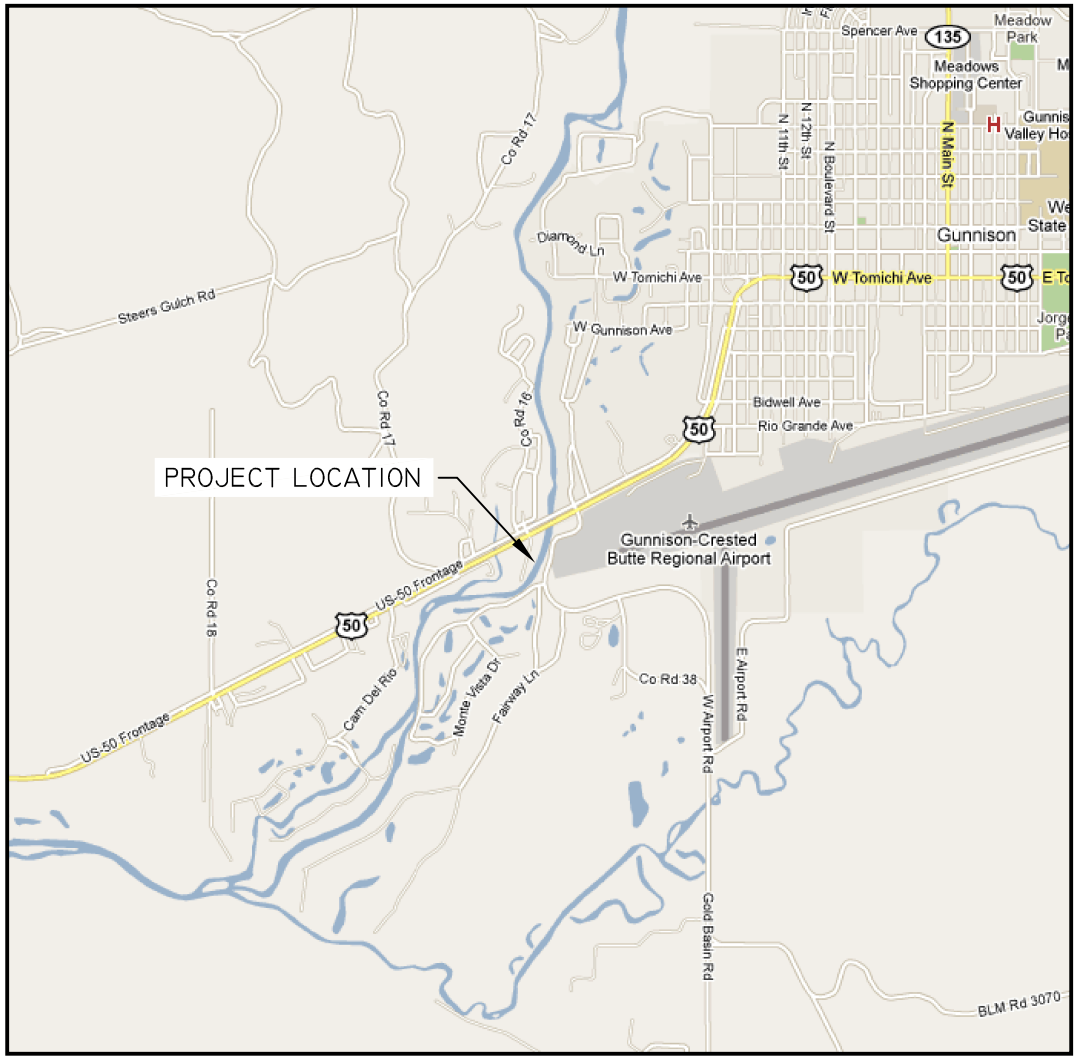
75 DITCH IMPROVEMENTS
GUNNISON RIVER, GUNNISON, COLORADO



PROJECT LOCATION MAP

NOVEMBER 5, 2010

PROJECT OWNER: GUNNISON COUNTY
200 E. VIRGINIA, STE 104
GUNNISON, CO 81230

ENGINEER: GARY M. LACY, P.E.
MIKE HARVEY, CFM, PMP
SHANE A. SIGLE, P.E.
RECREATION ENGINEERING AND PLANNING
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Recreation
Engineering & Planning

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PROJECT VICINITY MAP

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
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STRUCTURE #1

PLAN VIEW

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
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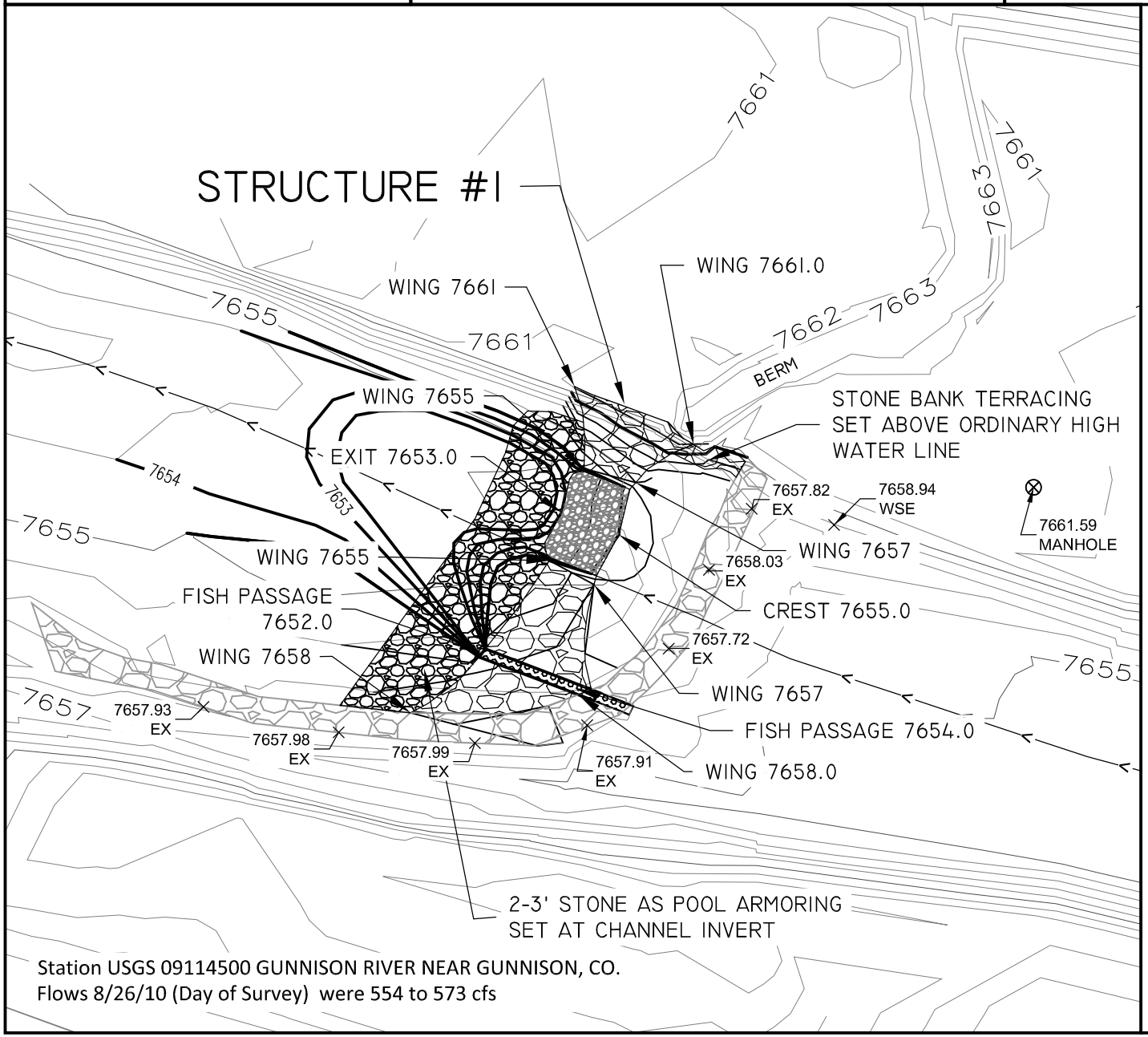

Station USGS 09114500 GUNNISON RIVER NEAR GUNNISON, CO.
Flows 8/26/10 (Day of Survey) were 554 to 573 cfs

LEGEND

- EXISTING COUNTOUR LINES
- STRUCTURE LOW FLOW
- STRUCTURE WING
- POOL ARMORING
- FISH PASSAGE (CONCEPTUAL LEVEL ONLY)
- EXISTING DIVERSION
- THALWEG AND DIRECTION OF FLOW

NOTES:
1) All elevations given in feet above sea level.
2) Rock fill/hatch images shown for illustrative purposes. Not to scale.

N

SCALE: 1" = 50'

0 50

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TYPICAL DETAILS-A

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
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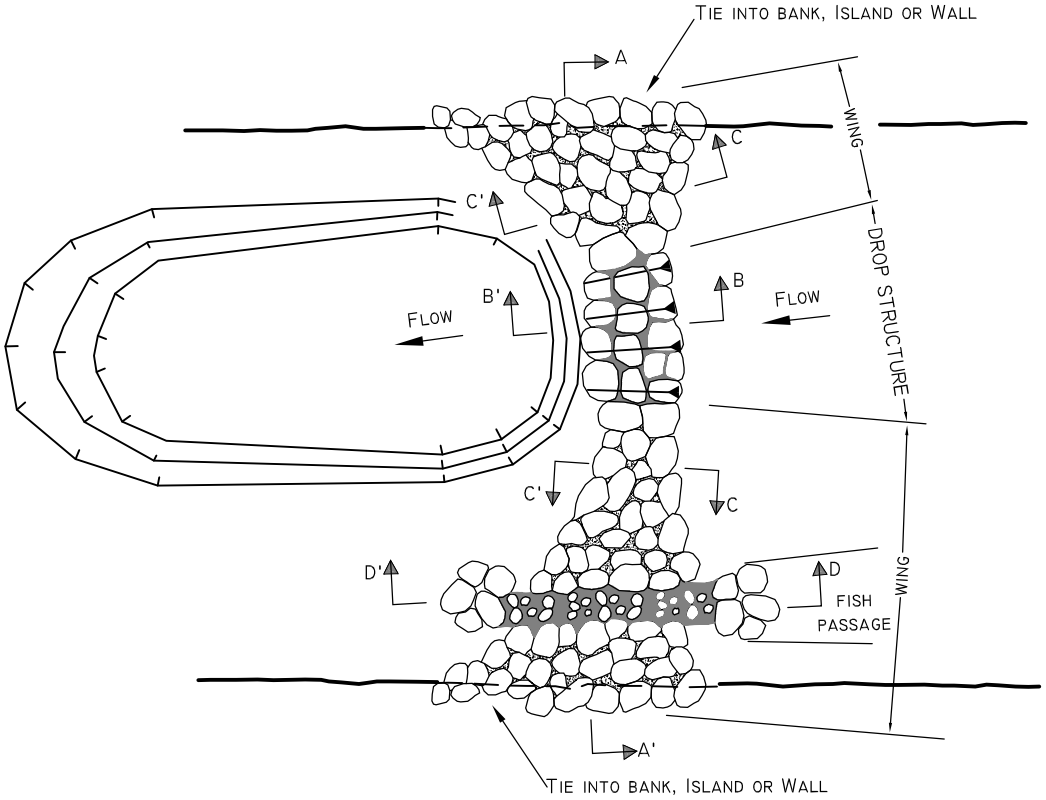
Typical Drop Structure



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TYPICAL DETAILS-B

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
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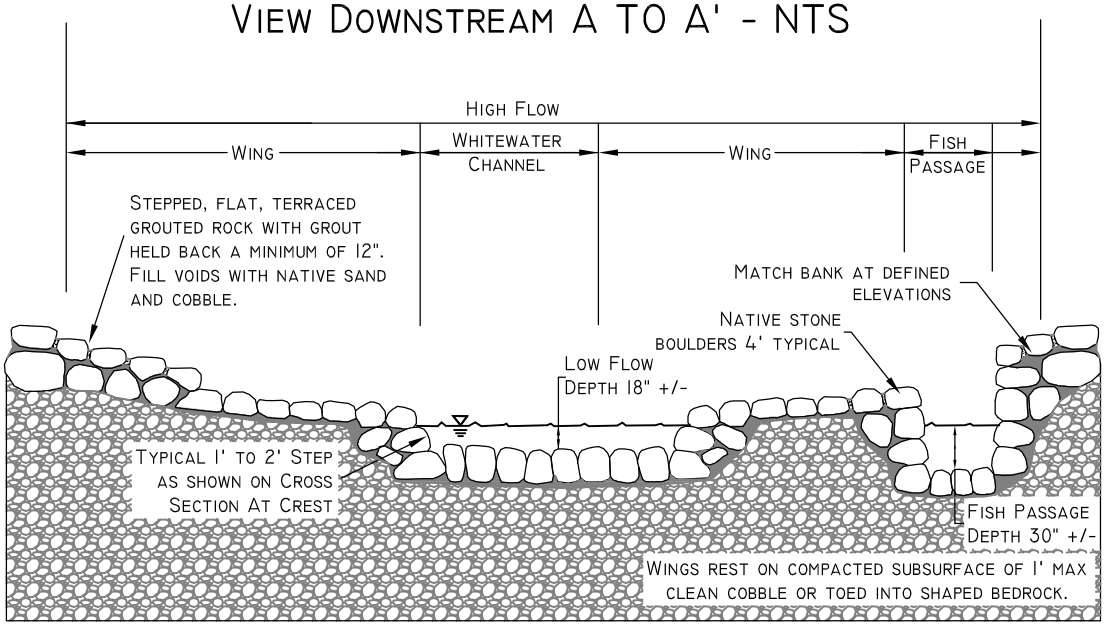
Typical Drop Structure Cross Section
View Downstream A to A' - NTS



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TYPICAL DETAILS-C

PRELIMINARY - NOT FOR CONSTRUCTION

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DATE	November 5, 2010
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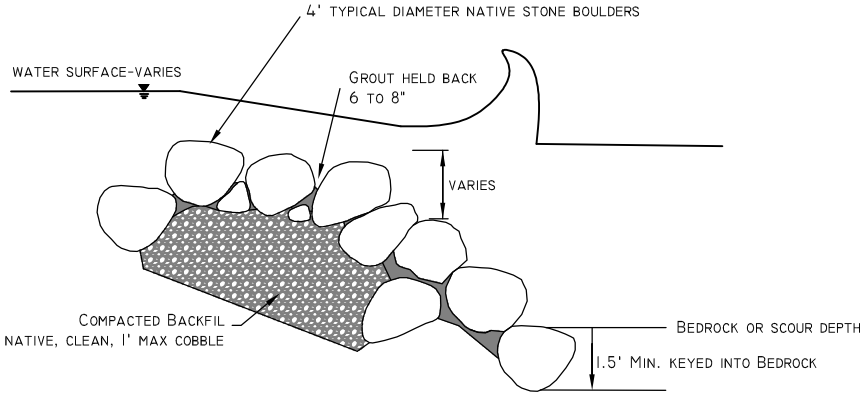
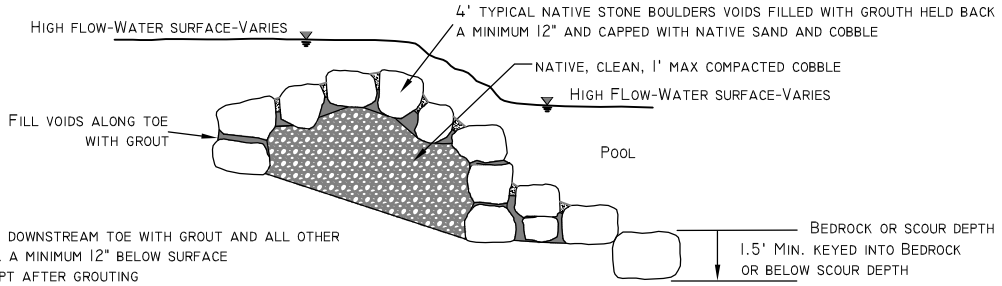


TYPICAL PROFILE OF ROCK IN CENTER LOW-FLOW, B TO B'
N.T.S



NOTE:
A) Fill voids along upstream and downstream toe with grout and all other voids filled with grout held back a minimum 12" below surface
All rock to to be clean and swept after grouting
B) Make wing rounded to prevent deep water boat pins on upstream side as as specified by whitewater engineer.
C) Step back side of wings with 18" to 30" steps to break up hydraulics
D) Capp voids on top of the wing with native sand and cobble.

TYPICAL PROFILE OF ROCK IN "WING & ISLAND", C TO C'
N.T.S

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TYPICAL DETAILS-D

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
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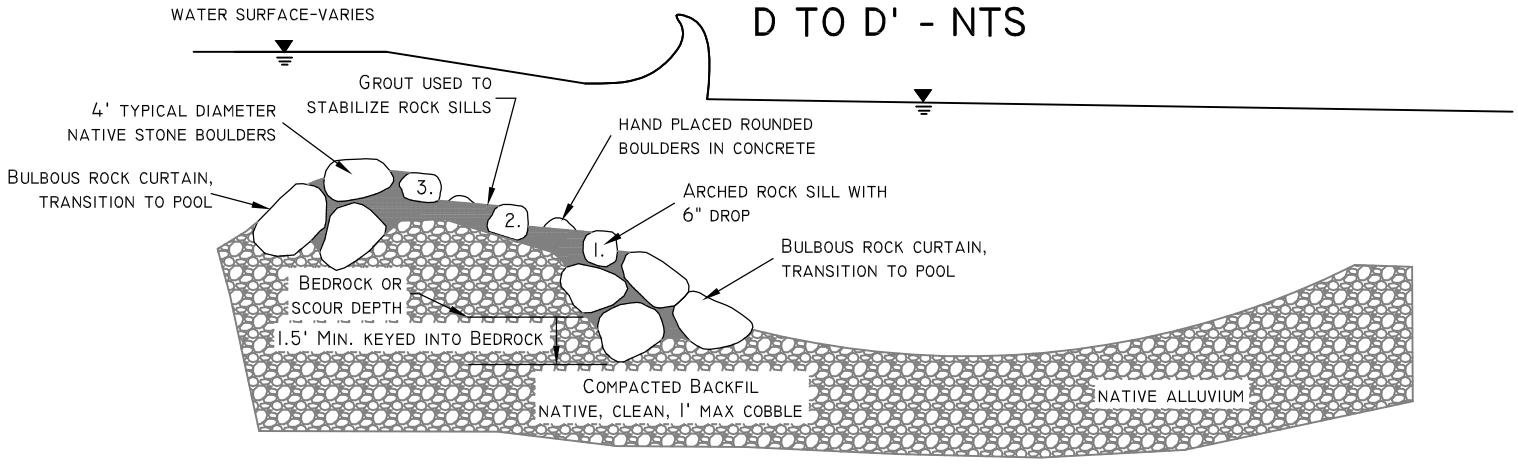
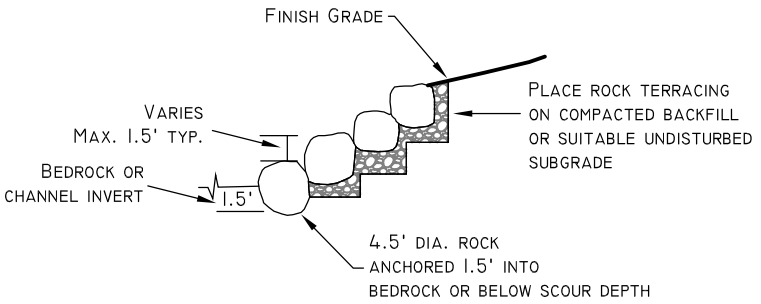
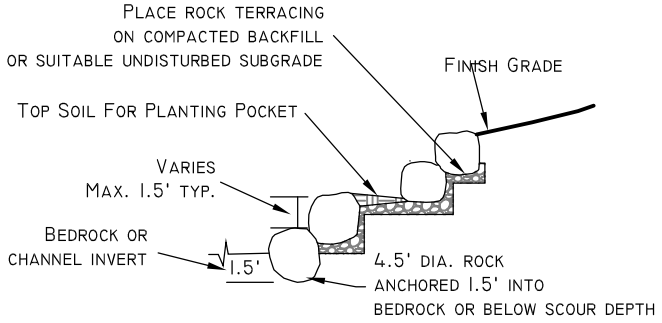
TYPICAL SECTION OF DROP STRUCTURE, IN FISH PASSAGE CHANNEL D TO D' - NTS





TERRACED ROCK TYPICAL N.T.S



TERRACED ROCK TYPICAL WITH PLANTING POCKET N.T.S

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TYPICAL DETAILS-E

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
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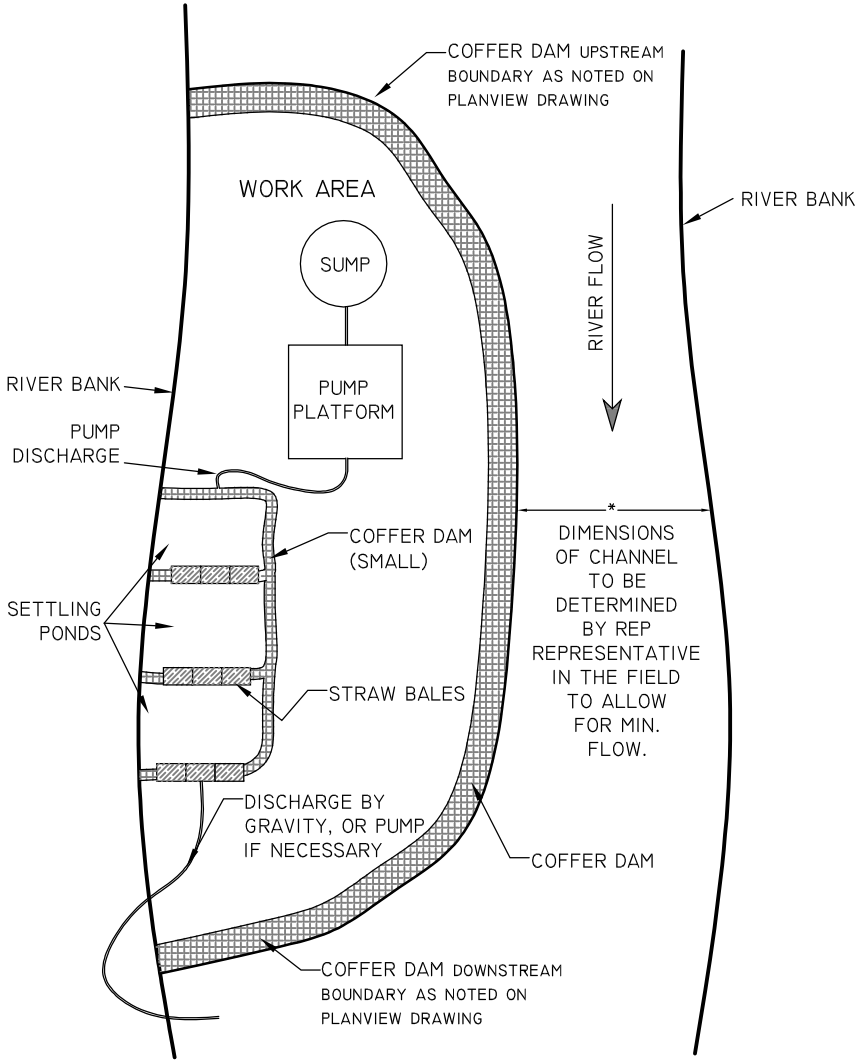
SHEET	8 of 11

Typical Layout Dewatering Area

Note: Schematic Layout to describe functionality only. Actual layout to be determined by qualified contractor, per permit conditions.



COFFER DAM

HAY BALES (PURE HAY)

NOTES: DEWATERING AREA DETAILS:

1. SUMPS CAN BE MADE FROM DIGGING A HOLE AND INSERTING A PERFORATED PIPE AND BACKFILLING WITH CLEAN DRAIN ROCK OR OTHER APPROVED METHOD.
2. SETTLING BASINS SHOULD BE BASED UPON SITE SPECIFICS (I.E. INFILTRATION AND SETTLING RATES, PARTICLE SIZE). DETENTION TIMES WILL BE BASED UPON THE SIZE OF THE SUSPENDED PARTICLES. IF THERE IS EXCESSIVE LEAKAGE THROUGH ANY COFFER DAM, BASE ROCK IS TO BE LINED WITH VISQUENE PRIOR TO BEING COVERED IN COBBLE. NUMBER OF SETTLING PONDS TO BE DETERMINED BY CLARITY OF DISCHARGE FLUID.
3. UPON COMPLETION VISQUENE AND SETTLED FINES SHALL BE REMOVED AND DISPOSED OF OFFSITE BY THE CONTRACTOR.
4. PUMP STATION SHALL BE ELEVATED. FUEL CONTAINMENT BMP'S SHALL BE ONSITE AT ALL TIMES.
5. PUMP REMAINING WATER IN CONSTRUCTION AREA AS NECESSARY, TO MANAGE GROUNDWATER AND LEAKAGE. ALL DISCHARGED WATER MUST BE ROUTED TO THE SETTLING BASINS.
6. CONTRACTOR IS RESPONSIBLE FOR OWN SECURITY DURING CONSTRUCTION. ANY VANDALISM WILL BE CORRECTED AT CONTRACTOR'S OWN EXPENSE.
7. DETAILS SUBJECT TO REVIEW AND CHANGE DURING 404 PERMIT APPLICATION PROCESS.

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TYPICAL DETAILS-F

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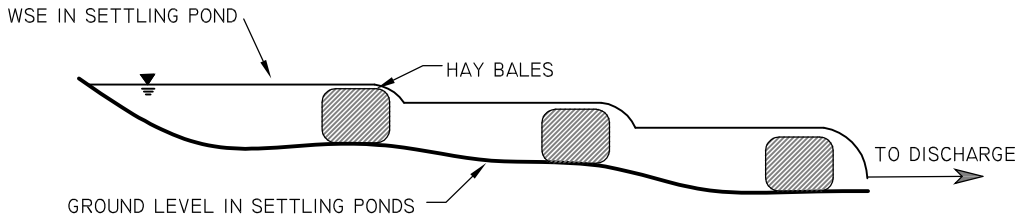
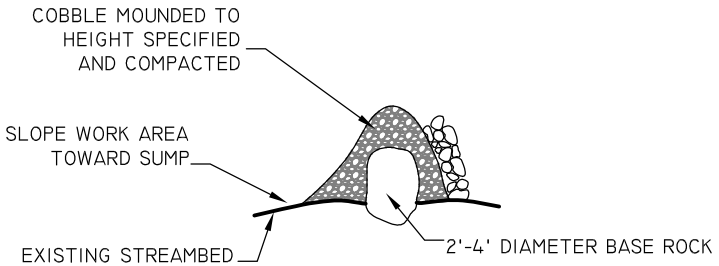


TYPICAL SECTION IN SETTLING POND

Note: Schematic Layout to describe functionality only. Actual layout to be determined by contractor, per permit conditions.



Typical Coffer Dam Cross Section

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TYPICAL DETAILS-G

PRELIMINARY - NOT FOR CONSTRUCTION

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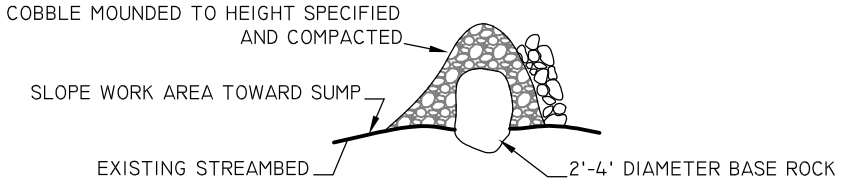

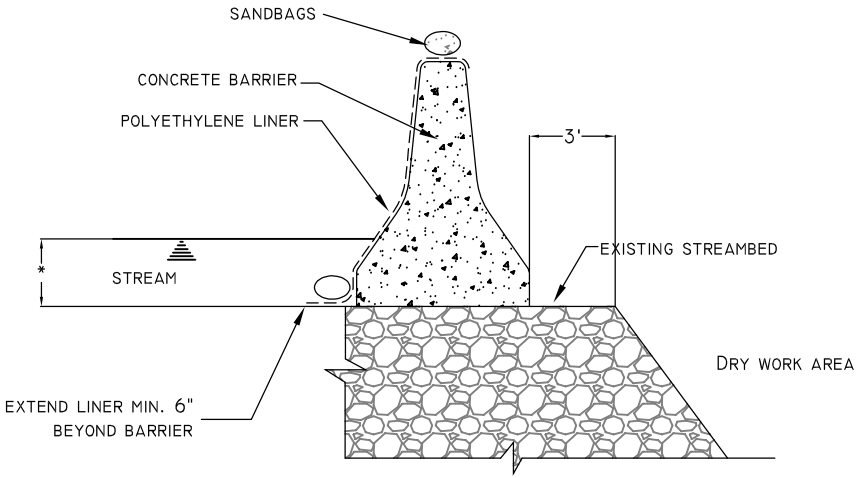

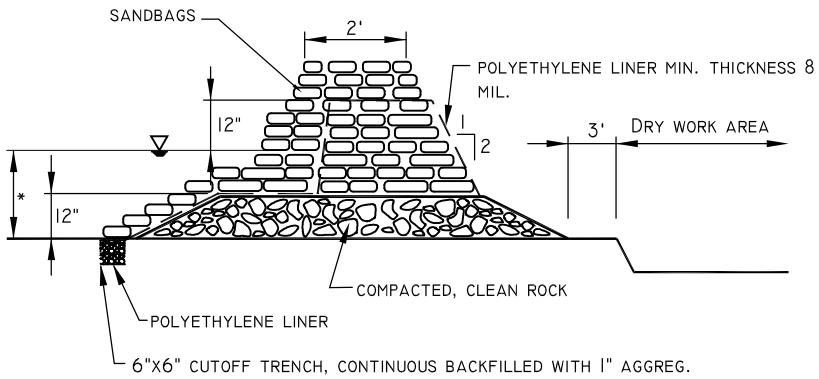

ALTERNATIVE COFFERDAM METHODS

NOTE: ALTERNATE METHODS PRESENTED TO DESCRIBE FUNCTIONALITY ONLY. ACTUAL METHOD TO BE DETERMINED BY QUALIFIED CONTRACTOR, PER PERMIT CONDITIONS, IN ORDER TO ACHIEVE DRY WORK AREA.

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SPECIFICATIONS

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
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General Notes

Engineers Oversight

1. All elevations, dimensions, alignments and orientation of all elements shown in the plans must be approved by the Engineer or Engineer's representative ("REP Engineer or REP Representative")

2. Work shall not commence until after the date of the on-site pre-construction meeting which will be attended by representatives of the Project Owner, Engineer, Contractor and any Sub-Contractors. In the event that work does not begin immediately following the pre-construction meeting, the contractor shall provide representatives of the Project Owner, REP Engineer, any Sub-Contractors, and relevant agencies noted in the permit, two weeks notice before construction commences.

Permits

1. The Contractor shall have copies of any required permits on site at all times.
2. The Contractor is responsible for compliance with all conditions and stipulations of all required permits.

Utilities

1. The Contractor shall locate all utilities within the project area prior to construction.
2. No excavation shall occur in the area surrounding a utility crossing. No improvements, that may cause scour; are to be placed in the vicinity of an at grade, above or below grade, utility crossing.
3. If utilities are identified within the project area. A minimum buffer of no disturbance is to be maintained on all utility crossings.

Rock

Quality

1. Individual stone boulders shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering.
2. The boulders shall be rounded to sub-rounded in shape. At a minimum exposed rock should have one flat surface and this should be the only exposed surface.
3. The rock shall have the following properties:
   A) Bulk specific gravity (saturated surface-dry basis) not less than 2.5.
   B) Absorption not more than 2% by weight.
   C) The bulk specific gravity and absorption shall be determined by AST M Method C-127.
4. Rock that fails to meet these requirements may be accepted only if similar rock from the same source has been demonstrated to be sound after five years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated. Alternatively native or imported stone, already at the site and meeting the standards outlined above, may be used.

Gradation

1. Rock shall be of the size and placed in a manner as specified by REP Engineer.

Site Preparation- Rocks Placed in Bank "Stone Terracing"

1. All rock placed as bank terracing or stabilization shall be keyed into the banks a minimum of 12" in the horizontal and vertical direction.
2. All stone terracing shall be set such that it is supported by placed stone or solid, existing, foundational material, as approved by REP Engineer.
3. All stone terracing shall be backfilled with clean fill.

Site Preparation- Rocks Placed in Channel

1. All rock structures shall be placed as directed by REP Representative.
2. No rock placement shall occur in channel until appropriate water control measures are in place (as outlined in the water control detailed plan).
3. Excavation for keystone boulders shall be below scour depth.

Placement

1. Stone boulders shall be placed as shown on the drawings without any gaps, so that each boulder touches the next one.
2. Each stone shall be placed to the final position be suitable equipment for handling material and, if necessary; the stone shall be picked up and repositioned.
3. Dragline buckets and skips shall not be used for placement of boulders. It should be anticipated that re-handling of individual stones, after initial placement will be required to achieve required slopes, grades, elevations andposition.
4. The engineer shall observe all rock placement and approve of the placement before boulders are chinked or backfilled, unless explicit exception is made by the engineer before placement.

Grout

Placement

1. Grout shall be pumped into voids as directed be REP Representative.
2. Low flow grout should be "held back 6 to 8 inches" from exposed rock. All other grout should be "held back 12 to 18".
3. All exposed visible grout shall be smoothed, even in void spaces.
4. At completion of placement all rock should be cleaned of concrete and concrete residue.
5. Grout shall not be placed unless appropriate water control measures are in place.
6. BMP's shall be employed to ensure that no water will be allowed to flow over the fresh concrete before the concrete has cured.

Material

1. Grout shall consist of Portland cement, sand and gravel, thoroughly mixed with water to produce grout having a thick, creamy consistency. The aggregate, for grout, shall consist of 70% sand and 30% 3/8 rock. Maximum aggregate shall be ½ inch. The concrete mix shall indicate evidence of meeting of exceeding the following criteria unless otherwise shown on the drawings.
   A) Minimum Strength: 4000lbs
   B) Slump: ASTM C-143, 3-5 inches

75 Ditch Improvements

Oct-10

Item Number	Structure		Estimated Quantity			
1	Pool Excavation: Excavate cobble and sand per grading plan. Remove the material from the site.		450 Cubic Yards (CY)			
2	Pool Armoring: Place 2'-3' stone at pool invert to prevent scour.		225 CY			
3	Drop Structure: 3'-5' large stone for grade control structure below existing 75 Ditch diversion structure.		500 CY			

May 16, 2011

Ms. Marlene Crosby
Gunnison County Public Works
811 Rio Grande
Gunnison, CO
81230

RE: One-dimensional hydraulic analysis (HEC-RAS) for the 75 Ditch Improvements, Gunnison River, Gunnison County, Colorado.

Summary

The 75 Ditch Improvements on the Gunnison River in Gunnison County are within an area that may be affected by changes to the 100-year discharge water surface elevation (100-yr elevation). During the design phase of the subject Improvements, the continuity and weir equations were used to design a modified diversion structure that created a “no rise” in the 100-yr elevation. The 1% annual chance flow of 8,930cfs was obtained from the FEMA Flood Insurance Study dated September 29, 1989. This report summarizes the results of the one-dimensional HEC-RAS hydraulic flow model that was created to compare existing conditions through the project area and proposed design conditions at the 75 Ditch Diversion. The site plans located in Appendix 1 show the improvements and the results of the model are located in Appendix 2. The model showed the improvements caused no rise in the 100-yr elevation through the modeled reach.

Background

REP was retained by the Gunnison Whitewater Festival to design, model and oversee construction for the 75 Ditch Improvements. REP completed the final design drawings and a one-dimensional hydraulic model (HEC-RAS) to test the effects of the proposed design on the 100-year elevation. HEC-RAS is the industry standard used to test in-stream structures and encroachments within the floodplain. This report summarizes the methodologies used to create that model, and the findings.

Modeled Reach

The modeled reach is shown in plan view in Appendix 1. The drop is located within the channel of the Gunnison River, immediately below the Highway 50 bridge, commonly referred to as the "twin bridges". The modeled reach can be characterized as heavily disturbed. In addition the diversion structure there is a recently completed pedestrian/bike trail underpass immediately upstream of the diversion.

Model Parameters

The one-dimensional HEC-RAS hydraulic model was created based on a survey completed by Landmark Surveying, a Professional Land Surveying (PLS) company from Salida, Colorado. A total of 10 cross sections were surveyed spanning approximately 750 longitudinal feet of riverbed. Surveyed cross sections were taken at intervals from a distance of 237 feet above the crest of the 75 Ditch Diversion and extended to a distance of 513 feet below the diversion structure. The pre-existing diversion structure acts as the hydraulic control at the upstream end of the project area.

The Manning's n value used for the existing conditions model channel was .036 and overbank was 0.05 which is consistent with the Federal Emergency Management Agency's Flood Insurance Study (FEMA) (FIS) for Gunnison County dated September 29, 1989 . The report published Manning's n values of 0.030 to 0.039 for the channel and 0.032 to 0.085 for the overbanks of the Gunnison River. REP's values are of .036 for the channel and .05 for the overbanks are based on the FIS and on qualitative observations of the channel through the project area.

The Manning's n value used for the proposed conditions model, within the channel varied from 0.03 to 0.036 depending on location. Values of 0.03 were used at the crest and exit of proposed drop structures to reflect the roughness of smoothed concrete drops and values of 0.036 were used at locations where the channel was graded by large equipment for riffle/pool combinations or was undisturbed.

The 100-year discharge was taken directly from the FEMA FIS peak discharge calculation for the Gunnison River near Gunnison. A 1% Annual Chance peak discharge of 8,930 cubic feet per second (CFS) was used in the model. According the peak discharge statistics available for the USGS gauge maintained in Gunnison River near Gunnison, the last time flows met or exceeded 8,930cfs on the Gunnison River was in 1957.

Boundary conditions of the known FEMA water surface elevations were used as the boundary conditions for the model. The model was run under steady flow conditions to reflect the existing hydraulic conditions within the modeled reach.

HEC-RAS Accuracy

HEC-RAS is a one-dimensional flow modeling program that was created by the U.S. Army Corps of Engineers. The model is relatively simple and, as such, the information that is provided by the model is somewhat limited. Additionally, the model suffers from accuracy problems that are related to the resolution of the model as well as the resolution of the inputs provided. Error in this model was induced through surveying accuracy,

roughness accuracy, the simplification of the complicated geometry of the drop structures, through the model itself, as well as through additional lesser factors. Previous studies have shown that for this type of river channel the accuracy is commonly within +/- 20%.

Methodology

The purpose of the flood study was to ensure the proposed design did not cause a rise to the 100-year elevation. Since a FEMA model for this reach was not able to be located and because of the desire to create a higher resolution model for this reach based on current conditions, a model of the existing floodplain had to be created as a baseline. This model was calibrated to the water surface elevations that were surveyed in August of 2010. The results of this calibration are shown below.

Cross Section	Model Run	Channel Invert (feet)	Water Surface Elevation (feet)	Difference (feet)	Flow (cfs)	Date	Notes
1060.00	Day of Survey	7649.97	7654.16				
	HEC RAS	7649.97	7654.15	-0.01	560.00		
1196.00	Day of Survey	7651.27	NA				
	HEC RAS	7651.27	7654.58		560.00		
1326.00	Day of Survey	7652.61	7655.16				
	HEC RAS	7652.61	7655.32	0.16	560.00		
1383.00	Day of Survey	7653.87	7655.74				7858.56 Surveyed WSE at Ditch
	HEC RAS	7653.87	7655.75	0.01	560.00		
1431.00	Day of Survey	7654.13	7655.96				
	HEC RAS	7654.13	7656.13	0.17	560.00		
1479.00	Day of Survey	7654.61	7656.37				
	HEC RAS	7654.61	7656.48	0.11	560.00		
1501.00	Day of Survey	7654.75	NA				
	HEC RAS	7654.75	7656.73		560.00		
1521.00	Day of Survey	7654.90	7657.37				
	HEC RAS	7654.90	7657.06	-0.31	560.00		
1554.00	Day of Survey	7654.88	7658.57				
	HEC RAS	7654.88	7658.25	-0.32	560.00		7858.72 Surveyed WSE at Ditch
1586.00	Day of Survey	7654.70	7658.94				
	HEC RAS	7654.70	7658.73	-0.21	560.00		
1688.00	Day of Survey	7654.18	7658.79				
	HEC RAS	7654.18	7658.76	-0.03	560.00		
1796.00	Day of Survey	7654.06	7658.64				
	HEC RAS	7654.06	7658.80	0.16	560.00		

Results

The results from the one-dimensional model analysis suggest the improvements, or "proposed" condition have a no-rise impact to the 100-year elevation through the project reach. The results are shown in tabular form Appendix 2 and graphical form in Figure 1 and again in Appendix 2. Specifically, the water surface elevations for the proposed

conditions (shown in column 4 of the summary table located in Appendix 2) are lower than the water surface elevations for the existing conditions.

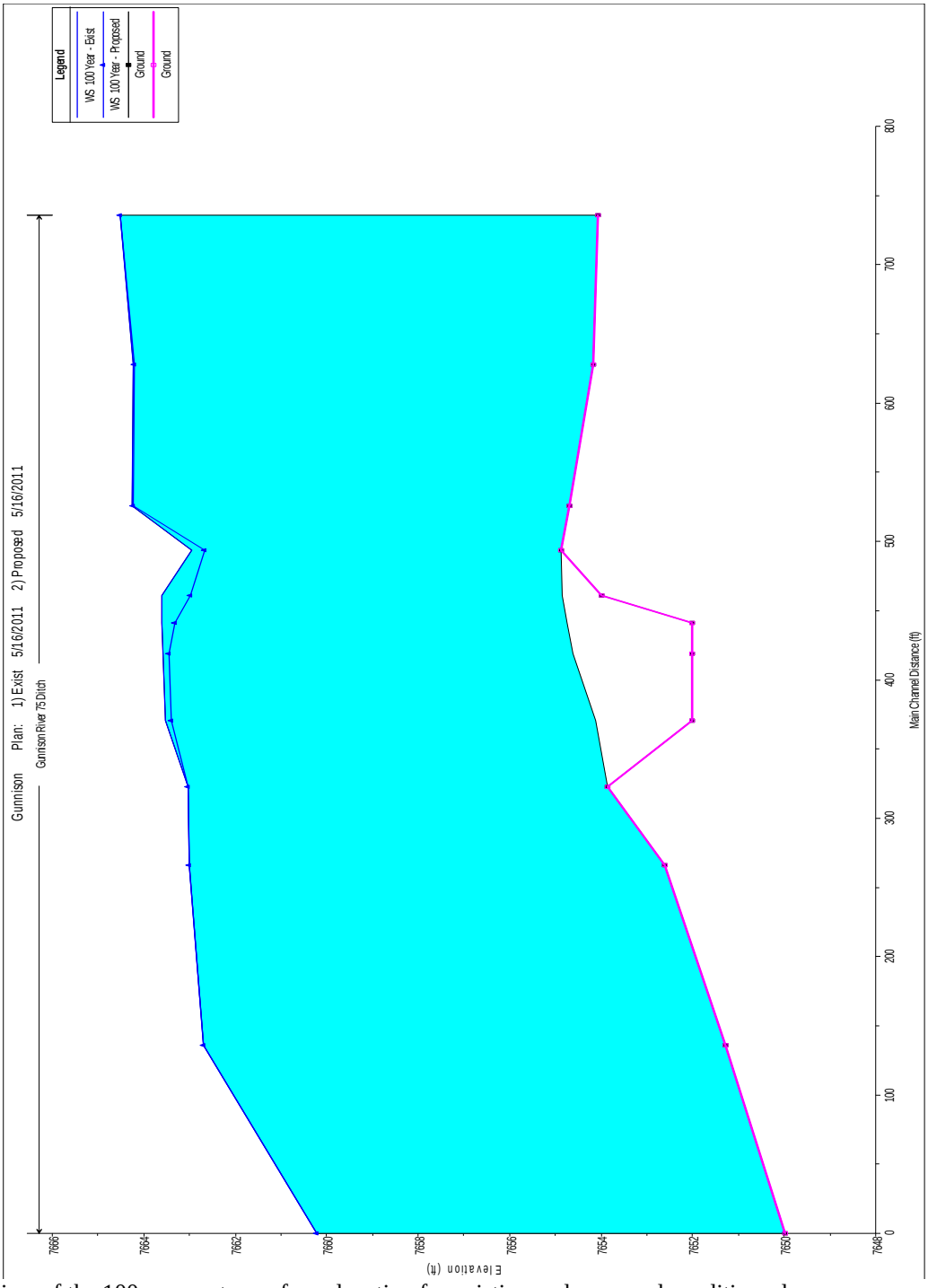


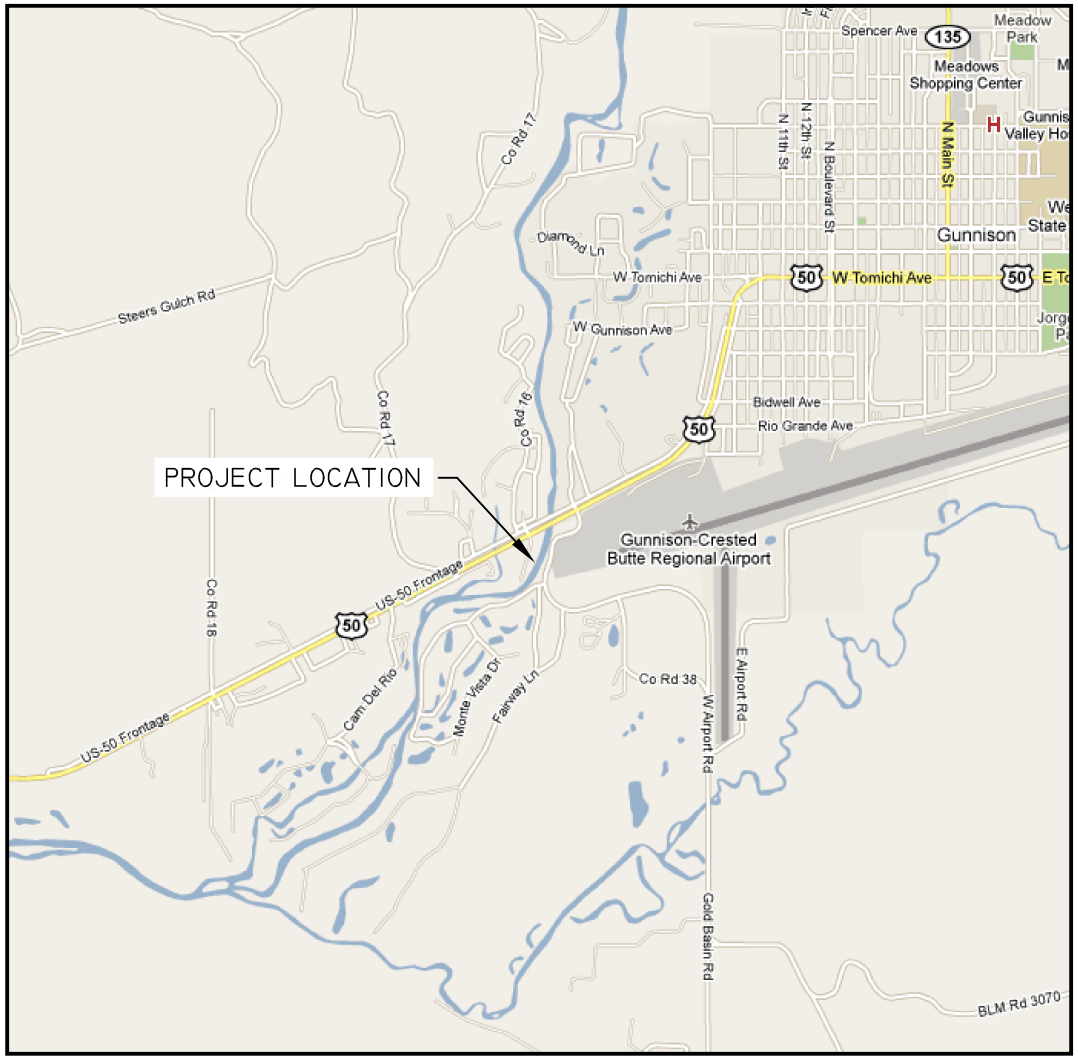
Figure 1: Profile view of the 100 year water surface elevation for existing and proposed conditions, larger plot located in Appendix 2.

Conclusion

Based on a HEC-RAS model created by REP using a professional survey completed by Landmark Surveying, specific parameters from the FEMA FIS, and REP's experience with hydraulic modeling, REP determined there is "no rise" to the 100-yr elevation within the project reach.

Appendix 1: Design Drawings for the 75 Ditch Diversion

75 DITCH IMPROVEMENTS
GUNNISON RIVER, GUNNISON, COLORADO



PROJECT LOCATION MAP

NOVEMBER 5, 2010

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200 E. VIRGINIA, STE 104
GUNNISON, CO 81230

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PROJECT VICINITY MAP

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STRUCTURE #1

PLAN VIEW

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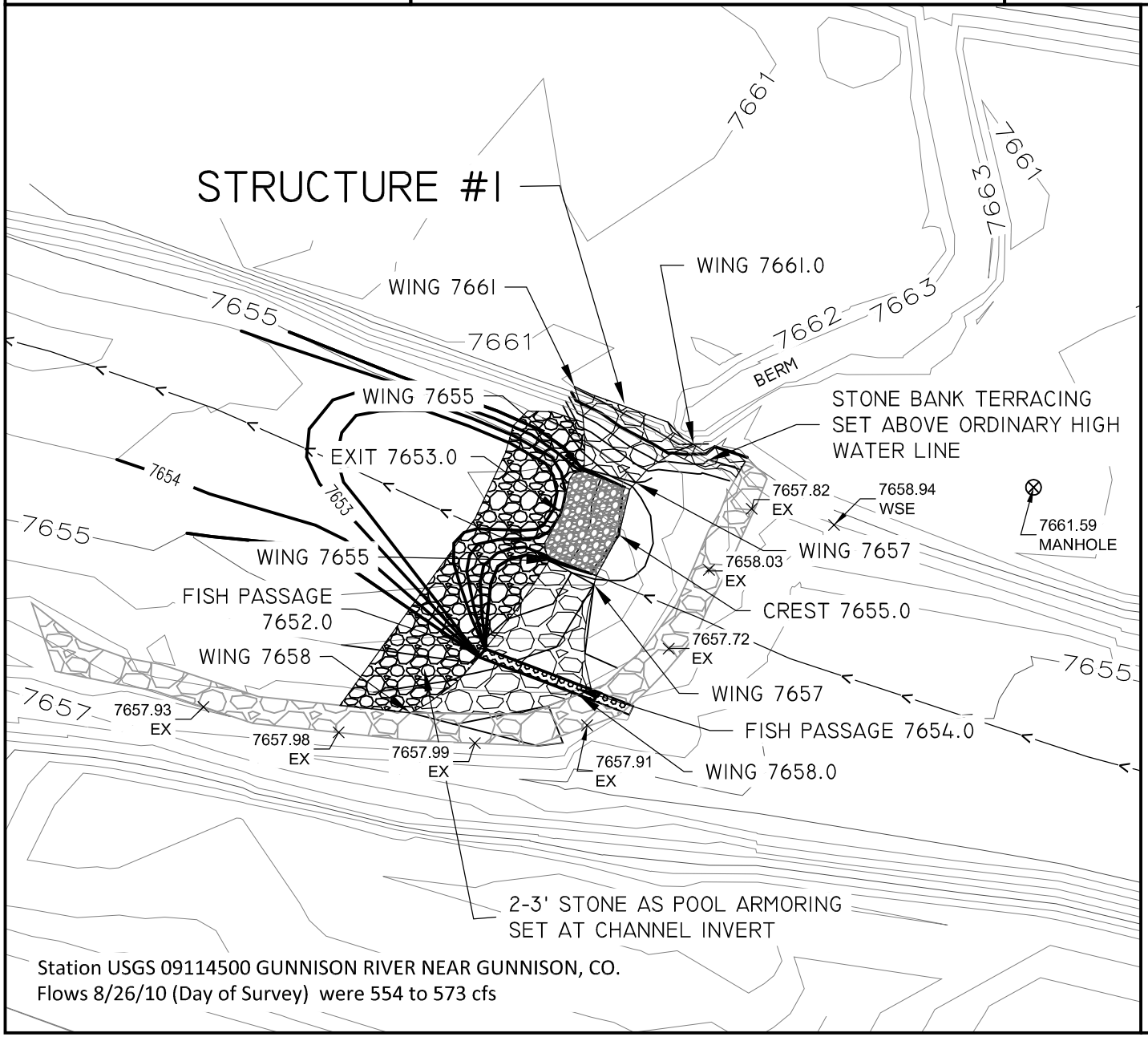
DATE	November 5, 2010
SHEET	3 of 11



Station USGS 09114500 GUNNISON RIVER NEAR GUNNISON, CO.
Flows 8/26/10 (Day of Survey) were 554 to 573 cfs

LEGEND

- EXISTING COUNTOUR LINES
- STRUCTURE LOW FLOW
- STRUCTURE WING
- POOL ARMORING
- FISH PASSAGE (CONCEPTUAL LEVEL ONLY)
- EXISTING DIVERSION
- THALWEG AND DIRECTION OF FLOW

NOTES:
1) All elevations given in feet above sea level.
2) Rock fill/hatch images shown for illustrative purposes. Not to scale.

N

SCALE: 1" = 50'

0 50

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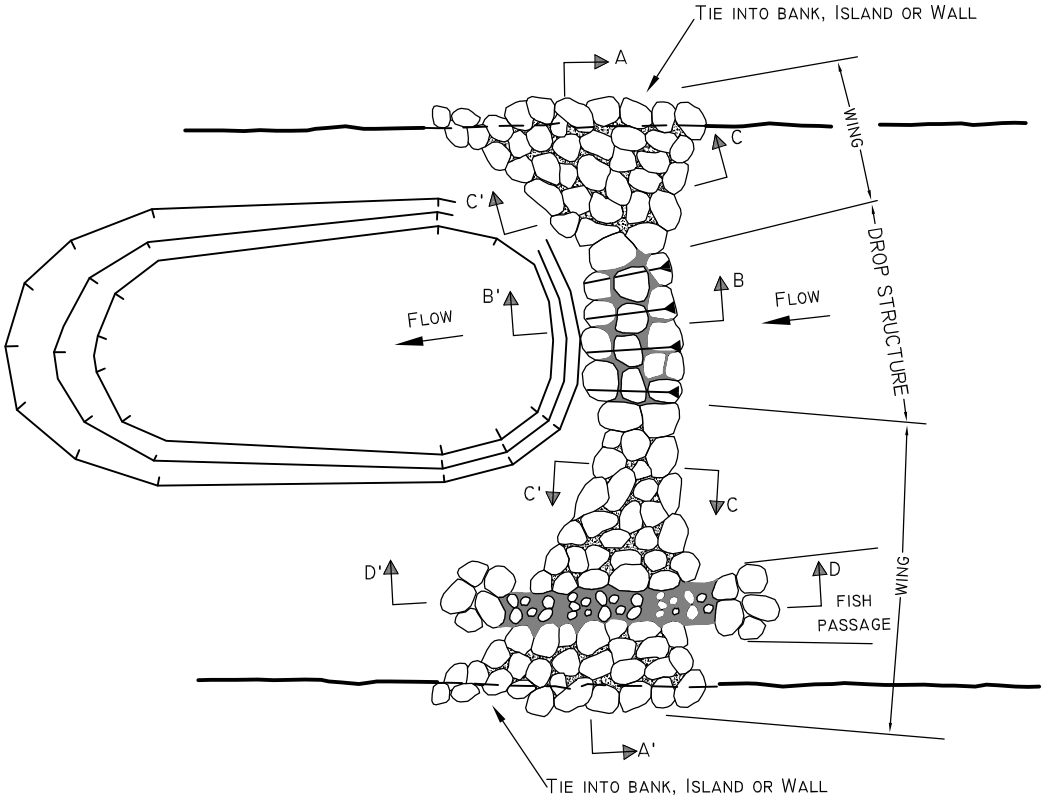
TYPICAL DETAILS-A

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
SHEET	4 of 11

Typical Drop Structure



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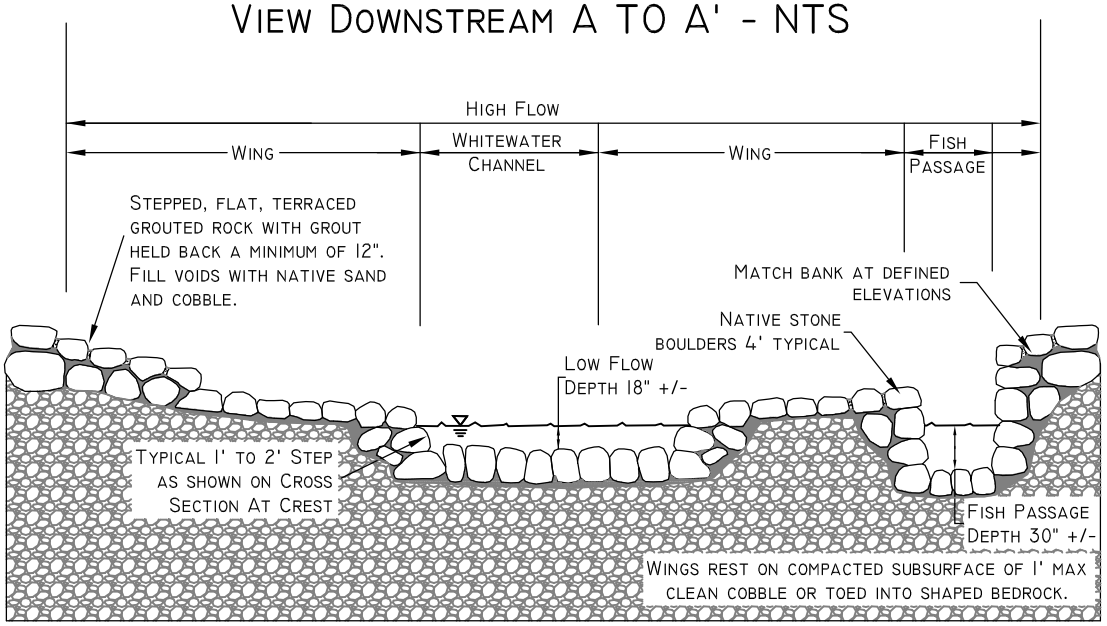
TYPICAL DETAILS-B

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
SHEET	5 of 11

Typical Drop Structure Cross Section
View Downstream A to A' - NTS



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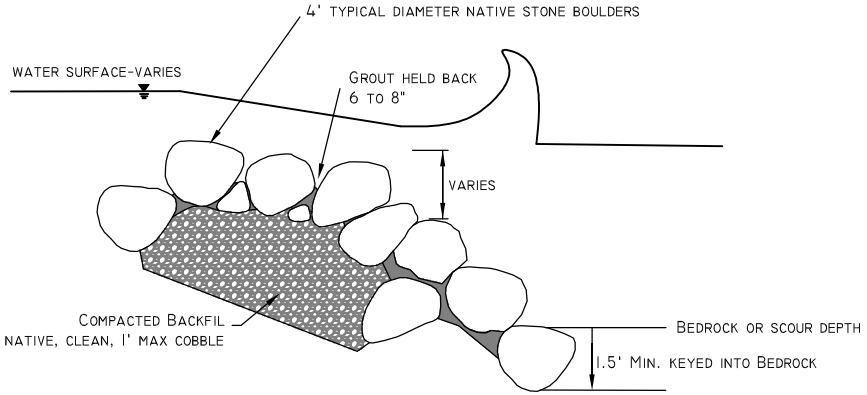
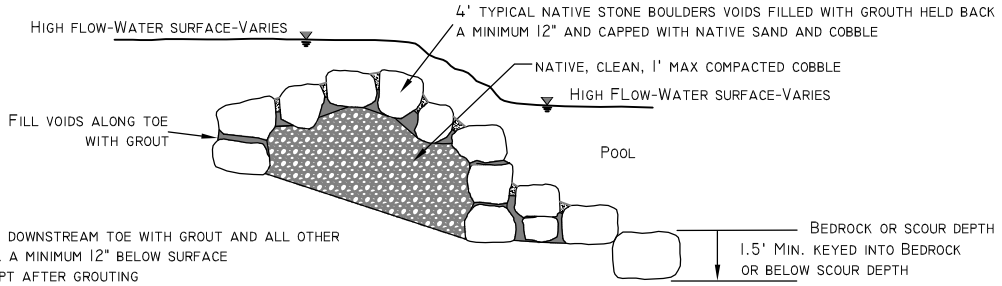
TYPICAL DETAILS-C

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
SHEET	6 of 11



TYPICAL PROFILE OF ROCK IN CENTER LOW-FLOW, B TO B'
N.T.S



NOTE:
A) Fill voids along upstream and downstream toe with grout and all other voids filled with grout held back a minimum 12" below surface
All rock to to be clean and swept after grouting
B) Make wing rounded to prevent deep water boat pins on upstream side as as specified by whitewater engineer.
C) Step back side of wings with 18" to 30" steps to break up hydraulics
D) Capp voids on top of the wing with native sand and cobble.

TYPICAL PROFILE OF ROCK IN "WING & ISLAND", C TO C'
N.T.S

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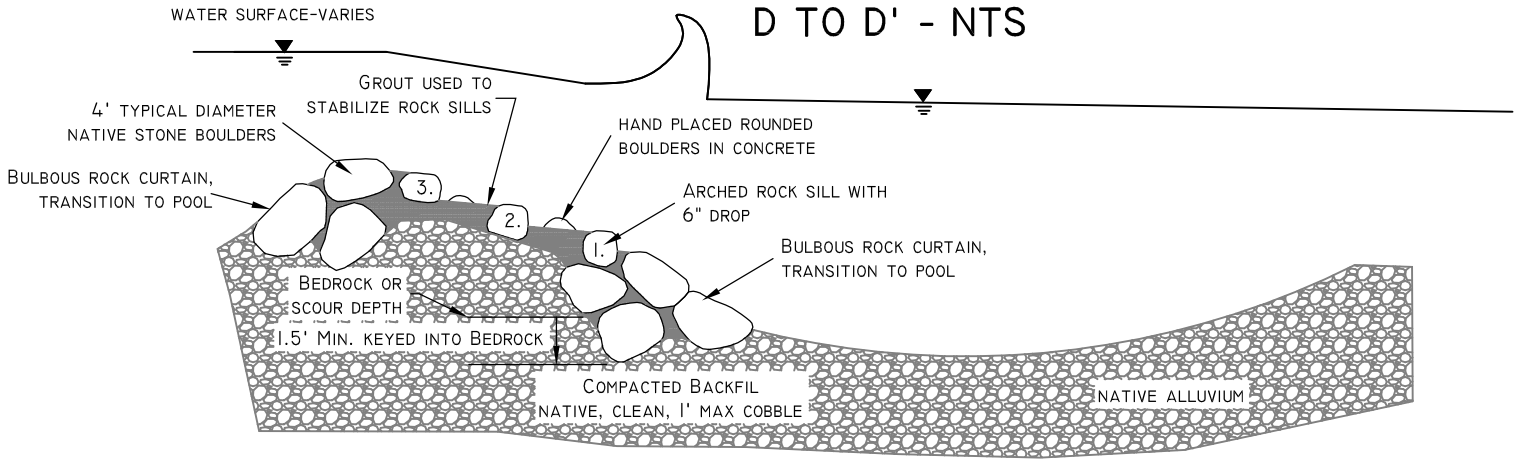
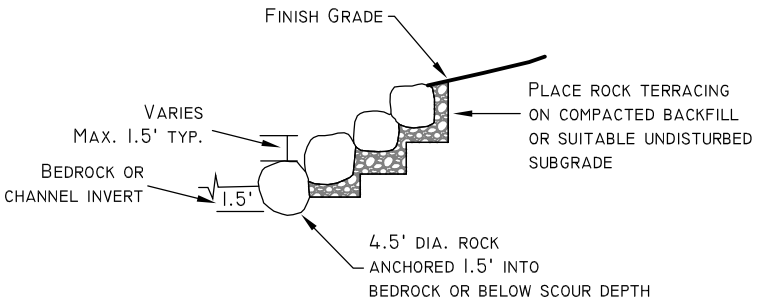
TYPICAL DETAILS-D

PRELIMINARY - NOT FOR CONSTRUCTION

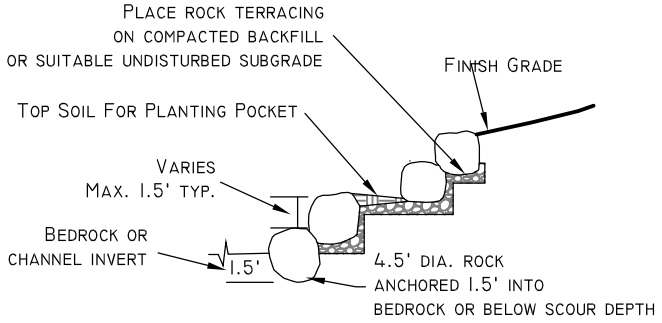
APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
SHEET	7 of 11

TYPICAL SECTION OF DROP STRUCTURE, IN FISH PASSAGE CHANNEL D TO D' - NTS





TERRACED ROCK TYPICAL N.T.S



TERRACED ROCK TYPICAL WITH PLANTING POCKET N.T.S

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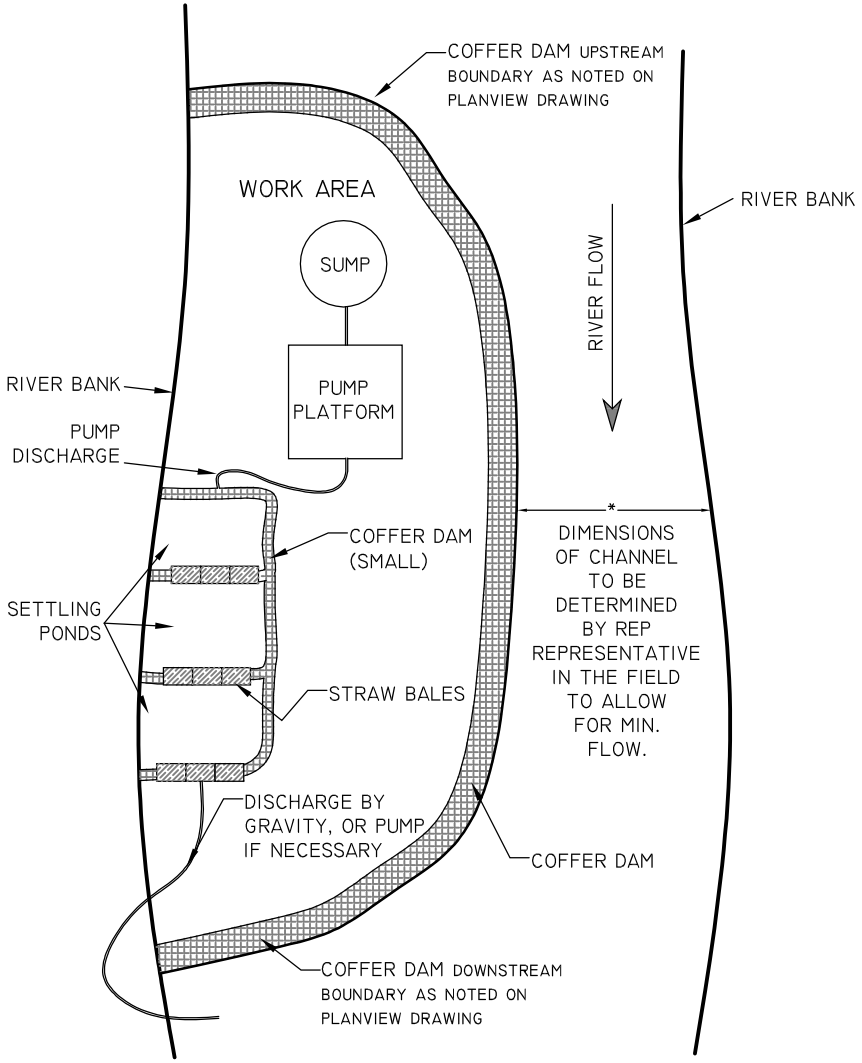
TYPICAL DETAILS-E

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
SHEET	8 of 11

Typical Layout Dewatering Area

Note: Schematic Layout to describe functionality only. Actual layout to be determined by qualified contractor, per permit conditions.



COFFER DAM

HAY BALES (PURE HAY)

NOTES: DEWATERING AREA DETAILS:

1. SUMPS CAN BE MADE FROM DIGGING A HOLE AND INSERTING A PERFORATED PIPE AND BACKFILLING WITH CLEAN DRAIN ROCK OR OTHER APPROVED METHOD.
2. SETTLING BASINS SHOULD BE BASED UPON SITE SPECIFICS (I.E. INFILTRATION AND SETTLING RATES, PARTICLE SIZE). DETENTION TIMES WILL BE BASED UPON THE SIZE OF THE SUSPENDED PARTICLES. IF THERE IS EXCESSIVE LEAKAGE THROUGH ANY COFFER DAM, BASE ROCK IS TO BE LINED WITH VISQUENE PRIOR TO BEING COVERED IN COBBLE. NUMBER OF SETTLING PONDS TO BE DETERMINED BY CLARITY OF DISCHARGE FLUID.
3. UPON COMPLETION VISQUENE AND SETTLED FINES SHALL BE REMOVED AND DISPOSED OF OFFSITE BY THE CONTRACTOR.
4. PUMP STATION SHALL BE ELEVATED. FUEL CONTAINMENT BMP'S SHALL BE ONSITE AT ALL TIMES.
5. PUMP REMAINING WATER IN CONSTRUCTION AREA AS NECESSARY, TO MANAGE GROUNDWATER AND LEAKAGE. ALL DISCHARGED WATER MUST BE ROUTED TO THE SETTLING BASINS.
6. CONTRACTOR IS RESPONSIBLE FOR OWN SECURITY DURING CONSTRUCTION. ANY VANDALISM WILL BE CORRECTED AT CONTRACTOR'S OWN EXPENSE.
7. DETAILS SUBJECT TO REVIEW AND CHANGE DURING 404 PERMIT APPLICATION PROCESS.

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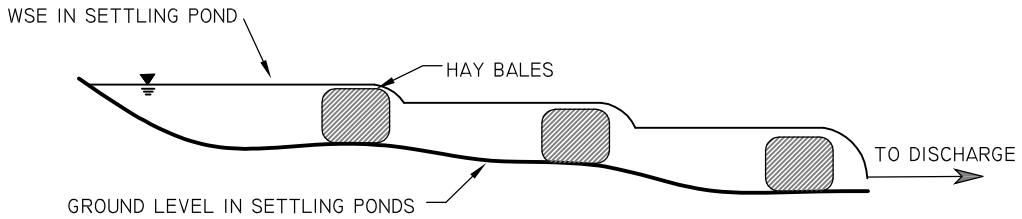
TYPICAL DETAILS-F

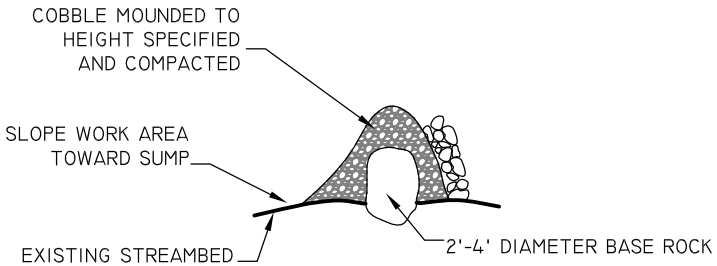
PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
SHEET	9 of 11



TYPICAL SECTION IN SETTLING POND

Note: Schematic Layout to describe functionality only. Actual layout to be determined by contractor, per permit conditions.



Typical Coffer Dam Cross Section

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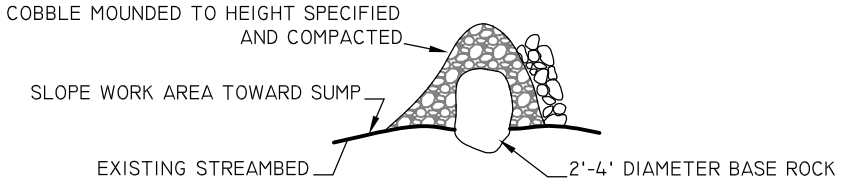
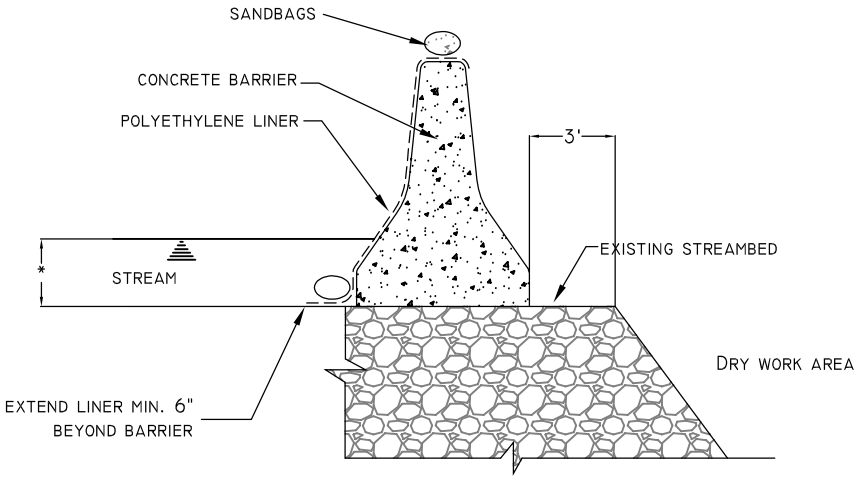
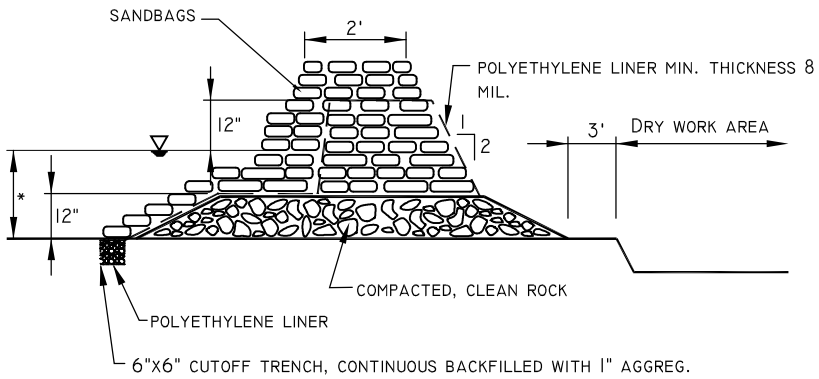
TYPICAL DETAILS-G

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
SHEET	10 of 11







ALTERNATIVE COFFERDAM METHODS

NOTE: ALTERNATE METHODS PRESENTED TO DESCRIBE FUNCTIONALITY ONLY. ACTUAL METHOD TO BE DETERMINED BY QUALIFIED CONTRACTOR, PER PERMIT CONDITIONS, IN ORDER TO ACHIEVE DRY WORK AREA.

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SPECIFICATIONS

PRELIMINARY - NOT FOR CONSTRUCTION

APPLICANT	Gunnison County
LOCATION	Gunnison River, Gunnison, Colorado
DATE	November 5, 2010
SHEET	11 of 11

General Notes

Engineers Oversight

1. All elevations, dimensions, alignments and orientation of all elements shown in the plans must be approved by the Engineer or Engineer's representative ("REP Engineer or REP Representative")

2. Work shall not commence until after the date of the on-site pre-construction meeting which will be attended by representatives of the Project Owner, Engineer, Contractor and any Sub-Contractors. In the event that work does not begin immediately following the pre-construction meeting, the contractor shall provide representatives of the Project Owner, REP Engineer, any Sub-Contractors, and relevant agencies noted in the permit, two weeks notice before construction commences.

Permits

1. The Contractor shall have copies of any required permits on site at all times.
2. The Contractor is responsible for compliance with all conditions and stipulations of all required permits.

Utilities

1. The Contractor shall locate all utilities within the project area prior to construction.
2. No excavation shall occur in the area surrounding a utility crossing. No improvements, that may cause scour; are to be placed in the vicinity of an at grade, above or below grade, utility crossing.
3. If utilities are identified within the project area. A minimum buffer of no disturbance is to be maintained on all utility crossings.

Rock

Quality

1. Individual stone boulders shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering.
2. The boulders shall be rounded to sub-rounded in shape. At a minimum exposed rock should have one flat surface and this should be the only exposed surface.
3. The rock shall have the following properties:
   A) Bulk specific gravity (saturated surface-dry basis) not less than 2.5.
   B) Absorption not more than 2% by weight.
   C) The bulk specific gravity and absorption shall be determined by AST M Method C-127.
4. Rock that fails to meet these requirements may be accepted only if similar rock from the same source has been demonstrated to be sound after five years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated. Alternatively native or imported stone, already at the site and meeting the standards outlined above, may be used.

Gradation

1. Rock shall be of the size and placed in a manner as specified by REP Engineer.

Site Preparation- Rocks Placed in Bank "Stone Terracing"

1. All rock placed as bank terracing or stabilization shall be keyed into the banks a minimum of 12" in the horizontal and vertical direction.
2. All stone terracing shall be set such that it is supported by placed stone or solid, existing, foundational material, as approved by REP Engineer.
3. All stone terracing shall be backfilled with clean fill.

Site Preparation- Rocks Placed in Channel

1. All rock structures shall be placed as directed by REP Representative.
2. No rock placement shall occur in channel until appropriate water control measures are in place (as outlined in the water control detailed plan).
3. Excavation for keystone boulders shall be below scour depth.

Placement

1. Stone boulders shall be placed as shown on the drawings without any gaps, so that each boulder touches the next one.
2. Each stone shall be placed to the final position be suitable equipment for handling material and, if necessary; the stone shall be picked up and repositioned.
3. Dragline buckets and skips shall not be used for placement of boulders. It should be anticipated that re-handling of individual stones, after initial placement will be required to achieve required slopes, grades, elevations andposition.
4. The engineer shall observe all rock placement and approve of the placement before boulders are chinked or backfilled, unless explicit exception is made by the engineer before placement.

Grout

Placement

1. Grout shall be pumped into voids as directed be REP Representative.
2. Low flow grout should be "held back 6 to 8 inches" from exposed rock. All other grout should be "held back 12 to 18".
3. All exposed visible grout shall be smoothed, even in void spaces.
4. At completion of placement all rock should be cleaned of concrete and concrete residue.
5. Grout shall not be placed unless appropriate water control measures are in place.
6. BMP's shall be employed to ensure that no water will be allowed to flow over the fresh concrete before the concrete has cured.

Material

1. Grout shall consist of Portland cement, sand and gravel, thoroughly mixed with water to produce grout having a thick, creamy consistency. The aggregate, for grout, shall consist of 70% sand and 30% 3/8 rock. Maximum aggregate shall be ½ inch. The concrete mix shall indicate evidence of meeting of exceeding the following criteria unless otherwise shown on the drawings.
   A) Minimum Strength: 4000lbs
   B) Slump: ASTM C-143, 3-5 inches

Appendix 2: HEC-RAS Output Summary

HEC-RAS Version 4.0.0 March 2008
U.S. Army Corps 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: Gunnison
Project File : Gunnison.prj
Run Date and Time: 4/26/2011 11:37:13 AM

Project in English units

PLAN DATA

Plan Title: Proposed
Plan File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.p03

Geometry Title: Proposed
Geometry File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.g04

Flow Title : Flows
Flow File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.f01

Plan Summary Information:
Number of: Cross Sections = 12 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: Flows
Flow File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.f01

Flow Data (cfs)

River	Reach	RS	Day of Survey	100 Year
Gunnison River	75 Ditch	1796	560	8930

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Gunnison River	75 Ditch	Day of Survey	Known WS = 7658.76	Known WS = 7654.15
Gunnison River	75 Ditch	100 Year	Normal S = -0.00111	Normal S = 0.0096

GEOMETRY DATA

Geometry Title: Proposed
Geometry File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.g04

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1796

INPUT
Description:
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7662.47	2.87	7662.48	31.19	7663.05	31.29	7663.05	37.66	7662.58
37.7	7662.59	48.08	7658.79	48.13	7658.76	48.2	7658.73	62.61	7654.08
62.74	7654.06	63.66	7654.08	105.82	7654.73	112.82	7655.28	113.32	7655.29
113.94	7655.29	122.94	7656.11	134.43	7657.32	135.27	7657.49	150.29	7658.64
150.32	7658.66	156.92	7660.5	164.1	7662.52	164.29	7662.58	164.3	7662.6
186.09	7663.82	214.87	7663.31	234.3	7667.16	240.75	7668.04	247.49	7668.27
266.17	7668.95	270.11	7669.06	285.12	7669.07				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	37.7	.036	164.1	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
37.7	164.1	108.3	108.3	108.3	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1688

INPUT

Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7664.8	4.56	7664.81	4.67	7664.78	24.62	7662.95	33.11	7661.95
40.44	7658.77	40.6	7658.7	45.87	7656.73	50.19	7655.11	50.2	7655.12
55.39	7654.18	55.4	7654.19	55.41	7654.18	90.37	7654.67	90.6	7654.68
90.88	7654.69	100.54	7654.7	112.75	7654.73	112.8	7654.74	112.85	7654.73
114.87	7654.94	125.62	7656.87	132.76	7658.79	140.66	7661.95	141.31	7662.19
141.33	7662.21	141.38	7662.21	141.43	7662.2	179.25	7662.21	185.66	7662.32
212.64	7662.77	214.92	7662.72	252.51	7661.71	253.38	7661.69	262.74	7661.71
302.84	7661.88	330.78	7666.46	338.24	7668.12	348.24	7668.13		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	33.11	.036	141.31	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
33.11	141.31	101.6	101.6	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1586

INPUT
Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7664.29	9.14	7664.31	10.66	7663.97	19.45	7662.81	22.61	7661.62
30.89	7658.72	38.77	7655.74	46.16	7654.76	46.65	7654.7	58.33	7655
69.47	7654.82	69.69	7654.83	80.35	7655.17	93.65	7655.67	93.69	7655.68
93.74	7655.68	107.28	7655.87	118.13	7655.82	135.93	7657.26	136.95	7657.54
138.14	7657.87	142.15	7658.89	148.26	7660.22	155.09	7661.7	168.03	7661.48
188.09	7661.21	200.93	7661.1	202.67	7661.11	220.71	7661.53	225.71	7661.66
238.7	7661.55	243.72	7661.42	249.64	7661.25	266.12	7661	275.81	7660.98
320.5	7661.24	333.34	7664.58	338.69	7665.99	347.78	7666		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	22.61	.036	155.09	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
22.61	155.09	32.3	32.3	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1554

INPUT
Description: Existing Diversion Crest
Station Elevation Data num= 53

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7663.19	4.69	7663.21	17.81	7662.74	18.45	7662.6	21.87	7661.12
27.31	7658.67	39.3	7655.48	44.69	7654.88	58.44	7658	77.88	7657.23
78.06	7655.46	81.64	7655.51	81.75	7657.1	83.48	7657.3	91.82	7657.68
118.3	7657.77	125.94	7657.8	141.27	7657.82	142.48	7658.25	155.03	7658
158.42	7657.91	161.18	7658.37	162	7658.48	165.62	7659.19	178.93	7661.41
188.49	7661.36	198.29	7661.47	200.96	7663.24	201.1	7663.42	201.33	7663.42
201.4	7663.41	206.94	7663.41	224.93	7663.15	227.59	7663.35	235.97	7663.47
255.6	7663.34	257.79	7663.35	258.11	7663.35	272.93	7663.94	274.72	7663.95

274.95	7663.97	285.74	7663.98	286.07	7663.98	286.99	7663.95
311.22	7663.62	312.47	7663.62	314.3	7663.6	349.59	7663.64
350.08	7663.66	362.67	7664.19	363.79	7664.36	365.59	7664.29
371.97	7664.3						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21.87	.036	178.93	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
21.87	178.93	32.8	32.8	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1521

INPUT
Description: Crest Structure 1
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7663.15	7.66	7663.16	8.78	7663.06	21.77	7662.58	22.53	7662.09
29.9	7658.68	47.34	7654.99	58.97	7658	59.23	7658.01	72.76	7658.01
79.53	7657.85	79.65	7654	82.65	7654.01	82.8	7657.7	114.88	7657
117.74	7655.33	117.88	7655.25	133.01	7655	148.14	7655.25	151.1	7657
153.83	7657.34	154.07	7657.4	154.32	7657.46	155.84	7657.88	173.13	7661.91
173.5	7661.32	173.52	7661.28	180.88	7661.54	181.02	7661.56	182.23	7661.56
197.41	7660.95	197.61	7660.96	197.8	7660.95	200.63	7660.96	203.44	7660.96
203.52	7661.01	211.12	7661.31	218.34	7661.5	231.7	7661.39	293.72	7661.1
305.54	7661.46	307.72	7661.38	313.05	7661.72	319.09	7661.96	320.33	7662.21
323.96	7662.76	327.8	7662.87	329.74	7662.88				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	22.53	.03	173.13	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
22.53	173.13	20	20	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1501

INPUT
Description: Exit Structure 1
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7663.03	10.22	7663.04	22.01	7662.1	22.23	7662.08	24.84	7661.99
29.86	7658.68	47.84	7655.36	57.67	7658	63.68	7658.01	81.89	7656.97
86.91	7656.7	87.06	7652	90.19	7652.01	90.28	7656.05	90.29	7656.2
90.3	7656.5	125.64	7655	126.51	7653.5	126.65	7653.25	141.51	7653
156.91	7653.25	157.91	7655	159.53	7655.4	159.65	7655.42	162.78	7656.17
162.81	7656.19	181.47	7661.36	181.62	7661.11	184.48	7661.21	185.88	7661.26
198.8	7661.37	207.63	7661.01	209.02	7661.02	210.4	7661.01	212.05	7661.02
213.67	7661.02	213.8	7661.1	222.23	7661.33	282.37	7660.79	304.37	7660.67
308.94	7660.81	326.4	7661.79	327.52	7661.83	327.63	7661.86	327.95	7661.9
328.29	7661.92	342.2	7662.32	349.54	7662.33				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	24.84	.03	181.47	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
24.84	181.47	22	22	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1479

INPUT
Description: Pool Structure 1
Station Elevation Data num= 64

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7662.99	7.24	7663	10.21	7662.84	22.22	7661.89	26.78	7658.68
44.07	7655.54	53.15	7658	61.99	7658.01	64.65	7657.8	72.49	7657
75.96	7656.82	80.05	7656.65	83.18	7655.29	89.78	7655	91.37	7654.77
91.42	7654	93.06	7653.76	93.1	7653	94.5	7652.76	94.54	7652
100.34	7652.01	104.52	7652	105.23	7652.26	109.39	7653	110.88	7653.22
112.26	7653.27	115.81	7653.4	119.64	7653.21	120.82	7653.13	121.48	7653
125.04	7652.39	126.36	7652	149.83	7652.01	154.68	7652.01	156.89	7652.8
157.45	7653	159.01	7653.5	160.31	7654	160.83	7654.2	162.89	7655
166.4	7655.94	171.48	7656.49	177.52	7660	177.7	7660.06	179.13	7660.9
179.55	7660.92	205.91	7661.15	207.5	7661.08	210.2	7661.09	212.86	7661.08
213.19	7661.09	213.52	7661.09	213.55	7661.11	215.28	7661.15	253.47	7660.82
283.86	7660.62	306.31	7660.5	310.3	7660.84	321.58	7661.36	327.32	7661.32
327.79	7661.34	334.79	7661.63	344.36	7661.91	353.36	7661.92		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	22.22	.036	179.13	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
22.22	179.13	48.2	48.2	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1431

INPUT
Description: Pool Structure 1
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7662.95	14.57	7662.96	30.14	7662.14	30.15	7662.15	30.21	7662.14
30.22	7662.12	30.67	7661.89	37.52	7658.59	48.3	7656.12	57.16	7657.97
83.46	7656.26	93.54	7655.76	113.22	7655.13	116.33	7655	118.45	7654.7
122.57	7654	125.26	7653.57	131.92	7653	137.88	7652.13	138.69	7652
142.15	7652.01	146.35	7652	158.41	7652.01	161.61	7652	163.35	7652.01
167.5	7652.48	171.05	7653	171.93	7653.35	175.28	7654	176.49	7654.32
178.23	7655	179.13	7655.19	183.55	7656.02	193.78	7661.07	198.7	7661.12
207.63	7661.05	210.53	7661.06	210.75	7661.06	213.6	7661.06	213.88	7661.06
231.96	7661	291.57	7660.78	306.99	7660.94	361.05	7660.43	364.58	7660.44
374.51	7660.43								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30.15	.036	193.78	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
30.15	193.78	48.2	48.2	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1383

INPUT
Description:
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7662.89	15.99	7662.9	16	7662.89	19.57	7662.76	32.17	7662.29
32.59	7662.14	42.31	7658.58	49.21	7656.72	61.22	7657.99	63.48	7658.15
78.88	7656.19	83.57	7656.33	98.82	7655.53	106.86	7655.26	110.83	7655.07
121.69	7654.67	132.39	7654.29	145.26	7654.2	152.24	7654.07	161.98	7653.94
162.62	7653.91	181.72	7653.87	183.66	7653.87	187.59	7654.41	196.8	7655.74
204.37	7661.03	206.16	7660.97	211.83	7661.27	214.18	7661.33	214.27	7661.34
214.35	7661.34	217.27	7661.34	220.2	7661.34	232.09	7661.33		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	32.59	.036	204.37	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
32.59	204.37	56.4	56.4	56.4	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
40.37	63.44	7658.2	F

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1326

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7663.03	9.56	7663.04	20.13	7660.04	33.22	7655.91	36.45	7655.94
50.66	7659.55	65.16	7656.79	70.18	7656.16	89.79	7655.19	116.6	7654.22
117.06	7654.2	131.18	7653.62	132.72	7653.62	155.01	7652.61	183.67	7655.13
197.4	7660.14	199.51	7660.23	201.49	7660.27	205.15	7660.32	209.31	7660.42
216	7660.43								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	9.56	.036	197.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9.56	197.4	130.1	130.1	130.1	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
20.47	50.46	7659.53	F

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1196

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7656.9	7.68	7656.92	13.22	7655.97	15.21	7655.98	20.49	7655.97
21.93	7655.97	32.51	7658.3	33.95	7658.39	43.05	7657.56	52.52	7655.88
139.01	7651.27	162.83	7654.81	167.47	7655.03	177.29	7655.04		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	52.52	.036	167.47	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
52.52	167.47	136	136	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
6.69	27.45	7656.9	F

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1060

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7657.65	15.59	7657.66	17.96	7657.88	22.7	7657.49	30.46	7657.67
32.99	7657.6	39	7655.87	42.76	7654.16	44.96	7653.69	50.3	7652.9
54.99	7651.83	64.27	7651.17	69.1	7650.39	88.52	7649.97	95	7654.24
98.48	7655.04	106.97	7655.92	111.03	7655.97	114.06	7656.4	115.79	7656.48
126.45	7658.28	136.77	7658.5	139.72	7658.37	149	7658.38		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	32.99	.036	126.45	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
32.99	126.45	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Gunnison River

Reach	River Sta.	n1	n2	n3
75 Ditch	1796	.05	.036	.05
75 Ditch	1688	.05	.036	.05
75 Ditch	1586	.05	.036	.05
75 Ditch	1554	.05	.036	.05
75 Ditch	1521	.05	.03	.05
75 Ditch	1501	.05	.03	.05
75 Ditch	1479	.05	.036	.05
75 Ditch	1431	.05	.036	.05
75 Ditch	1383	.05	.036	.05
75 Ditch	1326	.05	.036	.05
75 Ditch	1196	.05	.036	.05
75 Ditch	1060	.05	.036	.05

SUMMARY OF REACH LENGTHS

River: Gunnison River

Reach	River Sta.	Left	Channel	Right
75 Ditch	1796	108.3	108.3	108.3
75 Ditch	1688	101.6	101.6	101.6
75 Ditch	1586	32.3	32.3	32.3
75 Ditch	1554	32.8	32.8	32.8
75 Ditch	1521	20	20	20
75 Ditch	1501	22	22	22
75 Ditch	1479	48.2	48.2	48.2
75 Ditch	1431	48.2	48.2	48.2
75 Ditch	1383	56.4	56.4	56.4
75 Ditch	1326	130.1	130.1	130.1
75 Ditch	1196	136	136	136
75 Ditch	1060			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Gunnison River

Reach	River Sta.	Contr.	Expan.
75 Ditch	1796	.1	.3
75 Ditch	1688	.1	.3
75 Ditch	1586	.1	.3
75 Ditch	1554	.1	.3
75 Ditch	1521	.1	.3
75 Ditch	1501	.1	.3
75 Ditch	1479	.1	.3
75 Ditch	1431	.1	.3
75 Ditch	1383	.1	.3
75 Ditch	1326	.1	.3
75 Ditch	1196	.1	.3
75 Ditch	1060	.1	.3

HEC-RAS Version 4.0.0 March 2008
U.S. Army Corps 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: Gunnison
Project File : Gunnison.prj
Run Date and Time: 4/26/2011 11:37:13 AM

Project in English units

PLAN DATA

Plan Title: Proposed
Plan File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.p03

Geometry Title: Proposed
Geometry File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.g04

Flow Title : Flows
Flow File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.f01

Plan Summary Information:
Number of: Cross Sections = 12 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: Flows
Flow File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.f01

Flow Data (cfs)

River	Reach	RS	Day of Survey	100 Year
Gunnison River	75 Ditch	1796	560	8930

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Gunnison River	75 Ditch	Day of Survey	Known WS = 7658.76	Known WS = 7654.15
Gunnison River	75 Ditch	100 Year	Normal S = -0.00111	Normal S = 0.0096

GEOMETRY DATA

Geometry Title: Proposed
Geometry File : C:\Users\Mike\Documents\gunni\Gunnison HEC RAS-ar\Gunnison.g04

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1796

INPUT
Description:
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7662.47	2.87	7662.48	31.19	7663.05	31.29	7663.05	37.66	7662.58
37.7	7662.59	48.08	7658.79	48.13	7658.76	48.2	7658.73	62.61	7654.08
62.74	7654.06	63.66	7654.08	105.82	7654.73	112.82	7655.28	113.32	7655.29
113.94	7655.29	122.94	7656.11	134.43	7657.32	135.27	7657.49	150.29	7658.64
150.32	7658.66	156.92	7660.5	164.1	7662.52	164.29	7662.58	164.3	7662.6
186.09	7663.82	214.87	7663.31	234.3	7667.16	240.75	7668.04	247.49	7668.27
266.17	7668.95	270.11	7669.06	285.12	7669.07				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	37.7	.036	164.1	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
37.7	164.1	108.3	108.3	108.3	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1688

INPUT

Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7664.8	4.56	7664.81	4.67	7664.78	24.62	7662.95	33.11	7661.95
40.44	7658.77	40.6	7658.7	45.87	7656.73	50.19	7655.11	50.2	7655.12
55.39	7654.18	55.4	7654.19	55.41	7654.18	90.37	7654.67	90.6	7654.68
90.88	7654.69	100.54	7654.7	112.75	7654.73	112.8	7654.74	112.85	7654.73
114.87	7654.94	125.62	7656.87	132.76	7658.79	140.66	7661.95	141.31	7662.19
141.33	7662.21	141.38	7662.21	141.43	7662.2	179.25	7662.21	185.66	7662.32
212.64	7662.77	214.92	7662.72	252.51	7661.71	253.38	7661.69	262.74	7661.71
302.84	7661.88	330.78	7666.46	338.24	7668.12	348.24	7668.13		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	33.11	.036	141.31	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
33.11	141.31	101.6	101.6	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1586

INPUT
Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7664.29	9.14	7664.31	10.66	7663.97	19.45	7662.81	22.61	7661.62
30.89	7658.72	38.77	7655.74	46.16	7654.76	46.65	7654.7	58.33	7655
69.47	7654.82	69.69	7654.83	80.35	7655.17	93.65	7655.67	93.69	7655.68
93.74	7655.68	107.28	7655.87	118.13	7655.82	135.93	7657.26	136.95	7657.54
138.14	7657.87	142.15	7658.89	148.26	7660.22	155.09	7661.7	168.03	7661.48
188.09	7661.21	200.93	7661.1	202.67	7661.11	220.71	7661.53	225.71	7661.66
238.7	7661.55	243.72	7661.42	249.64	7661.25	266.12	7661	275.81	7660.98
320.5	7661.24	333.34	7664.58	338.69	7665.99	347.78	7666		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	22.61	.036	155.09	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
22.61	155.09	32.3	32.3	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1554

INPUT
Description: Existing Diversion Crest
Station Elevation Data num= 53

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7663.19	4.69	7663.21	17.81	7662.74	18.45	7662.6	21.87	7661.12
27.31	7658.67	39.3	7655.48	44.69	7654.88	58.44	7658	77.88	7657.23
78.06	7655.46	81.64	7655.51	81.75	7657.1	83.48	7657.3	91.82	7657.68
118.3	7657.77	125.94	7657.8	141.27	7657.82	142.48	7658.25	155.03	7658
158.42	7657.91	161.18	7658.37	162	7658.48	165.62	7659.19	178.93	7661.41
188.49	7661.36	198.29	7661.47	200.96	7663.24	201.1	7663.42	201.33	7663.42
201.4	7663.41	206.94	7663.41	224.93	7663.15	227.59	7663.35	235.97	7663.47
255.6	7663.34	257.79	7663.35	258.11	7663.35	272.93	7663.94	274.72	7663.95

274.95	7663.97	285.74	7663.98	286.07	7663.98	286.99	7663.95
311.22	7663.62	312.47	7663.62	314.3	7663.6	349.59	7663.64
350.08	7663.66	362.67	7664.19	363.79	7664.36	365.59	7664.29
371.97	7664.3						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21.87	.036	178.93	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
21.87	178.93	32.8	32.8	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1521

INPUT
Description: Crest Structure 1
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7663.15	7.66	7663.16	8.78	7663.06	21.77	7662.58	22.53	7662.09
29.9	7658.68	47.34	7654.99	58.97	7658	59.23	7658.01	72.76	7658.01
79.53	7657.85	79.65	7654	82.65	7654.01	82.8	7657.7	114.88	7657
117.74	7655.33	117.88	7655.25	133.01	7655	148.14	7655.25	151.1	7657
153.83	7657.34	154.07	7657.4	154.32	7657.46	155.84	7657.88	173.13	7661.91
173.5	7661.32	173.52	7661.28	180.88	7661.54	181.02	7661.56	182.23	7661.56
197.41	7660.95	197.61	7660.96	197.8	7660.95	200.63	7660.96	203.44	7660.96
203.52	7661.01	211.12	7661.31	218.34	7661.5	231.7	7661.39	293.72	7661.1
305.54	7661.46	307.72	7661.38	313.05	7661.72	319.09	7661.96	320.33	7662.21
323.96	7662.76	327.8	7662.87	329.74	7662.88				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	22.53	.03	173.13	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
22.53	173.13	20	20	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1501

INPUT
Description: Exit Structure 1
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7663.03	10.22	7663.04	22.01	7662.1	22.23	7662.08	24.84	7661.99
29.86	7658.68	47.84	7655.36	57.67	7658	63.68	7658.01	81.89	7656.97
86.91	7656.7	87.06	7652	90.19	7652.01	90.28	7656.05	90.29	7656.2
90.3	7656.5	125.64	7655	126.51	7653.5	126.65	7653.25	141.51	7653
156.91	7653.25	157.91	7655	159.53	7655.4	159.65	7655.42	162.78	7656.17
162.81	7656.19	181.47	7661.36	181.62	7661.11	184.48	7661.21	185.88	7661.26
198.8	7661.37	207.63	7661.01	209.02	7661.02	210.4	7661.01	212.05	7661.02
213.67	7661.02	213.8	7661.1	222.23	7661.33	282.37	7660.79	304.37	7660.67
308.94	7660.81	326.4	7661.79	327.52	7661.83	327.63	7661.86	327.95	7661.9
328.29	7661.92	342.2	7662.32	349.54	7662.33				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	24.84	.03	181.47	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
24.84	181.47	22	22	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1479

INPUT
Description: Pool Structure 1
Station Elevation Data num= 64

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7662.99	7.24	7663	10.21	7662.84	22.22	7661.89	26.78	7658.68
44.07	7655.54	53.15	7658	61.99	7658.01	64.65	7657.8	72.49	7657
75.96	7656.82	80.05	7656.65	83.18	7655.29	89.78	7655	91.37	7654.77
91.42	7654	93.06	7653.76	93.1	7653	94.5	7652.76	94.54	7652
100.34	7652.01	104.52	7652	105.23	7652.26	109.39	7653	110.88	7653.22
112.26	7653.27	115.81	7653.4	119.64	7653.21	120.82	7653.13	121.48	7653
125.04	7652.39	126.36	7652	149.83	7652.01	154.68	7652.01	156.89	7652.8
157.45	7653	159.01	7653.5	160.31	7654	160.83	7654.2	162.89	7655
166.4	7655.94	171.48	7656.49	177.52	7660	177.7	7660.06	179.13	7660.9
179.55	7660.92	205.91	7661.15	207.5	7661.08	210.2	7661.09	212.86	7661.08
213.19	7661.09	213.52	7661.09	213.55	7661.11	215.28	7661.15	253.47	7660.82
283.86	7660.62	306.31	7660.5	310.3	7660.84	321.58	7661.36	327.32	7661.32
327.79	7661.34	334.79	7661.63	344.36	7661.91	353.36	7661.92		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	22.22	.036	179.13	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
22.22	179.13	48.2	48.2	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1431

INPUT
Description: Pool Structure 1
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7662.95	14.57	7662.96	30.14	7662.14	30.15	7662.15	30.21	7662.14
30.22	7662.12	30.67	7661.89	37.52	7658.59	48.3	7656.12	57.16	7657.97
83.46	7656.26	93.54	7655.76	113.22	7655.13	116.33	7655	118.45	7654.7
122.57	7654	125.26	7653.57	131.92	7653	137.88	7652.13	138.69	7652
142.15	7652.01	146.35	7652	158.41	7652.01	161.61	7652	163.35	7652.01
167.5	7652.48	171.05	7653	171.93	7653.35	175.28	7654	176.49	7654.32
178.23	7655	179.13	7655.19	183.55	7656.02	193.78	7661.07	198.7	7661.12
207.63	7661.05	210.53	7661.06	210.75	7661.06	213.6	7661.06	213.88	7661.06
231.96	7661	291.57	7660.78	306.99	7660.94	361.05	7660.43	364.58	7660.44
374.51	7660.43								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30.15	.036	193.78	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
30.15	193.78	48.2	48.2	.1	.3

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1383

INPUT
Description:
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7662.89	15.99	7662.9	16	7662.89	19.57	7662.76	32.17	7662.29
32.59	7662.14	42.31	7658.58	49.21	7656.72	61.22	7657.99	63.48	7658.15
78.88	7656.19	83.57	7656.33	98.82	7655.53	106.86	7655.26	110.83	7655.07
121.69	7654.67	132.39	7654.29	145.26	7654.2	152.24	7654.07	161.98	7653.94
162.62	7653.91	181.72	7653.87	183.66	7653.87	187.59	7654.41	196.8	7655.74
204.37	7661.03	206.16	7660.97	211.83	7661.27	214.18	7661.33	214.27	7661.34
214.35	7661.34	217.27	7661.34	220.2	7661.34	232.09	7661.33		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	32.59	.036	204.37	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
32.59	204.37	56.4	56.4	56.4	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
40.37	63.44	7658.2	F

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1326

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7663.03	9.56	7663.04	20.13	7660.04	33.22	7655.91	36.45	7655.94
50.66	7659.55	65.16	7656.79	70.18	7656.16	89.79	7655.19	116.6	7654.22
117.06	7654.2	131.18	7653.62	132.72	7653.62	155.01	7652.61	183.67	7655.13
197.4	7660.14	199.51	7660.23	201.49	7660.27	205.15	7660.32	209.31	7660.42
216	7660.43								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	9.56	.036	197.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9.56	197.4	130.1	130.1	130.1	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
20.47	50.46	7659.53	F

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1196

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7656.9	7.68	7656.92	13.22	7655.97	15.21	7655.98	20.49	7655.97
21.93	7655.97	32.51	7658.3	33.95	7658.39	43.05	7657.56	52.52	7655.88
139.01	7651.27	162.83	7654.81	167.47	7655.03	177.29	7655.04		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	52.52	.036	167.47	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
52.52	167.47	136	136	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
6.69	27.45	7656.9	F

CROSS SECTION

RIVER: Gunnison River
REACH: 75 Ditch RS: 1060

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7657.65	15.59	7657.66	17.96	7657.88	22.7	7657.49	30.46	7657.67
32.99	7657.6	39	7655.87	42.76	7654.16	44.96	7653.69	50.3	7652.9
54.99	7651.83	64.27	7651.17	69.1	7650.39	88.52	7649.97	95	7654.24
98.48	7655.04	106.97	7655.92	111.03	7655.97	114.06	7656.4	115.79	7656.48
126.45	7658.28	136.77	7658.5	139.72	7658.37	149	7658.38		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	32.99	.036	126.45	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
32.99	126.45	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Gunnison River

Reach	River Sta.	n1	n2	n3
75 Ditch	1796	.05	.036	.05
75 Ditch	1688	.05	.036	.05
75 Ditch	1586	.05	.036	.05
75 Ditch	1554	.05	.036	.05
75 Ditch	1521	.05	.03	.05
75 Ditch	1501	.05	.03	.05
75 Ditch	1479	.05	.036	.05
75 Ditch	1431	.05	.036	.05
75 Ditch	1383	.05	.036	.05
75 Ditch	1326	.05	.036	.05
75 Ditch	1196	.05	.036	.05
75 Ditch	1060	.05	.036	.05

SUMMARY OF REACH LENGTHS

River: Gunnison River

Reach	River Sta.	Left	Channel	Right
75 Ditch	1796	108.3	108.3	108.3
75 Ditch	1688	101.6	101.6	101.6
75 Ditch	1586	32.3	32.3	32.3
75 Ditch	1554	32.8	32.8	32.8
75 Ditch	1521	20	20	20
75 Ditch	1501	22	22	22
75 Ditch	1479	48.2	48.2	48.2
75 Ditch	1431	48.2	48.2	48.2
75 Ditch	1383	56.4	56.4	56.4
75 Ditch	1326	130.1	130.1	130.1
75 Ditch	1196	136	136	136
75 Ditch	1060			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Gunnison River

Reach	River Sta.	Contr.	Expan.
75 Ditch	1796	.1	.3
75 Ditch	1688	.1	.3
75 Ditch	1586	.1	.3
75 Ditch	1554	.1	.3
75 Ditch	1521	.1	.3
75 Ditch	1501	.1	.3
75 Ditch	1479	.1	.3
75 Ditch	1431	.1	.3
75 Ditch	1383	.1	.3
75 Ditch	1326	.1	.3
75 Ditch	1196	.1	.3
75 Ditch	1060	.1	.3

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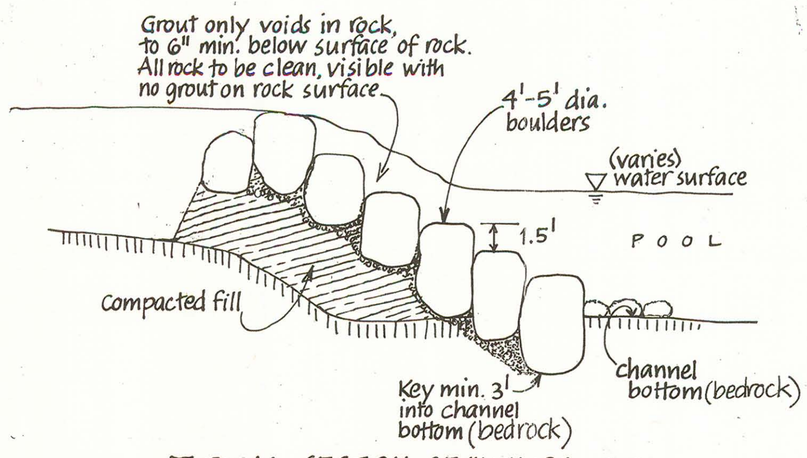
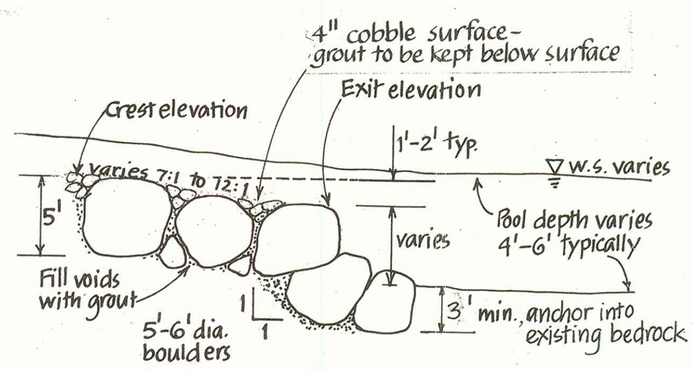
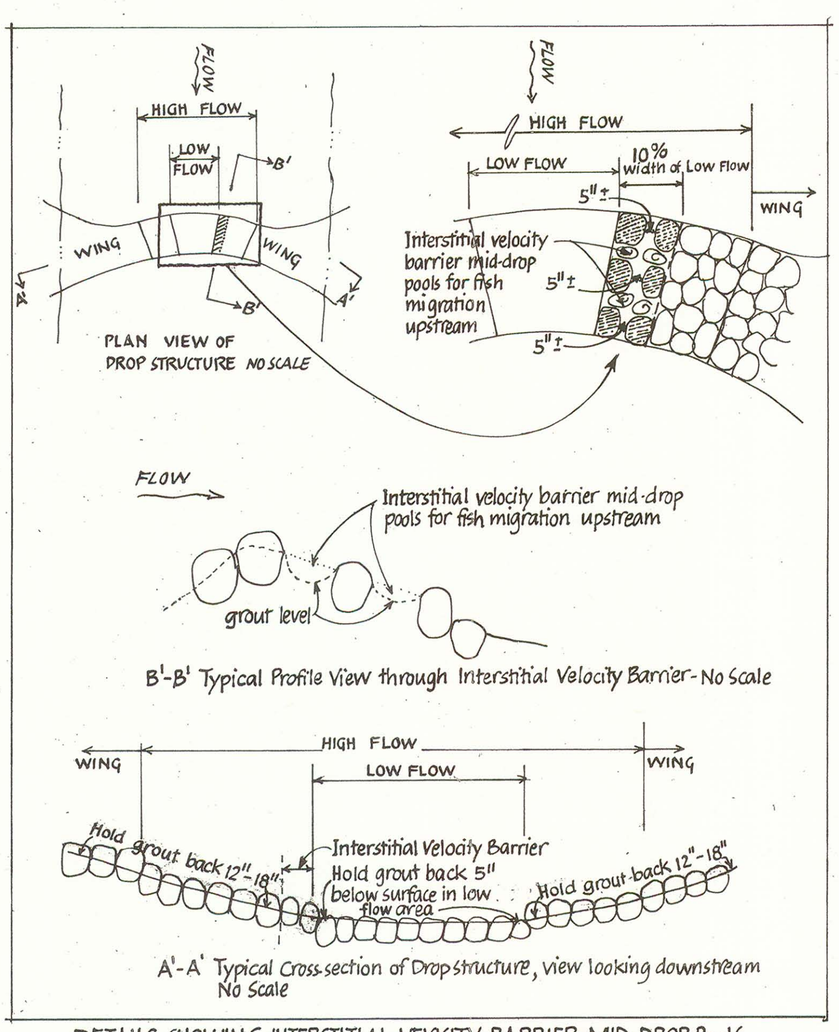


TYPICAL SECTION OF "WING", C-C
no scale



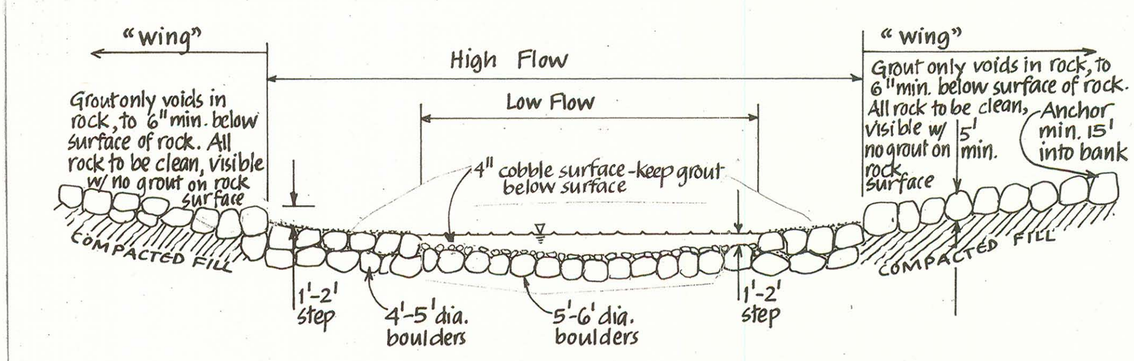
TYPICAL ℄ PROFILE VIEW OF LOW & HIGH FLOW AREAS, B-B
no scale



DETAILS SHOWING INTERSTITIAL VELOCITY BARRIER MID-DROP POOLS FOR FISH MIGRATION UPSTREAM NO SCALE

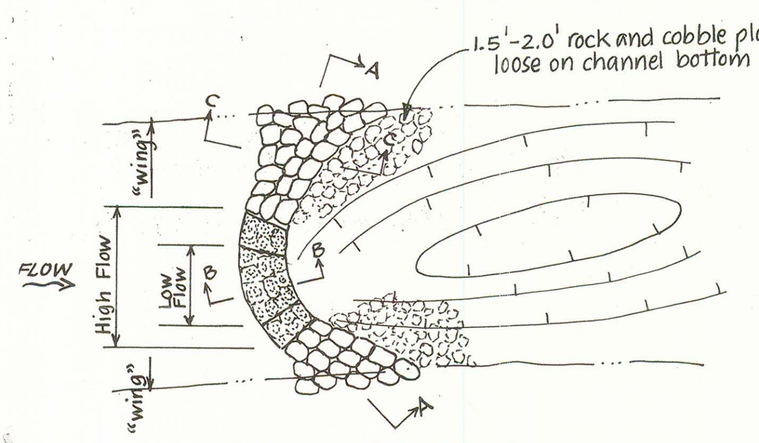
12/05

Fish Passage

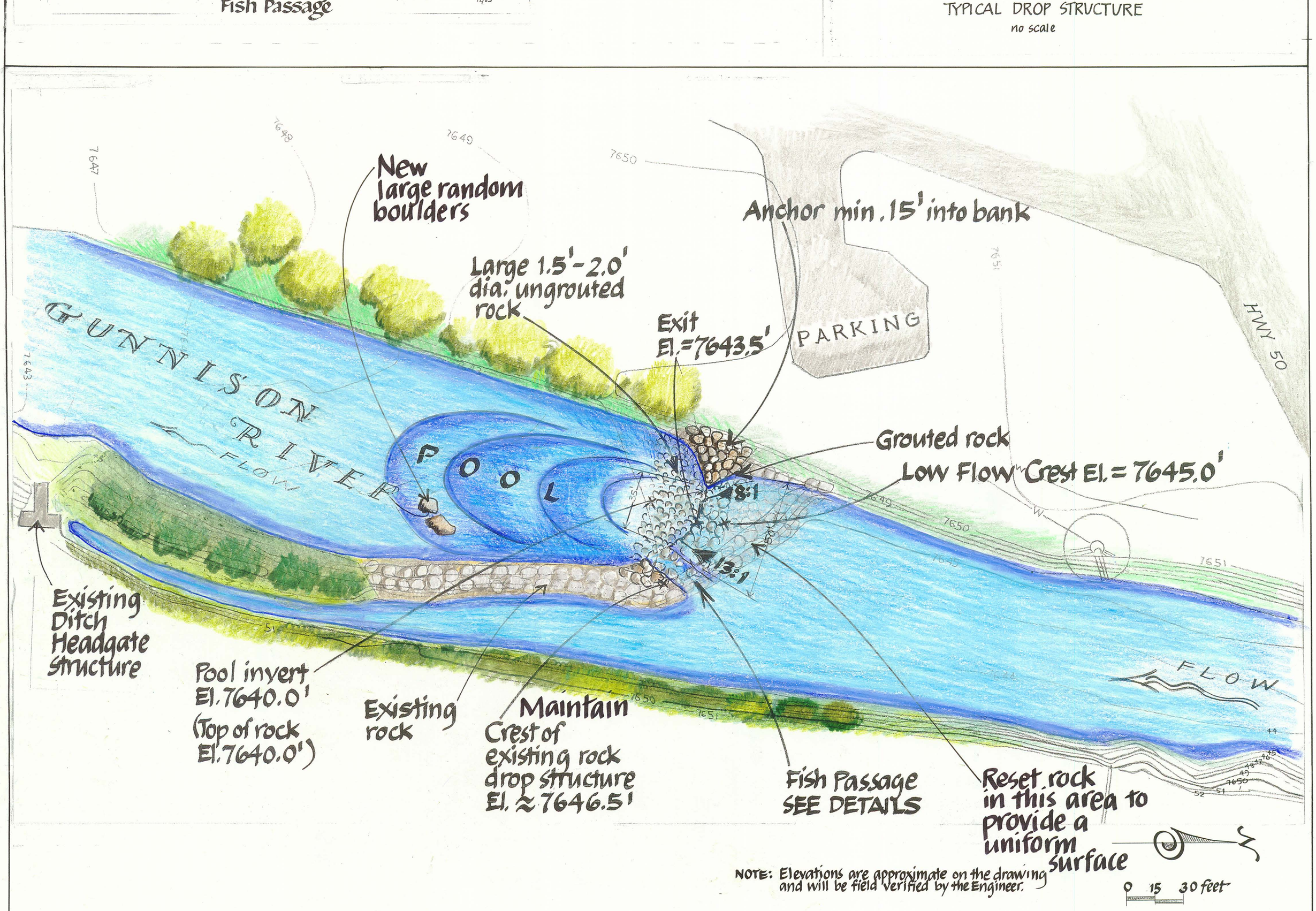


TYPICAL CROSS SECTION DROP STRUCTURE BANK TO BANK, A-A
looking downstream, no scale

NOTE: REP representative to be on-site during construction of new drop structure



TYPICAL DROP STRUCTURE
no scale



NOTE: Elevations are approximate on the drawing and will be field verified by the Engineer.

REVIEW DRAFT: NOT FOR CONSTRUCTION

Gunnison Whitewater Park · 75 Ditch

GUNNISON, COLORADO

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REV.	SHEET 1
	DATE Oct. 2009