion or invert degradation except in the vicinity of the breached embankment at channel cross-section 17. The broad cross-sections also provides for natural peak flow attenuation through floodplain storage.

There are presently no habitable structures that lie within the 100-year floodplain of either the Middle Tributary or Black Squirrel creeks. The intent of the development is to preserve the floodplains that now exist on these drainageways. Should improvements to drainageways such as channel and invert linings, relocations to the flow path, or roadway crossing be proposed, a Letter of Map Revision (LOMR) may have to be submitted to FEMA.

IX. FULL SPECTRUM DETENTION

In order to reduce the impacts caused by urbanized runoff upon the major drainageways, Full Spectrum Detention (FSD) is proposed for the Allison Valley project. This type of stormwater storage facility stores the Excess Urban Runoff Volume (EURV) and releases it over an extended period. The FSD basin also stores and routes other frequency storms such as the 5-, 10- and 100-year events and releases them at existing rates of discharge for the watershed served by the FSD. The EURV is the difference in 2-year storm frequency runoff volumes for the existing watershed condition assuming antecedent moisture condition AMC I, and the developed watershed condition assuming antecedent moisture condition AMC II. The EURV has been identified as the runoff that most greatly affects receiving drainageways with respect to bank and invert degradation. Releasing the EURV over a 70-hour period acts to mimic the rates of discharge for existing basin conditions during a 2-year storm event. Finally, providing storage of the EURV incorporates water quality capture volume (WQCV) for the watershed.

Presented on Exhibit DP1 are the EURV and total detention volume required for each of the sub-watersheds delineated within Allison Valley. Each FSD basin will be subject to refinement during the final design process. The location of each FSD should also be refined to be situated in areas that can preserve, supplement, enhance or restore open space and streamside habitat. If it is practical FSD storage

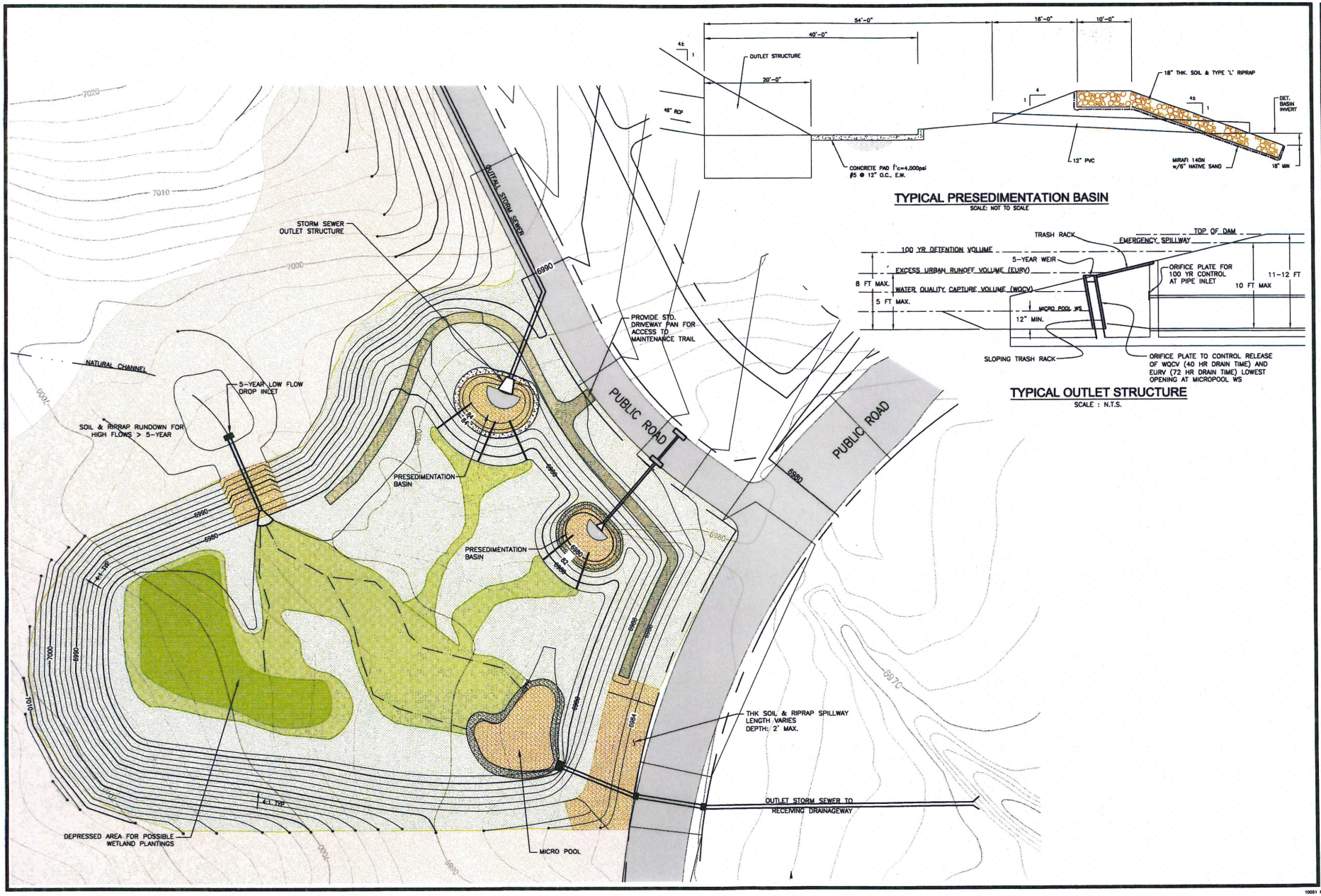
volume should be developed at roadway embankments. It is envisioned that none of the FSDs shown on Exhibit DP1 would have embankments that would come under the jurisdiction of the Office of the State Engineer. The FSDs will be sub-regional in size; that is, they will likely serve more than one development parcel or property. As such, the FSDs should be publicly owned and maintained by either the City of Colorado Springs or by a metropolitan district. The City is presently developing new stormwater management guidelines that will provide designers with criteria to size, site and design FSDs and their appurtenances. The methods and criteria outlined Volume III of the Urban Drainage and Flood Control District to determine the EURV was also used and comparable results were obtained. Contained in Appendix A are the calculations related to the determination of the EURV and an estimate of total detention volume for each of the FSDs presented on Exhibit DP1.

X. HYDRAULICS AND PROPOSED FACILITIES

The evaluation related to the sizing of the onsite major drainageway improvements were carried out in accordance with the City/County Storm Drainage Criteria Manual. The developed portions of the site will be drained primarily via sheet flow into the public streets and then collected into storm sewer systems and collector channels. These systems will outfall to the FSDs shown on Exhibit DP1. Each of the FSDs within the Black Squirrel Creek watershed will discharge directly to the creek. A schematic for an FSD is presented on Figure 3. The design for each FSD will be conducted during the final drainage plan phase or during master planning of parcels greater than 10 acres.

Presented at the rear of this report are conceptual design drawings for Black Squirrel and Middle Tributary creeks. These drawings show the locations of proposed bank stabilization, grade control structures and roadway culverts. The locations of the proposed embankment rehabilitation and reconstruction are also shown on the plan and profiles. Presented on Sheet 2 of the conceptual design drawings at the rear of this report are typical embankment, outlet structures and spillway details are prepared for each embankment within the drawings. Contained in Appendix B are hydraulic calculations that support the development of the conceptual design.

The design of the proposed drainageway facilities has been based upon preserving the existing 100-year floodplain and minimizing disturbances to the wetland and riparian habitat. There is a **potential** for the long-term degradation of the natural drainageways as the watersheds move towards full development. The



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ALLISON VALLEY
MASTER DEVELOPMENT DRAINAGE PLAN
TYPICAL FULL SPECTRUM STORAGE BASIN
COLORADO SPRINGS, COLORADO

Project No.:	10051
Date:	November 10, 2011
Design:	JGD/RNW
Drawn:	JGD
Check:	RNW
Revisions:	

SHEET

FIG. 3

OF X SHEETS

10051 Fig3.dwg/Nov 15, 2011/12:19pm

degradation will be in the form of bank sloughing and invert incision along the low flow area of the channel. Invert degradation and some localized bank sloughing have already occurred along portions of Middle Tributary Creek. A combination of vertical drop structures, rock vanes and low flow channel stabilization has been proposed to re-establish or maintain the longitudinal slope of the drainageways in the event that degradation occurs.

Drops can be built sloping or vertical, with no more than three feet of vertical fall. At the locations shown for vertical drops, sloping drops could be used as well. Vertical drops should be used where the invert has already degraded and is causing localized bank sloughing, such as has occurred along Middle Tributary downstream of the existing impoundment. Boulders used in the construction of drops should be ungrouted. Drops can also be used to control the invert downstream of roadway culverts and the outlet structures of the impoundments.

In order to address the potential for the incision of the low flow channel in the future, rock vanes are proposed. The rock vanes should be designed and located so that no more than two feet of vertical drop occurs through the vane. Rock vanes should be used wherever an incision along the low flow channel has reached or is approaching two-feet in depth. In between vanes and wherever the degraded longitudinal slope of the low flow channel exceeds 0.8 percent, cobbling of the incised low flow invert should be provided to prevent further flattening of the stream slope. Cobbling the invert is an alternative to installing additional rock vanes that would create a longitudinal slope of less than 0.8 percent. Maintaining a sinuous course along the low flow channel is encouraged as well. Willow stakes taken from the area local to the rock vane can be used to re-establish the vegetated channel banks that are typical along the drainageways at this time. Boulders for the rock vanes should not be grouted into place. Typical rock vane and low flow channel details are provided on the drawings.

At locations along the drainageway where minimal to no bank stabilization is proposed, an erosional setback was determined using the prudent line criteria contained within Reference 15. The erosional setback represents the limits of encroachment by land development activities along both Middle Tributary Creek and Black Squirrel Creek. Calculations for the erosional setback are contained in Appendix B. At each of the embankments to be reconstructed and where open water is to be maintained, a minimum 50-foot prudent line setback measured from the 100-year floodplain was assumed.

XI. WATER QUALITY MEASURES

As required by the City in Volume 2 of the Drainage Criteria Manual, water quality measures need to be introduced in new developments in order to reduce the detrimental effects of impervious areas upon stormwater runoff. The primary water quality measure that has been identified in this MDDP will come in the form of the FSD system depicted on Exhibit DP1. The storage pool for the EURV will release over a 70-hour period any accumulated runoff. Capturing the EURV will represent controlling runoff for over 95 percent of all runoff events from the sub-watersheds tributary to each FSD. Forebays at each stormwater outfall into an FSD will provide for the capture of sediment carried by the initial "flush" of runoff.

XII. CONCLUSIONS

The drainageway and Full Spectrum Detention (FSD) storage facilities proposed in this MDDP will collect and convey runoff generated from the developing areas of Allison Valley such that the release of stormwater will not cause detrimental impacts to Middle Tributary and Black Squirrel creeks at the property's outfall points. Runoff from the development for the 2-, 5-, 10-, 50- and 100-year recurrence intervals will be controlled by the FSD's shown on Exhibit DP1. The release of runoff from the FSDs will help to minimize impact to the receiving drainageways. FSD facilities should be constructed during the initial land development activities within any of the sub-watersheds shown on Exhibit DP1. They should be sited to take advantage of natural topographic features and integrated into overall open space plans for the area subject to development. However even with the installation of the FSD facilities, maintaining the existing storage behind the embankments and preserving the storage offered by the natural floodplains, runoff reaching USAFA property could still cause bank and invert degradation along the receiving drainageways in the absence of any bank linings or grade controls. The volume of stream base flow for Black Squirrel and Middle Tributary creeks will continue to increase as the watershed develops due to increased impervious surface area and irrigation of landscaping.

In determining the best concept to follow for the stabilization of the major drainageways, the wetland and riparian habitat that is present now was a major factor in re-thinking the channelization concept put forth in Reference 3. At the present time, the two segments of drainageway within Allison Valley represent a very valuable and rare natural open space corridor within the City of Colorado Springs. The floodplain preservation concept developed in this Update is central to

maintaining the existing wildlife and vegetative habitat along Black Squirrel and Middle Tributary creeks. There is the potential that localized stream bank and invert protection may be needed in the future. Yet, very little degradation is now present along the drainageways. Minimizing structures along the drainageways should only be done in combination with the establishment of an erosional setback. Floodplain preservation along with the erosional setback provide for the avoidance and minimization of impact to the habitat as well.

In order to preserve the present configuration of the major drainageways it is vital that the impoundments across Black Squirrel Creek and Middle Tributary be rehabilitated and maintained. These structures have provided for the localized storage of surface day-lighted groundwater. The stored runoff has in turn been responsible for creating the requisite hydrologic conditions necessary to support the wetland and riparian habitat along the drainageways. Removal of the impoundments (such as what effectively occurred at cross-section 17 when the embankment breached) would result in the loss of the wetland and riparian habitat in its current form. Removal of the impoundments would also have a significant affect upon the flood hydrology for the highly recurrent 2- and 5-year runoff events and runoff associated with these storm events would simply pass through Allison Valley at higher velocities. The volume of runoff reaching the outfall points would also increase with the removal of the impoundments.

It is recommended that geotechnical investigations be conducted for each of the impoundments to assess their present stability and to identity the rehabilitation measures necessary for the impoundments to remain. At a minimum each of the embankments should be redesigned to accommodate an emergency spillway capable of passing the 100-year inflow design storm event over the embankment without damage. Reconstructed embankments falling under the jurisdictional criteria of the Office of the State Engineer will have to meet Dam Safety Regulations and be designed in accordance with the State's criteria. It will also be likely that water rights to offset what is lost due to evaporation at each of the embankments would have to be purchased. The existing or installation of new, gated drains along with drop inlets capable of conveying the average daily flow and the five-year storm through the embankment is recommended.

Any construction proposed that could affect the wetland areas delineated on the plans or the PMJM Habitat Zone will need authorization from the U. S. Army Corps of Engineers (USACOE). The 404 permit that was authorized in 2007 will need to be amended to reflect the concepts presented in this Update. Contact will be

required with the USACOE and other commenting agencies as the design plans for the drainageway improvements are advanced. There is presently a Biological Assessment (BA) underway that will update Reference 10 and re-establish the limits of the PMJM habitat based upon the implementation of the drainageway improvements summarized in this MDDP.

The proposed facilities along Black Squirrel Creek and Middle Tributary Creek as well as the FSD's should be owned and maintained by a public or quasi-public entity, such as a metropolitan district. All of the facilities are considered regional as they convey and/or store runoff from areas within and outside of Allison Valley. Maintenance access to the facilities should be provided. Routine inspections of the embankments will also be required if they meet the requirements for a jurisdictional structure per the State's Dam Safety regulations.

APPENDIX A

Hydrology Calculations

TABLE 5-5
RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL COVER COMPLEXES - URBAN AND SUBURBAN CONDITIONS 1/
(Antecedent Moisture Condition II)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

Land Use		Hydrologic Soil Group A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
	Good condition: grass cover on 75% or more of the area	39*	61	74	80
	Fair condition: grass cover on 50% to 75% of the area	49*	69	79	84
Commercial and Business areas (85% Impervious)		89*	92	94	95
Industrial Districts 72% Impervious)		81*	88	91	93
Residential: 2/					
Acres per Dwelling Unit	Average % Impervious 3/				
1/8 acre or less	65	77*	85	90	92
1/4 acre	38	61*	75	83	87
1/3 acre	30	57*	72	81	86
1/2 acre	25	54*	70	80	85
1 acre	20	51*	68	79	84
Paved parking lots, roofs, driveways, etc.		98	98	98	98
Streets and Roads:					
paved with curbs and storm sewers		98	98	98	98
gravel		76*	85	89	91
dirt		72*	82	87	89

1/ For a more detailed description of agricultural land use curve numbers, refer to the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).
2/ Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.
3/ The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

* Not to be used wherever overlot grading or filling is to occur.

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 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
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*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   HEC-1
  2           ID   BLACK SQUIRREL CREEK AT VOYAGER    ALLISON VALLEY MDDP
  3           ID   KIOWA ENGINEERING CORPORATION  JOB NO. 10051
  4           ID   2, 5, 10 & 100-YEAR 24-HOUR STORMS PRESENT BASIN CONDITIONS
  5           ID   PRESENT CREEK CONDITIONS EXCEPT:
  6           ID   ASSUME BREACHED DAM AT XS17 IS REBUILT w/ SPILLWAY
  7           ID   FILENAME BSQCDEV.DAT
              *DIAGRAM
  8           IT       5       0       0     300
  9           IO       5
 10           JR    PREC      .4     .54     .65     1.0

 11           KK   BSQ-1
 12           KM        SUB-BASIN BSQ-1  LUMPED BASIN AT VOYAGER PARKWAY DBPS DP 8
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 13          BA     9.8
 14          UD     .67
 15          IN      15
 16          PB     4.6
 17          PC     0.0   .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
 18          PC   .0165   .0188   .0210   .0233   .0255   .0278   .0320   .0390   .0460   .0530
 19          PC   .0600   .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
 20          PC   .8000   .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
 21          PC   .8600   .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
 22          PC   .8975   .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
 23          PC   .9300   .9325   .9350   .9375   .9400   .9425   .9450   .9475   .9500   .9525
 24          PC   .9550   .9575   .9600   .9625   .9650   .9675   .9700   .9725   .9750   .9775
 25          PC   .9800   .9813   .9825   .9838   .9850   .9863   .9875   .9888   .9900   .9913
 26          PC   .9963   .9975   .9988  1.0000
 27          LS             64

 28          KK  DBXS24
 29          KM        ROUTE BSQ-1 THROUGH STORAGE AT CROSS SECTION 24
 30          RS       1    ELEV    6705
 31          SQ       0       0    1300    8067   18311
 32          SE    6705    6709    6710    6712    6714
 33          SA       4    4.61    5.03     5.8     6.5
 34          SE    6705    6709    6710    6712    6714

 35          KK  DBXS20
 36          KM        ROUTE OUTFLOW FROM DBXS24 THROUGH STORAGE AT CROSS SECTION 20
 37          RS       1    ELEV    6675
 38          SQ       0     195    1574    3823    6560
 39          SE    6675    6676    6678    6680    6682
 40          SA    1.76    2.31    2.91    3.44       4
 41          SE    6675    6676    6678    6680    6682

 42          KK  DBXS17
 43          KM        ROUTE OUTFLOW FROM DBXS20 THROUGH STORAGE AT CROSS SECTION 17
 44          RS       1    ELEV    6661
 45          SQ       0       0       0     500    2702    4160
 46          SE    6661    6663    6664    6665    6666    6667
 47          SA    2.30    2.89    3.38    3.84     4.0     4.8
 48          SE    6661    6663    6664    6665    6666    6667
1                                          HEC-1 INPUT                                    PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 49          KK   RDB17
 50          KM       ROUTE OUTFLOW FROM DBXS17 TO STORAGE AT CROSS SECTION 5
 51          RK    2250    .016    .080            TRAP      80       2

 52          KK   DBXS5
 53          KM       ROUTE RDB20 THROUGH STORAGE AT CROSS SECTION 5
 54          RS       1    ELEV    6607
 55          SQ       0       0     133     507    2086    5563
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            56          SE    6607    6609    6610    6612    6614    6616
            57          SA     4.5    4.72    5.02    5.61     6.2    6.87
            58          SE    6607    6609    6610    6612    6614    6616

            59          KK   DBXS2
            60          KM        ROUTE OUTFLOW FROM DBSX4 THROUGH STORAGE AT CROSS SECTION 2
            61          RS       1    ELEV    6581
            62          SQ       0       0     406    1239    3418    4372
            63          SE    6581  6584.5    6586    6588    6590    6592
            64          SA       2    2.15    2.28    2.46     2.6     2.8
            65          SE    6581  6584.5    6586    6588    6590    6592
            66          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    11       BSQ-1
                V
                V
    28      DBXS24
                V
                V
    35      DBXS20
                V
                V
    42      DBXS17
                V
                V
    49       RDB17
                V
                V
    52       DBXS5
                V
                V
    59       DBXS2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
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*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*               JUN   1998             *
*            VERSION 4.1               *
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*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
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HEC-1
BLACK SQUIRREL CREEK AT VOYAGER ALLISON VALLEY MDDP
KIOWA ENGINEERING CORPORATION JOB NO. 10051
2, 5, 10 & 100-YEAR 24-HOUR STORMS PRESENT BASIN CONDITIONS
PRESENT CREEK CONDITIONS EXCEPT:
ASSUME BREACHED DAM AT XS17 IS REBUILT w/ SPILLWAY
FILENAME BSQCDEV.DAT

9 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION

NPLAN	1	NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.40 .54 .65 1.00

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

				RATIOS APPLIED TO PRECIPITATION			
OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4
				.40	.54	.65	1.00

```
 HYDROGRAPH AT
+                BSQ-1       9.80     1   FLOW          72.      508.     1102.     4040.
                                          TIME         7.00      6.75      6.67      6.58

 ROUTED TO
+                DBXS24      9.80     1   FLOW          30.      496.     1093.     4028.
                                          TIME        10.75      6.83      6.75      6.58

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE     6709.02   6709.38   6709.84   6710.81
                                         TIME        10.75      6.83      6.75      6.58

 ROUTED TO
+                DBXS20      9.80     1   FLOW          28.      482.     1090.     4024.
                                          TIME        13.42      6.92      6.75      6.67

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE     6675.14   6676.42   6677.30   6680.15
                                         TIME        13.25      6.92      6.75      6.67

 ROUTED TO
+                DBXS17      9.80     1   FLOW          26.      376.     1134.     4007.
                                          TIME        14.83      7.25      6.75      6.67

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE     6664.05   6664.75   6665.29   6666.90
                                         TIME        14.83      7.25      6.75      6.67

 ROUTED TO
+                RDB17       9.80     1   FLOW          26.      374.     1115.     3987.
                                          TIME        15.17      7.33      6.83      6.75

 ROUTED TO
+                DBXS5       9.80     1   FLOW          21.      207.      760.     3964.
                                          TIME        21.00      8.25      7.33      6.75

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE     6609.16   6610.39   6612.32   6615.08
                                         TIME        21.00      8.25      7.33      6.75

 ROUTED TO
+                DBXS2       9.80     1   FLOW           0.      198.      723.     3908.
                                          TIME         .00      8.50      7.42      6.83

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE     6584.26   6585.23   6586.76   6591.03
                                         TIME        24.92      8.50      7.42      6.83
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 *** NORMAL END OF HEC-1 ***
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*            VERSION 4.1                *
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*    HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
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X     X  X        X                X
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X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   1          ID   HEC-1
   2          ID   BLACK SQUIRREL CREEK AT VOYAGER    ALLISON VALLEY MDDP
   3          ID   KIOWA ENGINEERING CORPORATION  JOB NO. 10051
   4          ID   10-YEAR AND 100-YEAR 24-HOUR STORMS PRESENT BASIN CONDITIONS
   5          ID   FILENAME BSQCREV3.DAT
              *DIAGRAM
   6          IT       5       0       0     300
   7          IO       5
   8          JR    PREC      .4     .54     .65     1.0

   9          KK   BSQ-1
  10          KM        SUB-BASIN BSQ-1  LUMPED BASIN AT VOYAGER PARKWAY DBPS DP 8
  11          BA     9.8
  12          UD     .67
```

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 13          IN      15
 14          PB     4.6
 15          PC     0.0    .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
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 17          PC   .0600    .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
 18          PC   .8000    .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
 19          PC   .8600    .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
 20          PC   .8975    .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
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 24          PC   .9963    .9975   .9988  1.0000
 25          LS              64

 26          KK  DBXS24
 27          KM        ROUTE BSQ-1 THROUGH STORAGE AT CROSS SECTION 24
 28          RS       1    ELEV    6705
 29          SQ       0       0    1300    8067   18311
 30          SE    6705    6709    6710    6712    6714
 31          SA       4    4.61    5.03     5.8     6.5
 32          SE    6705    6709    6710    6712    6714

 33          KK  DBXS20
 34          KM        ROUTE OUTFLOW FROM DBXS24 THROUGH STORAGE AT CROSS SECTION 20
 35          RS       1    ELEV    6675
 36          SQ       0     195    1574    3823    6560
 37          SE    6675    6676    6678    6680    6682
 38          SA    1.76    2.31    2.91    3.44       4
 39          SE    6675    6676    6678    6680    6682

 40          KK   RDB20
 41          KM       ROUTE OUTFLOW FROM DBXS20 TO STORAGE AT CROSS SECTION 5
 42          RK    3300    .016    .080            TRAP      80       2

 43          KK   DBXS5
 44          KM       ROUTE RDB20 THROUGH STORAGE AT CROSS SECTION 5
 45          RS       1    ELEV    6607
 46          SQ       0       0     133     507    2086    5563
 47          SE    6607    6609    6610    6612    6614    6616
 48          SA     4.5    4.72    5.02    5.61     6.2    6.87
 49          SE    6607    6609    6610    6612    6614    6616
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 50          KK   DBXS2
 51          KM        ROUTE OUTFLOW FROM DBSX4 THROUGH STORAGE AT CROSS SECTION 2
 52          RS       1    ELEV    6581
 53          SQ       0       0     406    1239    3418    4372
 54          SE    6581  6584.5    6586    6588    6590    6592
 55          SA       2    2.15    2.28    2.46     2.6     2.8
```

```
            56          SE    6581  6584.5    6586    6588    6590    6592
            57          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     9       BSQ-1
              V
              V
    26      DBXS24
              V
              V
    33      DBXS20
              V
              V
    40       RDB20
              V
              V
    43       DBXS5
              V
              V
    50       DBXS2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*             VERSION 4.1               *
*                                       *
*  RUN DATE   01FEB11  TIME  14:39:38   *
*                                       *
*****************************************

*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************

                        HEC-1
                        BLACK SQUIRREL CREEK AT VOYAGER    ALLISON VALLEY MDDP
                        KIOWA ENGINEERING CORPORATION  JOB NO. 10051
                        10-YEAR AND 100-YEAR 24-HOUR STORMS PRESENT BASIN CONDITIONS
                        FILENAME BSQCREV3.DAT

   7 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
```

```
      IT          HYDROGRAPH TIME DATA
                        NMIN            5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1     0  STARTING DATE
                       ITIME         0000  STARTING TIME
                          NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2     0  ENDING DATE
                      NDTIME         0055  ENDING TIME
                      ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL      .08 HOURS
                         TOTAL TIME BASE    24.92 HOURS

           ENGLISH UNITS
                DRAINAGE AREA          SQUARE MILES
                PRECIPITATION DEPTH    INCHES
                LENGTH, ELEVATION      FEET
                FLOW                   CUBIC FEET PER SECOND
                STORAGE VOLUME         ACRE-FEET
                SURFACE AREA           ACRES
                TEMPERATURE            DEGREES FAHRENHEIT

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                     .40       .54       .65      1.00
1

                PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                        TIME TO PEAK IN HOURS


                                                                  RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA    PLAN                RATIO 1  RATIO 2  RATIO 3  RATIO 4
                                                             .40      .54      .65     1.00

 HYDROGRAPH AT
+                  BSQ-1      9.80      1    FLOW           72.      508.    1102.    4040.
                                             TIME         7.00     6.75     6.67     6.58

 ROUTED TO
+                  DBXS24     9.80      1    FLOW           30.      496.    1093.    4028.
                                             TIME        10.75     6.83     6.75     6.58

                                       ** PEAK STAGES IN FEET **
                                       1   STAGE      6709.02  6709.38  6709.84  6710.81
                                             TIME        10.75     6.83     6.75     6.58

 ROUTED TO
+                  DBXS20     9.80      1    FLOW           28.      482.    1090.    4024.
```

DP 8

				TIME	13.42	6.92	6.75	6.67
			** PEAK STAGES IN FEET **					
			1	STAGE	6675.14	6676.42	6677.30	6680.15
				TIME	13.25	6.92	6.75	6.67
ROUTED TO								
+	RDB20	9.80	1	FLOW	28.	477.	1084.	3993.
				TIME	13.83	7.08	6.83	6.67
ROUTED TO								
+	DBXS5	9.80	1	FLOW	23.	247.	891.	3986.
				TIME	20.75	7.92	7.17	6.75
			** PEAK STAGES IN FEET **					
			1	STAGE	6609.17	6610.61	6612.49	6615.09
				TIME	20.67	7.92	7.17	6.75
ROUTED TO								
+	DBXS2	9.80	1	FLOW	23.	235.	833.	3937.
				TIME	20.83	8.17	7.33	6.83
			** PEAK STAGES IN FEET **					
			1	STAGE	6584.58	6585.37	6587.03	6591.09
				TIME	20.75	8.17	7.33	6.83
1								
			*** NORMAL END OF HEC-1 ***					

Excess Runoff (EURV)

Assume Type B soils

Use 6-hr 5yr storm ⇒ Q = 1.7 inches

Existing Condition

Use Antecedent Moisture Condition (AcM) I

- convert CN from AcM II to AcM I by reducing by 15 points

- Assume all basins are pasture in good condition

⇒ use CN for Basin K in Black Squirrel Creek DBPS

⇒ CN = 68 (AMC II) − 15 = 53 (AMC II)

Tables in "Peak Flows for Colorado" do not go below CN of 55 ⇒ use CN = 55

⇒ For CN = 55 & Rainfall = 1.7 inches

⇒ Excess Runoff = 0.00 inches

⇒ No runoff for 2-yr 6-hr storm

⇒ Detain entire Developed Runoff

Allison Valley
Excess Urban Runoff Volume (EURV) Calculations

Basin / Design Point	Total Area (acres)	Commercial (acres)	12-24 du/ac (acres)	8-10 du/ac (acres)	3.5-8 du/ac (acres)	2-3.5 du/ac (acres)	2 du/ac (acres)	School (acres)	Existing Curve Number (AMC I) (CN)	Proposed Curve Number (AMC II) (CN)	Runoff* (inches)	EURV (acre-feet)	Detention Storage** (acre-feet)
BS-1	45.06 ac				4.02 ac	34.34 ac	6.70 ac		55	72	0.20 inches	0.75 ac-ft	1.05 ac-ft
BS-2	25.08 ac			25.08 ac					55	87	0.68 inches	1.42 ac-ft	1.99 ac-ft
BS-3	39.70 ac	39.70 ac							55	92	0.54 inches	1.79 ac-ft	2.50 ac-ft
BS-4	30.30 ac	30.30 ac							55	92	0.97 inches	2.45 ac-ft	3.43 ac-ft
BS-5	51.08 ac	51.08 ac							55	92	0.97 inches	4.13 ac-ft	5.78 ac-ft
BS-6	25.69 ac			24.56 ac	1.13 ac				55	87	0.68 inches	1.46 ac-ft	2.04 ac-ft
BS-7	40.57 ac				1.73 ac	34.27 ac	4.57 ac		55	72	0.22 inches	0.74 ac-ft	1.04 ac-ft
BS-8	21.04 ac							21.04 ac	55	78	0.33 inches	0.58 ac-ft	0.81 ac-ft
BS-9	19.17 ac				19.17 ac				55	80	0.39 inches	0.62 ac-ft	0.87 ac-ft
MT-1	29.91 ac			0.31 ac	7.93 ac	6.11 ac	15.56 ac		55	73	0.20 inches	0.50 ac-ft	0.70 ac-ft
MT-2	8.15 ac	3.10 ac		4.37 ac		0.68 ac			55	88	0.63 inches	0.43 ac-ft	0.60 ac-ft

Curve Numbers	
Commercial	92
12-24 du/ac	90
8-10 du/ac	87
3.5-8 du/ac	80
2-3.5 du/ac	72
2 du/ac	70
School	78

EURV = (Runoff x Total Area) / 12

*From Peak Flows in Colorado by Soil Conservation Service - based upon a 6-hour, 5-year storm of 1.7 inches

**Assuming 40% increase in EURV will be needed for detention of major storm runoff

Allison Valley
Prudent Line Calculations

				Left				Right				Left		Right	
Cross Section	Station	Open Water	Channel Velocity	Bank Height (BH)	Incision Depth (ID)	Valley Width (VW)	Setback Eqn (1)	Bank Height (BH)	Incision Depth (ID)	Valley Width (VW)	Setback Eqn (1)	Valley Wall Crest (VC)	Setback Eqn (2)	Valley Wall Crest (VC)	Setback Eqn (2)
Black Squirrel Creek															
	13+00	Yes*		10 ft	0 ft	130 ft	150 ft	10 ft	0 ft	130 ft	150 ft	38 ft	88 ft	30 ft	80 ft
	14+00	Yes*		10 ft	0 ft	137 ft	157 ft	10 ft	0 ft	137 ft	157 ft	20 ft	70 ft	20 ft	70 ft
	17+00	Yes*		10 ft	0 ft	92 ft	112 ft	10 ft	0 ft	92 ft	112 ft	25 ft	75 ft	55 ft	105 ft
	22+00	Yes*		5 ft	0 ft	100 ft	110 ft	5 ft	0 ft	100 ft	110 ft	26 ft	76 ft	10 ft	60 ft
	26+00	Yes*		6 ft	0 ft	150 ft	162 ft	6 ft	0 ft	150 ft	162 ft	22 ft	72 ft	55 ft	105 ft
	28+00	Yes*		6 ft	0 ft	164 ft	176 ft	6 ft	0 ft	164 ft	176 ft	28 ft	78 ft	45 ft	95 ft
6	29+00	Yes*	2.0 fps	6 ft	0 ft	200 ft	212 ft	6 ft	0 ft	200 ft	212 ft	36 ft	86 ft	80 ft	130 ft
	30+60	Yes*		6 ft	0 ft	115 ft	127 ft	6 ft	0 ft	115 ft	127 ft	26 ft	76 ft	26 ft	76 ft
7	32+00	Yes*	2.7 fps	6 ft	0 ft	170 ft	182 ft	6 ft	0 ft	170 ft	182 ft	22 ft	72 ft	28 ft	78 ft
	33+00	Yes*		6 ft	0 ft	95 ft	107 ft	6 ft	0 ft	95 ft	107 ft	55 ft	105 ft	25 ft	75 ft
	34+00	Yes*		6 ft	0 ft	88 ft	100 ft	6 ft	0 ft	88 ft	100 ft	50 ft	100 ft	36 ft	86 ft
	35+00	Yes*		6 ft	0 ft	73 ft	85 ft	6 ft	0 ft	73 ft	85 ft	22 ft	72 ft	21 ft	71 ft
	37+50	Yes*		6 ft	0 ft	80 ft	92 ft	6 ft	0 ft	80 ft	92 ft	43 ft	93 ft	22 ft	72 ft
8***	39+30	No	8.5 fps	6 ft	5 ft	47 ft	69 ft	6 ft	5 ft	47 ft	69 ft	65 ft	115 ft	40 ft	90 ft
9	40+50	No	12.2 fps	4 ft	5 ft	45 ft	63 ft	4 ft	5 ft	45 ft	63 ft	35 ft	85 ft	20 ft	70 ft
	41+50	No		6 ft	5 ft	60 ft	82 ft	6 ft	5 ft	60 ft	82 ft	30 ft	80 ft	45 ft	95 ft
10	43+25	No	11.8 fps	4 ft	5 ft	56 ft	74 ft	4 ft	5 ft	56 ft	74 ft	33 ft	83 ft	20 ft	70 ft
11	45+60	No	10.2 fps	4 ft	5 ft	80 ft	98 ft	4 ft	5 ft	80 ft	98 ft	47 ft	97 ft	65 ft	115 ft
12	47+60	No	11.2 fps	4 ft	5 ft	74 ft	92 ft	4 ft	5 ft	74 ft	92 ft	25 ft	75 ft	35 ft	85 ft
13		No	10.4 fps	4 ft	5 ft	103 ft	121 ft	4 ft	5 ft	103 ft	121 ft	20 ft	70 ft	35 ft	85 ft
14		No	11.0 fps	4 ft	5 ft	72 ft	90 ft	4 ft	5 ft	72 ft	90 ft	34 ft	84 ft	40 ft	90 ft
15		No	11.6 fps	4 ft	5 ft	63 ft	81 ft	4 ft	5 ft	63 ft	81 ft	35 ft	85 ft	55 ft	105 ft
16		No	11.9 fps	6 ft	5 ft	66 ft	88 ft	6 ft	5 ft	66 ft	88 ft	60 ft	110 ft	60 ft	110 ft
	62+00	No		6 ft	5 ft	53 ft	75 ft	6 ft	5 ft	53 ft	75 ft	35 ft	85 ft	28 ft	78 ft
	64+00***	No		4 ft	5 ft	50 ft	68 ft	4 ft	5 ft	50 ft	68 ft	40 ft	90 ft	63 ft	113 ft
	64+50	No		4 ft	5 ft	60 ft	78 ft	4 ft	5 ft	60 ft	78 ft	12 ft	62 ft	28 ft	78 ft
	66+50	No		4 ft	5 ft	54 ft	72 ft	4 ft	5 ft	54 ft	72 ft	60 ft	110 ft	60 ft	110 ft
	68+00	No		4 ft	5 ft	56 ft	74 ft	4 ft	5 ft	56 ft	74 ft	60 ft	110 ft	40 ft	90 ft
19		No	10.9 fps	4 ft	5 ft	68 ft	86 ft	4 ft	5 ft	68 ft	86 ft	20 ft	70 ft	35 ft	85 ft
	71+00	Yes*		4 ft	0 ft	154 ft	162 ft	4 ft	0 ft	154 ft	162 ft	16 ft	66 ft	10 ft	60 ft
	72+00	Yes*		4 ft	0 ft	200 ft	208 ft	4 ft	0 ft	200 ft	208 ft	22 ft	72 ft	32 ft	82 ft
	74+50	Yes*		5 ft	0 ft	117 ft	127 ft	5 ft	0 ft	117 ft	127 ft	18 ft	68 ft	48 ft	98 ft
21		Yes*	4.7 fps	5 ft	0 ft	140 ft	150 ft	5 ft	0 ft	140 ft	150 ft	50 ft	100 ft	24 ft	74 ft
22***		No	11.2 fps	4 ft	5 ft	76 ft	94 ft	4 ft	5 ft	76 ft	94 ft	37 ft	87 ft	23 ft	73 ft
23		No	8.9 fps	2 ft	5 ft	163 ft	177 ft	2 ft	5 ft	163 ft	177 ft	25 ft	75 ft	26 ft	76 ft

Minimum Setback Equations
Eqn (1) 2* (BH + ID) + 1 VW
Eqn (2) VC + 50

*Open Water - Use 50-feet from 100-year Floodplain
**Velocity is non-erosive - Use 50-feet from 100-year Floodplain
***Outside Bank to be armored - Use 50-feet from 100-year Floodplain

Allison Valley
Prudent Line Calculations

				Left				Right				Left		Right	
Cross Section	Station	Open Water	Channel Velocity	Bank Height (BH)	Incision Depth (ID)	Valley Width (VW)	Setback Eqn (1)	Bank Height (BH)	Incision Depth (ID)	Valley Width (VW)	Setback Eqn (1)	Valley Wall Crest (VC)	Setback Eqn (2)	Valley Wall Crest (VC)	Setback Eqn (2)
Middle Tributary Creek															
2		No	8.9 fps	4 ft	5 ft	30 ft	48 ft	4 ft	5 ft	30 ft	48 ft	20 ft	70 ft	20 ft	70 ft
	12+70	No		4 ft	5 ft	33 ft	51 ft	4 ft	5 ft	33 ft	51 ft	60 ft	110 ft	30 ft	80 ft
3		No	8.2 fps	2 ft	5 ft	40 ft	54 ft	2 ft	5 ft	40 ft	54 ft	30 ft	80 ft	15 ft	65 ft
	15+00	No		2 ft	5 ft	30 ft	44 ft	2 ft	5 ft	30 ft	44 ft	20 ft	70 ft	50 ft	100 ft
4		No	7.7 fps	2 ft	5 ft	50 ft	64 ft	2 ft	5 ft	50 ft	64 ft	35 ft	85 ft	35 ft	85 ft
5		No	10.0 fps	4 ft	5 ft	11 ft	29 ft	4 ft	5 ft	11 ft	29 ft	90 ft	140 ft	40 ft	90 ft
	21+50	*Yes		2 ft	0 ft	280 ft	284 ft	2 ft	0 ft	280 ft	284 ft	40 ft	90 ft	20 ft	70 ft
7		No	5.2 fps	2 ft	5 ft	50 ft	64 ft	2 ft	5 ft	50 ft	64 ft	30 ft	80 ft	12 ft	62 ft
	25+00	No		2 ft	5 ft	45 ft	59 ft	2 ft	5 ft	45 ft	59 ft	20 ft	70 ft	10 ft	60 ft
8		No	7.7 fps	2 ft	5 ft	40 ft	54 ft	2 ft	5 ft	40 ft	54 ft	20 ft	70 ft	10 ft	60 ft
9		No	9.6 fps	2 ft	5 ft	23 ft	37 ft	2 ft	5 ft	23 ft	37 ft	20 ft	70 ft	20 ft	70 ft
10		No	9.0 fps	2 ft	5 ft	25 ft	39 ft	2 ft	5 ft	25 ft	39 ft	24 ft	74 ft	8 ft	58 ft
11		No	7.6 fps	2 ft	5 ft	65 ft	79 ft	2 ft	5 ft	65 ft	79 ft	10 ft	60 ft	15 ft	65 ft
13		No	9.6 fps	4 ft	5 ft	20 ft	38 ft	4 ft	5 ft	20 ft	38 ft	20 ft	70 ft	10 ft	60 ft
	34+80**	No		2 ft	5 ft	190 ft	204 ft	2 ft	5 ft	190 ft	204 ft	40 ft	90 ft	40 ft	90 ft
14**		No	4.8 fps	2 ft	1 ft	210 ft	216 ft	2 ft	1 ft	210 ft	216 ft	85 ft	135 ft	30 ft	80 ft
15**		No	5.1 fps	2 ft	1 ft	114 ft	120 ft	2 ft	1 ft	114 ft	120 ft	46 ft	96 ft	45 ft	95 ft
16**		No	5.3 fps	2 ft	1 ft	90 ft	96 ft	2 ft	1 ft	90 ft	96 ft	30 ft	80 ft	40 ft	90 ft
17**		No	5.1 fps	2 ft	1 ft	110 ft	116 ft	2 ft	1 ft	110 ft	116 ft	40 ft	90 ft	40 ft	90 ft
18**		No	6.2 fps	2 ft	1 ft	72 ft	78 ft	2 ft	1 ft	72 ft	78 ft	30 ft	80 ft	20 ft	70 ft
19**		No	4.9 fps	2 ft	1 ft	120 ft	126 ft	2 ft	1 ft	120 ft	126 ft	40 ft	90 ft	30 ft	80 ft
20**		No	5.0 fps	2 ft	1 ft	120 ft	126 ft	2 ft	1 ft	120 ft	126 ft	35 ft	85 ft	25 ft	75 ft
21**		No	7.0 fps	2 ft	1 ft	32 ft	38 ft	2 ft	1 ft	32 ft	38 ft	10 ft	60 ft	10 ft	60 ft

Minimum Setback Equations
Eqn (1) 2* (BH + ID) + 1 VW
Eqn (2) VC + 50

*Open Water - Use 50-feet from 100-year Floodplain
**Velocity is non-erosive - Use 50-feet from 100-year Floodplain
***Outside Bank to be armored - Use 50-feet from 100-year Floodplain

Cross Section D4

storage - stage discharge curve

Use weir eqn.

$Q = 2.6 L d^{1.5}$ ← weir coefficient

d = water depth in feet

L = length of weir (spillway) in feet

Low point in spillway = slightly below 6598
⇒ assume 6597

Elev	d	L	Q	2/3d	Q
6598	1'	18'	47 cfs		
6600	3'	103'	1,391 cfs	2'	757
6602	5'	146'	4,244 cfs	3.33'	2,307
6604	7'	167'	8,041 cfs	4.67'	4,382

Cross Section D2

Assume low point of 6584.5

Elev	d	L	Q	2/3d	Q
6586	1.5'	85'	406 cfs		
6588	3.5'	134'	2,281 cfs	2.33'	1,239
6590	5.5'	187'	4,271 cfs	3.67'	3,418
6592	7.5'	288'	15,380	5.0'	8,372

Kiowa Engineering Corporation

CLIENT _____ JOB NO. 10051 PAGE _____
PROJECT Allyson Valley DATE CHECKED _____ DATE 1/13/11
DETAIL Black Squirrel Creek CHECKED BY _____ COMPUTED BY JeD

Storage - Stage discharge curve

Use weir eqn.

$Q = 2.6 L d^{1.5}$

2.6 ↑ weir coefficient

L = length of weir (spillway)
d = water depth

Cross Section 24 — Assume low point of 6709

Elev	d	L	Q	2/3 d (centroid)	Q
6710	1'	500'	1300 cfs		
6712	3'	1097'	14,820 cfs	2'	8,067
6714	5'	1159'	33,691 cfs	3.33'	18,311

Cross Section 20 — Assume low point of 6675

Elev	d	L	Q	2/3 d	Q
6676	1'	75'	195 cfs		
6678	3'	214'	2,891 cfs	2'	1,574
6680	5'	242'	7,035 cfs	3.33'	3,823
6682	7'	250'	12,038	4.67'	6,560

Cross Section 5 — Assume low point of 6609

Elev	d	L	Q	2/3 d	Q
6610	1'	51'	133 cfs		
6612	3'	69'	932 cfs	2'	507
6614	5'	132'	3,837 cfs	3.33'	2086
6616	7'	212'	10,208 cfs	4.67'	5,563

Kiowa Engineering Corporation

CLIENT _____ JOB NO. 10051 PAGE _____
PROJECT Allison Valley DATE CHECKED _____ DATE 1/25/11
DETAIL Black Squirrel Creek CHECKED BY _____ COMPUTED BY JGD

Proposed Condition XS 17

rebuild breached dam

previous WSEL of pond = 6661± ← set this as proposed

proposed spillway crest 6663

" " length 200' w/ 6:1 side slopes

" " depth 4'

Storage - stage discharge curve.

weir eqn $Q = 2.6Ld^{1.5}$

Elev.	d	L	Q
6664	1'	200'	520 cfs
6665	2'	↓	1471 cfs
6666	3'	↓	2,702 cfs
6667	4'	↓	4,160 cfs

Elev	Area (sf)	Area (acres)	
6660	74,272	1.71	> 6661 2.30ac.
6662	125,684	2.89	
6664	147,361	3.38	
6666	167,219	3.84	
6668	186,327	4.28	

APPENDIX B

Hydraulic Calculations

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Allison Valley
Project File : Allison.prj
Run Date and Time: 2/8/2011 11:58:03 AM

Project in English units

Project Description:
Black Squirrel Creek and Middle Tributary Creek running through Allison Valley property - existing conditions for establishing 100-year floodplain

PLAN DATA

Plan Title: Existing Middle Tributary
Plan File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.p02

Geometry Title: Existing Middle Tributary
Geometry File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.g02

Flow Title : Existing Middle Tributary
Flow File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.f02

Plan Summary Information:

Number of:	Cross Sections	= 21	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Existing Middle Tributary
Flow File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.f02

Flow Data (cfs)

River	Reach	RS	PF 1
Middle Tributary	Allison Valley	21	546
Middle Tributary	Allison Valley	12	792

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Middle Tributary	Allison Valley	PF 1	Normal S = 0.037	

GEOMETRY DATA

Geometry Title: Existing Middle Tributary
Geometry File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.g02

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 21

INPUT
Description: North Property Boundary
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6714	1015	6712	1028	6710	1040	6708	1057	6707.6
1072	6708	1083	6710	1095	6712	1142	6714		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1028	.03	1083	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1028	1083	250	180	85	.1 .3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 20

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

1000	6710	1008	6708	1025	6706	1059	6704	1079	6704
1102	6703.8	1118	6704	1135	6704.2	1153	6704	1179	6704
1198	6706	1203	6708	1210	6710				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1008	.03	1203	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1008	1203	260	243	280	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 19

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6704	1020	6702	1046	6700	1096	6698	1121	6698.2
1133	6698	1141	6698.3	1174	6698	1212	6698	1239	6700
1243	6702	1247	6704						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1020	.03	1243	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1020	1243	200	237	265	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 18

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6700	1022	6698	1049	6696	1076	6694	1102	6692
1127	6690	1174	6692	1192	6694	1208	6696	1222	6698
1235	6700								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1076	.03	1192	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1076	1192	200	208	240	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 17

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

1000	6694	1016	6692	1034	6690	1050	6688	1081	6686
1146	6686	1154	6686.2	1182	6686	1224	6688	1259	6690
1276	6692	1284	6694						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1034	.03	1259	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1034	1259	225	191	150	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 16

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6688	1019	6686	1036	6684	1051	6682	1074	6680.1
1091	6680	1107	6680.2	1157	6680	1201	6682	1226	6684
1245	6686	1267	6688						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1036	.03	1226	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1036	1226	150	193	260	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 15

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6684	1051	6678	1071	6676	1111	6674	1127	6674
1248	6676	1280	6678	1291	6680	1317	6684		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1051	.03	1280	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1051	1280	250	212	165	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 14

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6680	1066	6672	1092	6670	1180	6668.2	1261	6668

1294	6668	1326	6670	1341	6672	1353	6674	1399	6680

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1066	.03	1341	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1066	1341	250	171	140	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 13

INPUT
Description: Above Breached Dam
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6666	1068	6664	1112	6662	1120	6660	1125	6658
1129	6656	1137	6652	1144	6654	1148	6656	1154	6662
1166	6664	1211	6666						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1129	.03	1148	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1129	1148	80	77	80	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 12

INPUT
Description: Breached Dam
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6670	1165	6668	1169	6666	1174	6662	1178	6656
1181	6654	1184	6652	1194	6650	1196	6650	1208	6652
1211	6654	1214	6656	1222	6668	1243	6670		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1181	.03	1211	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1181	1211	150	94	80	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 11

INPUT
Description: Downstream of Breached Dam
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6660	1020	6658	1025	6656	1031	6652	1034	6650
1044	6648.3	1060	6650	1076	6655	1087	6650	1097	6648

1107	6648	1116	6652	1121	6654	1149	6660

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1031	.03	1116	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1031	1116	120	144	155	.1 .3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 10

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6656	1012	6654	1028	6652	1038	6650	1046	6648
1052	6646	1062	6644	1076	6642	1080	6642	1086	6644
1088	6646	1093	6650	1099	6652	1114	6656		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1052	.03	1088	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1052	1088	165	172	180	.1 .3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 9

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6654	1014	6652	1042	6648	1047	6646	1057	6640
1062	6638	1074	6636	1084	6638	1086	6640	1091	6644
1097	6646	1108	6648	1126	6650	1145	6652	1169	6654

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1057	.03	1086	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1057	1086	240	266	280	.1 .3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 8

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6646	1026	6644	1047	6642	1065	6640	1108	6638
1130	6636	1154	6634	1170	6636	1173	6638	1176	6640

1182	6642	1196	6644	1232	6646

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1108	.03	1173	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1108	1173	250	250	210	.1 .3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 7

INPUT
Description: Upstream of Existing Pond
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6648	1019	6640	1041	6638	1055	6636	1061	6634
1082	6632	1119	6630	1134	6632	1145	6634	1158	6636
1184	6638	1206	6640	1221	6642				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1061	.03	1145	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1061	1145	520	481	560	.1 .3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 6

INPUT
Description: Existing Road/Dam
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6634	1073	6632	1207	6630	1420	6628.6	1475	6630
1553	6632	1576	6634						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.03	1073	.03	1553	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1073	1553	200	94	65	.1 .3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 5

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6614	1016	6616	1024	6616.6	1028	6616	1038	6612
1043	6610	1050	6608	1054	6608	1054	6610	1057	6612
1062	6614	1080	6616	1095	6618	1101	6620		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1038	.03	1057	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1038	1057	230	158	120	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 4

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6616	1027	6612	1045	6610	1055	6608	1084	6604
1107	6606	1121	6608	1138	6612	1165	6616		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1055	.03	1121	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1055	1121	250	273	265	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 3

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6610	1007	6608	1022	6604	1032	6602	1041	6600
1065	6598	1067	6598	1080	6600	1084	6602	1094	6606
1116	6610								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1032	.03	1084	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1032	1084	215	242	250	.1	.3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 2

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6604	1011	6602	1016	6600	1025	6596	1030	6594
1041	6592	1044	6591	1048	6592	1049	6592.1	1050	6592
1051	6592	1053	6592.1	1054	6592	1058	6592	1062	6594
1067	6596	1074	6598	1080	6600	1087	6602	1097	6604

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1025	.03	1067	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1025	1067	160	163	150	.1 .3

CROSS SECTION

RIVER: Middle Tributary
REACH: Allison Valley RS: 1

INPUT
Description: Near West Property Boundary
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6600	1025	6590	1027	6588	1033	6586	1048	6584
1067	6588	1114	6594	1154	6600				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1027	.03	1067	.045

Bank Sta: Left	Right	Coeff Contr.	Expan.
1027	1067	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Middle Tributary

Reach	River Sta.	n1	n2	n3
Allison Valley	21	.045	.03	.045
Allison Valley	20	.045	.03	.045
Allison Valley	19	.045	.03	.045
Allison Valley	18	.045	.03	.045
Allison Valley	17	.045	.03	.045
Allison Valley	16	.045	.03	.045
Allison Valley	15	.045	.03	.045
Allison Valley	14	.045	.03	.045
Allison Valley	13	.045	.03	.045
Allison Valley	12	.045	.03	.045
Allison Valley	11	.045	.03	.045
Allison Valley	10	.045	.03	.045
Allison Valley	9	.045	.03	.045
Allison Valley	8	.045	.03	.045
Allison Valley	7	.045	.03	.045
Allison Valley	6	.03	.03	.03
Allison Valley	5	.045	.03	.045
Allison Valley	4	.045	.03	.045
Allison Valley	3	.045	.03	.045
Allison Valley	2	.045	.03	.045
Allison Valley	1	.045	.03	.045

SUMMARY OF REACH LENGTHS

River: Middle Tributary

Reach	River Sta.	Left	Channel	Right
Allison Valley	21	250	180	85
Allison Valley	20	260	243	280
Allison Valley	19	200	237	265
Allison Valley	18	200	208	240
Allison Valley	17	225	191	150
Allison Valley	16	150	193	260
Allison Valley	15	250	212	165
Allison Valley	14	250	171	140
Allison Valley	13	80	77	80
Allison Valley	12	150	94	80
Allison Valley	11	120	144	155
Allison Valley	10	165	172	180
Allison Valley	9	240	266	280
Allison Valley	8	250	250	210
Allison Valley	7	520	481	560
Allison Valley	6	200	94	65
Allison Valley	5	230	158	120
Allison Valley	4	250	273	265
Allison Valley	3	215	242	250
Allison Valley	2	160	163	150
Allison Valley	1			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Middle Tributary

Reach	River Sta.	Contr.	Expan.
Allison Valley	21	.1	.3
Allison Valley	20	.1	.3
Allison Valley	19	.1	.3
Allison Valley	18	.1	.3
Allison Valley	17	.1	.3
Allison Valley	16	.1	.3
Allison Valley	15	.1	.3
Allison Valley	14	.1	.3
Allison Valley	13	.1	.3
Allison Valley	12	.1	.3
Allison Valley	11	.1	.3
Allison Valley	10	.1	.3
Allison Valley	9	.1	.3
Allison Valley	8	.1	.3
Allison Valley	7	.1	.3
Allison Valley	6	.1	.3
Allison Valley	5	.1	.3
Allison Valley	4	.1	.3
Allison Valley	3	.1	.3
Allison Valley	2	.1	.3
Allison Valley	1	.1	.3

HEC-RAS Plan: Existing MT River: Middle Tributary Reach: Allison Valley Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Allison Valley	21	PF 1	546.00	6707.60	6709.70	6709.70	6710.47	0.011801	7.04	77.60	51.59	1.01
Allison Valley	20	PF 1	546.00	6703.80	6704.83	6704.83	6705.22	0.014616	5.02	108.86	141.95	1.01
Allison Valley	19	PF 1	546.00	6698.00	6698.91	6698.91	6699.28	0.014913	4.92	110.86	150.83	1.01
Allison Valley	18	PF 1	546.00	6690.00	6692.22	6692.22	6692.81	0.013018	6.19	88.20	76.79	1.02
Allison Valley	17	PF 1	546.00	6686.00	6686.94	6686.94	6687.34	0.014292	5.08	107.52	135.33	1.00
Allison Valley	16	PF 1	546.00	6680.00	6681.10	6681.10	6681.54	0.013754	5.28	103.45	119.37	1.00
Allison Valley	15	PF 1	546.00	6674.00	6675.44	6675.44	6675.85	0.014146	5.11	106.82	132.11	1.00
Allison Valley	14	PF 1	546.00	6668.00	6668.91	6668.91	6669.26	0.014992	4.78	114.20	163.12	1.01
Allison Valley	13	PF 1	546.00	6652.00	6656.80	6656.80	6658.25	0.010113	9.69	57.13	21.40	0.99
Allison Valley	12	PF 1	792.00	6650.00	6654.11	6654.11	6655.51	0.010139	9.52	83.24	30.32	1.01
Allison Valley	11	PF 1	792.00	6648.00	6650.87	6650.87	6651.77	0.011382	7.62	103.98	58.46	1.01
Allison Valley	10	PF 1	792.00	6642.00	6646.01	6646.01	6647.26	0.010432	8.96	88.39	36.05	1.01
Allison Valley	9	PF 1	792.00	6636.00	6640.32	6640.32	6641.76	0.010130	9.64	82.32	29.92	1.01
Allison Valley	8	PF 1	792.00	6634.00	6637.30	6637.30	6638.23	0.011103	7.73	102.50	56.24	1.01
Allison Valley	7	PF 1	792.00	6630.00	6633.54	6632.95	6633.97	0.004547	5.24	151.28	76.69	0.66
Allison Valley	6	PF 1	792.00	6628.60	6629.93	6629.93	6630.27	0.015452	4.69	168.97	254.35	1.01
Allison Valley	5	PF 1	792.00	6608.00	6613.49	6613.49	6615.21	0.009376	10.61	78.87	26.45	0.95
Allison Valley	4	PF 1	792.00	6604.00	6607.39	6607.39	6608.30	0.011043	7.67	103.23	57.27	1.01
Allison Valley	3	PF 1	792.00	6598.00	6601.29	6601.29	6602.33	0.010737	8.18	96.79	47.39	1.01
Allison Valley	2	PF 1	792.00	6591.00	6595.07	6595.07	6596.29	0.010472	8.86	89.44	37.36	1.01
Allison Valley	1	PF 1	792.00	6584.00	6588.07	6588.07	6589.23	0.010362	8.64	91.70	40.59	1.01

Plan: Existing MT Middle Tributary Allison Valley RS: 21 Profile: PF 1

E.G. Elev (ft)	6710.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.		0.030	
W.S. Elev (ft)	6709.70	Reach Len. (ft)	250.00	180.00	85.00
Crit W.S. (ft)	6709.70	Flow Area (sq ft)		77.60	
E.G. Slope (ft/ft)	0.011801	Area (sq ft)		77.60	
Q Total (cfs)	546.00	Flow (cfs)		546.00	
Top Width (ft)	51.59	Top Width (ft)		51.59	
Vel Total (ft/s)	7.04	Avg. Vel. (ft/s)		7.04	
Max Chl Dpth (ft)	2.10	Hydr. Depth (ft)		1.50	
Conv. Total (cfs)	5026.2	Conv. (cfs)		5026.2	
Length Wtd. (ft)	180.00	Wetted Per. (ft)		51.90	
Min Ch El (ft)	6707.60	Shear (lb/sq ft)		1.10	
Alpha	1.00	Stream Power (lb/ft s)		7.75	
Frctn Loss (ft)	2.36	Cum Volume (acre-ft)	0.02	9.91	0.01
C & E Loss (ft)	0.11	Cum SA (acres)	0.03	8.57	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 20 Profile: PF 1

E.G. Elev (ft)	6705.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.		0.030	
W.S. Elev (ft)	6704.83	Reach Len. (ft)	260.00	243.00	280.00
Crit W.S. (ft)	6704.83	Flow Area (sq ft)		108.86	
E.G. Slope (ft/ft)	0.014616	Area (sq ft)		108.86	
Q Total (cfs)	546.00	Flow (cfs)		546.00	
Top Width (ft)	141.95	Top Width (ft)		141.95	
Vel Total (ft/s)	5.02	Avg. Vel. (ft/s)		5.02	
Max Chl Dpth (ft)	1.03	Hydr. Depth (ft)		0.77	
Conv. Total (cfs)	4516.2	Conv. (cfs)		4516.2	
Length Wtd. (ft)	243.00	Wetted Per. (ft)		142.02	
Min Ch El (ft)	6703.80	Shear (lb/sq ft)		0.70	
Alpha	1.00	Stream Power (lb/ft s)		3.51	
Frctn Loss (ft)	3.59	Cum Volume (acre-ft)	0.02	9.53	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.03	8.17	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 19 Profile: PF 1

E.G. Elev (ft)	6699.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.		0.030	
W.S. Elev (ft)	6698.91	Reach Len. (ft)	200.00	237.00	265.00
Crit W.S. (ft)	6698.91	Flow Area (sq ft)		110.86	

Plan: Existing MT Middle Tributary Allison Valley RS: 19 Profile: PF 1 (Continued)

E.G. Slope (ft/ft)	0.014913	Area (sq ft)		110.86	
Q Total (cfs)	546.00	Flow (cfs)		546.00	
Top Width (ft)	150.83	Top Width (ft)		150.83	
Vel Total (ft/s)	4.92	Avg. Vel. (ft/s)		4.92	
Max Chl Dpth (ft)	0.90	Hydr. Depth (ft)		0.74	
Conv. Total (cfs)	4471.0	Conv. (cfs)		4471.0	
Length Wtd. (ft)	237.00	Wetted Per. (ft)		150.90	
Min Ch El (ft)	6698.00	Shear (lb/sq ft)		0.68	
Alpha	1.00	Stream Power (lb/ft s)		3.37	
Frctn Loss (ft)	3.30	Cum Volume (acre-ft)	0.02	8.91	0.01
C & E Loss (ft)	0.02	Cum SA (acres)	0.03	7.35	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 18 Profile: PF 1

E.G. Elev (ft)	6692.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.		0.030	
W.S. Elev (ft)	6692.22	Reach Len. (ft)	200.00	208.00	240.00
Crit W.S. (ft)	6692.22	Flow Area (sq ft)		88.20	
E.G. Slope (ft/ft)	0.013018	Area (sq ft)		88.20	
Q Total (cfs)	546.00	Flow (cfs)		546.00	
Top Width (ft)	76.79	Top Width (ft)		76.79	
Vel Total (ft/s)	6.19	Avg. Vel. (ft/s)		6.19	
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)		1.15	
Conv. Total (cfs)	4785.4	Conv. (cfs)		4785.4	
Length Wtd. (ft)	208.00	Wetted Per. (ft)		76.93	
Min Ch El (ft)	6690.00	Shear (lb/sq ft)		0.93	
Alpha	1.00	Stream Power (lb/ft s)		5.77	
Frctn Loss (ft)	2.84	Cum Volume (acre-ft)	0.02	8.37	0.01
C & E Loss (ft)	0.06	Cum SA (acres)	0.03	6.73	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 17 Profile: PF 1

E.G. Elev (ft)	6687.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.		0.030	
W.S. Elev (ft)	6686.94	Reach Len. (ft)	225.00	191.00	150.00
Crit W.S. (ft)	6686.94	Flow Area (sq ft)		107.52	
E.G. Slope (ft/ft)	0.014292	Area (sq ft)		107.52	
Q Total (cfs)	546.00	Flow (cfs)		546.00	
Top Width (ft)	135.33	Top Width (ft)		135.33	
Vel Total (ft/s)	5.08	Avg. Vel. (ft/s)		5.08	

Plan: Existing MT Middle Tributary Allison Valley RS: 17 Profile: PF 1 (Continued)

Max Chl Dpth (ft)	0.94	Hydr. Depth (ft)		0.79	
Conv. Total (cfs)	4567.2	Conv. (cfs)		4567.2	
Length Wtd. (ft)	191.00	Wetted Per. (ft)		135.38	
Min Ch El (ft)	6686.00	Shear (lb/sq ft)		0.71	
Alpha	1.00	Stream Power (lb/ft s)		3.60	
Frctn Loss (ft)	2.68	Cum Volume (acre-ft)	0.02	7.91	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.03	6.23	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 16 Profile: PF 1

E.G. Elev (ft)	6681.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.		0.030	
W.S. Elev (ft)	6681.10	Reach Len. (ft)	150.00	193.00	260.00
Crit W.S. (ft)	6681.10	Flow Area (sq ft)		103.45	
E.G. Slope (ft/ft)	0.013754	Area (sq ft)		103.45	
Q Total (cfs)	546.00	Flow (cfs)		546.00	
Top Width (ft)	119.37	Top Width (ft)		119.37	
Vel Total (ft/s)	5.28	Avg. Vel. (ft/s)		5.28	
Max Chl Dpth (ft)	1.10	Hydr. Depth (ft)		0.87	
Conv. Total (cfs)	4655.6	Conv. (cfs)		4655.6	
Length Wtd. (ft)	193.00	Wetted Per. (ft)		119.44	
Min Ch El (ft)	6680.00	Shear (lb/sq ft)		0.74	
Alpha	1.00	Stream Power (lb/ft s)		3.93	
Frctn Loss (ft)	2.69	Cum Volume (acre-ft)	0.02	7.44	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.03	5.67	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 15 Profile: PF 1

E.G. Elev (ft)	6675.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.		0.030	
W.S. Elev (ft)	6675.44	Reach Len. (ft)	250.00	212.00	165.00
Crit W.S. (ft)	6675.44	Flow Area (sq ft)		106.82	
E.G. Slope (ft/ft)	0.014146	Area (sq ft)		106.82	
Q Total (cfs)	546.00	Flow (cfs)		546.00	
Top Width (ft)	132.11	Top Width (ft)		132.11	
Vel Total (ft/s)	5.11	Avg. Vel. (ft/s)		5.11	
Max Chl Dpth (ft)	1.44	Hydr. Depth (ft)		0.81	
Conv. Total (cfs)	4590.7	Conv. (cfs)		4590.7	
Length Wtd. (ft)	212.00	Wetted Per. (ft)		132.16	
Min Ch El (ft)	6674.00	Shear (lb/sq ft)		0.71	

Plan: Existing MT Middle Tributary Allison Valley RS: 15 Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)		3.65	
Frctn Loss (ft)	3.09	Cum Volume (acre-ft)	0.02	6.98	0.01
C & E Loss (ft)	0.02	Cum SA (acres)	0.03	5.11	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 14 Profile: PF 1

E.G. Elev (ft)	6669.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.		0.030	
W.S. Elev (ft)	6668.91	Reach Len. (ft)	250.00	171.00	140.00
Crit W.S. (ft)	6668.91	Flow Area (sq ft)		114.20	
E.G. Slope (ft/ft)	0.014992	Area (sq ft)		114.20	
Q Total (cfs)	546.00	Flow (cfs)		546.00	
Top Width (ft)	163.12	Top Width (ft)		163.12	
Vel Total (ft/s)	4.78	Avg. Vel. (ft/s)		4.78	
Max Chl Dpth (ft)	0.91	Hydr. Depth (ft)		0.70	
Conv. Total (cfs)	4459.2	Conv. (cfs)		4459.2	
Length Wtd. (ft)	171.06	Wetted Per. (ft)		163.15	
Min Ch El (ft)	6668.00	Shear (lb/sq ft)		0.66	
Alpha	1.00	Stream Power (lb/ft s)		3.13	
Frctn Loss (ft)	2.09	Cum Volume (acre-ft)	0.02	6.44	0.01
C & E Loss (ft)	0.11	Cum SA (acres)	0.03	4.39	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 13 Profile: PF 1

E.G. Elev (ft)	6658.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.45	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6656.80	Reach Len. (ft)	80.00	77.00	80.00
Crit W.S. (ft)	6656.80	Flow Area (sq ft)	0.64	56.18	0.32
E.G. Slope (ft/ft)	0.010113	Area (sq ft)	0.64	56.18	0.32
Q Total (cfs)	546.00	Flow (cfs)	1.07	544.48	0.46
Top Width (ft)	21.40	Top Width (ft)	1.60	19.00	0.80
Vel Total (ft/s)	9.56	Avg. Vel. (ft/s)	1.67	9.69	1.43
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)	0.40	2.96	0.40
Conv. Total (cfs)	5429.5	Conv. (cfs)	10.6	5414.4	4.5
Length Wtd. (ft)	77.00	Wetted Per. (ft)	1.79	20.70	1.13
Min Ch El (ft)	6652.00	Shear (lb/sq ft)	0.23	1.71	0.18
Alpha	1.03	Stream Power (lb/ft s)	0.38	16.61	0.25
Frctn Loss (ft)	0.78	Cum Volume (acre-ft)	0.01	6.10	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	4.03	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 12 Profile: PF 1

E.G. Elev (ft)	6655.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.41	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6654.11	Reach Len. (ft)	150.00	94.00	80.00
Crit W.S. (ft)	6654.11	Flow Area (sq ft)	0.01	83.22	0.01
E.G. Slope (ft/ft)	0.010139	Area (sq ft)	0.01	83.22	0.01
Q Total (cfs)	792.00	Flow (cfs)	0.00	791.99	0.00
Top Width (ft)	30.32	Top Width (ft)	0.16	30.00	0.16
Vel Total (ft/s)	9.51	Avg. Vel. (ft/s)	0.42	9.52	0.42
Max Chl Dpth (ft)	4.11	Hydr. Depth (ft)	0.05	2.77	0.05
Conv. Total (cfs)	7865.4	Conv. (cfs)	0.0	7865.3	0.0
Length Wtd. (ft)	94.00	Wetted Per. (ft)	0.19	31.57	0.19
Min Ch El (ft)	6650.00	Shear (lb/sq ft)	0.03	1.67	0.03
Alpha	1.00	Stream Power (lb/ft s)	0.01	15.88	0.01
Frctn Loss (ft)	1.01	Cum Volume (acre-ft)	0.01	5.98	0.01
C & E Loss (ft)	0.15	Cum SA (acres)	0.02	3.99	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 11 Profile: PF 1

E.G. Elev (ft)	6651.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.		0.030	
W.S. Elev (ft)	6650.87	Reach Len. (ft)	120.00	144.00	155.00
Crit W.S. (ft)	6650.87	Flow Area (sq ft)		103.98	
E.G. Slope (ft/ft)	0.011382	Area (sq ft)		103.98	
Q Total (cfs)	792.00	Flow (cfs)		792.00	
Top Width (ft)	58.46	Top Width (ft)		58.46	
Vel Total (ft/s)	7.62	Avg. Vel. (ft/s)		7.62	
Max Chl Dpth (ft)	2.87	Hydr. Depth (ft)		1.78	
Conv. Total (cfs)	7423.7	Conv. (cfs)		7423.7	
Length Wtd. (ft)	144.00	Wetted Per. (ft)		60.08	
Min Ch El (ft)	6648.00	Shear (lb/sq ft)		1.23	
Alpha	1.00	Stream Power (lb/ft s)		9.37	
Frctn Loss (ft)	1.57	Cum Volume (acre-ft)	0.01	5.78	0.01
C & E Loss (ft)	0.03	Cum SA (acres)	0.02	3.90	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 10 Profile: PF 1

E.G. Elev (ft)	6647.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.25	Wt. n-Val.	0.000	0.030	
W.S. Elev (ft)	6646.01	Reach Len. (ft)	165.00	172.00	180.00
Crit W.S. (ft)	6646.01	Flow Area (sq ft)	0.00	88.39	

Plan: Existing MT Middle Tributary Allison Valley RS: 10 Profile: PF 1 (Continued)

E.G. Slope (ft/ft)	0.010432	Area (sq ft)	0.00	88.39	0.00
Q Total (cfs)	792.00	Flow (cfs)	0.00	792.00	
Top Width (ft)	36.05	Top Width (ft)	0.03	36.00	0.01
Vel Total (ft/s)	8.96	Avg. Vel. (ft/s)	0.10	8.96	
Max Chl Dpth (ft)	4.01	Hydr. Depth (ft)	0.01	2.46	
Conv. Total (cfs)	7754.4	Conv. (cfs)	0.0	7754.4	
Length Wtd. (ft)	172.00	Wetted Per. (ft)	0.03	37.49	
Min Ch El (ft)	6642.00	Shear (lb/sq ft)		1.54	
Alpha	1.00	Stream Power (lb/ft s)		13.76	
Frctn Loss (ft)	1.77	Cum Volume (acre-ft)	0.01	5.46	0.01
C & E Loss (ft)	0.02	Cum SA (acres)	0.02	3.74	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 9 Profile: PF 1

E.G. Elev (ft)	6641.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.44	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6640.32	Reach Len. (ft)	240.00	266.00	280.00
Crit W.S. (ft)	6640.32	Flow Area (sq ft)	0.08	82.18	0.06
E.G. Slope (ft/ft)	0.010130	Area (sq ft)	0.08	82.18	0.06
Q Total (cfs)	792.00	Flow (cfs)	0.07	791.88	0.05
Top Width (ft)	29.92	Top Width (ft)	0.53	29.00	0.40
Vel Total (ft/s)	9.62	Avg. Vel. (ft/s)	0.88	9.64	0.82
Max Chl Dpth (ft)	4.32	Hydr. Depth (ft)	0.16	2.83	0.16
Conv. Total (cfs)	7869.0	Conv. (cfs)	0.7	7867.7	0.5
Length Wtd. (ft)	266.00	Wetted Per. (ft)	0.61	30.58	0.51
Min Ch El (ft)	6636.00	Shear (lb/sq ft)	0.09	1.70	0.08
Alpha	1.00	Stream Power (lb/ft s)	0.08	16.38	0.06
Frctn Loss (ft)	2.82	Cum Volume (acre-ft)	0.01	5.12	0.01
C & E Loss (ft)	0.15	Cum SA (acres)	0.02	3.61	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 8 Profile: PF 1

E.G. Elev (ft)	6638.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.93	Wt. n-Val.		0.030	
W.S. Elev (ft)	6637.30	Reach Len. (ft)	250.00	250.00	210.00
Crit W.S. (ft)	6637.30	Flow Area (sq ft)		102.50	
E.G. Slope (ft/ft)	0.011103	Area (sq ft)		102.50	
Q Total (cfs)	792.00	Flow (cfs)		792.00	
Top Width (ft)	56.24	Top Width (ft)		56.24	
Vel Total (ft/s)	7.73	Avg. Vel. (ft/s)		7.73	

Plan: Existing MT Middle Tributary Allison Valley RS: 8 Profile: PF 1 (Continued)

Max Chl Dpth (ft)	3.30	Hydr. Depth (ft)		1.82	
Conv. Total (cfs)	7516.3	Conv. (cfs)		7516.3	
Length Wtd. (ft)	250.00	Wetted Per. (ft)		56.90	
Min Ch El (ft)	6634.00	Shear (lb/sq ft)		1.25	
Alpha	1.00	Stream Power (lb/ft s)		9.65	
Frctn Loss (ft)	1.69	Cum Volume (acre-ft)	0.01	4.56	0.01
C & E Loss (ft)	0.15	Cum SA (acres)	0.02	3.35	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 7 Profile: PF 1

E.G. Elev (ft)	6633.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.		0.030	
W.S. Elev (ft)	6633.54	Reach Len. (ft)	520.00	481.00	560.00
Crit W.S. (ft)	6632.95	Flow Area (sq ft)		151.28	
E.G. Slope (ft/ft)	0.004547	Area (sq ft)		151.28	
Q Total (cfs)	792.00	Flow (cfs)		792.00	
Top Width (ft)	76.69	Top Width (ft)		76.69	
Vel Total (ft/s)	5.24	Avg. Vel. (ft/s)		5.24	
Max Chl Dpth (ft)	3.54	Hydr. Depth (ft)		1.97	
Conv. Total (cfs)	11745.2	Conv. (cfs)		11745.2	
Length Wtd. (ft)	481.00	Wetted Per. (ft)		77.09	
Min Ch El (ft)	6630.00	Shear (lb/sq ft)		0.56	
Alpha	1.00	Stream Power (lb/ft s)		2.92	
Frctn Loss (ft)	3.68	Cum Volume (acre-ft)	0.01	3.83	0.01
C & E Loss (ft)	0.03	Cum SA (acres)	0.02	2.97	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 6 Profile: PF 1

E.G. Elev (ft)	6630.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.34	Wt. n-Val.		0.030	
W.S. Elev (ft)	6629.93	Reach Len. (ft)	200.00	94.00	65.00
Crit W.S. (ft)	6629.93	Flow Area (sq ft)		168.97	
E.G. Slope (ft/ft)	0.015452	Area (sq ft)		168.97	
Q Total (cfs)	792.00	Flow (cfs)		792.00	
Top Width (ft)	254.35	Top Width (ft)		254.35	
Vel Total (ft/s)	4.69	Avg. Vel. (ft/s)		4.69	
Max Chl Dpth (ft)	1.33	Hydr. Depth (ft)		0.66	
Conv. Total (cfs)	6371.4	Conv. (cfs)		6371.4	
Length Wtd. (ft)	94.34	Wetted Per. (ft)		254.37	
Min Ch El (ft)	6628.60	Shear (lb/sq ft)		0.64	

Plan: Existing MT Middle Tributary Allison Valley RS: 6 Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)		3.00	
Frctn Loss (ft)	1.12	Cum Volume (acre-ft)	0.01	2.06	0.01
C & E Loss (ft)	0.14	Cum SA (acres)	0.02	1.14	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 5 Profile: PF 1

E.G. Elev (ft)	6615.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.72	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6613.49	Reach Len. (ft)	230.00	158.00	120.00
Crit W.S. (ft)	6613.49	Flow Area (sq ft)	2.78	73.31	2.78
E.G. Slope (ft/ft)	0.009376	Area (sq ft)	2.78	73.31	2.78
Q Total (cfs)	792.00	Flow (cfs)	6.94	778.11	6.94
Top Width (ft)	26.45	Top Width (ft)	3.73	19.00	3.73
Vel Total (ft/s)	10.04	Avg. Vel. (ft/s)	2.50	10.61	2.50
Max Chl Dpth (ft)	5.49	Hydr. Depth (ft)	0.75	3.86	0.75
Conv. Total (cfs)	8179.3	Conv. (cfs)	71.7	8035.9	71.7
Length Wtd. (ft)	158.15	Wetted Per. (ft)	4.01	22.27	4.01
Min Ch El (ft)	6608.00	Shear (lb/sq ft)	0.40	1.93	0.40
Alpha	1.10	Stream Power (lb/ft s)	1.01	20.45	1.01
Frctn Loss (ft)	1.61	Cum Volume (acre-ft)	0.01	1.80	0.00
C & E Loss (ft)	0.24	Cum SA (acres)	0.01	0.85	0.01

Plan: Existing MT Middle Tributary Allison Valley RS: 4 Profile: PF 1

E.G. Elev (ft)	6608.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.91	Wt. n-Val.		0.030	
W.S. Elev (ft)	6607.39	Reach Len. (ft)	250.00	273.00	265.00
Crit W.S. (ft)	6607.39	Flow Area (sq ft)		103.23	
E.G. Slope (ft/ft)	0.011043	Area (sq ft)		103.23	
Q Total (cfs)	792.00	Flow (cfs)		792.00	
Top Width (ft)	57.27	Top Width (ft)		57.27	
Vel Total (ft/s)	7.67	Avg. Vel. (ft/s)		7.67	
Max Chl Dpth (ft)	3.39	Hydr. Depth (ft)		1.80	
Conv. Total (cfs)	7536.7	Conv. (cfs)		7536.7	
Length Wtd. (ft)	273.00	Wetted Per. (ft)		57.69	
Min Ch El (ft)	6604.00	Shear (lb/sq ft)		1.23	
Alpha	1.00	Stream Power (lb/ft s)		9.47	
Frctn Loss (ft)	2.97	Cum Volume (acre-ft)	0.00	1.48	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.71	0.00

Plan: Existing MT Middle Tributary Allison Valley RS: 3 Profile: PF 1

E.G. Elev (ft)	6602.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.04	Wt. n-Val.		0.030	
W.S. Elev (ft)	6601.29	Reach Len. (ft)	215.00	242.00	250.00
Crit W.S. (ft)	6601.29	Flow Area (sq ft)		96.79	
E.G. Slope (ft/ft)	0.010737	Area (sq ft)		96.79	
Q Total (cfs)	792.00	Flow (cfs)		792.00	
Top Width (ft)	47.39	Top Width (ft)		47.39	
Vel Total (ft/s)	8.18	Avg. Vel. (ft/s)		8.18	
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)		2.04	
Conv. Total (cfs)	7643.5	Conv. (cfs)		7643.5	
Length Wtd. (ft)	242.00	Wetted Per. (ft)		48.08	
Min Ch El (ft)	6598.00	Shear (lb/sq ft)		1.35	
Alpha	1.00	Stream Power (lb/ft s)		11.04	
Frctn Loss (ft)	2.57	Cum Volume (acre-ft)	0.00	0.86	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.38	0.00

Plan: Existing MT Middle Tributary Allison Valley RS: 2 Profile: PF 1

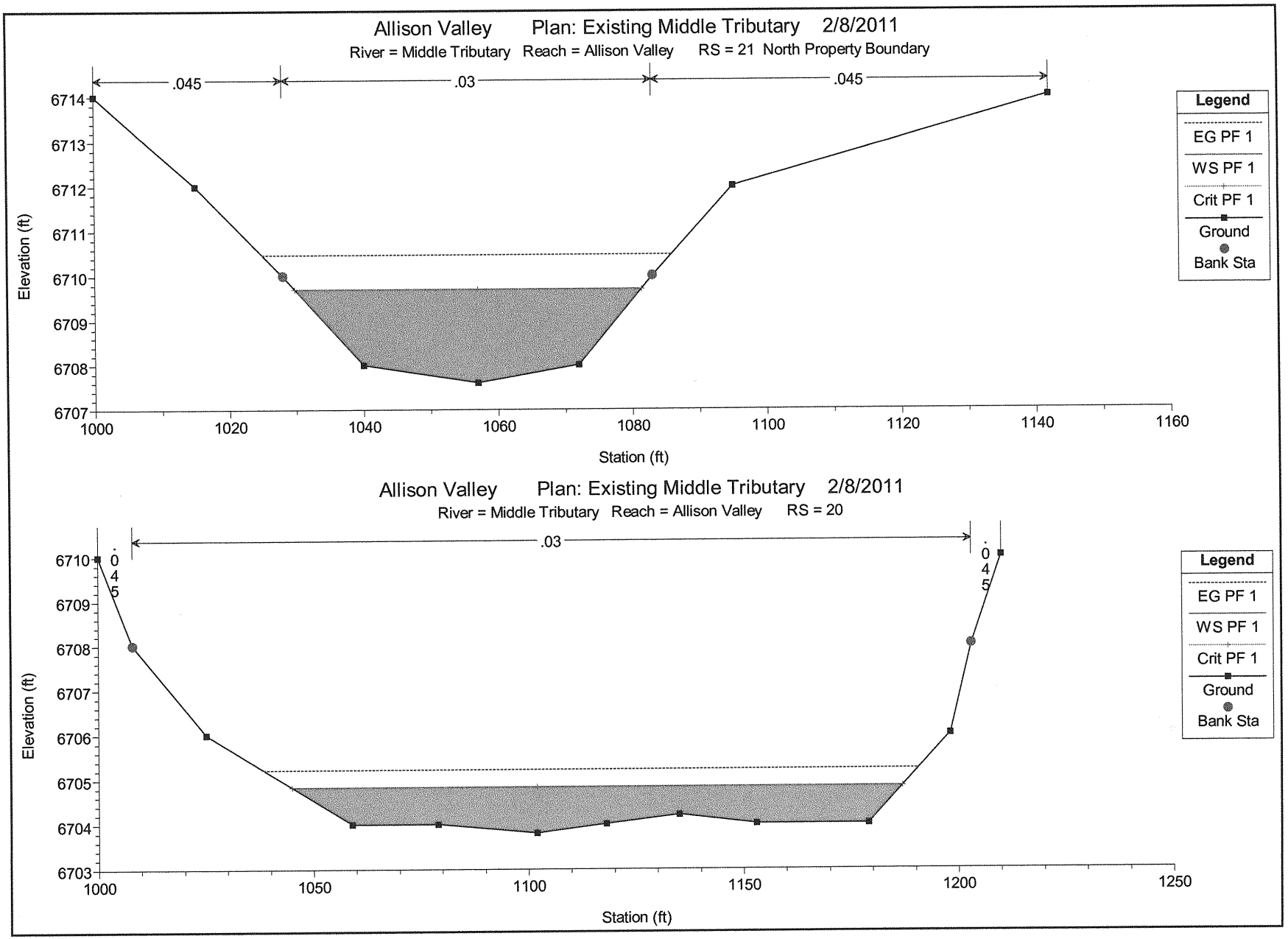
E.G. Elev (ft)	6596.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.22	Wt. n-Val.		0.030	
W.S. Elev (ft)	6595.07	Reach Len. (ft)	160.00	163.00	150.00
Crit W.S. (ft)	6595.07	Flow Area (sq ft)		89.44	
E.G. Slope (ft/ft)	0.010472	Area (sq ft)		89.44	
Q Total (cfs)	792.00	Flow (cfs)		792.00	
Top Width (ft)	37.36	Top Width (ft)		37.36	
Vel Total (ft/s)	8.86	Avg. Vel. (ft/s)		8.86	
Max Chl Dpth (ft)	4.07	Hydr. Depth (ft)		2.39	
Conv. Total (cfs)	7739.3	Conv. (cfs)		7739.3	
Length Wtd. (ft)	163.00	Wetted Per. (ft)		38.73	
Min Ch El (ft)	6591.00	Shear (lb/sq ft)		1.51	
Alpha	1.00	Stream Power (lb/ft s)		13.37	
Frctn Loss (ft)	1.70	Cum Volume (acre-ft)	0.00	0.34	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.14	0.00

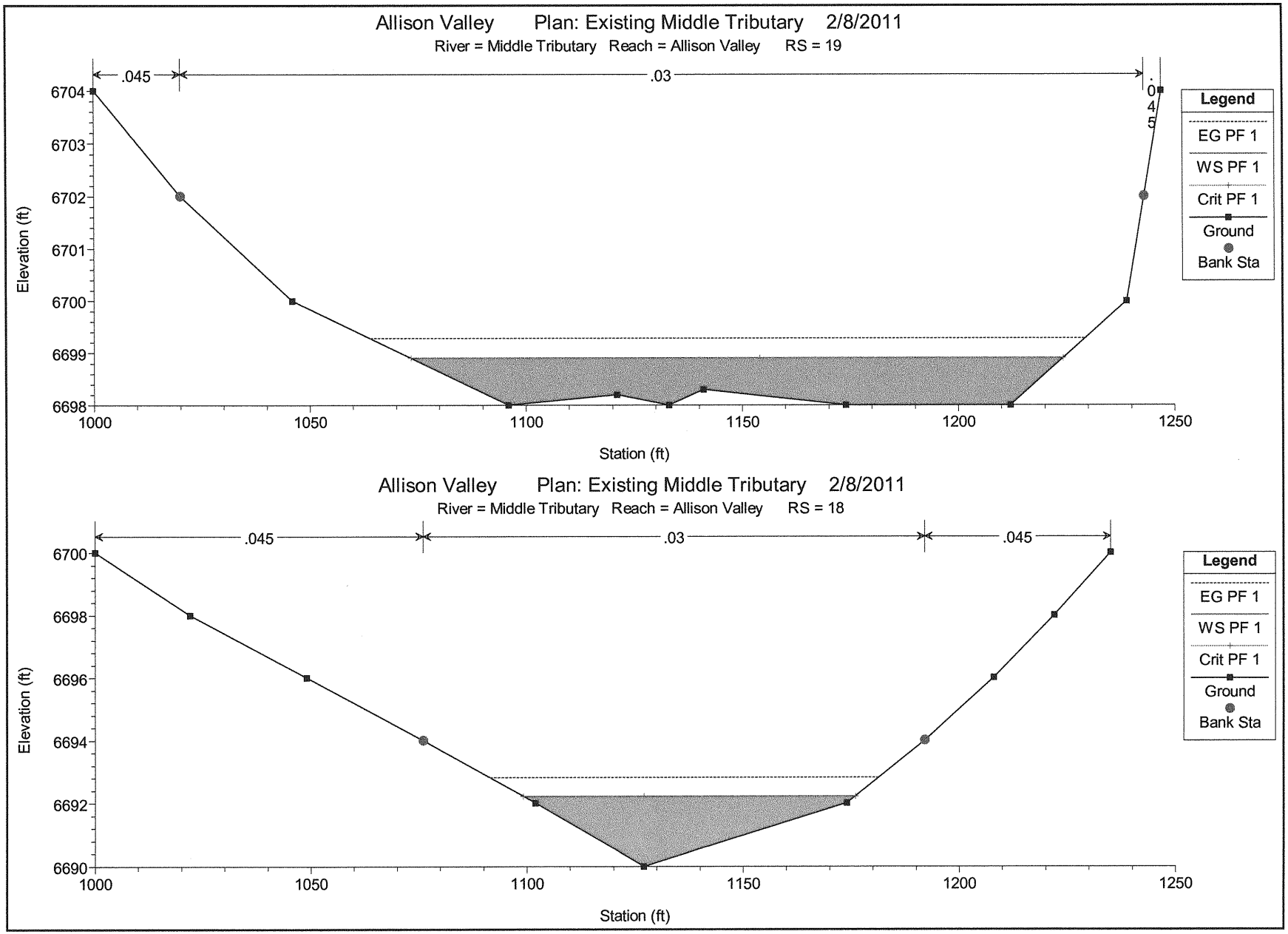
Plan: Existing MT Middle Tributary Allison Valley RS: 1 Profile: PF 1

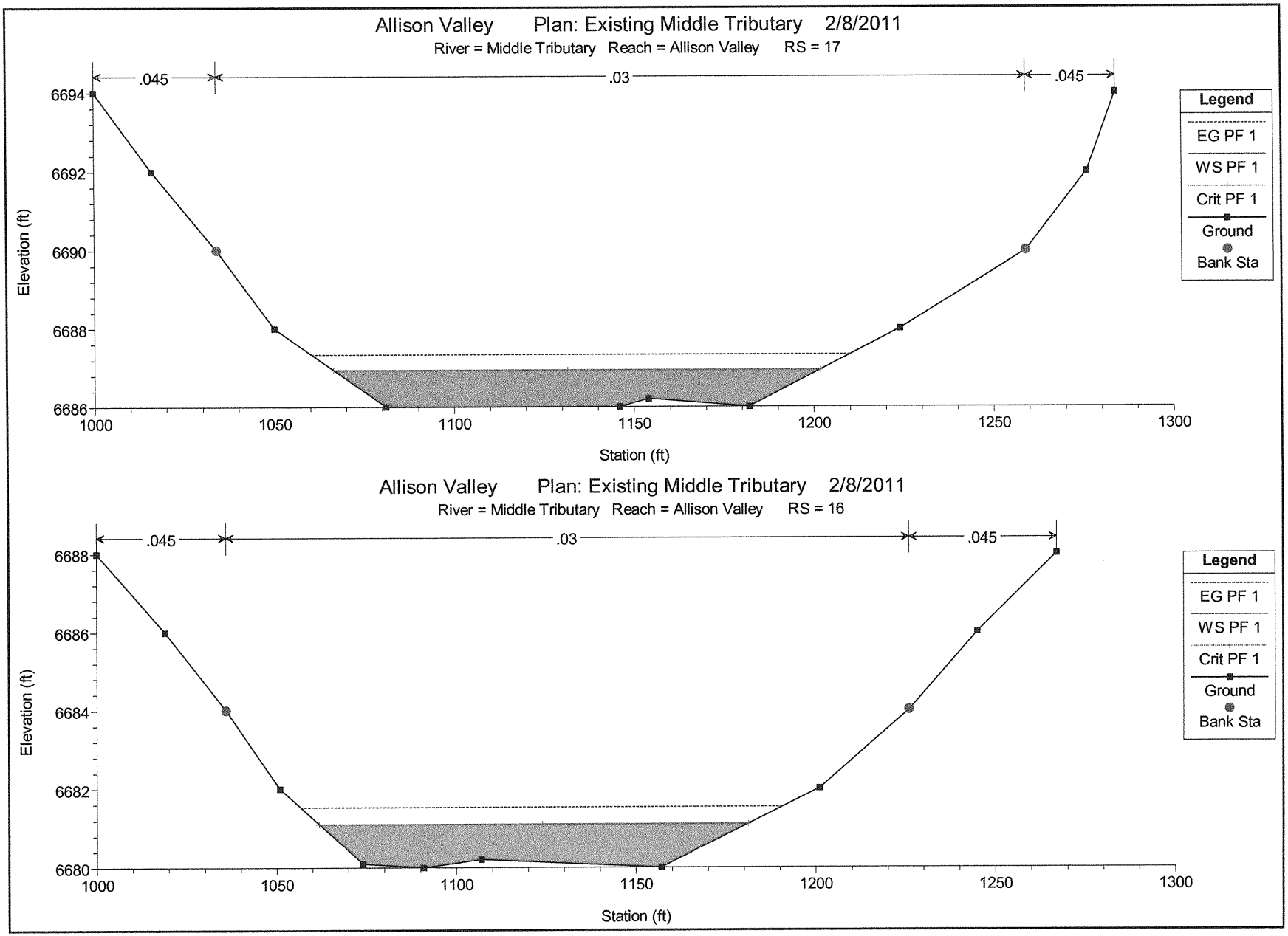
E.G. Elev (ft)	6589.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.16	Wt. n-Val.	0.000	0.030	0.045
W.S. Elev (ft)	6588.07	Reach Len. (ft)			
Crit W.S. (ft)	6588.07	Flow Area (sq ft)	0.00	91.68	0.02

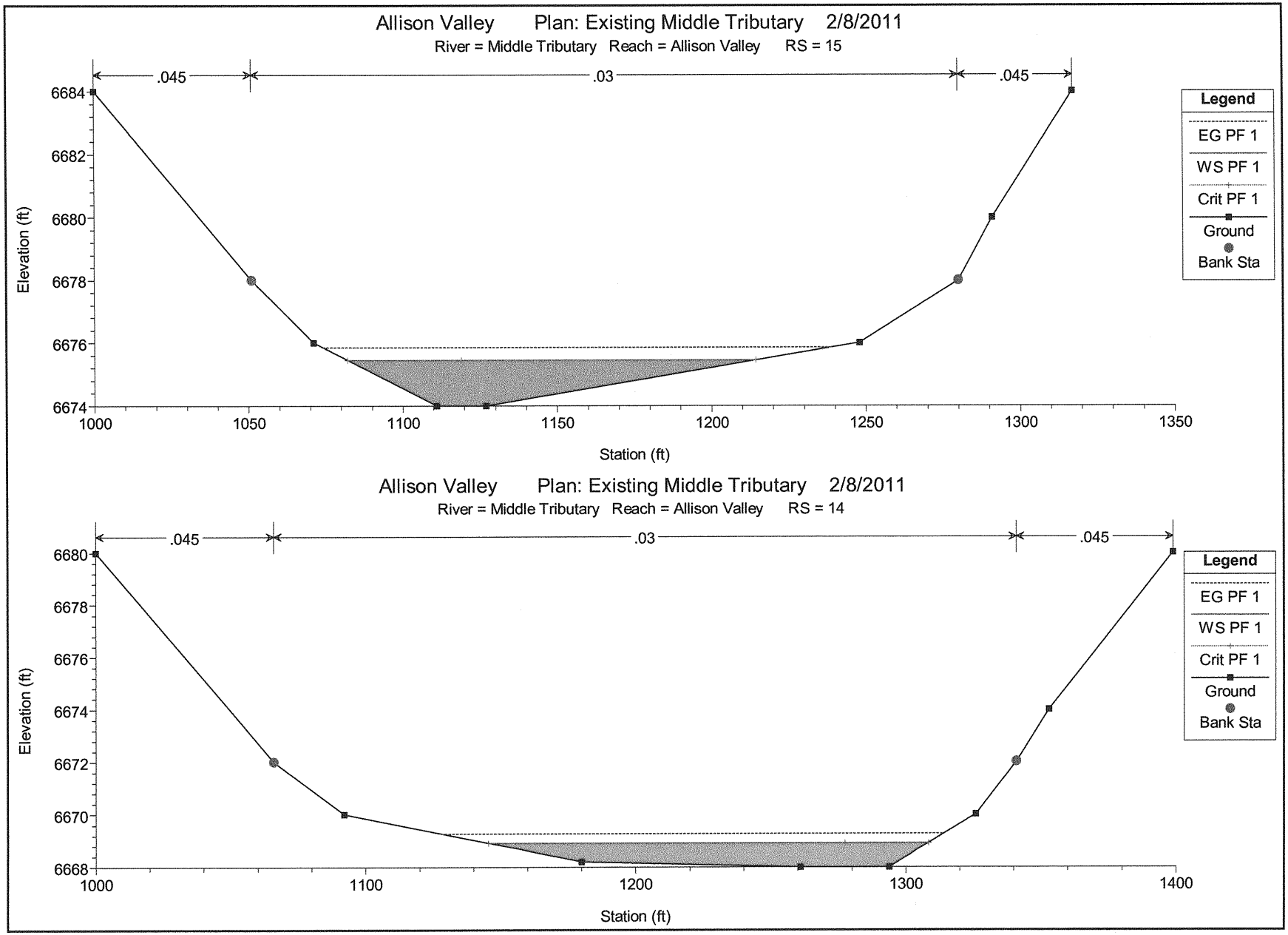
Plan: Existing MT Middle Tributary Allison Valley RS: 1 Profile: PF 1 (Continued)

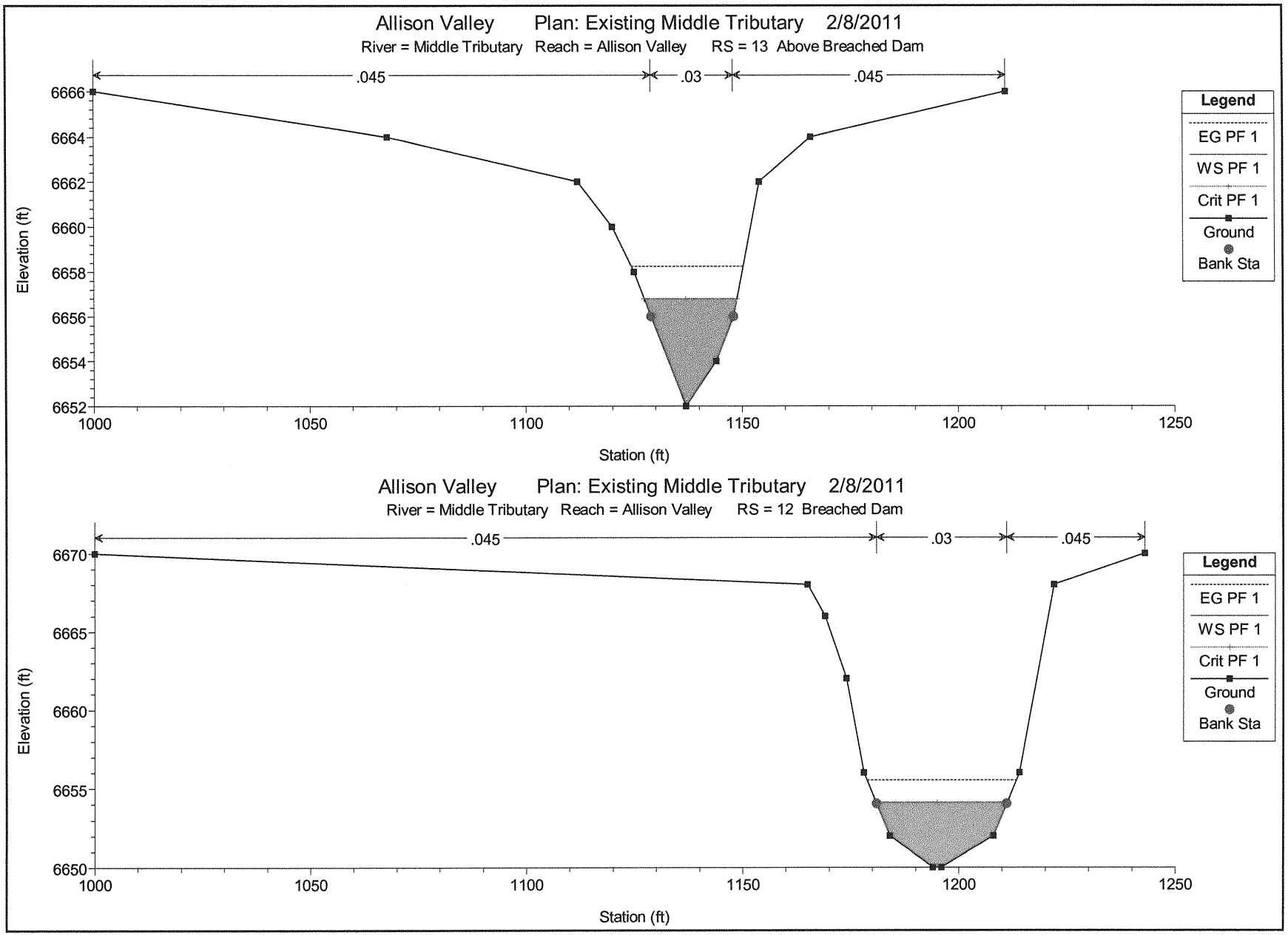
E.G. Slope (ft/ft)	0.010362	Area (sq ft)	0.00	91.68	0.02
Q Total (cfs)	792.00	Flow (cfs)	0.00	791.99	0.01
Top Width (ft)	40.59	Top Width (ft)	0.07	40.00	0.52
Vel Total (ft/s)	8.64	Avg. Vel. (ft/s)	0.28	8.64	0.35
Max Chl Dpth (ft)	4.07	Hydr. Depth (ft)	0.03	2.29	0.03
Conv. Total (cfs)	7780.5	Conv. (cfs)	0.0	7780.4	0.1
Length Wtd. (ft)		Wetted Per. (ft)	0.09	40.87	0.53
Min Ch El (ft)	6584.00	Shear (lb/sq ft)		1.45	0.02
Alpha	1.00	Stream Power (lb/ft s)		12.53	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

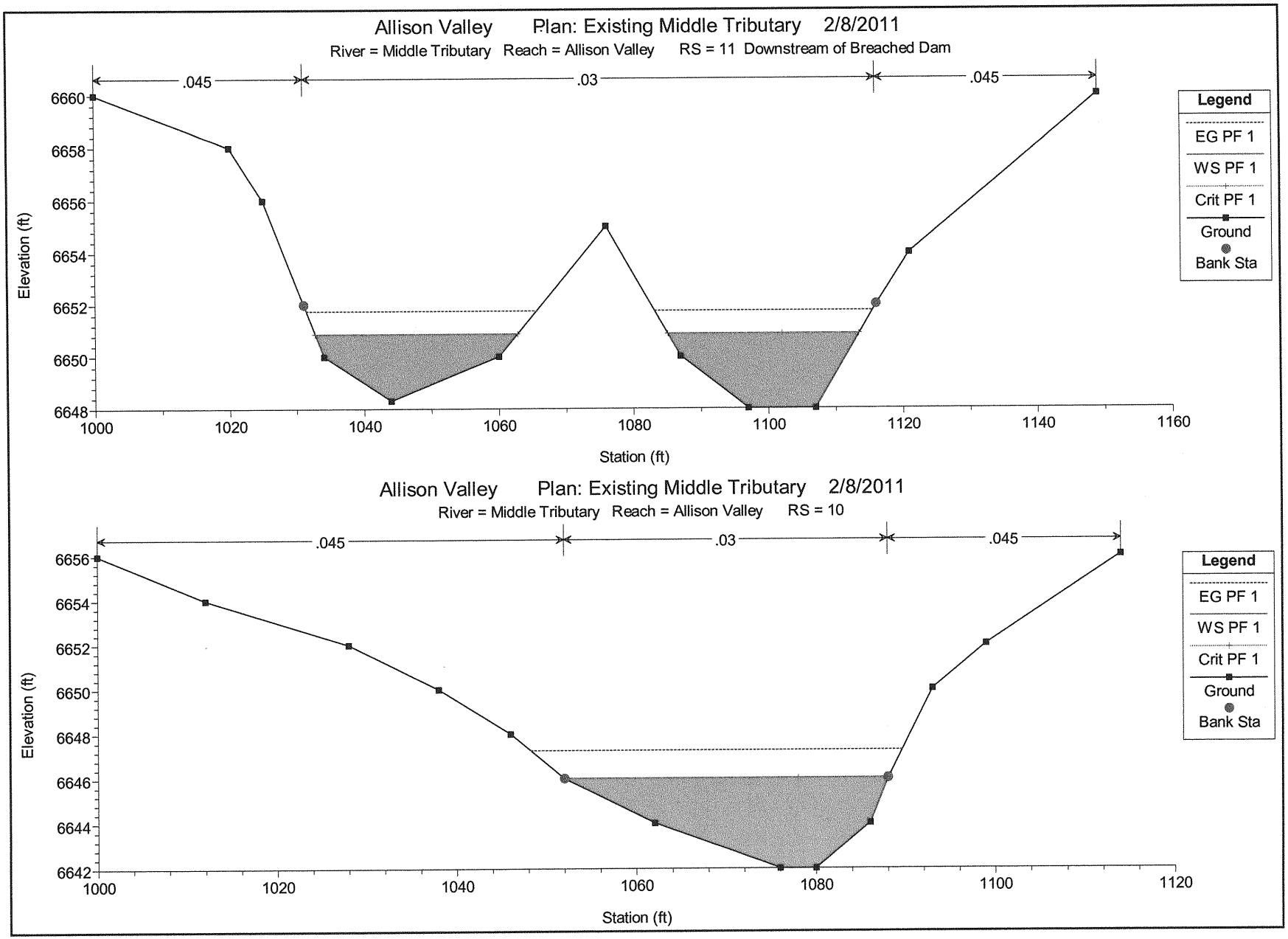

Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 21 North Property Boundary
.045
.03
.045
Elevation (ft)
6714
6713
6712
6711
6710
6709
6708
6707
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 20
.045
.03
.045
Elevation (ft)
6710
6709
6708
6707
6706
6705
6704
6703
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

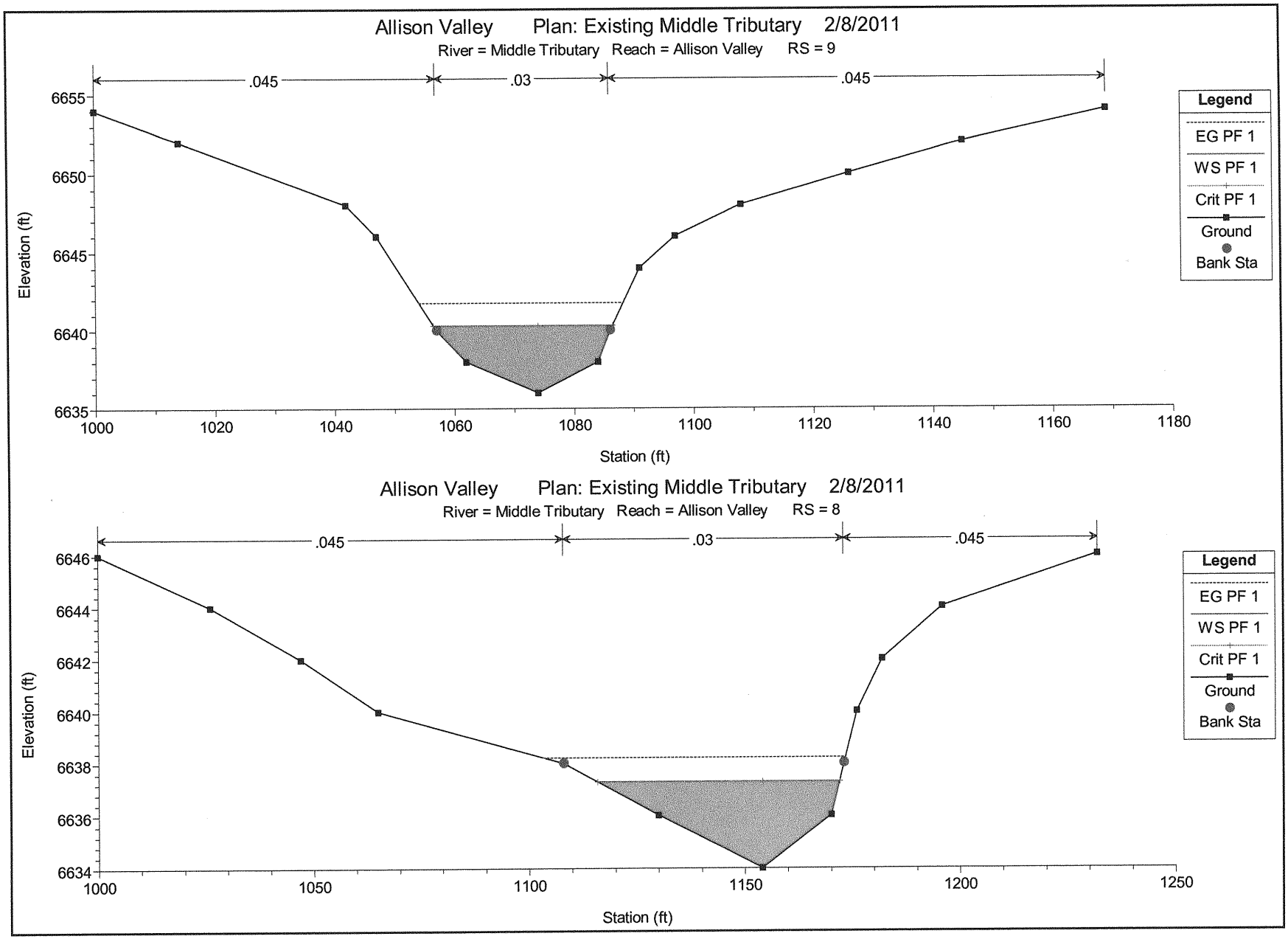

Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 19
.045
.03
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6704
6703
6702
6701
6700
6699
6698
1000
1050
1100
1150
1200
1250
Station (ft)
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 18
.045
.03
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6700
6698
6696
6694
6692
6690
1000
1050
1100
1150
1200
1250
Station (ft)

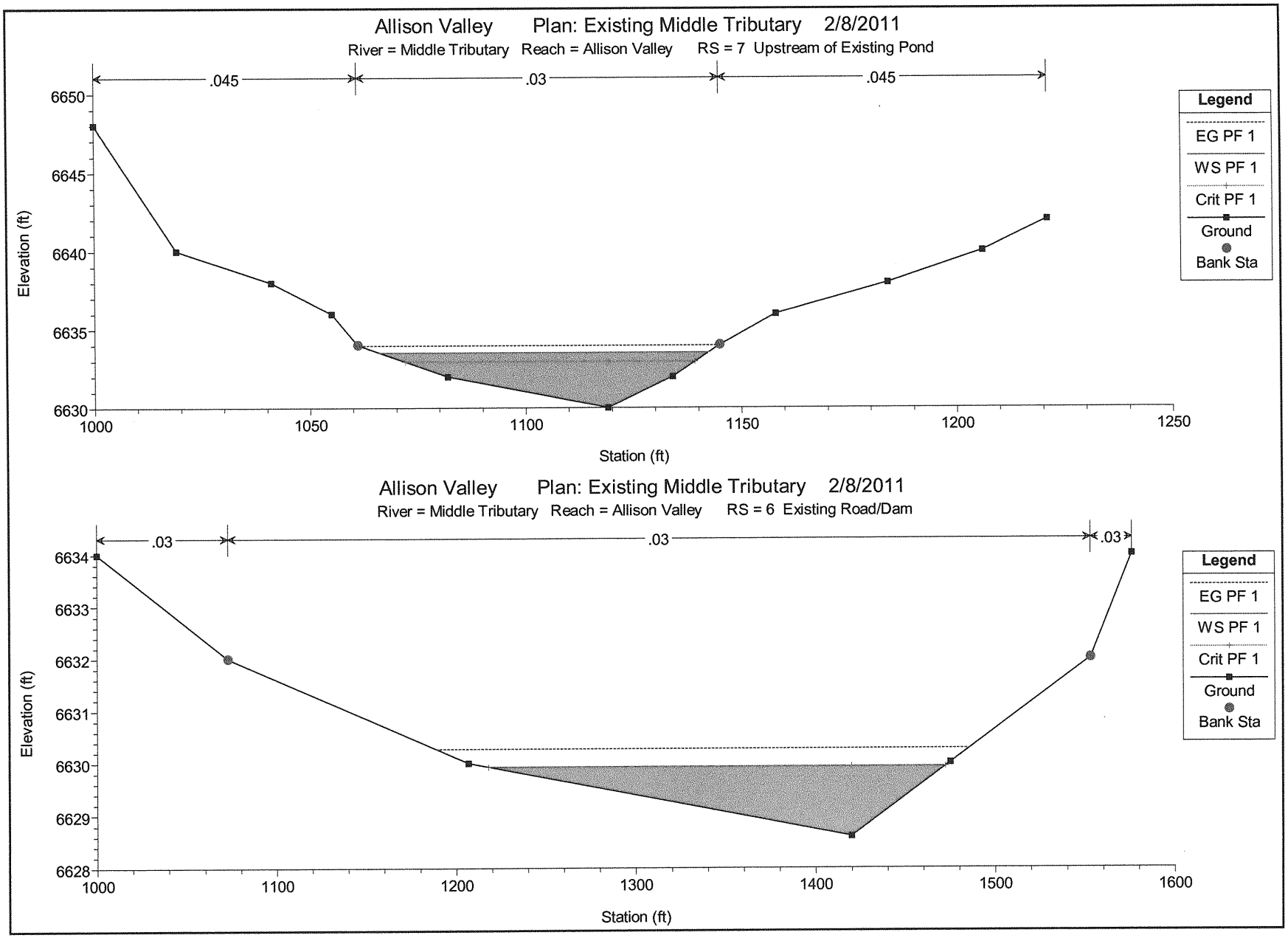

Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 17
.045
.03
.045
6694
6692
6690
6688
6686
Elevation (ft)
1000
1050
1100
1150
1200
1250
1300
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 16
.045
.03
.045
6688
6686
6684
6682
6680
Elevation (ft)
1000
1050
1100
1150
1200
1250
1300
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

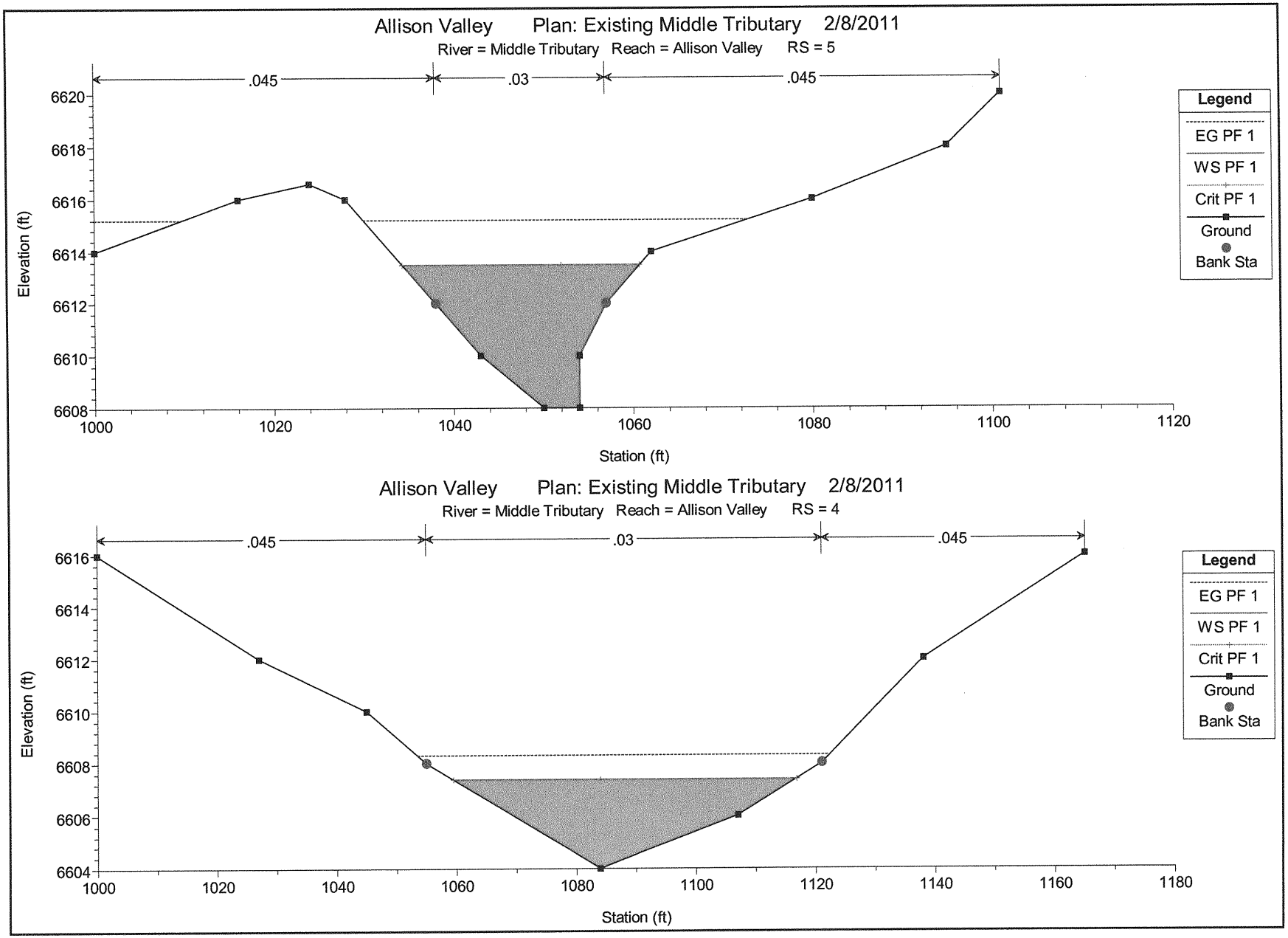

Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 15
.045
.03
.045
6684
6682
6680
6678
6676
6674
Elevation (ft)
1000
1050
1100
1150
1200
1250
1300
1350
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 14
.045
.03
.045
6680
6678
6676
6674
6672
6670
6668
Elevation (ft)
1000
1100
1200
1300
1400
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

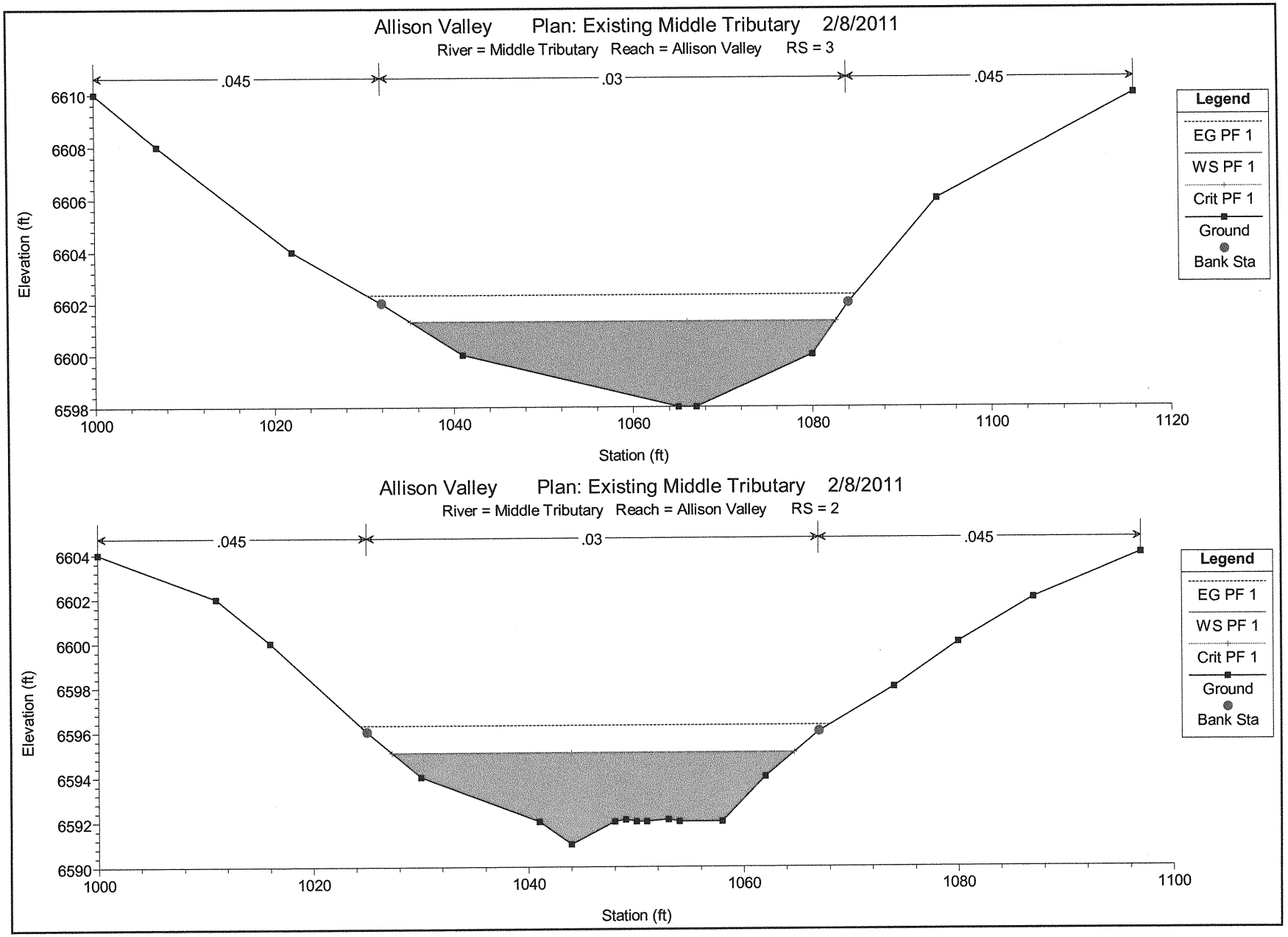

Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 13 Above Breached Dam
.045
.03
.045
Elevation (ft)
6666
6664
6662
6660
6658
6656
6654
6652
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 12 Breached Dam
.045
.03
.045
Elevation (ft)
6670
6665
6660
6655
6650
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

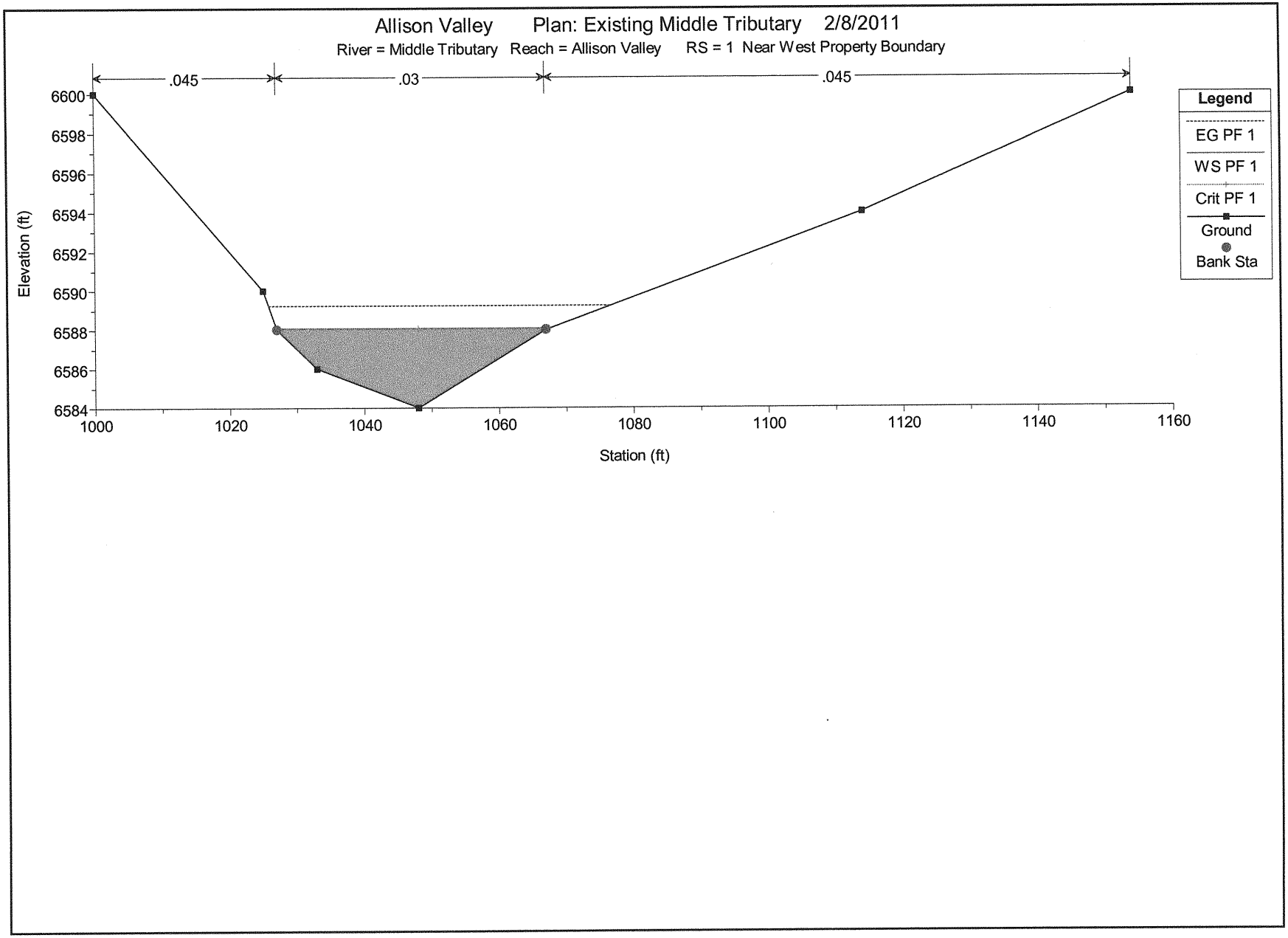

Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 11 Downstream of Breached Dam
.045
.03
.045
Elevation (ft)
6660
6658
6656
6654
6652
6650
6648
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 10
.045
.03
.045
Elevation (ft)
6656
6654
6652
6650
6648
6646
6644
6642
1000
1020
1040
1060
1080
1100
1120
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 9
.045
.03
.045
Elevation (ft)
6655
6650
6645
6640
6635
1000
1020
1040
1060
1080
1100
1120
1140
1160
1180
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 8
.045
.03
.045
Elevation (ft)
6646
6644
6642
6640
6638
6636
6634
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 7 Upstream of Existing Pond
.045
.03
.045
Elevation (ft)
6650
6645
6640
6635
6630
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 6 Existing Road/Dam
.03
.03
.03
Elevation (ft)
6634
6633
6632
6631
6630
6629
6628
1000
1100
1200
1300
1400
1500
1600
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 5
.045
.03
.045
Elevation (ft)
6620
6618
6616
6614
6612
6610
6608
1000
1020
1040
1060
1080
1100
1120
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 4
.045
.03
.045
Elevation (ft)
6616
6614
6612
6610
6608
6606
6604
1000
1020
1040
1060
1080
1100
1120
1140
1160
1180
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 3
.045
.03
.045
Elevation (ft)
6610
6608
6606
6604
6602
6600
6598
1000
1020
1040
1060
1080
1100
1120
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 2
.045
.03
.045
Elevation (ft)
6604
6602
6600
6598
6596
6594
6592
6590
1000
1020
1040
1060
1080
1100
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Middle Tributary 2/8/2011
River = Middle Tributary Reach = Allison Valley RS = 1 Near West Property Boundary
.045
.03
.045
Elevation (ft)
6600
6598
6596
6594
6592
6590
6588
6586
6584
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

Allison.rep

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
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X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Allison Valley
Project File : Allison.prj
Run Date and Time: 2/8/2011 12:05:27 PM

Project in English units

Project Description:
Black Squirrel Creek and Middle Tributary Creek running through Allison Valley property - existing conditions for establishing 100-year floodplain

PLAN DATA

Plan Title: Existing Conditions Black Squirrel Creek
Plan File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.p01

Geometry Title: Existing Black Squirrel Creek
Geometry File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.g01

Flow Title : Existing Black Squirrel Creek
Flow File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.f01

Plan Summary Information:

Number of:	Cross Sections	24	Multiple Openings	=	0
	Culverts	0	Inline Structures	=	0
	Bridges	0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	0.01
Critical depth calculation tolerance	0.01
Maximum number of iterations	20
Maximum difference tolerance	0.3
Flow tolerance factor	0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Existing Black Squirrel Creek
Flow File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Black Squirrel	Allison Valley	24	4051

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Black Squirrel	Allison Valley	PF 1		

Normal S = 0.035

GEOMETRY DATA

Geometry Title: Existing Black Squirrel Creek
Geometry File : d:\HEC\HEC-RAS\3.1.3\Allison\Allison.g01

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 24

INPUT
Description: Existing dirt road
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
934	6712	1000	6710	1040	6709	1140	6709	1300	6710
1400	6710.5	1543	6710	1650	6709.5	1747	6710	2032	6712

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
934	.03	1000	.03	1300	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1000	1300	180	96	110	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 23

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6694	1013	6692	1020	6688	1025	6686	1040	6684

1200	6684	1215	6688	1230	6694

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1020	.03	1215	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1020	1215	300	360	350	.1 .3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 22

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6686	1020	6682	1027	6680	1037	6678	1065	6676
1082	6676	1112	6678	1116	6680	1121	6682	1126	6684
1135	6686								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1027	.03	1116	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1027	1116	300	220	160 .1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 21

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6684	1005	6681.6	1015	6682	1017	6681.8	1019	6682
1023	6682.4	1027	6682	1031	6680	1040	6676	1080	6675
1103	6675	1179	6676	1202	6680	1245	6682	1320	6684

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1031	.03	1179	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1031	1179	420	570	560 .1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 20

INPUT
Description: Existing Dam
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6680	1015	6678	1131	6676	1180	6675	1206	6676
1242	6680								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.03	1000	.03	1242	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1000	1242	150	135	160	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 19

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6670	1002	6668	1007	6666	1011	6664	1030	6662
1050	6662	1065	6664	1070	6664.5	1076	6664	1084	6661
1094	6661	1099	6664	1105	6666	1117	6670		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1011	.03	1099	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1011	1099	400	380	270	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 18

INPUT
Description: Thru existing pond
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6674	1020	6666	1024	6664	1032	6662	1073	6660
1083	6658	1103	6656	1129	6658	1178	6660	1234	6662
1256	6664	1266	6666	1279	6668	1306	6670	1373	6674

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1073	.03	1178	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1073	1178	450	535	380	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 17

INPUT
Description: Existing dirt road (breached dam)
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6670	1060	6668	1140	6666	1185	6665	1223	6666
1250	6668	1485	6669.8	1485	6645	1515	6645	1515	6669.6
1542	6670								

```
Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .045    1485     .03    1515    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1485    1515              700     290     300            .1       .3

CROSS SECTION


RIVER: Black Squirrel
REACH: Allison Valley      RS: 16

INPUT
Description:
Station Elevation Data      num=       11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    6650    1014    6646    1025    6644    1038    6642    1043    6640
    1068    6638    1079    6640    1083    6642    1087    6644    1089    6646
    1099    6650

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .045    1038     .03    1083    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1038    1083              265     235     230            .1       .3

CROSS SECTION


RIVER: Black Squirrel
REACH: Allison Valley      RS: 15

INPUT
Description:
Station Elevation Data      num=        8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    6650    1019    6640    1027    6638    1048    6636    1065    6636
    1090    6638    1097    6640    1131    6650

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .045    1019     .03    1097    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1019    1097              275     290     300            .1       .3

CROSS SECTION


RIVER: Black Squirrel
REACH: Allison Valley      RS: 14

INPUT
Description:
Station Elevation Data      num=        7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    6650    1032    6638    1048    6634    1094    6632    1120    6634
    1133    6638    1156    6650

Manning's n Values          num=        3
```

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1032	.03	1133	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1032	1133	270	220	190	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 13

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6640	1004	6636	1008	6634	1018	6630	1075	6628
1081	6628	1120	6630	1132	6634	1150	6640		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1008	.03	1132	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1008	1132	250	205	140	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 12

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6640	1010	6636	1013	6634	1019	6630	1025	6626
1100	6626	1111	6630	1115	6632	1120	6634	1144	6640

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1019	.03	1111	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1019	1111	275	200	235	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 11

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6638	1029	6630	1037	6628	1060	6622	1063	6622
1127	6624	1158	6626	1166	6628	1182	6638		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1037	.03	1166	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1037	1166	130	245	320	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 10

INPUT
Description:

Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6630	1018	6620	1024	6618	1068	6616	1081	6618
1088	6620	1123	6630						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1018	.03	1088	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1018	1088	245	272	285	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 9

INPUT
Description:

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6630	1025	6616	1029	6614	1042	6612	1073	6610
1077	6610	1088	6612	1094	6614	1097	6616	1107	6626
1111	6628	1117	6630						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1025	.03	1097	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1025	1097	140	122	115	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 8

INPUT
Description:

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6620	1009	6616	1019	6614	1045	6610	1071	6608
1077	6608	1092	6610	1100	6614	1104	6616	1112	6618
1116	6620								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1019	.03	1100	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.

1019	1100	740	734	800	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 7

INPUT
Description: Through open water
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6620	1016	6612	1022	6607	1109	6607	1123	6608
1128	6610	1149	6610.5	1173	6610	1178	6608	1182	6607
1189	6608	1193	6610	1197	6612	1207	6618	1213	6620

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1016	.03	1197	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1016	1197	380	300	340	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 6

INPUT
Description: Through open water
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6620	1033	6612	1041	6607	1060	6607	1074	6608
1082	6612	1100	6613	1124	6612	1132	6608	1142	6607
1250	6607	1266	6610	1284	6612	1325	6616	1400	6618

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1033	.03	1284	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1033	1284	440	450	435	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 5

INPUT
Description: Existing dam
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6620	1033	6616	1052	6610	1078	6609	1102	6610
1110	6612	1169	6614	1245	6616	1269	6618	1273	6620

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.03	1033	.03	1245	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1033	1245	400	380	440	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 4

INPUT
Description: Existing dam
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6610	1015	6604	1034	6602	1075	6600	1145	6598
1155	6597	1163	6598	1179	6600	1196	6610		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.03	1075	.03	1179	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1075	1179	75	92	85	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 3

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6596	1013	6590	1020	6588	1030	6586	1060	6584
1081	6582	1094	6581.5	1111	6582	1118	6584	1125	6586
1130	6590	1138	6592	1150	6596				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1030	.03	1125	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1030	1125	860	860	960	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 2

INPUT
Description: Existing dirt road
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6590	1021	6588	1053	6586	1120	6584.5	1137	6586
1155	6588	1187	6590						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.03	1021	.03	1155	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1021	1155	160	135	100	.1	.3

CROSS SECTION

RIVER: Black Squirrel
REACH: Allison Valley RS: 1

INPUT
Description: Western property boundary
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	6580	1023	6578	1074	6576	1117	6574	1153	6576
1180	6578	1196	6580						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1074	.03	1153	.045

Bank Sta: Left	Right	Coeff Contr.	Expan.
1074	1153	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Black Squirrel

Reach	River Sta.	n1	n2	n3
Allison Valley	24	.03	.03	.03
Allison Valley	23	.045	.03	.045
Allison Valley	22	.045	.03	.045
Allison Valley	21	.045	.03	.045
Allison Valley	20	.03	.03	.03
Allison Valley	19	.045	.03	.045
Allison Valley	18	.045	.03	.045
Allison Valley	17	.045	.03	.045
Allison Valley	16	.045	.03	.045
Allison Valley	15	.045	.03	.045
Allison Valley	14	.045	.03	.045
Allison Valley	13	.045	.03	.045
Allison Valley	12	.045	.03	.045
Allison Valley	11	.045	.03	.045
Allison Valley	10	.045	.03	.045
Allison Valley	9	.045	.03	.045
Allison Valley	8	.045	.03	.045
Allison Valley	7	.045	.03	.045
Allison Valley	6	.045	.03	.045
Allison Valley	5	.03	.03	.03
Allison Valley	4	.03	.03	.03
Allison Valley	3	.045	.03	.045
Allison Valley	2	.03	.03	.03
Allison Valley	1	.045	.03	.045

SUMMARY OF REACH LENGTHS

River: Black Squirrel

Reach	River Sta.	Left	Channel	Right
Allison Valley	24	180	96	110
Allison Valley	23	300	360	350

Allison Valley	22	300	220	160
Allison Valley	21	420	570	560
Allison Valley	20	150	135	160
Allison Valley	19	400	380	270
Allison Valley	18	450	535	380
Allison Valley	17	700	290	300
Allison Valley	16	265	235	230
Allison Valley	15	275	290	300
Allison Valley	14	270	220	190
Allison Valley	13	250	205	140
Allison Valley	12	275	200	235
Allison Valley	11	130	245	320
Allison Valley	10	245	272	285
Allison Valley	9	140	122	115
Allison Valley	8	740	734	800
Allison Valley	7	380	300	340
Allison Valley	6	440	450	435
Allison Valley	5	400	380	440
Allison Valley	4	75	92	85
Allison Valley	3	860	860	960
Allison Valley	2	160	135	100
Allison Valley	1			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Black Squirrel

Reach	River Sta.	Contr.	Expan.
Allison Valley	24	.1	.3
Allison Valley	23	.1	.3
Allison Valley	22	.1	.3
Allison Valley	21	.1	.3
Allison Valley	20	.1	.3
Allison Valley	19	.1	.3
Allison Valley	18	.1	.3
Allison Valley	17	.1	.3
Allison Valley	16	.1	.3
Allison Valley	15	.1	.3
Allison Valley	14	.1	.3
Allison Valley	13	.1	.3
Allison Valley	12	.1	.3
Allison Valley	11	.1	.3
Allison Valley	10	.1	.3
Allison Valley	9	.1	.3
Allison Valley	8	.1	.3
Allison Valley	7	.1	.3
Allison Valley	6	.1	.3
Allison Valley	5	.1	.3
Allison Valley	4	.1	.3
Allison Valley	3	.1	.3
Allison Valley	2	.1	.3
Allison Valley	1	.1	.3

HEC-RAS Plan: Existing BSC River: Black Squirrel Reach: Allison Valley Profile: PF 1

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Allison Valley	24	PF 1	6711.22	6710.77	0.45	0.95	0.08	24.74	2635.17	1391.09	881.80
Allison Valley	23	PF 1	6687.84	6686.61	1.23	3.27	0.08		4051.00		186.29
Allison Valley	22	PF 1	6683.12	6681.13	1.99	0.51	0.49	4.49	4043.37	3.14	95.79
Allison Valley	21	PF 1	6681.31	6680.94	0.37	1.39	0.07	0.53	3928.74	121.73	192.99
Allison Valley	20	PF 1	6679.84	6678.75	1.09	1.24	0.09		4051.00		221.39
Allison Valley	19	PF 1	6668.60	6666.65	1.95	2.89	0.15	23.48	3990.60	36.92	101.57
Allison Valley	18	PF 1	6663.27	6661.82	1.45	4.75	0.27	87.97	3842.84	120.19	193.14
Allison Valley	17	PF 1	6657.41	6653.27	4.14	2.54	0.45		4051.00		30.00
Allison Valley	16	PF 1	6648.38	6645.74	2.64	1.68	0.15	179.94	3822.16	48.90	73.31
Allison Valley	15	PF 1	6643.71	6641.57	2.13	2.38	0.07	5.39	4035.42	10.18	86.33
Allison Valley	14	PF 1	6639.38	6637.49	1.89	1.92	0.06		4051.00		97.28
Allison Valley	13	PF 1	6634.26	6632.58	1.68	1.79	0.03		4051.00		116.19
Allison Valley	12	PF 1	6632.25	6630.29	1.96	1.75	0.10	0.05	4050.89	0.06	93.00
Allison Valley	11	PF 1	6628.73	6627.11	1.63	2.03	0.06		4051.00		122.00
Allison Valley	10	PF 1	6624.37	6622.10	2.27	2.17	0.01	10.84	4017.71	22.45	81.12
Allison Valley	9	PF 1	6618.78	6616.46	2.32	0.57	0.35	0.19	4050.71	0.09	73.28
Allison Valley	8	PF 1	6617.09	6615.93	1.16	0.36	0.31	16.42	4028.41	6.18	94.54
Allison Valley	7	PF 1	6616.41	6616.30	0.12	0.04	0.02	13.15	4027.19	10.66	196.76
Allison Valley	6	PF 1	6616.35	6616.29	0.07	0.17	0.13	22.15	3977.69	51.16	320.49
Allison Valley	5	PF 1	6616.05	6614.68	1.37	3.20	0.01		4051.00		157.67
Allison Valley	4	PF 1	6603.82	6602.34	1.48	0.14	0.33	275.64	3755.35	20.01	152.20
Allison Valley	3	PF 1	6591.90	6591.52	0.38	1.36	0.10	116.19	3907.77	27.04	126.36
Allison Valley	2	PF 1	6590.44	6589.01	1.43	1.04	0.00	15.24	4012.49	23.27	160.68
Allison Valley	1	PF 1	6580.53	6579.04	1.48			445.63	3372.04	233.33	177.37

Plan: Existing BSC Black Squirrel Allison Valley RS: 24 Profile: PF 1

E.G. Elev (ft)	6711.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.	0.030	0.030	0.030
W.S. Elev (ft)	6710.77	Reach Len. (ft)	180.00	96.00	110.00
Crit W.S. (ft)	6710.77	Flow Area (sq ft)	9.73	430.42	375.61
E.G. Slope (ft/ft)	0.009442	Area (sq ft)	9.73	430.42	375.61
Q Total (cfs)	4051.00	Flow (cfs)	24.74	2635.17	1391.09
Top Width (ft)	881.80	Top Width (ft)	25.35	300.00	556.45
Vel Total (ft/s)	4.97	Avg. Vel. (ft/s)	2.54	6.12	3.70
Max Chl Dpth (ft)	1.77	Hydr. Depth (ft)	0.38	1.43	0.68
Conv. Total (cfs)	41688.8	Conv. (cfs)	254.6	27118.5	14315.6
Length Wtd. (ft)	98.66	Wetted Per. (ft)	25.36	300.02	556.46
Min Ch El (ft)	6709.00	Shear (lb/sq ft)	0.23	0.85	0.40
Alpha	1.18	Stream Power (lb/ft s)	0.58	5.18	1.47
Frctn Loss (ft)	0.95	Cum Volume (acre-ft)	2.89	98.19	3.22
C & E Loss (ft)	0.08	Cum SA (acres)	1.86	20.47	2.61

Plan: Existing BSC Black Squirrel Allison Valley RS: 23 Profile: PF 1

E.G. Elev (ft)	6687.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.23	Wt. n-Val.		0.030	
W.S. Elev (ft)	6686.61	Reach Len. (ft)	300.00	360.00	350.00
Crit W.S. (ft)	6686.61	Flow Area (sq ft)		454.33	
E.G. Slope (ft/ft)	0.009914	Area (sq ft)		454.33	
Q Total (cfs)	4051.00	Flow (cfs)		4051.00	
Top Width (ft)	186.29	Top Width (ft)		186.29	
Vel Total (ft/s)	8.92	Avg. Vel. (ft/s)		8.92	
Max Chl Dpth (ft)	2.61	Hydr. Depth (ft)		2.44	
Conv. Total (cfs)	40685.7	Conv. (cfs)		40685.7	
Length Wtd. (ft)	359.96	Wetted Per. (ft)		186.88	
Min Ch El (ft)	6684.00	Shear (lb/sq ft)		1.50	
Alpha	1.00	Stream Power (lb/ft s)		13.42	
Frctn Loss (ft)	3.27	Cum Volume (acre-ft)	2.87	97.22	2.75
C & E Loss (ft)	0.08	Cum SA (acres)	1.81	19.93	1.90

Plan: Existing BSC Black Squirrel Allison Valley RS: 22 Profile: PF 1

E.G. Elev (ft)	6683.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.99	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6681.13	Reach Len. (ft)	300.00	220.00	160.00
Crit W.S. (ft)	6681.13	Flow Area (sq ft)	2.24	356.65	1.60

Plan: Existing BSC Black Squirrel Allison Valley RS: 22 Profile: PF 1 (Continued)

E.G. Slope (ft/ft)	0.008331	Area (sq ft)	2.24	356.65	1.60
Q Total (cfs)	4051.00	Flow (cfs)	4.49	4043.37	3.14
Top Width (ft)	95.79	Top Width (ft)	3.96	89.00	2.83
Vel Total (ft/s)	11.24	Avg. Vel. (ft/s)	2.01	11.34	1.96
Max Chl Dpth (ft)	5.13	Hydr. Depth (ft)	0.57	4.01	0.57
Conv. Total (cfs)	44382.5	Conv. (cfs)	49.2	44299.0	34.4
Length Wtd. (ft)	219.12	Wetted Per. (ft)	4.12	89.81	3.04
Min Ch El (ft)	6676.00	Shear (lb/sq ft)	0.28	2.07	0.27
Alpha	1.02	Stream Power (lb/ft s)	0.57	23.42	0.54
Frctn Loss (ft)	0.51	Cum Volume (acre-ft)	2.87	93.87	2.74
C & E Loss (ft)	0.49	Cum SA (acres)	1.79	18.80	1.89

Plan: Existing BSC Black Squirrel Allison Valley RS: 21 Profile: PF 1

E.G. Elev (ft)	6681.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6680.94	Reach Len. (ft)	420.00	570.00	560.00
Crit W.S. (ft)		Flow Area (sq ft)	0.88	793.46	76.93
E.G. Slope (ft/ft)	0.001073	Area (sq ft)	0.88	793.46	76.93
Q Total (cfs)	4051.00	Flow (cfs)	0.53	3928.74	121.73
Top Width (ft)	192.99	Top Width (ft)	1.87	148.00	43.11
Vel Total (ft/s)	4.65	Avg. Vel. (ft/s)	0.61	4.95	1.58
Max Chl Dpth (ft)	5.94	Hydr. Depth (ft)	0.47	5.36	1.78
Conv. Total (cfs)	123649.3	Conv. (cfs)	16.2	119917.4	3715.7
Length Wtd. (ft)	569.84	Wetted Per. (ft)	2.09	148.87	43.48
Min Ch El (ft)	6675.00	Shear (lb/sq ft)	0.03	0.36	0.12
Alpha	1.10	Stream Power (lb/ft s)	0.02	1.77	0.19
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)	2.86	90.96	2.60
C & E Loss (ft)	0.07	Cum SA (acres)	1.77	18.20	1.81

Plan: Existing BSC Black Squirrel Allison Valley RS: 20 Profile: PF 1

E.G. Elev (ft)	6679.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.09	Wt. n-Val.		0.030	
W.S. Elev (ft)	6678.75	Reach Len. (ft)	150.00	135.00	160.00
Crit W.S. (ft)	6678.75	Flow Area (sq ft)		483.11	
E.G. Slope (ft/ft)	0.010141	Area (sq ft)		483.11	
Q Total (cfs)	4051.00	Flow (cfs)		4051.00	
Top Width (ft)	221.39	Top Width (ft)		221.39	
Vel Total (ft/s)	8.39	Avg. Vel. (ft/s)		8.39	

Plan: Existing BSC Black Squirrel Allison Valley RS: 20 Profile: PF 1 (Continued)

Max Chl Dpth (ft)	3.75	Hydr. Depth (ft)		2.18	
Conv. Total (cfs)	40226.6	Conv. (cfs)		40226.6	
Length Wtd. (ft)	135.16	Wetted Per. (ft)		221.64	
Min Ch El (ft)	6675.00	Shear (lb/sq ft)		1.38	
Alpha	1.00	Stream Power (lb/ft s)		11.57	
Frctn Loss (ft)	1.24	Cum Volume (acre-ft)	2.85	82.61	2.10
C & E Loss (ft)	0.09	Cum SA (acres)	1.76	15.78	1.53

Plan: Existing BSC Black Squirrel Allison Valley RS: 19 Profile: PF 1

E.G. Elev (ft)	6668.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.95	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6666.65	Reach Len. (ft)	400.00	380.00	270.00
Crit W.S. (ft)	6666.65	Flow Area (sq ft)	7.13	353.94	10.53
E.G. Slope (ft/ft)	0.008305	Area (sq ft)	7.13	353.94	10.53
Q Total (cfs)	4051.00	Flow (cfs)	23.48	3990.60	36.92
Top Width (ft)	101.57	Top Width (ft)	5.62	88.00	7.95
Vel Total (ft/s)	10.90	Avg. Vel. (ft/s)	3.29	11.27	3.50
Max Chl Dpth (ft)	5.65	Hydr. Depth (ft)	1.27	4.02	1.32
Conv. Total (cfs)	44451.8	Conv. (cfs)	257.7	43789.1	405.1
Length Wtd. (ft)	378.14	Wetted Per. (ft)	6.22	89.66	8.38
Min Ch El (ft)	6661.00	Shear (lb/sq ft)	0.59	2.05	0.65
Alpha	1.06	Stream Power (lb/ft s)	1.96	23.08	2.28
Frctn Loss (ft)	2.89	Cum Volume (acre-ft)	2.84	81.31	2.08
C & E Loss (ft)	0.15	Cum SA (acres)	1.75	15.30	1.52

Plan: Existing BSC Black Squirrel Allison Valley RS: 18 Profile: PF 1

E.G. Elev (ft)	6663.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.45	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6661.82	Reach Len. (ft)	450.00	535.00	380.00
Crit W.S. (ft)	6661.82	Flow Area (sq ft)	33.85	387.83	46.24
E.G. Slope (ft/ft)	0.007047	Area (sq ft)	33.85	387.83	46.24
Q Total (cfs)	4051.00	Flow (cfs)	87.97	3842.84	120.19
Top Width (ft)	193.14	Top Width (ft)	37.26	105.00	50.89
Vel Total (ft/s)	8.66	Avg. Vel. (ft/s)	2.60	9.91	2.60
Max Chl Dpth (ft)	5.82	Hydr. Depth (ft)	0.91	3.69	0.91
Conv. Total (cfs)	48258.6	Conv. (cfs)	1047.9	45778.8	1431.8
Length Wtd. (ft)	531.78	Wetted Per. (ft)	37.30	105.42	50.92
Min Ch El (ft)	6656.00	Shear (lb/sq ft)	0.40	1.62	0.40

Plan: Existing BSC Black Squirrel Allison Valley RS: 18 Profile: PF 1 (Continued)

Alpha	1.25	Stream Power (lb/ft s)	1.04	16.04	1.04
Frctn Loss (ft)	4.75	Cum Volume (acre-ft)	2.65	78.08	1.91
C & E Loss (ft)	0.27	Cum SA (acres)	1.56	14.46	1.33

Plan: Existing BSC Black Squirrel Allison Valley RS: 17 Profile: PF 1

E.G. Elev (ft)	6657.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	4.14	Wt. n-Val.		0.030	
W.S. Elev (ft)	6653.27	Reach Len. (ft)	700.00	290.00	300.00
Crit W.S. (ft)	6653.27	Flow Area (sq ft)		248.06	
E.G. Slope (ft/ft)	0.011675	Area (sq ft)		248.06	
Q Total (cfs)	4051.00	Flow (cfs)		4051.00	
Top Width (ft)	30.00	Top Width (ft)		30.00	
Vel Total (ft/s)	16.33	Avg. Vel. (ft/s)		16.33	
Max Chl Dpth (ft)	8.27	Hydr. Depth (ft)		8.27	
Conv. Total (cfs)	37490.9	Conv. (cfs)		37490.9	
Length Wtd. (ft)	299.17	Wetted Per. (ft)		46.54	
Min Ch El (ft)	6645.00	Shear (lb/sq ft)		3.89	
Alpha	1.00	Stream Power (lb/ft s)		63.45	
Frctn Loss (ft)	2.54	Cum Volume (acre-ft)	2.48	74.17	1.71
C & E Loss (ft)	0.45	Cum SA (acres)	1.36	13.63	1.11

Plan: Existing BSC Black Squirrel Allison Valley RS: 16 Profile: PF 1

E.G. Elev (ft)	6648.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.64	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6645.74	Reach Len. (ft)	265.00	235.00	230.00
Crit W.S. (ft)	6645.74	Flow Area (sq ft)	43.94	285.29	12.47
E.G. Slope (ft/ft)	0.006443	Area (sq ft)	43.94	285.29	12.47
Q Total (cfs)	4051.00	Flow (cfs)	179.94	3822.16	48.90
Top Width (ft)	73.31	Top Width (ft)	22.57	45.00	5.74
Vel Total (ft/s)	11.86	Avg. Vel. (ft/s)	4.10	13.40	3.92
Max Chl Dpth (ft)	7.74	Hydr. Depth (ft)	1.95	6.34	2.17
Conv. Total (cfs)	50469.0	Conv. (cfs)	2241.8	47617.9	609.2
Length Wtd. (ft)	235.65	Wetted Per. (ft)	22.88	46.12	6.93
Min Ch El (ft)	6638.00	Shear (lb/sq ft)	0.77	2.49	0.72
Alpha	1.21	Stream Power (lb/ft s)	3.16	33.34	2.84
Frctn Loss (ft)	1.68	Cum Volume (acre-ft)	2.12	72.40	1.66
C & E Loss (ft)	0.15	Cum SA (acres)	1.18	13.38	1.09

Plan: Existing BSC Black Squirrel Allison Valley RS: 15 Profile: PF 1

E.G. Elev (ft)	6643.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.13	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6641.57	Reach Len. (ft)	275.00	290.00	300.00
Crit W.S. (ft)	6641.57	Flow Area (sq ft)	2.34	343.52	4.19
E.G. Slope (ft/ft)	0.007885	Area (sq ft)	2.34	343.52	4.19
Q Total (cfs)	4051.00	Flow (cfs)	5.39	4035.42	10.18
Top Width (ft)	86.33	Top Width (ft)	2.98	78.00	5.34
Vel Total (ft/s)	11.57	Avg. Vel. (ft/s)	2.30	11.75	2.43
Max Chl Dpth (ft)	5.57	Hydr. Depth (ft)	0.79	4.40	0.79
Conv. Total (cfs)	45619.6	Conv. (cfs)	60.7	45444.2	114.7
Length Wtd. (ft)	290.00	Wetted Per. (ft)	3.37	78.70	5.57
Min Ch El (ft)	6636.00	Shear (lb/sq ft)	0.34	2.15	0.37
Alpha	1.03	Stream Power (lb/ft s)	0.79	25.24	0.90
Frctn Loss (ft)	2.38	Cum Volume (acre-ft)	1.98	70.70	1.62
C & E Loss (ft)	0.07	Cum SA (acres)	1.10	13.05	1.06

Plan: Existing BSC Black Squirrel Allison Valley RS: 14 Profile: PF 1

E.G. Elev (ft)	6639.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.89	Wt. n-Val.		0.030	
W.S. Elev (ft)	6637.49	Reach Len. (ft)	270.00	220.00	190.00
Crit W.S. (ft)	6637.49	Flow Area (sq ft)		367.17	
E.G. Slope (ft/ft)	0.008568	Area (sq ft)		367.17	
Q Total (cfs)	4051.00	Flow (cfs)		4051.00	
Top Width (ft)	97.28	Top Width (ft)		97.28	
Vel Total (ft/s)	11.03	Avg. Vel. (ft/s)		11.03	
Max Chl Dpth (ft)	5.49	Hydr. Depth (ft)		3.77	
Conv. Total (cfs)	43764.0	Conv. (cfs)		43764.0	
Length Wtd. (ft)	220.00	Wetted Per. (ft)		98.36	
Min Ch El (ft)	6632.00	Shear (lb/sq ft)		2.00	
Alpha	1.00	Stream Power (lb/ft s)		22.03	
Frctn Loss (ft)	1.92	Cum Volume (acre-ft)	1.98	68.34	1.60
C & E Loss (ft)	0.06	Cum SA (acres)	1.10	12.47	1.04

Plan: Existing BSC Black Squirrel Allison Valley RS: 13 Profile: PF 1

E.G. Elev (ft)	6634.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.68	Wt. n-Val.		0.030	
W.S. Elev (ft)	6632.58	Reach Len. (ft)	250.00	205.00	140.00
Crit W.S. (ft)	6632.58	Flow Area (sq ft)		389.42	

Plan: Existing BSC Black Squirrel Allison Valley RS: 13 Profile: PF 1 (Continued)

E.G. Slope (ft/ft)	0.008896	Area (sq ft)		389.42	
Q Total (cfs)	4051.00	Flow (cfs)		4051.00	
Top Width (ft)	116.19	Top Width (ft)		116.19	
Vel Total (ft/s)	10.40	Avg. Vel. (ft/s)		10.40	
Max Chl Dpth (ft)	4.58	Hydr. Depth (ft)		3.35	
Conv. Total (cfs)	42951.1	Conv. (cfs)		42951.1	
Length Wtd. (ft)	205.00	Wetted Per. (ft)		117.19	
Min Ch El (ft)	6628.00	Shear (lb/sq ft)		1.85	
Alpha	1.00	Stream Power (lb/ft s)		19.20	
Frctn Loss (ft)	1.79	Cum Volume (acre-ft)	1.98	66.43	1.60
C & E Loss (ft)	0.03	Cum SA (acres)	1.10	11.93	1.04

Plan: Existing BSC Black Squirrel Allison Valley RS: 12 Profile: PF 1

E.G. Elev (ft)	6632.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.96	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6630.29	Reach Len. (ft)	275.00	200.00	235.00
Crit W.S. (ft)	6630.29	Flow Area (sq ft)	0.06	360.32	0.08
E.G. Slope (ft/ft)	0.008577	Area (sq ft)	0.06	360.32	0.08
Q Total (cfs)	4051.00	Flow (cfs)	0.05	4050.89	0.06
Top Width (ft)	93.00	Top Width (ft)	0.43	92.00	0.57
Vel Total (ft/s)	11.24	Avg. Vel. (ft/s)	0.74	11.24	0.78
Max Chl Dpth (ft)	4.29	Hydr. Depth (ft)	0.14	3.92	0.14
Conv. Total (cfs)	43740.4	Conv. (cfs)	0.5	43739.2	0.7
Length Wtd. (ft)	200.00	Wetted Per. (ft)	0.52	93.92	0.64
Min Ch El (ft)	6626.00	Shear (lb/sq ft)	0.06	2.05	0.07
Alpha	1.00	Stream Power (lb/ft s)	0.05	23.10	0.05
Frctn Loss (ft)	1.75	Cum Volume (acre-ft)	1.98	64.66	1.60
C & E Loss (ft)	0.10	Cum SA (acres)	1.09	11.44	1.04

Plan: Existing BSC Black Squirrel Allison Valley RS: 11 Profile: PF 1

E.G. Elev (ft)	6628.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.63	Wt. n-Val.		0.030	
W.S. Elev (ft)	6627.11	Reach Len. (ft)	130.00	245.00	320.00
Crit W.S. (ft)	6627.11	Flow Area (sq ft)		395.86	
E.G. Slope (ft/ft)	0.008973	Area (sq ft)		395.86	
Q Total (cfs)	4051.00	Flow (cfs)		4051.00	
Top Width (ft)	122.00	Top Width (ft)		122.00	
Vel Total (ft/s)	10.23	Avg. Vel. (ft/s)		10.23	

Plan: Existing BSC Black Squirrel Allison Valley RS: 11 Profile: PF 1 (Continued)

Max Chl Dpth (ft)	5.11	Hydr. Depth (ft)		3.24	
Conv. Total (cfs)	42766.4	Conv. (cfs)		42766.4	
Length Wtd. (ft)	245.05	Wetted Per. (ft)		122.89	
Min Ch El (ft)	6622.00	Shear (lb/sq ft)		1.80	
Alpha	1.00	Stream Power (lb/ft s)		18.47	
Frctn Loss (ft)	2.03	Cum Volume (acre-ft)	1.98	62.93	1.60
C & E Loss (ft)	0.06	Cum SA (acres)	1.09	10.95	1.04

Plan: Existing BSC Black Squirrel Allison Valley RS: 10 Profile: PF 1

E.G. Elev (ft)	6624.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.27	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6622.10	Reach Len. (ft)	245.00	272.00	285.00
Crit W.S. (ft)	6622.10	Flow Area (sq ft)	3.96	330.90	7.71
E.G. Slope (ft/ft)	0.007690	Area (sq ft)	3.96	330.90	7.71
Q Total (cfs)	4051.00	Flow (cfs)	10.84	4017.71	22.45
Top Width (ft)	81.12	Top Width (ft)	3.78	70.00	7.35
Vel Total (ft/s)	11.83	Avg. Vel. (ft/s)	2.73	12.14	2.91
Max Chl Dpth (ft)	6.10	Hydr. Depth (ft)	1.05	4.73	1.05
Conv. Total (cfs)	46194.8	Conv. (cfs)	123.6	45815.2	256.0
Length Wtd. (ft)	272.00	Wetted Per. (ft)	4.32	70.80	7.64
Min Ch El (ft)	6616.00	Shear (lb/sq ft)	0.44	2.24	0.48
Alpha	1.05	Stream Power (lb/ft s)	1.20	27.24	1.41
Frctn Loss (ft)	2.17	Cum Volume (acre-ft)	1.97	60.88	1.58
C & E Loss (ft)	0.01	Cum SA (acres)	1.09	10.41	1.01

Plan: Existing BSC Black Squirrel Allison Valley RS: 9 Profile: PF 1

E.G. Elev (ft)	6618.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.32	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6616.46	Reach Len. (ft)	140.00	122.00	115.00
Crit W.S. (ft)	6616.46	Flow Area (sq ft)	0.19	331.05	0.11
E.G. Slope (ft/ft)	0.008249	Area (sq ft)	0.19	331.05	0.11
Q Total (cfs)	4051.00	Flow (cfs)	0.19	4050.71	0.09
Top Width (ft)	73.28	Top Width (ft)	0.82	72.00	0.46
Vel Total (ft/s)	12.23	Avg. Vel. (ft/s)	1.03	12.24	0.89
Max Chl Dpth (ft)	6.46	Hydr. Depth (ft)	0.23	4.60	0.23
Conv. Total (cfs)	44601.5	Conv. (cfs)	2.1	44598.4	1.0
Length Wtd. (ft)	122.03	Wetted Per. (ft)	0.94	73.80	0.65
Min Ch El (ft)	6610.00	Shear (lb/sq ft)	0.10	2.31	0.08

Plan: Existing BSC Black Squirrel Allison Valley RS: 9 Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)	0.11	28.27	0.07
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	1.96	58.82	1.55
C & E Loss (ft)	0.35	Cum SA (acres)	1.07	9.96	0.99

Plan: Existing BSC Black Squirrel Allison Valley RS: 8 Profile: PF 1

E.G. Elev (ft)	6617.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.16	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6615.93	Reach Len. (ft)	740.00	734.00	800.00
Crit W.S. (ft)		Flow Area (sq ft)	9.35	465.66	3.74
E.G. Slope (ft/ft)	0.003033	Area (sq ft)	9.35	465.66	3.74
Q Total (cfs)	4051.00	Flow (cfs)	16.42	4028.41	6.18
Top Width (ft)	94.54	Top Width (ft)	9.67	81.00	3.87
Vel Total (ft/s)	8.46	Avg. Vel. (ft/s)	1.76	8.65	1.65
Max Chl Dpth (ft)	7.93	Hydr. Depth (ft)	0.97	5.75	0.97
Conv. Total (cfs)	73551.3	Conv. (cfs)	298.1	73141.2	112.1
Length Wtd. (ft)	734.16	Wetted Per. (ft)	9.86	82.46	4.32
Min Ch El (ft)	6608.00	Shear (lb/sq ft)	0.18	1.07	0.16
Alpha	1.04	Stream Power (lb/ft s)	0.32	9.25	0.27
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	1.94	57.70	1.55
C & E Loss (ft)	0.31	Cum SA (acres)	1.06	9.75	0.98

Plan: Existing BSC Black Squirrel Allison Valley RS: 7 Profile: PF 1

E.G. Elev (ft)	6616.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6616.30	Reach Len. (ft)	380.00	300.00	340.00
Crit W.S. (ft)		Flow Area (sq ft)	18.46	1464.98	15.39
E.G. Slope (ft/ft)	0.000195	Area (sq ft)	18.46	1464.98	15.39
Q Total (cfs)	4051.00	Flow (cfs)	13.15	4027.19	10.66
Top Width (ft)	196.76	Top Width (ft)	8.59	181.00	7.16
Vel Total (ft/s)	2.70	Avg. Vel. (ft/s)	0.71	2.75	0.69
Max Chl Dpth (ft)	9.30	Hydr. Depth (ft)	2.15	8.09	2.15
Conv. Total (cfs)	290229.3	Conv. (cfs)	942.3	288523.4	763.5
Length Wtd. (ft)	300.65	Wetted Per. (ft)	9.61	184.77	8.35
Min Ch El (ft)	6607.00	Shear (lb/sq ft)	0.02	0.10	0.02
Alpha	1.03	Stream Power (lb/ft s)	0.02	0.27	0.02
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	1.71	41.43	1.37
C & E Loss (ft)	0.02	Cum SA (acres)	0.90	7.54	0.88

Plan: Existing BSC Black Squirrel Allison Valley RS: 6 Profile: PF 1

E.G. Elev (ft)	6616.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6616.29	Reach Len. (ft)	440.00	450.00	435.00
Crit W.S. (ft)		Flow Area (sq ft)	37.92	1924.31	95.37
E.G. Slope (ft/ft)	0.000118	Area (sq ft)	37.92	1924.31	95.37
Q Total (cfs)	4051.00	Flow (cfs)	22.15	3977.69	51.16
Top Width (ft)	320.49	Top Width (ft)	17.69	251.00	51.80
Vel Total (ft/s)	1.97	Avg. Vel. (ft/s)	0.58	2.07	0.54
Max Chl Dpth (ft)	9.29	Hydr. Depth (ft)	2.14	7.67	1.84
Conv. Total (cfs)	373603.9	Conv. (cfs)	2043.0	366842.8	4718.2
Length Wtd. (ft)	449.88	Wetted Per. (ft)	18.20	254.85	52.00
Min Ch El (ft)	6607.00	Shear (lb/sq ft)	0.02	0.06	0.01
Alpha	1.08	Stream Power (lb/ft s)	0.01	0.11	0.01
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	1.46	29.76	0.94
C & E Loss (ft)	0.13	Cum SA (acres)	0.79	6.05	0.65

Plan: Existing BSC Black Squirrel Allison Valley RS: 5 Profile: PF 1

E.G. Elev (ft)	6616.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.37	Wt. n-Val.		0.030	
W.S. Elev (ft)	6614.68	Reach Len. (ft)	400.00	380.00	440.00
Crit W.S. (ft)	6614.68	Flow Area (sq ft)		431.05	
E.G. Slope (ft/ft)	0.009501	Area (sq ft)		431.05	
Q Total (cfs)	4051.00	Flow (cfs)		4051.00	
Top Width (ft)	157.67	Top Width (ft)		157.67	
Vel Total (ft/s)	9.40	Avg. Vel. (ft/s)		9.40	
Max Chl Dpth (ft)	5.68	Hydr. Depth (ft)		2.73	
Conv. Total (cfs)	41559.8	Conv. (cfs)		41559.8	
Length Wtd. (ft)	380.83	Wetted Per. (ft)		158.72	
Min Ch El (ft)	6609.00	Shear (lb/sq ft)		1.61	
Alpha	1.00	Stream Power (lb/ft s)		15.14	
Frctn Loss (ft)	3.20	Cum Volume (acre-ft)	1.27	17.60	0.46
C & E Loss (ft)	0.01	Cum SA (acres)	0.70	3.94	0.39

Plan: Existing BSC Black Squirrel Allison Valley RS: 4 Profile: PF 1

E.G. Elev (ft)	6603.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.48	Wt. n-Val.	0.030	0.030	0.030
W.S. Elev (ft)	6602.34	Reach Len. (ft)	75.00	92.00	85.00
Crit W.S. (ft)	6602.34	Flow Area (sq ft)	55.44	374.24	4.65

Plan: Existing BSC Black Squirrel Allison Valley RS: 4 Profile: PF 1 (Continued)

E.G. Slope (ft/ft)	0.007468	Area (sq ft)	55.44	374.24	4.65
Q Total (cfs)	4051.00	Flow (cfs)	275.64	3755.35	20.01
Top Width (ft)	152.20	Top Width (ft)	44.22	104.00	3.98
Vel Total (ft/s)	9.33	Avg. Vel. (ft/s)	4.97	10.03	4.30
Max Chl Dpth (ft)	5.34	Hydr. Depth (ft)	1.25	3.60	1.17
Conv. Total (cfs)	46875.6	Conv. (cfs)	3189.5	43454.6	231.5
Length Wtd. (ft)	91.14	Wetted Per. (ft)	44.29	104.27	4.61
Min Ch El (ft)	6597.00	Shear (lb/sq ft)	0.58	1.67	0.47
Alpha	1.09	Stream Power (lb/ft s)	2.90	16.79	2.02
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	1.01	14.08	0.44
C & E Loss (ft)	0.33	Cum SA (acres)	0.50	2.80	0.37

Plan: Existing BSC Black Squirrel Allison Valley RS: 3 Profile: PF 1

E.G. Elev (ft)	6591.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6591.52	Reach Len. (ft)	860.00	860.00	960.00
Crit W.S. (ft)		Flow Area (sq ft)	65.29	772.67	22.19
E.G. Slope (ft/ft)	0.000644	Area (sq ft)	65.29	772.67	22.19
Q Total (cfs)	4051.00	Flow (cfs)	116.19	3907.77	27.04
Top Width (ft)	126.36	Top Width (ft)	20.29	95.00	11.07
Vel Total (ft/s)	4.71	Avg. Vel. (ft/s)	1.78	5.06	1.22
Max Chl Dpth (ft)	10.02	Hydr. Depth (ft)	3.22	8.13	2.00
Conv. Total (cfs)	159626.6	Conv. (cfs)	4578.5	153982.7	1065.5
Length Wtd. (ft)	860.62	Wetted Per. (ft)	21.10	95.74	12.66
Min Ch El (ft)	6581.50	Shear (lb/sq ft)	0.12	0.32	0.07
Alpha	1.12	Stream Power (lb/ft s)	0.22	1.64	0.09
Frctn Loss (ft)	1.36	Cum Volume (acre-ft)	0.91	12.87	0.41
C & E Loss (ft)	0.10	Cum SA (acres)	0.44	2.59	0.36

Plan: Existing BSC Black Squirrel Allison Valley RS: 2 Profile: PF 1

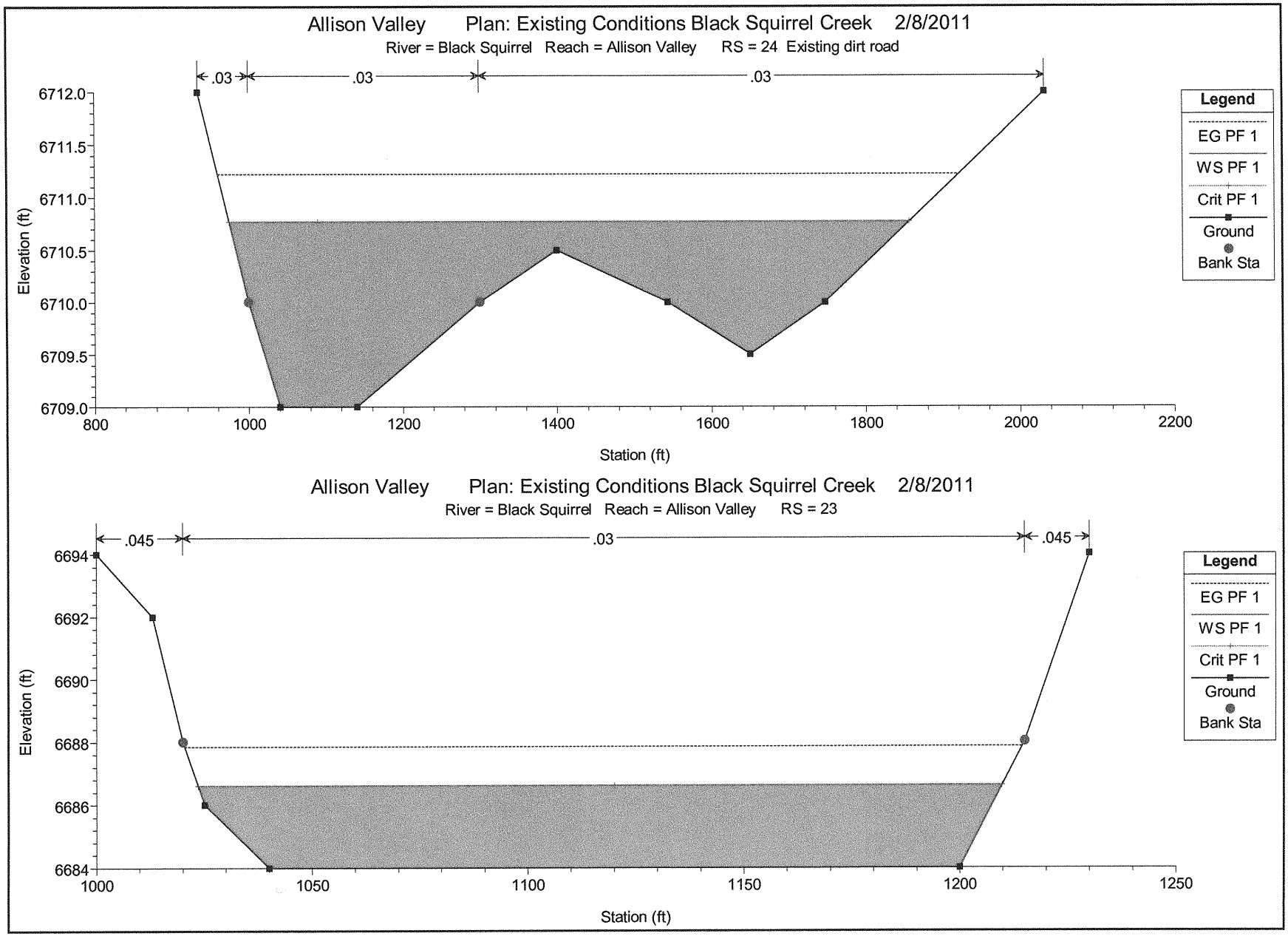
E.G. Elev (ft)	6590.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.43	Wt. n-Val.	0.030	0.030	0.030
W.S. Elev (ft)	6589.01	Reach Len. (ft)	160.00	135.00	100.00
Crit W.S. (ft)	6589.01	Flow Area (sq ft)	5.32	415.92	8.11
E.G. Slope (ft/ft)	0.008401	Area (sq ft)	5.32	415.92	8.11
Q Total (cfs)	4051.00	Flow (cfs)	15.24	4012.49	23.27
Top Width (ft)	160.68	Top Width (ft)	10.57	134.00	16.11
Vel Total (ft/s)	9.44	Avg. Vel. (ft/s)	2.86	9.65	2.87

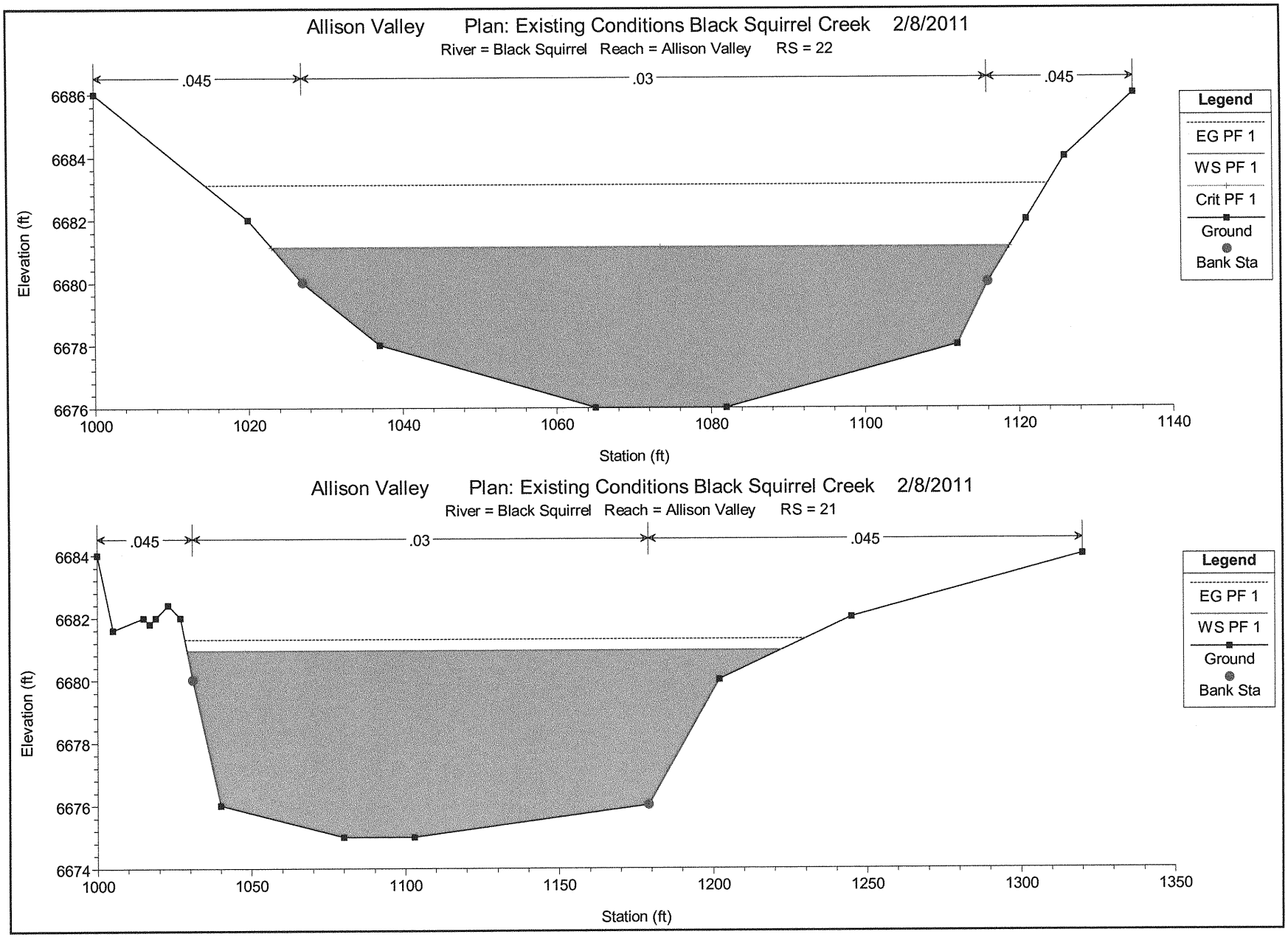
Plan: Existing BSC Black Squirrel Allison Valley RS: 2 Profile: PF 1 (Continued)

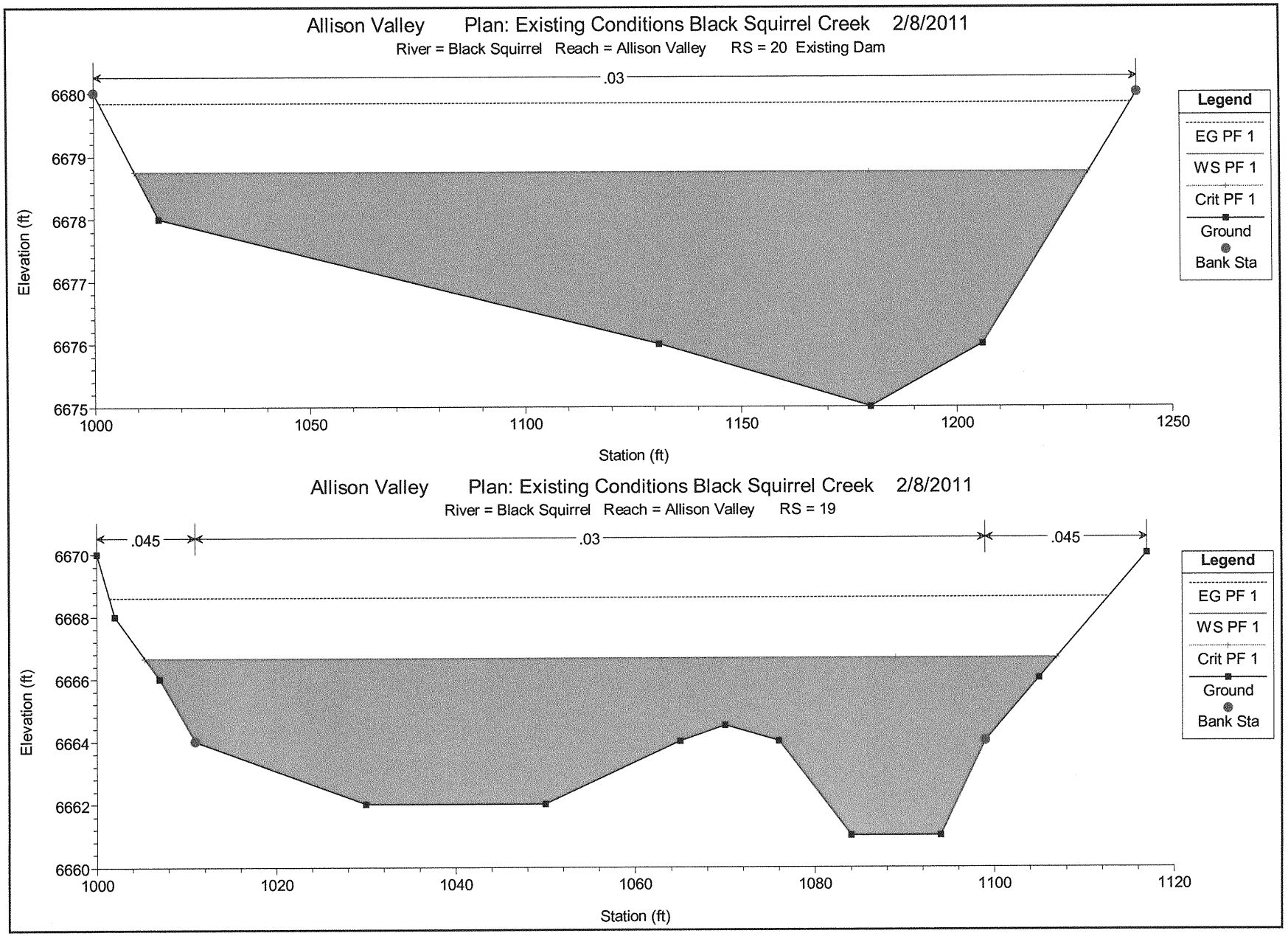
Max Chl Dpth (ft)	4.51	Hydr. Depth (ft)	0.50	3.10	0.50
Conv. Total (cfs)	44198.7	Conv. (cfs)	166.3	43778.5	253.9
Length Wtd. (ft)	135.31	Wetted Per. (ft)	10.62	134.26	16.14
Min Ch El (ft)	6584.50	Shear (lb/sq ft)	0.26	1.62	0.26
Alpha	1.04	Stream Power (lb/ft s)	0.75	15.67	0.76
Frctn Loss (ft)	1.04	Cum Volume (acre-ft)	0.21	1.14	0.08
C & E Loss (ft)	0.00	Cum SA (acres)	0.14	0.33	0.06

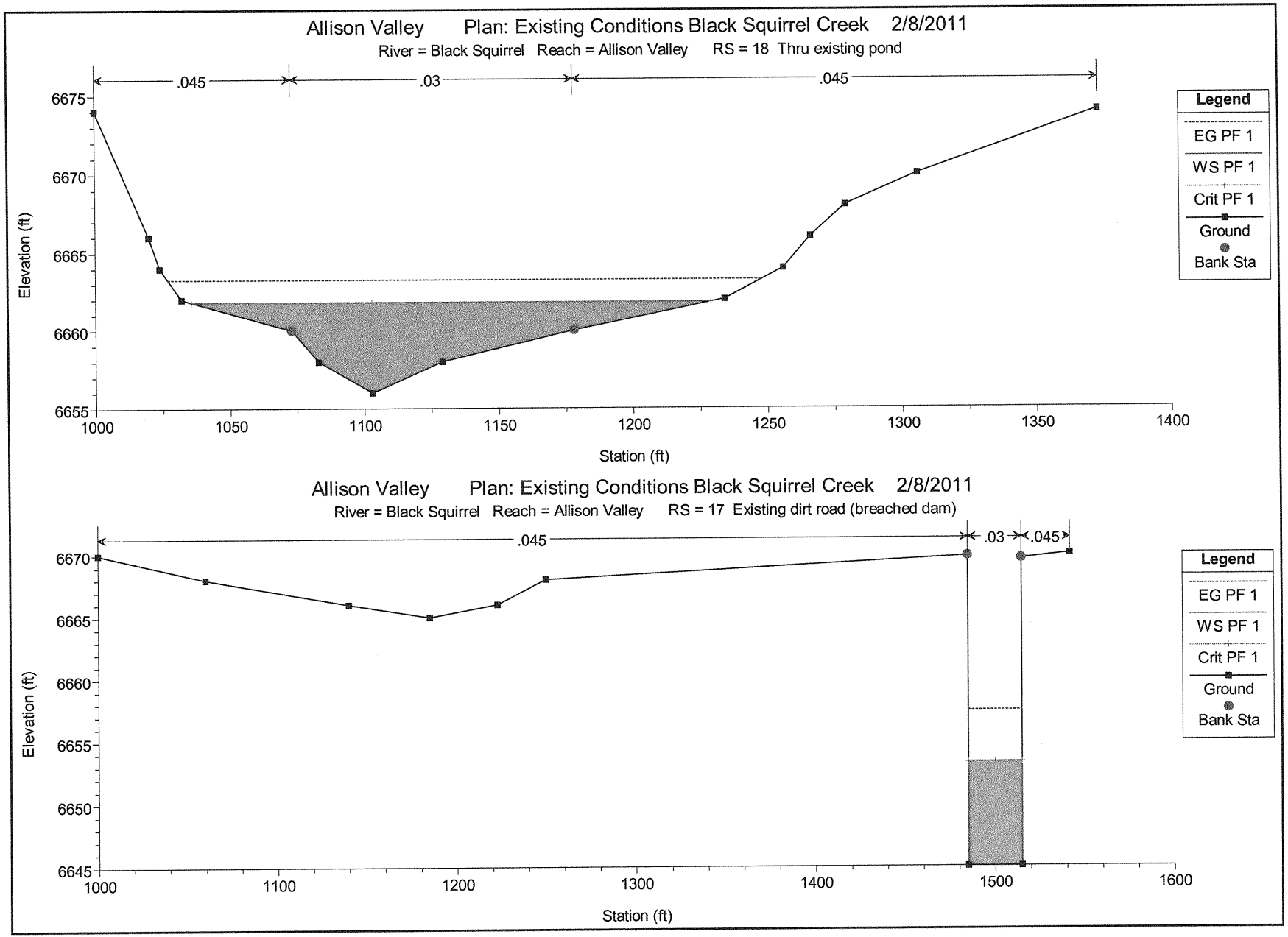
Plan: Existing BSC Black Squirrel Allison Valley RS: 1 Profile: PF 1

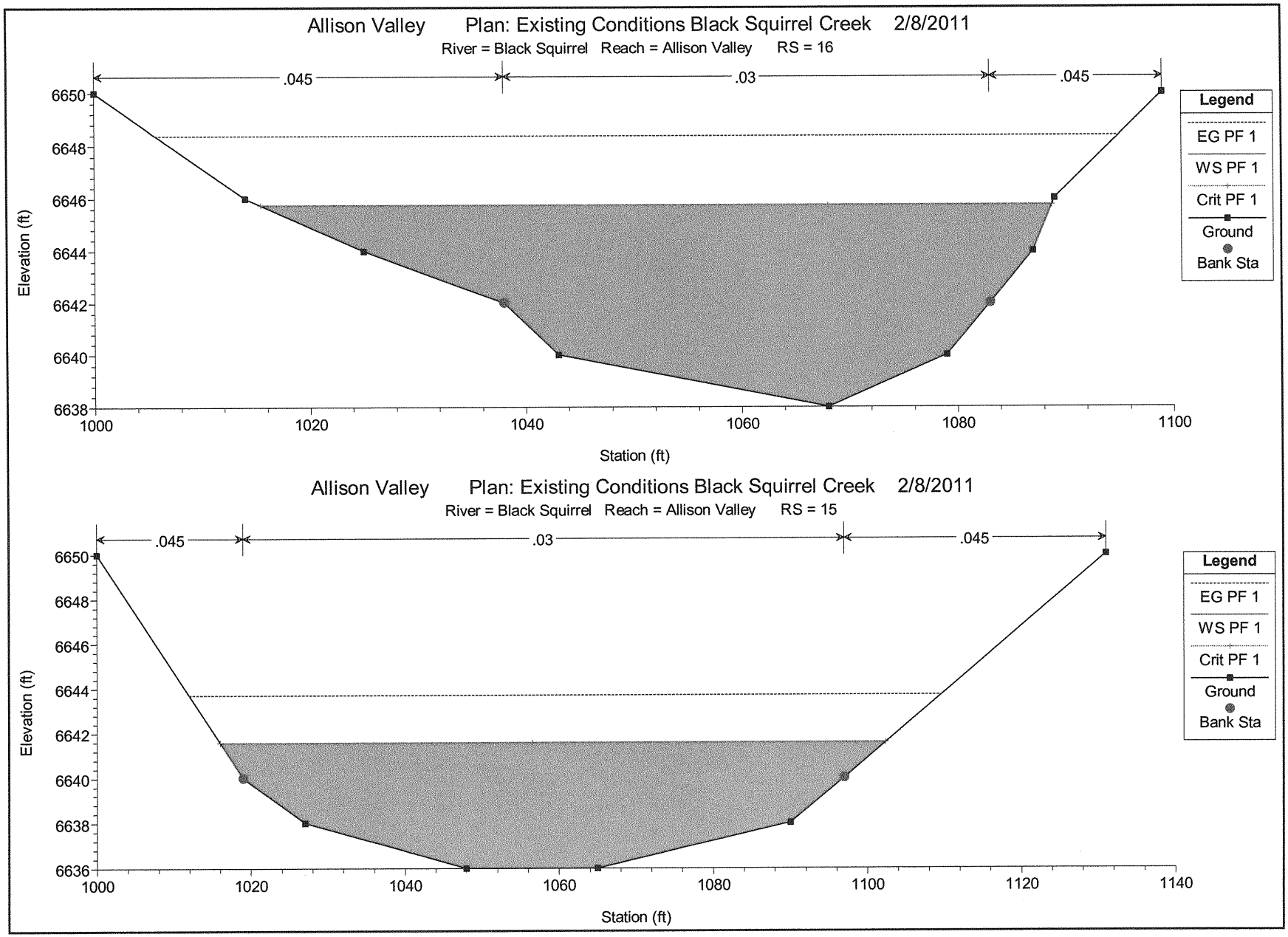
E.G. Elev (ft)	6580.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.48	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6579.04	Reach Len. (ft)			
Crit W.S. (ft)	6579.04	Flow Area (sq ft)	110.54	319.51	59.56
E.G. Slope (ft/ft)	0.007058	Area (sq ft)	110.54	319.51	59.56
Q Total (cfs)	4051.00	Flow (cfs)	445.63	3372.04	233.33
Top Width (ft)	177.37	Top Width (ft)	63.01	79.00	35.36
Vel Total (ft/s)	8.27	Avg. Vel. (ft/s)	4.03	10.55	3.92
Max Chl Dpth (ft)	5.04	Hydr. Depth (ft)	1.75	4.04	1.68
Conv. Total (cfs)	48219.9	Conv. (cfs)	5304.4	40138.1	2777.4
Length Wtd. (ft)		Wetted Per. (ft)	63.10	79.10	35.49
Min Ch El (ft)	6574.00	Shear (lb/sq ft)	0.77	1.78	0.74
Alpha	1.39	Stream Power (lb/ft s)	3.11	18.78	2.90
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

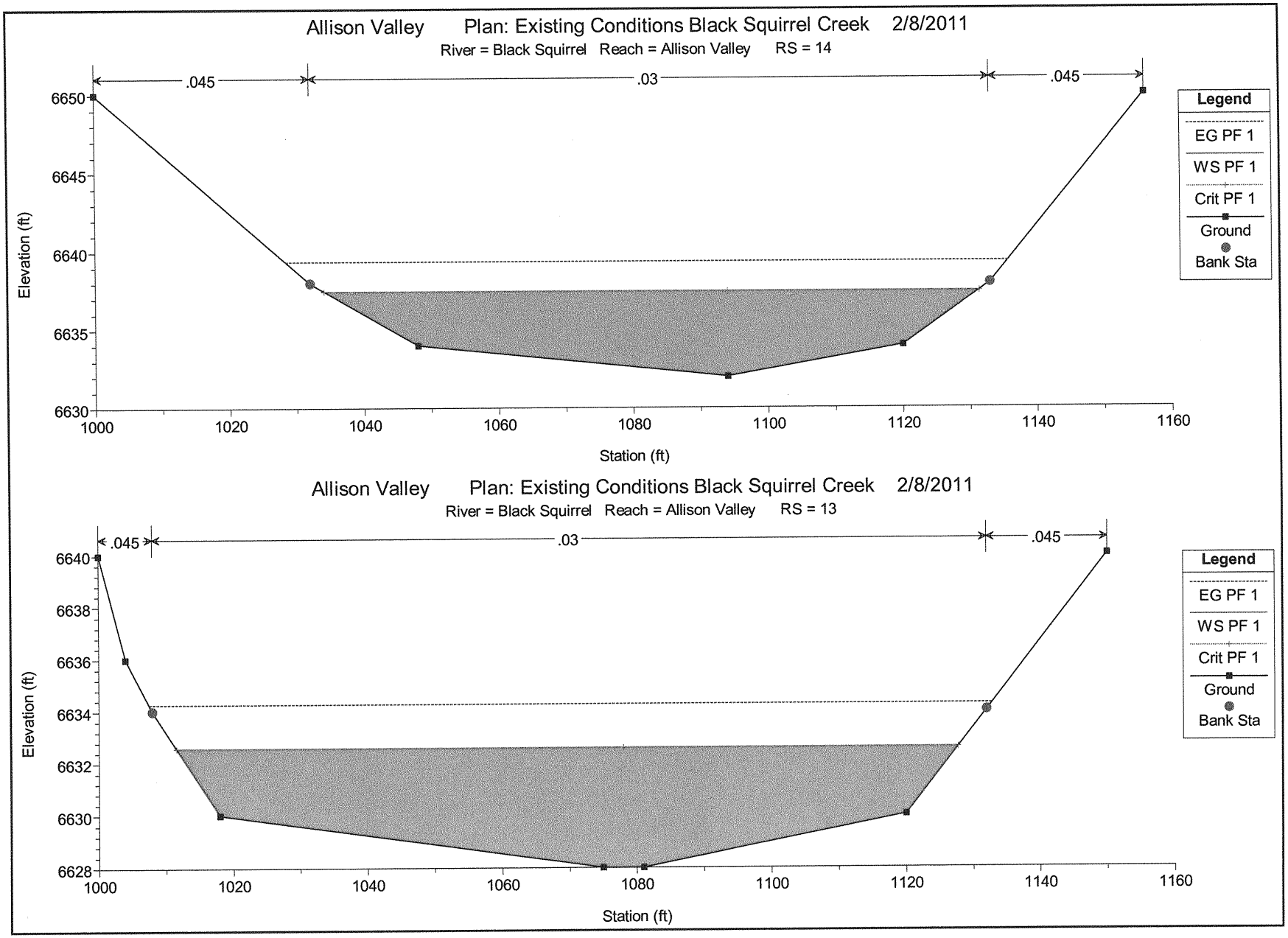

Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 24 Existing dirt road
.03
.03
.03
6712.0
6711.5
6711.0
6710.5
6710.0
6709.5
6709.0
Elevation (ft)
800
1000
1200
1400
1600
1800
2000
2200
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 23
.045
.03
.045
6694
6692
6690
6688
6686
6684
Elevation (ft)
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

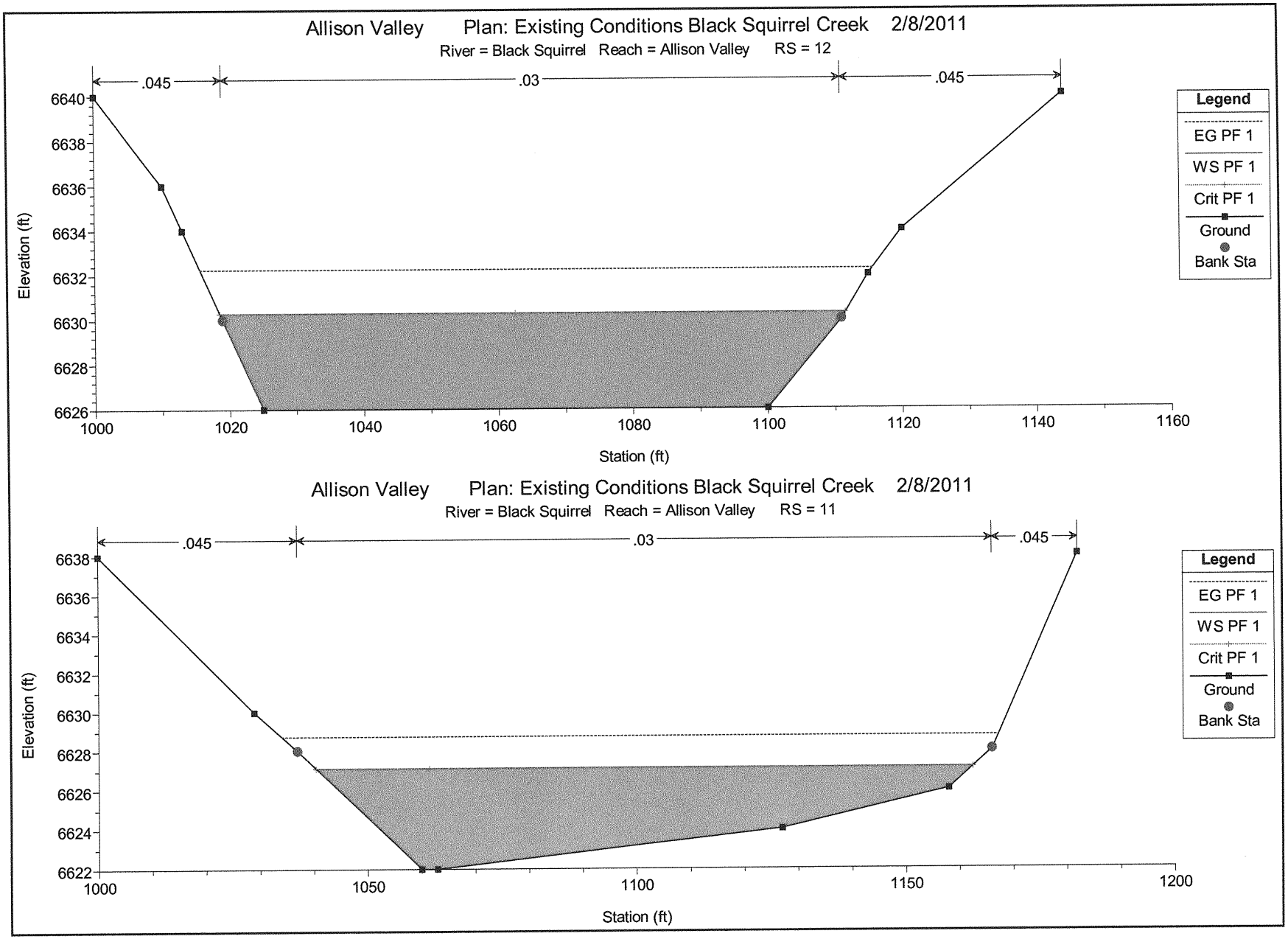

Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 22
.045
.03
.045
Elevation (ft)
6686
6684
6682
6680
6678
6676
1000
1020
1040
1060
1080
1100
1120
1140
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 21
.045
.03
.045
Elevation (ft)
6684
6682
6680
6678
6676
6674
1000
1050
1100
1150
1200
1250
1300
1350
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

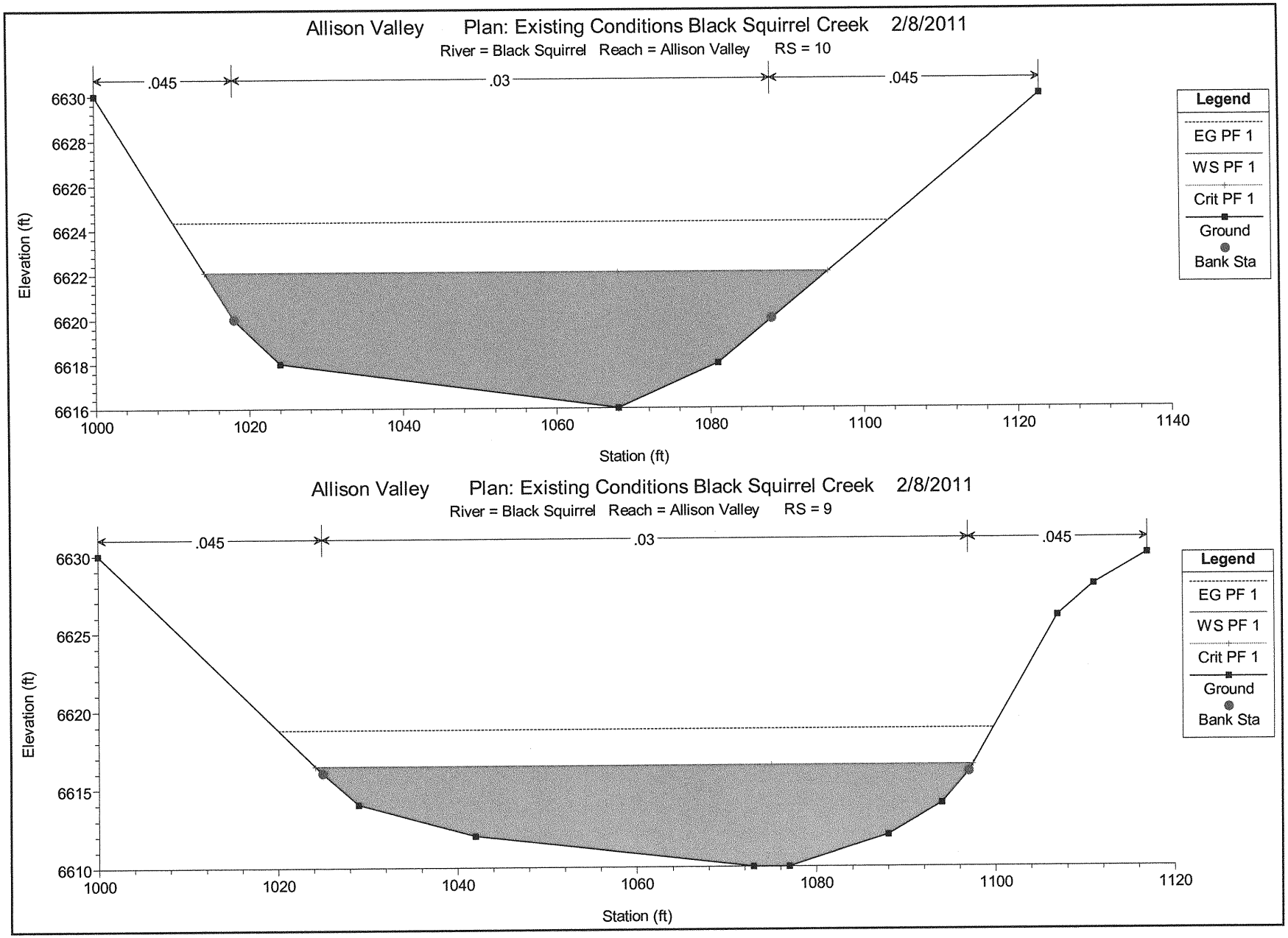

Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 20 Existing Dam
.03
6680
6679
6678
6677
6676
6675
Elevation (ft)
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 19
.045
.03
.045
6670
6668
6666
6664
6662
6660
Elevation (ft)
1000
1020
1040
1060
1080
1100
1120
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

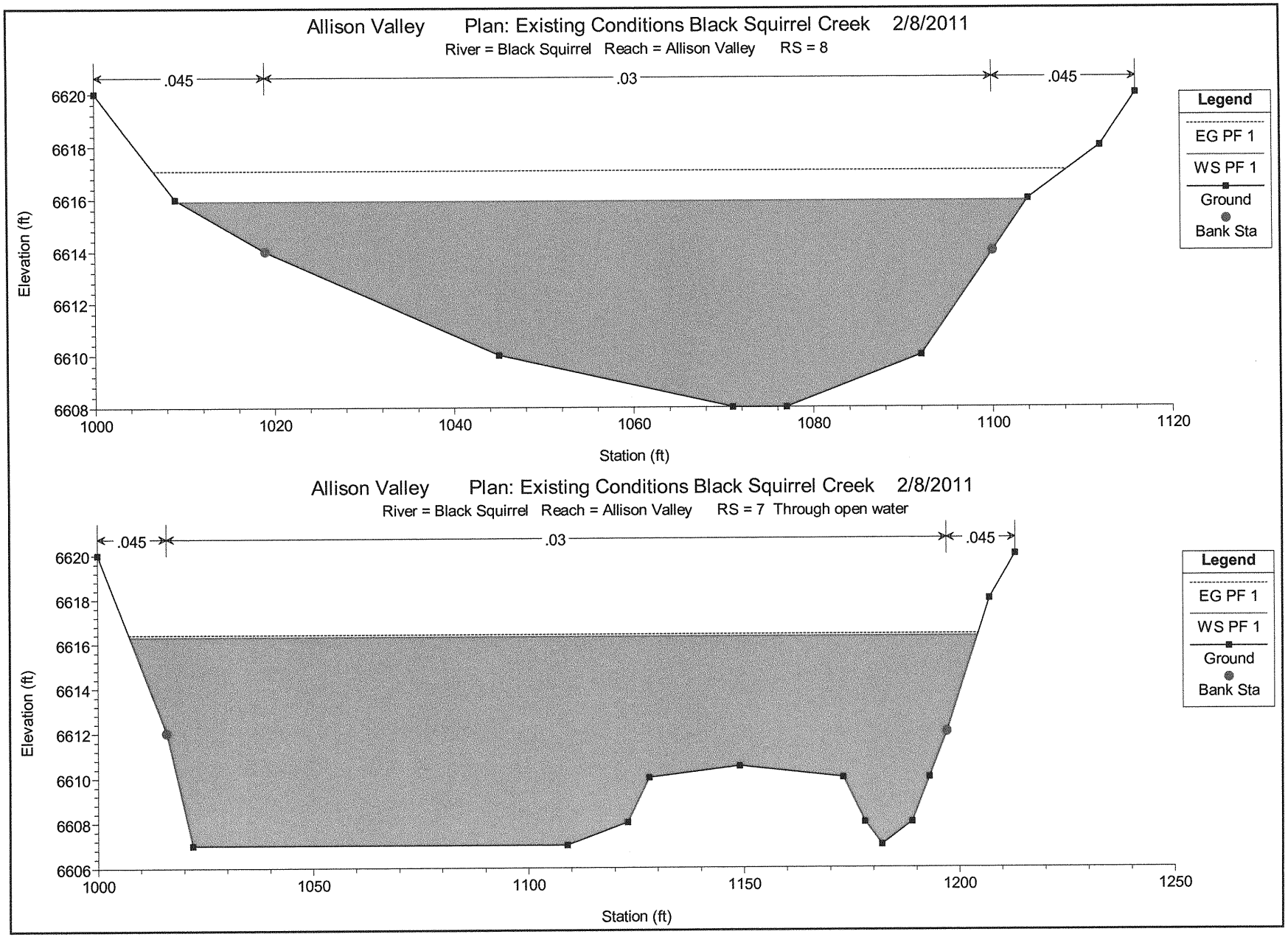

Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 18 Thru existing pond
.045
.03
.045
Elevation (ft)
6675
6670
6665
6660
6655
1000
1050
1100
1150
1200
1250
1300
1350
1400
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 17 Existing dirt road (breached dam)
.045
.03
.045
Elevation (ft)
6670
6665
6660
6655
6650
6645
1000
1100
1200
1300
1400
1500
1600
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

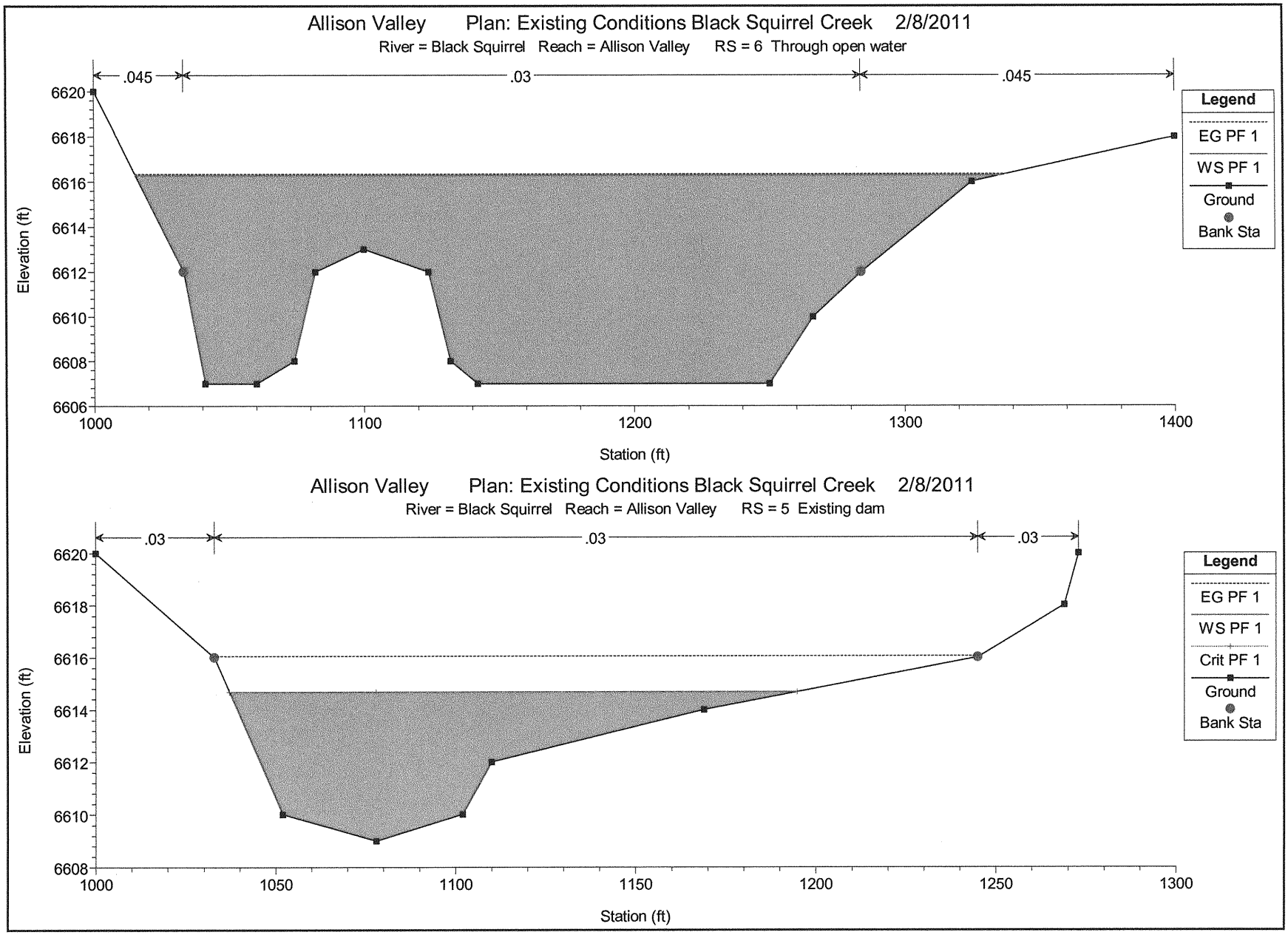

Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 16
.045
.03
.045
6650
6648
6646
6644
6642
6640
6638
Elevation (ft)
1000
1020
1040
1060
1080
1100
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 15
.045
.03
.045
6650
6648
6646
6644
6642
6640
6638
6636
Elevation (ft)
1000
1020
1040
1060
1080
1100
1120
1140
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

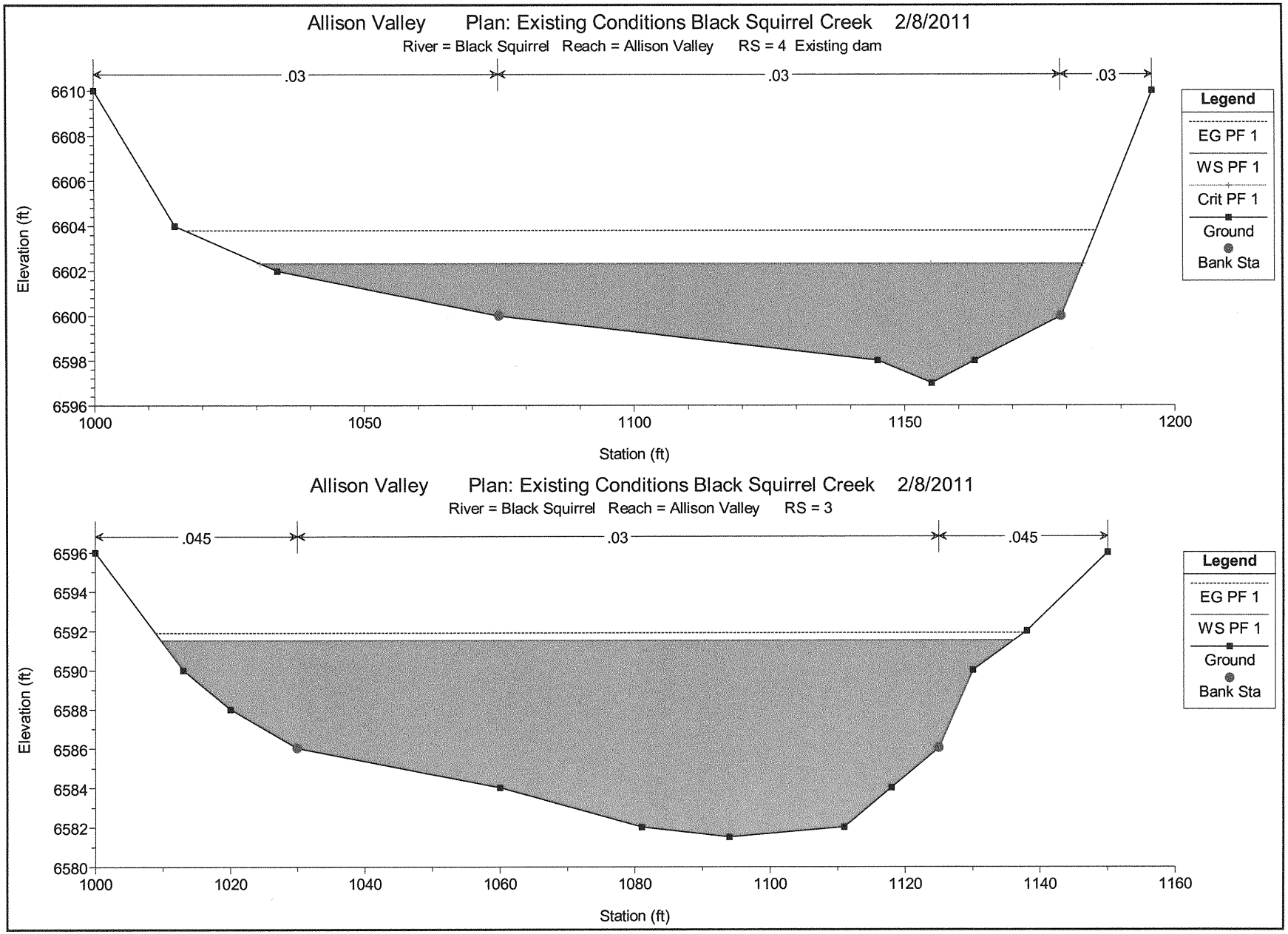

Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 14
.045
.03
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6650
6645
6640
6635
6630
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station (ft)
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 13
.045
.03
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6640
6638
6636
6634
6632
6630
6628
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station (ft)

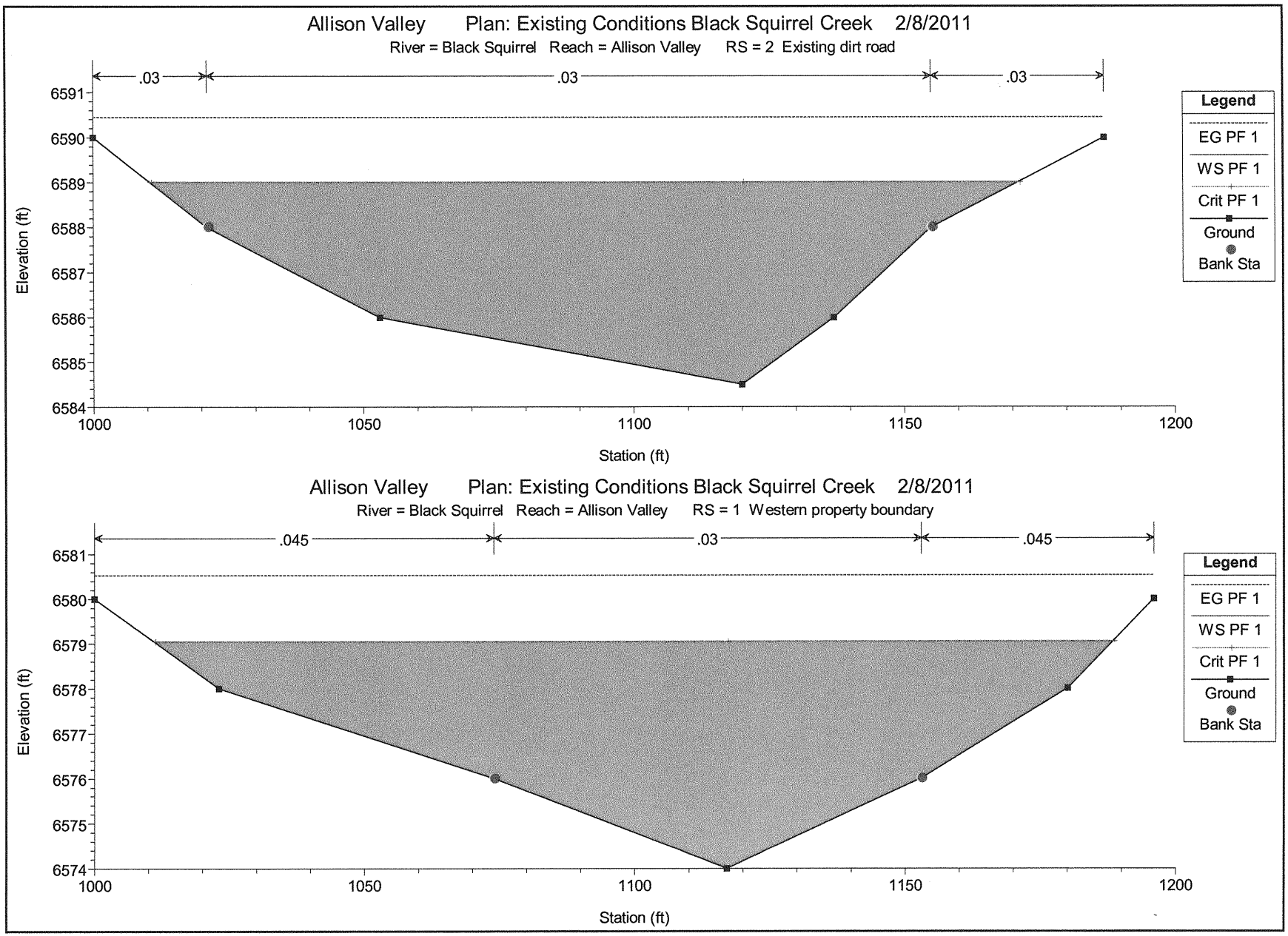

Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 12
.045
.03
.045
Elevation (ft)
6640
6638
6636
6634
6632
6630
6628
6626
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 11
.045
.03
.045
Elevation (ft)
6638
6636
6634
6632
6630
6628
6626
6624
6622
1000
1050
1100
1150
1200
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 10
.045
.03
.045
Elevation (ft)
6630
6628
6626
6624
6622
6620
6618
6616
1000
1020
1040
1060
1080
1100
1120
1140
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 9
.045
.03
.045
Elevation (ft)
6630
6625
6620
6615
6610
1000
1020
1040
1060
1080
1100
1120
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 8
.045
.03
.045
6620
6618
6616
6614
6612
6610
6608
Elevation (ft)
1000
1020
1040
1060
1080
1100
1120
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 7 Through open water
.045
.03
.045
6620
6618
6616
6614
6612
6610
6608
6606
Elevation (ft)
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 6 Through open water
.045
.03
.045
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6620
6618
6616
6614
6612
6610
6608
6606
1000
1100
1200
1300
1400
Station (ft)
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 5 Existing dam
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6620
6618
6616
6614
6612
6610
6608
1000
1050
1100
1150
1200
1250
1300
Station (ft)


Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 4 Existing dam
.03
.03
.03
Elevation (ft)
6610
6608
6606
6604
6602
6600
6598
6596
1000
1050
1100
1150
1200
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 3
.045
.03
.045
Elevation (ft)
6596
6594
6592
6590
6588
6586
6584
6582
6580
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 2 Existing dirt road
.03
.03
.03
6591
6590
6589
6588
6587
6586
6585
6584
Elevation (ft)
1000
1050
1100
1150
1200
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Allison Valley Plan: Existing Conditions Black Squirrel Creek 2/8/2011
River = Black Squirrel Reach = Allison Valley RS = 1 Western property boundary
.045
.03
.045
6581
6580
6579
6578
6577
6576
6575
6574
Elevation (ft)
1000
1050
1100
1150
1200
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 04
Emergency Spillway Sizing

Emergency Spillway Calculation (Q_{100}=4051 cfs less Q_5=480 cfs = 3571 cfs)

Description	Water Elevation	Weir Coefficient	Crest Length	Crest Elevation	Flow Depth	**Flow**
Spillway	6600.0	2.6	175.0 ft	6596.0	4.0	**3640 cfs**
Spillway	6599.5	2.6	210.0 ft	6596.0	3.5	**3575 cfs**
Spillway	6599.0	2.6	265.0 ft	6596.0	3.0	**3580 cfs**
Spillway	6598.5	2.6	350.0 ft	6596.0	2.5	**3597 cfs**
Spillway	6598.0	2.6	490.0 ft	6596.0	2.0	**3603 cfs**

Weir Equation:

$Q = CLH^{1.5}$

C = Weir coefficient (dimensionless), C = 2.6

L = Length of weir, in ft

H = Depth of flow over the crest, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 05
Outlet Structure Sizing

Outlet Structure - Chamber Orifice (Q_5=480 cfs)

Orifice Calculation

Orifice Coefficient		0.6
Opening Size	Rise	4.00 ft
	Span	8.00 ft
Opening Area		32.00 sf
Opening Flowline Elevation		6591.50
Opening Centerline Elevation		6593.50
Opening Top Elevation		6595.50

Water Elevation	Head / Flow Depth	Flow Through Single Culvert
6602.00	8.50 ft	449.2 cfs
6603.00	9.50 ft	474.9 cfs
6604.00	10.50 ft	499.3 cfs
6605.00	11.50 ft	522.5 cfs
6606.00	12.50 ft	544.8 cfs
6607.00	13.50 ft	566.1 cfs
6608.00	14.50 ft	586.7 cfs
6609.00	15.50 ft	606.6 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 05
Outlet Grate Sizing

Orifice Calculation - Calculation for Front Chamber Grate (Q_5=480 cfs)

Orifice Coefficient		0.6
Opening Size	Length	14.00 ft
	Depth	5.0 ft
Opening Area		70.00 sf
Opening Area w/00% Blockage		70.00 sf
Opening Elevation		6607.00

Water Elevation	Head / Flow Depth	Orifice Flow
6608.00	1.00 ft	337.0 cfs
6608.25	1.25 ft	376.8 cfs
6608.50	1.50 ft	412.8 cfs
6608.75	1.75 ft	445.9 cfs
6609.00	2.00 ft	476.7 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 05
Emergency Spillway Sizing

Emergency Spillway Calculation (Q_{100}=4051 cfs less Q_5=480 cfs = 3571 cfs)

Description	Water Elevation	Weir Coefficient	Crest Length	Crest Elevation	Flow Depth	**Flow**
Spillway	6613.0	2.6	175.0 ft	6609.0	4.0	**3640 cfs**
Spillway	6612.5	2.6	210.0 ft	6609.0	3.5	**3575 cfs**
Spillway	6612.0	2.6	265.0 ft	6609.0	3.0	**3580 cfs**
Spillway	6611.5	2.6	350.0 ft	6609.0	2.5	**3597 cfs**
Spillway	6611.0	2.6	490.0 ft	6609.0	2.0	**3603 cfs**

Weir Equation:

$Q = CLH^{1.5}$

C = Weir coefficient (dimensionless), C = 2.6

L = Length of weir, in ft

H = Depth of flow over the crest, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 17
Outlet Structure Sizing

Outlet Structure - Chamber Orifice (Q_5=480 cfs)

Orifice Calculation

Orifice Coefficient		0.6
Opening Size	Rise	4.00 ft
	Span	8.00 ft
Opening Area		32.00 sf
Opening Flowline Elevation		6648.00
Opening Centerline Elevation		6650.00
Opening Top Elevation		6652.00

Water Elevation	Head / Flow Depth	Flow Through Single Culvert
6659.00	9.00 ft	462.2 cfs
6660.00	10.00 ft	487.2 cfs
6661.00	11.00 ft	511.0 cfs
6662.00	12.00 ft	533.7 cfs
6663.00	13.00 ft	555.5 cfs
6664.00	14.00 ft	576.5 cfs
6665.00	15.00 ft	596.7 cfs
6666.00	16.00 ft	616.3 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 17
Outlet Grate Sizing

Orifice Calculation - Calculation for Front Chamber Grate (Q_5=480 cfs)

Orifice Coefficient		0.6
Opening Size	Length	14.00 ft
	Depth	5.0 ft
Opening Area		70.00 sf
Opening Area w/00% Blockage		70.00 sf
Opening Elevation		6664.00

Water Elevation	Head / Flow Depth	Orifice Flow
6665.00	1.00 ft	337.0 cfs
6665.25	1.25 ft	376.8 cfs
6665.50	1.50 ft	412.8 cfs
6665.75	1.75 ft	445.9 cfs
6666.00	2.00 ft	476.7 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 17
Emergency Spillway Sizing

Emergency Spillway Calculation (Q_{100}=4051 cfs less Q_5=480 cfs = 3571 cfs)

Description	Water Elevation	Weir Coefficient	Crest Length	Crest Elevation	Flow Depth	**Flow**
Spillway	6668.0	2.6	175.0 ft	6664.0	4.0	**3640 cfs**
Spillway	6667.5	2.6	210.0 ft	6664.0	3.5	**3575 cfs**
Spillway	6667.0	2.6	265.0 ft	6664.0	3.0	**3580 cfs**
Spillway	6666.5	2.6	350.0 ft	6664.0	2.5	**3597 cfs**
Spillway	6666.0	2.6	490.0 ft	6664.0	2.0	**3603 cfs**

Weir Equation:

$Q = CLH^{1.5}$

C = Weir coefficient (dimensionless), C = 2.6

L = Length of weir, in ft

H = Depth of flow over the crest, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 20
Outlet Structure Sizing

Outlet Structure - Chamber Orifice (Q_5=480 cfs)

Orifice Calculation

Orifice Coefficient		0.6
Opening Size	Rise	4.00 ft
	Span	8.00 ft
Opening Area		32.00 sf
Opening Flowline Elevation		6664.00
Opening Centerline Elevation		6666.00
Opening Top Elevation		6668.00

Water Elevation	Head / Flow Depth	Flow Through Single Culvert
6671.00	5.00 ft	344.5 cfs
6672.00	6.00 ft	377.4 cfs
6673.00	7.00 ft	407.7 cfs
6674.00	8.00 ft	435.8 cfs
6675.00	9.00 ft	462.2 cfs
6676.00	10.00 ft	487.2 cfs
6677.00	11.00 ft	511.0 cfs
6678.00	12.00 ft	533.7 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 20
Outlet Grate Sizing

Orifice Calculation - Calculation for Front Chamber Grate (Q_5=480 cfs)

Orifice Coefficient		0.6
Opening Size	Length	14.00 ft
	Depth	5.0 ft
Opening Area		70.00 sf
Opening Area w/00% Blockage		70.00 sf
Opening Elevation		6676.00

Water Elevation	Head / Flow Depth	Orifice Flow
6677.00	1.00 ft	337.0 cfs
6677.25	1.25 ft	376.8 cfs
6677.50	1.50 ft	412.8 cfs
6677.75	1.75 ft	445.9 cfs
6678.00	2.00 ft	476.7 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 20
Emergency Spillway Sizing

Emergency Spillway Calculation (Q_{100}=4051 cfs less Q_5=480 cfs = 3571 cfs)

Description	Water Elevation	Weir Coefficient	Crest Length	Crest Elevation	Flow Depth	**Flow**
Spillway	6682.0	2.6	175.0 ft	6678.0	4.0	**3640 cfs**
Spillway	6681.5	2.6	210.0 ft	6678.0	3.5	**3575 cfs**
Spillway	6681.0	2.6	265.0 ft	6678.0	3.0	**3580 cfs**
Spillway	6680.5	2.6	350.0 ft	6678.0	2.5	**3597 cfs**
Spillway	6680.0	2.6	490.0 ft	6678.0	2.0	**3603 cfs**

Weir Equation:

$Q = CLH^{1.5}$

C = Weir coefficient (dimensionless), C = 2.6

L = Length of weir, in ft

H = Depth of flow over the crest, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 24
Outlet Structure Sizing

Outlet Structure - Chamber Orifice (Q_5=480 cfs)

Orifice Calculation

Orifice Coefficient		0.6
Opening Size	Rise	4.00 ft
	Span	6.00 ft
Opening Area		24.00 sf
Opening Flowline Elevation		6684.00
Opening Centerline Elevation		6686.00
Opening Top Elevation		6688.00

Water Elevation	Head / Flow Depth	Flow Through Single Culvert
6703.00	17.00 ft	476.5 cfs
6704.00	18.00 ft	490.3 cfs
6705.00	19.00 ft	503.7 cfs
6706.00	20.00 ft	516.8 cfs
6707.00	21.00 ft	529.6 cfs
6708.00	22.00 ft	542.0 cfs
6709.00	23.00 ft	554.2 cfs
6710.00	24.00 ft	566.1 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 24
Outlet Grate Sizing

Orifice Calculation - Calculation for Front Chamber Grate (Q_5=480 cfs)

Orifice Coefficient		0.6
Opening Size	Length	14.00 ft
	Depth	5.0 ft
Opening Area		70.00 sf
Opening Area w/00% Blockage		70.00 sf
Opening Elevation		6708.00

Water Elevation	Head / Flow Depth	Orifice Flow
6709.00	1.00 ft	337.0 cfs
6709.25	1.25 ft	376.8 cfs
6709.50	1.50 ft	412.8 cfs
6709.75	1.75 ft	445.9 cfs
6710.00	2.00 ft	476.7 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 24
Emergency Spillway Sizing

Emergency Spillway Calculation (Q_{100}=4051 cfs less Q_5=480 cfs = 3571 cfs)

Description	Water Elevation	Weir Coefficient	Crest Length	Crest Elevation	Flow Depth	**Flow**
Spillway	6714.0	2.6	175.0 ft	6710.0	4.0	**3640 cfs**
Spillway	6713.5	2.6	210.0 ft	6710.0	3.5	**3575 cfs**
Spillway	6713.0	2.6	265.0 ft	6710.0	3.0	**3580 cfs**
Spillway	6712.5	2.6	350.0 ft	6710.0	2.5	**3597 cfs**
Spillway	6712.0	2.6	490.0 ft	6710.0	2.0	**3603 cfs**

Weir Equation:

$Q = CLH^{1.5}$

C = Weir coefficient (dimensionless), C = 2.6

L = Length of weir, in ft

H = Depth of flow over the crest, in ft

Drop Inlet: $Q_{100} = 770$ cfs

FSD Det # MT-1

$$Q = CA\sqrt{2gH}$$

(1) H = mean head to spillway crest

Spillway Crest = 31.0 Top of Grate = 29.0

$\therefore H = 2'$ $C = .75$ (includes blockage)

$\sqrt{2gH} = 11.3$ $\therefore A = \frac{770}{11.3(.75)} = 91.0$ sf

Outlet culvert = 6'H x 10'W

with $L \times W = 91$ $\therefore$ say $W = 6'$

$\therefore L = 15.1'$ say 15.

$\therefore$ 15' x 6' drop inlet.

(2) with inlet elevation = 28.5; Assume first 1.5' is for FSD storage; $\therefore H = 1'$

$\therefore \sqrt{2gH} = 8.1$ $A = 770/(8.1)(.75) = 128$ sf.

w/ $W = 6'$ $\therefore L = 128/6 = 21.3'$ say 21'

use 21' x 6' drop inlet

Check of Storage at MT-1

Elevation 28.5 Area = 75,300 sf

@ 31.0 100,666 sf

Avg Af = $\frac{(100{,}666 - 75{,}300)}{2} \times 1.5$

= 13211.7 cf

= 3.0 Af

Reqd FSD storage w/ 40% allowance for flood flows = MT1 + MT2

= .6 Af + .7 Af = 1.3 Af

∴ adequate storage

Outlet culvert from FSD MT-1

CURRENT DATE: 01-25-2011
CURRENT TIME: 11:23:28

FILE DATE: 01-25-2011
FILE NAME: MT1

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	17.50	12.60	140.09	1 RCB	10.00	6.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: MT1 DATE: 01-25-2011

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
17.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
19.59	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.00	1
20.81	160.0	160.0	0.0	0.0	0.0	0.0	0.0	0.00	1
21.83	240.0	240.0	0.0	0.0	0.0	0.0	0.0	0.00	1
22.76	320.0	320.0	0.0	0.0	0.0	0.0	0.0	0.00	1
23.65	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
24.57	480.0	480.0	0.0	0.0	0.0	0.0	0.0	0.00	1
25.56	560.0	560.0	0.0	0.0	0.0	0.0	0.0	0.00	1
26.65	640.0	640.0	0.0	0.0	0.0	0.0	0.0	0.00	1
27.87	720.0	720.0	0.0	0.0	0.0	0.0	0.0	0.00	1
28.70	770.0	770.0	0.0	0.0	0.0	0.0	0.0	0.00	1
31.00	892.5	892.5	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: MT1 DATE: 01-25-2011

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
17.50	0.000	0.00	0.00	0.00
19.59	0.000	80.00	0.00	0.00
20.81	0.000	160.00	0.00	0.00
21.83	0.000	240.00	0.00	0.00
22.76	0.000	320.00	0.00	0.00
23.65	0.000	400.00	0.00	0.00
24.57	0.000	480.00	0.00	0.00
25.56	0.000	560.00	0.00	0.00
26.65	0.000	640.00	0.00	0.00
27.87	0.000	720.00	0.00	0.00
28.70	0.000	770.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 01-25-2011 FILE DATE: 01-25-2011
CURRENT TIME: 11:23:28 FILE NAME: MT1

PERFORMANCE CURVE FOR CULVERT 1 - 1(10.00 (ft) BY 6.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	17.50	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
80.00	19.59	2.09	2.09	1-S2n	0.52	1.26	0.46	0.68	17.39	2.24
160.00	20.81	3.31	3.31	1-S2n	0.83	2.00	0.93	1.03	17.20	2.91
240.00	21.83	4.33	4.33	1-S2n	1.09	2.62	1.28	1.31	18.74	3.38
320.00	22.76	5.26	5.26	1-S2n	1.32	3.18	1.61	1.56	19.94	3.76
400.00	23.65	6.15	6.15	5-S2n	1.53	3.68	1.92	1.77	20.79	4.07
480.00	24.57	7.07	7.07	5-S2n	1.74	4.16	2.23	1.97	21.52	4.34
560.00	25.56	8.06	8.06	5-S2n	1.93	4.61	2.51	2.16	22.30	4.59
640.00	26.65	9.15	9.15	5-S2n	2.11	5.04	2.81	2.34	22.78	4.80
720.00	27.87	10.37	10.37	5-S2n	2.29	5.45	3.05	2.50	23.59	5.00
770.00	28.70	11.20	11.20	5-S2n	2.40	5.70	3.26	2.60	23.61	5.12

El. inlet face invert 17.50 ft El. outlet invert 12.60 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

** SITE DATA ***** CULVERT INVERT **********

INLET STATION	100.00 ft
INLET ELEVATION	17.50 ft
OUTLET STATION	240.00 ft
OUTLET ELEVATION	12.60 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0350
CULVERT LENGTH ALONG SLOPE	140.09 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	6.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

CURRENT DATE: 01-25-2011
CURRENT TIME: 11:23:28

FILE DATE: 01-25-2011
FILE NAME: MT1

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	50.00 ft
SIDE SLOPE H/V (X:1)	3.0
CHANNEL SLOPE V/H (ft/ft)	0.010
MANNING'S n (.01-0.1)	0.050
CHANNEL INVERT ELEVATION	12.60 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	12.60 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	12.60	0.000	0.00	0.00	0.00
80.00	13.28	0.478	0.68	2.24	0.43
160.00	13.63	0.505	1.03	2.91	0.64
240.00	13.91	0.520	1.31	3.38	0.82
320.00	14.16	0.531	1.56	3.76	0.97
400.00	14.38	0.539	1.77	4.07	1.11
480.00	14.57	0.545	1.97	4.34	1.23
560.00	14.76	0.550	2.16	4.59	1.35
640.00	14.94	0.554	2.34	4.80	1.46
720.00	15.10	0.558	2.50	5.00	1.56
770.00	15.20	0.560	2.60	5.12	1.62

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	40.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	31.00 ft

Culvert of Future Roadway over Middle Tributary

CURRENT DATE: 01-25-2011
CURRENT TIME: 13:18:31

FILE DATE: 01-25-2011
FILE NAME: MT2

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	60.40	59.70	110.00	1 RCB	14.00	6.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: MT2 DATE: 01-25-2011

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
60.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
61.94	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.00	1
62.84	160.0	160.0	0.0	0.0	0.0	0.0	0.0	0.00	1
63.60	240.0	240.0	0.0	0.0	0.0	0.0	0.0	0.00	1
64.29	320.0	320.0	0.0	0.0	0.0	0.0	0.0	0.00	1
64.92	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
65.52	480.0	480.0	0.0	0.0	0.0	0.0	0.0	0.00	1
66.10	560.0	560.0	0.0	0.0	0.0	0.0	0.0	0.00	1
66.69	640.0	640.0	0.0	0.0	0.0	0.0	0.0	0.00	1
67.31	720.0	720.0	0.0	0.0	0.0	0.0	0.0	0.00	1
67.72	770.0	770.0	0.0	0.0	0.0	0.0	0.0	0.00	1
70.00	1013.4	1013.4	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: MT2 DATE: 01-25-2011

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
60.40	0.000	0.00	0.00	0.00
61.94	0.000	80.00	0.00	0.00
62.84	0.000	160.00	0.00	0.00
63.60	0.000	240.00	0.00	0.00
64.29	0.000	320.00	0.00	0.00
64.92	0.000	400.00	0.00	0.00
65.52	0.000	480.00	0.00	0.00
66.10	0.000	560.00	0.00	0.00
66.69	0.000	640.00	0.00	0.00
67.31	0.000	720.00	0.00	0.00
67.72	0.000	770.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 01-25-2011
CURRENT TIME: 13:18:31

FILE DATE: 01-25-2011
FILE NAME: MT2

PERFORMANCE CURVE FOR CULVERT 1 - 1(14.00 (ft) BY 6.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	60.40	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
80.00	61.94	1.54	1.54	1-S2n	0.73	1.01	0.76	1.10	7.52	2.73
160.00	62.84	2.44	2.44	1-S2n	1.15	1.60	1.21	1.61	9.46	3.36
240.00	63.60	3.20	3.20	1-S2n	1.49	2.09	1.61	1.99	10.62	3.78
320.00	64.29	3.89	3.89	1-S2n	1.81	2.54	1.98	2.31	11.56	4.10
400.00	64.92	4.52	4.52	1-S2n	2.08	2.94	2.32	2.58	12.29	4.37
480.00	65.52	5.12	5.12	1-S2n	2.36	3.32	2.64	2.83	12.97	4.59
560.00	66.10	5.70	5.70	1-S2n	2.61	3.68	2.96	3.05	13.49	4.79
640.00	66.69	6.29	6.29	5-S2n	2.86	4.03	3.26	3.26	14.03	4.97
720.00	67.31	6.91	6.91	5-S2n	3.10	4.36	3.56	3.45	14.46	5.13
770.00	67.72	7.32	7.32	5-S2n	3.25	4.56	3.73	3.56	14.76	5.22

El. inlet face invert 60.40 ft
El. outlet invert 59.70 ft
El. inlet throat invert 0.00 ft
El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	100.00 ft
INLET ELEVATION	60.40 ft
OUTLET STATION	210.00 ft
OUTLET ELEVATION	59.70 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0064
CULVERT LENGTH ALONG SLOPE	110.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	14.00 ft
BARREL RISE	6.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 01-25-2011
CURRENT TIME: 13:18:31

FILE DATE: 01-25-2011
FILE NAME: MT2

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	20.00 ft
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (ft/ft)	0.010
MANNING'S n (.01-0.1)	0.050
CHANNEL INVERT ELEVATION	59.70 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	59.70 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	59.70	0.000	0.00	0.00	0.00
80.00	60.80	0.457	1.10	2.73	0.69
160.00	61.31	0.468	1.61	3.36	1.00
240.00	61.69	0.473	1.99	3.78	1.24
320.00	62.01	0.476	2.31	4.10	1.44
400.00	62.28	0.479	2.58	4.37	1.61
480.00	62.53	0.481	2.83	4.59	1.76
560.00	62.75	0.483	3.05	4.79	1.90
640.00	62.96	0.485	3.26	4.97	2.03
720.00	63.15	0.487	3.45	5.13	2.15
770.00	63.26	0.487	3.56	5.22	2.22

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	60.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	70.00 ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 17
Outlet Structure Sizing

Outlet Structure - Chamber Orifice (Q_5=480 cfs)

Orifice Calculation

Orifice Coefficient		0.6
Opening Size	Rise	4.00 ft
	Span	8.00 ft
Opening Area		32.00 sf
Opening Flowline Elevation		6648.00
Opening Centerline Elevation		6650.00
Opening Top Elevation		6652.00

Water Elevation	Head / Flow Depth	Flow Through Single Culvert
6659.00	9.00 ft	462.2 cfs
6660.00	10.00 ft	487.2 cfs
6661.00	11.00 ft	511.0 cfs
6662.00	12.00 ft	533.7 cfs
6663.00	13.00 ft	555.5 cfs
6664.00	14.00 ft	576.5 cfs
6665.00	15.00 ft	596.7 cfs
6666.00	16.00 ft	616.3 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 17
Outlet Grate Sizing

Orifice Calculation - Calculation for Front Chamber Grate (Q_5=480 cfs)

Orifice Coefficient		0.6
Opening Size	Length	14.00 ft
	Depth	5.0 ft
Opening Area		70.00 sf
Opening Area w/00% Blockage		70.00 sf
Opening Elevation		6664.00

Water Elevation	Head / Flow Depth	Orifice Flow
6665.00	1.00 ft	337.0 cfs
6665.25	1.25 ft	376.8 cfs
6665.50	1.50 ft	412.8 cfs
6665.75	1.75 ft	445.9 cfs
6666.00	2.00 ft	476.7 cfs

Orifice Equation:

$Q = CA(2gH)^{0.5}$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec^2

H = Head above the centerline of the pipe, in ft

Allison Valley Master Development Drainage Plan
Black Squirrel Creek
Cross Section 17
Emergency Spillway Sizing

Emergency Spillway Calculation (Q_{100}=4051 cfs less Q_5=480 cfs = 3571 cfs)

Description	Water Elevation	Weir Coefficient	Crest Length	Crest Elevation	Flow Depth	**Flow**
Spillway	6667.5	2.6	145.0 ft	6663.0	4.5	**3599 cfs**
Spillway	6667.0	2.6	175.0 ft	6663.0	4.0	**3640 cfs**
Spillway	6666.5	2.6	210.0 ft	6663.0	3.5	**3575 cfs**
Spillway	6666.0	2.6	265.0 ft	6663.0	3.0	**3580 cfs**

Weir Equation:

$Q = CLH^{1.5}$

C = Weir coefficient (dimensionless), C = 2.6

L = Length of weir, in ft

H = Depth of flow over the crest, in ft

APPENDIX C

Photographs along Major Drainageways

Photograph # 1

Cross Section 12 - Looking Upstream of Breached Dam

Photograph # 2

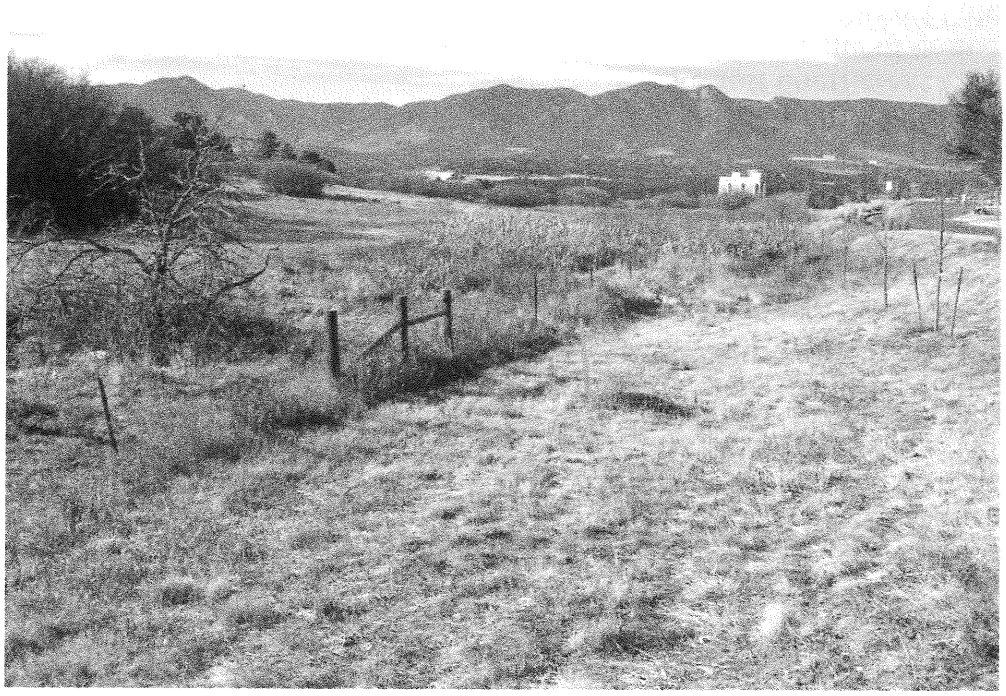
Cross Section 12 - Looking Downstream of Breached Dam

Photograph # 3

Cross Section 6 - Looking Upstream at Impoundment

Photograph # 4

Cross Section 6 - Looking Downstream



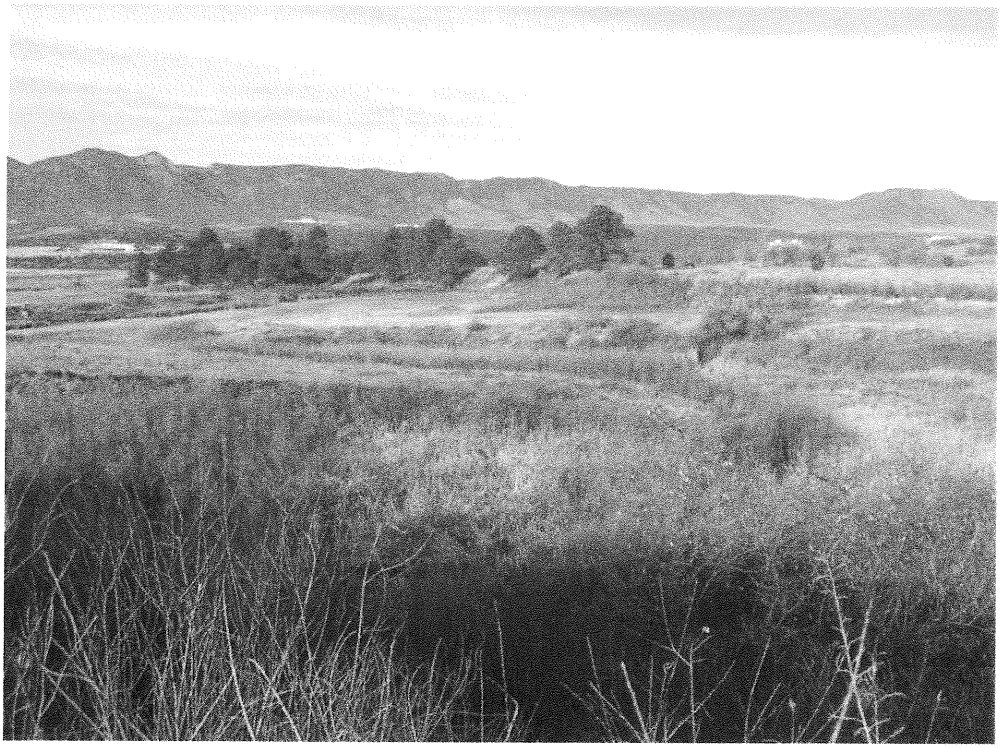
Photograph # 5

Cross Section 21 - Looking Downstream

Black Squirrel Creek

Photograph # 1

Cross Section 24 - Looking Upstream at Impoundment



Photograph # 2

Cross Section 24 - Looking Downstream

Photograph # 3

Cross Section 21 - Looking Downstream at Impoundment

Photograph # 4

Cross Section 20 - Looking Downstream

Photograph # 5

Cross Section 17 - Looking across Channel Upstream of Breached Dam

Photograph # 6

Cross Section 17 - Looking Downstream at Breached Dam

Photograph # 7

Cross Section 14 - Looking Upstream

Photograph # 8

Cross Section 13 - Looking South Across Channel

Photograph # 9

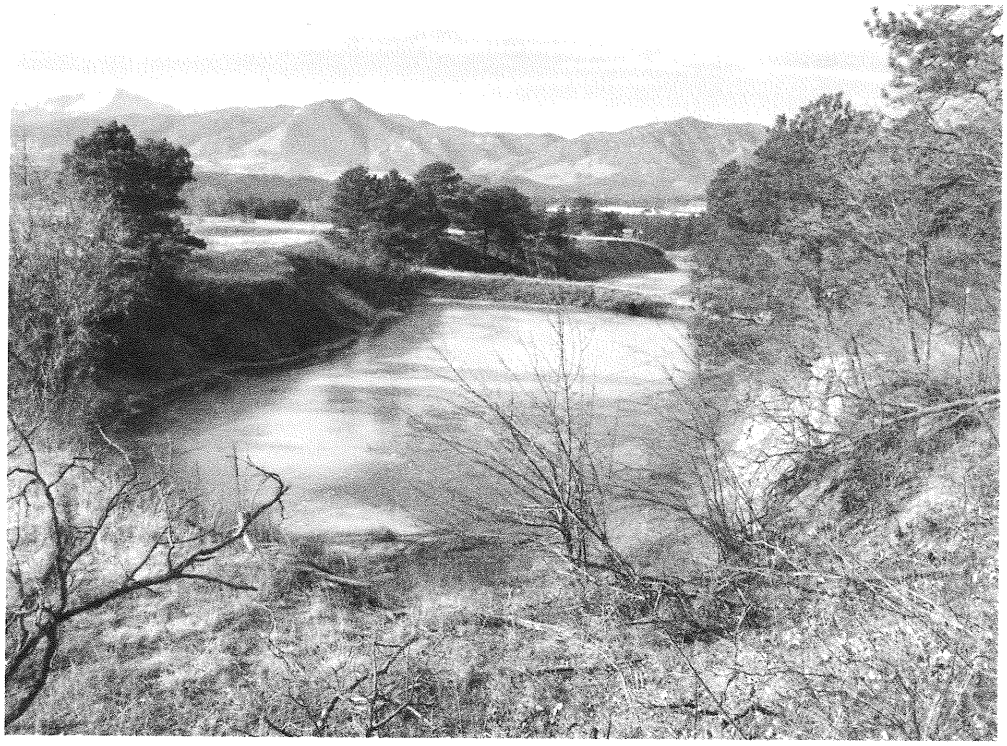
Cross Section 11 - Looking Downstream

Photograph # 10

Cross Section 9 - Looking Upstream

Photograph # 11

Cross Section 5 - Looking Upstream at Impoundment



Photograph # 12

Cross Section 5 - Looking Downstream at Impoundments

Photograph # 13

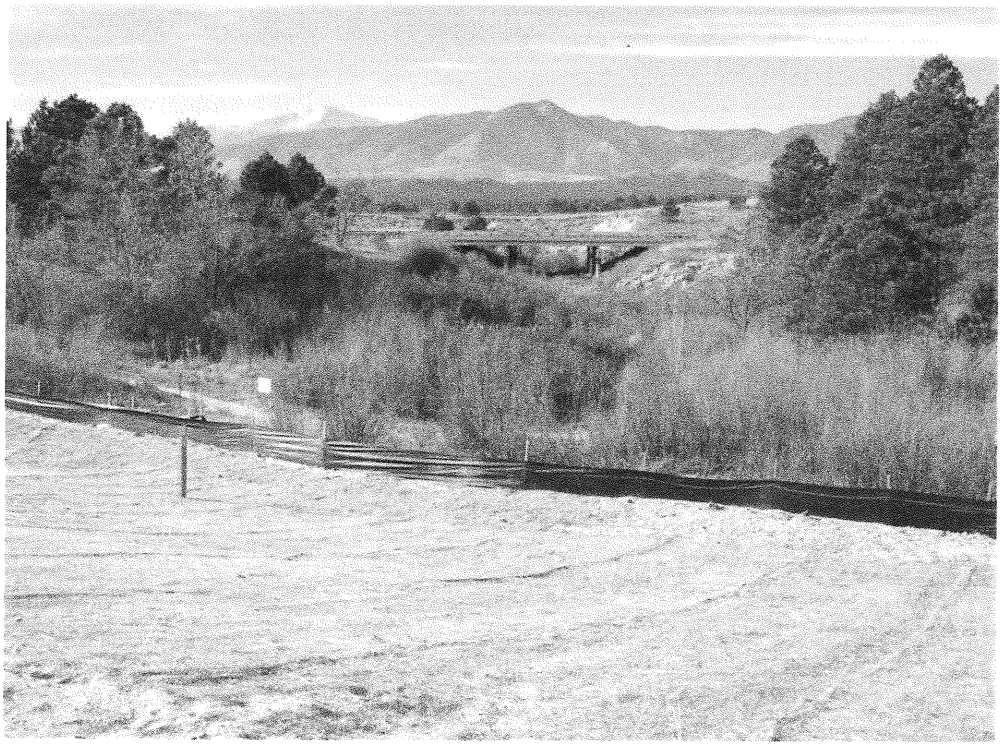
Cross Section 4 - Looking Upstream at Impoundment

Photograph # 14

Cross Section 4 - Looking Downstream at Impoundment

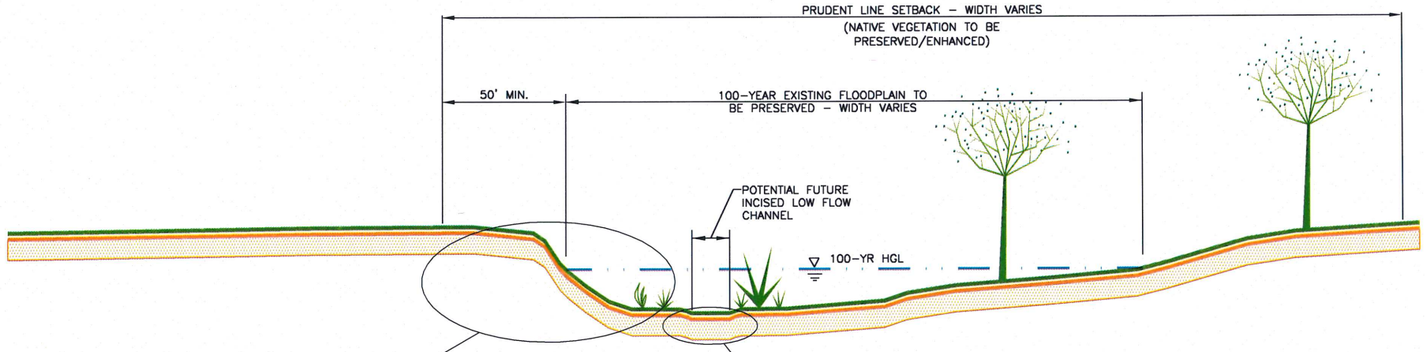
Photograph # 15

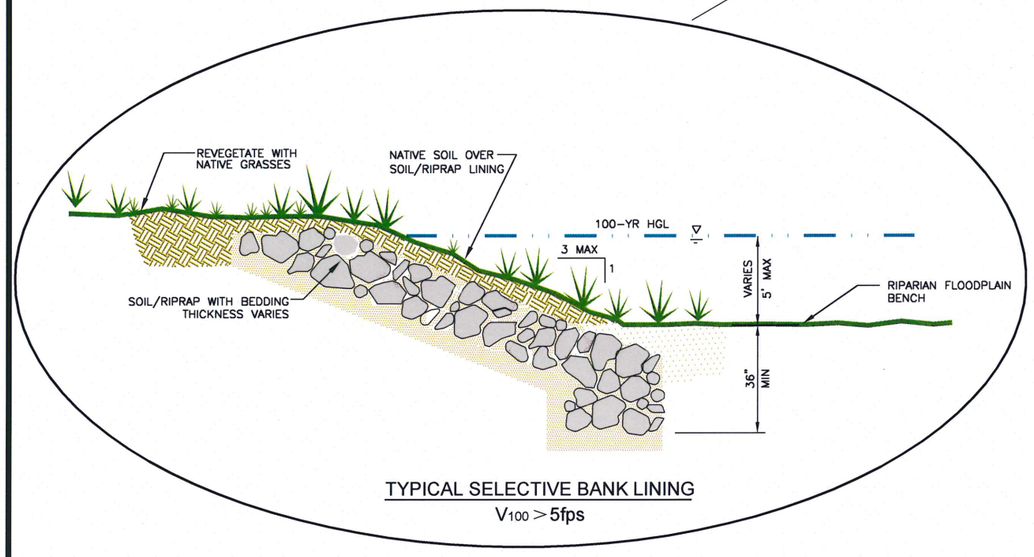
Cross Section 2 - Looking Upstream at Impoundment



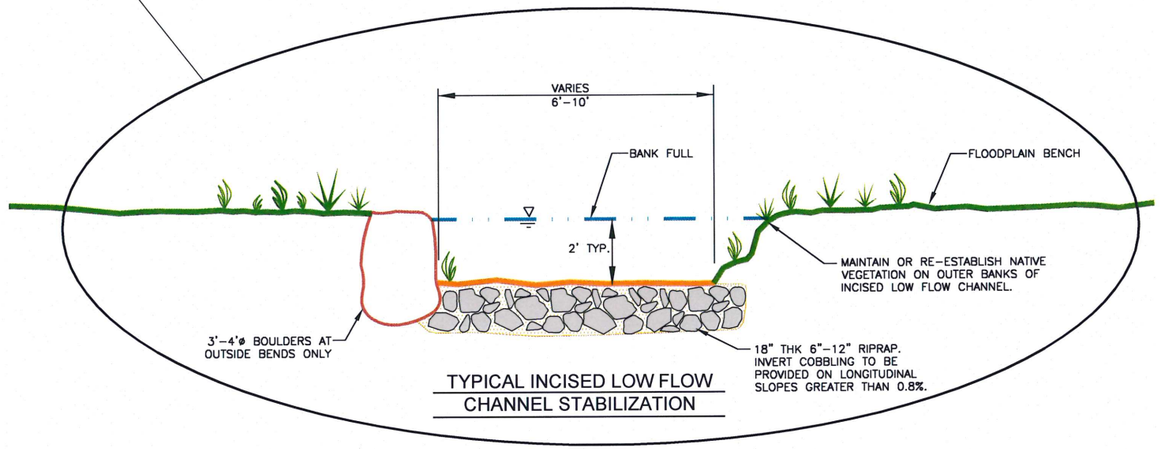
Photograph # 16

Cross Section 2 - Looking Downstream at Property Boundary and I-25

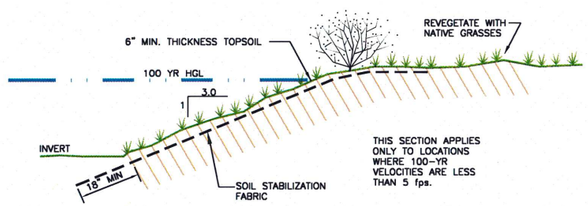




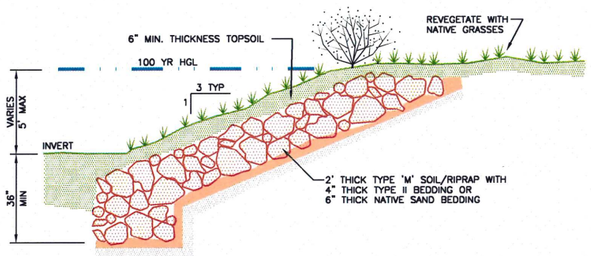
TYPICAL SELECTIVE BANK LINING
$V_{100} > 5$fps



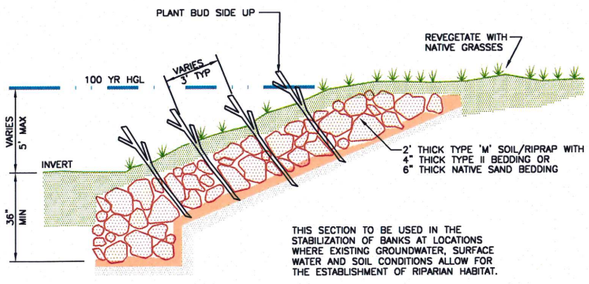
TYPICAL INCISED LOW FLOW CHANNEL STABILIZATION



GRASSLINED BANK DETAIL

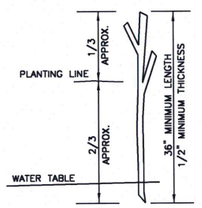


SOIL/RIPRAP BANK LINING DETAIL
NTS



BIOENGINEERED ROCK AND SOIL BANK LINING DETAIL
NTS

PROTECT LIVE WILLOW STAKES FROM DAMAGE DURING INSTALLATION. EITHER USE PRY BAR OR PROBE TO MAKE OPENING BETWEEN ROCKS OR USE TUBING TO PROVIDE OPENINGS. REMOVE TUBING AND TAMP NATIVE SOIL TO ELIMINATE VOIDS AROUND STEM.



WILLOW CUTTING DETAIL
NATIVE SANDBAR WILLOW STAKE
SALIX EXIGUA

TYPICAL BANK STABILIZATION SECTIONS

SCALE : N.T.S.

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN

TYPICAL CHANNEL DETAILS
COLORADO SPRINGS, COLORADO

Project No.:	10051
Date:	November 10, 2011
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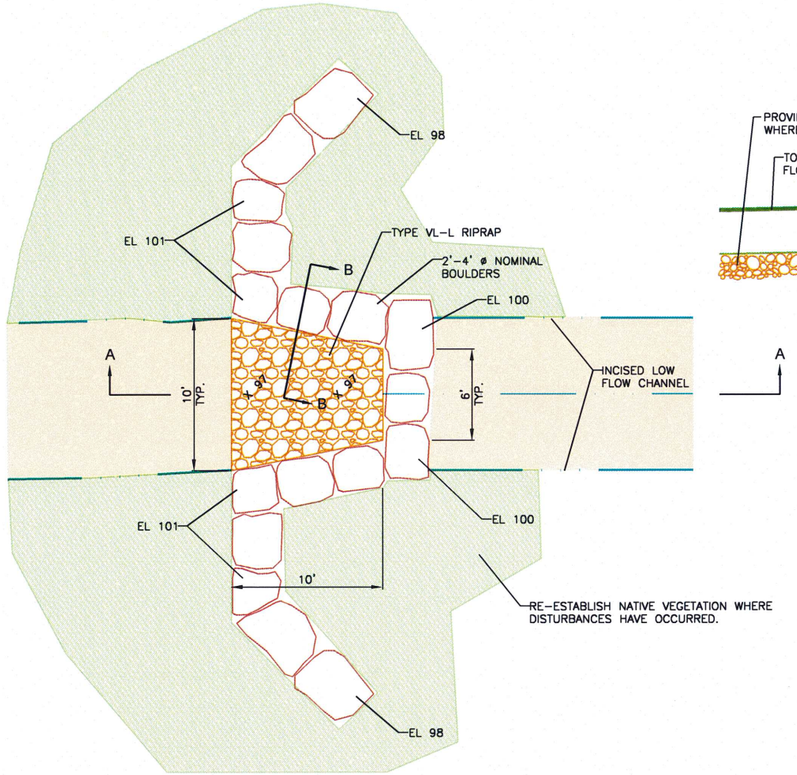
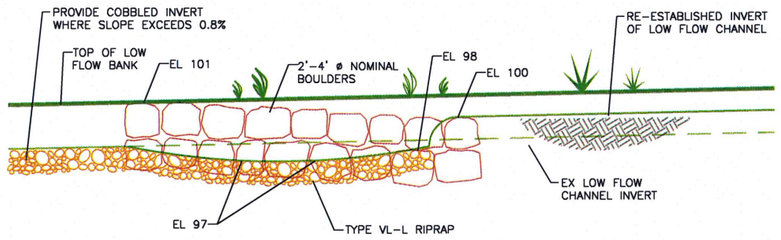
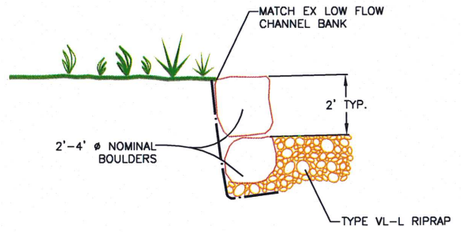


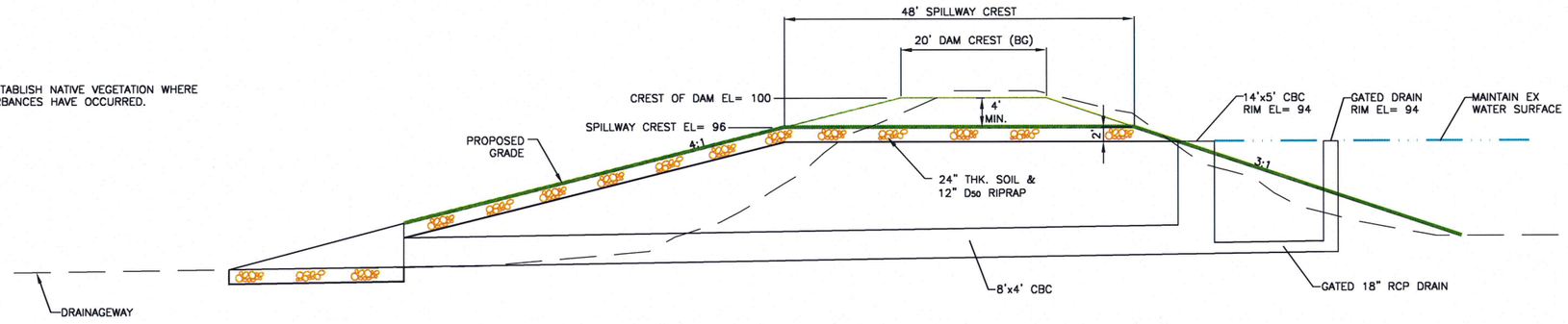
TYPICAL ROCK VANE PLAN
SCALE: 1"=5'



SECTION A-A
SCALE: 1"=5'

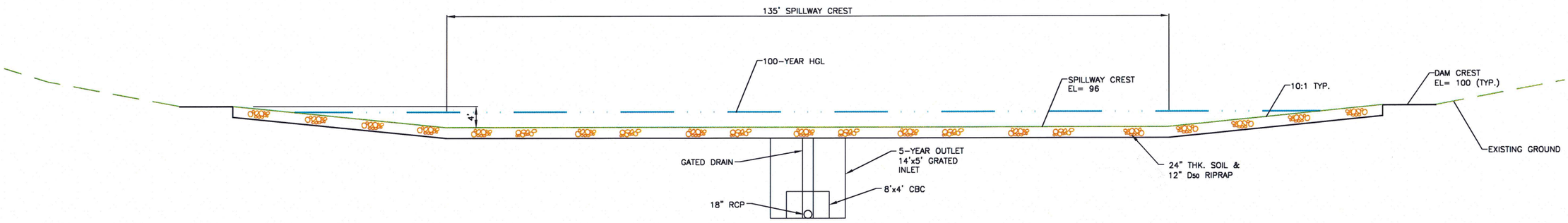


SECTION B-B
SCALE: NTS



TYPICAL SPILLWAY LONGITUDINAL SECTION
SCALE: 1"=10'

TYPICAL EMBANKMENT SECTIONS
BLACK SQUIRREL & MIDDLE TRIBUTARY



TYPICAL SPILLWAY CROSS SECTION
SCALE: 1"=10'

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ALLISON VALLEY
MASTER DEVELOPMENT
TYPICAL MAJOR DRAINAGEWAY AND EMBANKMENT SECTIONS
COLORADO SPRINGS, COLORADO

Project No.:	10051
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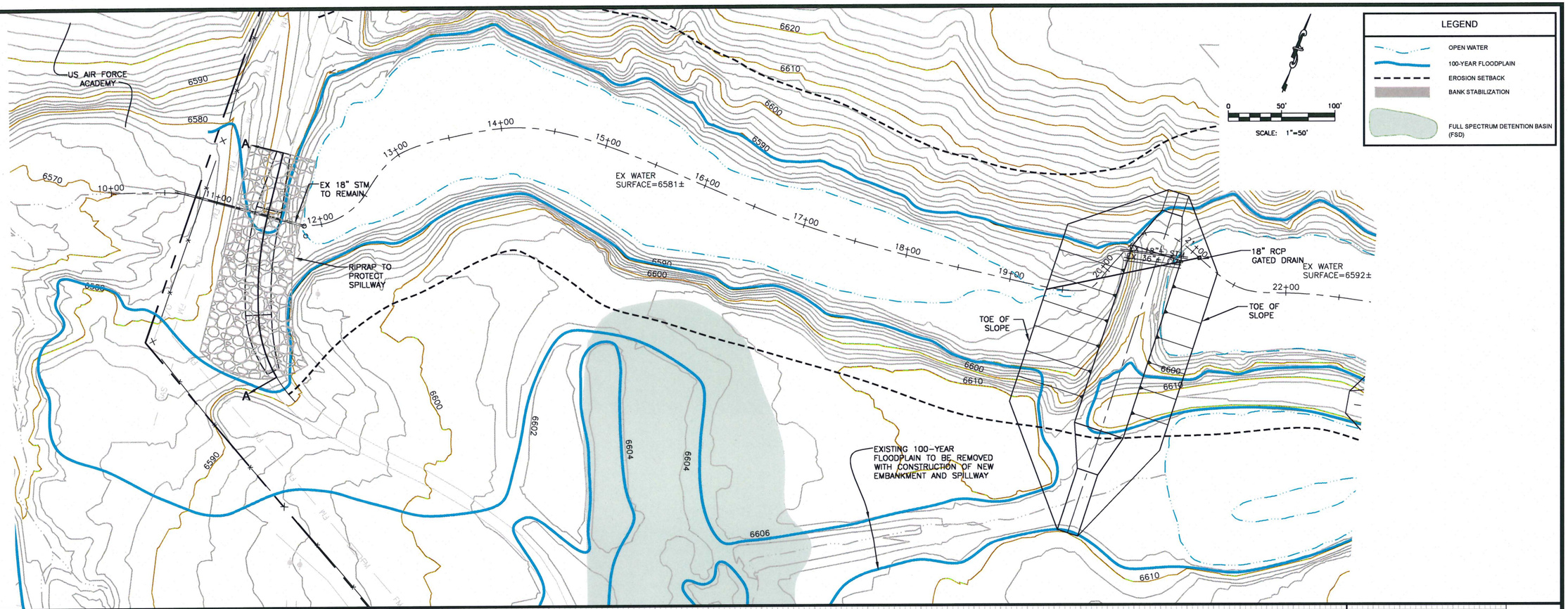

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
BLACK SQUIRREL CREEK CONCEPTUAL DESIGN
STA 10+00 TO STA 22+00 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

Project No.:	10051
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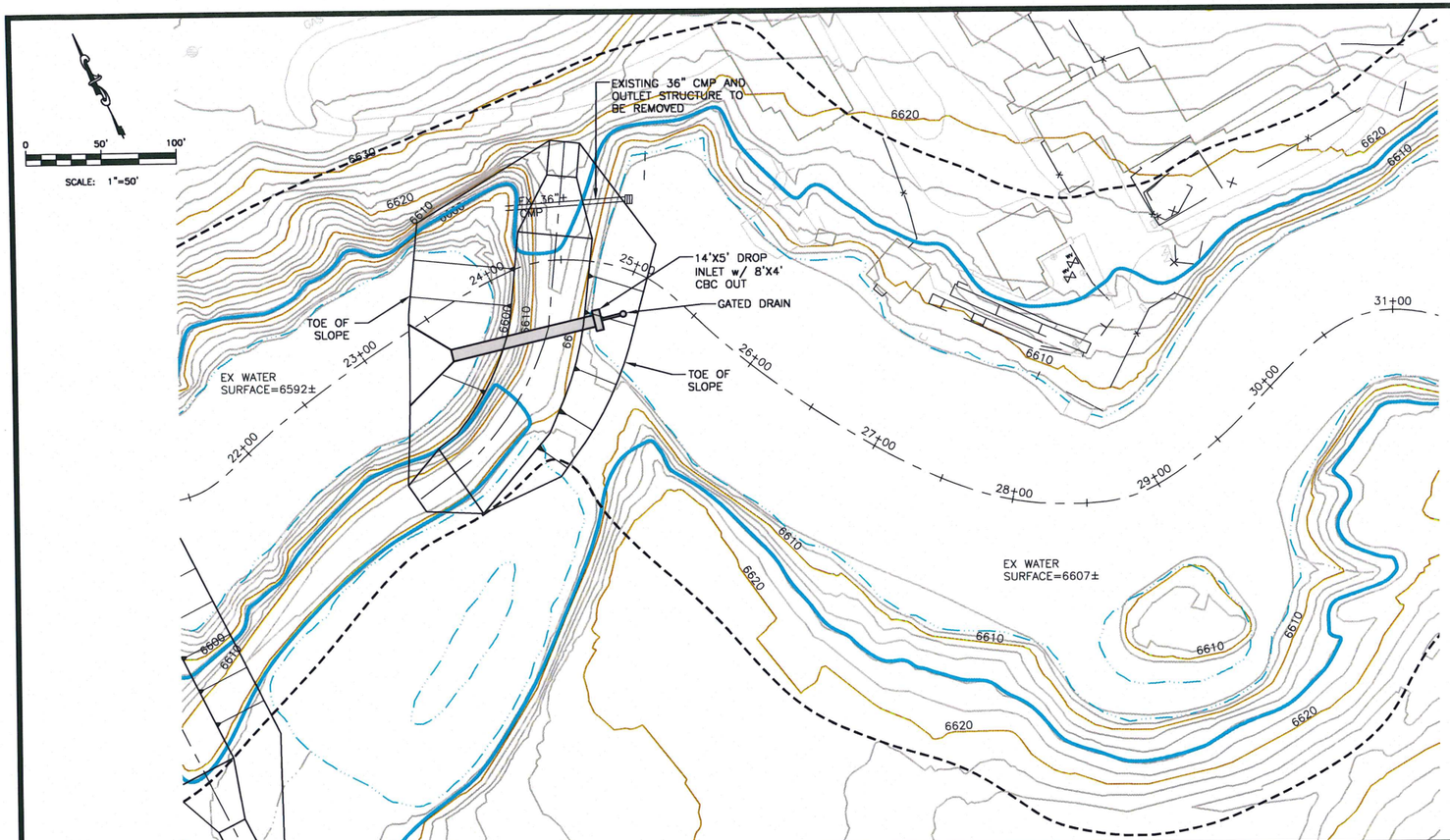

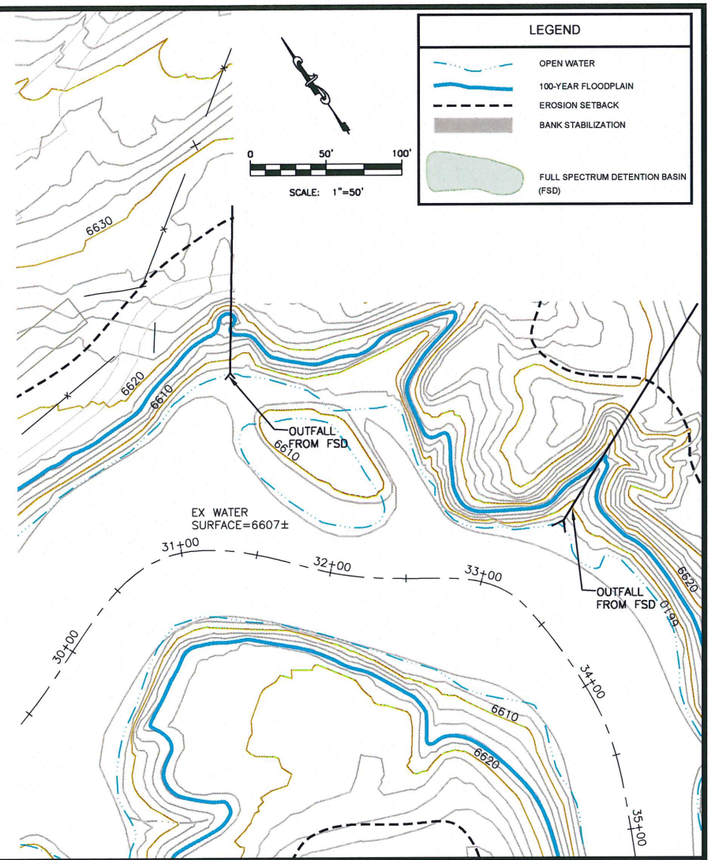

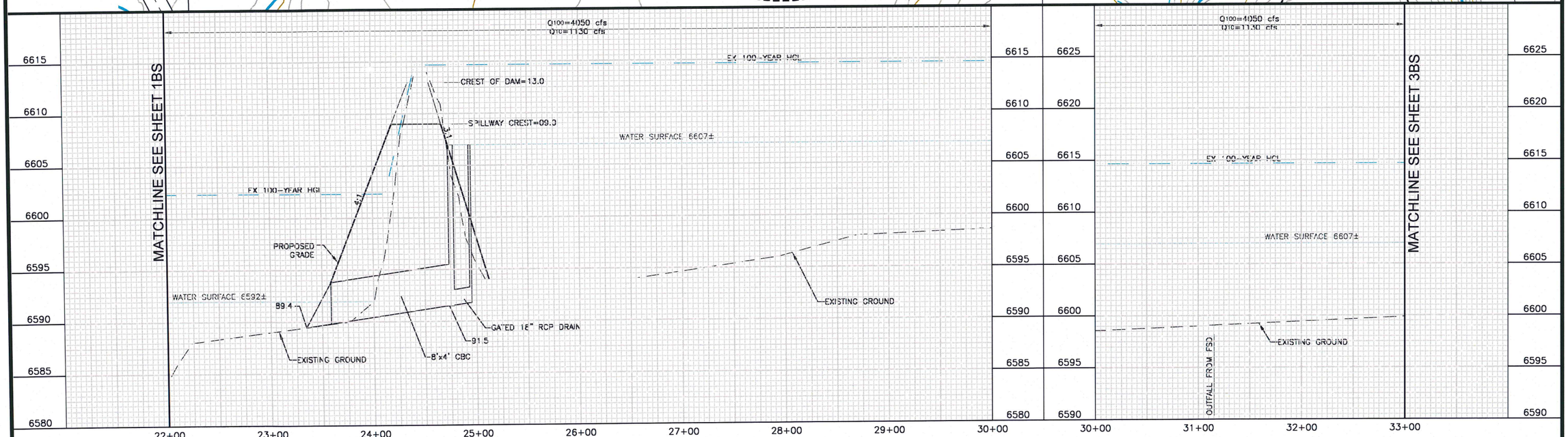

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
BLACK SQUIRREL CREEK CONCEPTUAL DESIGN
STA 22+00 TO STA 33+00 PLAN AND PROFILE
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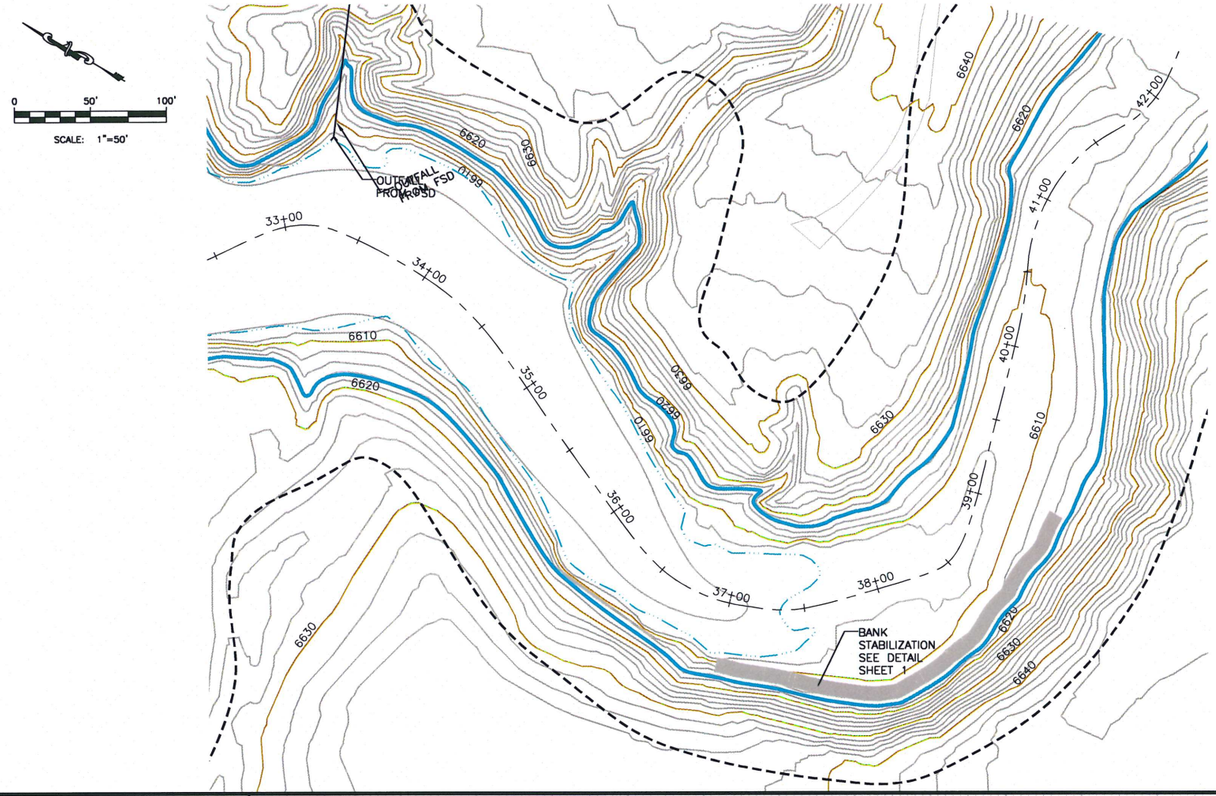

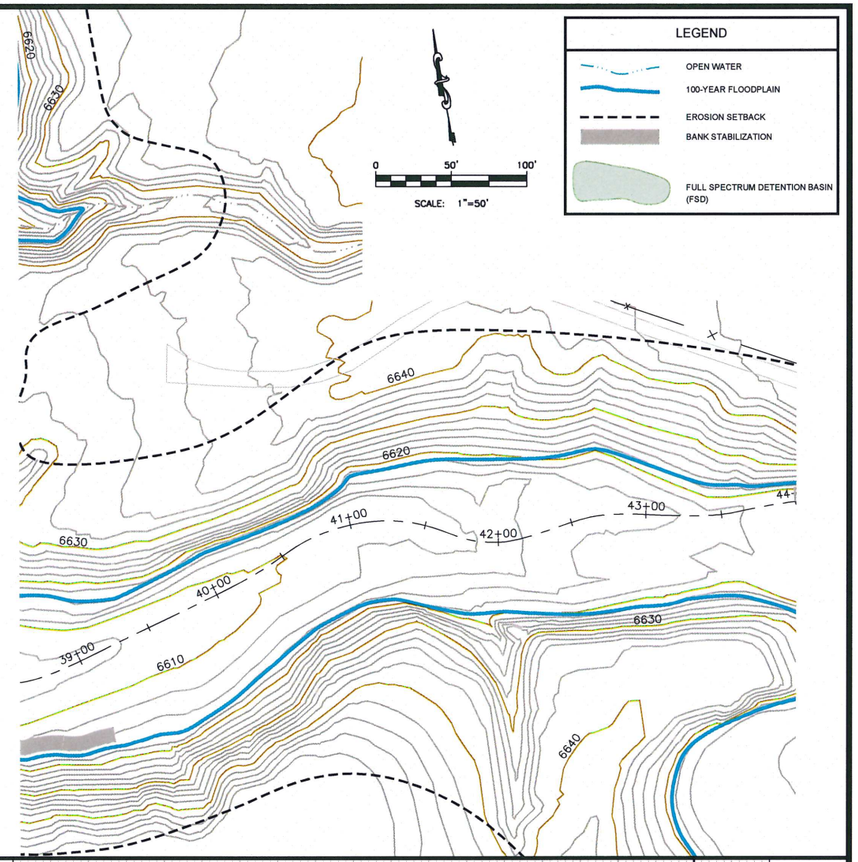

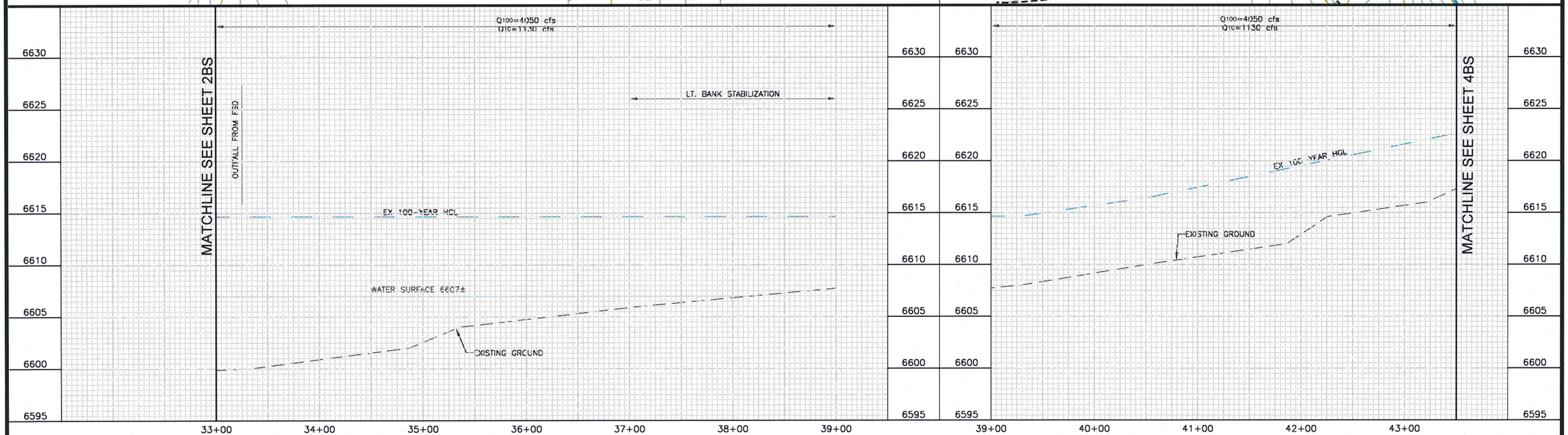

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
BLACK SQUIRREL CREEK CONCEPTUAL DESIGN
STA 33+00 TO STA 43+50 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

Project No.:	10051
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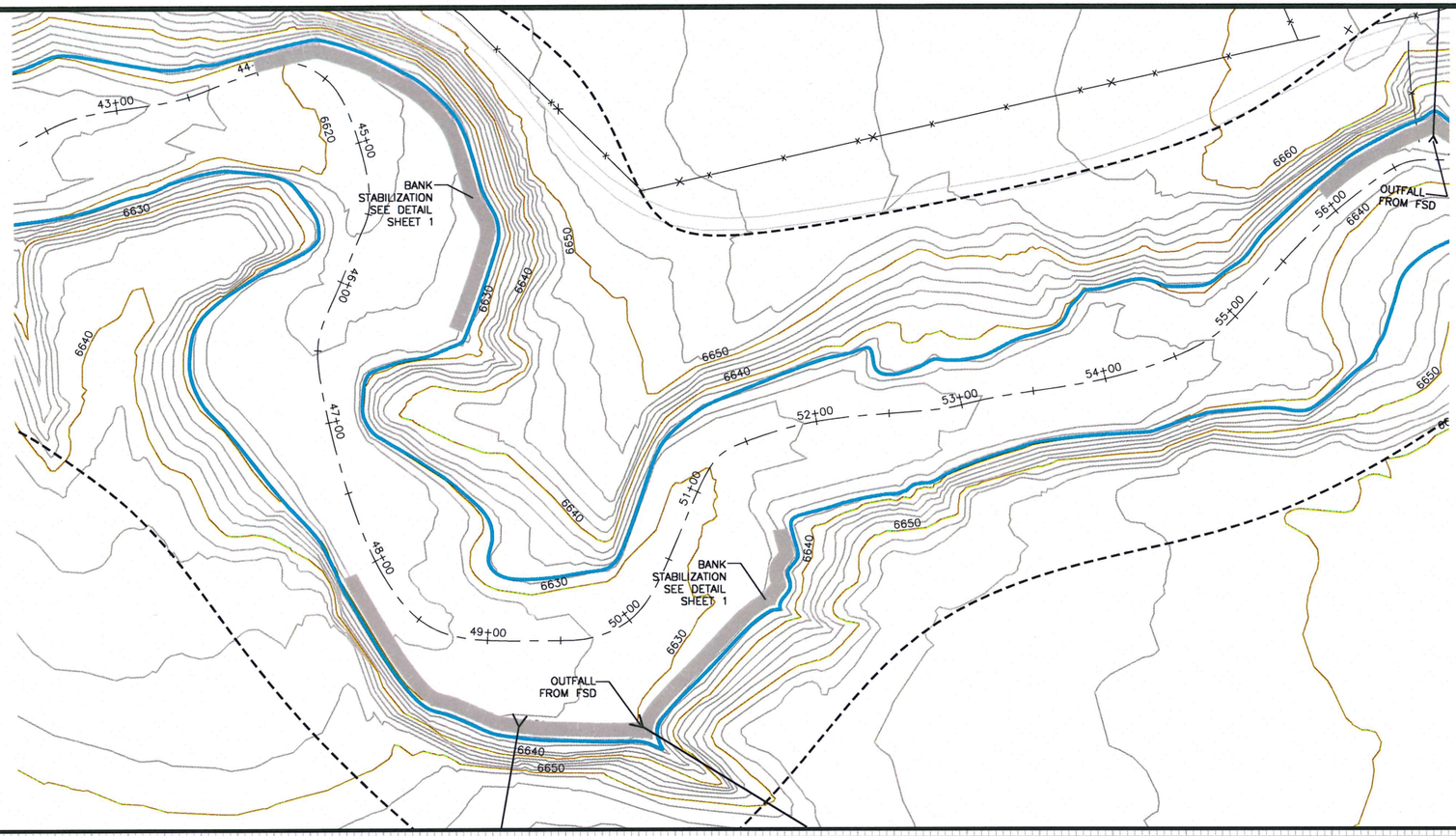

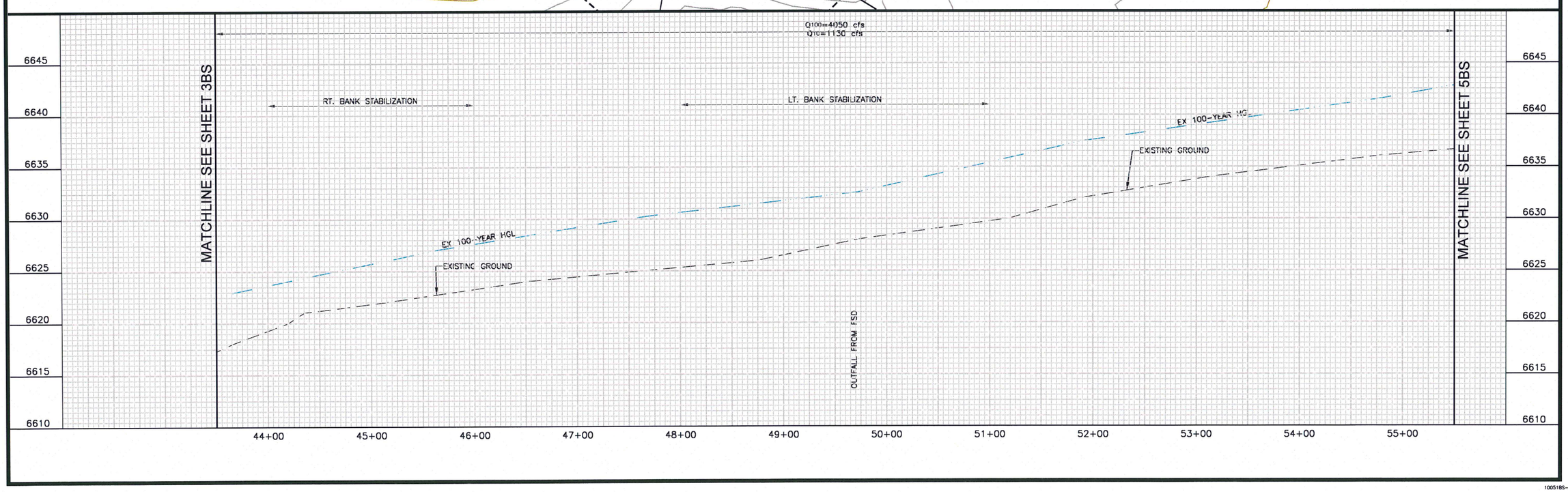

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
BLACK SQUIRREL CREEK CONCEPTUAL DESIGN
STA 43+50 TO STA 55+50 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

Project No.:	10051
Date:	November 10, 2011
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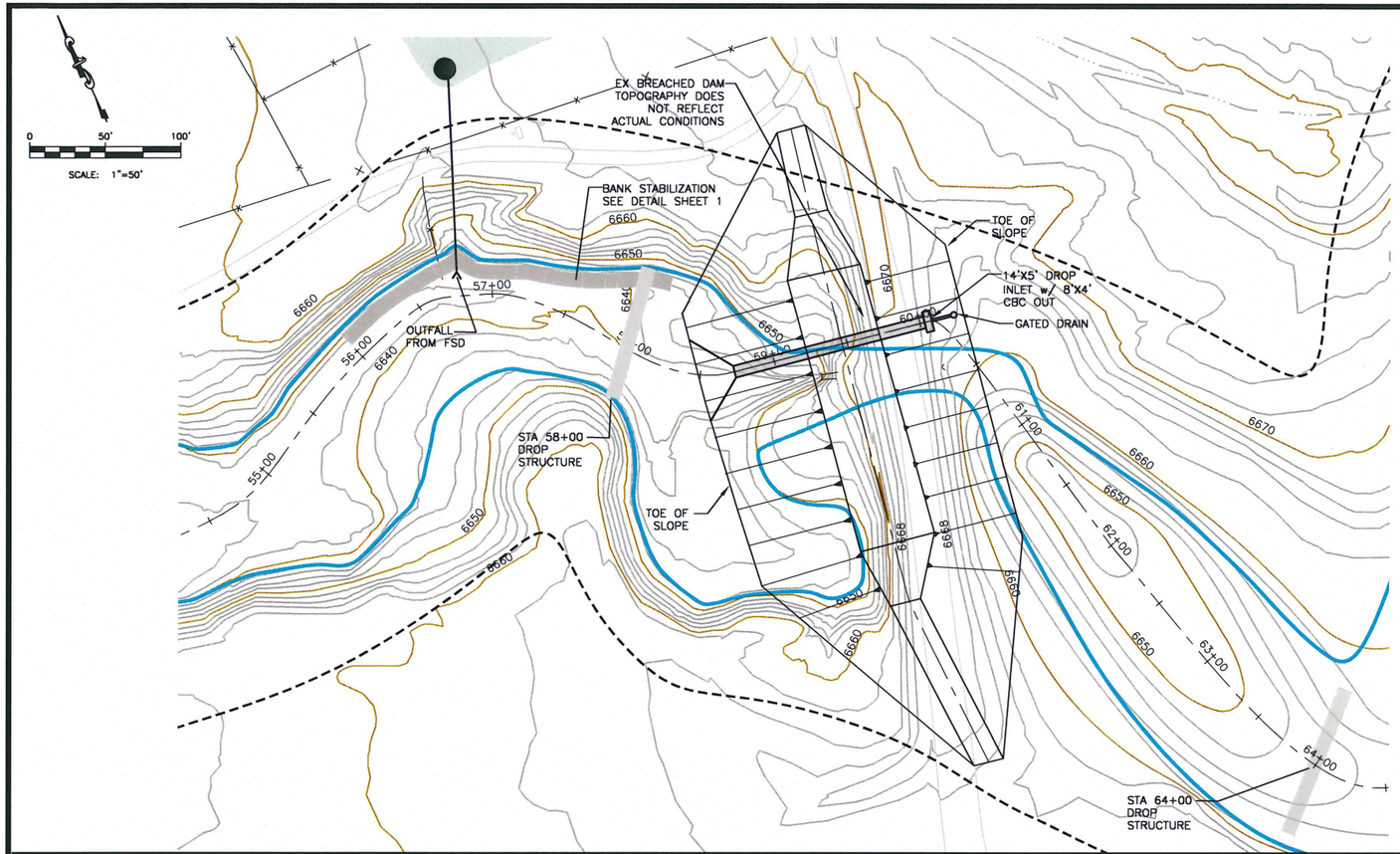

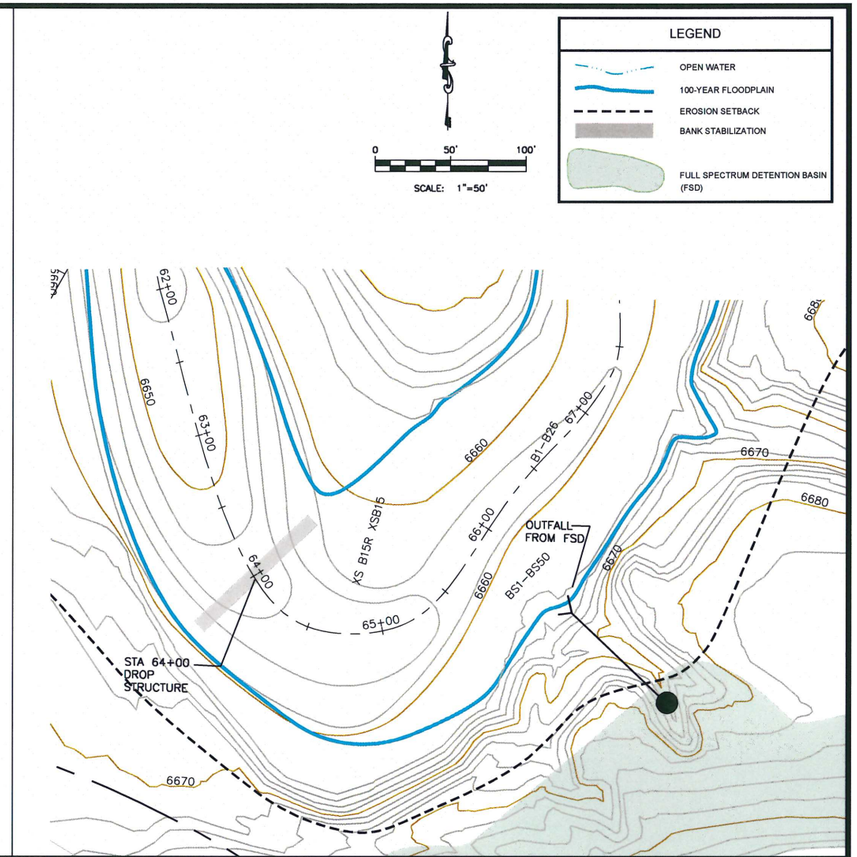

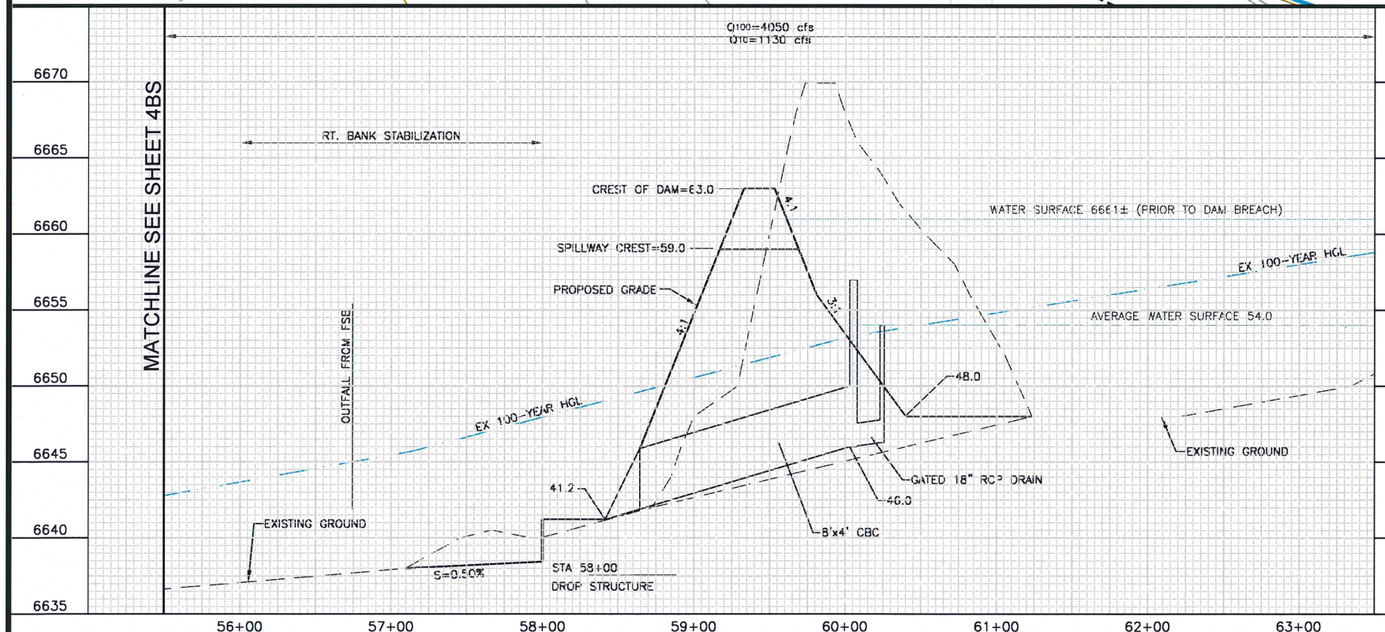

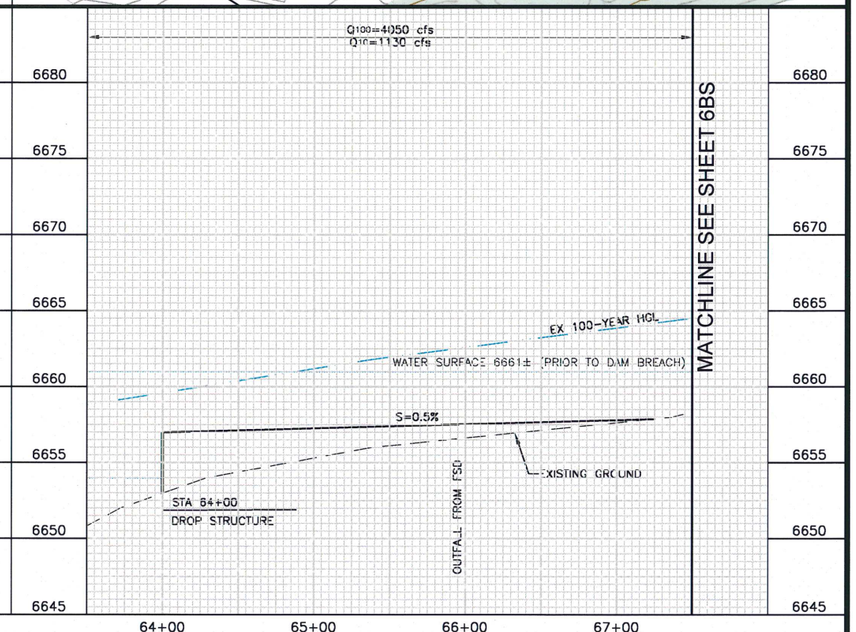

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
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STA 55+50 TO STA 67+50 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

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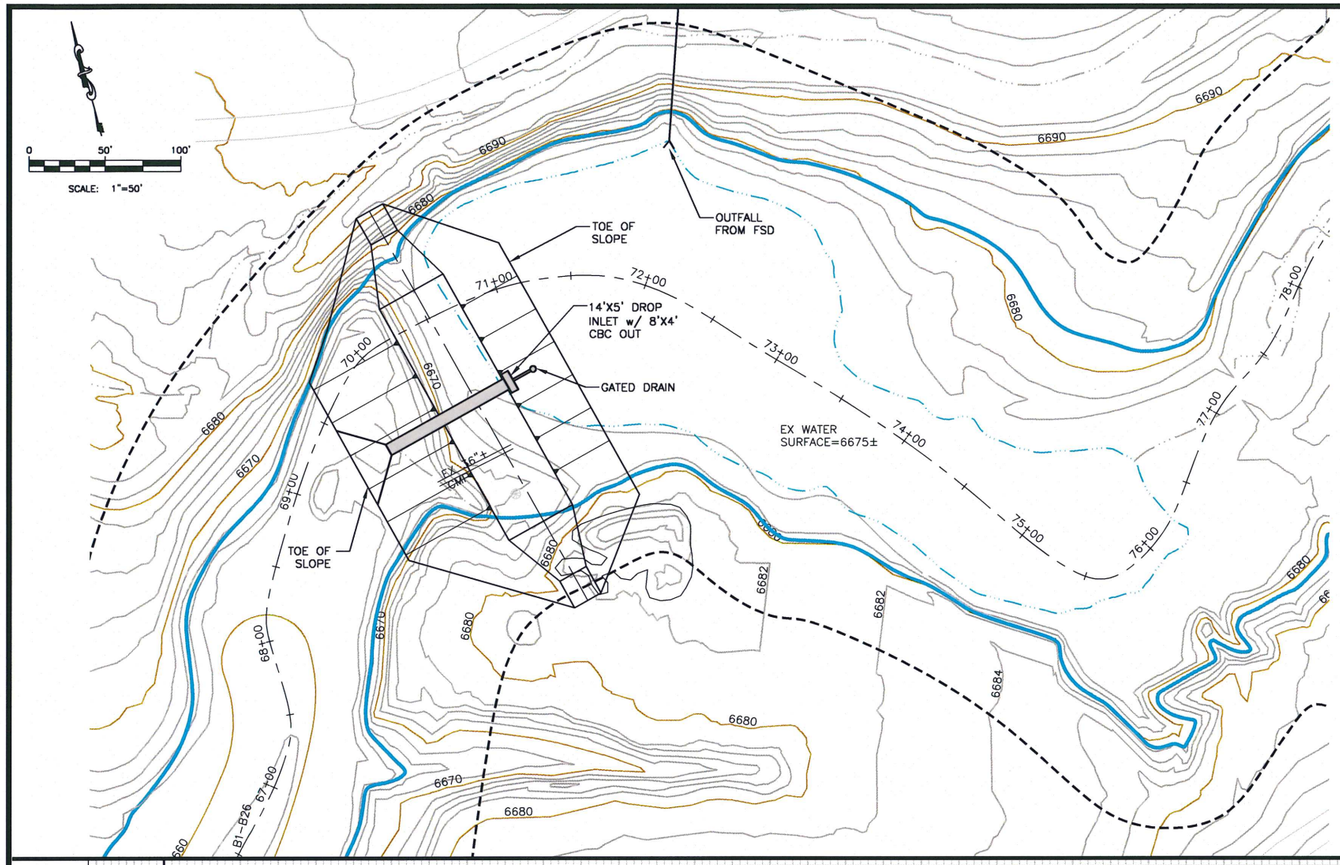

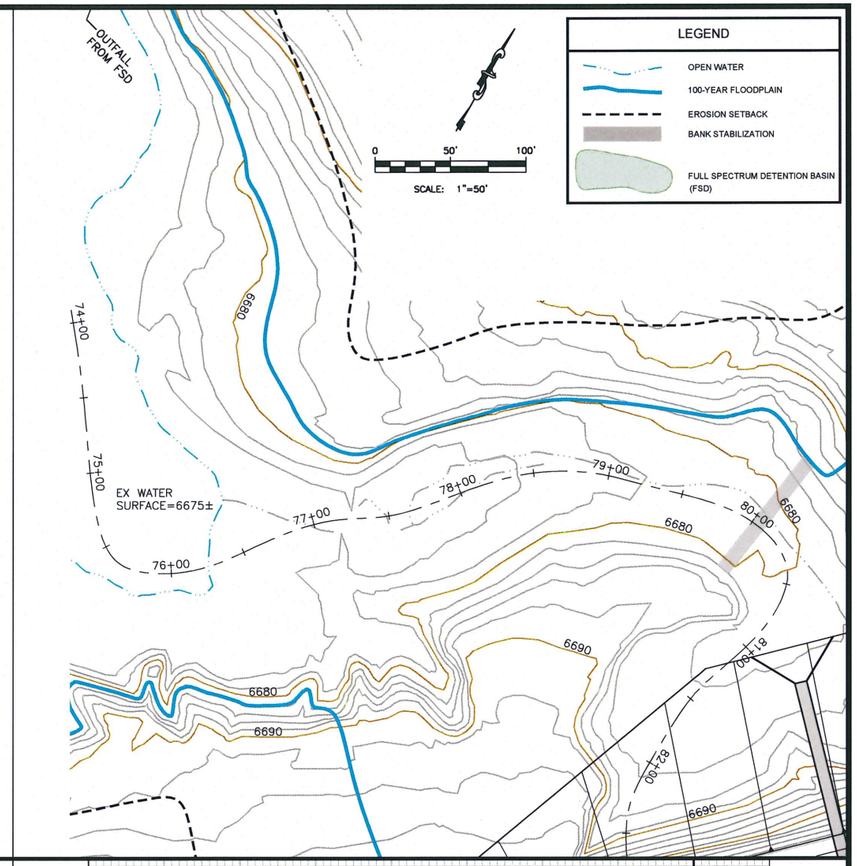

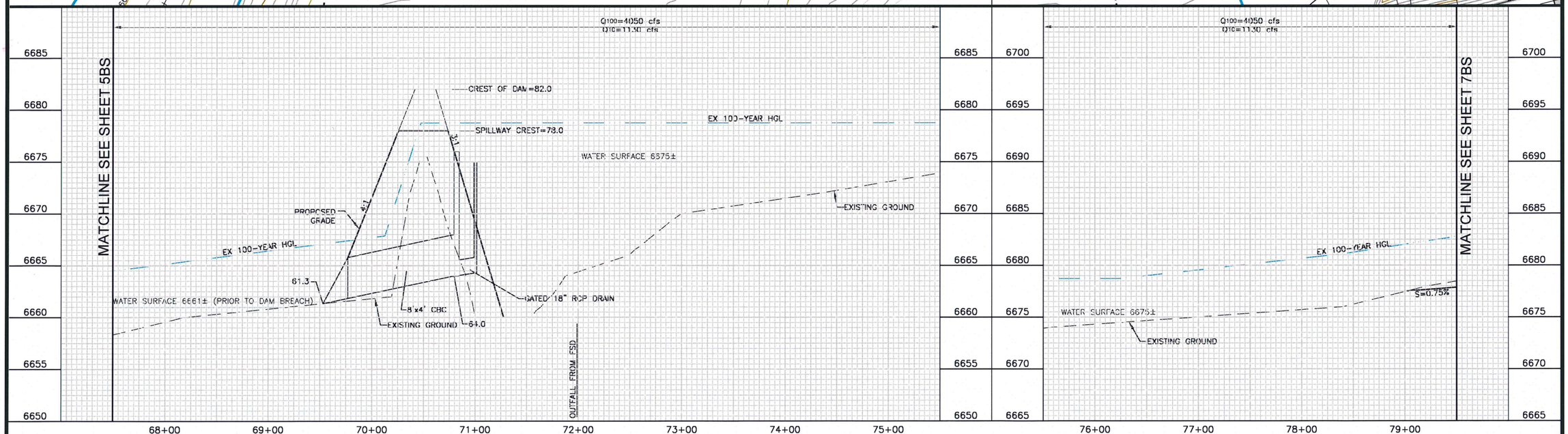

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
BLACK SQUIRREL CREEK CONCEPTUAL DESIGN
STA 67+50 TO STA 79+50 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

Project No.:	10051
Date:	November 10, 2011
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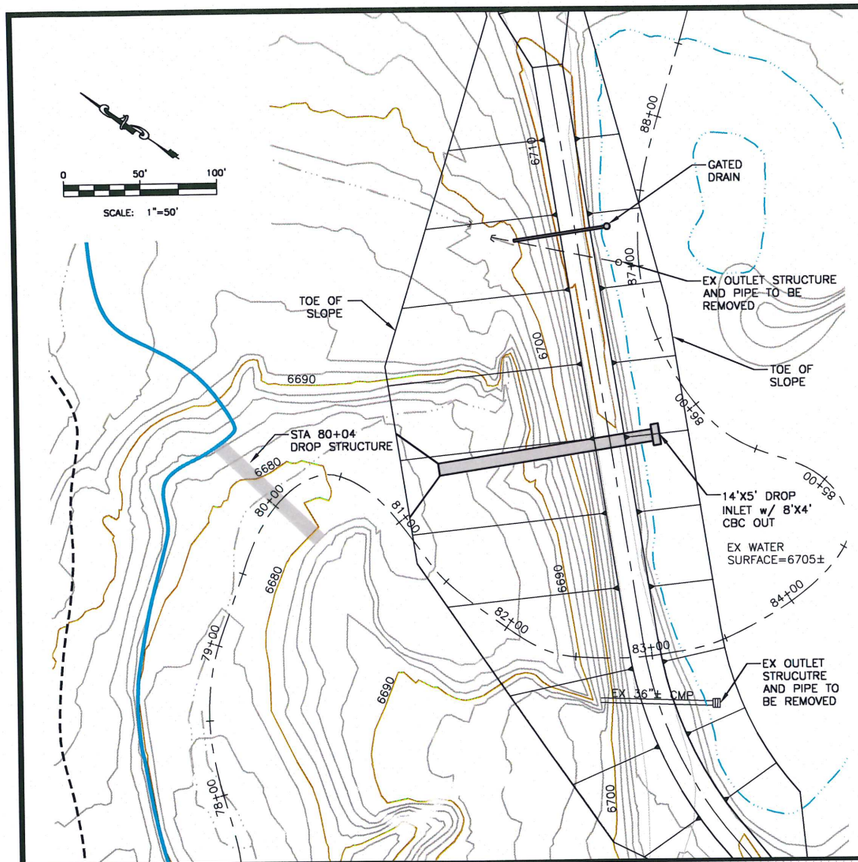

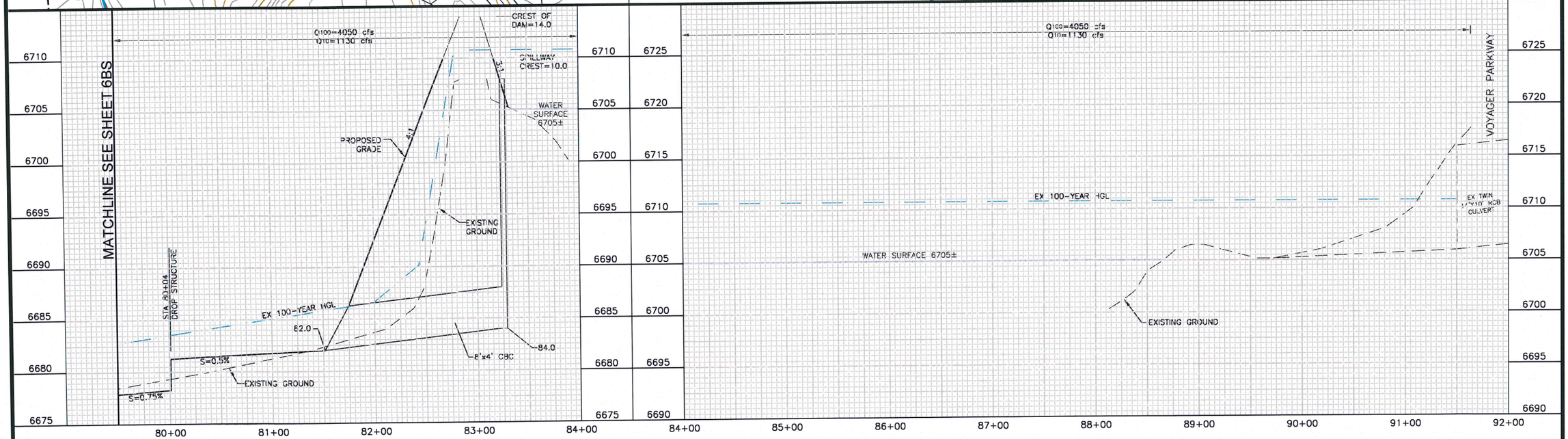

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
BLACK SQUIRREL CREEK CONCEPTUAL DESIGN
STA 790+50 TO STA 91+63.74 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

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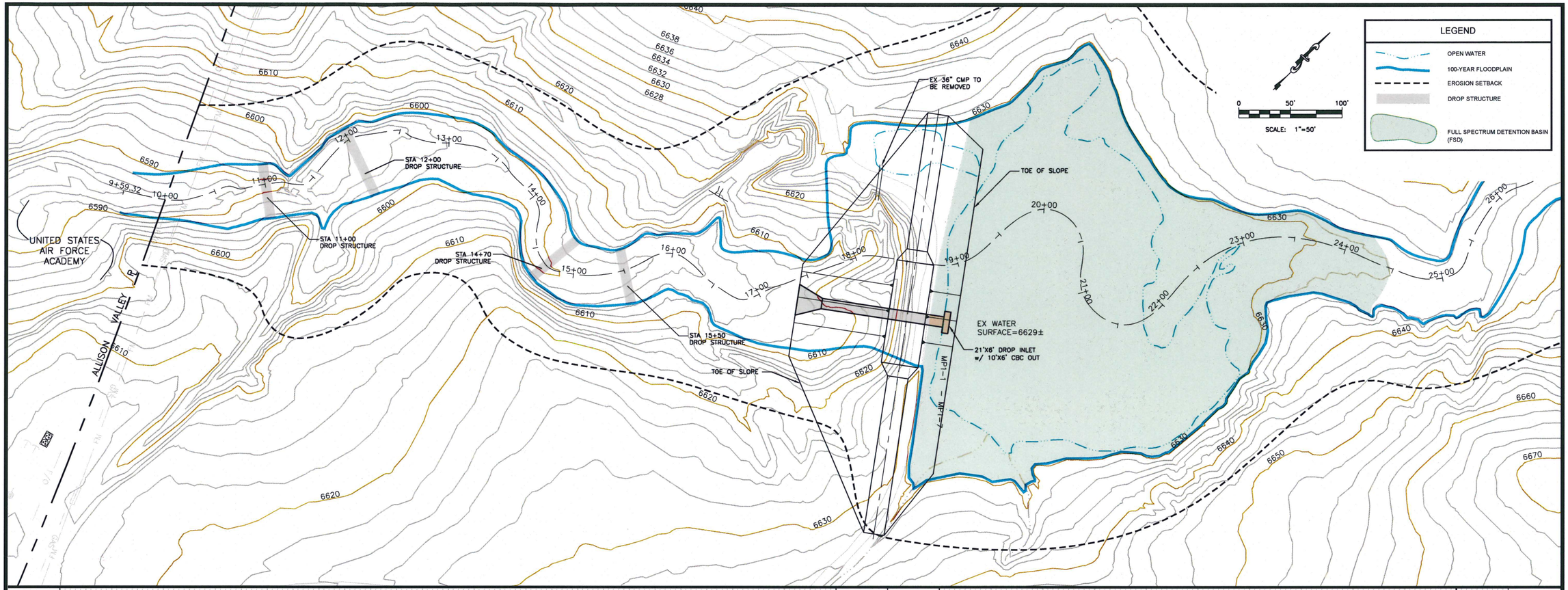

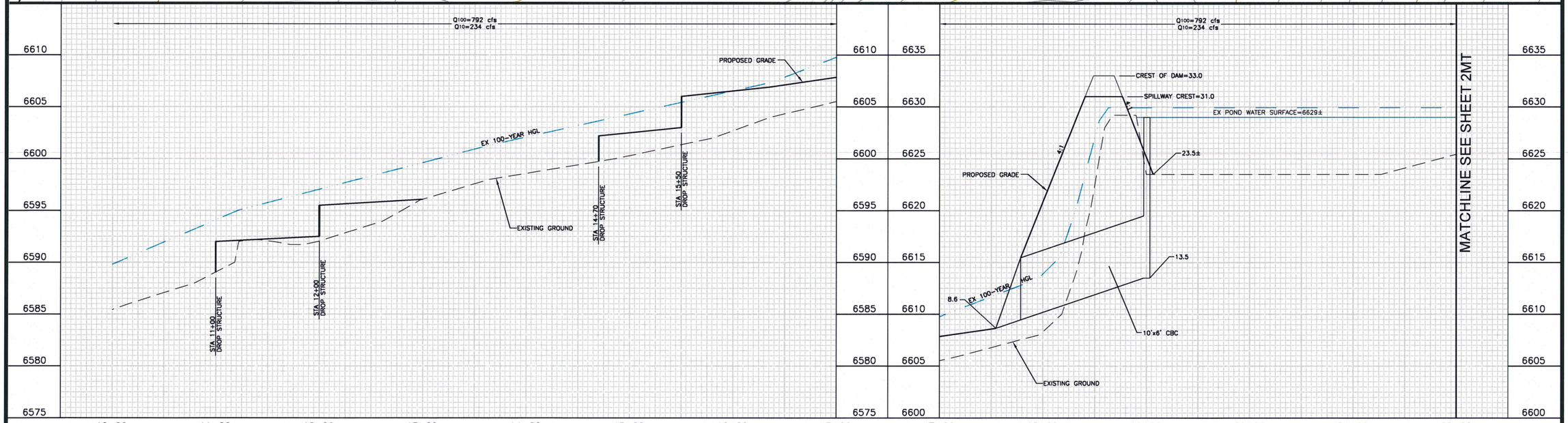

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
MIDDLE TRIBUTARY CREEK CONCEPTUAL DESIGN
STA 10+00 TO STA 22+00 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

Project No.:	10051
Date:	December 7, 2011
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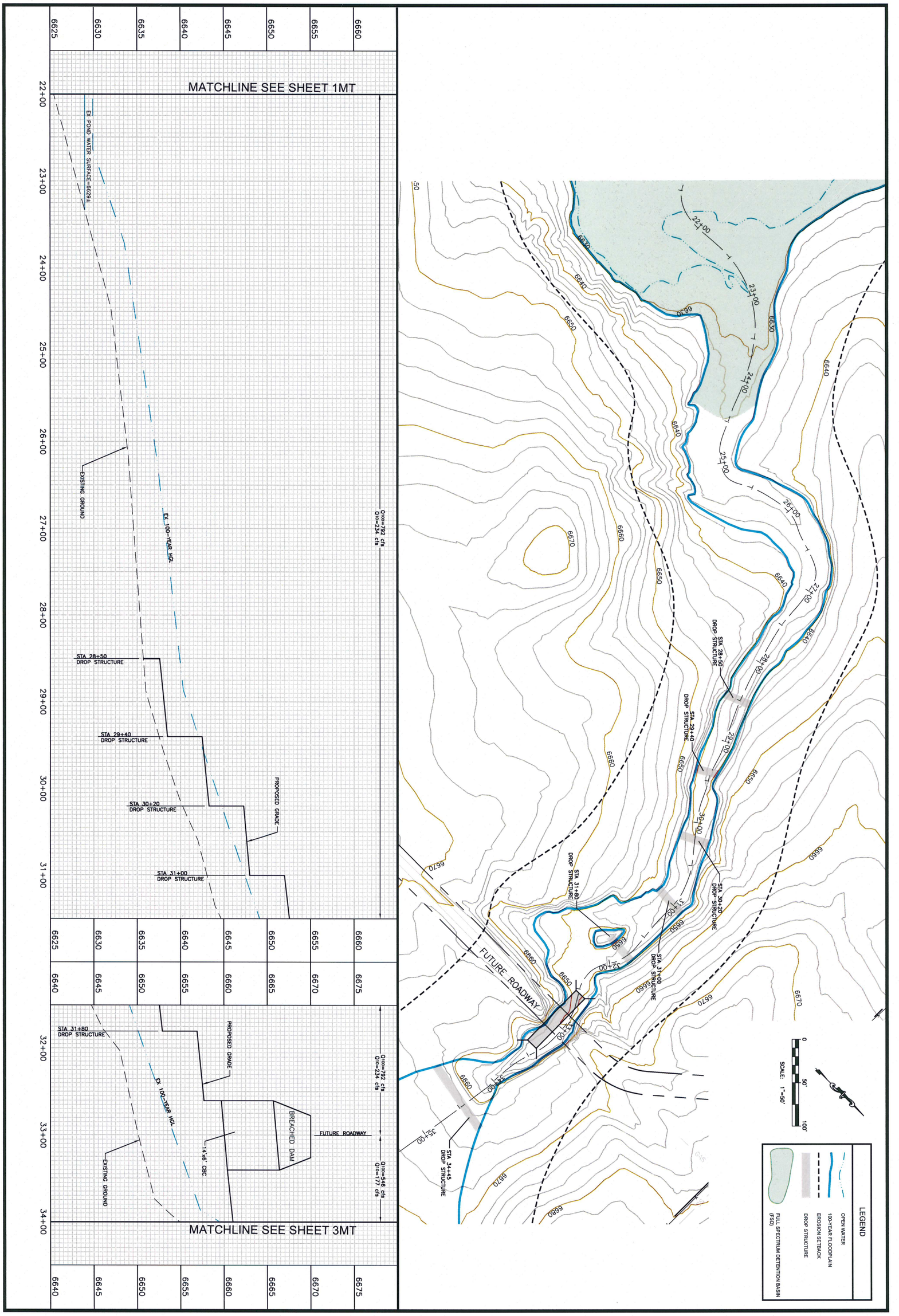

ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
MIDDLE TRIBUTARY CREEK CONCEPTUAL DESIGN
STA 22+00 TO STA 34+00 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

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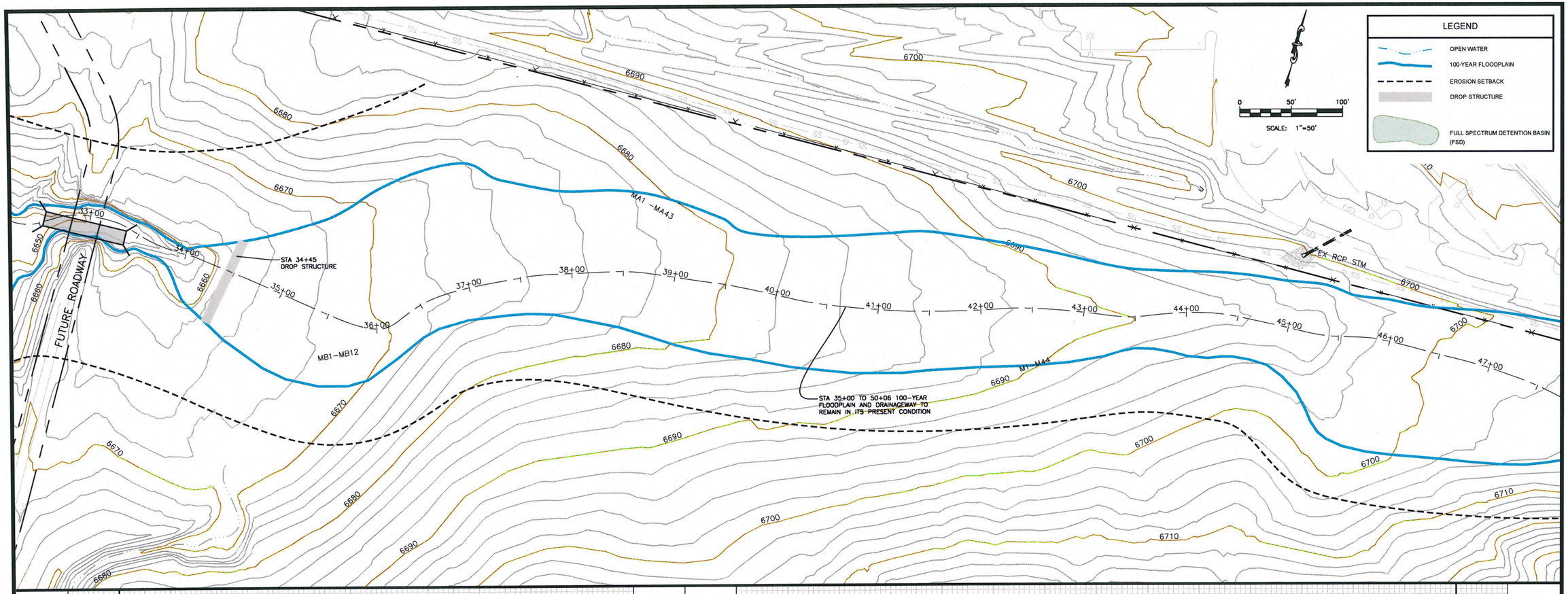

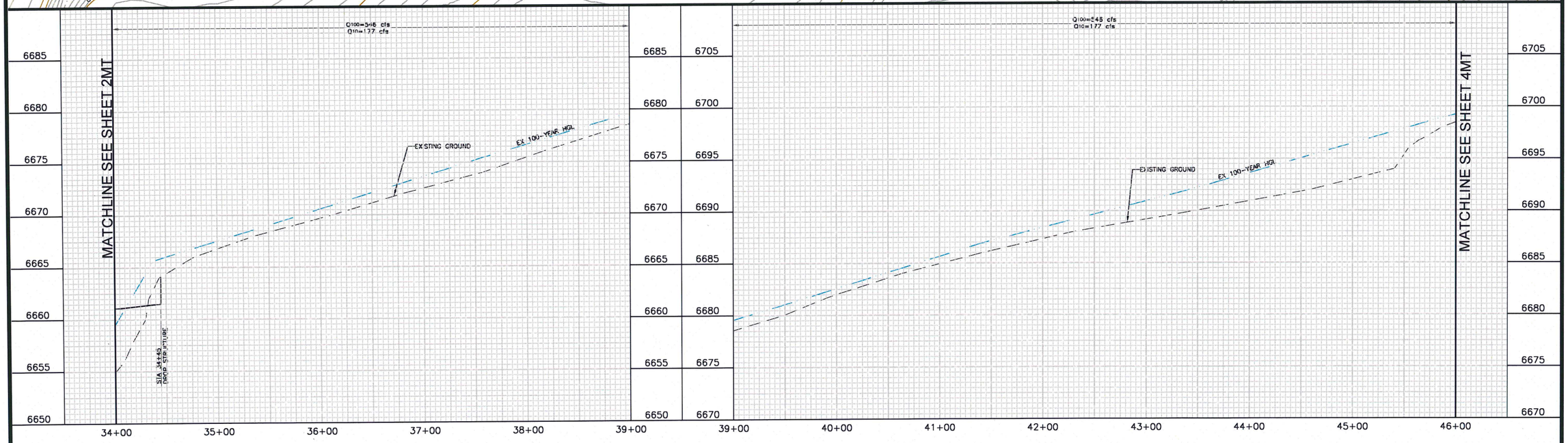

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
MIDDLE TRIBUTARY CREEK CONCEPTUAL DESIGN
STA 34+00 TO STA 46+00 PLAN AND PROFILE
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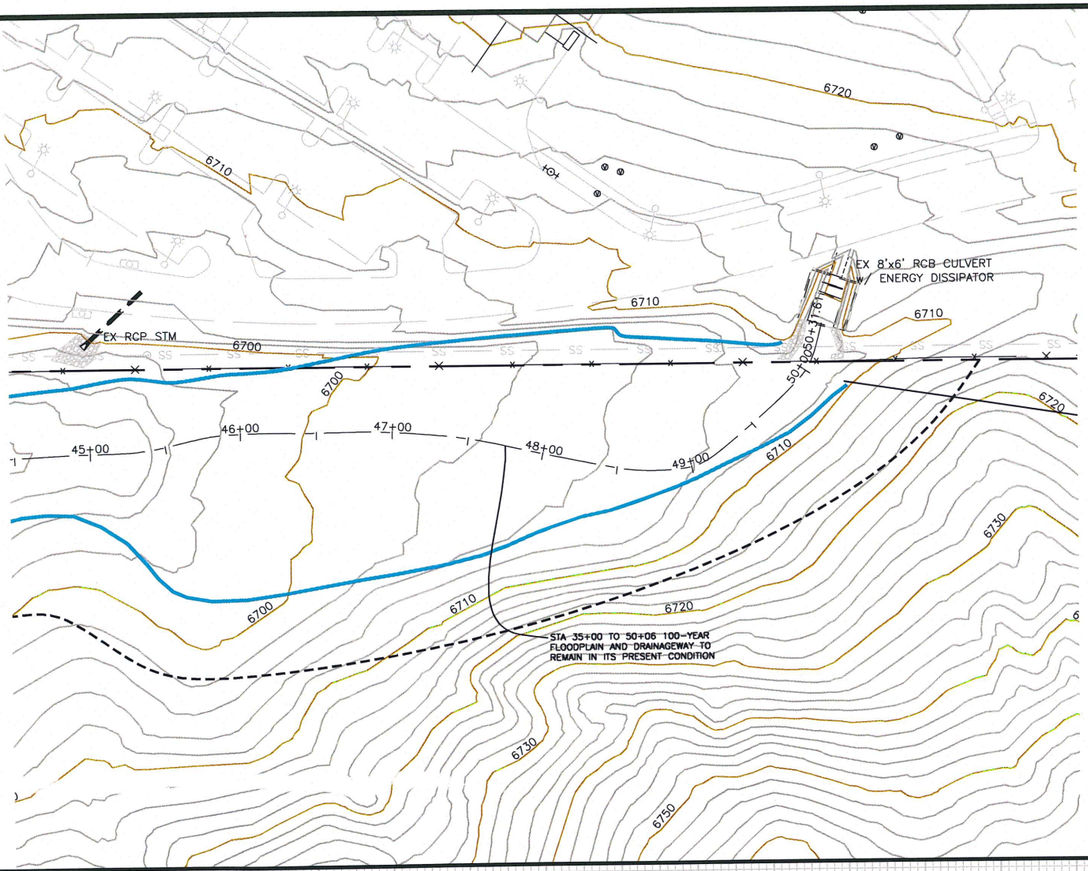
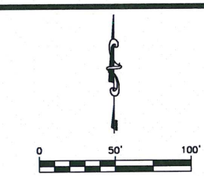
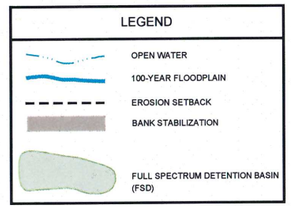
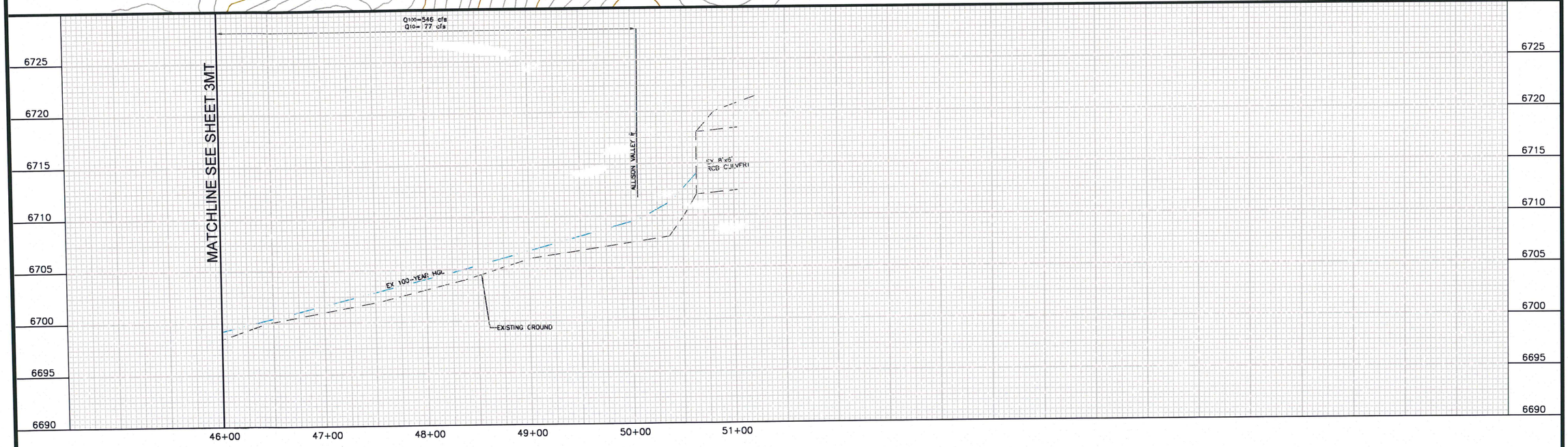
OF 4 SHEETS









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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN
MIDDLE TRIBUTARY CREEK CONCEPTUAL DESIGN
STA 46+00 TO STA 50+06.96 PLAN AND PROFILE
COLORADO SPRINGS, COLORADO

Project No.:	10051
Date:	November 10, 2011
Design:	JGD/RNW
Drawn:	JGD
Check:	RNW
Revisions:	

SHEET
4MT
OF 4 SHEETS

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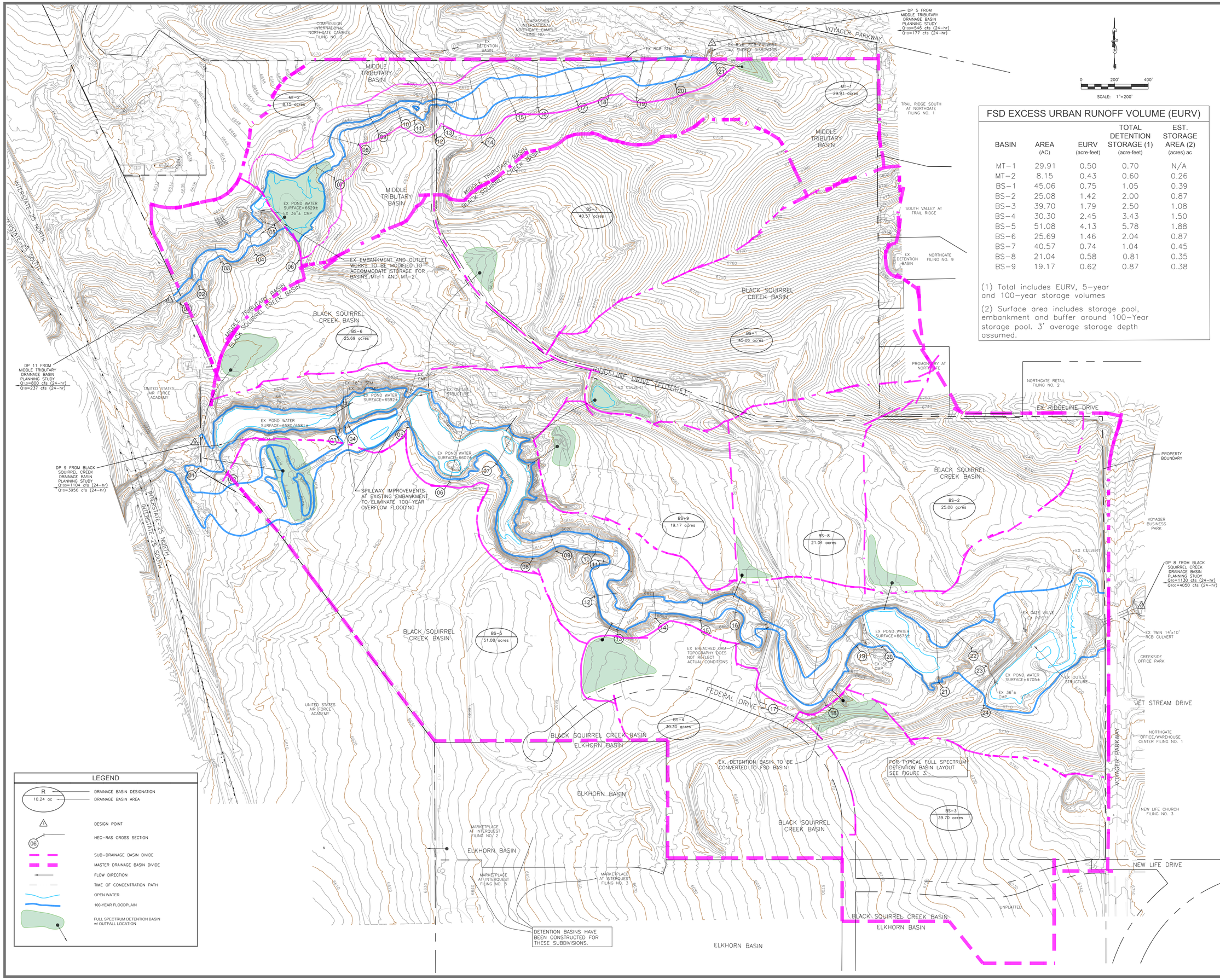

FSD EXCESS URBAN RUNOFF VOLUME (EURV)

BASIN	AREA (AC)	EURV (acre-feet)	TOTAL DETENTION STORAGE (1) (acre-feet)	EST. STORAGE AREA (2) (acres) ac
MT-1	29.91	0.50	0.70	N/A
MT-2	8.15	0.43	0.60	0.26
BS-1	45.06	0.75	1.05	0.39
BS-2	25.08	1.42	2.00	0.87
BS-3	39.70	1.79	2.50	1.08
BS-4	30.30	2.45	3.43	1.50
BS-5	51.08	4.13	5.78	1.88
BS-6	25.69	1.46	2.04	0.87
BS-7	40.57	0.74	1.04	0.45
BS-8	21.04	0.58	0.81	0.35
BS-9	19.17	0.62	0.87	0.38

(1) Total includes EURV, 5-year and 100-year storage volumes

(2) Surface area includes storage pool, embankment and buffer around 100-Year storage pool. 3' average storage depth assumed.

LEGEND

- R / 10.24 ac — DRAINAGE BASIN DESIGNATION / DRAINAGE BASIN AREA
- DESIGN POINT
- 06 — HEC-RAS CROSS SECTION
- SUB-DRAINAGE BASIN DIVIDE
- MASTER DRAINAGE BASIN DIVIDE
- FLOW DIRECTION
- TIME OF CONCENTRATION PATH
- OPEN WATER
- 100-YEAR FLOODPLAIN
- FULL SPECTRUM DETENTION BASIN w/ OUTFALL LOCATION

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ALLISON VALLEY MASTER DEVELOPMENT DRAINAGE PLAN

MASTER DEVELOPMENT DRAINAGE PLAN

EXISTING AND PROPOSED CONDITIONS

COLORADO SPRINGS, COLORADO

Project No.:	10051
Date:	November 8, 2011
Design:	RNW/JGD
Drawn:	JGD
Check:	RNW
Revisions:	

SHEET

DP1

OF 1 SHEETS

10051DP1.dwg/Jan 19, 2012