DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS - MOBILE DISTRICT
BIRMINGHAM FIELD OFFICE
218 SUMMIT PARKWAY, SUITE 222
HOMEWOOD, ALABAMA 35209

REPLY TO
ATTENTION OF:

November 2, 2011

Inland Section North
Regulatory Division

SUBJECT: Nationwide Permit Authorization - Permit Number SAM-2011-01072-CMS, Shannon Mine No. 4, Shannon, LLC

Shannon, LLC
c/o McGehee Engineering Corporation
Attention: Mr. Stephen Blankenship
Post Office Box 3431
Jasper, Alabama 35502

Dear Mr. Blankenship:

This letter is in response to your September 12, 2011 application, submitted on behalf of Shannon, LLC, for a Department of the Army (DA) permit to impact 6,397 linear feet (0.15 acre) of ephemeral stream and 3,283 linear feet (0.19 acre) of intermittent stream in association with Shannon Mine No. 4. The project is located in Sections 1,2,3,4,9,10 and 11, Township 20 South, Range 6 West and Sections 25,34,35 and 36, Township 19 South, Range 6 West in Jefferson and Tuscaloosa County, Alabama (N 33.32885, W 87.13806).

DA authorization is necessary because the project will involve the placement of fill material into jurisdictional waters of the United States, regulated under Section 404 of the Clean Water Act. The project involves open mining at the project site, of which 60% has been previously disturbed through mining operations. Project impacts include 6,397 linear feet of ephemeral stream and 3,283 linear feet of intermittent stream.

Based upon the Pre-Construction Notification and Mitigation Plan submitted on September 12, 2011, including the addendums dated October 18, 2011 and October 27, 2011, your proposal is authorized by Nationwide Permit (NWP) 49 for Coal Remining Activities (Federal Register, March 12, 2007 Vol. 72, No. 47). In order for this NWP authorization to be valid, you must ensure that the work is performed in accordance with the General Conditions of *Nationwide Permit 49*, which can be viewed at our website at www.sam.usace.army.mil/RD/reg, and the following special conditions:

a. To mitigate for the intermittent stream impacts, the permittee shall implement the Mitigation Plan dated September 12, 2011 including any addendums. The mitigation includes the construction of 3,283 linear feet of intermittent stream and stream buffer restoration, which shall generate at least 13,460.3 credits.

b. To mitigate for the ephemeral stream impacts, the permittee shall purchase 0.15 wetland credit from the Big Sandy Mitigation Bank. Proof of credit purchase must be received by this office prior to commencing work in waters of the United States.

c. Your responsibility to complete the required compensatory mitigation as set forth in Special Condition "a", will not be considered fulfilled until you have demonstrated compensatory mitigation project success for 5 consecutive years. If project success has been demonstrated after this 5 year period, you will receive written verification of that success from the U.S. Army Corps of Engineers. Only then is the mitigation project considered complete. If mitigation, including any adaptive management, is determined to be unsuccessful the Corps shall require the permittee to purchase credits at a Corps approved mitigation bank to offset any difference in the required number of stream SOP credits (listed in Special Condition "a").

d. The permittee shall submit a performance bond, or other suitable financial assurances, to the U.S. Army Corps of Engineers, Mobile District, Regulatory Division for approval prior to being executed. The approved financial assurances shall be posted before mining activities authorized by this permit begin. The financial assurances will be based on the financial assurance table submitted with Addendum No. 2 dated October 27, 2011.

e. You shall comply with all the terms and conditions of the Alabama Department of Environmental Management Section 401 Water Quality Certifications for the Nationwide Permits. This document can be viewed at our website: www.sam.usace.army.mil/rd/reg/nwp/htm, or at your request a paper copy will be provided to you.

This verification is valid until the NWP is modified, reissued, or revoked. All of the existing NWPs are scheduled to be modified, reissued, or revoked prior to March 18, 2012. It is incumbent upon you to remain informed of changes to the NWPs. We will issue a public notice when the NWPs are reissued. Furthermore, if you commence or are under contract to commence this activity before the date that the relevant nationwide permit is modified or revoked, you will have twelve (12) months from the date of the modification or revocation of the NWP to complete the activity under the present terms and conditions of this nationwide permit.

This letter of authorization does not obviate the necessity to obtain any other Federal, State, or local permits, which may be required. Further, please note General Condition 26 requires that you submit a signed certification to us once any work has commenced and when the work and required mitigation are completed. Please complete and submit the attached Notification of Commencement of Work when work has begun and the attached Compliance Certification form to this office within 60 days of completion of the authorized work.

Please contact me at 205-290-9096 or at Courtney.m.shea@usace.army.mil and refer to File Number SAM-2011-01072-CMS if you have any questions. For additional information about our Regulatory Program, visit our web site at www.sam.usace.army.mil/RD/reg, and please take a moment to complete our customer satisfaction survey while you are there. Your responses are appreciated and will allow us to improve our services.

Sincerely,

Courtney Shea
Project Manager
Regulatory Division
Birmingham Field Office

Enclosures

BILL OF SALE

CONTRACT #45

PERMIT NO. SAM-2011-01325-CMS

For valuable consideration, the receipt of which is hereby acknowledged, WESTERVELT ECOLOGICAL SERVICES, LLC, a Delaware limited liability company ("Owner"), does hereby bargain, sell and transfer to Shannon, LLC, Shannon Mine #4 ("Buyer"): **0.17 Wetland Mitigation Credits** (0.15 acres impact) from Big Sandy Mitigation Bank, Tuscaloosa County, AL.

DATED: November 28, 2011

WESTERVELT ECOLOGICAL SERVICES, LLC,
a Delaware limited liability company

By: Michelle O'Neal

Name: Michelle O'Neal

Title: Sales & Marketing Manager

SHANNON, LLC.

SHANNON MINE NO. 4

U. S. ARMY CORPS OF ENGINEERS

DRAFT MITIGATION PLAN

Prepared by:

MCGEHEE ENGINEERING CORP.
P. O. Box 3431
450 19th Street West
Jasper, Alabama 35502-3431
Telephone: (205) 221-0686
Fax: (205) 221-7721
Email: stephenb@mcgehee.org

Executive Summary

Shannon, LLC. proposes to permit 2,262 acres at the project site in Sections , 2, 3, 4, 9, 10 & 11, Township 20 South, Range 6 West, & Sections 25, 34, 35 & 36, Township 19 South, Range 6 West all located in Jefferson and Tuscaloosa County, Alabama on the McCalla and Abernant, Alabama U.S.G.S Quadrangle. Site location is shown in a 2000' scale map in (*Appendix "A"*).

The project area as described above is all undeveloped land with over 50% of the area has been previously disturbed through historic mining operations. All of this area lies in the middle of a heaving mining community, with currently existing mining operations just south of the project area.

The purpose of this proposed activity is surface coal mining commonly known as Area Mining. The surface mining activity is scheduled to commence October 2011 and will be completed by 2016.

Stream channel design concepts will be utilized in the stream restoration and relocation design plan incorporated within this mitigation plan, to ensure the appropriate pattern, profile and dimension of the restored stream channel. All necessary stream channel design will be in accordance with standard generally accepted engineering design practices.

The included information outlines the total jurisdictional areas and quantifies that number. This information is shown in the *Jurisdictional Impact Table* **(Table 1)** indicating that the total jurisdictional area of this project will affect no more than 6,397 linear feet of ephemeral and 3,283 linear feet of intermittent (Non-RPW) drainage course **totaling 0.34 acres** of jurisdictional waters.

The goal of this mitigation plan is to offset the temporary loss of stream and associated wetland and stream functions due to the proposed surface mining operation and the associated sediment basin construction. The loss of these waters will be mitigated for by onsite restoration at a 1:1 ratio in addition existing non-jurisdictional drainage courses will be connected to downstream jurisdictional streams creating the addition of a net gain in jurisdictional waters.

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Appendix G — Stream Restoration Structure Typicals
Appendix H — Stream Restoration Structure Specifications (Rosgen 2006)

Acronyms and Abbreviations

LWD	large woody debris
NON-RPW	Non Relatively Permanent Water
NWI	National Wetlands Inventory
PEM	palustrine emergent
PFO	palustrine forested
PSS	palustrine scrub-shrub
RPW	Relatively Permanent Water
SOP	Standard Operation Procedure (as it relates to the Mobile District Steam SOP)
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

Chapter 1. Proposed Project

1.1 Introduction

Shannon, LLC. proposes to temporally impact three (3) small intermittent drainage courses and seven (7) small low grade ephemeral drainage courses, one (1) very small low grade wetland feature and ten small jurisdictional impoundment for the purpose of surface mining operations (**Figure 1**). The proposed project will impact these ephemeral and intermittent drainage courses and waters of the US during the mining phases of the project. This report identifies the project impacts associated with these drains and describes a proposal to mitigate for those unavoidable impacts.

This report will be used to obtain the following permits:

- U.S. Army Corps of Engineers Section 404 permit

Observed conditions are discussed in the *Wetland Delineation Report* (McGehee 2010). This mitigation report addresses project impacts and their mitigation. The following documents and guidelines were used in preparation of this report:

- *Wetland Delineation Report* (McGehee 2010)
- Mitigation Plan (33CFR 332.4(c)/40 CFR 230.92.4(c))
- *USACE Regulatory Guidance Letter 08-03 (USACE 2008)*
- Department of Army Mobile District, Corps of Engineers *Standard Operation Procedure Compensatory Stream Mitigation Guidelines* (March 2009)
- *Rapid Bioassessment Protocols for Use in Stream& Wadeable Rivers* (EPA Second Edition – EPA841-B-99-002)
- *A Classification of Natural Rivers* By David L. Rosgen Published Elsevier, Catena 22 (1994) pages 169 -199

1.2 Project Location

Shannon, LLC.– Shannon Mine No. 4, 2,262 acre project is located Sections , 2, 3, 4, 9, 10 & 11, Township 20 South, Range 6 West, & Sections 25, 34, 35 & 36, Township 19 South, Range 6 West all located in Jefferson and Tuscaloosa County, Alabama on the McCalla and Abernant,, Alabama U.S.G.S Quadrangle. The site is located in the Upper Black Warrior Watershed HUC Code # 03160112. The sub-watershed area is Lower Valley Creek Water Shed HUC Code# 03160112-30. The proposed site location is shown below on the attached 2000' scale project area map Figure 1. and (Appendix "A").

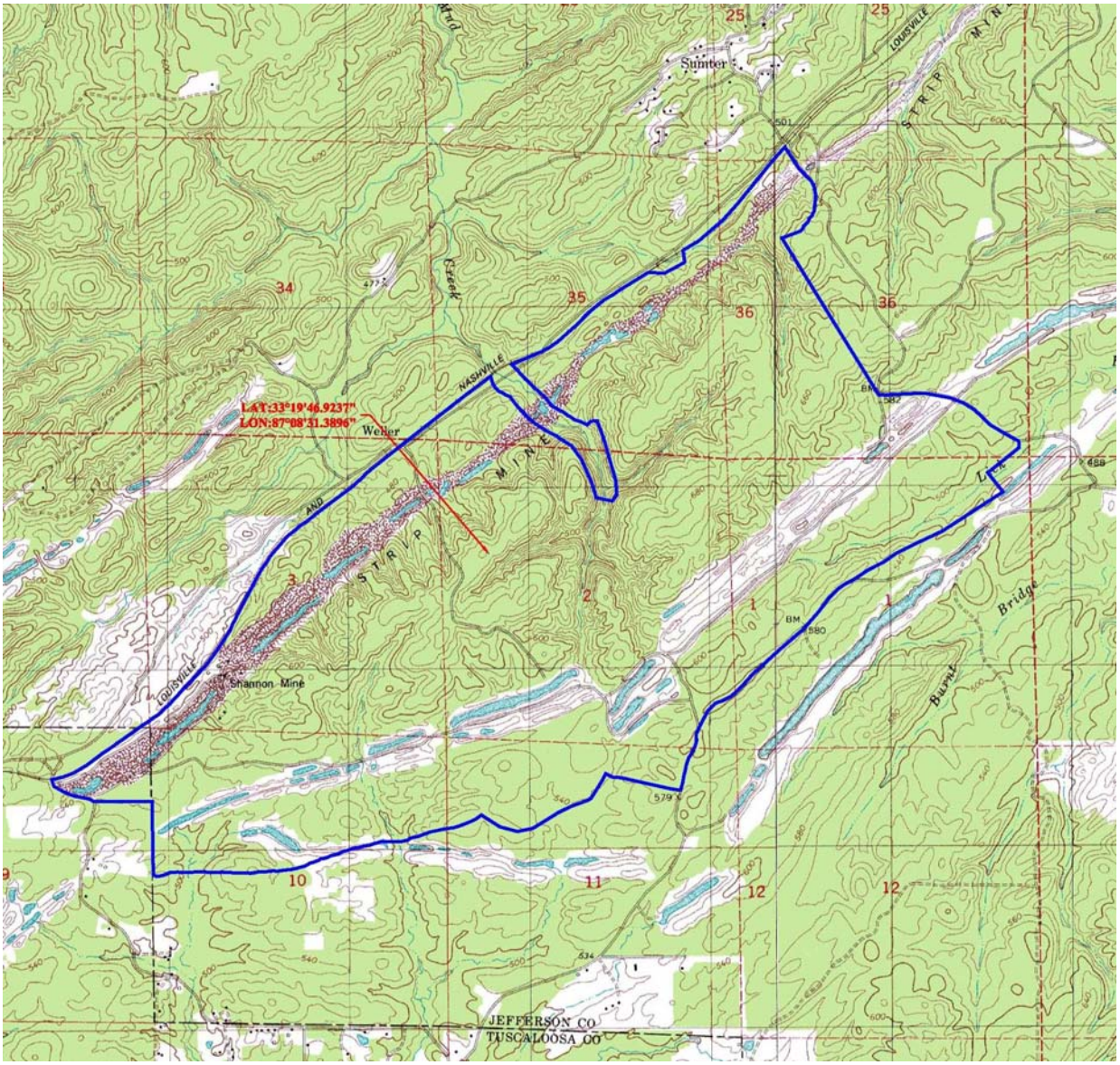


Figure 1. Project vicinity map.
(Not to Scale)

1.3 Project Purpose and Description

The purpose of this project is primarily for coal extraction via surface mining operations. The method of mining that will be utilized at this site is area mining. There are NO mountain top removals or valley fills associated with this mining project.

The project consists of 2,363 acres some of which consist of existing ephemeral and intermittent drainage courses that will be temporary impacted. There will be temporary effects on the drainage courses as the operations progresses; however, restoration will take place immediately following the mineral extraction.

1.4 Project Schedule

The project is set to commence in November 2011 and be completed by 2016. However, actual commencement date will depend on the authorization from all of the associated regulatory authorities.

1.5 Responsible Parties

Shannon, LLC. located at 74 Industrial Parkway, Jasper, Alabama 35502 will be the responsible party for the permits at this site. ASMC License No. L-0813.

Chapter 2. Existing Conditions

This chapter summarizes the landscape setting, existing conditions of the wetlands and streams within or near the project setting, and watershed conditions.

2.1 Landscape Setting

The landscape in this area is representative of a mining area with existing silviculture area riddled logging access roads and historic un-reclaimed portions as well as portions that have been previously reclaimed. Some of the topography has been altered through these various types of impacts. Most of the dominant tree vegetation of the area is loblolly pines and along various upland herbaceous species with some young growth hardwoods in the mix along different portions of the area.

The land would be classified as un-developed no current use and currently zoned as I-3S which allows for surface mining operations.

The majority of the Soil consists mainly of Montevallo-Nauvoo association, steep which well drained. A more detailed evaluation of the soil as well as the soil maps can be found in the *Wetland Delineation Report (McGehee 2010).*

There are mainly a mix of upland and riparian vegetation with a good bit of invasive species located throughout the project area. However, most of the vegetation consists of Loblolly Pines, young growth hardwoods, privet hedge and various upland herbaceous species. This is described in more detail in the *Wetland Delineation Report (McGehee 2010).*

2.1.1. Streams

There were ten jurisdictional drainage courses found within the project area. Seven of these are considered ephemeral Non-RPW drainage courses and three that are considered intermittent RPW with Seasonal Flow drainage courses.

Headwaters of Mud Creek and Lick Branch originate within the project area. Downstream portions of these tributaries could have been used of to dispose of spoil material thereby decreasing the expense associated with moving the material further across the project area and also could have been used for sediment basin outfalls located further downstream that would allow for the removal of more coal within the area. However, Shannon is purposefully avoiding these downstream stream segments in order to minimize the jurisdictional impacts associated with this project.

The quantified stream impact information can be found in **(Table 1.)** below. The associated stream impact map can be found in Appendix “B”.

Table 1. Jurisdictional Impact Table.

	ID. *(Identification)*	*Latitude*	*Longitude*	*Cowardin Class*	*Class of Aquatic Resource*	*Flow Regime*	*Average Width of Channel* *(Feet)*	*Linear Feet of Drainage Course* *(Feet)*	*Non-Jurisdictional Waters* *(Acres)*	*Jurisdictional Waters* *(Acres)*
S1	**Point 9**	33°19'18" N	87°08'58" W	**Riverine**	**Non-section --10 Non Wetland**	**Ephemeral**	**0.75**	**838**	**0.01**	
	Point 10	33°19'26" N	87°08'56" W							
OW-6	**Point 11**	33°19'09" N	87°09'06" W	**Palustrine**	**Non-section --10 Non Wetland**	**Open water**			**2.43**	
OW-7	**Point 12**	33°19'10" N	87°08'48" W	**Palustrine**	**Non-section --10 Non Wetland**	**Open water**			**0.12**	
OW-10	**Point 15**	33°19'16" N	87°08'37" W	**Palustrine**	**Non-section --10 Non Wetland**	**Open water**			**14.67**	
OW-12	**Point 17**	33°19'31" N	87°07'37" W	**Palustrine**	**Non-section --10 Non Wetland**	**Open water**			**0.2**	
OW-14	**Point 20**	33°19'06" N	87°09'50" W	**Palustrine**	**Non-section --10 Non Wetland**	**Open water**			**0.85**	
OW-15	**Point 23**	33°19'25" N	87°09'21" W	**Palustrine**	**Non-section --10 Non Wetland**	**Open water**			**0.91**	
OW-19	**Point 34**	33°19'50" N	87°08'50" W	**Palustrine**	**Non-section --10 Non Wetland**	**Open water**			**2.82**	
	Point 36	33°19'53" N	87°08'45" W							
OW-21	**Point 43**	33°19'41" N	87°08'51" W	**Palustrine**	**Non-section --10 Non**	**Open water**			**6.89**	

					Wetland					
S2	**Point 44**	33°20'01" N	87°08'17" W	**Riverine**	**Non-section --10 Non Wetland**	**Ephemeral**	**1**	**1172**		**0.03**
S3	**Point 49**	33°19'46" N	87°08'42" W	**Riverine**	**Non-section --10 Non Wetland**	**Intermittent**	**2.3**	**1203**		**0.06**
	Point 50	33°19'42" N	87°08'40" W							
	Point 51	33°19'56" N	87°08'38" W							
S4	**Point 52**	33°19'53" N	87°08'33" W	**Riverine**	**Non-section --10 Non Wetland**	**Ephemeral**	**1**	**1386**		**0.03**
S5	**Point 57**	33°19'48" N	87°08'21" W	**Riverine**	**Non-section --10 Non Wetland**	**Ephemeral**	**1**	**1931**		**0.04**
	Point 58	33°19'44" N	87°08'28" W							
S6	**Point 60**	33°19'44" N	87°08'04" W	**Riverine**	**Non-section --10 Non Wetland**	**Ephemeral**	**1**	**1011**		**0.02**
	Point 61	33°19'39" N	87°08'01" W							
S7	**Point 64**	33°19'58" N	87°08'03" W	**Riverine**	**Non-section --10 Non Wetland**	**Intermittent**	**3**	**1040**		**0.07**
S8	**Point 65**	33°20'06" N	87°07'52" W	**Riverine**	**Non-section --10 Non Wetland**	**Ephemeral**	**1**	**897**		**0.02**
S9	**Point 78**	33°20'39" N	87°07'30" W	**Riverine**	**Non-section --10 Non wetland**	**Ephemeral**	**1.5**	**2150**	**0.07**	
	Point 79	33°20'28" N	87°07'28" W							
S10	**Point 88**	33°20'03" N	87°06'38" W	**Riverine**	**Non-section --10 Non wetland**	**Intermittent**	**2.5**	**1040**		**0.06**
	Point 89	33°19'56" N	87°06'50" W							

	Point 90	33°19'49" N	87°07'05" W							
OW-23	**Point 91**	33°19'25" N	87°08'14" W	**Palustrine**	**Non-section --10 Non wetland**	**Open water**			**0.25**	
W1	**Point 95**	33°20'04" N	87°06'46" W	**Palustrine**	**Non-section --10 wetland**	**Wetland**			**0.3**	
OW-24	**Point 97**	33°19'53" N	87°07'28" W	**Palustrine**	**Non-section --10 wetland**	**Open water**			**0.31**	
			Total Jurisdictional Acres:						**29.84**	**0.34**

Total Jurisdictional Waters by Classification:

Ephemeral Drainage Course	**0.15**	**Acres**	**6,397**	**l/f**
Intermittent Drainage Course	**0.19**	**Acres**	**3,283**	**l/f**
Perennial Stream	**0.00**	**Acres**	**0**	**l/f**
Wetlands	**0.00**	**Acres**	**0**	**l/f**
Water Impoundments	**0.00**	**Acres**		
		Total Jurisdictional Waters:		**0.34**

Total Non-Jurisdictional Waters by Classification:

Ephemeral Drainage Course	**0.09**	**Acres**	**2,988**	**l/f**
Intermittent Drainage Course	**0.00**	**Acres**	**0**	**l/f**
Perennial Stream	**0.00**	**Acres**	**0**	**l/f**
Wetlands	**0.30**	**Acres**		
Water Impoundments	**29.45**	**Acres**		
		Total Non-Jurisdictional Waters:		**29.84**

2.1.2. Wetlands

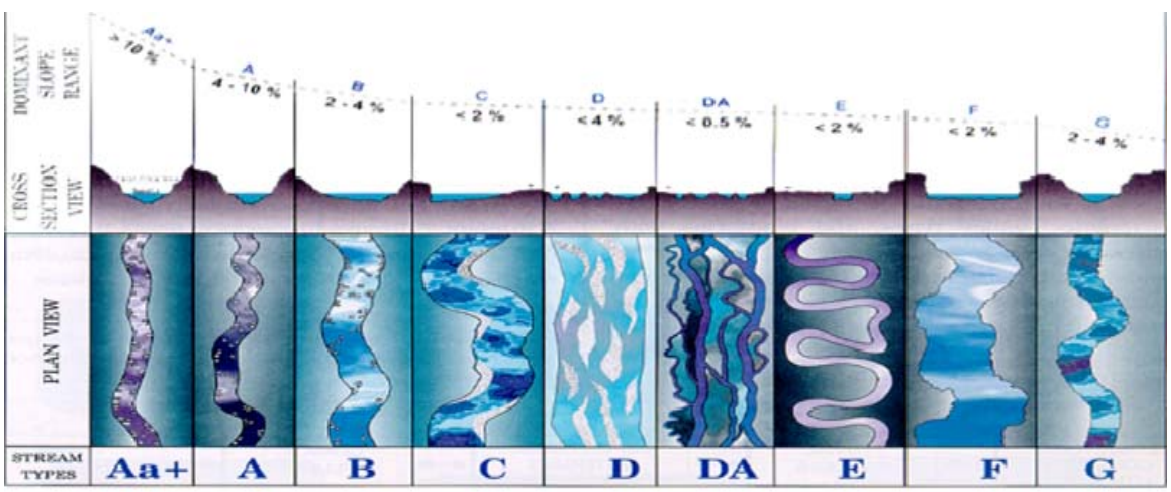
This project area has been evaluated for Wetlands and there were areas of jurisdictional wetlands identified within the delineation, however, all of the jurisdictional wetlands have since been avoided in order to minimize the wetland impacts associated with this project. The only wetland that remains in the project area is W-1 a man-made wetland which is small low grade emergent wetland created from historic man made disturbance not allowing water to adequately drain and is not jurisdictional.

2.1.3. Buffers/Uplands

The identified wetland area to the north of the project boundary which is in the headwater of Mud Creek will have a minimum of a 100 foot vegetated buffer zone between it and the project boundary. This will help ensure the water quality of Mud Creek and its associated wetlands is not adversely affected from the mining operation. Additional BMP's will also be in place to protect this stream as well as any other adjacent tributaries which may consist of but are not limited to: utilization of silt fences, straw bales, rock check dams, properly timed grading, mulching and seeding and sediment basin outfalls.

2.1.4. Reference Reach

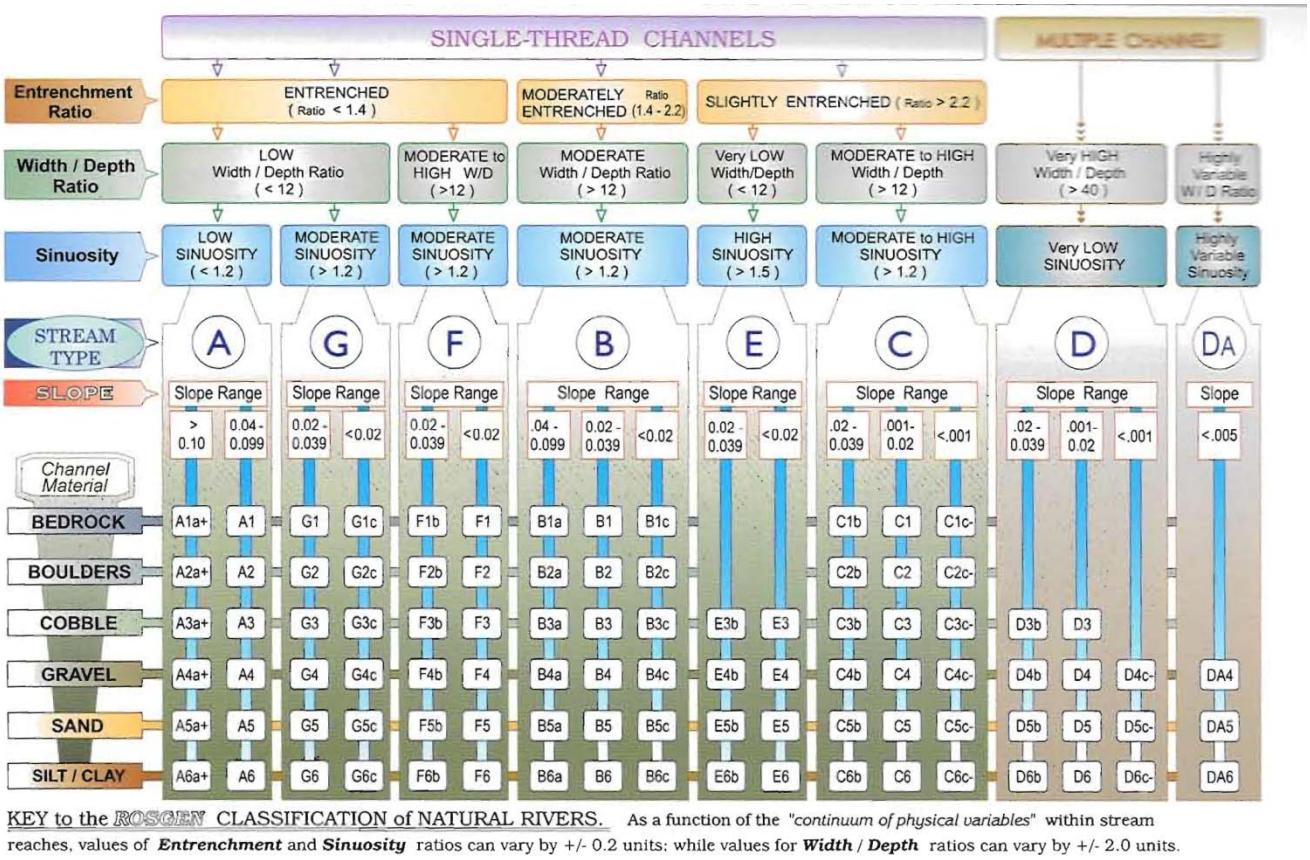
Stream restoration projects are typically based on a reference reach condition. However, most of the potential reference reaches in this area have had significant impact in the past. However, the drainage courses proposed for impact in this project have been evaluated both upstream and downstream for a reference to establish the proposed site condition. There are three intermittent stream segments within the project boundary; one identified as S-3 which is a F-3 Rosgen's type stream one is identified as S-7 which is a F-2 Rosgen's type stream and the other S-10 which is a B-6 Rosgen's stream type. Therefore, this plan is designed based on the basic premise of stream type changes as described by Rosgen 1994 and 1997 (Figure 2.0). The methodology utilized in this plan will ultimately support the biological and chemical integrity of the streams, including the transport of water and sediment produced by the surrounding activities.



(D. L. Rosgen 1994/1997 Catena 1994)

Figure 2. Rosgens Evolutinary Stages of Channel Progression.

As mentioned above the existing intermittent stream corridors within the project area consists of an F-3, F-2 & B-6 stream channel. Substrates within the existing F-3 channel consist of approximately 75% Cobble / Boulder, 10 % Gravel and 10% Silt-Clay. Substrate within the existing F-2 channel consist of 60% Boulder / Cobble, 10 % Gravel and 30% Silt-Clay. Substrate within the existing B-6 consist of approximately 100% silt/clay Classification reference information for the above descriptions can be found below in Figure 3.0.



(D. L. Rosgen 1994 Classification of Natural Rivers)

Figure 3. Rosgens Classification of Natural Rivers.

2.1.5. Specific Rosgens Classification

The below listed table identifies the existing stream classification for the existing intermittent streams within that will be impacted within the project boundary.

Stream ID	Rosgen's Classification	Proposed Reconstructed Stream Type
S3	F-3	B-3
S7	F-2	B-2
S10	B-6	B-6

Table 2. Specific Rosgen's Stream Classification

2.2 Land Use History

The historic land use as it relates to wetlands, streams and buffers based on historic mapping appeared to potentially have more ephemeral and intermittent drains. However, historic mining operations with minimal reclamation have significantly disturbed the area and now the quantity of the jurisdictional waters is very minimal.

2.3 Existing Water Quality Information

As part of our field delineation and assessment of the project site, we typical performed some water quality analysis studies to determine the pre-impact conditions of the site. This particular site already has extensive water quality analysis on the downstream portions of the tributaries that originate within the project boundary which can be used to determine the pre-project and historic water quality in this area.

2.3.1. Steam Water Quality Analysis

Pre-project Water Quality Samples were taken immediately downstream of the project at the sites designated on the attached Hydrologic Monitoring Map. The sampling site for these analyses can be found on the attached Hydrologic Monitoring Stream Sampling Site Location Map Appendix "D". The report of findings for this analysis can be found in Appendix "F".

2.4 Stream SOP Evaluation Information

As part of our field delineation and assessment of the project site, we have evaluated the intermittent jurisdictional water courses within the Department of Army Mobile District, Corps of Engineers March 2009 Standard Operation Procedure (Stream SOP) Compensatory Stream Mitigation Guidelines. The attached quantified information as it relates to the Stream SOP can be found in Appendix "E".

In particular the stream impacts credits as determined by the above referenced stream SOP worksheets are as follows:

Stream SOP Worksheet Quantified Numbers

Worksheet Number	Credit Description	Sub-Total
Worksheet No. 1	Stream Impact Mitigation Credits	-13,788.6
Worksheet No. 2	Stream Restoration Credits Generated	9,192.4
Worksheet No. 3	Riparian Restoration Credits Generated	5,581.1
	Total Credits Generated	**984.90**

Table 3. Stream SOP Worksheet Quantified Numbers

Thereby, the total relocation and reconstruction of the stream reach equates to a net positive gain.

Chapter 3. Wetland and Wetland Buffer Impact Assessment

This chapter summarizes the landscape setting, the existing conditions of the wetlands to be impacted, and the assessment of impacts to wetlands and functions related to the proposed project.

3.1 Existing Conditions of Wetlands and Buffers to be Impacted

Summaries of existing conditions for each wetland and buffer that will be impacted are provided in the Wetland Impacts Summary Section (**Section 3.3**). Refer also to the *Wetland Delineation Report* (McGehee, 2010) for more details about each wetland, including field data forms.

Wetlands are classified using:

- USFWS system (Cowardin et al. 1979)
- Hydrogeomorphic Classification system (Brinson 1993)

The condition of wetland buffers was qualitatively assessed using the following criteria:

- Dominant land use (e.g., agriculture, residential, commercial, industrial).
- Dominant buffer vegetation type (tree, shrub, herb, vine, un-vegetated).
- Estimated percent cover of invasive plants by species.

3.2 Wetland Impacts

There is only one area of wetland impacts associated with this project. This area is identified as W-1 and further discussed in section 3.2.2 below.

3.2.1. Permanent Wetland Impacts

The proposed project will result in zero (0) unavoidable permanent wetlands impacts (**Table1**).

3.2.2. Temporary Wetland Impacts

The proposed project will result in one (1) unavoidable temporary wetlands impacts (**Table1**). This Wetland is identified as W-1 and is 0.30 acres of low grade emergent wetland.

3.2.3. Indirect Wetland Impacts

There are no known indirect wetland impacts associated with this project.

3.3 Wetland Impacts Summary

The impacts to wetland and associated functions that would result from the proposed project can be found in the *Wetland Delineation Report (McGehee 2010)*. For this particular project there is only one area of a small wetland impact associated with this project. Therefore, in summary only the previously listed stream reaches and one small emergent wetland will be temporarily impacted from the project operations.

Chapter 4. Mitigation Strategy

The mitigation strategy described in this chapter involves avoidance, minimization of wetland impacts, stream impacts and compensatory mitigation for unavoidable wetland and stream impacts.

4.1 Avoidance and Minimization of Wetland and Stream Impacts

Shannon, LLC. has avoided and minimized impacts to potential wetlands, wetland buffers and higher grade streams to the greatest extent practicable. However, total avoidance of all jurisdictional waters was not possible due to location of the coal seams and topography of the project area and the location of the adjacent topographic features such as roads, railroads and downstream tributaries and wetlands. Impacts were minimized primarily through site-specific design techniques including reduction of the project area and buffer and avoidance of the initially included impacts further downstream to the greatest extent feasible. Onsite relocation and restoration mitigation will replace stream/wetland area and functions lost as a result of these unavoidable impacts.

Ways in which impacts to wetlands & streams have specifically been minimized during the mining layout design include the following:

- The initial project included a downstream segment of Lick Creek located to the east and a downstream segment of Mud Creek and its tributaries and Wetlands to the north. Also there is a stream segment to the south which is an un-named tributary that Shannon, LLC. has purposely avoided, this can be seen on the buffer and avoidance map as referenced below.

- BMP's have been moved to within the project boundary to limit the amount of downstream impact, thereby making the unavoidable impacts limited to the drainage way to be relocated.

The Avoidance and Buffer Zone Maps can be seen in Appendix "C".

4.2 Compensatory Mitigation

4.2.1. Project Mitigation Proposal

The proposed project will temporarily impact 6,397 l/f of ephemeral non-rpw and 3,283 linear feet of intermittent Non-RPW with seasonal flow drainage course totaling 0.34acres. This impact although only temporary in nature will reduce sediment removal, and nutrient/toxicant removal functions in the basin. However, the proposed BMP's will accommodate and compensate for this temporal function loss.

In order to compensate for unavoidable impacts to jurisdictional waters, the applicant is proposing to perform on-site stream reestablishment. The proposed “mine-through” activity associated with surface coal removal would result in direct impact to an estimated 6,397 l/f of ephemeral non-rpw and 3,283 linear feet of intermittent Non-RPW with seasonal flow drainage course totaling 0.34 acres. Shannon, LLC.is proposing to perform on-site stream and wetland reestablishment at a minimum ratio of 1:1 (length in feet reestablished for each linear foot of stream impacted and acre for acre of impacted wetlands).

Additionally Shannon, LLC. will reconnect non-jurisdictional drainage courses such as S-1 and S-9 to downstream tributaries thereby creating additional jurisdictional waters.

4.2.2. Buffer Zones and BMP’s

For the jurisdictional areas shown for avoidance, existing vegetated buffer zones and BMP’s will be in place in accordance with the Alabama Surface Mining Commission Administrative Code, Chapter 880-X-10C, PERFORMANCE STANDARDS SURFACE MINNG ACTIVITIES.

Chapter 5. Compensatory Mitigation

This chapter describes the key elements of the proposed compensatory mitigation site.

5.1 Site Location

All compensatory mitigation work is proposed to be conducted onsite and within the same watersheds as the proposed project impacts. Stream mitigation work would be designed and performed under the direction of a qualified engineer. The stream and wetland restoration and re-establishment will be conducted onsite.

5.1.1. Buffers

Vegetated riparian buffer zones will be created at a minimum of 100 ft wide for each side of the restored intermittent stream segments. Plantings would consist of native plants, trees, and shrubs rather than species or subspecies of exotic origin and would be planted in a manner sufficient to ultimately provide adequate shading of the restored stream channel.

5.1.2. Site Protection

With respect to site protection, the applicant would undertake to protect the mitigation sites and riparian areas for the duration of the monitoring period through the use of signage, restriction of access and/or other appropriate and reasonable measures to prevent the mitigation area(s) from being disturbed except by those activities that would not adversely affect the intended extent, condition, and function of the mitigation areas.

5.2 Stream Channel Target Type

The initial baseline evaluation of the three existing intermittent streams has been assessed as being categorized as a Rosgen's F-3, F-2 & B-6 depending upon the particular area of reach evaluated. Therefore Shannon target channel type for the S-3 stream restoration project will be to restore the stream to a Rosgen's B-3 category, for the S-7 stream restoration will be to restore this stream to a Rosgen's B-2 category stream and for the S-10 stream restoration will be to restore this stream to a Rosgen's back to a B-6 category stream. Explanation of this category is shown within figure 3.0 of this mitigation plan.

5.3 Riparian Buffer Zone Revegetation Plan

Native riparian vegetative species will be planted upon completion of intermittent stream reconstruction along a minimum 100 foot zone adjacent to the relocated intermittent stream reach. A riparian zone will be created along each side stream reach to provide habitat, nutrients, enhanced substrate, and temperature regulation for aquatic organisms. The re-vegetation will be completed by planting to the specifications as

noted below. A riparian zone will be planted to a minimum of 100 feet wide along both sides of the banks of the reconstructed stream channel. Initial vegetative protection will be provided by planting a combination of at least three of the grass species as outlined below. Trees and shrubs will also be planted either mechanically or manually resulting in 236 trees and shrubs per acre. The trees and shrubs to be planted should include at least six species of trees and shrubs, including at least two hard mast species, two soft mast species and two shrub species.

Riparian Zone Re-Vegetation Plan							
Grass Species	*(choose three or more)*	Annual Rye	Big Bluestem	Bushy Beardgrass	Creeping Spikerush	Eastern Gammagrass	Indiangrass
		Rice Cutgrass	River Cane	Red Glover	Soft Rush	Switchgrass	Woolgrass
		Three Square Bulrush	Square Stem Spikerush	Sensitive Fern			
Tree Species	*(choose two or more)*	Black Oak	Black Walnut	Bur Oak	Chestnut Oak	Flowering Dogwood	Overcup Oak
		Pin Oak	Red Maple	Shagbark Hickory	Shellbark Hickory	Water Oak	White Oak
	(choose two or more)	American Beech	American Elm	Black Willow	Green Ash	Loblolly Pine	River Birch
		Serviceberry	Sourwood	Sweetbay	Sweetgum	Sycamore	Yellow Poplar
Shrub Species	*(choose two or more)*	American Witch Hazel	Buttonbush	Elderberry	Alder	Mountain Laurel	Oakleaf Hydrangea
		Red Buckeye	Silky Dogwood	Sweetshrub	Wild Hydrangea	Winterberry	Withe-rod Viburnum

Table 4. Riparian Buffer Zone Revegetation Plan Plant List

5.4 Implementation Schedule

As site reclamation progresses, a minimum of 9,680 linear feet of stream channel would be reestablished across the post-project regrade area in the approximate original channel locations and configurations. Stream reestablishment would consist of reconstructing the stream channels utilizing natural stream design techniques, substrate restoration, bank stabilization, installation of in-stream habitat features, re-establishment of a

riparian buffer zone and/or other appropriate measures. Restoration of the channel would be to a hydro-geomorphically stable configuration. This would include reestablishing the approximate pre-project stream cross-section and meander to the extent practicable and appropriate. Substrate composition would be returned as practicable to similar or equal to pre-project compositions, or to compositions based upon appropriate reference reach information. Appropriate bank protection measures such as root wads, cross vanes, revegetation, boulders or other clean non-toxic material would be utilized in areas that require erosion control. In-stream structures such as boulders, boulder clusters, root wads, large woody debris (LWD), and so forth would be installed as appropriate to provide aquatic habitat, to promote riffle/pool sequences, or to create step/pools for grade control.

The applicant would be responsible for monitoring, maintenance, and management of the compensatory mitigation project(s) for a period of up to five years from completion of each phase of the mitigation work.

Overall, the proposed mitigation efforts are intended to offset and restore functional stream value lost or impacted as a result of project impacts and other unavoidable losses associated with project activity.

5.5 Methodology

The proposed project focuses on re-constructing, restoring and enhancement of approximately 9,680 linear feet of newly reconstructed stream channel to a natural pattern, dimension and profile.

Stream reestablishment would consist of reconstructing the stream channels utilizing natural stream design techniques, substrate restoration, bank stabilization, installation of in-stream habitat features, re-establishment of a riparian buffer zone and/or other appropriate measures. Restoration of the channel would be to a hydro-geomorphically stable configuration. This would include establishing the approximate pre-project stream cross-section and meander to the extent practicable and appropriate or better. Substrate composition would be returned as practicable to similar or equal to pre-project compositions, or to compositions based upon appropriate reference reach information. Appropriate bank protection measures such as root wads, cross vanes, revegetation, boulders or other clean non-toxic material would be utilized in areas that require erosion control. In-stream structures such as boulders, boulder clusters, root wads, large woody debris (LWD), and so forth would be installed as appropriate to provide aquatic habitat, to promote riffle/pool sequences, or to create step/pools for grade control. Structure Typicals can be found in Appendix “G” .

To create a stable functioning stream reach, the following scope of work is proposed for the project:

- Temporary installation of sediment basin downstream of restoration site to reduce potential sediment loading in the receiving waters.

- Construction of approximately 9,680 linear feet of reconstructed and restored stream channel at a stable radius of curvature, pattern, dimension and profile.

- Construct newly relocated channel with a low bank erosion potential by creating a bankfull bench and lay back bank.

- Installation of log vanes as needed to reduce and redirect flow away from the outer bank.

- Incorporation of appropriate substrates into restored channel.

- Incorporation of bioremediation techniques such as Jute Mesh, Coconut fiber matting and/or coir logs for bank stabilization as needed to stabilize stream banks.

- Planting of herbaceous and hardwood floodplain species along bankfull bench and lay back bank for additional bank stabilization (see Table 4.0 for Species Listing).

- Creation of riparian zone and restoration of disturbed areas.

Best Management practices will be used site wide to minimize pollutants in storm water run-off. All temporary workspaces will be returned to approximate original pre-project contours to the maximum extent practicable.

Also, as referenced in section 2.4 the Mobile District Stream SOP Worksheets required to calculate adverse impacts and stream channel restoration credits are located in Appendix “E”.

5.6 Monitoring

The applicant would be responsible for monitoring, maintenance, and management of the compensatory mitigation project(s) for a period of up to five years from completion of each phase of the mitigation work.

Monitoring of the restoration site and associated reporting will be conducted on an annual basis unless determined otherwise by the Mobile District Corps of Engineers Office. Monitoring will be in compliance with Regulatory Guidance Letter No. 08-03, dated October 10, 2008. The monitoring period proposed for the project will be no less than five years as required by 33 CFR 332.6(b) and will be sufficient to demonstrate that performance standards established by the Mobile District Corps of Engineers have been met.

However, a reduction in the monitoring period's length may be requested by Shannon, LLC. if the project has met its performance standards in a least two consecutive monitoring reports.

Overall, the proposed mitigation efforts are intended to offset and restore functional stream value lost or impacted as a result of project impacts and other unavoidable losses associated with project activity.

5.6.1. Stream Channel Monitoring

Shannon, LLC. will collect information on the physical parameters of the restored intermittent streams within and below the restoration site and monitor the parameters annually for at least five years. Physical parameters that are to be measured include stream pattern, profile, and dimension, water temperature, pH, stream substrate characteristics, and erosion patterns.

In addition to the annual inspections Shannon, LLC. will monitor the stable stream parameters after two bankfull events to ensure that the physical parameters are maintained. The second bankfull event will be monitored to demonstrate the long-term stability of the restored channel.

5.6.2. Riparian Buffer Restoration

Shannon, LLC. will collect information on vegetation within the existing and adjacent riparian buffers to establish the habitat success criteria. Once the impacted riparian buffer has been restored Shannon, LLC. will monitor the restored buffer on an annual basis for a minimum of five years or until the final target density is obtained.

The minimum information to be collected annually will include vegetation present, species composition, density and structure including average species height and diameter-at-breast-height (dbh). During each annual inspection Shannon, LLC. will note the presence of exotic or invasive species and take appropriate actions when necessary to eradicate those species.

5.7 Long Term Management Plan

In regards to the future use and long term management of the project area, the land use classification of the site was predominately previously mined, with the remainder being undeveloped no current use. As stated in the Alabama Surface Mining Commission proposed permit application for this project the post mining land use will be forested. Therefore, there are no future plans for any development after the project operations are completed.

Shannon, LLC. will be responsible for the maintenance and performance of the stream restoration for the minimum of five years during the reconstruction and stabilization

phase of the stream restoration. After the lease to this area is terminated upon completion of the mining operation, the responsibility for the stream site will revert back to the current landowner.

5.8 Adaptive Management Plan

Deviations from the stable target stream conditions and riparian buffer restoration and creation will be monitored and documented. In the event that the project fails to achieve interim or final success criteria, an Adaptive Management Plan will be executed to ensure that the appropriate remedial actions are taken.

The following table 2.0 gives detailed information in regards to the proposed Adaptive Management Plan.

Adaptive Management Plan Action Criteria Chart

Parameter	Success	Failure	Action
Photo Reference of Site: *Above, within and below restored stream reach.*	No substantial Instream aggradation, degradation or bank erosion	Substantial aggradation, degradation, and or bank erosion	When Substantial aggradation, degradation and or bank erosion occurs, reasons for failure will be evaluated and adaptive management actions will be planned, approved and implemented.
Riparian Vegetation and Hydrology	Achievement of target hydrology, tree and plant species diversity, composition, and structure within the riparian buffer	Failure to achieve target hydrology, tree and plant species diversity, composition, and structure within the riparian buffer	Target species will be re-seeded and/or fertilize; live stakes and bare root seedlings will be planted to achieve desired densities. Adaptive Management actions will be planned, approved and implemented.
Channel Stability	Stable stream with pattern, profile and dimension of target stream design goals	Substantial evidence of instability in which target stream design goals are not achieved.	When substantial evidence of instability occurs reasons for failure will be evaluated and adaptive management actions will be planned, approved and implemented.

Table 5. Adaptive Management Plan Action Criteria Chart

Chapter 6. References

Brinson, M.M. 1993. *A Hydrogeomorphic Classification for Wetlands*. Technical Report WRPDE-4. US Amy Engineers Waterways Experiment Station, Vicksburg, MS.

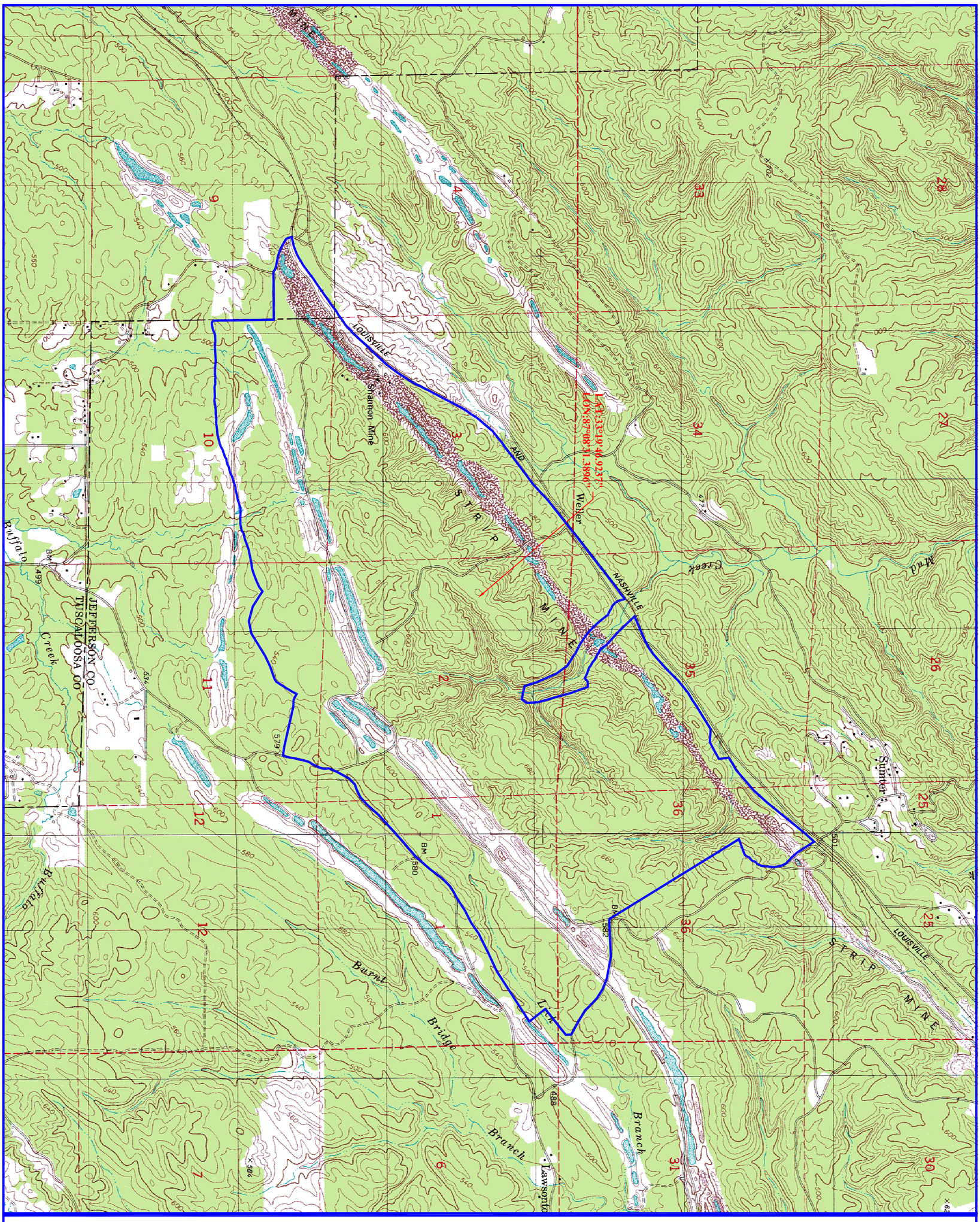
Cowardin, L.M., V. Carter, F.C. Golet and E.T. Laroe. 1979. Classification of Wetlands and Deep Water Habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS 79/31.

Rosgen, D. L. 1994. A Classification of Natural Rivers. Catena 22: 166-199

Rosgen, D. L. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

U. S. Army Corps of Engineers. 2009. Stream Mitigation Standard Operating Procedures and Guidelines. Department of the Army Mobile District Corps of Engineers, Mobile, Alabama. Draft Edition , March 2009.

Appendix A — Project Area Map



SCALE: 1" = 2000'
September 1st, 2011

SHANNON, LLC.
SHANNON MINE NO. 4
(APPROXIMATELY 2,262 ACRES TOTAL)

PROJECT AREA MAP

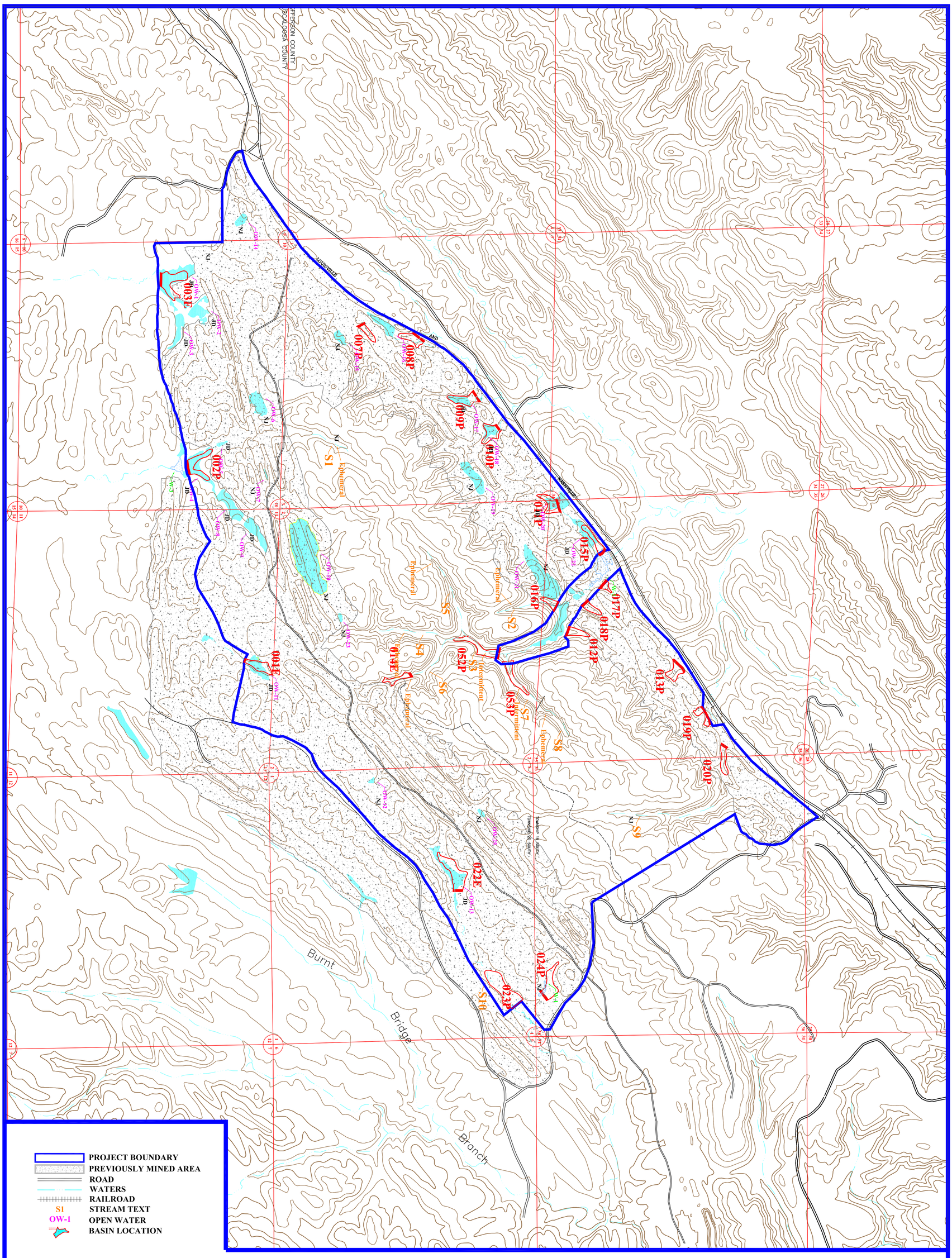
SECTIONS 1, 2, 3, 4, 9, 10 & 11
TOWNSHIP 20 SOUTH, RANGE 6 WEST,
SECTIONS 25, 34, 35 & 36, TOWNSHIP 19 SOUTH, RANGE 6 WEST,
ALL IN JEFFERSON COUNTY, ALABAMA
AS FOUND ON THE MCCALLA & ABERNANT, ALABAMA USGS QUAD.

mcgehee engineering corp
post office box 3431
jasper, alabama 35502-3431
telephone: (205) 221-0686 fax: 221-7721
email: staff@mcgehee.org

PROJECT BOUNDARY

Latitude: 33°19'46" N
Longitude: 87°08'31" W

Appendix B — Jurisdictional Impact Map



PROJECT BOUNDARY
PREVIOUSLY MINED AREA
ROAD
WATERS
RAILROAD
S1 STREAM TEXT
OW-1 OPEN WATER
BASIN LOCATION

SHANNON, LLC.
SHANNON MINE NO. 4
(APPROXIMATELY 2,262 ACRES TOTAL)

JURISDICTIONAL IMPACT MAP

SECTIONS 1, 2, 3, 4, 9, 10 & 11
TOWNSHIP 20 SOUTH, RANGE 6 WEST,
SECTIONS 25, 34, 35 & 36, TOWNSHIP 19 SOUTH, RANGE 6 WEST,
ALL IN JEFFERSON & TUSCALOOSA COUNTY, ALABAMA
AS FOUND ON THE MCCALLA & ABERNANT, ALABAMA USGS QUAD.

SCALE: 1" = 800'
September 1st, 2011

Latitude: 33°19'46" N
Longitude: 87°08'31" W

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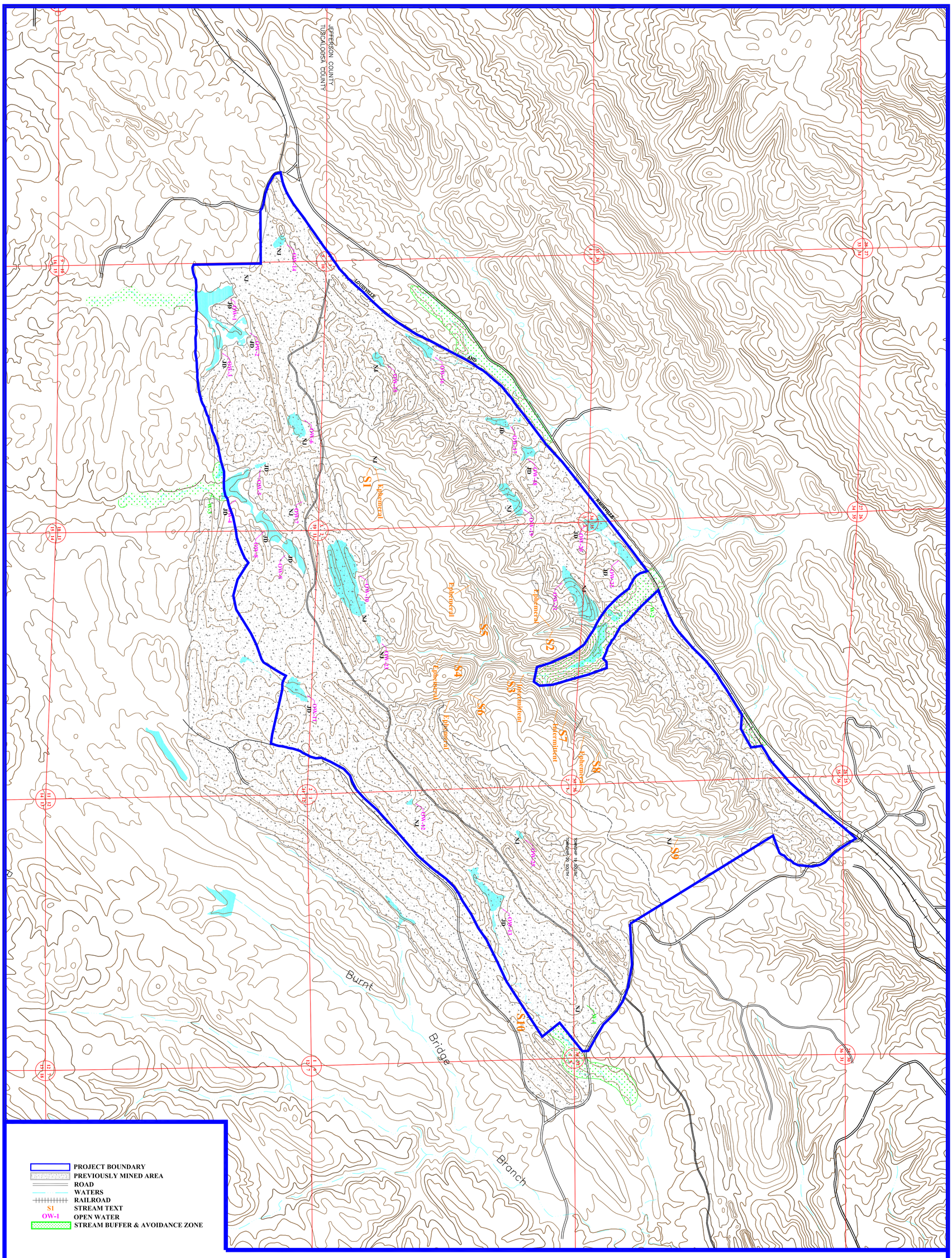
Appendix C — Stream Buffer Zone Map



SHANNON, LLC.
SHANNON MINE NO. 4
(APPROXIMATELY 2,262 ACRES TOTAL)

STREAM BUFFER & AVOIDANCE ZONE MAP

SECTIONS 1, 2, 3, 4, 9, 10 & 11
TOWNSHIP 20 SOUTH, RANGE 6 WEST,
SECTION 25, 34, 35 & 36, TOWNSHIP 19 SOUTH, RANGE 6 WEST,
ALL IN TUSCALOOSA & JEFFERSON COUNTY, ALABAMA
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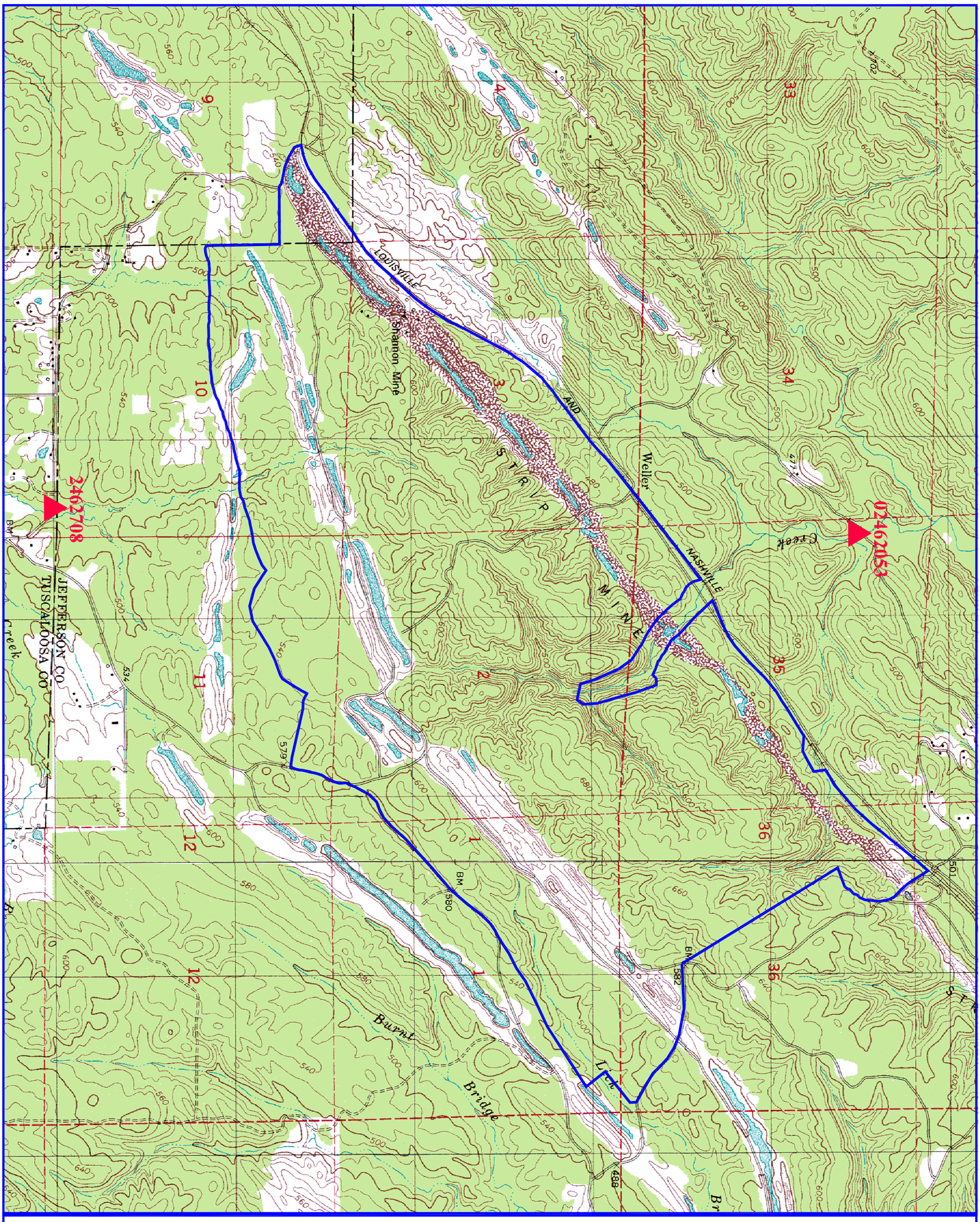
SCALE: 1" = 600'
September 1st, 2011

Latitude: 33°19'46" N
Longitude: 87°08'31" W

Appendix D —Stream Sampling Site Location Map



SCALE: 1" = 1500'
September 1st, 2011

SHANNON, LLC.
SHANNON MINE NO. 4
(APPROXIMATELY 2,262 ACRES TOTAL)

STREAM SAMPLING SITE LOCATION MAP

SECTIONS 1, 2, 3, 4, 9, 10 & 11
TOWNSHIP 20 SOUTH, RANGE 6 WEST,
SECTION 25, 34, 35 & 36, TOWNSHIP 19 SOUTH, RANGE 6 WEST,
ALL IN TUSCALOOSA & JEFFERSON COUNTY, ALABAMA
AS FOUND ON THE MCCALLA & ABERNANT, ALABAMA USGS QUAD.

NPDES PERMIT BOUNDARY
SAMPLING SITE LOCATION

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email: staff@mcgehee.org

Latitude: 33°19'46" N
Longitude: 87°08'31" W

Appendix E — Streams SOP Data Sheets

WORKSHEET 1: ADVERSE IMPACT FACTORS FOR RIVERINE SYSTEMS WORKSHEET

Stream Type Impacted	Intermittent 0.1			1st or 2nd Order Perennial Stream 0.8			>2nd Order Perennial Stream 0.4		
Priority Area	Tertiary 0.1			Secondary 0.4			Primary 0.8		
Existing Condition	Fully Impaired 0.1			Somewhat Impaired 0.8			Fully Functional 1.6		
Impact Duration	Temporary 0.05			Recurrent 0.1			Permanent 0.3		
Dominant Impact	Shade/ Clear 0.05	Utility Crossing 0.15	Below Grade Culvert 0.3	Bank Armor 0.5	Detention / Weir 0.75	Morpho-logicn Change 1.5	Impound-ment (dam) 2	Pipe >100" 2.2	Fill 2.5
Cumulative Impact Factor	< 100' impact 0	100-200' impact 0.05	201-500' impact 0.1	501-1000' impact 0.2	> 1000' impact each 1000' feet of impact impacts to the nearest 1000') impact – scaling factor = 0.8; 0.4 for (round (example: 2,200' of 2,800' of impact – scaling factor – 1.2)				

Reaches to be Impacted	Reach 1	Reach 2	Reach 3	Reach 4
Transect Number	**S3**	**S7**	**S10**	
Point Numbers	**49**	**64**	**88**	
Rosgen Stream Type	**F3**	**F2**	**B6**	
Bankfull Width & Depth	Width: 60" Depth: 3"	Width: 36" Depth: 2"	Width: 30" Depth: 10"	Width: Depth:

Factors	Reach 1	Reach 2	Reach 3	Reach 4
Stream Type Impacted	0.1	0.1	0.1	0.1
Priority Area	0.1	0.1	0.1	0.1
Existing Condition	0.8	0.8	0.8	0.8
Duration	0.3	0.3	0.3	0.3
Dominant Impact	2.5	2.5	2.5	2.5
Cumulative Impacts Factor	0.4	0.4	0.4	
Sum of Factors M=	4.2	4.2	4.2	3.8
Linear Feet of Stream Impacted In Reach LF=	1203	1040	1040	
M x LF =	**5052.6**	**4368**	**4368**	**0**

Total Mitigation Credits Required = (M X LF) = 13788.6

WORKSHEET 2: STREAM CHANNEL RESTORATION, STREAM RELOCATION, AND STREAMBANK RESTORATION WORKSHEET

Stream Type	Intermittent 0.05	1st or 2nd Order Perennial Stream 0.4	>2nd Order Perennial Stream (Bankfull Width)			
			>15' 0.4	15'-30' 0.6	30'-50' 0.8	>50' 1.0
Priority Area	Tertiary 0.05	Secondary 0.2	Primary 0.4			
Existing Condition	Impaired 0.4	Somewhat Impaired 0.5				
Net Benefit	Streambank Relocation 0.1	Stream Channel Restoration and Stream Relocation				
		Moderate 1.0	Good 2.0	Excellent 3.5		
Streambank Stability	Stable Banks 0.4	Moderately Stable Banks 0.2				
Instream Habitat	>5 cover types 0.35	5 cover types 0.25	4 cover types 0.15	3 cover types 0.1		
Timing of Mitigation	Before 0.15	During 0.05	After 0			

Reaches to be Restored	Reach 1	Reach 2	Reach 3	Reach 4
Transect Number	**S3**	**S7**	**S10**	**1**
Point Numbers	**49**	**64**	**88**	

Factors	Reach 1	Reach 2	Reach 3	Reach 4
Stream Type Restored	0.05	0.05	0.05	0.05
Priority Area	0.05	0.05	0.05	0.05
Existing Condition	0.4	0.4	0.4	0.4
Net Benefit	2.0	2.0	2.0	2.0
Bank Stability	0.2	0.2	0.2	0.2
Instream Habitat	0.1	0.1	0.1	0.1
Timing of Mitigation	0	0	0	0
Sum of Factors (M) =	2.8	2.8	2.8	2.8
Stream Length *(do not count each bank separately)* LF=	1203	1040	1040	
Credits (C) = M x LF =	**3368.4**	**2912**	**2912**	**0**
Mitigation Factors Use (MF) = 0.5 or 1.0	**1**	**1**	**1**	**1**
Total Credits Generated C x MF =	**3368.4**	**2912**	**2912**	**0**

Total Mitigation Credits Generated this sheet = (C X MF X Listed Reach) = 9192.4

WORKSHEET 3: RIPARIAN RESTORATION AND PRESERVATION WORKSHEET

Stream Type	Intermittent 0.05	>2nd Order Perennial Stream 0.2	1st or 2nd Order Perennial 0.4
Priority Area	Tertiary 0.05	Secondary 0.2	Primary 0.4
Net Benefit *(for each side of stream)*	Riparian Restoration, Enhancement, and Preservation Factors (select values from Table I) (MBW = Minimum Buffer Width = 50" + 2" / 1% slope)		
System Protection Credit	Condition: MBW restored or protected on both streambanks To calculate: (Net Benefit Stream Side A + Net Benefit Stream Side B) / 2		
Timining of Mitigation	Before 0.15	During 0.05	After 0

Reaches to be Restored	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**
Transect Number	**S3**	**S7**	**S10**	**1**
Point Numbers	**49**	**64**	**88**	

Factors	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**
Stream Type Restored	0.05	0.05	0.05	0.05
Priority Area	0.05	0.05	0.05	0.05
Net Benefit Stream Side A	0.8	0.8	0.8	0.8
Stream Side B	0.8	0.8	0.8	0.8
System Protection Credit: Condition Met (Buffer on both sides)	0.0	0.0	0.0	0.0
Timing of Mitigation Stream Side A	0.0	0.0	0.0	0.0
Stream Side B	0.0	0.0	0.0	0.0
Sum of Factors (M) =	1.7	1.7	1.7	1.7
Stream Buffer Linear Feet *(do not count each bank separately)* LF=	1203	1040	1040	
Credits (C) = M x LF =	**2045.1**	**1768**	**1768**	**0**
Mitigation Factors Use (MF) = 0.5 or 1.0	**1**	**1**	**1**	**1**
Total Credits Generated C x MF =	**2045.1**	**1768**	**1768**	**0**

Total Mitigation Credits Generated this sheet = (C X MF X Listed Reach) = **5581.1**

Appendix F — Water Quality Baseline Information

PERC ENGINEERING CO., INC.
P.O. Box 1712
Jasper, Alabama 35502
(205) 384-5553

ample Number : 130827
lient : Twin Pines Coal Company, Inc.
acility : Shannon Mine P-3859
ob Number :
PDES Permit # :
asin,Stream,Well ID: 02462765
ode : s
ate Taken : 03/22/2010
ampled By : dcm
ime Taken : 1445
epth or Flow : 28.96cfs
ests to be done : pH, Cond, Fe, Mn, TSS, Report,

arameter	Result	Units	Analyst	Date	Time	Method
onductivity	203	umhos	Danny C. Mays	03/22/2010	1445	120.1 (1)
on	0.67	mg/l	Allen Bailey	03/29/2010	1440	236.1 (1)
anganese	0.14	mg/l	Allen Bailey	03/29/2010	1525	243.1 (1)
I	7.41	s.u.	Danny C. Mays	03/22/2010	1445	150.1 (1)
eport			Sherri Fields	03/30/2010		
S	5	mg/l	Heath Brown	03/23/2010	1505	160.2 (1)

EPA-600/4-79-020 Revised March 1983

Standard Methods for the Examination Water and Wastes Water

HACH Water Analysis Handbook, 2nd Edition

EPA-600/4-88/039 Revised July 1991

EPA, Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition

Code of Federal Regulations, Title 40, Part 136, Appendix A

APPROVED BY: Mark Williams

PERC ENGINEERING CO., INC.
P.O. Box 1712
Jasper, Alabama 35502
(205) 384-5553

ample Number	:	130786
lient	:	Twin Pines Coal Company, Inc.
acility	:	Shannon Mine P-3859
ob Number	:	
PDES Permit #	:	
asin,Stream,Well ID	:	BCCSMSW-1
ode	:	s
ate Taken	:	03/19/2010
ampled By	:	dcm
ime Taken	:	1125
epth or Flow	:	
ests to be done	:	pH, Fe, Mn, Cond, TSS, Report,

arameter	Result	Units	Analyst	Date	Time	Method
cidity	6	mg/l	Heath Brown	03/26/2010	0900	305.1 (1)
lkalinity	190	mg/l	Heath Brown	03/26/2010	1050	310.1 (1)
onductivity	476	umhos	Danny C. Mays	03/19/2010	1125	120.1 (1)
ron	0.34	mg/l	Allen Bailey	03/29/2010	1440	236.1 (1)
anganese	0.31	mg/l	Allen Bailey	03/29/2010	1525	243.1 (1)
H	7.54	s.u.	Danny C. Mays	03/19/2010	1125	150.1 (1)
eport			Sherri Fields	03/30/2010		
ulfate	310	mg/l	Heath Brown	03/26/2010	0800	8051 (3)
SS	4	mg/l	Heath Brown	03/23/2010	0955	160.2 (1)

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P.O. Box 1712
Jasper, Alabama 35502
(205) 384-5553

ample Number	:	130828
lient	:	Twin Pines Coal Company, Inc.
acility	:	Shannon Mine P-3859
ob Number	:	
PDES Permit #	:	
asin,Stream,Well ID	:	-2462708
ode	:	s
ate Taken	:	03/22/2010
ampled By	:	dcm
ime Taken	:	1315
epth or Flow	:	3.035cfs
ests to be done	:	pH, Cond, Fe, Mn, TSS, Report,

arameter	Result	Units	Analyst	Date	Time	Method
onductivity	1168	umhos	Danny C. Mays	03/22/2010	1315	120.1 (1)
ron	0.60	mg/l	Allen Bailey	03/29/2010	1440	236.1 (1)
anganese	0.40	mg/l	Allen Bailey	03/29/2010	1525	243.1 (1)
H	7.85	s.u.	Danny C. Mays	03/22/2010	1315	150.1 (1)
eport			Sherri Fields	03/30/2010		
SS	5	mg/l	Heath Brown	03/23/2010	1505	160.2 (1)

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P.O. Box 1712
Jasper, Alabama 35502
(205) 384-5553

ample Number : 130829
lient : Twin Pines Coal Company, Inc.
acility : Shannon Mine P-3859
ob Number :
PDES Permit # :
asin,Stream,Well ID: 02462053
ode : s
ate Taken : 03/22/2010
ampled By : dcm
ime Taken : 1135
epth or Flow : 8.029cfs
ests to be done : pH, Cond, Fe, Mn, TSS, Report,

arameter	Result	Units	Analyst	Date	Time	Method
onductivity	1361	umhos	Danny C. Mays	03/22/2010	1135	120.1 (1)
con	0.29	mg/l	Allen Bailey	03/29/2010	1440	236.1 (1)
anganese	0.24	mg/l	Allen Bailey	03/29/2010	1525	243.1 (1)
I	7.69	s.u.	Danny C. Mays	03/22/2010	1135	150.1 (1)
eport			Sherri Fields	03/30/2010		
SS	5	mg/l	Heath Brown	03/23/2010	1505	160.2 (1)

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PERC ENGINEERING CO., INC.
P.O. Box 1712
Jasper, Alabama 35502
(205) 384-5553

Sample Number : 134212
Client : Twin Pines Coal Company, Inc.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: 02462765
Code : s
Date Taken : 07/15/2010
Sampled By : swr
Time Taken : 1010
Depth or Flow : 0.464cfs
Tests to be done : pH, Cond, Fe, Mn, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	756	umhos	Heath Brown	07/20/2010	0845	120.1 (1)
Iron	0.80	mg/l	Allen Bailey	07/20/2010	1425	236.1 (1)
Manganese	8.96	mg/l	Allen Bailey	07/20/2010	1515	243.1 (1)
pH	7.53	s.u.	Steve Riddlesperger	07/15/2010	1010	150.1 (1)
Report			Sherri Fields	08/03/2010		
TSS	7	mg/l	Heath Brown	07/19/2010	1405	160.2 (1)

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Jasper, Alabama 35502
(205) 384-5553

Sample Number : 134213
Client : Twin Pines Coal Company, Inc.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: -2462708
Code : s
Date Taken : 07/15/2010
Sampled By : swr
Time Taken : 1037
Depth or Flow : 0.196cfs
Tests to be done : pH, Cond, Fe, Mn, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	1399	umhos	Heath Brown	07/20/2010	0845	120.1 (1)
Iron	0.41	mg/l	Allen Bailey	07/20/2010	1425	236.1 (1)
Manganese	0.25	mg/l	Allen Bailey	07/20/2010	1515	243.1 (1)
pH	7.57	s.u.	Steve Riddlesperger	07/15/2010	1037	150.1 (1)
Report			Sherri Fields	08/03/2010		
TSS	5	mg/l	Heath Brown	07/19/2010	1405	160.2 (1)

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(205) 384-5553

Sample Number : 134215
Client : Twin Pines Coal Company, Inc.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: 02462053
Code : s
Date Taken : 07/15/2010
Sampled By : swr
Time Taken : 1132
Depth or Flow : 0.959cfs
Tests to be done : pH, Cond, Fe, Mn, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	2270	umhos	Heath Brown	07/20/2010	0845	120.1 (1)
Iron	0.18	mg/l	Allen Bailey	07/20/2010	1425	236.1 (1)
Manganese	0.17	mg/l	Allen Bailey	07/20/2010	1515	243.1 (1)
pH	7.70	s.u.	Steve Riddlesperger	07/15/2010	1132	150.1 (1)
Report			Sherri Fields	08/03/2010		
TSS	5	mg/l	Heath Brown	07/19/2010	1405	160.2 (1)

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(205) 384-5553

Sample Number : 134216
Client : Twin Pines Coal Company, Inc.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: BCCSMSW-1
Code : s
Date Taken : 07/15/2010
Sampled By : swr
Time Taken : 1149
Depth or Flow : 1.553cfs
Tests to be done : pH, Cond, Fe, Mn, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	631	umhos	Heath Brown	07/20/2010	1600	120.1 (1)
Iron	0.24	mg/l	Allen Bailey	07/20/2010	1425	236.1 (1)
Manganese	0.16	mg/l	Allen Bailey	07/20/2010	1515	243.1 (1)
pH	7.32	s.u.	Steve Riddlesperger	07/15/2010	1149	150.1 (1)
Report			Sherri Fields	08/03/2010		
TSS	5	mg/l	Heath Brown	07/19/2010	1405	160.2 (1)

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P.O. Box 1712
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Sample Number : 137929
Client : Twin Pines Coal Company, Inc.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: 02462765
Code : s
Date Taken : 12/02/2010
Sampled By : dcm
Time Taken : 1315
Depth or Flow : 7.10cfs
Tests to be done : pH, TSS, Fe, Mn, Cond, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	227	umhos	Danny C. Mays	12/02/2010	1315	120.1 (1)
Iron	0.36	mg/l	Allen Bailey	12/07/2010	1450	236.1 (1)
Manganese	0.08	mg/l	Allen Bailey	12/07/2010	1505	243.1 (1)
pH	7.03	s.u.	Danny C. Mays	12/02/2010	1315	150.1 (1)
Report			Sherri Fields	12/09/2010		
TSS	2	mg/l	Heath Brown	12/03/2010	1020	160.2 (1)

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PERC ENGINEERING CO., INC.
P.O. Box 1712
Jasper, Alabama 35502
(205) 384-5553

Sample Number : 137930
Client : Twin Pines Coal Company, Inc.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: -2462708
Code : s
Date Taken : 12/02/2010
Sampled By : dcm
Time Taken : 1215
Depth or Flow : 0.06 cfs
Tests to be done : pH, TSS, Fe, Mn, Cond, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	391	umhos	Danny C. Mays	12/02/2010	1215	120.1 (1)
Iron	0.31	mg/l	Allen Bailey	12/07/2010	1450	236.1 (1)
Manganese	0.60	mg/l	Allen Bailey	12/07/2010	1505	243.1 (1)
pH	6.16	s.u.	Danny C. Mays	12/02/2010	1215	150.1 (1)
Report			Sherri Fields	12/09/2010		
TSS	1	mg/l	Heath Brown	12/03/2010	1020	160.2 (1)

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Jasper, Alabama 35502
(205) 384-5553

Sample Number : 137931
Client : Twin Pines Coal Company, Inc.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: 02462053
Code : s
Date Taken : 12/02/2010
Sampled By : dcm
Time Taken : 1105
Depth or Flow : 1.35cfs
Tests to be done : pH, TSS, Fe, Mn, Cond, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	1283	umhos	Danny C. Mays	12/02/2010	1105	120.1 (1)
Iron	0.33	mg/l	Allen Bailey	12/07/2010	1450	236.1 (1)
Manganese	0.26	mg/l	Allen Bailey	12/07/2010	1505	243.1 (1)
pH	7.23	s.u.	Danny C. Mays	12/02/2010	1105	150.1 (1)
Report			Sherri Fields	12/09/2010		
TSS	1	mg/l	Heath Brown	12/03/2010	1020	160.2 (1)

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Jasper, Alabama 35502
(205) 384-5553

Sample Number : 137933
Client : Twin Pines Coal Company, Inc.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: BCCSMSW-1
Code : s
Date Taken : 12/02/2010
Sampled By : dcm
Time Taken : 1500
Depth or Flow : 3.57 cfs
Tests to be done : pH, Fe, Mn, Cond, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	547	umhos	Danny C. Mays	12/02/2010	1500	120.1 (1)
Iron	0.10	mg/l	Allen Bailey	12/07/2010	1450	236.1 (1)
Manganese	0.04	mg/l	Allen Bailey	12/07/2010	1505	243.1 (1)
pH	7.43	s.u.	Danny C. Mays	12/02/2010	1500	150.1 (1)
Report			Sherri Fields	12/09/2010		
TSS	1	mg/l	Heath Brown	12/03/2010	1020	160.2 (1)

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PERC ENGINEERING CO., INC.
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Jasper, Alabama 35502
(205) 384-5553

Sample Number : 141213
Client : Shannon, LLC.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: BCCSMSW1
Code : s
Date Taken : 03/21/2011
Sampled By : swr
Time Taken : 1020
Depth or Flow :
Tests to be done : pH, Cond, Fe, Mn, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	429	us/cm	Heath Brown	03/28/2011	1350	120.1 (1)
Iron	0.51	mg/l	Allen Bailey	04/01/2011	1220	236.1 (1)
Manganese	0.25	mg/l	Allen Bailey	04/01/2011	1325	243.1 (1)
pH	8.00	s.u.	Steve Riddlesperger	03/21/2011	1020	150.1 (1)
Report			Sherri Fields	04/01/2011		
TSS	4	mg/l	Heath Brown	03/22/2011	1555	160.2 (1)

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PERC ENGINEERING CO., INC.
P.O. Box 1712
Jasper, Alabama 35502
(205) 384-5553

Sample Number : 141383
Client : Shannon, LLC.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: -2462708
Code : s
Date Taken : 03/24/2011
Sampled By : swr
Time Taken : 1240
Depth or Flow : 0.691cfs
Tests to be done : pH, Fe, Mn, Cond, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	702	us/cm	Heath Brown	03/29/2011	0900	120.1 (1)
Iron	0.69	mg/l	Allen Bailey	04/05/2011	1425	236.1 (1)
Manganese	0.23	mg/l	Allen Bailey	04/07/2011	0705	243.1 (1)
pH	7.43	s.u.	Steve Riddlesperger	03/24/2011	1240	150.1 (1)
Report			Sherri Fields	04/07/2011		
TSS	6	mg/l	Heath Brown	03/25/2011	1625	160.2 (1)

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P.O. Box 1712
Jasper, Alabama 35502
(205) 384-5553

Sample Number : 141384
Client : Shannon, LLC.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: 02462765
Code : s
Date Taken : 03/24/2011
Sampled By : swr
Time Taken : 1327
Depth or Flow : 1.999cfs
Tests to be done : pH, Fe, Mn, Cond, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	141	us/cm	Heath Brown	03/29/2011	0900	120.1 (1)
Iron	0.82	mg/l	Allen Bailey	04/05/2011	1425	236.1 (1)
Manganese	0.15	mg/l	Allen Bailey	04/07/2011	0705	243.1 (1)
pH	7.72	s.u.	Steve Riddlesperger	03/24/2011	1327	150.1 (1)
Report			Sherri Fields	04/07/2011		
TSS	11	mg/l	Heath Brown	03/25/2011	1625	160.2 (1)

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Jasper, Alabama 35502
(205) 384-5553

Sample Number : 141385
Client : Shannon, LLC.
Facility : Shannon Mine P-3859
Job Number :
NPDES Permit # :
Basin,Stream,Well ID: 02462053
Code : s
Date Taken : 03/24/2011
Sampled By : swr
Time Taken : 1420
Depth or Flow : 1.991cfs
Tests to be done : pH, Fe, Mn, Cond, TSS, Report,

Parameter	Result	Units	Analyst	Date	Time	Method
Conductivity	1417	us/cm	Heath Brown	03/29/2011	0900	120.1 (1)
Iron	0.30	mg/l	Allen Bailey	04/05/2011	1425	236.1 (1)
Manganese	0.26	mg/l	Allen Bailey	04/07/2011	0705	243.1 (1)
pH	7.90	s.u.	Steve Riddlesperger	03/24/2011	1420	150.1 (1)
Report			Sherri Fields	04/07/2011		
TSS	5	mg/l	Heath Brown	03/25/2011	1625	160.2 (1)

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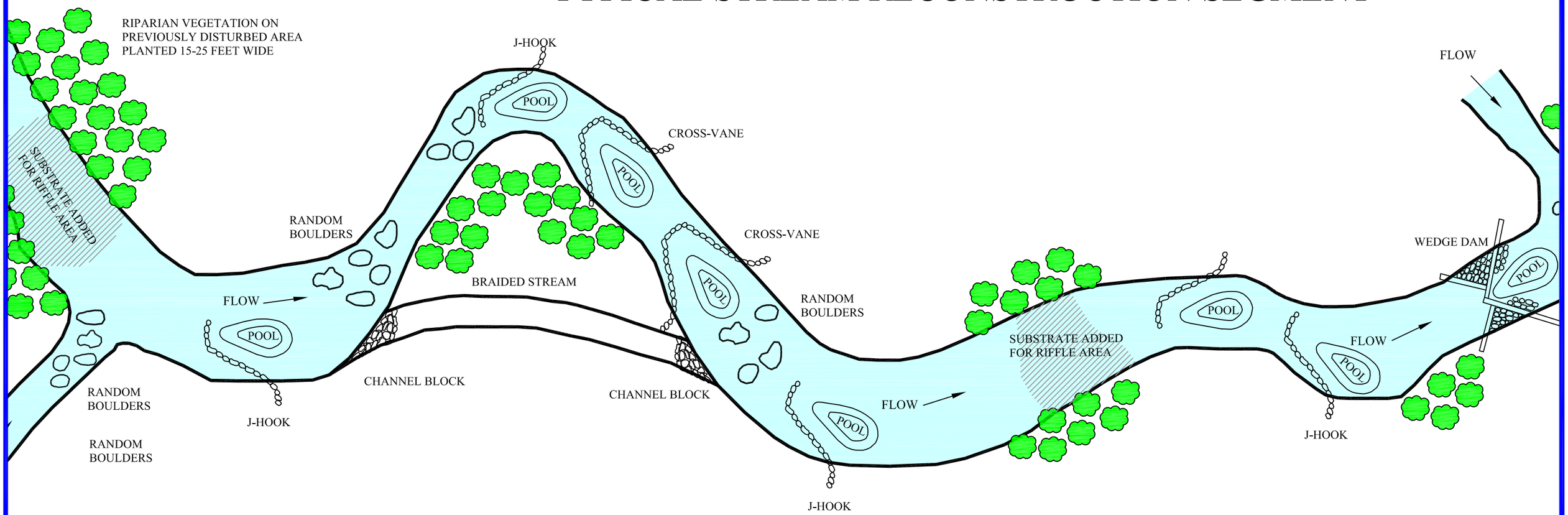
Appendix G — Stream Restoration Structure Typicals

TYPICAL STREAM RECONSTRUCTION SEGMENT



Shannon, LLC. -- Shannon Mine No. 4
INITAL PERMIT REQUEST

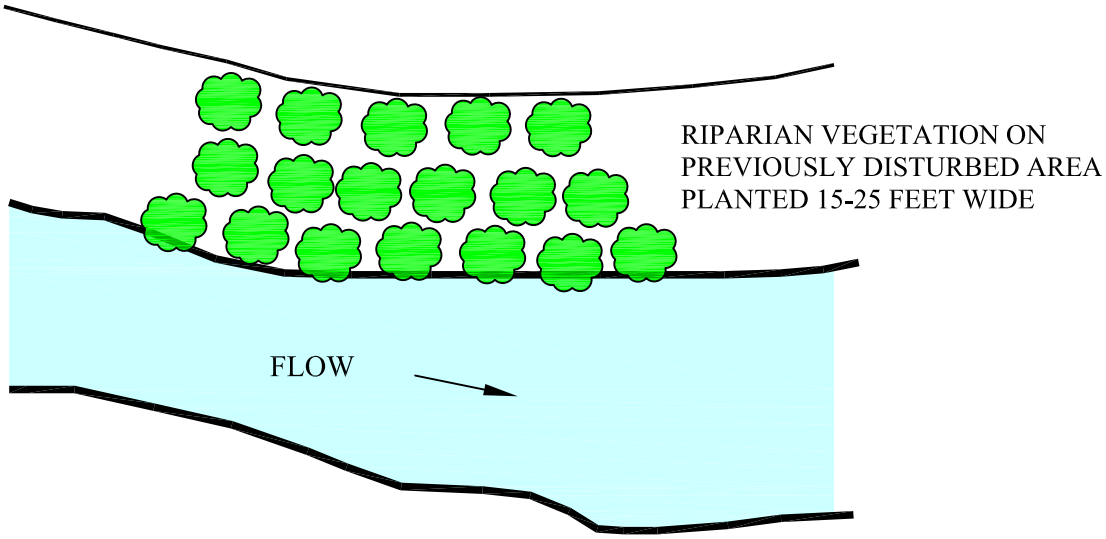
mcgehee engineering corp
post office box 3431
jasper, alabama 35502-3431
telephone: (205) 221-0686 fax: 221-7721
email: staff@mcgehee.org

STREAM RECONSTRUCTION SEGMENT TYPICAL

Not to Scale

RIPARIAN ZONE PLANTING

PLAN VIEW



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jasper, alabama 35502-3431
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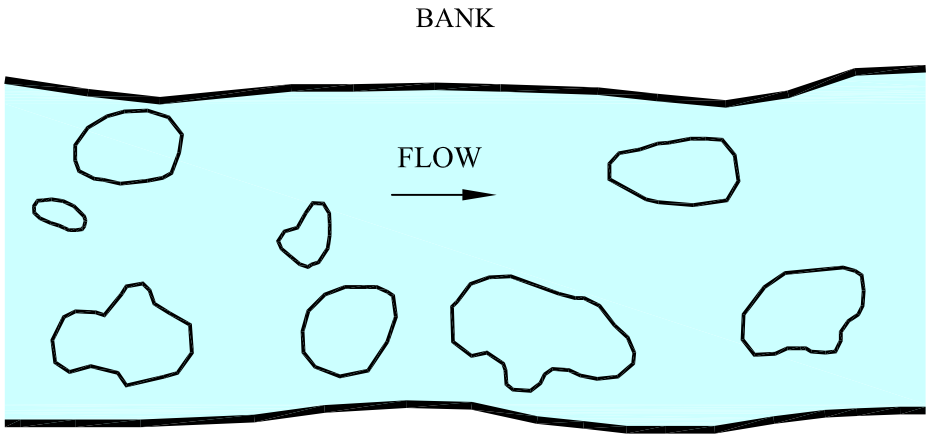
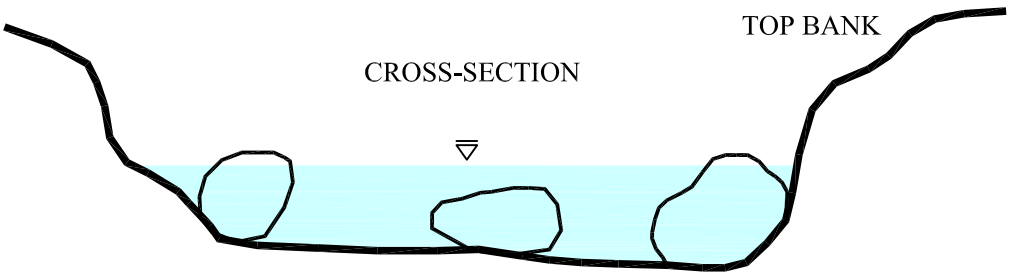
email: staff@mcgehee.org

Not to Scale

RANDOM BOULDER PLACEMENT

PLAN VIEW





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jasper, alabama 35502-3431
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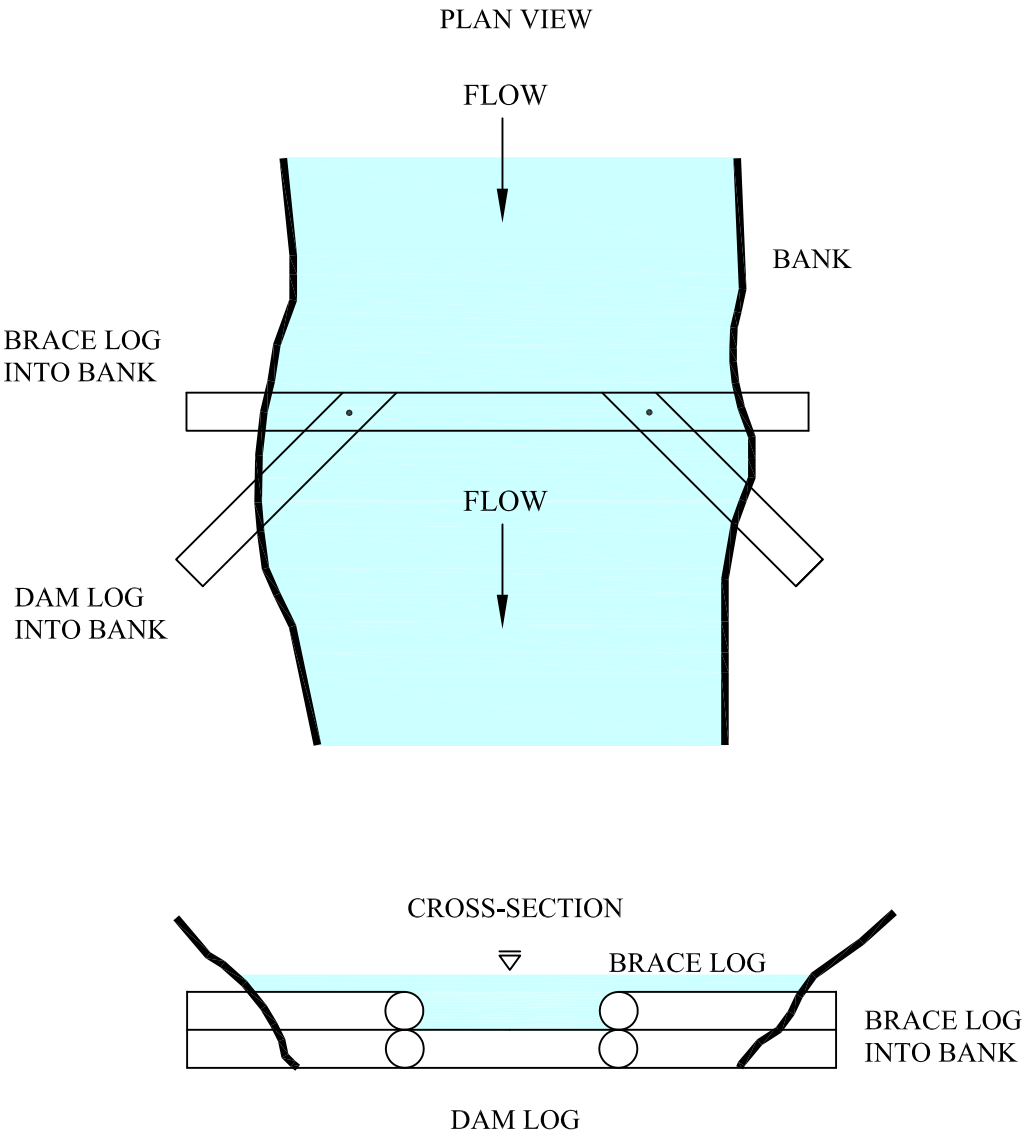
email: staff@mcgehee.org

RANDOM BOULDER PLACEMENT TYPICAL

Not to Scale



Shannon, LLC. -- Shannon Mine No. 4
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jasper, alabama 35502-3431
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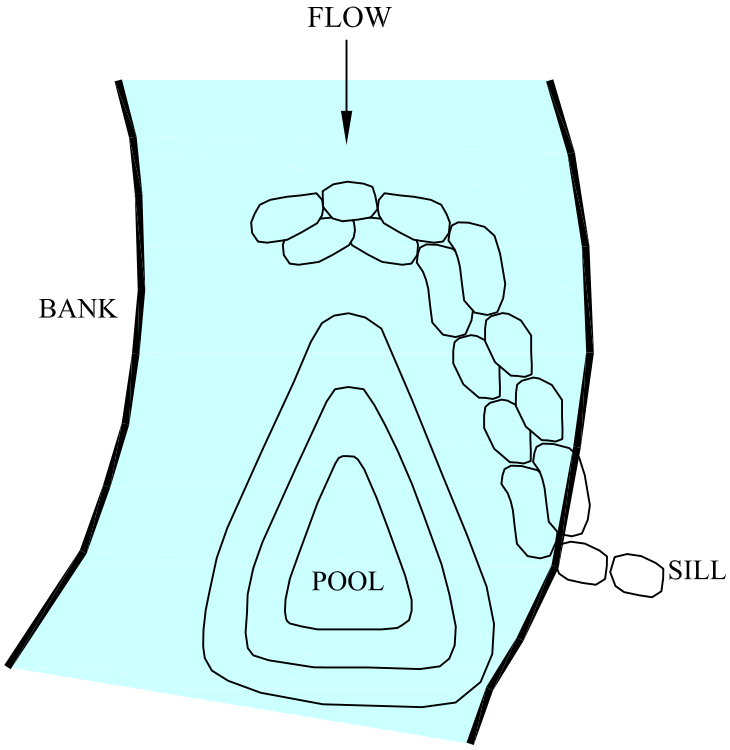
email: staff@mcgehee.org

Not to Scale

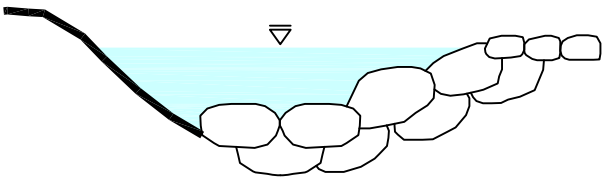
J-HOOK

PLAN VIEW



SILL

CROSS-SECTION



Shannon, LLC. -- Shannon Mine No. 4
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J - HOOK TYPICAL

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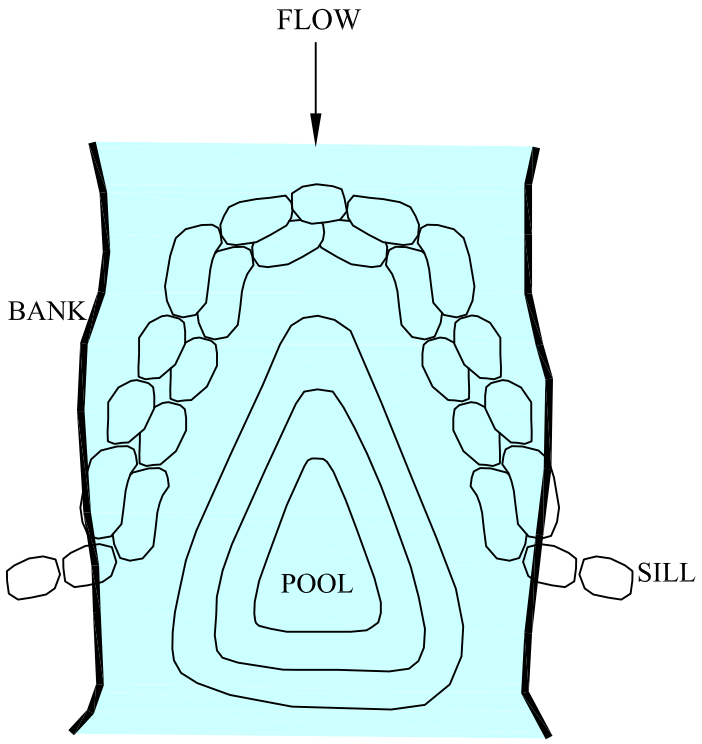
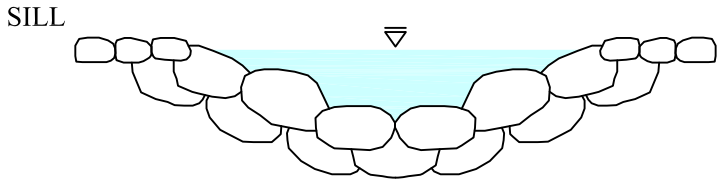
Not to Scale

CROSS VANE

PLAN VIEW



CROSS-SECTION



Shannon, LLC. -- Shannon Mine No. 4
INITAL PERMIT REQEUST

CROSS VANE TYPICAL

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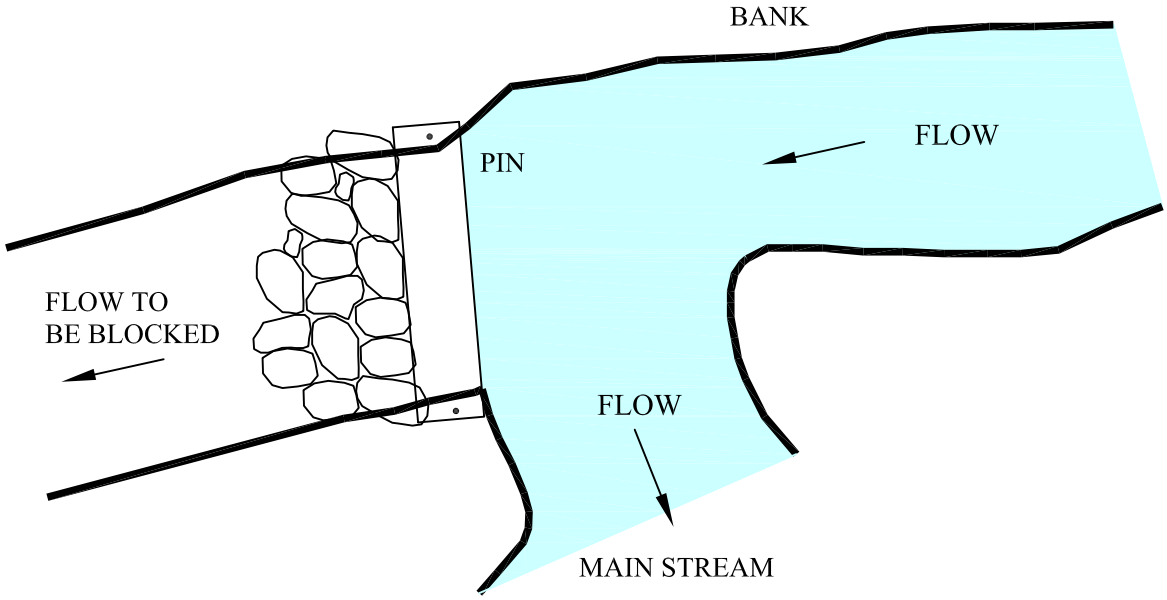
email: staff@mcgehee.org

Not to Scale

CHANNEL BLOCK

PLAN VIEW



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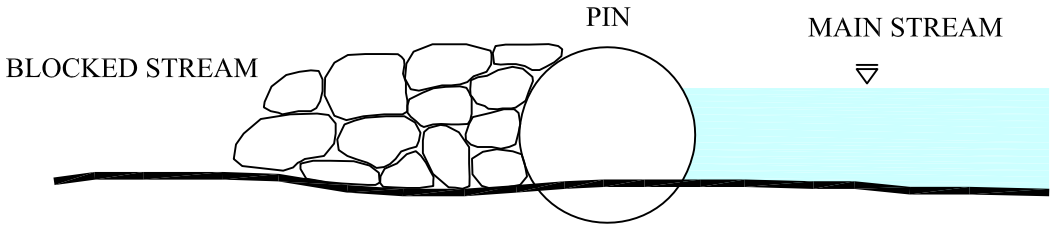

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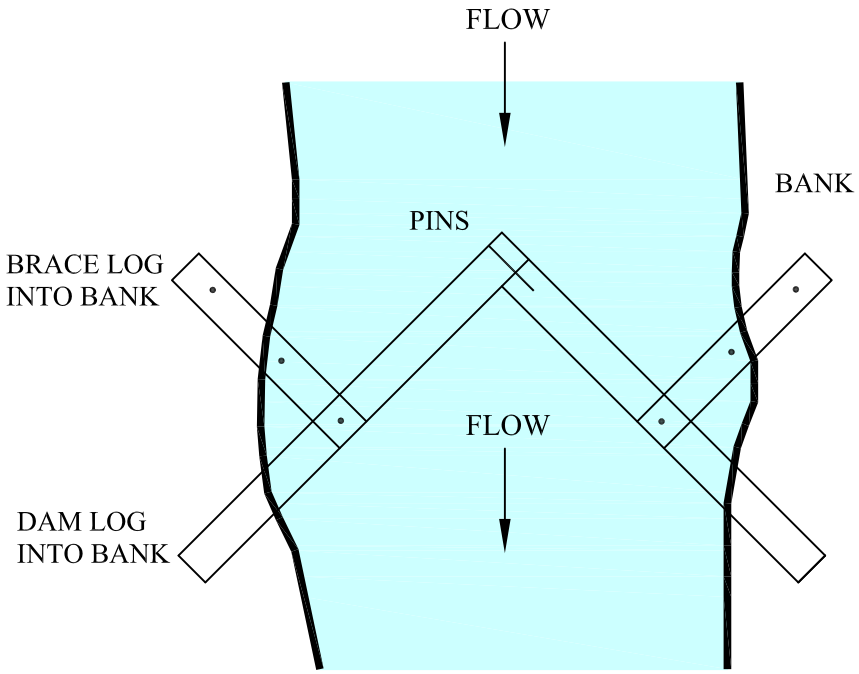
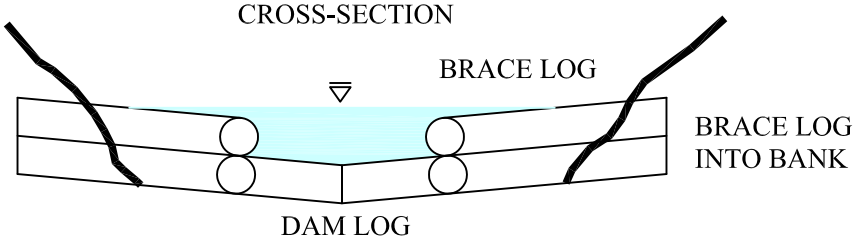
Not to Scale

WEDGE DAM

PLAN VIEW



CROSS-SECTION



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Not to Scale

Appendix H — Stream Restoration Structure Specifications (Rosgen 2006)

(f) Phase VI—Selection and design of stabilization and enhancement structures/methodologies

The objectives of river structures are often primarily designed to:

- buy time to protect the new channel from excess erosion until significant riparian vegetation can become established
- reduce accelerated streambank erosion
- provide grade control
- provide recreational boating
- obtain stable flow diversions
- enhance fish habitat including instream cover, holding cover, spawning habitat, and habitat diversity
- reintroduce and stabilize large wood for fishery, stability, and aesthetic purposes
- protect infrastructure adjacent to streams
- protect bridges, culverts, and drainageway crossings
- reduce flood levels
- transport sediment
- provide energy dissipation

River stabilization and enhancement structures are numerous and continue to be improved and developed. The effort here will not be to make a complete listing, but rather present methods used in the Rosgen geomorphic channel design methodology consistent with the objectives. The structures and methods primarily utilize native materials such as natural boulders, logs, rootwads, and vegetative transplants.

Design objectives will be presented to provide the user with alternatives to standard or traditional structures.

Grade control

Often cross-channel check dams are used for grade control. NRCS has successfully used many types of channel grade control structures, but streams with high sediment loads have experienced some adverse channel adjustment in some case. The adjustments are associated with aggradation, lateral erosion, flood stage increase, migration barriers for fish, increased recreational boating risk, land loss, channel incision through lateral migration and channel avulsion. To prevent these stability problems, the cross vane was developed (fig.11–27 (Rosgen 2001e)).

Application of this design is also very effective for bridge pier scour reduction (Johnson, Hey, et al. 2002). A photograph depicting the structure as constructed on the lower Blanco River, Colorado, is shown in figure 11–28. The structure also decreases near-bank shear stress, minimizing streambank erosion.

The photographs in figures 11–29 and 11–30 demonstrate the use of cross vanes in river restoration. In this example, a reconstructed river project on the East Fork Piedra River, Colorado, in a valley type V (glacial trough), converted a braided (D4) stream type to a meandering (C4) stream type. The use of the cross vane structure was effective at maintaining grade control, transporting excessive coarse bed load, reducing bank erosion, buying time for riparian vegetation colonization, and providing trout habitat. The structures located along 3 miles of this project withstood floods at twice the bankfull discharge magnitude in 2004. Logs and rootwads can also be utilized in this structure as designed in Rosgen (2001e) and as shown in figure 11–31. The use of large wood in this structure assists in the visual, as well as biological enhancement objectives. The step in the upper third of the structure dissipates energy, reduces footer scour, and minimizes risk for recreational boating and fish passage.

A structure designed for larger rivers for grade control and streambank protection is the W-weir. This structure can also be effectively used for irrigation diversions, protection of central piers and approach sections on bridges, bed-load transport, recreational boating, and fish habitat. Visually, it is improved over a line of rock often used in grade control. It resembles natural bedrock features in stream channels. Figure 11–32 depicts the design (Rosgen 2001e), and figure 11–33 shows a typical W-weir structure as installed on the Uncompahgre River in Colorado.

Streambank stabilization

Most stream restoration projects require some degree of streambank stabilization. Often the stabilization involves riparian vegetation reestablishment or change in management. Regardless, there is a time element that is needed to establish rooting depth, density, and

Figure 11–27 Cross section, profile, and plan view of a cross vane

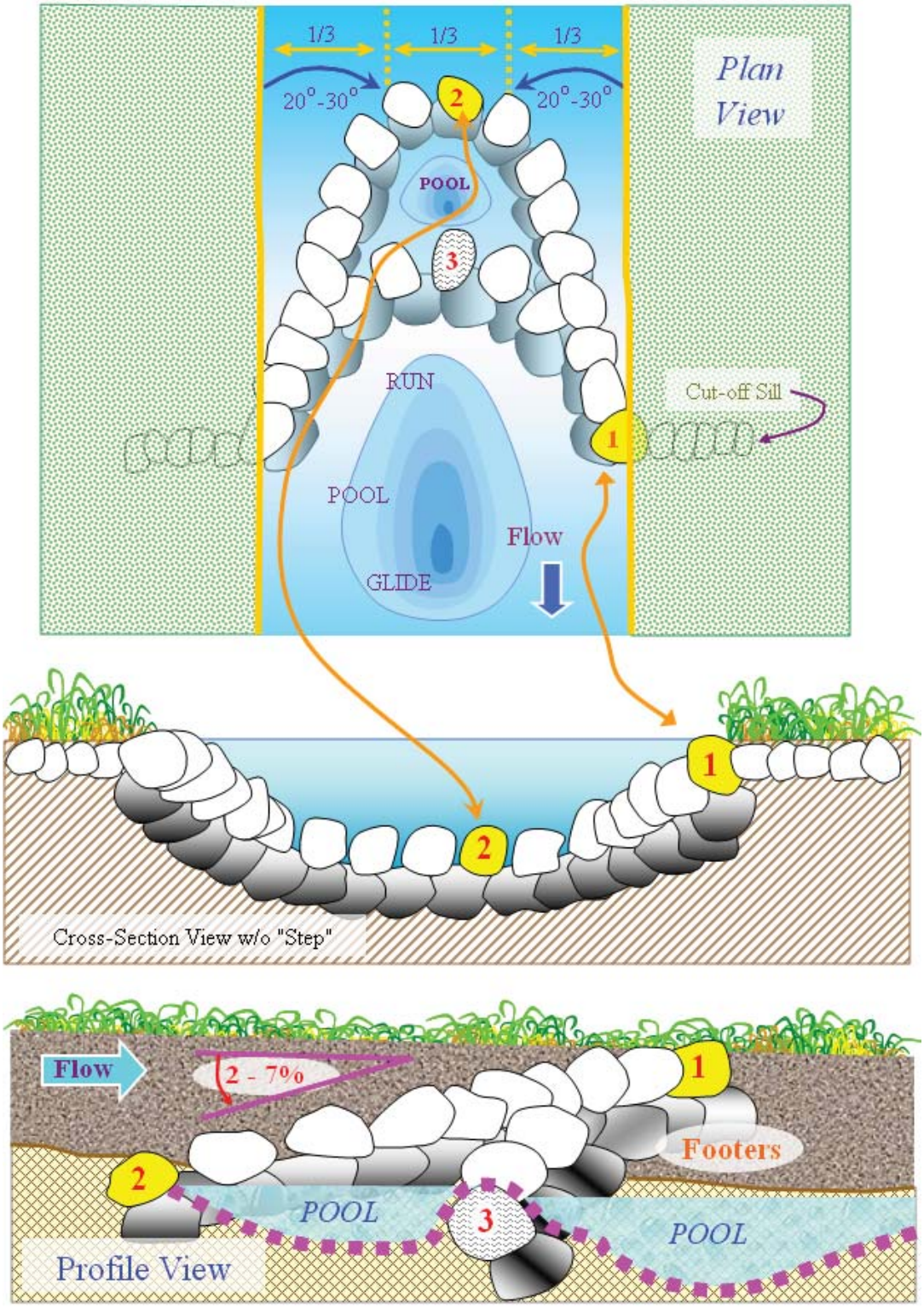


Figure 11–28 Cross vane installed on the lower Blanco River, CO

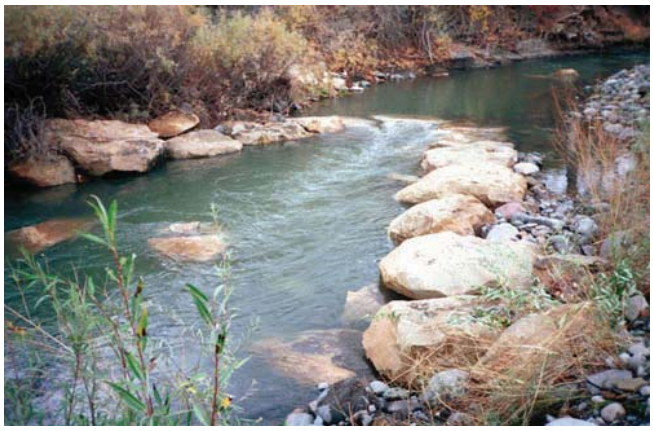


Figure 11–29 Cross vane structure with step on the East Fork Piedra River, CO

Figure 11–30 Cross vane/step-pool on the East Fork Piedra River, CO

Figure 11–31 Cross vane/rootwad/log vane step-pool, converting a braided D4→C4 stream type on the East Fork Piedra River, CO

Figure 11–32 Plan, cross section, and profile views of a W-weir structure

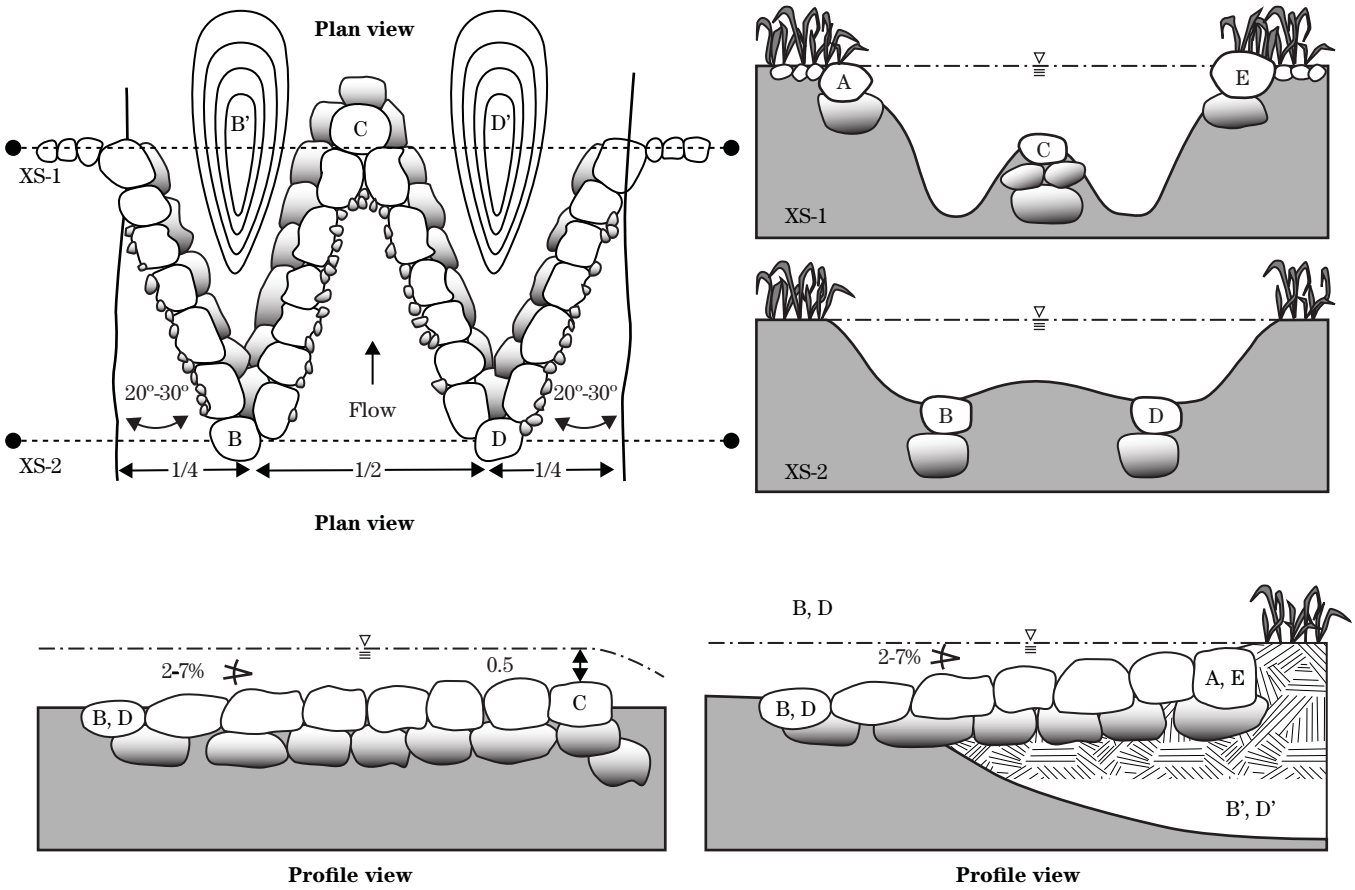


Figure 11–33 W-weir installed on the Uncompahgre River, CO

Figure 11–34 Plan, profile, and section views of the J-hook vane structure

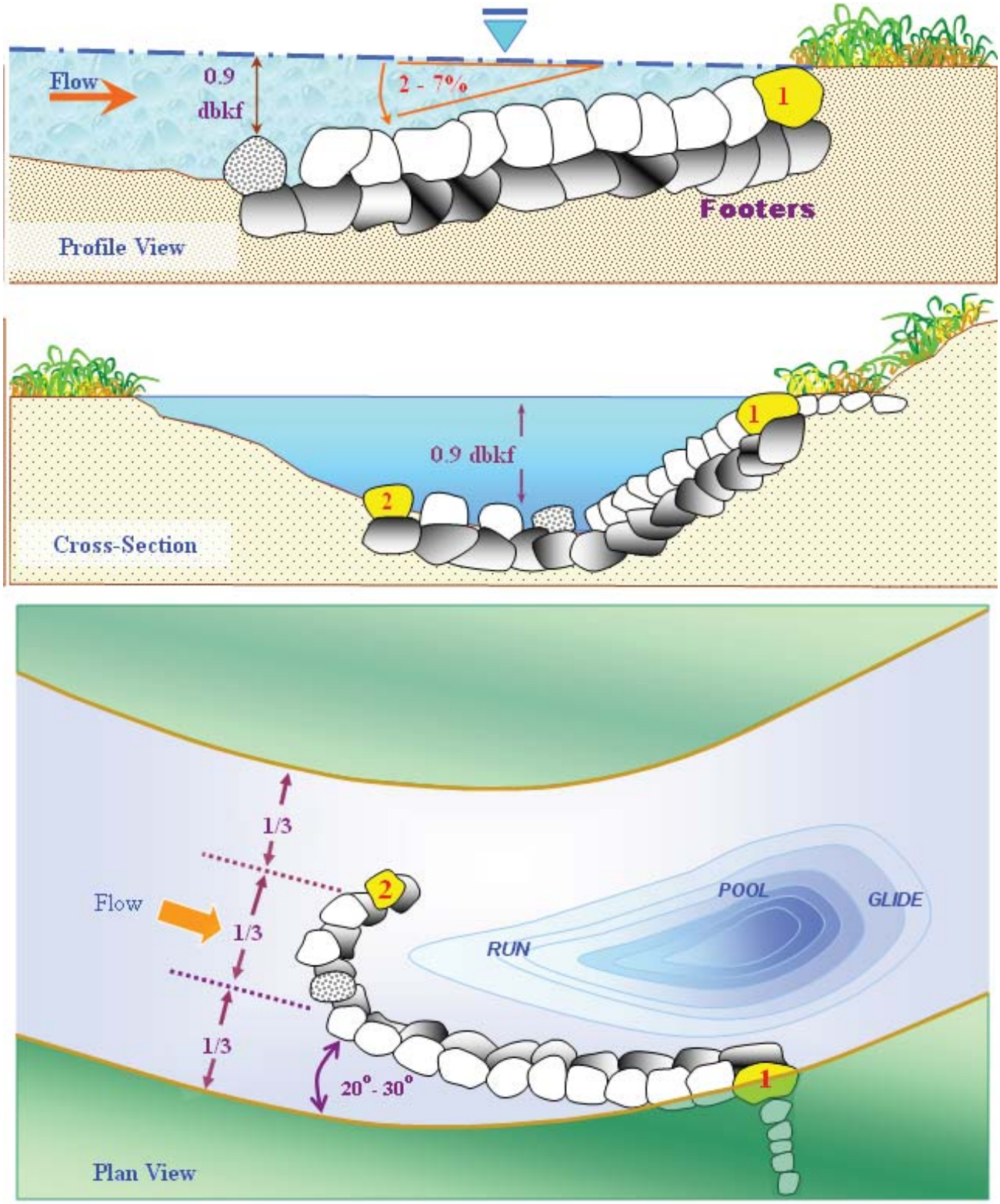


Figure 11–35 Log vane/J-hook combo with rootwad structure

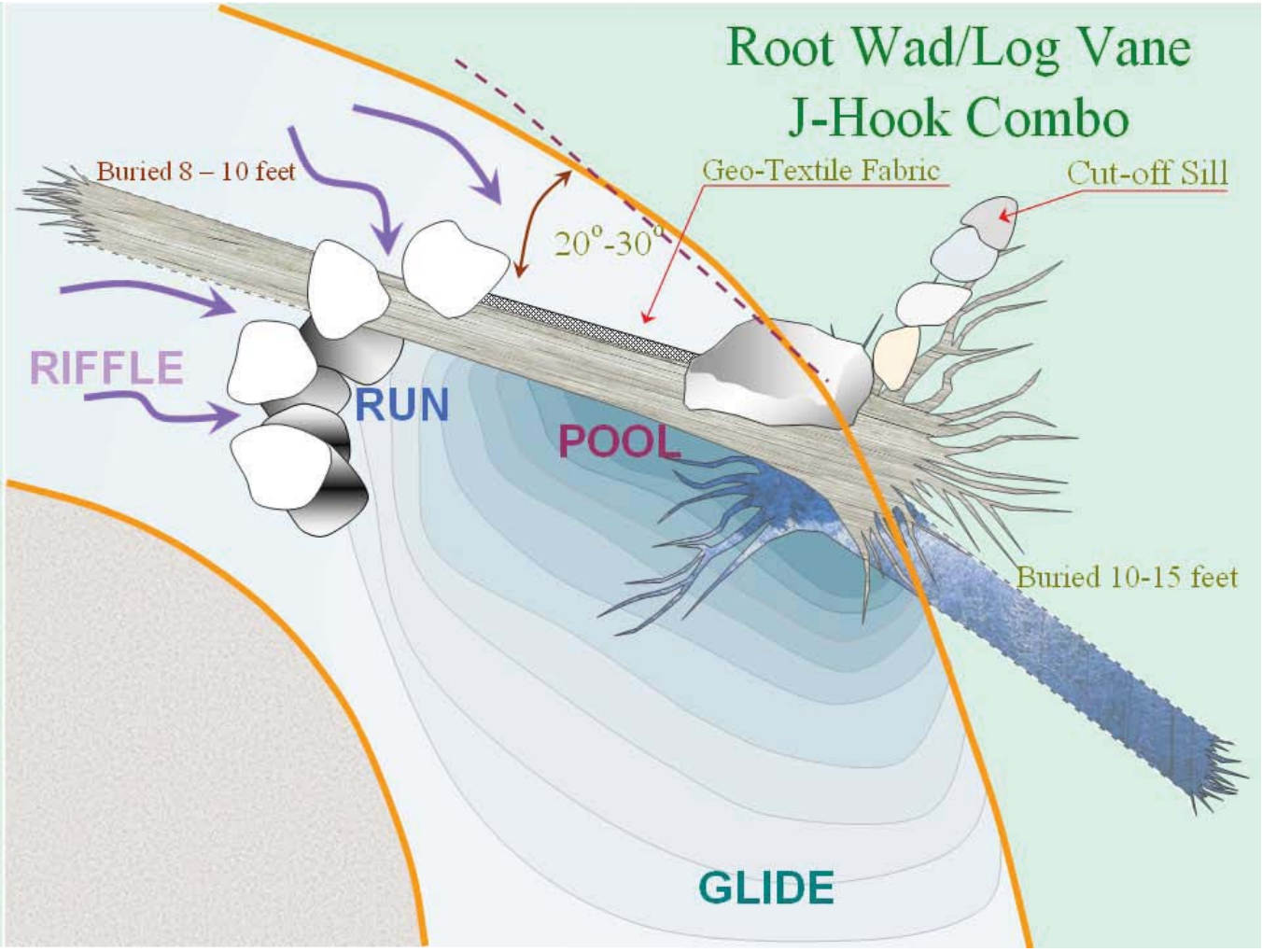


Figure 11–36 Rock vane/J-hook combo with rootwad and log vane footer

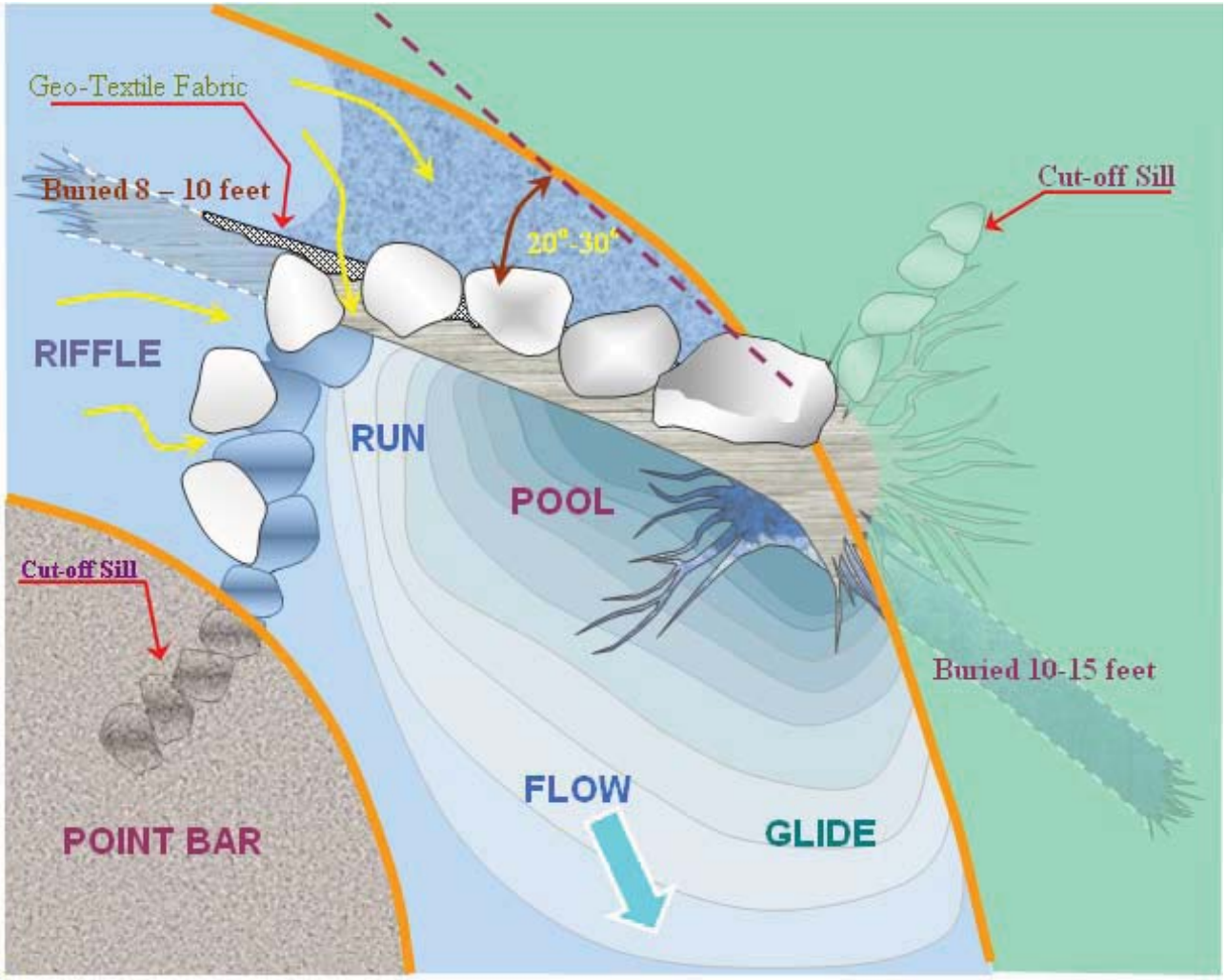


Figure 11–37 Native boulder J-hook with cut-off sill, East Fork Piedra River, CO

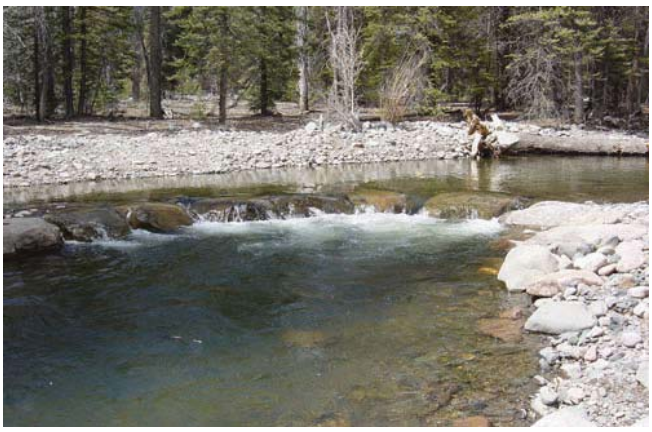


Figure 11–38 Rootwad/log vane/J-hook structure, East Fork Piedra River, CO

Figure 11–39 J-hook/log vane/log step with cut-off sill, East Fork Piedra River, CO

Figure 11–40 Longitudinal profile of proposed C4 stream type showing bed features in relation to structure location

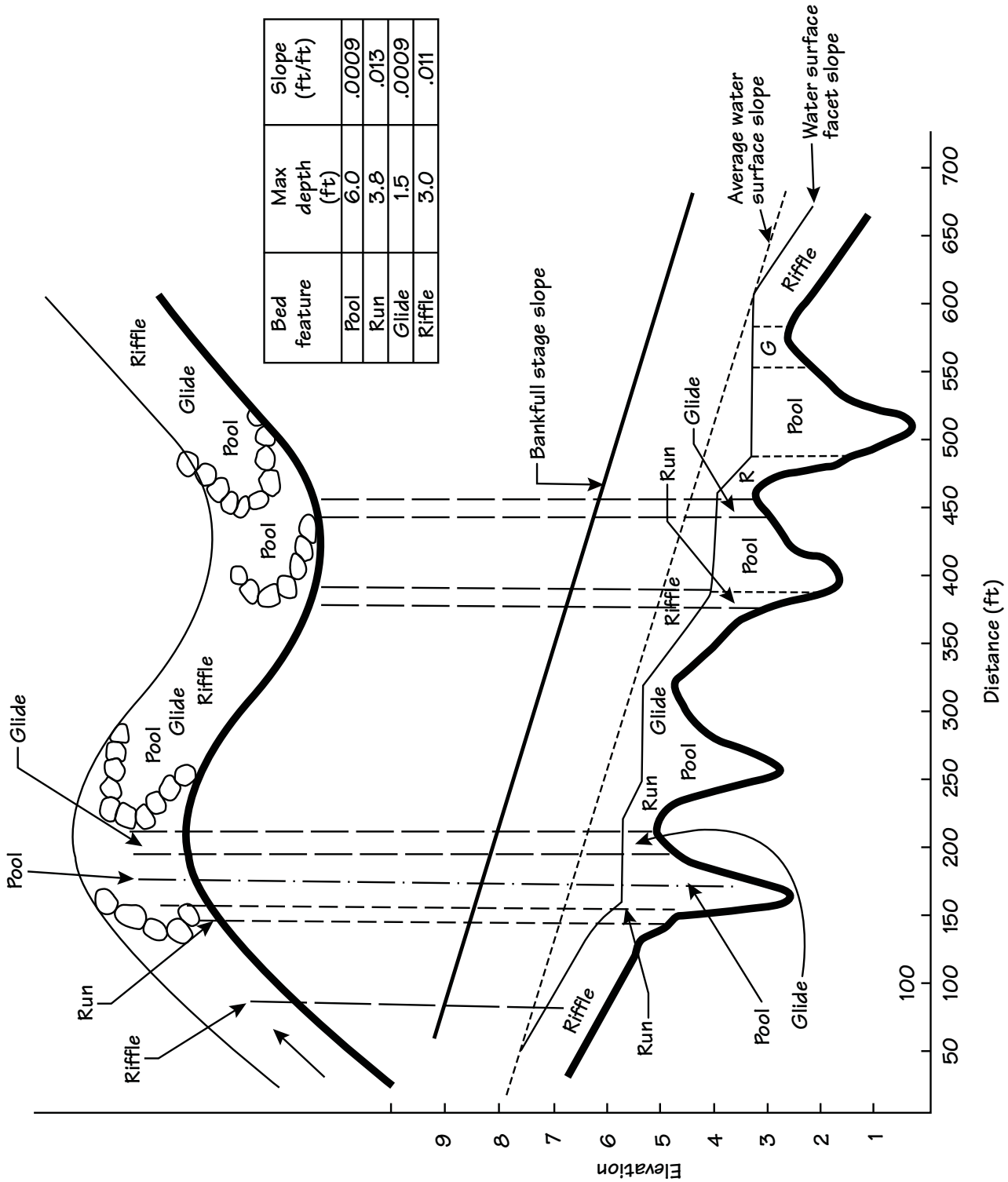


Figure 11–41 Boulder cross vane and constructed bankfull bench

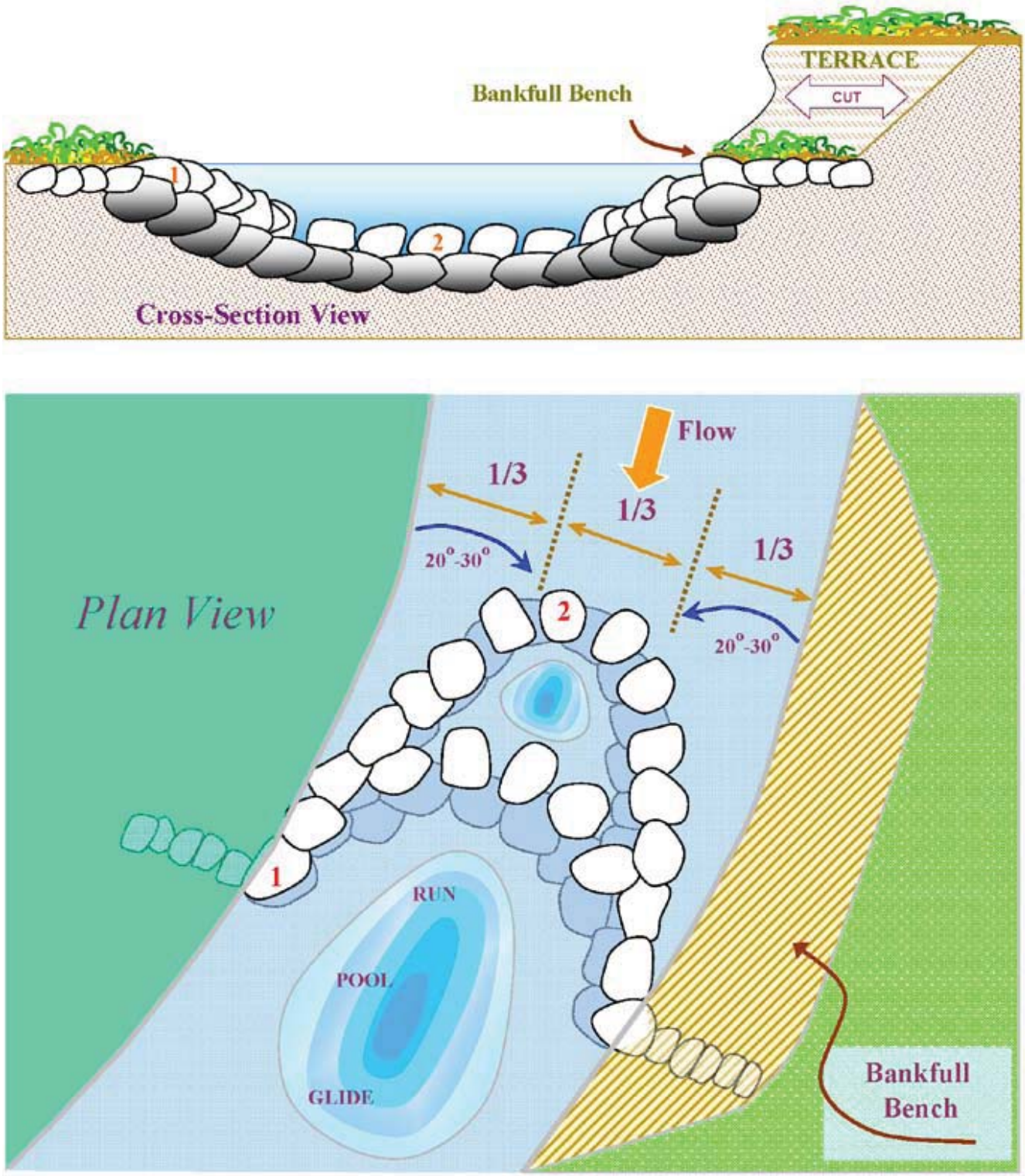
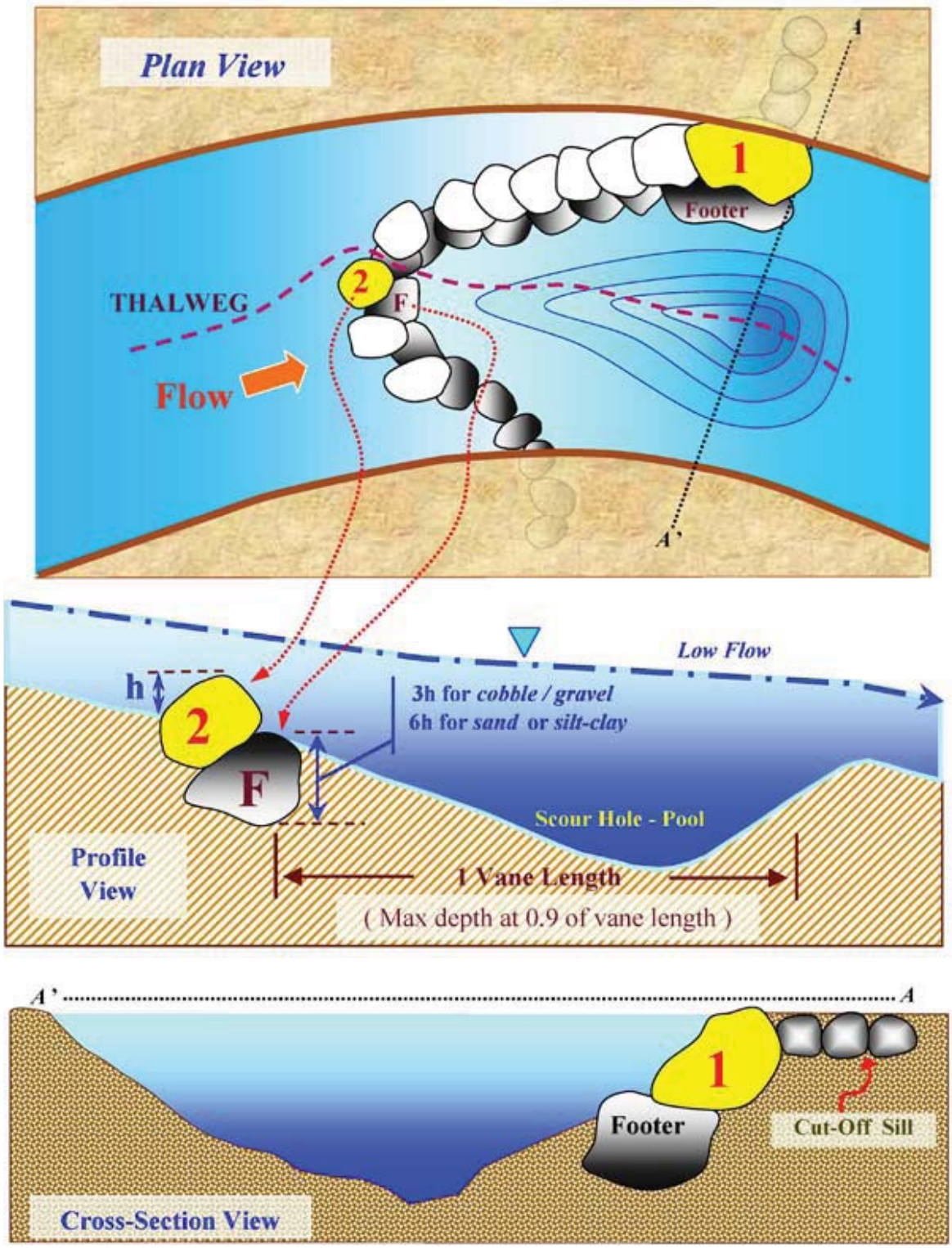


Figure 11–42 Locations/positions of rocks and footers in relation to channel shape and depths



strength to help maintain bank stability. The use of the J–hook (or fish hook) vane was developed to reduce near-bank stress to buy time for root development. The design is shown in figure 11–34 (Rosgen 2001e). Materials other than boulder are used in the J–hook vane. Logs and rootwads can be effectively used for multiple objectives (fig. 11–35 (Rosgen 2001e)). Variations in the use of materials are shown in figure 11–36 (Rosgen 2001e). An example of a J–hook vane is shown in figure 11–37, as constructed out of native boulders located in a reconstructed East Fork Piedra River. The structure also provides fish habitat, energy dissipation, bed-load transport, and provides protection of developments along streambanks. The use of a J–hook vane reduces the need for toe rock stabilization or a surfacing or hardening of the bank with riprap or other resistant structure. The length of bank protected is approximately two and a half to three times the length of the vane. The J–hook vane also is used to protect bridges and structures (Johnson, Hey, et al. 2001). Figures 11–38 and 11–39 provide examples of a J–hook vane using logs, rootwads, and log steps, as well as native boulders.

An example of the use of structure location forming compound pools consistent with meander curvature and bed features is shown in figure 11–40. The accompanying data indicate the slope and depth of the corresponding bed features. Regardless of structures, riparian vegetation establishment and management must be an active part of Rosgen geomorphic channel design.

Vane design specifications

The use of structures must be compatible with curvature and bed features of natural rivers. Figures 11–41 and 11–42 illustrate the use of rock for cross vanes, as well as for footers. Figure 11–43 provides guidance on rock sizing.

Vane slope—The slope of the vane extending from the bankfull stage bank should vary between 2 to 7 percent. Vane slope is defined by the ratio of bank height/vane length. For installation in meander bends, ratios of J-hook vane length/bankfull width is calculated as a function of the ratio of radius of curvature/bankfull width and departure angle (table 11–15). Equations for predicting ratios of J-hook vane spacing/bankfull width on meander bends based on ratio of radius of curvature/bankfull width and departure angle are shown in table 11–16. Vane length is the distance measured from the bankfull bank to the intercept with

Figure 11–43 Rock size

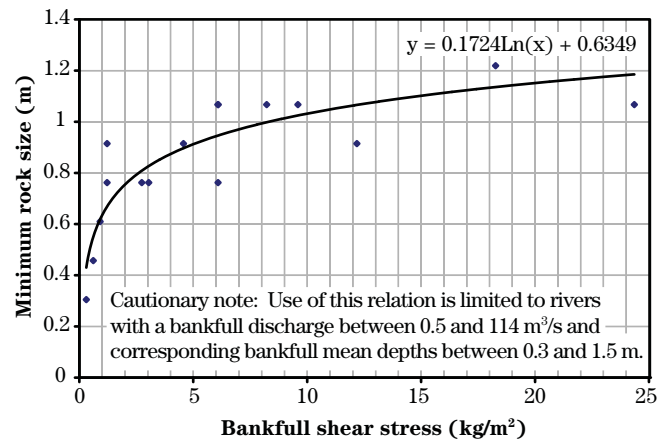


Table 11–15 Equations for predicting ratio of vane length/bankfull width (V_L) as a function of ratio of radius of curvature/width and departure angle, where W = bankfull width (SI units)

Rc/W	Departure angle (degrees)	Equation
3	20	$V_L = 0.0057\ W+0.9462$
3	30	$V_L = 0.0089\ W+0.5933$
5	20	$V_L = 0.0057\ W+1.0462$
5	30	$V_L = 0.0057\ W+0.8462$

Table 11–16 Equations for predicting ratio of vane spacing/width (V_s) as a function of ratio of radius of curvature/width and departure angle, where W = bankfull width (SI units)

Rc/W	Departure angle (degrees)	Equation
3	20	$V_s = -0.006\ W+2.4781$
3	30	$V_s = -0.0114\ W+1.9077$
5	20	$V_s = -0.0057\ W+2.5538$
5	30	$V_s = -0.0089\ W+2.2067$

the invert elevation of the streambed at a third of the bankfull channel width for either cross vanes or J-hook vanes. For very large rivers, where it is impractical to extend the vane length to a third of the bankfull width, vane slope is calculated based on the specified angle of departure and the ratio of bank height/vane length where the vane arm intercepts the proposed invert of the structure.

The spacing of J-hook vanes can be increased by 0.40W for a low BEHI of less than 30 (Rosgen 1996, 2001b).

Bank height—The structure should only extend to the bankfull stage elevation. If the bank is higher, a bankfull bench is constructed adjacent to the higher bank, and the structure is integrated into the bench. The use of a cross vane is shown in figure 11–41 where a bankfull bench is created adjacent to a terrace bank.

Footers—The minimum footer depth at the invert for cobble and gravel-bed streams is associated with a ratio of three times the protrusion height of the invert rock. This is applicable to all three structures and is shown in figure 11–41 for a J-hook vane. For sand-bed streams, the minimum depth is doubled due to the deeper scour depths that occur. All rocks for all three structures require footers. If spaces are left between the invert rocks for cross vane and W-weirs, the top of the footer rocks becomes the invert elevation for grade control. If no gaps are left, the top of the surface rock becomes the base level of the stream.

Rock size—The relationship of bankfull shear stress to minimum rock size used for all three structures is shown in figure 11–43. The application of this empirical relation is limited to size of rivers whose bankfull discharge varies from 0.56 cubic meters per second (20 ft^3/s) to 113.3 cubic meters per second (4,000 ft^3/s). For example, appropriate minimum rock sizes for values of bankfull shear stress less than 1.7 kilograms per square meter (0.35 lb/ft^2) are associated only with stream channel bankfull depths from 0.26 to 1.5 meters (2–5 ft). This relation would not be appropriate for applications outside the limits of the data for a river slope of 0.0003 and a mean depth of 6.1 meters, even though a similar shear stress results, as in the example presented.

(g) Phase VII—Design implementation

A key requirement at this phase is to correctly implement the proposed design. This involves the layout, construction supervision, and water quality controls during construction.

Layout

It is necessary to pre-stake the alignment of the channel and to provide for protection of existing vegetation outside of the construction alignment. The layout involves making necessary onsite adjustments to the design based on constraints that may have been previously overlooked. Terrain irregularities, vegetation, property boundaries, and channel changes since the field data were collected can all require local modifications to placement. Staging areas for materials must be located for both the collection and temporary storage of materials. Stockpile areas, vegetative donor sites, and boundary references/facilities requiring special identification must be flagged. Locations of structure placement and type must be flagged.

Construction supervision (oversight)

Without exception, it is critical to have daily onsite inspection and construction coordination. It is essential to check grades, dimensions, structure placement, slopes, angles, and footers as an on-going requirement. It is most effective to coordinate this work during construction, rather than wait and provide a postconstruction inspection and find problems after the work is completed. The daily field review and documentation at this phase is very helpful to properly implement the design.

Water quality controls

As part of the layout, sediment detention basins, diversions, silt fences, and pump sites must be located to prevent onsite and downstream sediment problems and as required by Federal, state, and local ordinances. Staging of construction should also be conducted in such a manner to minimize sedimentation problems. Monitoring of water quality during construction may be required; thus, preventative measures will reduce future potential problems.

(h) Phase VIII—Monitoring and maintenance

Monitoring

The key to a successful monitoring program is the focus on the question or the specific objectives of monitoring. Monitoring is generally recommended to:

- measure the response of a system from combined process interaction due to imposed change
- document or observe the response of a specific process and compare to predicted response for a prescribed treatment
- define short-term versus long-term changes
- document spatial variability of process and system response
- ease the anxiety of uncertainty of prediction
- provide confidence in specific management practice modifications or mitigation recommendations to offset adverse water resource impacts
- evaluate effectiveness of stabilization or restoration approaches
- reduce risk once predictions and/or practices are assessed
- build a data base to extrapolate for similar applications
- determine specific maintenance requirements

Watershed and river assessments leading to restoration involve complex process interactions, making accurate predictions somewhat precarious. Measured data reflecting specific processes will continually improve understanding and prediction of sedimentological, hydrological, morphological, and biological process relations. Another great benefit resulting from monitoring is the demonstration of the effectiveness of reduced sediment problems and improved river stability due to management/mitigation—the central purpose of watershed and sediment assessments and restoration.

The state of the science cannot be advanced, nor can the understanding of complex processes be improved without monitoring. This phase is divided into three major categories:

- implementation monitoring to ensure restoration designs were laid out and constructed correctly
- validation monitoring (matching predicted to observed response, including model calibration and model validation)
- effectiveness monitoring (response of a process or system to imposed change)

Field methods/procedures are also addressed.

Implementation monitoring—Often the best-laid design plans are not implemented correctly due to various reasons. Response of a process and/or system must first address the question or possible variable of potential problem in instituting the design and stabilization/enhancement structures correctly. Riparian vegetation response may be ineffective if heavy grazing of livestock occurred. Exclusion fence maintenance can also be a key in vegetative recovery. If restoration designs were correct, but the contractor installed structures at the wrong angle, slope, or position on the bank, then near-bank stress reduction or erosion rate would not be a correct design implementation related to the effectiveness of the mitigation structure.

As-built measurements of dimension, pattern, and profile are essential to compare to design plans. Documentation of exact locations and types of stabilization and/or enhancement structures is also required. Many failures observed in monitoring are due to poor structure placement locations, construction problems, as well as inability to implement correct design specifications.

Vegetation establishment problems are often traced to establishing the wrong plant associations (species), planting at the wrong time of year and at the wrong elevations on the bank (water table), using the wrong techniques in transplanting and/or cutting plantings, and lacking an irrigation plan, if needed. This monitoring leads the designer to be very thorough in the vegetative planning and implementation phase of restoration.

Validation monitoring—For every prediction methodology, there is a procedure to validate the model. Some methods are more difficult and time consuming to validate than others, while some results can be determined on a short-term, rather than a long-term basis.

The monitoring will improve predictive capability for the future and potentially reduce mitigation measures that would not be effective for continued implementation. Conversely, if management practices indicate that sediment and/or stability conditions create obvious impairment, revised practices or specific process-based mitigation such as restoration may be recommended. The restoration specialist will gain the most confidence in the procedure only by field measurements, which not only validate a prediction, but determine if the initial assessment objectives were met. The various categories of validation monitoring include calibration and validation.

- **Validation**—Model validation involves testing of a model with a data set representing local field data. This data set represents an independent source (different from the data used to develop the relation). Often these data are used to extend the range of conditions for which the model was developed. Due to the uncertainty of prediction, this step is very important prior to widespread application of model output. Models can be extremely helpful in comparative analysis, even if observed values depart from measured. It is important, however, to be aware of the variability in the prediction. Often this monitoring outcome develops tighter relations or subsets of the initial relation, improving the understanding of the processes being predicted. An example of this type of monitoring would be similar to the effectiveness monitoring of streambank erosion rates presented previously. However, beyond measuring bank erosion rate, the observer is additionally required to measure the same parameters used to predict streambank erosion. The streambank prediction involves calculating a bank erosion hazard index (BEHI) and near-bank stress (NBS) (Rosgen 1996, 2001b). The analysis involves plotting the observed values with the predicted values for the same prediction variables. In many cases (with sufficient numbers of observations), this monitoring can lead to improved local or regional models, adapted for unique soil types and vegetation. Validation modeling provides documentation not only on how well the mitigation performed but also on the performance of the model.

  Validation modeling is designed to answer specific questions at specific sites/reaches. Design must be matched with a strong understanding of the prediction model. Validation modeling for the dimensionless ratio sediment rating curves would involve sampling sediment over the full range of streamflows to compare predicted to observed values. The measurements would need to be stratified by the same stream type and stability rating used for the prediction.

- **Calibration**—Models are often used to predict potential impairment. Model calibration is the initial testing of a model and tuning it to a set of field data. Field data are necessary to guide the modeler in choosing the empirical coefficients used to predict the effect of management techniques. An example of this is the data set of measured suspended sediment and bed-load sediment by stream type and stability to establish dimensionless ratio sediment rating curves used for design. These data were not collected in all areas where the model would potentially be applied; thus, another type of monitoring (validation) is helpful to determine if the model is appropriate for extrapolation to a particular region.

Effectiveness monitoring—The specific restoration design and implementation needs to be monitored. Monitoring will determine the appropriateness or effectiveness of specific designs and is implemented to reduce potential adverse sediment and/or river stability effects. Since monitoring requires site-specific measurements, temporal, spatial, scale, streamflow variation, and site/reach, monitoring is required to properly represent such variability and extrapolate findings of a process and/or system response to imposed change. Such variability factors are summarized as:

- **Temporal**—To isolate the variability of season and/or annual change, designs of monitoring should include monitoring over time scales. For example, measuring annual lateral erosion rates should include measurements once per year at the same time of year. If the objectives are to identify seasons where disproportionate erosion occurs, measurements may be obtained during snowmelt runoff, later post stormflow runoff, ice-off, and other periods of time associated with a given erosional process. Annual replicate surveys of particle size gradation of bed material under a permanent glide cross section will provide valuable information of

magnitude, direction, and consequence of annual shifts. Temporal measurements must also cover a range of time during bed-load sampling as surges occur or slugs of bed load often appear as discontinuities of time. Sampling over recommended time periods for a given flow (generally 20 minutes) helps the probability of observing this variability (as opposed to an instantaneous point sample). Short-term versus long-term monitoring must also be considered based on the probability of change, the severity and consequence of effects, and the likelihood of variation. Sampling over many years, although costly, may be warranted to cover changes in wet/dry periods.

- **Spatial**—Variability of change/response involving spatial considerations can be identified by measurements of the same process at more than one site (cross section) or even more intense on the same site. For example, a longitudinal profile measured over a couple of meander wavelengths will indicate changes in the maximum depth and/or slope of pools, rather than just monitoring one pool at one location. Identifying more than one reach of the same morphological type can also be used to understand response trends. Sampling the spatial variability (both vertically and laterally) within a cross section of velocity and sediment helps identify or at least integrate such variability into a documented observation.
- **Scale**—Monitoring streams of various sizes and/or stream orders, but of the same morphological type and condition, will help identify variability in system response for proper extrapolation of results. For example, vertical stability measurements should be made on river reaches of the same condition and the same type, but at locations that reflect various stream widths (size) and stream order.
- **Streamflow variation**—Measurements of channel process relations need to be stratified over a range of seasonal and annual flows. For example, both suspended and bed-load sediment should be measured over a wide range of flows during the freshet, low-elevation snowmelt, high-elevation snowmelt, rising versus recession stages, stormflow runoff, and baseflow. This stratification for streamflow allows the field observer to plot a sediment rating curve that represents the widest range of seasonal flows where changes in sediment supply can vary.
- **Site or reach variation**—Monitoring a site for soil loss should include a soil type designation for potential extrapolation for similar conditions on similar soil types. The same is true for stream types. Sediment, hydraulic, and stability monitoring need to be stratified by stream type since such data will naturally vary for the reference (stable) reach between stream types. This information is helpful to be able to readily detect departure from a reference stream type, rather than differences between stream types.
- **Design concepts for effectiveness monitoring**—The key information summary from the assessments used to identify impairment and resultant restoration designs are as follows:
  - Summarize the causes of land use impacts responsible for the impairment.
  - Understand the processes affected.
  - Identify specific locations and reaches associated with adverse impacts.
  - Determine the time trends of impacts (potential recovery periods).
  - Identify the specific nature of impairment (direction, magnitude, and trend of change).
  - Evaluate the consequence of change.
  - Determine the nature, location, extent and quality of mitigation (implementation).

The information supplied in the following list leads the observer to identify the locations, nature of processes affected, the extent of the impact, and quality of the mitigation implementation. For example, if the dominant process impacted by a land use is causing disproportionate sediment supply, land loss and river instability, and is determined to be accelerated streambank erosion, then the lateral stability monitoring would emulate the following design:

- Locate reaches of the same stream type that represent an unstable bank.
- Locate reaches of the same stream type that represent a stable bank.

- Install permanent cross sections on each set of reaches.
- Install bank pins (if conditions warrant) and/or toe pins (see monitoring methods).
- Inventory vegetation, bank material, and slope for each site (see monitoring methods).
- Resurvey both streambanks at least once per year to measure soil loss (lateral erosion) and total volume (in cubic feet and tons/year).
- Compare annual lateral erosion rates over time to the stable reach and document rate of recovery based on the nature of the mitigation.

Vertical stability and enlargement rates and direction can also be monitored using permanent cross sections in a similar stratification procedure (comparison to reference reach, above versus below, before versus after).

Physical and biological monitoring—The sediment and river stability changes associated with assessment and design are primarily related to physical changes. However, the consequences of such physical changes are directly related to potential impairment of the biological function. Changes in river stability, such as aggradation, degradation, enlargement, and stream type changes, are also related to habitat and food chains. Limiting factor analyses assesses habitat loss due to river instability and/or excess sediment such as relations of holding cover, instream/overhead cover, water temperature, dissolved oxygen, and benthics. A range of information associated with stream condition can be stratified by stream type by stream stability including diversity index, population dynamics, age class distribution, spawning, rearing habitat, and many more attributes related to stream health. Biological monitoring should follow similar rules of inventory stratification based on the diverse nature of streams and their natural variability.

If a biologist is studying only the biological parameters within a specific ecoregion, the natural stable differences between reference reach stream types cannot be identified if the stratification of the inventory does not include stream types. In other words, a stable C4 stream type will not have the attributes of a stable E4 or B4 stream type, even though they are all gravel-bed streams. If the biological inventory is not stratified by stream type or stream stability, departure of habitat conditions between a stable C4 and an unstable C4 cannot be easily identified. Reference conditions that reflect biological potential must be stratified as a minimum by stream type and stream stability for adequate departure analysis to identify degree, direction, and magnitude of impairment. Companion biological inventories of assessment and monitoring can be very compatible with the monitoring methods of the physical system described.

Once this information is analyzed, the monitoring design can proceed. The next step is to identify a strategy of monitoring. Effectiveness monitoring should always be conducted near the activity responsible for the initial impairment. Four primary design strategies often utilized are as follows:

- Measurements obtained before versus after the initiation of a management change in the land use activity, mitigation, restoration, and enhancement. This can be very effective as it establishes a precalibration period that identifies premitigation variability of the measured parameters. Following mitigation, departure can be readily determined, assuming measurements take into consideration the aforementioned variability factors.
- Measurements or observations taken above versus below impact areas related to specific land uses and specific mitigation. For example, if two different grazing strategies are implemented, measurements of effectiveness can be observed above versus below fence line contrasts. This can also be implemented where a mitigation may only influence the lower reach of a river compared to the upper reach (assuming the same stream type).
- Measurements obtained determining departure from a paired watershed are often helpful as similar climatic events similarly impact both watersheds. The pairing would contrast a watershed that had extensive mitigation or land management change with one that had not been changed. This also assumes variability of scale, temporal, and spatial variability and comparisons of similar landscapes and stream types have been identified.

- Measurements obtained of a disturbed reach or site, receiving mitigation compared to a reference condition. This type of monitoring can occur at locations far removed from the reference reach. The reference condition, however, must be of the same soil type, stream type, valley type, lithology, and vegetative type.

Maintenance plan

To ensure that the implemented design is successful, it is key to have a maintenance plan. The maintenance plan must ensure the following:

- Survival of the riparian vegetation reestablishment—This could involve an irrigation supply or replanting/interplanting.
- Structure stability—Post-runoff inspections must be conducted of structures for grade control, bank stabilization and/or fish habitat enhancement. Maintenance needs are assessed and implemented to prevent future failures and to secure proper function.
- The dimension, pattern, and profile must stay within the natural variability or range as depicted in table 11–5 for each variable. Maintenance of these variables is recommended only if the values exceed the design channel ranges.
- The biological maintenance may involve reestablishment of described populations of various age classes and/or species of fish and/or food sources.

654.1103 Conclusion

The individual(s) responsible for the project should also become experienced by being involved in all phases of this methodology. If the same individual conducts the assessment and also completes the design, implementation, and monitoring, the desired objectives of restoration are the most likely to be accomplished. The complexity of this method requires great attention to detail, training, and an understanding of processes. The monitoring of the project, including the implementation, validation and effectiveness procedures, is the best approach to become experienced and knowledgeable about the Rosgen geomorphic channel design methodology.

Mathematical definitions

Variables	
Riffle cross-sectional area at bankfull	A_{bkf}
Pool cross-sectional area at bankfull	A_{bkfp}
Mean riffle depth at bankfull	d_{bkf}
Mean pool depth at bankfull	d_{bkfp}
Maximum glide depth at bankfull	d_g
Maximum riffle depth at bankfull	d_{mbkf}
Maximum pool depth at bankfull	d_{mbkfp}
Maximum run depth at bankfull	d_{run}
Diameter of riffle particle at 50% finer than size	D_{50}
Diameter of bar sample particle at 50% finer than size	$\hat{D}_{50}$
Diameter of riffle particle at 84% finer than size	D_{84}
Maximum size of particle on bar	D_{max}
Gravitational acceleration	g
Weight density of water	γ
Sinuosity	k
Low bank height	LBH
Meander length	Lm
Meander-length ratio	(Lm/W_{bkf})
Manning's n	n
Pool-to-pool spacing (based on pattern)	(p-p)
Bankfull discharge	Q_{bkf}
Hydraulic radius	R
Radius of curvature of meander	Rc
Average water surface slope (bankfull slope)	S
Slope of glide (water surface facet slope)	S_g
Stream length	SL
Slope of pool (water surface facet slope)	S_p
Slope of riffle (water surface facet slope)	S_{rif}
Slope of run (water surface facet slope)	S_{run}
Bankfull shear stress	τ
Dimensionless bankfull shear stress	τ^*
Bankfull mean velocity	u_{bkf}
Shear velocity	u^*

Variables	
Valley length	V_L
Valley slope	V_S
Riffle width at bankfull	W_{bkf}
Width-to-depth ratio at bankfull	(W_{bkf}/d_{bkf})
Width-to-depth ratio at bankfull of reference reach	$(W_{bkf}/d_{bkf})_{ref}$
Pool width at bankfull	W_{bkfp}
Belt width	W_{blt}
Meander-width ratio	(W_{blt}/W_{bkf})
Width of flood-prone area	W_{fpa}
Entrenchment ratio	(W_{fpa}/W_{bkf})
Stream power	ω

Subscripts	
Bankfull	bkf
Meander belt	blt
Flood-prone area	fpa
Glide	g
Maximum at bankfull	mbkf
Maximum at bankfull in pool	mbkfp
Pool	p
Reference reach	ref
Riffle	rif
Run	run

PERFORMANCE BOND

Bond Number: 105729934

DATE BOND EXECUTED (Must be same or earlier than date of permit.) March 7, 2012
OBLIGEE: Mobile District, United States Army Corps of Engineers 218 Summit Parkway, Suite 222, Homewood, AL 35209

PRINCIPAL (Legal name and business address)
Shannon, LLC 74 Industrial Parkway Jasper, AL 35501
TYPE OF ORGANIZATION ("X" ONE)
___Individual ___Partnership ___Joint Venture _X_Corporation
STATE OF INCORPORATION Alabama

Surety(ies) (Legal name(s) and business address(es))
Travelers Casualty & Surety Co. of America One Tower Square Hartford, CT 06183

PENAL SUM OF BOND, amount determined solely by Obligee			
Million(s)	Thousand(s)	Hundred(s)	Cent(s)
	212	328	01
PERMIT DATE		PERMIT NO.	
November 2, 2011		SAM 2011 01072 CMS	

OBLIGATION:

We, the Principal and Surety(ies) hereto, are firmly bound as Obligors to the U.S Army Corps of Engineers (hereinafter called the Obligee) in the above penal sum, an amount determined solely by the Obligee. For the payment of the penal sum, we bind ourselves, our heirs, executors, administrators, assigns, and successors, jointly and severally. However, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us. For all other purposes, each Surety binds itself, jointly and severally with the Principal, for the payment of the sum shown below the name of the Surety. The limit of liability shall be the full amount of the penal sum.

CONDITIONS:

The Principal received the permit identified above.

THEREFORE:

The above obligation is void if the Principal –

(a) Specifically performs and fulfills all of the obligations, covenants, terms, conditions and agreements of the permit during the original term of the permit and any extensions thereof that may be granted by the Obligee, with or without notice to the Surety(ies), and during the life of any guaranty required under the permit, and -
(b) Also specifically performs and fulfills all of the obligations, covenants, terms, conditions, and agreements of any and all duly authorized modifications of the permit that may hereafter be made. Notice of those modifications to the Surety(ies) are waived.

IT IS FURTHER EXPRESSLY PROVIDED THAT:

The Obligee shall have the full and final authority to determine whether the Principal and Surety(ies) have specifically performed and fulfilled some or all of the obligations, covenants, terms, conditions and agreements of the permit.

Within thirty (30) business days of receiving notice from the Obligee that the Principal has defaulted on some or all of the obligations, covenants, terms, conditions and agreements of the permit, the Surety(ies) shall either -

(a) Remedy the default of the Principal to the full satisfaction of the Obligee by a certain date determined by the Obligee, or -
(b) Immediately tender to a party or parties identified by the Obligee the portion of the penal sum that the Obligee determines is due and owing and necessary to remedy the default. In no circumstance shall such a sum be tendered to the Obligee. Any new party or parties identified by the Obligee under this section shall immediately become a Surety or Sureties to this bond. If the Obligee determines that it is unable to identify such a party or parties, the Surety(ies) shall remedy the default of the Principal under (a) of this section.

In the event that the Surety(ies) fail(s) to respond within thirty (30) business days to the Obligee's notice of default, or to honor commitments to the full satisfaction of the Obligee under (a) or (b) above of this section, the full penal sum may, at the election of the Obligee, immediately become due and owing and paid to a party or parties identified by the Obligee. In no circumstance shall the full penal sum be tendered to the Obligee. Any new party or parties identified by the Obligee under this paragraph shall immediately become a Surety or Sureties to this bond.

WITNESS:

The Obligee, Principal and Surety(ies) have executed this performance bond and have affixed their seals on the date set forth above.

PRINCIPAL		
Signature 1 (Seal) David Muncher	Signature 2 (Seal)	Corporate Seal
Name, title 1 (typed) David Muncher, Managing Committee Member	Name, title 2 (typed)	

INDIVIDUAL SURETY(IES)	
Signature 1 (Seal)	Signature 2 (Seal)
Name, title 1 (typed)	Name, title 2 (typed)

COPORATE SURETY(IES)		
Surety A		
Name & address Travelers Casualty & Surety Co. of America One Tower Square Hartford, CT 06183	State of Incorporation CT	Liability limit $212,328.01
Signature 1 (Seal) George S. Byars	Signature 2 (Seal)	
Name, title 1 (typed) George S. Byars, Attorney-in-Fact	Name, title 2 (typed)	
Surety B		
Name & address	State of Incorporation TN	Liability limit
Signature 1 (Seal)	Signature 2 (Seal)	
Name, title 1 (typed)	Name, title 2 (typed)	
Surety C		
Name & address	State of Incorporation	Liability limit
Signature 1 (Seal)	Signature 2 (Seal)	
Name, title 1 (typed)	Name, title 2 (typed)	

Surety D		
Name & address	State of Incorporation	Liability limit
Signature 1 (Seal)	Signature 2 (Seal)	
Name, title 1 (typed)	Name, title 2 (typed)	
Surety E		
Name & address	State of Incorporation	Liability limit
Signature 1 (Seal)	Signature 2 (Seal)	
Name, title 1 (typed)	Name, title 2 (typed)	
Surety F		
Name & address	State of Incorporation	Liability limit
Signature 1 (Seal)	Signature 2 (Seal)	
Name, title 1 (typed)	Name, title 2 (typed)	
Surety G		
Name & address	State of Incorporation	Liability limit
Signature 1 (Seal)	Signature 2 (Seal)	
Name, title 1 (typed)	Name, title 2 (typed)	
Obligee		
Mobile District U.S. Army Corps of Engineers, 218 Summit Parkway, Suite 222 Homewood, AL 35209		
Signature 1 (Seal)	Signature 2 (optional) (Seal)	

Name, title 1 (typed)	Name, title 2 (typed)

Bond Premium	Rate Per Thou. ($)	Total ($)
[redacted]	[redacted]	[redacted]

INSTRUCTIONS

1. Insert the full legal name and business address of the Principal in the space designated "Principal" on the face of the form. An authorized person shall sign the bond. Any person signing in a representative capacity (e.g., an attorney-in-fact) must furnish evidence of authority if that representative is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved.

2. (a) Corporations executing the bond as sureties must appear on the Department of the Treasury's list of approved sureties and must act within the limitation listed therein. Where more than one corporate surety is involved, their names and addresses shall appear in the spaces (Surety A, Surety B, etc.) headed "CORPORATE SURETY(IES)." In the space designated "SURETY(IES)" on the face of the form, insert only the letter identification of the sureties.

(b) Where individual sureties are involved, a completed Affidavit of Individual Surety for each individual surety shall accompany the bond. The Government may require the surety to furnish additional substantiating information concerning their financial capability.

3. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Corporate Seal", and shall affix an adhesive seal if executed in Maine, New Hampshire, or any other jurisdiction requiring adhesive seals.

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, Kori M. Johanson, the undersigned, Assistant Secretary, of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 7th day of February, 20 12

Kori M. Johanson, Assistant Secretary

To verify the authenticity of this Power of Attorney, call 1-800-421-3880 or contact us at www.travelersbond.com. Please refer to the Attorney-In-Fact number, the above-named individuals and the details of the bond to which the power is attached.