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1425 · / 97 REVIEWER: JKS

December 9, 1997

Due Date: 1-22-98

No Permit Action Required

Mr. Larry Crislip
Manager - Permits
Illinois EPA
2309 West Main Street
Marion, IL 62959

HEC-RAS hydraulic evaluation of as-built permanent Galum and Bonnie Creek restorations — required as condition of IDOT approval of original diversions.

1/22/98

RE: Galum and Bonnie Creek As-Built Restoration
Illinois DNR - Office of Mines and Minerals Permits #74 Rev I and #152
IDOT Permit #19103
Corps of Engineers Permit P-1633

Keep with project files

Mr. Crislip:

Enclosed you will find documentation fulfilling conditions associated with OMM Permit #74, Revision #1 and IDOT Permit #19103 concerning the relocation of Galum and Bonnie Creeks through the North Field at Consolidation Coal Company's (Consol) Burning Star #4 Mine. Specifically, the requirements of Condition #4 to OMM Permit #74, Revision #1 and Special Condition #3 to IDOT Permit #19103 are addressed in this submittal.

Mining operations have ceased at the Burning Star #4 Mine and final reclamation is being completed. Small portions of the relocated Galum and Bonnie Creeks have yet to be constructed. Before flow can be redirected through the new channels, approval from the applicable regulatory agencies will be acquired. Among the criteria used to obtain this approval is the modeling of the As-Built Condition of the Galum and Bonnie Creek channels and floodplains.

This submittal contains a hydrologic model of the system using the Corps of Engineers' HEC-RAS program. Results of this model were compared to the Existing Condition (pre-mining) model from the 1987 permit modification to the original hydrology submittal. The Existing Condition was originally modeled using HEC-1 and HEC-2 programs. The Existing Condition HEC-2 results were recreated using HEC-RAS to ensure that valid comparisons could be made between the HEC-2 Existing Condition and HEC-RAS As-Built Condition models. A 100YR-24HR design storm was used for all evaluations.

The criteria used to evaluate the restoration were: 1) maintaining a maximum increase in flood stage less than 0.5 feet in the uncontrolled property north of IL 154 highway; and 2) maintaining flood storage volume +/-10 percent within the river system. Both criteria have been attained in this As-Built model.

RECEIVED
DEC 15 1997
IL Environmental Protection Agency
MARION REGIONAL OFFICE

This submittal contains the As-Built HEC-RAS output report along with summary tables that correspond to tables generated in the HEC-2 Existing Condition report. Also included are maps showing HEC-1 flows, cross-section locations, and flood-prone areas and As-Built cross sections.

If you have any questions or need additional information, please call me at the above location.

Sincerely,

John Gefferth
Environmental Engineer

kap
Enclosures (2 copies)
Copy under separate cover: Don Pflederer - Department of Natural Resources (3)
Bryan Martindale - IDNR - Water Resources (1)
Sue Horneman - U.S. Army Corps. of Engineers (1)

N P N
ENVIRONMENTAL ENGINEERS, INC.

BURNING STAR #4 - PERMIT #74
GALUM/BONNIE AS-BUILT RESTORATION
CONSOLIDATION COAL COMPANY

Prepared for:

CONSOLIDATION COAL COMPANY
ILL./W. KENTUCKY OPERATIONS
STATE ROUTE 148 NORTH
P.O. BOX 566
SESSER, ILLINOIS 62884

IDPA-DIVISION OF RECORDS MANAGEMENT
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REVIEWER: JKS

Prepared by:

NPN ENVIRONMENTAL ENGINEERS, INC.
927 HORAN DRIVE
ST. LOUIS, MISSOURI 63026

December 1997
Contract C-97070.02

927 Horan Drive St. Louis, MO 63026 314-343-1300 fax 314-343-8192

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GALUM AND BONNIE CREEK AS-BUILT RESTORATION

INTRODUCTION

Consolidation Coal Company (Consol) has completed surface mining activities at the Burning Star #4 Mine – North Field near Cutler, Illinois. As part of the reclamation plan, Galum and Bonnie Creek channels and floodplain are being restored. Galum Restoration has been completed with the exception of 1600 feet of channel at the northern end of the field and near three mine operation roads at the southern end of the field. Bonnie Restoration is complete with the exception of 3700 feet at the northern portion of the field.

The Galum/Bonnie stream system is permitted by the Illinois Department of Natural Resources (IDNR) – Office of Mines and Minerals (OMM), IDNR - Office of Water Resources (formerly IDOT), and U.S. Army Corps of Engineers. Hydrology and hydraulic simulations of the pre-mining, temporary diversion, and post-mining conditions were modeled using the Corps of Engineers HEC-1 and HEC-2 computer programs. Both the OMM permit and the IDOT permit require computer modeling of the post-mining restoration of Galum and Bonnie Creeks.

As condition 4) to OMM Permit #74 Revision #1, Consol was required to submit additional documentation of the stream diversion design. Specifically, the condition states:

> "*Approval of the stream diversion design is conditional upon approval of the HEC-II runs by the Illinois Department of Transportation. Upon receipt, the permitted shall provide the Regulatory Authority with a copy of IDOT approval of the HEC-II runs.*"

The IDOT approval under Permit #19103 Special Condition 3) required:

> "*Upon completion of the restoration construction, the permittee shall provide the Department with necessary post-mining topography and computer analyses showing that the natural water surface profiles outside the project right-of-way are not increased by 0.5 feet or more for any frequency flood up to and including the one-hundred (100) year frequency flood.*"

The following submittal with supporting documentation is provided to meet these permit conditions. The post-mining restoration has been compared with the pre-mining model approved with the 1987 permit modification. Assumptions taken with hydrology and hydraulics and summary of the post-mining (as-built) conditions are presented.

To clarify terminology, the following terms will be used during the supporting text:

Existing Condition	Represents Galum and Bonnie pre-mining condition as modeled in the 1987 permit modification.
Temporary Diversion	Modeled with Galum and Bonnie in temporary channels around the western and eastern property boundaries, respectfully.
Final Restoration	Design geometry for the reconstruction of Galum and Bonnie. 1987 submittal included as-built portions of Galum and design cross sections for Bonnie.
As-Built Condition	Represents actual reconstructed channel and floodplain of Galum and Bonnie Creek. Data obtained from revised topographic map dated January 1997 and field-verified cross sections.

BACKGROUND

The North Field at Burning Star #4 is covered under two OMM permits: Permit #74 and Permit #152. Permit #74 represents the western portion of the field and contains Galum Creek and Galum Diversion. Under Permit #152, the eastern portion of the field is covered and contains Bonnie Creek, Bonnie Diversion, and the Final Pit. The reconstructed streams and floodplains have been built in their approximate original locations with corresponding channel lengths and meanders.

The initial permit submittal contained only Galum Creek and was permitted under Illinois Department of Transportation (IDOT) Permit #17045. In 1987, the Galum and Bonnie system was modeled under one submittal and permitted under IDOT Permit #19103 and Corps of Engineers Permit #P-1633.

The last submittal modeled the system utilizing the Corp's HEC-1 program for hydrology and flow development. The HEC-2 program was used for hydraulics and establishing flood stages. Both models were mainframe versions of the programs that have since become available in Windows-based software. Since the 1987 modification, the Corps has developed a new model for stream hydraulics: HEC-RAS. This program was used in evaluating the Galum/Bonnie Restoration. Approved data and assumptions from previous versions were used in developing the "as-built" simulation.

Input and output files from the modeling are provided with this submittal on computer disc.

HYDROLOGY

The design storm for evaluating flood impacts of the restored channel is the 100YR-24HR event. The HEC-1 model was developed for Existing and Final Restoration Conditions and design flows established for use in the HEC-2 model. The HEC-1 model was not updated for this evaluation. Flows developed under the approved plan were used to predict the impacts under the As-Built Condition. Because of altered topography, HEC-1 models were developed for Existing Condition and Final Restoration. The Final Restoration HEC-1 flows were used in presenting the As-Built Condition. Map A presents the design flows obtained from the HEC-1 model and the location along the stream channel where the HEC-RAS model changed flows.

Peak flows from the hydrographs at each subbasin were used as the design flow for the HEC-2 model. The design storm was routed through the system and the impacts of bridges and impoundments were included in the model. This conservative approach utilizes the highest peak flow at each subbasin and is not meant to represent one point in time. This approach was used in the original submittal, the 1987 modification, and with the As-Built Condition model presented with this update.

To prevent re-establishing the Existing Condition model, assumptions were made with regard to Rock Fork drainage and IL 154 bridge geometry. These assumptions are presented below.

Rock Fork Drainage

Under the approved plan, drainage from the west (identified as Rock Fork) was designed to flow north into Galum Creek near the IL Route 154 bridge. With this as-built update, a revision to Permit #74 is being prepared to redirect Rock Fork flow to the south and enter Galum Creek near the Bonnie confluence. The Final Restoration HEC-1 model was developed with Rock Fork entering the system at the IL 154 bridge. This resulted in a 17% increase in the peak flow as modeled in the HEC-2 simulation. Because this condition would represent a "worst case" scenario, the HEC-1 model was not re-evaluated to establish flows with Rock Fork draining south. The potential for off-site flooding would be the greater with Rock Fork flowing north; therefore, the Final Restoration flows were used in this submittal. Redirecting Rock Fork south more closely represents the pre-mining condition and eliminates the potential for off-site backup and maintenance issues if Rock Fork entered at the IL 154 bridge.

IL 154 Bridge Routing

Galum and Bonnie Creek flow under bridges on IL Route 154 before entering the North Field. These bridges were evaluated during the 1987 modification and routing curves

developed to represent backwater influences. The Stage-Discharge relationships were included in the HEC-1 model and corresponding flows into the HEC-2 evaluation. Since this submittal, Illinois Department of Transportation (IDOT) has improved both structures and enlarged the bridge openings. To maintain continuity with the approved design, the old bridge openings and rating curves were used in evaluating the As-Built Condition. The larger openings would reduce backup effects from Galum and Bonnie; therefore, by using the former bridges, the model would represent a greater restriction. This "worst case" approach would ensure that off-site impacts will not occur if modeling determines no increased flooding will be created.

HYDRAULICS

A new topographic map was created from aerial photography dated January 1997 and an As-Built hydraulic model was developed to represent actual constructed channel and floodplain. Cross sections were established at approximately the same locations as previous models. In locations where mine reclamation has not been completed, a cross section was created that will be used during final grading. Since the last submittal, the Corps of Engineers - Hydrologic Engineering Center (HEC) has developed a new program under the River Analysis System (RAS) to predict flood impacts. This model is called HEC-RAS and replaces HEC-2 as the method used to evaluate stream hydraulics. In determining the As-Built Condition, HEC-RAS was used to simulate the 100YR-24HR design storm. The HEC-RAS program utilizes improved computational methods than HEC-2. To ensure that comparisons of the Existing Condition (developed under HEC-2) to the As-Built Condition were as close a possible, a HEC-RAS model was created for the Existing Condition to reproduce the HEC-2 results.

Bridge Routing

One area of improvement in the HEC-RAS is how the model handles bridges and bridge routing routines. The special bridge routine is not available and the pier routines are different. Therefore, in comparing the Existing Condition (HEC-2) with the HEC-RAS version, differences are noticeable around the bridges. Adjustments were made to simulate the HEC-2 model. In areas where the special bridge routine was used, a HEC-RAS method was substituted.

Confluence

At the confluence of Galum and Bonnie Creek, the HEC-RAS model does not exactly match the previous version. The method of determining tributary streams has changed and reach measurement is different. The HEC-RAS model was adjusted to closely simulate the original model by adjusting the reach lengths.

Manning's n

Existing Condition Manning's n was determined by the pre-mining land use based on topographic maps and field surveys. The same Manning's n was used to prepare the HEC-RAS version of Existing Conditions. For the As-Built Conditions, a Manning's n for the proposed post-mining land use was modeled. The values used to represent post-mining land use assumed mature growth of trees and a stabilized channel. Values selected had been approved by the agencies in the 1987 modification and will reflect the final reclamation plan to be submitted at a later date. Located on Map A are the Manning's n used and the approximate break points in the field. The following values for Manning's n and the corresponding land use were used in modeling the As-Built Condition:

Manning's n	*Land Use*
0.030	Cultivated - No Crop
0.040	Channel
0.070	Wetland
0.125	Wildlife Habitat

Jamestown Bridge Relocated

The Existing Condition modeled a bridge on a north/south road near the permit boundary of Permit #74 and #152 known as Jamestown Road. This structure is not being replaced under this submittal; however, a hydraulic opening was modeled in the As-Built Condition that approximates the original structure hydraulic opening. The opening was modeled to be representative of pre-mining conditions and allows a similar structure to be constructed after final bond release. This right-of-way will be returned to the Perry County Road Commission and construction of a bridge over Galum Creek will be their responsibility.

Existing Condition Comparisons

The HEC-2 model was successfully reproduced with the HEC-RAS computer program. Specifically, at the upstream portions of the system (north of the bridges on IL 154), flood stages were within 0.15 feet. The minor differences that appear are within Consol's controlled property and will not greatly impact the restoration modeling. Table 1 presents the comparison of HEC-2 versus HEC-RAS flood stages on Galum and Bonnie above IL 154.

TABLE 1
Upstream Flood Stage - Existing Condition
100YR-24HR Design Event
HEC-2 vs. HEC-RAS

Station	Flood Stage HEC-2	Flood Stage HEC-RAS
Galum Creek		
466+07	455.11	455.18
466+40	455.19	455.25
468+50	455.34	455.37
470+60	455.36	455.38
473+00	455.41	455.42
476+40	455.48	455.48
481+00	455.53	455.52
487+40	455.64	455.61
490+90	456.04	455.96
497+40	456.35	456.24
Bonnie Creek		
198+61	454.15	454.29
198+63	454.28	454.29
199+50	455.08	455.07
205+10	456.00	456.02
219+30	457.06	457.11
226+35	459.20	459.25

POST-MINING EVALUATION

Cross sections were developed from the current topographic map and incorporated into a HEC-RAS model representative of post-mining conditions. The HEC-RAS model used to compare Existing Conditions was modified to reflect the field conditions and future land use. Flows from the Final Restoration were used to represent the 100YR-24HR design event. The following sections present the modeling results with regard to upstream effects and flood storage.

Upstream Flood Stages

Uncontrolled property north of the mining activities and IL 154 was evaluated for the impacts of the final As-Built Condition of Galum and Bonnie Creeks. The model utilized the same methodology as approved in 1987 and incorporates the above assumptions. The criterion used to evaluate the restoration is maintaining a maximum increase in flood stage

less than 0.5 feet. Table 2 presents the flood stage comparison of Existing Condition and As-Built Condition. All locations were actually lower than the Existing Condition model developed with HEC-2. This difference was anticipated based on the revised bridge routines in HEC-RAS.

TABLE 2
Upstream Flood Stage
100YR-24HR Design Event
Existing vs. As-Built Conditions

Station	Flood Stage Existing (HEC-2)	Flood Stage As-Built (HEC-RAS)	Variance
Galum Creek			
466+07	455.11	454.21	-0.90
466+40	455.19	454.32	-0.87
468+50	455.34	454.51	-0.83
470+60	455.36	454.54	-0.82
473+00	455.41	454.60	-0.81
476+40	455.48	454.71	-0.77
481+00	455.53	454.78	-0.75
487+40	455.64	454.95	-0.69
490+90	456.04	455.51	-0.53
497+40	456.35	455.89	-0.46
Bonnie Creek			
198+61	454.15	451.09	-3.06
198+63	454.28	451.11	-3.17
199+50	455.08	452.06	-3.02
205+10	456.00	454.58	-1.42
219+30	457.06	456.89	-0.17
226+35	459.20	459.20	0.00

Flood Storage

The Galum/Bonnie system was evaluated for flood storage volume difference in the As-Built Condition versus the Existing Condition. The criterion used for flood storage was a change of +/- 10 percent of the Existing Condition volume. The As-Built Condition HEC-RAS model calculated a flood storage 9.0 percent higher than the HEC-2 Existing Condition model. The comparison was for the entire Galum/Bonnie system upstream of the MOPAC Railroad Bridge and includes only the volumes calculated from the modeling. Map B delineates some ineffective flow areas within the permit that will contribute to flood storage. Reclamation activity is ongoing; therefore, the aerial extent is only an estimate.

HEC-1 flows used in the As-Built condition represent a "worst-case" scenario with Rock Fork drainage flowing north and entering Galum Creek immediately south of the IL 154 Bridge. This increases the flow in Galum Creek by 17 percent over the Existing Condition model. As a result of this increased flow, flood storage within the permitted area for the Galum and Lower Galum Reaches is increased.

Flood storage in the Galum Reach was also affected by the location of wetlands established in the floodplain. These wetlands were constructed to satisfy reclamation requirements. The combination of the increased flow and the wetlands results in a 13 percent increase in flood storage in the Galum Reach. Table 3 presents a comparison of the flood storage volumes for the Existing Condition and As-Built Condition.

TABLE 3
Flood Storage Volume
100YR-24HR Design Event
Existing vs. As-Built Conditions

Reach	Section	Existing HEC-2 (ac-ft)	As-Built HEC-RAS (ac-ft)	Variance
Galum	Upstream of IL 154	510.54	459.63	-50.91
	Downstream of IL 154	2908.70	3402.61	+493.91
	Total Reach	3419.24	3862.24	+443.00
Bonnie	Upstream of IL 154	217.56	132.47	-85.09
	Downstream of IL 154	1962.61	1987.63	+25.02
	Total Reach	2180.17	2120.10	-60.07
Lower Galum	Upstream of RR	416.76	574.30	+157.54
Total System		6016.17	6556.64	+540.47

SUMMARY

Consolidation Coal Company has completed surface mining activities at the Burning Star # 4 Mine - North Field. As part of mining operations, portions of Galum and Bonnie Creek were temporarily diverted around the mine. With ongoing reclamation, most of the channel and floodplain of both streams have been reconstructed. As a condition of Permit #74, a post-mining computer model representing as-built conditions was to be submitted to the

Regulatory Authority. This documentation is provided to satisfy the conditions of OMM and IDOT permits.

Based on a HEC-RAS evaluation of the system and comparison to pre-mining conditions, the restoration does not increase the upstream flood stages above the allowable 0.5 feet on property uncontrolled by Consolidation Coal Company. The flood storage comparison indicates that the pre-mining storage is provided within the corresponding reaches of Galum and Bonnie Creek.

In support of this submittal, computer files generated from the HEC-RAS model are provided in electronic form for the agencies review. The following naming convention was used:

Type	Name
Input Files	
Existing Condition	
Project	BS4 EXIST.PRJ
Plan	BS4 EXIST.P07
Geometry	BS4 EXIST.G05
Flow	BS4 EXIST.F02
As-Built Condition	
Project	BS4-R100.PRJ
Plan	BS4-R100.P11
Geometry	BS4-R100.G08
Flow	BS4-R100.F01
Output Files	
Existing Condition	BS4 EXIST.DOC
As-Built Condition	BS4-R100.DOC

APPENDIX A

HEC-RAS Model for As-Built Condition

HEC-RAS Version 2.0 April 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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

PROJECT DATA
Project Title: BS 4 Restoration Model (100 yr.)
Project File : bs4-r100.prj
Run Date and Time: 12/3/97 7:30:24 AM

Project in English units

PLAN DATA

Plan Title: Final Plan
Plan File : c:\npnmws\1997\97070\galmrest\bs4-r100.p11

Geometry Title: Final Plan
Geometry File : c:\npnmws\1997\97070\galmrest\bs4-r100.g08

Flow Title : BS 4 Restoration Model (100 yr.)
Flow File : c:\npnmws\1997\97070\galmrest\bs4-r100.f01

Plan Summary Information:

Number of:	Cross Sections	= 84	Mulitple Openings	=	0
	Culverts	= 0	Inline Weirs	=	0
	Bridges	= 4			

Computational Information

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

Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: BS 4 Restoration Model (100 yr.)
Flow File : c:\npnmws\1997\97070\galmrest\bs4-r100.f01

Flow Data (cfs)

River	Reach	RS	2-yr	100-yr
Restoration	Bonnie	226.35	2587	5823
Restoration	Bonnie	199.50	2516	5333
Restoration	Bonnie	11	2516	5333
Restoration	Bonnie	10	2677	5565
Restoration	Bonnie	7	2752	5708
Restoration	Bonnie	2	2706	5693
Restoration	Galum	497.40	2615	6266
Restoration	Galum	465.21	2574	5712
Restoration	Galum	16	2855	6700
Restoration	Galum	7	2762	6353
Restoration	Galum	2.6	2730	6318
Restoration	Lower Galum	246.00	3856	10728
Restoration	Lower Galum	212.00	3881	10848
Restoration	Lower Galum	211.09	3408	8285
Restoration	Lower Galum	44.80	3409	8306

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Restoration	Lower Galum	2-yr		Known WS = 421.5
Restoration	Lower Galum	100-yr		Known WS = 425.5

GEOMETRY DATA

Geometry Title: Final Plan
Geometry File : c:\npnmws\1997\97070\galmrest\bs4-r100.g08

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
Restoration	Bonnie		Confluence
Restoration	Galum		Confluence
Restoration	Lower Galum	Confluence	

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 226.35

INPUT
Description: Station 226+35
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	476	95	475	190	470	420	470	625	470
675	465	935	458	2150	458	2169	454.5	2175	452.5
2191	452.5	2201	454.5	2715	458	2800	465	3305	470
3515	475	3915	480	3965	481				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	2169	.05	2201	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
2169	2201	715	705	675	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	459.20	Element			
Vel Head (ft)	0.09	Wt. n-Val.	0.065	0.050	0.065
E.G. Elev (ft)	459.29	Reach Len. (ft)	715.00	705.00	675.00
Crit W.S. (ft)		Flow Area (sq ft)	1544.44	198.49	1526.55
E.G. Slope (ft/ft)	0.001943	Area (sq ft)	1544.44	198.49	1526.55
Q Total (cfs)	5823.00	Flow (cfs)	1800.16	868.45	3154.39
Top Width (ft)	1839.28	Top Width (ft)	1278.68	32.00	528.61
Vel Total (ft/s)	1.78	Avg. Vel. (ft/s)	1.17	4.38	2.07
Max Chl Dpth (ft)	6.70	Hydr. Depth (ft)	1.21	6.20	2.89
Conv. Total (cfs)	132090.7	Conv. (cfs)	40835.3	19700.2	71555.2
Length Wtd. (ft)	697.15	Wetted Per. (ft)	1279.01	32.52	528.67
Min Ch El (ft)	452.50	Shear (lb/sq ft)	0.15	0.74	0.35
Alpha	1.76	Stream Power (lb/ft s)	0.17	3.24	0.72
Frctn Loss (ft)	2.15	Cum Volume (acre-ft)	1073.14	303.89	743.07
C & E Loss (ft)	0.02	Cum SA (acres)	231.43	24.93	142.69

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 219.30

INPUT
Description: Station 219+30
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	471	70	470	115	465	165	460	430	459
1160	457	1405	455	1630	453	1675	453	1680	451.5
1696	451.5	1701	453	1860	455	1890	460	1910	465
2685	470	2860	473						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.065	430	.14	1160	.065	1675	.05	1701	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1675	1701	1020	1420	1340	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	456.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.065	0.050	0.065
E.G. Elev (ft)	457.13	Reach Len. (ft)	1020.00	1420.00	1340.00
Crit W.S. (ft)		Flow Area (sq ft)	1043.72	132.62	470.10
E.G. Slope (ft/ft)	0.005582	Area (sq ft)	1043.72	132.62	470.10
Q Total (cfs)	5823.00	Flow (cfs)	3351.09	862.85	1609.06
Top Width (ft)	697.77	Top Width (ft)	501.43	26.00	170.34
Vel Total (ft/s)	3.54	Avg. Vel. (ft/s)	3.21	6.51	3.42
Max Chl Dpth (ft)	5.39	Hydr. Depth (ft)	2.08	5.10	2.76
Conv. Total (cfs)	77936.7	Conv. (cfs)	44852.0	11548.7	21536.1
Length Wtd. (ft)	1195.42	Wetted Per. (ft)	501.45	26.44	170.50
Min Ch El (ft)	451.50	Shear (lb/sq ft)	0.73	1.75	0.96
Alpha	1.23	Stream Power (lb/ft s)	2.33	11.37	3.29
Frctn Loss (ft)	2.39	Cum Volume (acre-ft)	1051.90	301.21	727.60
C & E Loss (ft)	0.03	Cum SA (acres)	216.82	24.46	137.28

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 205.10

INPUT
Description: Station 205+10
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	471	180	470	395	465	415	460	495	455
635	455	1030	455	1200	452	1630	450	1662	446.5
1670	446	1686	446	1694	450	1890	452	1935	455
1970	460	2000	465	2830	467				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	25	1200	.065	1630	.04	1694	.065	1890	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1630	1694	905	560	515	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	454.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.069	0.040	0.067
E.G. Elev (ft)	454.70	Reach Len. (ft)	905.00	560.00	515.00
Crit W.S. (ft)		Flow Area (sq ft)	1726.81	458.99	751.12
E.G. Slope (ft/ft)	0.001019	Area (sq ft)	1726.81	458.99	751.12
Q Total (cfs)	5823.00	Flow (cfs)	2626.24	1999.80	1196.96
Top Width (ft)	874.75	Top Width (ft)	576.08	64.00	234.67
Vel Total (ft/s)	1.98	Avg. Vel. (ft/s)	1.52	4.36	1.59
Max Chl Dpth (ft)	8.58	Hydr. Depth (ft)	3.00	7.17	3.20
Conv. Total (cfs)	182453.4	Conv. (cfs)	82288.5	62660.2	37504.7
Length Wtd. (ft)	654.88	Wetted Per. (ft)	576.11	65.15	234.77
Min Ch El (ft)	446.00	Shear (lb/sq ft)	0.19	0.45	0.20
Alpha	2.06	Stream Power (lb/ft s)	0.29	1.95	0.32
Frctn Loss (ft)	1.06	Cum Volume (acre-ft)	1019.46	291.56	708.82
C & E Loss (ft)	0.34	Cum SA (acres)	204.20	22.99	131.05

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 199.50

INPUT
Description: Station 199+50
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	471	110	470	180	465	200	460	265	455
1450	453	1465	453	1520	445	1530	439.6	1548	439.6
1558	445	1600	453	1630	453	2260	455	2325	460

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	25	1450	.05	1520	.04	1558	.05	1600	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1520	1558	87	87	87	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	452.06	Element			
Vel Head (ft)	1.25	Wt. n-Val.	0.050	0.040	0.050
E.G. Elev (ft)	453.31	Reach Len. (ft)	87.00	87.00	87.00
Crit W.S. (ft)		Flow Area (sq ft)	171.14	419.33	130.69
E.G. Slope (ft/ft)	0.003197	Area (sq ft)	171.14	419.33	130.69
Q Total (cfs)	5333.00	Flow (cfs)	661.83	4168.24	502.93
Top Width (ft)	123.55	Top Width (ft)	48.51	38.00	37.04
Vel Total (ft/s)	7.39	Avg. Vel. (ft/s)	3.87	9.94	3.85
Max Chl Dpth (ft)	12.46	Hydr. Depth (ft)	3.53	11.03	3.53
Conv. Total (cfs)	94320.1	Conv. (cfs)	11705.2	73720.1	8894.8
Length Wtd. (ft)	87.00	Wetted Per. (ft)	49.02	40.73	37.71
Min Ch El (ft)	439.60	Shear (lb/sq ft)	0.70	2.05	0.69
Alpha	1.47	Stream Power (lb/ft s)	2.69	20.43	2.66
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)	999.75	285.92	703.60
C & E Loss (ft)	0.14	Cum SA (acres)	197.71	22.34	129.44

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 198.63

INPUT
Description: Station 198+63
Cross-section immediately upstream of bridge.
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	500	453	500.1	445.7	510	443.5	520	440.5
530	438.25	540	439.9	550	444.5	554.9	447	555	453
1000	460								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	500	.04	555	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
500	555	2	2	2	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	500	458.5	555	1000	458.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	451.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.71	Wt. n-Val.		0.040	
E.G. Elev (ft)	452.81	Reach Len. (ft)	2.00	2.00	2.00
Crit W.S. (ft)	448.44	Flow Area (sq ft)		508.72	
E.G. Slope (ft/ft)	0.005335	Area (sq ft)		508.72	
Q Total (cfs)	5333.00	Flow (cfs)		5333.00	
Top Width (ft)	54.94	Top Width (ft)		54.94	
Vel Total (ft/s)	10.48	Avg. Vel. (ft/s)		10.48	
Max Chl Dpth (ft)	12.86	Hydr. Depth (ft)		9.26	
Conv. Total (cfs)	73012.1	Conv. (cfs)		73012.1	
Length Wtd. (ft)	2.00	Wetted Per. (ft)		66.99	
Min Ch El (ft)	438.25	Shear (lb/sq ft)		2.53	
Alpha	1.00	Stream Power (lb/ft s)		26.52	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	999.58	284.99	703.47
C & E Loss (ft)	0.00	Cum SA (acres)	197.66	22.24	129.41

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 198.61

INPUT
Description: Station 198+61 154 Bridge over Bonnie
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	500	453	500.1	445.7	510	443.5	520	440.5
530	438.25	540	439.9	550	444.5	554.9	447	555	453
1000	460								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	500	.04	555	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
500	555	32	32	32	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	500	458.5	555	1000	458.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	451.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.71	Wt. n-Val.		0.040	
E.G. Elev (ft)	452.80	Reach Len. (ft)	0.00	0.00	0.00
Crit W.S. (ft)	448.45	Flow Area (sq ft)		507.93	
E.G. Slope (ft/ft)	0.005360	Area (sq ft)		507.93	
Q Total (cfs)	5333.00	Flow (cfs)		5333.00	
Top Width (ft)	54.94	Top Width (ft)		54.94	
Vel Total (ft/s)	10.50	Avg. Vel. (ft/s)		10.50	
Max Chl Dpth (ft)	12.84	Hydr. Depth (ft)		9.24	
Conv. Total (cfs)	72845.4	Conv. (cfs)		72845.4	
Length Wtd. (ft)	0.00	Wetted Per. (ft)		66.96	
Min Ch El (ft)	438.25	Shear (lb/sq ft)		2.54	
Alpha	1.00	Stream Power (lb/ft s)		26.65	
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	999.58	284.97	703.47
C & E Loss (ft)	0.00	Cum SA (acres)	197.66	22.24	129.41

BRIDGE RIVER: Restoration
REACH: Bonnie RS: 198.45

INPUT
Description: Bridge over Bonnie at 154
Distance from Upstream XS = 0
Deck/Roadway Width = 32
Weir Coefficient = 2.6
Bridge Deck/Roadway Skew =
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	465	460	500	458	453	500.1	458	453.7
520	458	453.7	550	458	453.7	554.9	458	453.7
555	458	453	1000	465	460			

BRIDGE OUTPUT Profile #100-yr
Opening : Bridge #1

E.G. US. (ft)	452.80	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	451.09	E.G. Elev (ft)	452.80	452.57
Q Total (cfs)	5333.00	W.S. Elev (ft)	451.09	450.71
Q Bridge (cfs)	5333.00	Crit W.S. (ft)	448.45	448.44
Q Weir (cfs)		Max Chl Dpth (ft)	12.84	12.46
Weir Sta Lft (ft)		Vel Total (ft/s)	10.50	10.95
Weir Sta Rgt (ft)		Flow Area (sq ft)	507.93	486.94
Weir Submerg		Froude # Chl	0.61	0.65
Weir Max Depth (ft)		Specif Force (cu ft)	4253.92	4138.81
Min Top Rd (ft)	458.00	Hydr Depth (ft)	9.24	8.86
Min El Prs (ft)	453.70	W.P. Total (ft)	66.96	66.20
Delta EG (ft)	0.23	Conv. Total (cfs)	72845.4	68417.8
Delta WS (ft)	0.38	Top Width (ft)	54.94	54.93
BR Open Area (sq ft)	651.28	Frctn Loss (ft)	0.18	0.00
BR Open Vel (ft/s)	10.95	C & E Loss (ft)	0.05	0.00
Coef of Q		Shear Total (lb/sq ft)	2.54	2.79
Br Sel Mthd	Energy only	Power Total (lb/ft s)	26.65	30.56

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 198.29

INPUT
Description: Station 198+29 154 Bridge over Bonnie
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	500	453	500.1	445.7	510	443.5	520	440.5
530	438.25	540	439.9	550	444.5	554.9	447	555	453
1000	460								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	500	.04	555	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
500	555	2	2	2	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	450.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.86	Wt. n-Val.		0.040	
E.G. Elev (ft)	452.57	Reach Len. (ft)	2.00	2.00	2.00
Crit W.S. (ft)		Flow Area (sq ft)		486.94	
E.G. Slope (ft/ft)	0.006076	Area (sq ft)		486.94	
Q Total (cfs)	5333.00	Flow (cfs)		5333.00	
Top Width (ft)	54.93	Top Width (ft)		54.93	
Vel Total (ft/s)	10.95	Avg. Vel. (ft/s)		10.95	
Max Chl Dpth (ft)	12.46	Hydr. Depth (ft)		8.86	
Conv. Total (cfs)	68417.8	Conv. (cfs)		68417.8	
Length Wtd. (ft)	2.00	Wetted Per. (ft)		66.20	
Min Ch El (ft)	438.25	Shear (lb/sq ft)		2.79	
Alpha	1.00	Stream Power (lb/ft s)		30.56	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	999.58	284.60	703.47
C & E Loss (ft)	0.00	Cum SA (acres)	197.66	22.20	129.41

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	500	453	500.1	445.7	510	443.5	520	440.5
530	438.25	540	439.9	550	444.5	554.9	447	555	453
1000	460								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	500	.04	555	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
500	555	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	500	458.5	555	1000	458.5

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	465	460	500	458	453	500.1	458	453.7
520	458	453.7	550	458	453.7	554.9	458	453.7
555	458	453	1000	465	460			

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	500	453	500.1	445.7	510	443.5	520	440.5
530	438.25	540	439.9	550	444.5	554.9	447	555	453
1000	460								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	500	.04	555	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
500	555	.3	.5

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Energy

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the downstream end
Criteria to check for pressure flow = Upstream water surface

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CROSS SECTION
REACH: nnie

RIVER: Restoration
RS: 198.27

INPUT
Descri n: Station 198+27
Statio vation Data num= 11

Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
460	500	453	500.1	445.7	510	443.5	520	440.5
38.25	540	439.9	550	444.5	554.9	447	555	453
460								

Manni Values num= 3

Val	Sta	n Val	Sta	n Val
.05	500	.04	555	.05

Bank	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
)	555		830	900	775	.3	.5

Inflow num= 2

R	Elev	Sta L	Sta R	Elev
0	453	555	1000	453

CROUTPUT Profile #100-yr

450.69	Element	Left OB	Channel	Right OB
1.87	Wt. n-Val.		0.040	
452.56	Reach Len. (ft)	830.00	900.00	775.00
448.49	Flow Area (sq ft)		486.01	
0.006110	Area (sq ft)		486.01	
5333.00	Flow (cfs)		5333.00	
54.93	Top Width (ft)		54.93	
10.97	Avg. Vel. (ft/s)		10.97	
12.44	Hydr. Depth (ft)		8.85	
68225.1	Conv. (cfs)		68225.1	
873.41	Wetted Per. (ft)		66.16	
438.25	Shear (lb/sq ft)		2.80	
1.00	Stream Power (lb/ft s)		30.75	
2.37	Cum Volume (acre-ft)	999.58	284.58	703.47
0.80	Cum SA (acres)	197.66	22.20	129.41

y head has changed by more than 0.5 ft (0.15 m). This may indicate the need
dditional cross sections.
ce ratio (upstream conveyance divided by downstream conveyance) is less
.7 or greater than 1.4. This may indicate the need for additional cross sections.
ss was greater than 1.0 ft (0.3 m). between the current and previous cross
. This may indicate the need for additional cross sections.
search method failed to converge on critical depth. The program will try the
ction slice/secant method to find critical depth.
depths were found at this location. The critical depth with the lowest, valid,
rface was used.

VER: Restoration
RS: 13

num= 17

Elev	Sta	Elev	Sta	Elev	Sta	Elev
452	100	451	205	450	700	448
447	940	438	960	438	980	447
446	1310	446	1340	446	1450	448
454						

= 5

Val	Sta	n Val	Sta	n Val	Sta	n Val
125	925	.04	980	.125	1340	.03

ths: Left Channel Right Coeff Contr. Expan.
1390 1400 710 .1 .3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	449.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.032	0.040	0.080
E.G. Elev (ft)	449.39	Reach Len. (ft)	1390.00	1400.00	710.00
Crit W.S. (ft)	448.36	Flow Area (sq ft)	529.81	454.38	1197.54
E.G. Slope (ft/ft)	0.001527	Area (sq ft)	529.81	454.38	1197.54
Q Total (cfs)	5333.00	Flow (cfs)	1144.23	2560.25	1628.52
Top Width (ft)	1070.66	Top Width (ft)	503.47	55.00	512.19
Vel Total (ft/s)	2.44	Avg. Vel. (ft/s)	2.16	5.63	1.36
Max Chl Dpth (ft)	11.13	Hydr. Depth (ft)	1.05	8.26	2.34
Conv. Total (cfs)	136462.9	Conv. (cfs)	29279.0	65512.8	41671.1
Length Wtd. (ft)	1119.31	Wetted Per. (ft)	503.47	59.42	512.26
Min Ch El (ft)	438.00	Shear (lb/sq ft)	0.10	0.73	0.22
Alpha	2.81	Stream Power (lb/ft s)	0.22	4.11	0.30
Frctn Loss (ft)	3.06	Cum Volume (acre-ft)	994.53	274.87	692.82
C & E Loss (ft)	0.04	Cum SA (acres)	192.87	21.06	124.85

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 12

INPUT
Description: B-12
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	456	106	450	340	448	486	446	734	446
788	447	853	446	920	446	1000	446	1031	446
1045	437.4	1065	437.4	1085	446	1152	446	1224	444
1460	444	1710	444	1796	450	1894	452		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	1000	.125	1031	.04	1085	.125	1460	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1031	1085	805	1200	880	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	445.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.		0.040	0.048
E.G. Elev (ft)	446.28	Reach Len. (ft)	805.00	1200.00	880.00
Crit W.S. (ft)	445.58	Flow Area (sq ft)		296.08	832.96
E.G. Slope (ft/ft)	0.006307	Area (sq ft)		296.08	832.96
Q Total (cfs)	5333.00	Flow (cfs)		2639.87	2693.13
Top Width (ft)	618.08	Top Width (ft)		52.36	565.73
Vel Total (ft/s)	4.72	Avg. Vel. (ft/s)		8.92	3.23
Max Chl Dpth (ft)	8.18	Hydr. Depth (ft)		5.66	1.47
Conv. Total (cfs)	67151.4	Conv. (cfs)		33240.4	33911.0
Length Wtd. (ft)	965.87	Wetted Per. (ft)		56.35	565.80
Min Ch El (ft)	437.40	Shear (lb/sq ft)		2.07	0.58
Alpha	2.00	Stream Power (lb/ft s)		18.45	1.87
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	986.08	262.81	676.27
C & E Loss (ft)	0.21	Cum SA (acres)	184.83	19.34	116.07

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	451.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	451.72	Reach Len. (ft)	785.00	880.00	750.00
Crit W.S. (ft)		Flow Area (sq ft)	622.09	890.59	2974.75
E.G. Slope (ft/ft)	0.000322	Area (sq ft)	622.09	890.59	2974.75
Q Total (cfs)	6700.00	Flow (cfs)	440.99	3565.14	2693.87
Top Width (ft)	565.75	Top Width (ft)	132.45	59.00	374.30
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)	0.71	4.00	0.91
Max Chl Dpth (ft)	16.58	Hydr. Depth (ft)	4.70	15.09	7.95
Conv. Total (cfs)	373636.3	Conv. (cfs)	24592.5	198815.7	150228.0
Length Wtd. (ft)	825.99	Wetted Per. (ft)	133.03	60.45	374.69
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.09	0.30	0.16
Alpha	3.99	Stream Power (lb/ft s)	0.07	1.18	0.14
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	1225.29	379.18	1114.19
C & E Loss (ft)	0.01	Cum SA (acres)	117.67	23.44	108.11

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 11

INPUT
Description: G-11
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	70	458.5	85	458	148	456	182	455
217	456	229	454	255	452	305	452	325	450
384	444	415	442	487	442	573	442	664	440
685	438	697	435	716	435	730	440	761	442
799	444	872	454	919	456	943	460		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	70	.125	664	.04	730	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
664	730	1750	1720	1155	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	451.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	451.46	Reach Len. (ft)	1750.00	1720.00	1155.00
Crit W.S. (ft)		Flow Area (sq ft)	2941.42	941.66	834.52
E.G. Slope (ft/ft)	0.000289	Area (sq ft)	2941.42	941.66	834.52
Q Total (cfs)	6700.00	Flow (cfs)	2581.17	3453.88	664.95
Top Width (ft)	541.04	Top Width (ft)	352.43	66.00	122.61
Vel Total (ft/s)	1.42	Avg. Vel. (ft/s)	0.88	3.67	0.80
Max Chl Dpth (ft)	16.34	Hydr. Depth (ft)	8.35	14.27	6.81
Conv. Total (cfs)	393900.1	Conv. (cfs)	151749.5	203057.4	39093.2
Length Wtd. (ft)	1688.14	Wetted Per. (ft)	352.89	67.33	123.22
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.15	0.25	0.12
Alpha	3.62	Stream Power (lb/ft s)	0.13	0.93	0.10
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	1193.18	360.67	1081.40
C & E Loss (ft)	0.01	Cum SA (acres)	113.30	22.18	103.83

BRIDGE OUTPUT Profile #100-yr
Opening : Bridge #1

E.G. US. (ft)	452.80	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	451.09	E.G. Elev (ft)	452.80	452.57
Q Total (cfs)	5333.00	W.S. Elev (ft)	451.09	450.71
Q Bridge (cfs)	5333.00	Crit W.S. (ft)	448.45	448.44
Q Weir (cfs)		Max Chl Dpth (ft)	12.84	12.46
Weir Sta Lft (ft)		Vel Total (ft/s)	10.50	10.95
Weir Sta Rgt (ft)		Flow Area (sq ft)	507.93	486.94
Weir Submerg		Froude # Chl	0.61	0.65
Weir Max Depth (ft)		Specif Force (cu ft)	4253.92	4138.81
Min Top Rd (ft)	458.00	Hydr Depth (ft)	9.24	8.86
Min El Prs (ft)	453.70	W.P. Total (ft)	66.96	66.20
Delta EG (ft)	0.23	Conv. Total (cfs)	72845.4	68417.8
Delta WS (ft)	0.38	Top Width (ft)	54.94	54.93
BR Open Area (sq ft)	651.28	Frctn Loss (ft)	0.18	0.00
BR Open Vel (ft/s)	10.95	C & E Loss (ft)	0.05	0.00
Coef of Q		Shear Total (lb/sq ft)	2.54	2.79
Br Sel Mthd	Energy only	Power Total (lb/ft s)	26.65	30.56

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 198.29

INPUT
Description: Station 198+29 154 Bridge over Bonnie
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	500	453	500.1	445.7	510	443.5	520	440.5
530	438.25	540	439.9	550	444.5	554.9	447	555	453
1000	460								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	500	.04	555	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
500	555	2	2	2	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	450.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.86	Wt. n-Val.		0.040	
E.G. Elev (ft)	452.57	Reach Len. (ft)	2.00	2.00	2.00
Crit W.S. (ft)		Flow Area (sq ft)		486.94	
E.G. Slope (ft/ft)	0.006076	Area (sq ft)		486.94	
Q Total (cfs)	5333.00	Flow (cfs)		5333.00	
Top Width (ft)	54.93	Top Width (ft)		54.93	
Vel Total (ft/s)	10.95	Avg. Vel. (ft/s)		10.95	
Max Chl Dpth (ft)	12.46	Hydr. Depth (ft)		8.86	
Conv. Total (cfs)	68417.8	Conv. (cfs)		68417.8	
Length Wtd. (ft)	2.00	Wetted Per. (ft)		66.20	
Min Ch El (ft)	438.25	Shear (lb/sq ft)		2.79	
Alpha	1.00	Stream Power (lb/ft s)		30.56	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	999.58	284.60	703.47
C & E Loss (ft)	0.00	Cum SA (acres)	197.66	22.20	129.41

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning - Divided flow computed for this cross-section.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 11

INPUT
Description: B-11
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	452	132	450	390	442	460	440	500	440
535	440	550	436	570	436	585	440	648	440
668	440	957	441	1166	440	1304	440	1670	440
2060	446	2108	448	2177	450	2625	452		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	500	.125	535	.04	585	.125	957	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
535	585	930	1040	560	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	445.69	Element			
Vel Head (ft)	0.01	Wt. n-Val.	0.037	0.040	0.039
E.G. Elev (ft)	445.70	Reach Len. (ft)	930.00	1040.00	560.00
Crit W.S. (ft)		Flow Area (sq ft)	975.66	424.70	6982.65
E.G. Slope (ft/ft)	0.000031	Area (sq ft)	975.66	424.70	6982.65
Q Total (cfs)	5333.00	Flow (cfs)	585.64	359.44	4387.92
Top Width (ft)	1769.24	Top Width (ft)	264.13	50.00	1455.11
Vel Total (ft/s)	0.64	Avg. Vel. (ft/s)	0.60	0.85	0.63
Max Chl Dpth (ft)	9.69	Hydr. Depth (ft)	3.69	8.49	4.80
Conv. Total (cfs)	961070.2	Conv. (cfs)	105539.2	64776.2	790754.8
Length Wtd. (ft)	772.91	Wetted Per. (ft)	264.22	51.05	1455.16
Min Ch El (ft)	436.00	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.02	Stream Power (lb/ft s)	0.00	0.01	0.01
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	977.06	252.88	597.33
C & E Loss (ft)	0.05	Cum SA (acres)	182.39	17.93	95.65

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 10

INPUT
Description: B-10
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	452	71	450	368	444	470	443	738	442
794	440	805	435	823	435	832	440	871	442
967	444	1073	446	1250	446	1696	449	1842	450

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	470	.125	794	.04	832	.125	871	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
794	832	895	1720	1040	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	445.05	Element			
Vel Head (ft)	0.52	Wt. n-Val.	0.093	0.040	0.051
E.G. Elev (ft)	445.57	Reach Len. (ft)	895.00	1720.00	1040.00
Crit W.S. (ft)		Flow Area (sq ft)	1096.57	331.98	384.36
E.G. Slope (ft/ft)	0.002802	Area (sq ft)	1096.57	331.98	384.36
Q Total (cfs)	5565.00	Flow (cfs)	1769.52	2659.00	1136.48
Top Width (ft)	706.84	Top Width (ft)	478.08	38.00	190.76
Vel Total (ft/s)	3.07	Avg. Vel. (ft/s)	1.61	8.01	2.96
Max Chl Dpth (ft)	10.05	Hydr. Depth (ft)	2.29	8.74	2.01
Conv. Total (cfs)	105139.1	Conv. (cfs)	33431.5	50236.2	21471.4
Length Wtd. (ft)	1211.76	Wetted Per. (ft)	478.13	40.38	190.84
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.40	1.44	0.35
Alpha	3.53	Stream Power (lb/ft s)	0.65	11.52	1.04
Frctn Loss (ft)	0.88	Cum Volume (acre-ft)	954.94	243.85	549.97
C & E Loss (ft)	0.14	Cum SA (acres)	174.47	16.88	85.07

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 9

INPUT
Description: B-9
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	449	123	448	285	446	410	444	520	442
1025	441	1311	440	1370	441	1412	440	1427	433
1448	433	1453	438	1470	440	1500	441	1541	442
1671	450								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	1025	.125	1412	.04	1470	.125	1500	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1412	1470	790	1660	1020	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	444.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.051	0.040	0.048
E.G. Elev (ft)	444.54	Reach Len. (ft)	790.00	1660.00	1020.00
Crit W.S. (ft)		Flow Area (sq ft)	3235.65	499.99	293.76
E.G. Slope (ft/ft)	0.000328	Area (sq ft)	3235.65	499.99	293.76
Q Total (cfs)	5565.00	Flow (cfs)	3861.74	1356.08	347.19
Top Width (ft)	1202.86	Top Width (ft)	1033.24	58.00	111.62
Vel Total (ft/s)	1.38	Avg. Vel. (ft/s)	1.19	2.71	1.18
Max Chl Dpth (ft)	11.50	Hydr. Depth (ft)	3.13	8.62	2.63
Conv. Total (cfs)	307375.3	Conv. (cfs)	213297.8	74901.2	19176.3
Length Wtd. (ft)	995.27	Wetted Per. (ft)	1033.29	61.74	111.73
Min Ch El (ft)	433.00	Shear (lb/sq ft)	0.06	0.17	0.05
Alpha	1.50	Stream Power (lb/ft s)	0.08	0.45	0.06
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	910.43	227.42	541.88
C & E Loss (ft)	0.00	Cum SA (acres)	158.95	14.98	81.46

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 8

INPUT
Description: B-8
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	595	446	852	440	929	438	1000	437
1090	436	1286	434	1301	431	1306	431	1324	436
1335	438	1366	440	1391	442	1413	444	1432	443
1447	444	1480	444	1537	448	1647	450		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	1000	.125	1286	.04	1324	.125	1480	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1286	1324	1000	1240	880	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	444.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.040	0.125
E.G. Elev (ft)	444.29	Reach Len. (ft)	1000.00	1240.00	880.00
Crit W.S. (ft)		Flow Area (sq ft)	3785.71	436.30	386.71
E.G. Slope (ft/ft)	0.000195	Area (sq ft)	3785.71	436.30	386.71
Q Total (cfs)	5565.00	Flow (cfs)	4261.69	1133.17	170.14
Top Width (ft)	814.06	Top Width (ft)	616.38	38.00	159.68
Vel Total (ft/s)	1.21	Avg. Vel. (ft/s)	1.13	2.60	0.44
Max Chl Dpth (ft)	13.26	Hydr. Depth (ft)	6.14	11.48	2.42
Conv. Total (cfs)	398287.0	Conv. (cfs)	305009.1	81101.1	12176.7
Length Wtd. (ft)	1043.58	Wetted Per. (ft)	616.48	38.98	160.16
Min Ch El (ft)	431.00	Shear (lb/sq ft)	0.07	0.14	0.03
Alpha	1.61	Stream Power (lb/ft s)	0.08	0.35	0.01
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	846.76	209.58	533.91
C & E Loss (ft)	0.00	Cum SA (acres)	143.99	13.15	78.29

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 7

INPUT
Description: B-7
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	88	450	371	440	428	438	562	436
580	435.8	869	434	882	429	897	429	910	434
954	436	984	438	1073	450	1099	450	1115	452

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	580	.125	869	.04	910	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
869	910	855	1080	590	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	444.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.063	0.040	0.125
E.G. Elev (ft)	444.14	Reach Len. (ft)	855.00	1080.00	590.00
Crit W.S. (ft)		Flow Area (sq ft)	4298.22	554.89	753.69
E.G. Slope (ft/ft)	0.000106	Area (sq ft)	4298.22	554.89	753.69
Q Total (cfs)	5708.00	Flow (cfs)	4188.68	1172.30	347.03
Top Width (ft)	774.96	Top Width (ft)	614.58	41.00	119.38
Vel Total (ft/s)	1.02	Avg. Vel. (ft/s)	0.97	2.11	0.46
Max Chl Dpth (ft)	15.12	Hydr. Depth (ft)	6.99	13.53	6.31
Conv. Total (cfs)	553411.6	Conv. (cfs)	406107.8	113658.4	33645.4
Length Wtd. (ft)	877.45	Wetted Per. (ft)	614.71	42.86	119.91
Min Ch El (ft)	429.00	Shear (lb/sq ft)	0.05	0.09	0.04
Alpha	1.57	Stream Power (lb/ft s)	0.05	0.18	0.02
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	753.97	195.47	522.39
C & E Loss (ft)	0.01	Cum SA (acres)	129.86	12.03	75.47

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 6

INPUT
Description: B-6
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	452	86	450	375	444	461	438	497	436
515	429	540	429	556	434	648	436	698	436
840	436	917	452						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	375	.125	497	.04	556	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
497	556	625	1800	1310	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	443.97	Reach Len. (ft)	625.00	1800.00	1310.00
Crit W.S. (ft)		Flow Area (sq ft)	489.71	772.09	2463.90
E.G. Slope (ft/ft)	0.000392	Area (sq ft)	489.71	772.09	2463.90
Q Total (cfs)	5708.00	Flow (cfs)	325.31	3083.44	2299.25
Top Width (ft)	500.28	Top Width (ft)	119.59	59.00	321.69
Vel Total (ft/s)	1.53	Avg. Vel. (ft/s)	0.66	3.99	0.93
Max Chl Dpth (ft)	14.83	Hydr. Depth (ft)	4.09	13.09	7.66
Conv. Total (cfs)	288125.5	Conv. (cfs)	16420.9	155644.3	116060.3
Length Wtd. (ft)	1515.90	Wetted Per. (ft)	119.85	61.08	322.52
Min Ch El (ft)	429.00	Shear (lb/sq ft)	0.10	0.31	0.19
Alpha	3.83	Stream Power (lb/ft s)	0.07	1.24	0.17
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	706.98	179.02	500.60
C & E Loss (ft)	0.00	Cum SA (acres)	122.65	10.79	72.48

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 5

INPUT
Description: B-5
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	134	448	213	446	300	434	350	434
369	428	389	428	410	434	415	434	526	436
703	438	773	440	810	442	868	444	1003	446
1113	448	1163	450	1293	454	1402	454		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	213	.125	350	.04	410	.125	810	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
350	410	1265	1600	800	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.125	0.040	0.124
E.G. Elev (ft)	443.40	Reach Len. (ft)	1265.00	1600.00	800.00
Crit W.S. (ft)		Flow Area (sq ft)	774.88	796.14	2479.93
E.G. Slope (ft/ft)	0.000360	Area (sq ft)	774.88	796.14	2479.93
Q Total (cfs)	5708.00	Flow (cfs)	655.07	3083.94	1968.99
Top Width (ft)	614.00	Top Width (ft)	117.20	60.00	436.80
Vel Total (ft/s)	1.41	Avg. Vel. (ft/s)	0.85	3.87	0.79
Max Chl Dpth (ft)	15.27	Hydr. Depth (ft)	6.61	13.27	5.68
Conv. Total (cfs)	300928.9	Conv. (cfs)	34535.8	162587.0	103806.1
Length Wtd. (ft)	1241.71	Wetted Per. (ft)	117.84	61.77	436.93
Min Ch El (ft)	428.00	Shear (lb/sq ft)	0.15	0.29	0.13
Alpha	4.23	Stream Power (lb/ft s)	0.12	1.12	0.10
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	697.91	146.62	426.26
C & E Loss (ft)	0.02	Cum SA (acres)	120.95	8.33	61.08

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 4

INPUT
Description: B-4
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	54	448	107	446	130	448	216	448
230	446	439	446	962	444	1145	442	1182	438
1210	436	1286	434	1380	432	1395	427	1415	427
1430	432	1623	434	1724	436	1798	440	1893	442
2131	446	2495	446	2587	448	2785	450		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	1145	.125	1380	.04	1430	.125	1798	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1380	1430	980	1100	955	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.123	0.040	0.116
E.G. Elev (ft)	443.07	Reach Len. (ft)	980.00	1100.00	955.00
Crit W.S. (ft)		Flow Area (sq ft)	1877.32	725.70	3335.06
E.G. Slope (ft/ft)	0.000182	Area (sq ft)	1877.32	725.70	3335.06
Q Total (cfs)	5708.00	Flow (cfs)	1238.68	2118.51	2350.81
Top Width (ft)	901.11	Top Width (ft)	327.78	50.00	523.33
Vel Total (ft/s)	0.96	Avg. Vel. (ft/s)	0.66	2.92	0.70
Max Chl Dpth (ft)	16.01	Hydr. Depth (ft)	5.73	14.51	6.37
Conv. Total (cfs)	423079.8	Conv. (cfs)	91811.4	157024.8	174243.5
Length Wtd. (ft)	1005.27	Wetted Per. (ft)	328.12	51.62	523.50
Min Ch El (ft)	427.00	Shear (lb/sq ft)	0.07	0.16	0.07
Alpha	3.75	Stream Power (lb/ft s)	0.04	0.47	0.05
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	659.40	118.67	372.86
C & E Loss (ft)	0.01	Cum SA (acres)	114.49	6.31	52.26

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 3

INPUT
Description: B-3
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	24	448	44	442	114	440	198	440
233	438	250	440	597	441	1025	440	1260	438
1440	433.5	1514	432	1595	430	1676	432	1750	435
1852	432	1882	425	1902	425	1926	432	1963	434
1986	438	2108	439	2256	438	2645	442	2726	444
2840	446	3000	450						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	1440	.125	1852	.04	1926	.125	1986	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1852	1926	1010	1860	1088	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.058	0.040	0.038
E.G. Elev (ft)	443.01	Reach Len. (ft)	1010.00	1860.00	1088.00
Crit W.S. (ft)		Flow Area (sq ft)	9177.52	1143.77	2941.16
E.G. Slope (ft/ft)	0.000016	Area (sq ft)	9177.52	1143.77	2941.16
Q Total (cfs)	5708.00	Flow (cfs)	3417.36	1037.03	1253.60
Top Width (ft)	2645.29	Top Width (ft)	1811.37	74.00	759.92
Vel Total (ft/s)	0.43	Avg. Vel. (ft/s)	0.37	0.91	0.43
Max Chl Dpth (ft)	18.01	Hydr. Depth (ft)	5.07	15.46	3.87
Conv. Total (cfs)	1427984.0	Conv. (cfs)	854929.8	259436.6	313617.1
Length Wtd. (ft)	1172.80	Wetted Per. (ft)	1811.96	75.81	760.36
Min Ch El (ft)	425.00	Shear (lb/sq ft)	0.01	0.02	0.00
Alpha	1.47	Stream Power (lb/ft s)	0.00	0.01	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	535.05	95.07	304.06
C & E Loss (ft)	0.00	Cum SA (acres)	90.43	4.74	38.19

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 2

INPUT
Description: B-2
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	38	446	184	445	330	446	625	446
710	444	1602	442	2156	440	2327	438	2354	436
2420	434	2844	434	2894	432	2906	425	2924	425
2938	432	2950	433	2974	434	2995	434	3280	438
3318	438	3383	440	3966	444	4133	444	4316	444
4402	450								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	2327	.125	2894	.04	2938	.125	2950	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
2894	2938	1800	1660	890	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	442.98	Element			
Vel Head (ft)	0.01	Wt. n-Val.	0.086	0.040	0.031
E.G. Elev (ft)	442.99	Reach Len. (ft)	1800.00	1660.00	890.00
Crit W.S. (ft)		Flow Area (sq ft)	6992.74	700.28	3629.52
E.G. Slope (ft/ft)	0.000025	Area (sq ft)	6992.74	700.28	3629.52
Q Total (cfs)	5693.00	Flow (cfs)	2141.93	775.21	2775.86
Top Width (ft)	2654.61	Top Width (ft)	1730.73	44.00	879.87
Vel Total (ft/s)	0.50	Avg. Vel. (ft/s)	0.31	1.11	0.76
Max Chl Dpth (ft)	17.98	Hydr. Depth (ft)	4.04	15.92	4.13
Conv. Total (cfs)	1147919.0	Conv. (cfs)	431891.8	156310.6	559716.1
Length Wtd. (ft)	1335.21	Wetted Per. (ft)	1730.89	47.54	880.01
Min Ch El (ft)	425.00	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.93	Stream Power (lb/ft s)	0.00	0.03	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	347.58	55.70	222.01
C & E Loss (ft)	0.00	Cum SA (acres)	49.36	2.22	17.71

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Bonnie RS: 1

INPUT
Description: B-1
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	210	448	333	446	357	444	457	442
503	440	538	438	650	430	800	430	892	430
905	428	920	421	932	421	950	428	988	428
1050	426	1180	425	1238	426	1353	426	1395	428
1441	428	1452	430	1466	432	1475	432.3	1548	434
1615	436	1653	436	1940	444	2416	446	2510	450

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	800	.125	905	.04	950	.125	1475	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
905	950	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	442.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.040	0.040	0.088
E.G. Elev (ft)	442.97	Reach Len. (ft)	800.00	800.00	800.00
Crit W.S. (ft)		Flow Area (sq ft)	4578.70	873.21	10961.22
E.G. Slope (ft/ft)	0.000007	Area (sq ft)	4578.70	873.21	10961.22
Q Total (cfs)	5693.00	Flow (cfs)	2271.53	592.16	2829.31
Top Width (ft)	1494.66	Top Width (ft)	496.56	45.00	953.09
Vel Total (ft/s)	0.35	Avg. Vel. (ft/s)	0.50	0.68	0.26
Max Chl Dpth (ft)	21.97	Hydr. Depth (ft)	9.22	19.40	11.50
Conv. Total (cfs)	2161135.0	Conv. (cfs)	862302.4	224790.3	1074042.0
Length Wtd. (ft)	800.00	Wetted Per. (ft)	497.11	47.87	953.66
Min Ch El (ft)	421.00	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	1.49	Stream Power (lb/ft s)	0.00	0.01	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	71.33	14.69	126.79
C & E Loss (ft)	0.00	Cum SA (acres)			

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 497.40

INPUT
Description: Station 497+40
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	20	450	53	449.5	61	440.5	79	440.5
87	449.5	600	449.5	1025	450	1045	455	1065	460

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.14	53	.083	87	.065	600	.14

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
53	87	595	650	560	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	455.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.140	0.083	0.085
E.G. Elev (ft)	455.90	Reach Len. (ft)	595.00	650.00	560.00
Crit W.S. (ft)		Flow Area (sq ft)	237.25	451.22	5955.71
E.G. Slope (ft/ft)	0.000246	Area (sq ft)	237.25	451.22	5955.71
Q Total (cfs)	6266.00	Flow (cfs)	124.04	615.93	5526.03
Top Width (ft)	1040.33	Top Width (ft)	44.78	34.00	961.55
Vel Total (ft/s)	0.94	Avg. Vel. (ft/s)	0.52	1.37	0.93
Max Chl Dpth (ft)	15.39	Hydr. Depth (ft)	5.30	13.27	6.19
Conv. Total (cfs)	399584.8	Conv. (cfs)	7909.8	39278.2	352396.8
Length Wtd. (ft)	578.62	Wetted Per. (ft)	46.17	42.08	962.28
Min Ch El (ft)	440.50	Shear (lb/sq ft)	0.08	0.16	0.10
Alpha	1.07	Stream Power (lb/ft s)	0.04	0.22	0.09
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)	1495.96	508.50	1857.78
C & E Loss (ft)	0.01	Cum SA (acres)	155.58	32.46	218.34

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 490.90

INPUT
Description: Station 490+90
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	10	455	65	450	103	448.8	111	439.8
129	439.8	137	448.8	565	450	600	455	610	457

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.14	103	.083	137	.14

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
103	137	320	350	340	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	455.51	Element			
Vel Head (ft)	0.08	Wt. n-Val.	0.140	0.083	0.140
E.G. Elev (ft)	455.59	Reach Len. (ft)	320.00	350.00	340.00
Crit W.S. (ft)		Flow Area (sq ft)	398.27	462.10	2720.55
E.G. Slope (ft/ft)	0.001797	Area (sq ft)	398.27	462.10	2720.55
Q Total (cfs)	6266.00	Flow (cfs)	503.81	1732.63	4029.56
Top Width (ft)	595.09	Top Width (ft)	95.54	34.00	465.54
Vel Total (ft/s)	1.75	Avg. Vel. (ft/s)	1.26	3.75	1.48
Max Chl Dpth (ft)	15.71	Hydr. Depth (ft)	4.17	13.59	5.84
Conv. Total (cfs)	147805.9	Conv. (cfs)	11884.1	40870.2	95051.5
Length Wtd. (ft)	339.25	Wetted Per. (ft)	95.84	42.08	465.95
Min Ch El (ft)	439.80	Shear (lb/sq ft)	0.47	1.23	0.66
Alpha	1.77	Stream Power (lb/ft s)	0.59	4.62	0.97
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	1491.62	501.69	1802.01
C & E Loss (ft)	0.00	Cum SA (acres)	154.62	31.96	209.17

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 487.40

INPUT
Description: Station 487+40
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	10	455	15	450	223	448.4	231	439.4
249	439.4	257	448.4	600	450	690	455	700	457

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.14	223	.083	257	.14	600	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
223	257	550	640	290	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	454.95	Element			
Vel Head (ft)	0.07	Wt. n-Val.	0.140	0.083	0.131
E.G. Elev (ft)	455.02	Reach Len. (ft)	550.00	640.00	290.00
Crit W.S. (ft)		Flow Area (sq ft)	1207.44	456.57	2191.12
E.G. Slope (ft/ft)	0.001588	Area (sq ft)	1207.44	456.57	2191.12
Q Total (cfs)	6266.00	Flow (cfs)	1629.16	1596.23	3040.62
Top Width (ft)	678.98	Top Width (ft)	212.95	34.00	432.03
Vel Total (ft/s)	1.63	Avg. Vel. (ft/s)	1.35	3.50	1.39
Max Chl Dpth (ft)	15.55	Hydr. Depth (ft)	5.67	13.43	5.07
Conv. Total (cfs)	157248.4	Conv. (cfs)	40884.5	40058.1	76305.7
Length Wtd. (ft)	390.12	Wetted Per. (ft)	215.00	42.08	432.17
Min Ch El (ft)	439.40	Shear (lb/sq ft)	0.56	1.08	0.50
Alpha	1.71	Stream Power (lb/ft s)	0.75	3.76	0.70
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	1405.72	498.00	1782.85
C & E Loss (ft)	0.02	Cum SA (acres)	153.49	31.68	205.67

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 481.00

INPUT
Description: Station 481+00
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	5	450	84	448.2	91	439.2	109	439.2
116	448.2	880	450	1165	455	1175	457		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.14	84	.083	116	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
84	116	450	460	230	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	454.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.140	0.083	0.065
E.G. Elev (ft)	454.80	Reach Len. (ft)	450.00	460.00	230.00
Crit W.S. (ft)		Flow Area (sq ft)	457.02	435.62	4992.50
E.G. Slope (ft/ft)	0.000251	Area (sq ft)	457.02	435.62	4992.50
Q Total (cfs)	6266.00	Flow (cfs)	241.88	598.77	5425.34
Top Width (ft)	1150.97	Top Width (ft)	82.42	32.00	1036.56
Vel Total (ft/s)	1.06	Avg. Vel. (ft/s)	0.53	1.37	1.09
Max Chl Dpth (ft)	15.58	Hydr. Depth (ft)	5.55	13.61	4.82
Conv. Total (cfs)	395686.6	Conv. (cfs)	15274.5	37811.5	342600.6
Length Wtd. (ft)	258.15	Wetted Per. (ft)	84.90	40.80	1036.60
Min Ch El (ft)	439.20	Shear (lb/sq ft)	0.08	0.17	0.08
Alpha	1.07	Stream Power (lb/ft s)	0.04	0.23	0.08
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	1475.21	491.44	1758.93
C & E Loss (ft)	0.00	Cum SA (acres)	151.63	31.20	200.78

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 476.40

INPUT
Description: Station 476+40
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	10	455	10	450	25	448	33	439
50	439	58	448	720	450	1300	455	1310	457

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.14	25	.083	58	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
25	58	300	340	450	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	454.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.140	0.083	0.065
E.G. Elev (ft)	454.73	Reach Len. (ft)	300.00	340.00	450.00
Crit W.S. (ft)		Flow Area (sq ft)	85.67	446.46	5067.94
E.G. Slope (ft/ft)	0.000287	Area (sq ft)	85.67	446.46	5067.94
Q Total (cfs)	6266.00	Flow (cfs)	40.84	664.36	5560.80
Top Width (ft)	1256.48	Top Width (ft)	15.00	33.00	1208.48
Vel Total (ft/s)	1.12	Avg. Vel. (ft/s)	0.48	1.49	1.10
Max Chl Dpth (ft)	15.71	Hydr. Depth (ft)	5.71	13.53	4.19
Conv. Total (cfs)	369859.4	Conv. (cfs)	2410.6	39214.9	328233.8
Length Wtd. (ft)	436.66	Wetted Per. (ft)	19.84	41.08	1208.50
Min Ch El (ft)	439.00	Shear (lb/sq ft)	0.08	0.19	0.08
Alpha	1.04	Stream Power (lb/ft s)	0.04	0.29	0.08
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	1472.41	486.78	1732.37
C & E Loss (ft)	0.00	Cum SA (acres)	151.12	30.85	194.85

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 473.00

INPUT
Description: Station 473+00
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	10	455	10	450	63.5	448.6	71.5	438.6
88.5	438.6	96.5	448.6	860	448.6	1400	448	1550	450
1675	455	1685	457						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.14	63.5	.083	96.5	.065	860	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
63.5	96.5	190	240	295	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	454.60	Element			
Vel Head (ft)	0.01	Wt. n-Val.	0.140	0.083	0.128
E.G. Elev (ft)	454.61	Reach Len. (ft)	190.00	240.00	295.00
Crit W.S. (ft)		Flow Area (sq ft)	283.66	448.07	9090.85
E.G. Slope (ft/ft)	0.000253	Area (sq ft)	283.66	448.07	9090.85
Q Total (cfs)	6266.00	Flow (cfs)	137.76	612.25	5515.99
Top Width (ft)	1655.05	Top Width (ft)	53.50	33.00	1568.55
Vel Total (ft/s)	0.64	Avg. Vel. (ft/s)	0.49	1.37	0.61
Max Chl Dpth (ft)	16.00	Hydr. Depth (ft)	5.30	13.58	5.80
Conv. Total (cfs)	394031.6	Conv. (cfs)	8662.8	38500.8	346868.0
Length Wtd. (ft)	283.84	Wetted Per. (ft)	58.12	42.61	1568.66
Min Ch El (ft)	438.60	Shear (lb/sq ft)	0.08	0.17	0.09
Alpha	1.26	Stream Power (lb/ft s)	0.04	0.23	0.06
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	1471.14	483.29	1659.24
C & E Loss (ft)	0.00	Cum SA (acres)	150.89	30.60	180.51

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 470.60

INPUT
Description: Station 470+60
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	10	455	10	450	120	448.4	129	438.4
146	438.4	153	448.4	915	448.5	918	445	927	445
930	448.5	1260	445	1320	450	1350	455	1360	457

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.065	120	.083	153	.065	915	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
120	153	105	210	345	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	454.54	Element			
Vel Head (ft)	0.01	Wt. n-Val.	0.065	0.083	0.116
E.G. Elev (ft)	454.54	Reach Len. (ft)	105.00	210.00	345.00
Crit W.S. (ft)		Flow Area (sq ft)	586.94	452.48	7823.10
E.G. Slope (ft/ft)	0.000209	Area (sq ft)	586.94	452.48	7823.10
Q Total (cfs)	6266.00	Flow (cfs)	576.98	565.79	5123.23
Top Width (ft)	1337.21	Top Width (ft)	110.00	33.00	1194.21
Vel Total (ft/s)	0.71	Avg. Vel. (ft/s)	0.98	1.25	0.65
Max Chl Dpth (ft)	16.14	Hydr. Depth (ft)	5.34	13.71	6.55
Conv. Total (cfs)	433086.3	Conv. (cfs)	39879.1	39105.4	354101.8
Length Wtd. (ft)	295.14	Wetted Per. (ft)	114.55	42.66	1198.04
Min Ch El (ft)	438.40	Shear (lb/sq ft)	0.07	0.14	0.09
Alpha	1.16	Stream Power (lb/ft s)	0.07	0.17	0.06
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	1469.24	480.81	1601.97
C & E Loss (ft)	0.00	Cum SA (acres)	150.53	30.41	171.15

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 468.50

INPUT
Description: Station 468+50
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	10	455	25	450	50	446.2	303.5	446.2
311.5	438.2	328.5	438.2	336.5	446.2	992	446.2	995	442.5
1004	442.5	1007	446.2	1055	445	1100	446	1180	450
1280	455	1290	457						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.065	303.5	.083	336.5	.065	1100	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
303.5	336.5	150	210	340	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	454.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.065	0.083	0.070
E.G. Elev (ft)	454.52	Reach Len. (ft)	150.00	210.00	340.00
Crit W.S. (ft)		Flow Area (sq ft)	2297.44	474.24	7173.90
E.G. Slope (ft/ft)	0.000052	Area (sq ft)	2297.44	474.24	7173.90
Q Total (cfs)	6266.00	Flow (cfs)	1527.64	321.16	4417.20
Top Width (ft)	1258.74	Top Width (ft)	292.03	33.00	933.71
Vel Total (ft/s)	0.63	Avg. Vel. (ft/s)	0.66	0.68	0.62
Max Chl Dpth (ft)	16.31	Hydr. Depth (ft)	7.87	14.37	7.68
Conv. Total (cfs)	866664.4	Conv. (cfs)	211291.0	44420.7	610952.7
Length Wtd. (ft)	233.43	Wetted Per. (ft)	293.05	39.63	937.47
Min Ch El (ft)	438.20	Shear (lb/sq ft)	0.03	0.04	0.02
Alpha	1.00	Stream Power (lb/ft s)	0.02	0.03	0.02
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	1465.76	478.58	1542.58
C & E Loss (ft)	0.01	Cum SA (acres)	150.04	30.26	162.72

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 466.40

INPUT
Description: Station 466+40
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	10	455	35	450	58	446.18	203.5	446.18
211.5	438.18	228.5	438.18	236.5	446.16	250	446.18	942	445.35
978	445.35	981	440.35	990	440.35	993	445.35	1029	445.35
1050	445	1245	450	1260	455	1270	457		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	25	58	.065	203.5	.083	236.5	.065	250	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
203.5	236.5	33	33	33	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	454.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.073	0.083	4.210
E.G. Elev (ft)	454.47	Reach Len. (ft)	33.00	33.00	33.00
Crit W.S. (ft)		Flow Area (sq ft)	1375.03	468.82	8424.22
E.G. Slope (ft/ft)	0.001434	Area (sq ft)	1375.03	468.82	8424.22
Q Total (cfs)	6266.00	Flow (cfs)	4152.69	1650.38	462.93
Top Width (ft)	1244.59	Top Width (ft)	190.12	33.00	1021.47
Vel Total (ft/s)	0.61	Avg. Vel. (ft/s)	3.02	3.52	0.05
Max Chl Dpth (ft)	16.14	Hydr. Depth (ft)	7.23	14.21	8.25
Conv. Total (cfs)	165492.1	Conv. (cfs)	109677.1	43588.5	12226.5
Length Wtd. (ft)	33.00	Wetted Per. (ft)	190.86	39.61	1027.90
Min Ch El (ft)	438.18	Shear (lb/sq ft)	0.64	1.06	0.73
Alpha	25.00	Stream Power (lb/ft s)	1.95	3.73	0.04
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	1459.44	476.31	1481.70
C & E Loss (ft)	0.01	Cum SA (acres)	149.21	30.10	155.09

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 466.07

INPUT
Description: Station 466+07
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457	10	455	35	450	78	445.9	173.5	445.9
181.5	437.9	198.5	437.9	206.5	445.9	230	445.9	952	445.12
978	445.12	981	440.12	990	440.12	993	445.12	1019	445.12
1050	445	1245	450	1260	455	1270	457		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	25	78	.065	230	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
173.5	206.5	48	48	48	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	454.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.085	0.065	2.643
E.G. Elev (ft)	454.41	Reach Len. (ft)	48.00	48.00	48.00
Crit W.S. (ft)		Flow Area (sq ft)	1107.14	474.24	8764.69
E.G. Slope (ft/ft)	0.001707	Area (sq ft)	1107.14	474.24	8764.69
Q Total (cfs)	6266.00	Flow (cfs)	3078.11	2343.76	844.12
Top Width (ft)	1243.68	Top Width (ft)	159.55	33.00	1051.13
Vel Total (ft/s)	0.61	Avg. Vel. (ft/s)	2.78	4.94	0.10
Max Chl Dpth (ft)	16.31	Hydr. Depth (ft)	6.94	14.37	8.34
Conv. Total (cfs)	151643.5	Conv. (cfs)	74493.5	56721.4	20428.7
Length Wtd. (ft)	48.00	Wetted Per. (ft)	160.16	39.63	1057.54
Min Ch El (ft)	437.90	Shear (lb/sq ft)	0.74	1.28	0.88
Alpha	35.26	Stream Power (lb/ft s)	2.05	6.30	0.09
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	1458.50	475.95	1475.19
C & E Loss (ft)	0.18	Cum SA (acres)	149.08	30.07	154.31

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 465.59

INPUT
Description: Station 465+59
Cross-section upstream of bridge
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	455	10	450	20	441.16	27	438.7	50	442.74
63	437.86	71.5	441.86	92	444.83	100	450	110	455

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	25	20	.065	92	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20	92	38	38	38	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	20	455.16	92	110	455.16

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	453.31	Element			
Vel Head (ft)	0.80	Wt. n-Val.		0.065	
E.G. Elev (ft)	454.11	Reach Len. (ft)	3.00	3.00	3.00
Crit W.S. (ft)	447.39	Flow Area (sq ft)		870.93	
E.G. Slope (ft/ft)	0.003751	Area (sq ft)	88.25	870.93	58.11
Q Total (cfs)	6266.00	Flow (cfs)		6266.00	
Top Width (ft)	103.24	Top Width (ft)	16.62	72.00	14.62
Vel Total (ft/s)	7.19	Avg. Vel. (ft/s)		7.19	
Max Chl Dpth (ft)	15.45	Hydr. Depth (ft)		12.10	
Conv. Total (cfs)	102309.4	Conv. (cfs)		102309.4	
Length Wtd. (ft)	3.00	Wetted Per. (ft)		74.77	
Min Ch El (ft)	437.86	Shear (lb/sq ft)		2.73	
Alpha	1.00	Stream Power (lb/ft s)		19.63	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1457.84	475.21	1470.33
C & E Loss (ft)	0.00	Cum SA (acres)	148.99	30.01	153.72

Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

BRIDGE RIVER: Restoration
REACH: Galum RS: 465.40

INPUT
Description:
Distance from Upstream XS = 3
Deck/Roadway Width = 32
Weir Coefficient = 2.6
Bridge Deck/Roadway Skew =
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	455.16	455.16	10	455.16	450	20	455.16	441.16
20	455.16	453.33	92.01	455.16	453.33	92.01	455.16	441.16
100	455.16	450	110	455.16	455			

Upstream Bridge Cross Section Data
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	455	10	450	20	441.16	27	438.7	50	442.74
63	437.86	71.5	441.86	92	444.83	100	450	110	455

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	25	20	.065	92	25

Bank Sta: Left	Right	Coeff Contr.	Expan.
20	92	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	20	455.16	92	110	455.16

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	455.16	455.16	10	455.16	450	20	455.16	441.16
20	455.16	453.33	92.01	455.16	453.33	92.01	455.16	441.16
100	455.16	450	110	455.16	455			

Downstream Bridge Cross Section Data
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	455	10	450	20	441.16	27	438.7	50	442.74
63	437.86	71.5	441.86	92	444.83	100	450	110	455

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	25	20	.065	92	25

Bank Sta: Left	Right	Coeff Contr.	Expan.
20	92	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	20	455.16	92	110	455.16

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Energy

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the downstream end
Criteria to check for pressure flow = Upstream water surface

BRIDGE OUTPUT Profile #100-yr
Opening : Bridge #1

			Inside BR US	Inside BR DS
E.G. US. (ft)	454.11	Element		
W.S. US. (ft)	453.31	E.G. Elev (ft)	454.10	453.94
Q Total (cfs)	6266.00	W.S. Elev (ft)	453.30	453.11
Q Bridge (cfs)	6266.00	Crit W.S. (ft)	447.39	447.39
Q Weir (cfs)		Max Chl Dpth (ft)	15.44	15.25
Weir Sta Lft (ft)		Vel Total (ft/s)	7.20	7.31
Weir Sta Rgt (ft)		Flow Area (sq ft)	869.92	856.72
Weir Submerg		Froude # Chl	0.37	0.37
Weir Max Depth (ft)		Specif Force (cu ft)	6768.82	6632.11
Min Top Rd (ft)	455.16	Hydr Depth (ft)	12.08	11.90
Min El Prs (ft)	455.16	W.P. Total (ft)	86.90	86.72
Delta EG (ft)	0.32	Conv. Total (cfs)	92370.2	90172.3
Delta WS (ft)	0.21	Top Width (ft)	72.21	72.20
BR Open Area (sq ft)	872.41	Frctn Loss (ft)	0.15	0.01
BR Open Vel (ft/s)	7.31	C & E Loss (ft)	0.01	0.00
Coef of Q		Shear Total (lb/sq ft)	2.88	2.98
Br Sel Mthd	Energy only	Power Total (lb/ft s)	20.71	21.78

Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 465.21

INPUT
Description: Station 465+21
Cross-section immediately downstream of bridge
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	455	10	450	20	441.16	27	438.7	50	442.74
63	437.86	71.5	441.86	92	444.83	100	450	110	455

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	25	20	.065	92	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20	92	110	140	195	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	20	455.16	92	110	455.16

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	453.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.		0.065	
E.G. Elev (ft)	453.79	Reach Len. (ft)	110.00	140.00	195.00
Crit W.S. (ft)	447.02	Flow Area (sq ft)		855.65	
E.G. Slope (ft/ft)	0.003306	Area (sq ft)	84.77	855.65	55.05
Q Total (cfs)	5712.00	Flow (cfs)		5712.00	
Top Width (ft)	102.39	Top Width (ft)	16.19	72.00	14.19
Vel Total (ft/s)	6.68	Avg. Vel. (ft/s)		6.68	
Max Chl Dpth (ft)	15.24	Hydr. Depth (ft)		11.88	
Conv. Total (cfs)	99336.6	Conv. (cfs)		99336.6	
Length Wtd. (ft)	142.82	Wetted Per. (ft)		74.77	
Min Ch El (ft)	437.86	Shear (lb/sq ft)		2.36	
Alpha	1.00	Stream Power (lb/ft s)		15.77	
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	1457.83	474.45	1470.33
C & E Loss (ft)	0.27	Cum SA (acres)	148.98	29.95	153.72

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 17

INPUT
Description: G-17
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	455	183	450	210	448	353	446	399	436.5
417	436.5	434	446	452	446	537	446	620	448
646	456	688	458						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	353	.04	434	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
353	434	490	680	825	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	453.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	453.41	Reach Len. (ft)	490.00	680.00	825.00
Crit W.S. (ft)		Flow Area (sq ft)	1204.22	1058.18	1311.99
E.G. Slope (ft/ft)	0.000339	Area (sq ft)	1204.22	1058.18	1311.99
Q Total (cfs)	5712.00	Flow (cfs)	789.98	3904.45	1017.56
Top Width (ft)	573.35	Top Width (ft)	289.26	81.00	203.09
Vel Total (ft/s)	1.60	Avg. Vel. (ft/s)	0.66	3.69	0.78
Max Chl Dpth (ft)	16.76	Hydr. Depth (ft)	4.16	13.06	6.46
Conv. Total (cfs)	310250.5	Conv. (cfs)	42908.2	212072.7	55269.6
Length Wtd. (ft)	696.72	Wetted Per. (ft)	289.39	84.45	203.90
Min Ch El (ft)	436.50	Shear (lb/sq ft)	0.09	0.27	0.14
Alpha	3.71	Stream Power (lb/ft s)	0.06	0.98	0.11
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	1456.21	471.38	1467.27
C & E Loss (ft)	0.01	Cum SA (acres)	148.60	29.71	153.23

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 16

INPUT
Description: G-16
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	455	184	446	224	444	280	446	293	444
306	440	310	436	321	436	336	442	391	444
503	446	712	446	737	450	785	460		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	293	.04	336	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
293	336	880	820	700	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	453.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	453.13	Reach Len. (ft)	880.00	820.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	1374.89	600.34	3058.90
E.G. Slope (ft/ft)	0.000440	Area (sq ft)	1374.89	600.34	3058.90
Q Total (cfs)	6700.00	Flow (cfs)	1157.88	2576.37	2965.75
Top Width (ft)	710.71	Top Width (ft)	252.27	43.00	415.44
Vel Total (ft/s)	1.33	Avg. Vel. (ft/s)	0.84	4.29	0.97
Max Chl Dpth (ft)	17.01	Hydr. Depth (ft)	5.45	13.96	7.36
Conv. Total (cfs)	319571.0	Conv. (cfs)	55227.8	122885.5	141457.7
Length Wtd. (ft)	788.83	Wetted Per. (ft)	252.68	46.41	416.12
Min Ch El (ft)	436.00	Shear (lb/sq ft)	0.15	0.35	0.20
Alpha	4.30	Stream Power (lb/ft s)	0.13	1.52	0.20
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	1441.70	458.43	1425.88
C & E Loss (ft)	0.01	Cum SA (acres)	145.55	28.74	147.38

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 15

INPUT
Description: G-15
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	476	193	448	208	444	211	443	216	444
304	444	375	444	446	442	457	442	466	440
476	436	481	436	489	440	499	442	575	444
792	446	810	450	845	460	853	462	928	470

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	457	.04	499	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
457	499	1700	2060	2030	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	452.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	452.81	Reach Len. (ft)	1700.00	2060.00	2030.00
Crit W.S. (ft)		Flow Area (sq ft)	2448.51	571.62	2514.73
E.G. Slope (ft/ft)	0.000343	Area (sq ft)	2448.51	571.62	2514.73
Q Total (cfs)	6700.00	Flow (cfs)	2291.50	2168.51	2239.99
Top Width (ft)	659.15	Top Width (ft)	296.60	42.00	320.55
Vel Total (ft/s)	1.21	Avg. Vel. (ft/s)	0.94	3.79	0.89
Max Chl Dpth (ft)	16.73	Hydr. Depth (ft)	8.26	13.61	7.85
Conv. Total (cfs)	361841.4	Conv. (cfs)	123754.9	117113.0	120973.5
Length Wtd. (ft)	1953.09	Wetted Per. (ft)	297.75	44.13	321.41
Min Ch El (ft)	436.00	Shear (lb/sq ft)	0.18	0.28	0.17
Alpha	3.56	Stream Power (lb/ft s)	0.16	1.05	0.15
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	1403.08	447.40	1381.09
C & E Loss (ft)	0.01	Cum SA (acres)	140.01	27.94	141.46

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 14

INPUT
Description: G-14
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	227	454	295	452	339	451	377	452
387	452	404	450	465	444	548	442	577	440
586	435	613	435	623	440	641	442	815	444
858	446	944	460						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	577	.04	623	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
577	623	815	800	615	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	451.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	452.09	Reach Len. (ft)	815.00	800.00	615.00
Crit W.S. (ft)		Flow Area (sq ft)	1410.18	731.28	2156.55
E.G. Slope (ft/ft)	0.000389	Area (sq ft)	1410.18	731.28	2156.55
Q Total (cfs)	6700.00	Flow (cfs)	1326.16	3272.90	2100.94
Top Width (ft)	583.09	Top Width (ft)	265.66	46.00	271.43
Vel Total (ft/s)	1.56	Avg. Vel. (ft/s)	0.94	4.48	0.97
Max Chl Dpth (ft)	16.93	Hydr. Depth (ft)	5.31	15.90	7.95
Conv. Total (cfs)	339520.4	Conv. (cfs)	67202.7	165853.0	106464.7
Length Wtd. (ft)	748.77	Wetted Per. (ft)	266.19	48.48	272.08
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.13	0.37	0.19
Alpha	4.22	Stream Power (lb/ft s)	0.12	1.64	0.19
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	1327.78	416.59	1272.25
C & E Loss (ft)	0.04	Cum SA (acres)	129.04	25.86	127.67

Warning - Divided flow computed for this cross-section.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 13

INPUT
Description: G-13
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	223	446	335	440	471	438	690	440
705	440	715	435	730	435	738	438	758	438
854	440	938	442	1011	444	1053	446	1070	448
1141	450	1194	452	1314	456	1332	458	1391	460

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	705	.04	738	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
705	738	430	1600	1520	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	451.90	Element			
Vel Head (ft)	0.02	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	451.92	Reach Len. (ft)	430.00	1600.00	1520.00
Crit W.S. (ft)		Flow Area (sq ft)	6034.30	520.83	3710.31
E.G. Slope (ft/ft)	0.000093	Area (sq ft)	6034.30	520.83	3710.31
Q Total (cfs)	6700.00	Flow (cfs)	3557.27	1136.56	2006.17
Top Width (ft)	1062.50	Top Width (ft)	576.04	33.00	453.45
Vel Total (ft/s)	0.65	Avg. Vel. (ft/s)	0.59	2.18	0.54
Max Chl Dpth (ft)	16.90	Hydr. Depth (ft)	10.48	15.78	8.18
Conv. Total (cfs)	693671.0	Conv. (cfs)	368294.8	117671.7	207704.5
Length Wtd. (ft)	1222.84	Wetted Per. (ft)	576.41	34.72	453.76
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.06	0.09	0.05
Alpha	2.53	Stream Power (lb/ft s)	0.04	0.19	0.03
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	1258.14	405.10	1230.83
C & E Loss (ft)	0.01	Cum SA (acres)	121.16	25.13	122.55

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 12

INPUT
Description: G-12
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	222	446	252	442	266	440	280	435
304	435	325	440	435	442	584	444	637	446
669	448	678	450	705	452	730	454	770	454
807	456	883	460						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	266	.04	325	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
266	325	785	880	750	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	451.58	Element			
Vel Head (ft)	0.14	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	451.72	Reach Len. (ft)	785.00	880.00	750.00
Crit W.S. (ft)		Flow Area (sq ft)	622.09	890.59	2974.75
E.G. Slope (ft/ft)	0.000322	Area (sq ft)	622.09	890.59	2974.75
Q Total (cfs)	6700.00	Flow (cfs)	440.99	3565.14	2693.87
Top Width (ft)	565.75	Top Width (ft)	132.45	59.00	374.30
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)	0.71	4.00	0.91
Max Chl Dpth (ft)	16.58	Hydr. Depth (ft)	4.70	15.09	7.95
Conv. Total (cfs)	373636.3	Conv. (cfs)	24592.5	198815.7	150228.0
Length Wtd. (ft)	825.99	Wetted Per. (ft)	133.03	60.45	374.69
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.09	0.30	0.16
Alpha	3.99	Stream Power (lb/ft s)	0.07	1.18	0.14
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	1225.29	379.18	1114.19
C & E Loss (ft)	0.01	Cum SA (acres)	117.67	23.44	108.11

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 11

INPUT
Description: G-11
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	70	458.5	85	458	148	456	182	455
217	456	229	454	255	452	305	452	325	450
384	444	415	442	487	442	573	442	664	440
685	438	697	435	716	435	730	440	761	442
799	444	872	454	919	456	943	460		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	70	.125	664	.04	730	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
664	730	1750	1720	1155	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	451.34	Element			
Vel Head (ft)	0.11	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	451.46	Reach Len. (ft)	1750.00	1720.00	1155.00
Crit W.S. (ft)		Flow Area (sq ft)	2941.42	941.66	834.52
E.G. Slope (ft/ft)	0.000289	Area (sq ft)	2941.42	941.66	834.52
Q Total (cfs)	6700.00	Flow (cfs)	2581.17	3453.88	664.95
Top Width (ft)	541.04	Top Width (ft)	352.43	66.00	122.61
Vel Total (ft/s)	1.42	Avg. Vel. (ft/s)	0.88	3.67	0.80
Max Chl Dpth (ft)	16.34	Hydr. Depth (ft)	8.35	14.27	6.81
Conv. Total (cfs)	393900.1	Conv. (cfs)	151749.5	203057.4	39093.2
Length Wtd. (ft)	1688.14	Wetted Per. (ft)	352.89	67.33	123.22
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.15	0.25	0.12
Alpha	3.62	Stream Power (lb/ft s)	0.13	0.93	0.10
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	1193.18	360.67	1081.40
C & E Loss (ft)	0.01	Cum SA (acres)	113.30	22.18	103.83

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 10

INPUT
Description: G-10
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	200	442	333	440	358	439	382	435
401	435	420	440	452	444	477	452	528	460

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	358	.04	420	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
358	420	1580	1980	2005	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	450.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	450.81	Reach Len. (ft)	1580.00	1980.00	2005.00
Crit W.S. (ft)		Flow Area (sq ft)	1961.40	870.77	342.48
E.G. Slope (ft/ft)	0.000501	Area (sq ft)	1961.40	870.77	342.48
Q Total (cfs)	6700.00	Flow (cfs)	2184.36	4172.03	343.60
Top Width (ft)	367.97	Top Width (ft)	253.39	62.00	52.58
Vel Total (ft/s)	2.11	Avg. Vel. (ft/s)	1.11	4.79	1.00
Max Chl Dpth (ft)	15.59	Hydr. Depth (ft)	7.74	14.04	6.51
Conv. Total (cfs)	299257.5	Conv. (cfs)	97565.2	186345.1	15347.2
Length Wtd. (ft)	1913.78	Wetted Per. (ft)	253.81	62.98	53.86
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.24	0.43	0.20
Alpha	3.31	Stream Power (lb/ft s)	0.27	2.07	0.20
Frctn Loss (ft)	1.64	Cum Volume (acre-ft)	1094.69	324.89	1065.80
C & E Loss (ft)	0.04	Cum SA (acres)	101.13	19.65	101.51

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 9

INPUT
Description: G-9
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	454	181	452	227	450	355	444	380	435
398	435	407	438	462	440	519	442	558	450
600	454								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	355	.04	407	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
355	407	790	860	940	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	448.53	Element			
Vel Head (ft)	0.61	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	449.14	Reach Len. (ft)	790.00	860.00	940.00
Crit W.S. (ft)		Flow Area (sq ft)	218.62	577.42	1056.90
E.G. Slope (ft/ft)	0.001781	Area (sq ft)	218.62	577.42	1056.90
Q Total (cfs)	6700.00	Flow (cfs)	188.95	4390.67	2120.38
Top Width (ft)	292.40	Top Width (ft)	96.58	52.00	143.82
Vel Total (ft/s)	3.62	Avg. Vel. (ft/s)	0.86	7.60	2.01
Max Chl Dpth (ft)	13.53	Hydr. Depth (ft)	2.26	11.10	7.35
Conv. Total (cfs)	158753.4	Conv. (cfs)	4477.1	104034.8	50241.5
Length Wtd. (ft)	871.07	Wetted Per. (ft)	96.69	54.06	144.55
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.25	1.19	0.81
Alpha	3.00	Stream Power (lb/ft s)	0.22	9.03	1.63
Frctn Loss (ft)	2.96	Cum Volume (acre-ft)	1055.16	291.97	1033.59
C & E Loss (ft)	0.15	Cum SA (acres)	94.78	17.06	96.99

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 8

INPUT
Description: G-8
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	454	49	450	83	442	190	440	214	435
223	435	237	436	249	440	327	442	371	450
433	452	509	454						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	190	.04	249	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
190	249	1240	660	530	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	443.92	Element			
Vel Head (ft)	2.11	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	446.02	Reach Len. (ft)	1240.00	660.00	530.00
Crit W.S. (ft)	443.92	Flow Area (sq ft)	319.71	422.99	237.47
E.G. Slope (ft/ft)	0.008923	Area (sq ft)	319.71	422.99	237.47
Q Total (cfs)	6700.00	Flow (cfs)	723.02	5445.18	531.80
Top Width (ft)	262.67	Top Width (ft)	115.14	59.00	88.53
Vel Total (ft/s)	6.84	Avg. Vel. (ft/s)	2.26	12.87	2.24
Max Chl Dpth (ft)	8.92	Hydr. Depth (ft)	2.78	7.17	2.68
Conv. Total (cfs)	70928.5	Conv. (cfs)	7654.1	57644.6	5629.8
Length Wtd. (ft)	822.81	Wetted Per. (ft)	115.38	60.20	88.73
Min Ch El (ft)	435.00	Shear (lb/sq ft)	1.54	3.91	1.49
Alpha	2.90	Stream Power (lb/ft s)	3.49	50.39	3.34
Frctn Loss (ft)	1.28	Cum Volume (acre-ft)	1050.28	282.10	1019.63
C & E Loss (ft)	0.60	Cum SA (acres)	92.86	15.97	94.48

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 7

INPUT
Description: G-7
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	63	446	116	444	197	442	298	441
450	442	1084	442	1152	440	1232	438	1265	435
1290	435	1318	436	1398	438	1438	440	1520	452

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	1084	.125	1232	.04	1318	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1232	1318	1070	1480	1820	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.042	0.040	0.125
E.G. Elev (ft)	443.71	Reach Len. (ft)	1070.00	1480.00	1820.00
Crit W.S. (ft)		Flow Area (sq ft)	2159.87	677.47	758.59
E.G. Slope (ft/ft)	0.000594	Area (sq ft)	2159.87	677.47	758.59
Q Total (cfs)	6353.00	Flow (cfs)	3218.94	2426.28	707.78
Top Width (ft)	1331.15	Top Width (ft)	1100.45	86.00	144.71
Vel Total (ft/s)	1.77	Avg. Vel. (ft/s)	1.49	3.58	0.93
Max Chl Dpth (ft)	8.62	Hydr. Depth (ft)	1.96	7.88	5.24
Conv. Total (cfs)	260579.2	Conv. (cfs)	132030.2	99518.2	29030.8
Length Wtd. (ft)	1513.68	Wetted Per. (ft)	1100.53	86.15	145.05
Min Ch El (ft)	435.00	Shear (lb/sq ft)	0.07	0.29	0.19
Alpha	1.96	Stream Power (lb/ft s)	0.11	1.05	0.18
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	1014.98	273.76	1013.57
C & E Loss (ft)	0.03	Cum SA (acres)	75.56	14.87	93.06

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 6

INPUT
Description: G-6
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	447	90	446	210	444	260	442	395	440
440	434	505	432	530	430	542	429	603	429
613	430	1275	430	1296	434	1424	448	1443	450

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	210	.125	530	.04	613	.07	1275	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
530	613	525	1000	770	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.125	0.040	0.071
E.G. Elev (ft)	443.60	Reach Len. (ft)	525.00	1000.00	770.00
Crit W.S. (ft)		Flow Area (sq ft)	1682.79	1200.48	9665.10
E.G. Slope (ft/ft)	0.000019	Area (sq ft)	1682.79	1200.48	9665.10
Q Total (cfs)	6353.00	Flow (cfs)	348.68	1149.53	4854.79
Top Width (ft)	1163.64	Top Width (ft)	309.90	83.00	770.74
Vel Total (ft/s)	0.51	Avg. Vel. (ft/s)	0.21	0.96	0.50
Max Chl Dpth (ft)	14.60	Hydr. Depth (ft)	5.43	14.46	12.54
Conv. Total (cfs)	1461988.0	Conv. (cfs)	80239.8	264537.3	1117211.0
Length Wtd. (ft)	727.78	Wetted Per. (ft)	310.46	83.09	771.64
Min Ch El (ft)	429.00	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.41	Stream Power (lb/ft s)	0.00	0.02	0.01
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	967.79	241.86	795.81
C & E Loss (ft)	0.00	Cum SA (acres)	58.24	12.00	73.94

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 5

INPUT
Description: G-5
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	57	448	160	432	512	432	523	434
562	434	695	432	712	428	727	428	750	434
804	435	1006	435	1135	436	1208	438	1472	448
1625	450								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	57	.125	160	.07	523	.125	695	.04
750	.125								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
695	750	1450	1280	780	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.081	0.040	0.125
E.G. Elev (ft)	443.58	Reach Len. (ft)	1450.00	1280.00	780.00
Crit W.S. (ft)		Flow Area (sq ft)	6399.45	753.41	4151.70
E.G. Slope (ft/ft)	0.000048	Area (sq ft)	6399.45	753.41	4151.70
Q Total (cfs)	6353.00	Flow (cfs)	3943.59	1090.47	1318.94
Top Width (ft)	1269.56	Top Width (ft)	609.49	55.00	605.07
Vel Total (ft/s)	0.56	Avg. Vel. (ft/s)	0.62	1.45	0.32
Max Chl Dpth (ft)	15.57	Hydr. Depth (ft)	10.50	13.70	6.86
Conv. Total (cfs)	919776.2	Conv. (cfs)	570945.4	157876.5	190954.3
Length Wtd. (ft)	1187.53	Wetted Per. (ft)	610.58	56.23	605.22
Min Ch El (ft)	428.00	Shear (lb/sq ft)	0.03	0.04	0.02
Alpha	1.95	Stream Power (lb/ft s)	0.02	0.06	0.01
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	919.08	219.43	673.69
C & E Loss (ft)	0.00	Cum SA (acres)	52.70	10.41	61.78

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 4

INPUT
Description: G-4
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	444	37	444	45	446	87	448	130	449
168	448	300	438	445	432	522	430	555	428
575	426	583	426	600	430	740	430	892	432
913	434	968	438	1066	440	1315	442	1415	442
1542	444	1642	450						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.125	522	.04	600	.125	913	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
522	600	908	2600	2270	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	443.48	Element			
Vel Head (ft)	0.03	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	443.51	Reach Len. (ft)	908.00	2600.00	2270.00
Crit W.S. (ft)		Flow Area (sq ft)	2388.67	1210.41	5689.45
E.G. Slope (ft/ft)	0.000079	Area (sq ft)	2388.67	1210.41	5689.45
Q Total (cfs)	6353.00	Flow (cfs)	1126.32	2471.84	2754.85
Top Width (ft)	1281.29	Top Width (ft)	294.33	78.00	908.96
Vel Total (ft/s)	0.68	Avg. Vel. (ft/s)	0.47	2.04	0.48
Max Chl Dpth (ft)	17.48	Hydr. Depth (ft)	8.12	15.52	6.26
Conv. Total (cfs)	715175.4	Conv. (cfs)	126792.6	278261.7	310121.1
Length Wtd. (ft)	2056.27	Wetted Per. (ft)	294.69	78.62	909.25
Min Ch El (ft)	426.00	Shear (lb/sq ft)	0.04	0.08	0.03
Alpha	3.77	Stream Power (lb/ft s)	0.02	0.15	0.01
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	772.82	190.58	585.58
C & E Loss (ft)	0.01	Cum SA (acres)	37.65	8.46	48.22

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 2.6

INPUT
Description: G-2.6 Upstream Jamestown Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.5	20	442	235	433.5	410	433.5	435	422.5
445	422.5	465	433	500	433.5	560	443.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	410	.04	465	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
410	465	1	1	1	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	443.21	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)		Flow Area (sq ft)	2826.17	888.85	618.45
E.G. Slope (ft/ft)	0.000311	Area (sq ft)	2826.17	888.85	618.45
Q Total (cfs)	6318.00	Flow (cfs)	2312.27	3513.63	492.10
Top Width (ft)	551.69	Top Width (ft)	404.27	55.00	92.42
Vel Total (ft/s)	1.46	Avg. Vel. (ft/s)	0.82	3.95	0.80
Max Chl Dpth (ft)	20.57	Hydr. Depth (ft)	6.99	16.16	6.69
Conv. Total (cfs)	358519.1	Conv. (cfs)	131211.3	199383.3	27924.5
Length Wtd. (ft)	1.00	Wetted Per. (ft)	404.47	59.90	93.22
Min Ch El (ft)	422.50	Shear (lb/sq ft)	0.14	0.29	0.13
Alpha	4.23	Stream Power (lb/ft s)	0.11	1.14	0.10
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	718.46	127.93	421.22
C & E Loss (ft)	0.00	Cum SA (acres)	30.37	4.49	22.13

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 2.5

INPUT
Description: G-2.5 Restored Jamestown Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.5	20	442	235	433.5	415	433.5	435	422.5
445	422.5	465	433.5	500	433.5	560	443.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	415	.04	465	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
415	465	22	22	22	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	415	436.5	465	560	436.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	443.21	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	434.77	Flow Area (sq ft)	2871.65	808.21	609.17
E.G. Slope (ft/ft)	0.000346	Area (sq ft)	2871.65	808.21	609.17
Q Total (cfs)	6318.00	Flow (cfs)	2486.92	3326.56	504.52
Top Width (ft)	551.57	Top Width (ft)	409.19	50.00	92.39
Vel Total (ft/s)	1.47	Avg. Vel. (ft/s)	0.87	4.12	0.83
Max Chl Dpth (ft)	20.56	Hydr. Depth (ft)	7.02	16.16	6.59
Conv. Total (cfs)	339425.2	Conv. (cfs)	133606.0	178714.6	27104.6
Length Wtd. (ft)	1.00	Wetted Per. (ft)	409.40	55.65	93.18
Min Ch El (ft)	422.50	Shear (lb/sq ft)	0.15	0.31	0.14
Alpha	4.27	Stream Power (lb/ft s)	0.13	1.29	0.12
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	718.40	127.91	421.21
C & E Loss (ft)	0.01	Cum SA (acres)	30.36	4.49	22.13

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

BRIDGE RIVER: Restoration
REACH: Galum RS: 2.4

INPUT
Description: Restored Jamestown Bridge
Distance from Upstream XS = 1
Deck/Roadway Width = 20
Weir Coefficient = 2.6
Bridge Deck/Roadway Skew =
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	446	443.5	20	445	442	235	436.5	433.5
500	436.5	433.5	560	446	443.5			

Upstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.5	20	442	235	433.5	415	433.5	435	422.5
445	422.5	465	433.5	500	433.5	560	443.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	415	.04	465	.125

Bank Sta: Left	Right	Coeff Contr.	Expan.
415	465	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	415	436.5	465	560	436.5

Downstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	446	443.5	20	445	442	235	436.5	433.5
500	436.5	433.5	560	446	443.5			

Downstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.5	20	442	235	433.5	415	433.5	435	422.5
445	422.5	465	433.5	500	433.5	560	443.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	415	.04	465	.125

Bank Sta: Left	Right	Coeff Contr.	Expan.
415	465	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	415	436.5	465	560	436.5

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 2

Pier Data
Pier Station Upstream= 435 Downstream= 435
Upstream num= 2

Width	Elev	Width	Elev
1	422.5	1	433.5

Downstream num= 2

Width	Elev	Width	Elev
1	422.5	1	433.5

Pier Data
Pier Station Upstream= 445 Downstream= 445
Upstream num= 2

Width	Elev	Width	Elev
1	422.5	1	433.5

Downstream num= 2

Width	Elev	Width	Elev
1	422.5	1	433.5

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the downstream end
Criteria to check for pressure flow = Upstream water surface

BRIDGE OUTPUT Profile #100-yr
Opening : Bridge #1

			Inside BR US	Inside BR DS
E.G. US. (ft)	443.21	Element		
W.S. US. (ft)	443.06	E.G. Elev (ft)	443.20	443.15
Q Total (cfs)	6318.00	W.S. Elev (ft)	443.07	443.02
Q Bridge (cfs)	863.17	Crit W.S. (ft)	438.65	438.65
Q Weir (cfs)		Max Chl Dpth (ft)	20.57	20.52
Weir Sta Lft (ft)		Vel Total (ft/s)	2.31	2.33
Weir Sta Rgt (ft)		Flow Area (sq ft)	2731.37	2706.76
Weir Submerg		Froude # Chl	0.10	0.10
Weir Max Depth (ft)		Specif Force (cu ft)	11982.30	11845.77
Min Top Rd (ft)	436.50	Hydr Depth (ft)	5.78	5.75
Min El Prs (ft)	433.50	W.P. Total (ft)	618.28	616.63
Delta EG (ft)	0.06	Conv. Total (cfs)	128838.8	127330.6
Delta WS (ft)	0.06	Top Width (ft)	472.67	471.03
BR Open Area (sq ft)	308.14	Frctn Loss (ft)	0.05	0.00
BR Open Vel (ft/s)	2.80	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.66	0.67
Br Sel Mthd	Energy only	Power Total (lb/ft s)	1.53	1.57

Note - Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Warning - The cross section had to be extended vertically during the critical depth calculations.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The cross section had to be extended vertically during the critical depth calculations.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 2.3

INPUT
Description: G-2.3 Restored Jamestown Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.5	20	442	235	433.5	415	433.5	435	422.5
445	422.5	465	433.5	500	433.5	560	443.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	415	.04	465	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
415	465	1	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	415	436.5	465	560	436.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	443.15	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	434.77	Flow Area (sq ft)	2845.58	805.02	603.29
E.G. Slope (ft/ft)	0.000354	Area (sq ft)	2845.58	805.02	603.29
Q Total (cfs)	6318.00	Flow (cfs)	2477.13	3338.05	502.82
Top Width (ft)	550.34	Top Width (ft)	408.34	50.00	92.00
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)	0.87	4.15	0.83
Max Chl Dpth (ft)	20.50	Hydr. Depth (ft)	6.97	16.10	6.56
Conv. Total (cfs)	336035.2	Conv. (cfs)	131750.9	177540.8	26743.5
Length Wtd. (ft)	1.00	Wetted Per. (ft)	408.54	55.65	92.79
Min Ch El (ft)	422.50	Shear (lb/sq ft)	0.15	0.32	0.14
Alpha	4.28	Stream Power (lb/ft s)	0.13	1.32	0.12
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	568.01	127.58	387.89
C & E Loss (ft)	0.00	Cum SA (acres)	30.19	4.46	22.09

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 2.1

INPUT
Description: G-2.1 Downstream Jamestown Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.5	20	442	235	433.5	410	433.5	435	422.5
445	422.5	465	433	500	433.5	560	443.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.125	410	.04	465	.125

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
410	465	1532	1700	410	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	443.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.125	0.040	0.125
E.G. Elev (ft)	443.14	Reach Len. (ft)	1532.00	1700.00	410.00
Crit W.S. (ft)		Flow Area (sq ft)	2798.82	885.12	612.20
E.G. Slope (ft/ft)	0.000317	Area (sq ft)	2798.82	885.12	612.20
Q Total (cfs)	6318.00	Flow (cfs)	2301.95	3525.69	490.36
Top Width (ft)	550.38	Top Width (ft)	403.36	55.00	92.01
Vel Total (ft/s)	1.47	Avg. Vel. (ft/s)	0.82	3.98	0.80
Max Chl Dpth (ft)	20.50	Hydr. Depth (ft)	6.94	16.09	6.65
Conv. Total (cfs)	354799.4	Conv. (cfs)	129270.2	197992.2	27537.1
Length Wtd. (ft)	1532.14	Wetted Per. (ft)	403.57	59.90	92.80
Min Ch El (ft)	422.50	Shear (lb/sq ft)	0.14	0.29	0.13
Alpha	4.23	Stream Power (lb/ft s)	0.11	1.17	0.10
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	567.94	127.56	387.88
C & E Loss (ft)	0.04	Cum SA (acres)	30.18	4.46	22.09

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 2

INPUT
Description: G-2
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	448	165	440	220	438	240	437	265	436
322	429	786	429	809	432	850	435	920	432
940	422	954	422	966	434	1005	434	1030	436
1100	444	1200	444	1220	442	1257	446	1275	448

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	240	.125	322	.07	786	.125	920	.04
966	.125								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
920	966	510	1800	1800	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	442.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.074	0.040	0.125
E.G. Elev (ft)	443.00	Reach Len. (ft)	510.00	1800.00	1800.00
Crit W.S. (ft)		Flow Area (sq ft)	9015.36	793.64	773.86
E.G. Slope (ft/ft)	0.000029	Area (sq ft)	9015.36	793.64	773.86
Q Total (cfs)	6318.00	Flow (cfs)	5181.48	957.25	179.26
Top Width (ft)	1006.99	Top Width (ft)	816.71	46.00	144.28
Vel Total (ft/s)	0.60	Avg. Vel. (ft/s)	0.57	1.21	0.23
Max Chl Dpth (ft)	20.99	Hydr. Depth (ft)	11.04	17.25	5.36
Conv. Total (cfs)	1177253.0	Conv. (cfs)	965482.1	178367.9	33402.7
Length Wtd. (ft)	931.54	Wetted Per. (ft)	817.66	53.33	144.86
Min Ch El (ft)	422.00	Shear (lb/sq ft)	0.02	0.03	0.01
Alpha	1.38	Stream Power (lb/ft s)	0.01	0.03	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	360.19	94.80	381.36
C & E Loss (ft)	0.00	Cum SA (acres)	8.72	2.49	20.98

Warning - Divided flow computed for this cross-section.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Galum RS: 1

INPUT
Description: G-1 (Beginning Station)
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	157	448	438	434	500	434.5	525	435
550	434	590	426	994	426	1095	427	1120	421
1138	421	1151	424	1171	426	1189	428	1340	430
1485	428	1785	434	1833	436	1860	437	1915	438
2090	438	2180	440	2576	450				

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	500	.125	590	.07	994	.125	1095	.04
1189	.125	1860	.03						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1095	1189	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	442.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.071	0.040	0.097
E.G. Elev (ft)	442.99	Reach Len. (ft)	1680.00	1680.00	1680.00
Crit W.S. (ft)		Flow Area (sq ft)	10816.55	1784.14	10003.18
E.G. Slope (ft/ft)	0.000006	Area (sq ft)	10816.55	1784.14	10003.18
Q Total (cfs)	6318.00	Flow (cfs)	3325.36	1136.35	1856.30
Top Width (ft)	2040.58	Top Width (ft)	837.35	94.00	1109.23
Vel Total (ft/s)	0.28	Avg. Vel. (ft/s)	0.31	0.64	0.19
Max Chl Dpth (ft)	21.99	Hydr. Depth (ft)	12.92	18.98	9.02
Conv. Total (cfs)	2598804.0	Conv. (cfs)	1367830.0	467417.0	763556.4
Length Wtd. (ft)	1680.00	Wetted Per. (ft)	838.40	95.26	1109.44
Min Ch El (ft)	421.00	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	1.70	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	270.08	48.41	247.78
C & E Loss (ft)	0.00	Cum SA (acres)			

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 246.00

INPUT
Description: LG-2
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	155	444	200	440	285	434	330	432
375	432	400	432.3	515	434	605	432	780	430
818	429	836	422	852	420	869	420	890	428
975	430	1090	434	1420	438	1620	440	1705	442
1762	444	1825	446	1850	448	1860	450		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	400	.125	818	.04	890	.125	1420	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
818	890	1030	1400	900	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	442.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.040	0.096
E.G. Elev (ft)	442.95	Reach Len. (ft)	1030.00	1400.00	900.00
Crit W.S. (ft)		Flow Area (sq ft)	6377.94	1452.06	5691.45
E.G. Slope (ft/ft)	0.000059	Area (sq ft)	6377.94	1452.06	5691.45
Q Total (cfs)	10728.00	Flow (cfs)	4954.31	2984.02	2789.67
Top Width (ft)	1564.52	Top Width (ft)	650.98	72.00	841.54
Vel Total (ft/s)	0.79	Avg. Vel. (ft/s)	0.78	2.06	0.49
Max Chl Dpth (ft)	22.93	Hydr. Depth (ft)	9.80	20.17	6.76
Conv. Total (cfs)	1399372.0	Conv. (cfs)	646245.4	389239.4	363887.1
Length Wtd. (ft)	1110.30	Wetted Per. (ft)	651.43	74.91	841.71
Min Ch El (ft)	420.00	Shear (lb/sq ft)	0.04	0.07	0.02
Alpha	2.41	Stream Power (lb/ft s)	0.03	0.15	0.01
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	239.25	619.73	519.85
C & E Loss (ft)	0.01	Cum SA (acres)	26.56	49.09	79.95

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 231.65

INPUT
Description: LG-1 (Beginning Station)
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	52	440	103	430	137	428	160	420
182	420	200	426	511	428	588	442	627	444
705	445	1000	443	1338	446	1345	450		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	103	.125	137	.04	200	.125	588	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
137	200	1500	1830	1755	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	442.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.058	0.040	0.125
E.G. Elev (ft)	442.85	Reach Len. (ft)	1500.00	1830.00	1755.00
Crit W.S. (ft)		Flow Area (sq ft)	883.73	1288.09	5505.84
E.G. Slope (ft/ft)	0.000158	Area (sq ft)	883.73	1288.09	5505.84
Q Total (cfs)	10728.00	Flow (cfs)	1372.43	4395.62	4959.95
Top Width (ft)	565.25	Top Width (ft)	99.37	63.00	402.88
Vel Total (ft/s)	1.40	Avg. Vel. (ft/s)	1.55	3.41	0.90
Max Chl Dpth (ft)	22.76	Hydr. Depth (ft)	8.89	20.45	13.67
Conv. Total (cfs)	852358.8	Conv. (cfs)	109042.4	349239.9	394076.6
Length Wtd. (ft)	1711.51	Wetted Per. (ft)	100.66	65.33	404.17
Min Ch El (ft)	420.00	Shear (lb/sq ft)	0.09	0.20	0.13
Alpha	2.79	Stream Power (lb/ft s)	0.13	0.67	0.12
Frctn Loss (ft)	0.41	Cum Volume (acre-ft)	153.39	575.69	404.18
C & E Loss (ft)	0.00	Cum SA (acres)	17.69	46.92	67.09

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 212.00

INPUT
Description: Station 212+00 Upstream from MOPAC Bridge

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	445	45	440	120	435	288	432.5	435	430
465	427.5	472	420.3	518	420.3	525	427.5	550	430
665	435	702	435	940	435	1040	440	1210	445

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	25	288	.065	465	.065	525	.14	702	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
465	525	90	90	90	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	442.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.109	0.065	0.278
E.G. Elev (ft)	442.43	Reach Len. (ft)	90.00	90.00	90.00
Crit W.S. (ft)		Flow Area (sq ft)	3874.84	1272.84	4075.23
E.G. Slope (ft/ft)	0.000411	Area (sq ft)	3874.84	1272.84	4075.23
Q Total (cfs)	10848.00	Flow (cfs)	4845.96	4236.19	1765.84
Top Width (ft)	1096.22	Top Width (ft)	441.19	60.00	595.03
Vel Total (ft/s)	1.18	Avg. Vel. (ft/s)	1.25	3.33	0.43
Max Chl Dpth (ft)	22.05	Hydr. Depth (ft)	8.78	21.21	6.85
Conv. Total (cfs)	535402.3	Conv. (cfs)	239172.2	209077.1	87153.0
Length Wtd. (ft)	90.00	Wetted Per. (ft)	441.63	66.08	595.43
Min Ch El (ft)	420.30	Shear (lb/sq ft)	0.22	0.49	0.18
Alpha	3.65	Stream Power (lb/ft s)	0.28	1.64	0.08
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	71.46	521.90	211.17
C & E Loss (ft)	0.14	Cum SA (acres)	8.39	44.33	46.99

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 211.10

INPUT
Description: STA 211+10
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	27	436.44	40	429.11	77	429.11	86	420.35
135	420.35	140	425.61	192	450				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	77	.033	140	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
77	140	1	1	1	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	441.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.	0.050	0.033	0.050
E.G. Elev (ft)	442.26	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)		Flow Area (sq ft)	611.07	1294.22	276.93
E.G. Slope (ft/ft)	0.000414	Area (sq ft)	611.07	1294.22	276.93
Q Total (cfs)	10848.00	Flow (cfs)	1835.91	8382.40	629.68
Top Width (ft)	157.89	Top Width (ft)	60.53	63.00	34.36
Vel Total (ft/s)	4.97	Avg. Vel. (ft/s)	3.00	6.48	2.27
Max Chl Dpth (ft)	21.38	Hydr. Depth (ft)	10.10	20.54	8.06
Conv. Total (cfs)	533353.4	Conv. (cfs)	90264.7	412129.8	30959.0
Length Wtd. (ft)	1.00	Wetted Per. (ft)	63.71	68.82	37.96
Min Ch El (ft)	420.35	Shear (lb/sq ft)	0.25	0.49	0.19
Alpha	1.39	Stream Power (lb/ft s)	0.74	3.15	0.43
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	66.83	519.25	206.67
C & E Loss (ft)	0.07	Cum SA (acres)	7.87	44.21	46.34

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 211.09

INPUT
Description: STA 211+09
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	27	436.44	27.01	450	28.24	450	28.25	436.44
40	429.11	40.01	450	41.24	450	41.25	429.11	46.75	429.11
46.76	450	48	450	48.01	429.11	77	429.11	86	420.35
98.5	420.35	98.51	450	107.49	450	107.5	420.35	135	420.35
140	425.61	151.5	431.5	151.51	450	152.74	450	152.75	431.5
159.25	435	159.26	450	160.49	450	160.5	435	167	438.5
167.01	450	168.24	450	168.25	438.5	192	450		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	77	.033	140	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
77	140	18	18	18	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	441.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.	0.050	0.033	0.050
E.G. Elev (ft)	442.19	Reach Len. (ft)	0.00	0.00	0.00
Crit W.S. (ft)	430.94	Flow Area (sq ft)	572.17	1105.58	251.88
E.G. Slope (ft/ft)	0.000662	Area (sq ft)	572.17	1105.58	251.88
Q Total (cfs)	8285.00	Flow (cfs)	1512.42	6244.09	528.50
Top Width (ft)	142.28	Top Width (ft)	56.93	54.01	31.33
Vel Total (ft/s)	4.29	Avg. Vel. (ft/s)	2.64	5.65	2.10
Max Chl Dpth (ft)	21.44	Hydr. Depth (ft)	10.05	20.47	8.04
Conv. Total (cfs)	322042.9	Conv. (cfs)	58788.5	242711.4	20543.1
Length Wtd. (ft)	0.00	Wetted Per. (ft)	121.70	102.70	76.00
Min Ch El (ft)	420.35	Shear (lb/sq ft)	0.19	0.44	0.14
Alpha	1.39	Stream Power (lb/ft s)	0.51	2.51	0.29
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	66.82	519.22	206.67
C & E Loss (ft)	0.00	Cum SA (acres)	7.87	44.21	46.34

Warning - Divided flow computed for this cross-section.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

BRIDGE RIVER: Restoration
REACH: Lower Galum RS: 211.00

INPUT
Description: MOPAC Bridge 852 over Galum
over Galum
Distance from Upstream XS = 0
Deck/Roadway Width = 18
Weir Coefficient = 2.6
Bridge Deck/Roadway Skew =
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	458.1	450	192	458.1	450

Upstream Bridge Cross Section Data
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	27	436.44	27.01	450	28.24	450	28.25	436.44
40	429.11	40.01	450	41.24	450	41.25	429.11	46.75	429.11
46.76	450	48	450	48.01	429.11	77	429.11	86	420.35
98.5	420.35	98.51	450	107.49	450	107.5	420.35	135	420.35
140	425.61	151.5	431.5	151.51	450	152.74	450	152.75	431.5
159.25	435	159.26	450	160.49	450	160.5	435	167	438.5
167.01	450	168.24	450	168.25	438.5	192	450		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	77	.033	140	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
77	140	.3	.5

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	458.1	450	192	458.1	450

Downstream Bridge Cross Section Data
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	27	436.44	27.01	450	28.24	450	28.25	436.44
40	429.11	40.01	450	41.24	450	41.25	429.11	46.75	429.11
46.76	450	48	450	48.01	429.11	77	429.11	86	420.35
98.5	420.35	98.51	450	107.49	450	107.5	420.35	135	420.35
140	425.61	151.5	431.5	151.51	450	152.74	450	152.75	431.5
159.25	435	159.26	450	160.49	450	160.5	435	167	438.5
167.01	450	168.24	450	168.25	438.5	192	450		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	77	.033	140	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
77	140	.3	.5

Upstream Embankment side slope = horiz. to 1.0 vertical
Downstream Embankment side slope = horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Energy

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the downstream end
Criteria to check for pressure flow = Upstream water surface

BRIDGE OUTPUT Profile #100-yr
Opening : Bridge #1

E.G. US. (ft)	442.19	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	441.79	E.G. Elev (ft)	442.19	442.18
Q Total (cfs)	8285.00	W.S. Elev (ft)	441.79	441.78
Q Bridge (cfs)	8285.00	Crit W.S. (ft)	430.94	430.94
Q Weir (cfs)		Max Chl Dpth (ft)	21.44	21.43
Weir Sta Lft (ft)		Vel Total (ft/s)	4.29	4.30
Weir Sta Rgt (ft)		Flow Area (sq ft)	1929.63	1927.85
Weir Submerg		Froude # Chl	0.22	0.22
Weir Max Depth (ft)		Specif Force (cu ft)	17375.95	17352.92
Min Top Rd (ft)	458.10	Hydr Depth (ft)	13.56	13.55
Min El Prs (ft)	450.00	W.P. Total (ft)	300.39	300.20
Delta EG (ft)	0.01	Conv. Total (cfs)	322042.9	321673.9
Delta WS (ft)	0.01	Top Width (ft)	142.28	142.23
BR Open Area (sq ft)	3233.96	Frctn Loss (ft)	0.01	0.00
BR Open Vel (ft/s)	4.30	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.27	0.27
Br Sel Mthd	Energy only	Power Total (lb/ft s)	1.14	1.14

Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 210.91

INPUT
Description: STA 210+91
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	27	436.44	27.01	450	28.24	450	28.25	436.44
40	429.11	40.01	450	41.24	450	41.25	429.11	46.75	429.11
46.76	450	48	450	48.01	429.11	77	429.11	86	420.35
98.5	420.35	98.51	450	107.49	450	107.5	420.35	135	420.35
140	425.61	151.5	431.5	151.51	450	152.74	450	152.75	431.5
159.25	435	159.26	450	160.49	450	160.5	435	167	438.5
167.01	450	168.24	450	168.25	438.5	192	450		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	77	.033	140	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
77	140	1	1	1	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	441.78	Element			
Vel Head (ft)	0.40	Wt. n-Val.	0.050	0.033	0.050
E.G. Elev (ft)	442.18	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)		Flow Area (sq ft)	571.46	1104.90	251.49
E.G. Slope (ft/ft)	0.000663	Area (sq ft)	571.46	1104.90	251.49
Q Total (cfs)	8285.00	Flow (cfs)	1511.64	6245.23	528.13
Top Width (ft)	142.23	Top Width (ft)	56.91	54.01	31.30
Vel Total (ft/s)	4.30	Avg. Vel. (ft/s)	2.65	5.65	2.10
Max Chl Dpth (ft)	21.43	Hydr. Depth (ft)	10.04	20.46	8.03
Conv. Total (cfs)	321673.9	Conv. (cfs)	58691.2	242477.5	20505.2
Length Wtd. (ft)	1.00	Wetted Per. (ft)	121.61	102.69	75.90
Min Ch El (ft)	420.35	Shear (lb/sq ft)	0.19	0.45	0.14
Alpha	1.39	Stream Power (lb/ft s)	0.51	2.52	0.29
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	66.58	518.76	206.56
C & E Loss (ft)	0.05	Cum SA (acres)	7.84	44.18	46.32

Warning - Divided flow computed for this cross-section.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 210.90

INPUT
Description: STA 210+90
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	27	436.44	40	429.11	77	429.11	86	420.35
135	420.35	140	425.61	192	450				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	77	.033	140	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
77	140	90	90	90	.3	.5

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	441.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.050	0.033	0.050
E.G. Elev (ft)	442.13	Reach Len. (ft)	90.00	90.00	90.00
Crit W.S. (ft)		Flow Area (sq ft)	617.13	1300.52	280.37
E.G. Slope (ft/ft)	0.000237	Area (sq ft)	617.13	1300.52	280.37
Q Total (cfs)	8285.00	Flow (cfs)	1409.02	6391.78	484.19
Top Width (ft)	158.30	Top Width (ft)	60.73	63.00	34.58
Vel Total (ft/s)	3.77	Avg. Vel. (ft/s)	2.28	4.91	1.73
Max Chl Dpth (ft)	21.48	Hydr. Depth (ft)	10.16	20.64	8.11
Conv. Total (cfs)	538538.2	Conv. (cfs)	91588.8	415476.0	31473.4
Length Wtd. (ft)	90.00	Wetted Per. (ft)	63.93	68.82	38.19
Min Ch El (ft)	420.35	Shear (lb/sq ft)	0.14	0.28	0.11
Alpha	1.39	Stream Power (lb/ft s)	0.33	1.37	0.19
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	66.57	518.74	206.56
C & E Loss (ft)	0.07	Cum SA (acres)	7.84	44.18	46.32

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 210.00

INPUT
Description: STA 210+00
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	90	445	145	440	175	435	273	435
280	435	320	430	385	429	394	420.35	440	420.35
445	425.5	475	430	537	430.7	935	435	1010	440
1065	445								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	25	273	.14	385	.065	445	.14	537	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
385	445	400	400	400	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	441.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.203	0.065	0.510
E.G. Elev (ft)	442.03	Reach Len. (ft)	400.00	400.00	400.00
Crit W.S. (ft)		Flow Area (sq ft)	2050.48	1239.39	5074.67
E.G. Slope (ft/ft)	0.000623	Area (sq ft)	2050.48	1239.39	5074.67
Q Total (cfs)	8285.00	Flow (cfs)	1628.98	5015.23	1640.78
Top Width (ft)	906.14	Top Width (ft)	260.57	60.00	585.57
Vel Total (ft/s)	0.99	Avg. Vel. (ft/s)	0.79	4.05	0.32
Max Chl Dpth (ft)	21.52	Hydr. Depth (ft)	7.87	20.66	8.67
Conv. Total (cfs)	331811.4	Conv. (cfs)	65240.1	200858.4	65712.9
Length Wtd. (ft)	400.00	Wetted Per. (ft)	261.39	65.66	586.18
Min Ch El (ft)	420.35	Shear (lb/sq ft)	0.31	0.73	0.34
Alpha	10.25	Stream Power (lb/ft s)	0.24	2.97	0.11
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	63.81	516.11	201.03
C & E Loss (ft)	0.02	Cum SA (acres)	7.51	44.05	45.68

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 206.00

INPUT
Description: STA 206+00
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	450	65	424	108	424	148	437.9	205	437.9
245	450								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.033	148	.05	205	25

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	148	1300	1300	1300	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	441.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.		0.033	0.053
E.G. Elev (ft)	441.78	Reach Len. (ft)	1300.00	1300.00	1300.00
Crit W.S. (ft)		Flow Area (sq ft)		1541.69	218.14
E.G. Slope (ft/ft)	0.000500	Area (sq ft)		1541.69	218.14
Q Total (cfs)	8285.00	Flow (cfs)		7982.84	302.16
Top Width (ft)	194.93	Top Width (ft)		126.44	68.49
Vel Total (ft/s)	4.71	Avg. Vel. (ft/s)		5.18	1.39
Max Chl Dpth (ft)	17.38	Hydr. Depth (ft)		12.19	3.18
Conv. Total (cfs)	370622.9	Conv. (cfs)		357106.2	13516.7
Length Wtd. (ft)	1300.00	Wetted Per. (ft)		132.13	69.01
Min Ch El (ft)	424.00	Shear (lb/sq ft)		0.36	0.10
Alpha	1.17	Stream Power (lb/ft s)		1.88	0.14
Frctn Loss (ft)	0.52	Cum Volume (acre-ft)	54.40	503.34	176.72
C & E Loss (ft)	0.05	Cum SA (acres)	6.31	43.20	42.68

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 193.00

INPUT
Description: STA 193+00
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	445.5	110	427.3	165	427.3	210	424.1	237	424.1
267.6	449.6								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	25	110	.05	165	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
165	267.6	700	700	700	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	440.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.073	0.033	
E.G. Elev (ft)	441.22	Reach Len. (ft)	700.00	700.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	1316.44	1313.31	
E.G. Slope (ft/ft)	0.000324	Area (sq ft)	1316.44	1313.31	
Q Total (cfs)	8285.00	Flow (cfs)	2300.46	5984.54	
Top Width (ft)	229.86	Top Width (ft)	137.62	92.24	
Vel Total (ft/s)	3.15	Avg. Vel. (ft/s)	1.75	4.56	
Max Chl Dpth (ft)	16.87	Hydr. Depth (ft)	9.57	14.24	
Conv. Total (cfs)	460437.6	Conv. (cfs)	127847.7	332589.8	
Length Wtd. (ft)	700.00	Wetted Per. (ft)	138.74	98.46	
Min Ch El (ft)	424.10	Shear (lb/sq ft)	0.19	0.27	
Alpha	1.60	Stream Power (lb/ft s)	0.34	1.23	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	34.75	460.74	173.47
C & E Loss (ft)	0.00	Cum SA (acres)	4.26	39.94	41.66

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 186.00

INPUT
Description: STA 186+00
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	445.8	110	427.3	165	427.3	210	420.8	227	420.8
267	445.8								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	25	110	.05	165	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
165	267	500	500	500	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	440.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.073	0.033	
E.G. Elev (ft)	441.00	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)	1279.80	1410.61	
E.G. Slope (ft/ft)	0.000280	Area (sq ft)	1279.80	1410.61	
Q Total (cfs)	8285.00	Flow (cfs)	2086.47	6198.53	
Top Width (ft)	229.02	Top Width (ft)	135.07	93.95	
Vel Total (ft/s)	3.08	Avg. Vel. (ft/s)	1.63	4.39	
Max Chl Dpth (ft)	19.97	Hydr. Depth (ft)	9.48	15.02	
Conv. Total (cfs)	495172.9	Conv. (cfs)	124702.8	370470.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)	136.20	100.14	
Min Ch El (ft)	420.80	Shear (lb/sq ft)	0.16	0.25	
Alpha	1.59	Stream Power (lb/ft s)	0.27	1.08	
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	13.89	438.85	173.47
C & E Loss (ft)	0.01	Cum SA (acres)	2.07	38.44	41.66

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 181.00

INPUT
Description: STA 181+00
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	442.9	70	431.4	90	436.4	125	420.4	160	420.4
180	432.4	225	432.4	260	442.9				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	25	90	.033	180	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
90	180	1000	1000	1000	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	440.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	25.000	0.033	0.050
E.G. Elev (ft)	440.83	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	380.19	1404.41	470.18
E.G. Slope (ft/ft)	0.000376	Area (sq ft)	380.19	1404.41	470.18
Q Total (cfs)	8285.00	Flow (cfs)	1.30	7292.61	991.10
Top Width (ft)	236.91	Top Width (ft)	75.08	90.00	71.83
Vel Total (ft/s)	3.67	Avg. Vel. (ft/s)	0.00	5.19	2.11
Max Chl Dpth (ft)	20.05	Hydr. Depth (ft)	5.06	15.60	6.55
Conv. Total (cfs)	427338.8	Conv. (cfs)	66.9	376151.3	51120.7
Length Wtd. (ft)	1000.00	Wetted Per. (ft)	76.43	96.81	73.01
Min Ch El (ft)	420.40	Shear (lb/sq ft)	0.12	0.34	0.15
Alpha	1.80	Stream Power (lb/ft s)	0.00	1.77	0.32
Frctn Loss (ft)	0.40	Cum Volume (acre-ft)	4.36	422.70	170.77
C & E Loss (ft)	0.01	Cum SA (acres)	0.86	37.38	41.25

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 171.00

INPUT
Description: STA 171+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.1	38	419.6	68	419.6	157	443.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	157	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	157	1000	1000	1000	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	440.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.		0.033	
E.G. Elev (ft)	440.42	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)		1746.69	
E.G. Slope (ft/ft)	0.000417	Area (sq ft)		1746.69	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	140.64	Top Width (ft)		140.64	
Vel Total (ft/s)	4.74	Avg. Vel. (ft/s)		4.74	
Max Chl Dpth (ft)	20.47	Hydr. Depth (ft)		12.42	
Conv. Total (cfs)	405659.5	Conv. (cfs)		405659.5	
Length Wtd. (ft)	1000.00	Wetted Per. (ft)		149.11	
Min Ch El (ft)	419.60	Shear (lb/sq ft)		0.31	
Alpha	1.00	Stream Power (lb/ft s)		1.45	
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)		386.53	165.37
C & E Loss (ft)	0.01	Cum SA (acres)		34.74	40.42

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 161.00

INPUT
Description: STA 161+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.8	80	418.8	100	418.8	175	455.3

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	175	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	175	1300	1300	1300	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	439.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.		0.033	
E.G. Elev (ft)	439.93	Reach Len. (ft)	1300.00	1300.00	1300.00
Crit W.S. (ft)		Flow Area (sq ft)		1536.76	
E.G. Slope (ft/ft)	0.000569	Area (sq ft)		1536.76	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	128.65	Top Width (ft)		128.65	
Vel Total (ft/s)	5.39	Avg. Vel. (ft/s)		5.39	
Max Chl Dpth (ft)	20.68	Hydr. Depth (ft)		11.95	
Conv. Total (cfs)	347473.1	Conv. (cfs)		347473.1	
Length Wtd. (ft)	1300.00	Wetted Per. (ft)		136.57	
Min Ch El (ft)	418.80	Shear (lb/sq ft)		0.40	
Alpha	1.00	Stream Power (lb/ft s)		2.15	
Frctn Loss (ft)	0.76	Cum Volume (acre-ft)		348.84	165.37
C & E Loss (ft)	0.00	Cum SA (acres)		31.65	40.42

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 148.00

INPUT
Description: STA 148+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457.3	124	418.1	149	420.1	224	457.3

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	224	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	224	900	900	900	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	438.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.		0.033	
E.G. Elev (ft)	439.17	Reach Len. (ft)	900.00	900.00	900.00
Crit W.S. (ft)		Flow Area (sq ft)		1510.28	
E.G. Slope (ft/ft)	0.000595	Area (sq ft)		1510.28	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	127.68	Top Width (ft)		127.68	
Vel Total (ft/s)	5.49	Avg. Vel. (ft/s)		5.49	
Max Chl Dpth (ft)	20.60	Hydr. Depth (ft)		11.83	
Conv. Total (cfs)	339665.4	Conv. (cfs)		339665.4	
Length Wtd. (ft)	900.00	Wetted Per. (ft)		135.30	
Min Ch El (ft)	418.10	Shear (lb/sq ft)		0.41	
Alpha	1.00	Stream Power (lb/ft s)		2.27	
Frctn Loss (ft)	0.69	Cum Volume (acre-ft)		303.37	165.37
C & E Loss (ft)	0.03	Cum SA (acres)		27.82	40.42

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 139.00

INPUT
Description: STA 139+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	452.6	90	419.6	120	417.6	150	455.9

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	150	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	150	1500	1500	1500	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	437.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.		0.033	
E.G. Elev (ft)	438.45	Reach Len. (ft)	1500.00	1500.00	1500.00
Crit W.S. (ft)		Flow Area (sq ft)		1176.30	
E.G. Slope (ft/ft)	0.001015	Area (sq ft)		1176.30	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	95.05	Top Width (ft)		95.05	
Vel Total (ft/s)	7.04	Avg. Vel. (ft/s)		7.04	
Max Chl Dpth (ft)	20.08	Hydr. Depth (ft)		12.38	
Conv. Total (cfs)	260086.8	Conv. (cfs)		260086.8	
Length Wtd. (ft)	1500.00	Wetted Per. (ft)		108.10	
Min Ch El (ft)	417.60	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		4.86	
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)		275.62	165.37
C & E Loss (ft)	0.02	Cum SA (acres)		25.52	40.42

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 124.00

INPUT
Description: STA 124+00
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	453.8	56	434.8	82	416.8	99	416.8	115	419.8
235	469.8								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	235	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	235	1700	1700	1700	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	436.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.		0.033	
E.G. Elev (ft)	436.96	Reach Len. (ft)	1700.00	1700.00	1700.00
Crit W.S. (ft)		Flow Area (sq ft)		1216.72	
E.G. Slope (ft/ft)	0.000952	Area (sq ft)		1216.72	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	102.72	Top Width (ft)		102.72	
Vel Total (ft/s)	6.81	Avg. Vel. (ft/s)		6.81	
Max Chl Dpth (ft)	19.44	Hydr. Depth (ft)		11.85	
Conv. Total (cfs)	268494.8	Conv. (cfs)		268494.8	
Length Wtd. (ft)	1700.00	Wetted Per. (ft)		112.15	
Min Ch El (ft)	416.80	Shear (lb/sq ft)		0.64	
Alpha	1.00	Stream Power (lb/ft s)		4.39	
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)		234.42	165.37
C & E Loss (ft)	0.10	Cum SA (acres)		22.11	40.42

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 107.00

INPUT
Description: STA 107+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	448.4	103	415.9	129	415.9	240	452.9

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	240	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	240	800	800	800	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	435.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.		0.033	
E.G. Elev (ft)	435.72	Reach Len. (ft)	800.00	800.00	800.00
Crit W.S. (ft)		Flow Area (sq ft)		1671.60	
E.G. Slope (ft/ft)	0.000496	Area (sq ft)		1671.60	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	145.95	Top Width (ft)		145.95	
Vel Total (ft/s)	4.96	Avg. Vel. (ft/s)		4.96	
Max Chl Dpth (ft)	19.44	Hydr. Depth (ft)		11.45	
Conv. Total (cfs)	372064.7	Conv. (cfs)		372064.7	
Length Wtd. (ft)	800.00	Wetted Per. (ft)		152.10	
Min Ch El (ft)	415.90	Shear (lb/sq ft)		0.34	
Alpha	1.00	Stream Power (lb/ft s)		1.69	
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)		178.06	165.37
C & E Loss (ft)	0.01	Cum SA (acres)		17.26	40.42

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 99.00

INPUT
Description: STA 99+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.9	77	415.6	107	415.6	175	446.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	175	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	175	800	800	800	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	434.79	Element			
Vel Head (ft)	0.48	Wt. n-Val.		0.033	
E.G. Elev (ft)	435.28	Reach Len. (ft)	800.00	800.00	800.00
Crit W.S. (ft)		Flow Area (sq ft)		1487.78	
E.G. Slope (ft/ft)	0.000609	Area (sq ft)		1487.78	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	125.02	Top Width (ft)		125.02	
Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)		5.57	
Max Chl Dpth (ft)	19.19	Hydr. Depth (ft)		11.90	
Conv. Total (cfs)	335844.7	Conv. (cfs)		335844.7	
Length Wtd. (ft)	800.00	Wetted Per. (ft)		132.54	
Min Ch El (ft)	415.60	Shear (lb/sq ft)		0.43	
Alpha	1.00	Stream Power (lb/ft s)		2.37	
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)		149.04	165.37
C & E Loss (ft)	0.05	Cum SA (acres)		14.77	40.42

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 91.00

INPUT
Description: STA 91+00
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	439.4	50	417.7	65	415.2	85	417.7	110	439.3

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	110	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	110	900	900	900	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	433.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.01	Wt. n-Val.		0.033	
E.G. Elev (ft)	434.51	Reach Len. (ft)	900.00	900.00	900.00
Crit W.S. (ft)		Flow Area (sq ft)		1029.60	
E.G. Slope (ft/ft)	0.001412	Area (sq ft)		1029.60	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	89.72	Top Width (ft)		89.72	
Vel Total (ft/s)	8.05	Avg. Vel. (ft/s)		8.05	
Max Chl Dpth (ft)	18.31	Hydr. Depth (ft)		11.48	
Conv. Total (cfs)	220515.3	Conv. (cfs)		220515.3	
Length Wtd. (ft)	900.00	Wetted Per. (ft)		99.25	
Min Ch El (ft)	415.20	Shear (lb/sq ft)		0.91	
Alpha	1.00	Stream Power (lb/ft s)		7.36	
Frctn Loss (ft)	0.98	Cum Volume (acre-ft)		125.93	165.37
C & E Loss (ft)	0.10	Cum SA (acres)		12.80	40.42

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 82.00

INPUT
Description: STA 82+00
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	440.7	60	416.2	80	414.7	100	416.2	145	441.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	145	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	145	1000	1000	1000	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	432.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.		0.033	
E.G. Elev (ft)	433.42	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)		1273.94	
E.G. Slope (ft/ft)	0.000873	Area (sq ft)		1273.94	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	110.16	Top Width (ft)		110.16	
Vel Total (ft/s)	6.50	Avg. Vel. (ft/s)		6.50	
Max Chl Dpth (ft)	18.07	Hydr. Depth (ft)		11.56	
Conv. Total (cfs)	280444.6	Conv. (cfs)		280444.6	
Length Wtd. (ft)	1000.00	Wetted Per. (ft)		117.85	
Min Ch El (ft)	414.70	Shear (lb/sq ft)		0.59	
Alpha	1.00	Stream Power (lb/ft s)		3.83	
Frctn Loss (ft)	0.89	Cum Volume (acre-ft)		102.13	165.37
C & E Loss (ft)	0.02	Cum SA (acres)		10.74	40.42

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 72.00

INPUT
Description: STA 72+00
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	439.2	60	416.7	75	414.2	95	416.7	155	431.7

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	155	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	155	675	675	675	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	431.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.		0.033	
E.G. Elev (ft)	432.51	Reach Len. (ft)	675.00	675.00	675.00
Crit W.S. (ft)		Flow Area (sq ft)		1349.21	
E.G. Slope (ft/ft)	0.000914	Area (sq ft)		1349.21	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	135.60	Top Width (ft)		135.60	
Vel Total (ft/s)	6.14	Avg. Vel. (ft/s)		6.14	
Max Chl Dpth (ft)	17.73	Hydr. Depth (ft)		9.95	
Conv. Total (cfs)	274086.7	Conv. (cfs)		274086.7	
Length Wtd. (ft)	675.00	Wetted Per. (ft)		140.80	
Min Ch El (ft)	414.20	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		3.36	
Frctn Loss (ft)	0.78	Cum Volume (acre-ft)		72.02	165.37
C & E Loss (ft)	0.03	Cum SA (acres)		7.92	40.42

Warning - The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 65.25

INPUT
Description: STA 65+25
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	441.8	68	417.1	85	414.1	105	417.1	158	435.7

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	158	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	158	375	375	375	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	430.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.		0.033	
E.G. Elev (ft)	431.70	Reach Len. (ft)	375.00	375.00	375.00
Crit W.S. (ft)		Flow Area (sq ft)		1088.49	
E.G. Slope (ft/ft)	0.001494	Area (sq ft)		1088.49	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	113.77	Top Width (ft)		113.77	
Vel Total (ft/s)	7.61	Avg. Vel. (ft/s)		7.61	
Max Chl Dpth (ft)	16.70	Hydr. Depth (ft)		9.57	
Conv. Total (cfs)	214363.5	Conv. (cfs)		214363.5	
Length Wtd. (ft)	375.00	Wetted Per. (ft)		119.00	
Min Ch El (ft)	414.10	Shear (lb/sq ft)		0.85	
Alpha	1.00	Stream Power (lb/ft s)		6.49	
Frctn Loss (ft)	0.65	Cum Volume (acre-ft)		53.13	165.37
C & E Loss (ft)	0.03	Cum SA (acres)		5.98	40.42

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 61.50

INPUT
Description: STA 61+50
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	443.2	71	417.3	100	414	110	417.3	159	437.7

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	159	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	159	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	429.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.15	Wt. n-Val.		0.033	
E.G. Elev (ft)	431.03	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)		961.70	
E.G. Slope (ft/ft)	0.002011	Area (sq ft)		961.70	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	103.69	Top Width (ft)		103.69	
Vel Total (ft/s)	8.61	Avg. Vel. (ft/s)		8.61	
Max Chl Dpth (ft)	15.88	Hydr. Depth (ft)		9.27	
Conv. Total (cfs)	184734.3	Conv. (cfs)		184734.3	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		109.14	
Min Ch El (ft)	414.00	Shear (lb/sq ft)		1.11	
Alpha	1.00	Stream Power (lb/ft s)		9.53	
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)		44.31	165.37
C & E Loss (ft)	0.04	Cum SA (acres)		5.05	40.42

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 58.50

INPUT
Description: STA 58+50
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	444.3	75	417.5	95	413.9	115	417.5	160	439.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.033	160	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	160	650	650	650	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	428.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.58	Wt. n-Val.		0.033	
E.G. Elev (ft)	430.26	Reach Len. (ft)	650.00	650.00	650.00
Crit W.S. (ft)		Flow Area (sq ft)		820.99	
E.G. Slope (ft/ft)	0.003001	Area (sq ft)		820.99	
Q Total (cfs)	8285.00	Flow (cfs)		8285.00	
Top Width (ft)	94.03	Top Width (ft)		94.03	
Vel Total (ft/s)	10.09	Avg. Vel. (ft/s)		10.09	
Max Chl Dpth (ft)	14.78	Hydr. Depth (ft)		8.73	
Conv. Total (cfs)	151243.5	Conv. (cfs)		151243.5	
Length Wtd. (ft)	650.00	Wetted Per. (ft)		99.21	
Min Ch El (ft)	413.90	Shear (lb/sq ft)		1.55	
Alpha	1.00	Stream Power (lb/ft s)		15.64	
Frctn Loss (ft)	2.07	Cum Volume (acre-ft)		38.17	165.37
C & E Loss (ft)	0.07	Cum SA (acres)		4.37	40.42

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 52.00

INPUT
Description: STA 52+00 (South Field F.Cut)
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	441	1	433.25	64	416	82	413.2	108	415.5
137	430.2	140	435	147	440	157	441	162	440
177	435	197	430	212	425	672	425	697	430
732	435	757	445	777	445	932	445	997	440
1147	440	1277	445	1447	440	1477	435	1522	430
1587	425	1667	420	2262	420	2267	425	2287	430
2307	435	2337	440	2367	445				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	1	.037	137	.05	157	20

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1	137	600	720	780	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	426.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.34	Wt. n-Val.		0.037	20.000
E.G. Elev (ft)	428.12	Reach Len. (ft)	600.00	720.00	780.00
Crit W.S. (ft)		Flow Area (sq ft)		879.62	5250.59
E.G. Slope (ft/ft)	0.003383	Area (sq ft)		879.62	5250.59
Q Total (cfs)	8285.00	Flow (cfs)		8213.22	71.78
Top Width (ft)	1289.98	Top Width (ft)		105.60	1184.38
Vel Total (ft/s)	1.35	Avg. Vel. (ft/s)		9.34	0.01
Max Chl Dpth (ft)	13.58	Hydr. Depth (ft)		8.33	4.43
Conv. Total (cfs)	142447.6	Conv. (cfs)		141213.4	1234.2
Length Wtd. (ft)	720.38	Wetted Per. (ft)		110.06	1187.36
Min Ch El (ft)	413.20	Shear (lb/sq ft)		1.69	0.93
Alpha	47.32	Stream Power (lb/ft s)		15.76	0.01
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)		25.48	126.20
C & E Loss (ft)	0.17	Cum SA (acres)		2.88	31.58

Warning - Divided flow computed for this cross-section.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 44.80

INPUT
Description: STA 44+80
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	500	15	500	181.7	450	191.7	450	303.3	412.8
353.3	412.8	443.9	443	454	443	494	445	594	445
614	440	624	435	654	430	684	425	944	423
1204	425	1234	430	1264	435	1284	440	1314	445
1469	445	1534	440	1684	440	1814	445	1984	440
2014	435	2059	430	2124	425	2204	420	2799	420
2804	425	2824	430	2844	435	2874	440	2904	445

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.035	191.7	.03	443.9	.1	454	20

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
191.7	443.9	80	140	180	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	425.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.78	Wt. n-Val.		0.030	20.000
E.G. Elev (ft)	426.64	Reach Len. (ft)	80.00	140.00	180.00
Crit W.S. (ft)		Flow Area (sq ft)		1164.29	4746.39
E.G. Slope (ft/ft)	0.001136	Area (sq ft)		1164.29	4746.39
Q Total (cfs)	8306.00	Flow (cfs)		8272.40	33.60
Top Width (ft)	1353.19	Top Width (ft)		128.34	1224.85
Vel Total (ft/s)	1.41	Avg. Vel. (ft/s)		7.11	0.01
Max Chl Dpth (ft)	13.06	Hydr. Depth (ft)		9.07	3.88
Conv. Total (cfs)	246464.0	Conv. (cfs)		245467.1	997.0
Length Wtd. (ft)	140.16	Wetted Per. (ft)		132.58	1227.37
Min Ch El (ft)	412.80	Shear (lb/sq ft)		0.62	0.27
Alpha	25.46	Stream Power (lb/ft s)		4.42	0.00
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)		8.59	36.69
C & E Loss (ft)	0.00	Cum SA (acres)		0.94	10.01

Warning - Divided flow computed for this cross-section.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 43.40

INPUT
Description: STA 43+40
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	15	460	98.3	435	108.3	435	175.5	412.6
225.5	412.6	308	440	318	440	328	441.4	353	445
423	445	443	440	458	435	483	430	513	425
778	423	1033	425	1073	430	1103	435	1133	440
1163	445	1318	445	1383	440	1533	440	1663	445
1833	440	1863	435	1908	430	1973	425	2053	420
2648	420	2653	425	2673	430	2693	435	2723	440
2753	445								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.035	108.3	.03	308	.11	328	20

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
108.3	308	72	72	72	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	425.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.		0.030	20.000
E.G. Elev (ft)	426.48	Reach Len. (ft)	72.00	72.00	72.00
Crit W.S. (ft)		Flow Area (sq ft)		1171.43	4561.41
E.G. Slope (ft/ft)	0.001118	Area (sq ft)		1171.43	4561.41
Q Total (cfs)	8306.00	Flow (cfs)		8274.47	31.53
Top Width (ft)	1350.63	Top Width (ft)		128.77	1221.86
Vel Total (ft/s)	1.45	Avg. Vel. (ft/s)		7.06	0.01
Max Chl Dpth (ft)	13.11	Hydr. Depth (ft)		9.10	3.73
Conv. Total (cfs)	248376.3	Conv. (cfs)		247433.3	943.0
Length Wtd. (ft)	72.00	Wetted Per. (ft)		133.02	1224.32
Min Ch El (ft)	412.60	Shear (lb/sq ft)		0.61	0.26
Alpha	23.68	Stream Power (lb/ft s)		4.34	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)		4.84	17.46
C & E Loss (ft)	0.00	Cum SA (acres)		0.53	4.96

Warning - Divided flow computed for this cross-section.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 42.68

INPUT
Description: STA 42+68
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	15	460	98.3	435	108.3	435	175.5	412.5
225.5	412.5	308	440	318	440	328	441.4	353	445
423	445	443	440	458	435	483	430	513	425
778	423	1033	425	1073	430	1103	435	1133	440
1163	445	1318	445	1383	440	1533	440	1663	445
1833	440	1863	435	1908	430	1973	425	2053	420
2648	420	2653	425	2673	430	2693	435	2723	440
2753	445								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.035	108.3	.03	308	.1	328	20

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
108.3	308	16	16	16	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

			Left OB	Channel	Right OB
W.S. Elev (ft)	425.62	Element			
Vel Head (ft)	0.77	Wt. n-Val.		0.030	20.000
E.G. Elev (ft)	426.40	Reach Len. (ft)	16.00	16.00	16.00
Crit W.S. (ft)		Flow Area (sq ft)		1171.72	4461.88
E.G. Slope (ft/ft)	0.001116	Area (sq ft)		1171.72	4461.88
Q Total (cfs)	8306.00	Flow (cfs)		8275.45	30.55
Top Width (ft)	1347.90	Top Width (ft)		128.57	1219.33
Vel Total (ft/s)	1.47	Avg. Vel. (ft/s)		7.06	0.01
Max Chl Dpth (ft)	13.12	Hydr. Depth (ft)		9.11	3.66
Conv. Total (cfs)	248679.3	Conv. (cfs)		247764.7	914.6
Length Wtd. (ft)	16.00	Wetted Per. (ft)		132.84	1221.77
Min Ch El (ft)	412.50	Shear (lb/sq ft)		0.61	0.25
Alpha	22.86	Stream Power (lb/ft s)		4.34	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		2.90	10.01
C & E Loss (ft)	0.00	Cum SA (acres)		0.32	2.94

Warning - Divided flow computed for this cross-section.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 42.50

INPUT
Description: STA 42+50
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	460	15	460	98.3	435	108.3	435	175.5	412.5
225.5	412.5	308	440	318	440	328	441.4	353	445
423	445	443	440	458	435	483	430	513	425
778	423	1033	425	1073	430	1103	435	1133	440
1163	445	1318	445	1383	440	1533	440	1663	445
1833	440	1863	435	1908	430	1973	425	2053	420
2648	420	2653	425	2673	430	2693	435	2723	440
2753	445								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.035	108.3	.03	308	.1	328	20

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
108.3	308	92	92	92	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	425.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.78	Wt. n-Val.		0.030	20.000
E.G. Elev (ft)	426.38	Reach Len. (ft)	92.00	92.00	92.00
Crit W.S. (ft)		Flow Area (sq ft)		1169.11	4437.14
E.G. Slope (ft/ft)	0.001122	Area (sq ft)		1169.11	4437.14
Q Total (cfs)	8306.00	Flow (cfs)		8275.59	30.41
Top Width (ft)	1347.15	Top Width (ft)		128.45	1218.70
Vel Total (ft/s)	1.48	Avg. Vel. (ft/s)		7.08	0.01
Max Chl Dpth (ft)	13.10	Hydr. Depth (ft)		9.10	3.64
Conv. Total (cfs)	247912.8	Conv. (cfs)		247005.2	907.6
Length Wtd. (ft)	92.00	Wetted Per. (ft)		132.71	1221.13
Min Ch El (ft)	412.50	Shear (lb/sq ft)		0.62	0.25
Alpha	22.74	Stream Power (lb/ft s)		4.37	0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)		2.47	8.37
C & E Loss (ft)	0.00	Cum SA (acres)		0.27	2.49

Warning - Divided flow computed for this cross-section.

CROSS SECTION RIVER: Restoration
REACH: Lower Galum RS: 41.6

INPUT
Description: STA 41+60 (Beginning Station)
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	478.5	15	478.5	151.7	437.5	161.7	437.5	237	412.4
287	412.4	354.8	435	364.8	435	410	430	450	425
950	425	1030	430	1055	435	1090	440	1140	445
1180	448	1275	445	1320	440	1410	436.75	1500	440
1570	445	1650	445	1770	440	1805	435	1850	430
1940	425	2000	420	2550	420	2560	425	2580	430
2600	435	2620	440	2650	445				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.35	161.7	.03	354.8	.1	450	20

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
161.7	354.8	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-yr

W.S. Elev (ft)	425.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.78	Wt. n-Val.		0.030	19.844
E.G. Elev (ft)	426.28	Reach Len. (ft)			
Crit W.S. (ft)	420.42	Flow Area (sq ft)		1169.83	3490.75
E.G. Slope (ft/ft)	0.001123	Area (sq ft)		1169.83	3490.75
Q Total (cfs)	8306.00	Flow (cfs)		8280.86	25.14
Top Width (ft)	1271.60	Top Width (ft)		128.60	1143.00
Vel Total (ft/s)	1.78	Avg. Vel. (ft/s)		7.08	0.01
Max Chl Dpth (ft)	13.10	Hydr. Depth (ft)		9.10	3.05
Conv. Total (cfs)	247828.0	Conv. (cfs)		247078.0	750.0
Length Wtd. (ft)		Wetted Per. (ft)		132.85	1144.51
Min Ch El (ft)	412.40	Shear (lb/sq ft)		0.62	0.21
Alpha	15.73	Stream Power (lb/ft s)		4.37	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning - Divided flow computed for this cross-section.

SUMMARY OF MANNING'S N VALUES

River:Restoration

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
Bonnie	226.35	.065	.05	.065				
Bonnie	219.30	.065	.14	.065	.05	.065		
Bonnie	205.10	25	.065	.04	.065	25		
Bonnie	199.50	25	.05	.04	.05	25		
Bonnie	198.63	.05	.04	.05				
Bonnie	198.61	.05	.04	.05				
Bonnie	198.45	Bridge						
Bonnie	198.29	.05	.04	.05				
Bonnie	198.27	.05	.04	.05				
Bonnie	13	.03	.125	.04	.125	.03		
Bonnie	12	.03	.125	.04	.125	.03		
Bonnie	11	.03	.125	.04	.125	.03		
Bonnie	10	.03	.125	.04	.125	.03		
Bonnie	9	.03	.125	.04	.125	.03		
Bonnie	8	.03	.125	.04	.125	.03		
Bonnie	7	.03	.125	.04	.125			
Bonnie	6	.03	.125	.04	.125			
Bonnie	5	.03	.125	.04	.125	.03		
Bonnie	4	.03	.125	.04	.125	.03		
Bonnie	3	.03	.125	.04	.125	.03		
Bonnie	2	.03	.125	.04	.125	.03		
Bonnie	1	.03	.125	.04	.125	.03		
Galum	497.40	.14	.083	.065	.14			
Galum	490.90	.14	.083	.14				
Galum	487.40	.14	.083	.14	.065			
Galum	481.00	.14	.083	.065				
Galum	476.40	.14	.083	.065				
Galum	473.00	.14	.083	.065	25			
Galum	470.60	.065	.083	.065	25			
Galum	468.50	.065	.083	.065	25			
Galum	466.40	25	.065	.083	.065	25		
Galum	466.07	25	.065	25				
Galum	465.59	25	.065	25				
Galum	465.40	Bridge						
Galum	465.21	25	.065	25				
Galum	17	.125	.04	.125				
Galum	16	.125	.04	.125				
Galum	15	.125	.04	.125				
Galum	14	.125	.04	.125				
Galum	13	.125	.04	.125				
Galum	12	.125	.04	.125				
Galum	11	.03	.125	.04	.125			
Galum	10	.125	.04	.125				
Galum	9	.125	.04	.125				
Galum	8	.125	.04	.125				
Galum	7	.03	.125	.04	.125			
Galum	6	.03	.125	.04	.07	.125		
Galum	5	.03	.125	.07	.125	.04	.125	
Galum	4	.125	.04	.125	.125			
Galum	2.6	.125	.04	.125				
Galum	2.5	.125	.04	.125				
Galum	2.4	Bridge						
Galum	2.3	.125	.04	.125				
Galum	2.1	.125	.04	.125				
Galum	2	.03	.125	.07	.125	.04	.125	
Galum	1	.03	.125	.07	.125	.04	.125	.03
Lower Galum	246.00	.03	.125	.04	.125	.03		
Lower Galum	231.65	.03	.125	.04	.125	.03		
Lower Galum	212.00	25	.065	.065	.14	25		
Lower Galum	211.10	.05	.033	.05				
Lower Galum	211.09	.05	.033	.05				
Lower Galum	211.00	Bridge						
Lower Galum	210.91	.05	.033	.05				
Lower Galum	210.90	.05	.033	.05				
Lower Galum	210.00	25	.14	.065	.14	25		
Lower Galum	206.00	.033	.05	25				
Lower Galum	193.00	25	.05	.033				
Lower Galum	186.00	25	.05	.033				

Lower Galum	181.00	25	.033	.05	
Lower Galum	171.00	.05	.033	.05	
Lower Galum	161.00	.05	.033	.05	
Lower Galum	148.00	.05	.033	.05	
Lower Galum	139.00	.05	.033	.05	
Lower Galum	124.00	.05	.033	.05	
Lower Galum	107.00	.05	.033	.05	
Lower Galum	99.00	.05	.033	.05	
Lower Galum	91.00	.05	.033	.05	
Lower Galum	82.00	.05	.033	.05	
Lower Galum	72.00	.05	.033	.05	
Lower Galum	65.25	.05	.033	.05	
Lower Galum	61.50	.05	.033	.05	
Lower Galum	58.50	.05	.033	.05	
Lower Galum	52.00	.05	.037	.05	20
Lower Galum	44.80	.035	.03	.1	20
Lower Galum	43.40	.035	.03	.11	20
Lower Galum	42.68	.035	.03	.1	20
Lower Galum	42.50	.035	.03	.1	20
Lower Galum	41.6	.35	.03	.1	20

SUMMARY OF REACH LENGTHS

River: Restoration

Reach	River Sta.	Left	Channel	Right
Bonnie	226.35	715	705	675
Bonnie	219.30	1020	1420	1340
Bonnie	205.10	905	560	515
Bonnie	199.50	87	87	87
Bonnie	198.63	2	2	2
Bonnie	198.61	32	32	32
Bonnie	198.45	Bridge		
Bonnie	198.29	2	2	2
Bonnie	198.27	830	900	775
Bonnie	13	1390	1400	710
Bonnie	12	805	1200	880
Bonnie	11	930	1040	560
Bonnie	10	895	1720	1040
Bonnie	9	790	1660	1020
Bonnie	8	1000	1240	880
Bonnie	7	855	1080	590
Bonnie	6	625	1800	1310
Bonnie	5	1265	1600	800
Bonnie	4	980	1100	955
Bonnie	3	1010	1860	1088
Bonnie	2	1800	1660	890
Bonnie	1	0	0	0
Galum	497.40	595	650	560
Galum	490.90	320	350	340
Galum	487.40	550	640	290
Galum	481.00	450	460	230
Galum	476.40	300	340	450
Galum	473.00	190	240	295
Galum	470.60	105	210	345
Galum	468.50	150	210	340
Galum	466.40	33	33	33
Galum	466.07	48	48	48
Galum	465.59	38	38	38
Galum	465.40	Bridge		
Galum	465.21	110	140	195
Galum	17	490	680	825
Galum	16	880	820	700
Galum	15	1700	2060	2030
Galum	14	815	800	615
Galum	13	430	1600	1520
Galum	12	785	880	750
Galum	11	1750	1720	1155
Galum	10	1580	1980	2005
Galum	9	790	860	940
Galum	8	1240	660	530
Galum	7	1070	1480	1820
Galum	6	525	1000	770
Galum	5	1450	1280	780
Galum	4	908	2600	2270
Galum	2.6	1	1	1
Galum	2.5	22	22	22
Galum	2.4	Bridge		
Galum	2.3	1	1	1
Galum	2.1	1532	1700	410
Galum	2	510	1800	1800
Galum	1	0	0	0
Lower Galum	246.00	1030	1400	900
Lower Galum	231.65	1500	1830	1755
Lower Galum	212.00	90	90	90
Lower Galum	211.10	1	1	1
Lower Galum	211.09	18	18	18
Lower Galum	211.00	Bridge		
Lower Galum	210.91	1	1	1
Lower Galum	210.90	90	90	90
Lower Galum	210.00	400	400	400
Lower Galum	206.00	1300	1300	1300
Lower Galum	193.00	700	700	700
Lower Galum	186.00	500	500	500

Lower Galum	181.00	1000	1000	1000
Lower Galum	171.00	1000	1000	1000
Lower Galum	161.00	1300	1300	1300
Lower Galum	148.00	900	900	900
Lower Galum	139.00	1500	1500	1500
Lower Galum	124.00	1700	1700	1700
Lower Galum	107.00	800	800	800
Lower Galum	99.00	800	800	800
Lower Galum	91.00	900	900	900
Lower Galum	82.00	1000	1000	1000
Lower Galum	72.00	675	675	675
Lower Galum	65.25	375	375	375
Lower Galum	61.50	300	300	300
Lower Galum	58.50	650	650	650
Lower Galum	52.00	600	720	780
Lower Galum	44.80	80	140	180
Lower Galum	43.40	72	72	72
Lower Galum	42.68	16	16	16
Lower Galum	42.50	92	92	92
Lower Galum	41.6	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Restoration

Reach	River Sta.		Contr.	Expan.
Bonnie	226.35		.1	.3
Bonnie	219.30		.1	.3
Bonnie	205.10		.3	.5
Bonnie	199.50		.3	.5
Bonnie	198.63		.3	.5
Bonnie	198.61		.3	.5
Bonnie	198.45	Bridge		
Bonnie	198.29		.3	.5
Bonnie	198.27		.3	.5
Bonnie	13		.1	.3
Bonnie	12		.1	.3
Bonnie	11		.1	.3
Bonnie	10		.1	.3
Bonnie	9		.1	.3
Bonnie	8		.1	.3
Bonnie	7		.1	.3
Bonnie	6		.1	.3
Bonnie	5		.1	.3
Bonnie	4		.1	.3
Bonnie	3		.1	.3
Bonnie	2		.1	.3
Bonnie	1		.1	.3
Galum	497.40		.1	.3
Galum	490.90		.1	.3
Galum	487.40		.1	.3
Galum	481.00		.1	.3
Galum	476.40		.1	.3
Galum	473.00		.1	.3
Galum	470.60		.1	.3
Galum	468.50		.1	.3
Galum	466.40		.1	.3
Galum	466.07		.3	.5
Galum	465.59		.3	.5
Galum	465.40	Bridge		
Galum	465.21		.3	.5
Galum	17		.1	.3
Galum	16		.1	.3
Galum	15		.1	.3
Galum	14		.1	.3
Galum	13		.1	.3
Galum	12		.1	.3
Galum	11		.1	.3
Galum	10		.1	.3
Galum	9		.1	.3
Galum	8		.1	.3
Galum	7		.1	.3
Galum	6		.1	.3
Galum	5		.1	.3
Galum	4		.1	.3
Galum	2.6		.3	.5
Galum	2.5		.3	.5
Galum	2.4	Bridge		
Galum	2.3		.3	.5
Galum	2.1		.1	.3
Galum	2		.1	.3
Galum	1		.1	.3
Lower Galum	246.00		.1	.3
Lower Galum	231.65		.1	.3
Lower Galum	212.00		.3	.5
Lower Galum	211.10		.3	.5
Lower Galum	211.09		.3	.5
Lower Galum	211.00	Bridge		
Lower Galum	210.91		.3	.5
Lower Galum	210.90		.3	.5
Lower Galum	210.00		.1	.3
Lower Galum	206.00		.1	.3
Lower Galum	193.00		.1	.3
Lower Galum	186.00		.1	.3

Lower Galum	181.00	.1	.3
Lower Galum	171.00	.1	.3
Lower Galum	161.00	.1	.3
Lower Galum	148.00	.1	.3
Lower Galum	139.00	.1	.3
Lower Galum	124.00	.1	.3
Lower Galum	107.00	.1	.3
Lower Galum	99.00	.1	.3
Lower Galum	91.00	.1	.3
Lower Galum	82.00	.1	.3
Lower Galum	72.00	.1	.3
Lower Galum	65.25	.1	.3
Lower Galum	61.50	.1	.3
Lower Galum	58.50	.1	.3
Lower Galum	52.00	.1	.3
Lower Galum	44.80	.1	.3
Lower Galum	43.40	.1	.3
Lower Galum	42.68	.1	.3
Lower Galum	42.50	.1	.3
Lower Galum	41.6	.1	.3

APPENDIX B

HEC-RAS Summary Tables

HEC-RAS Plan: Final River: Restoration Reach: Galum

Reach	River Sta	Profile	Trvl Tme Chl	Q Total	W.S. Elev	Max Chl Dpth	Vel Chnl	Volume
			(hrs)	(cfs)	(ft)	(ft)	(ft/s)	(acre-ft)
Galum	1	100-yr	0.35	6318.00	442.99	21.99	0.64	566.26
Galum	2	100-yr	0.65	6318.00	442.99	20.99	1.21	836.35
Galum	2.1	100-yr	0.84	6318.00	443.00	20.50	3.98	1083.38
Galum	2.3	100-yr	0.84	6318.00	443.00	20.50	4.15	1083.48
Galum	2.4		Bridge					
Galum	2.5	100-yr	0.84	6318.00	443.06	20.56	4.12	1267.51
Galum	2.6	100-yr	0.84	6318.00	443.07	20.57	3.95	1267.91
Galum	4	100-yr	1.08	6353.00	443.48	17.48	2.04	1549.97
Galum	5	100-yr	1.28	6353.00	443.57	15.57	1.45	1812.20
Galum	6	100-yr	1.51	6353.00	443.60	14.60	0.96	2005.45
Galum	7	100-yr	1.69	6353.00	443.62	8.62	3.58	2302.31
Galum	8	100-yr	1.72	6700.00	443.92	8.92	12.87	2352.00
Galum	9	100-yr	1.74	6700.00	448.53	13.53	7.60	2380.72
Galum	10	100-yr	1.83	6700.00	450.59	15.59	4.79	2485.38
Galum	11	100-yr	1.94	6700.00	451.34	16.34	3.67	2635.25
Galum	12	100-yr	2.00	6700.00	451.58	16.58	4.00	2718.66
Galum	13	100-yr	2.15	6700.00	451.90	16.90	2.18	2884.07
Galum	14	100-yr	2.22	6700.00	451.93	16.93	4.48	3016.62
Galum	15	100-yr	2.35	6700.00	452.73	16.73	3.79	3231.57
Galum	16	100-yr	2.41	6700.00	453.01	17.01	4.29	3326.01
Galum	17	100-yr	2.46	5712.00	453.26	16.76	3.69	3394.85
Galum	465.21	100-yr	2.46	5712.00	453.10	15.24	6.68	3402.61
Galum	465.40		Bridge					
Galum	465.59	100-yr	2.47	6266.00	453.31	15.45	7.19	3403.38
Galum	466.07	100-yr	2.47	6266.00	454.21	16.31	4.94	3409.64
Galum	468.40	100-yr	2.47	6266.00	454.32	16.14	3.52	3417.45
Galum	468.50	100-yr	2.50	6266.00	454.51	16.31	0.68	3486.92
Galum	470.60	100-yr	2.56	6266.00	454.54	16.14	1.25	3552.02
Galum	473.00	100-yr	2.61	6266.00	454.60	16.00	1.37	3613.67
Galum	476.40	100-yr	2.68	6266.00	454.71	15.71	1.49	3691.57
Galum	481.00	100-yr	2.77	6266.00	454.78	15.58	1.37	3725.59
Galum	487.40	100-yr	2.84	6266.00	454.95	15.55	3.50	3766.56
Galum	490.90	100-yr	2.87	6266.00	455.51	15.71	3.75	3795.32
Galum	497.40	100-yr	2.94	6266.00	455.89	15.39	1.37	3862.24

HEC-RAS Plan: Final River: Restoration Reach: Lower Galum

Reach	River Sta	Profile	Trvl Tme Chl	Q Total	W.S. Elev	Max Chl Dpth	Vel Chnl	Volume
			(hrs)	(cfs)	(ft)	(ft)	(ft/s)	(acre-ft)
Lower Galum	41.6	100-yr	0.00	8306.00	425.50	13.10	7.08	
Lower Galum	42.50	100-yr	0.00	8306.00	425.60	13.10	7.08	10.84
Lower Galum	42.68	100-yr	0.00	8306.00	425.62	13.12	7.06	12.91
Lower Galum	43.40	100-yr	0.01	8306.00	425.71	13.11	7.06	22.30
Lower Galum	44.80	100-yr	0.01	8306.00	425.86	13.06	7.11	45.28
Lower Galum	52.00	100-yr	0.04	8285.00	426.78	13.58	9.34	151.68
Lower Galum	58.50	100-yr	0.06	8285.00	428.68	14.78	10.09	203.54
Lower Galum	61.50	100-yr	0.06	8285.00	429.88	15.88	8.61	209.68
Lower Galum	65.25	100-yr	0.08	8285.00	430.80	16.70	7.61	218.51
Lower Galum	72.00	100-yr	0.10	8285.00	431.93	17.73	6.14	237.39
Lower Galum	82.00	100-yr	0.15	8285.00	432.77	18.07	6.50	267.50
Lower Galum	91.00	100-yr	0.18	8285.00	433.51	18.31	8.05	291.30
Lower Galum	99.00	100-yr	0.22	8285.00	434.79	19.19	5.57	314.42
Lower Galum	107.00	100-yr	0.26	8285.00	435.34	19.44	4.98	343.43
Lower Galum	124.00	100-yr	0.34	8285.00	436.24	19.44	6.81	399.79
Lower Galum	139.00	100-yr	0.40	8285.00	437.68	20.08	7.04	440.99
Lower Galum	148.00	100-yr	0.44	8285.00	438.70	20.60	5.49	468.75
Lower Galum	161.00	100-yr	0.50	8285.00	439.48	20.68	5.39	514.21
Lower Galum	171.00	100-yr	0.56	8285.00	440.07	20.47	4.74	551.90
Lower Galum	181.00	100-yr	0.62	8285.00	440.45	20.05	5.19	597.83
Lower Galum	186.00	100-yr	0.64	8285.00	440.77	19.97	4.39	626.21
Lower Galum	193.00	100-yr	0.69	8285.00	440.97	16.87	4.56	668.96
Lower Galum	206.00	100-yr	0.76	8285.00	441.38	17.38	5.18	734.46
Lower Galum	210.00	100-yr	0.79	8285.00	441.87	21.52	4.05	780.95
Lower Galum	210.90	100-yr	0.79	8285.00	441.83	21.48	4.91	791.88
Lower Galum	210.91	100-yr	0.79	8285.00	441.78	21.43	5.65	791.91
Lower Galum	211.00		Bridge					
Lower Galum	211.09	100-yr	0.79	8285.00	441.79	21.44	5.65	792.70
Lower Galum	211.10	100-yr	0.79	10848.00	441.73	21.38	6.48	792.75
Lower Galum	212.00	100-yr	0.80	10848.00	442.35	22.05	3.33	804.53
Lower Galum	231.65	100-yr	0.95	10728.00	442.76	22.78	3.41	1133.28
Lower Galum	246.00	100-yr	1.09	10728.00	442.93	22.93	2.06	1378.83

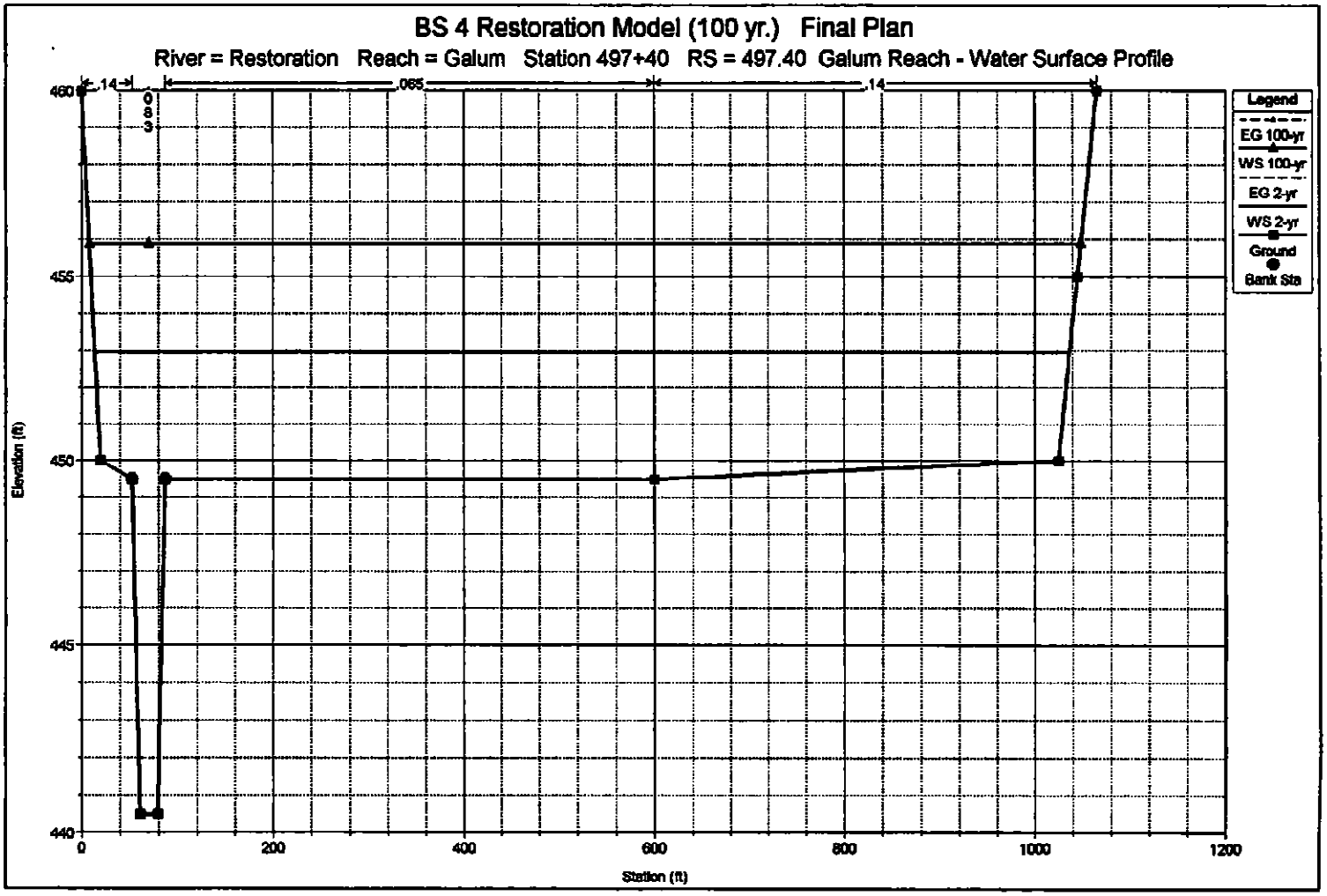
HEC-RAS Plan: Final River: Restoration Reach: Bonnie

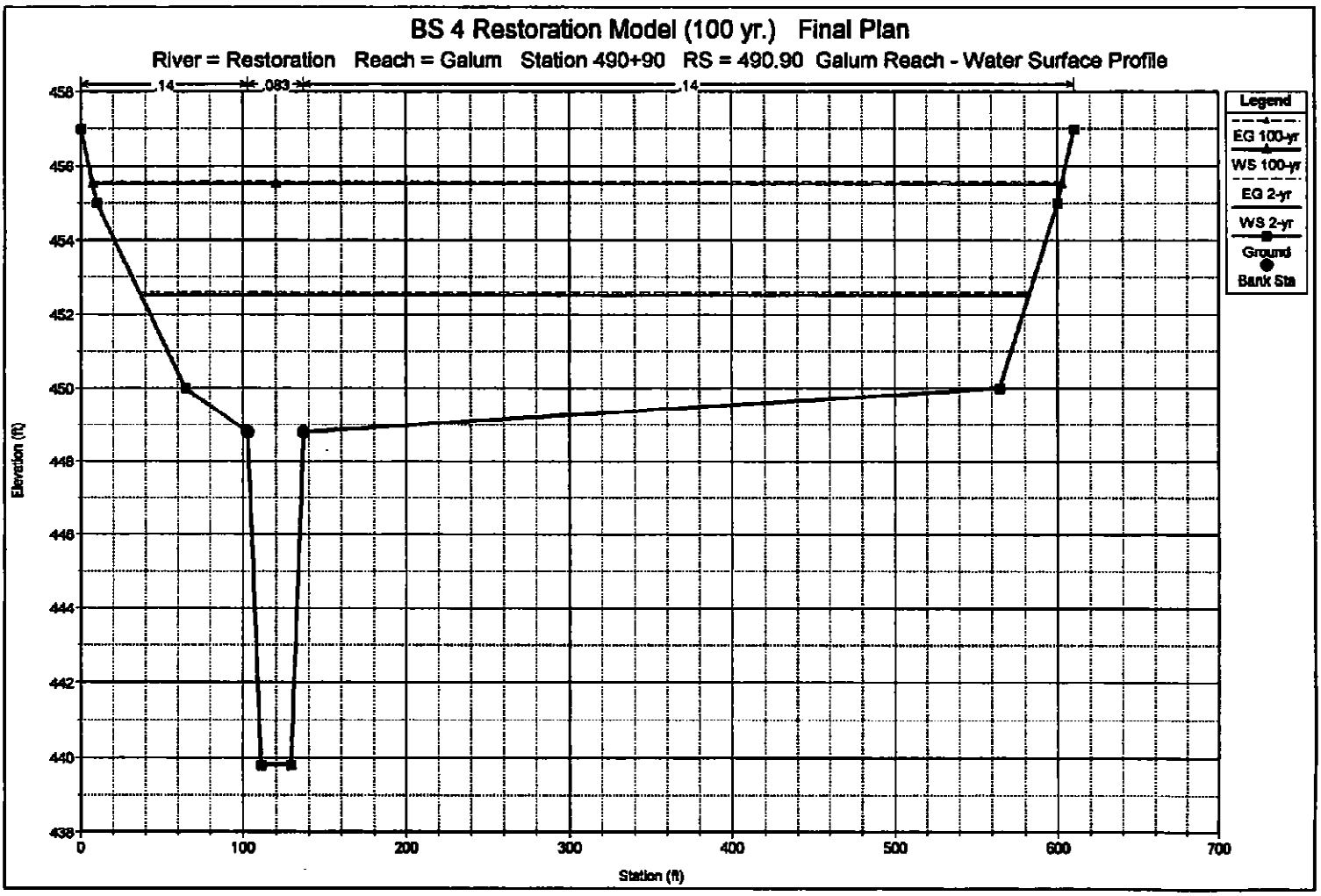
Reach	River Sta	Profile	Trvl Tme Chl	Q Total	W.S. Elev	Max Chl Dpth	Vel Chnl	Volume
			(hrs)	(cfs)	(ft)	(ft)	(ft/s)	(acre-ft)
Bonnie	1	100-yr	0.16	5693.00	442.97	21.97	0.68	212.60
Bonnie	2	100-yr	0.45	5693.00	442.98	17.98	1.11	625.29
Bonnie	3	100-yr	0.97	5708.00	443.01	18.01	0.91	934.18
Bonnie	4	100-yr	1.13	5708.00	443.01	16.01	2.92	1150.94
Bonnie	5	100-yr	1.26	5708.00	443.27	15.27	3.87	1270.79
Bonnie	6	100-yr	1.39	5708.00	443.83	14.83	3.99	1368.61
Bonnie	7	100-yr	1.48	5708.00	444.12	15.12	2.11	1471.84
Bonnie	8	100-yr	1.63	5565.00	444.26	13.26	2.60	1590.25
Bonnie	9	100-yr	1.80	5565.00	444.50	11.50	2.71	1679.73
Bonnie	10	100-yr	1.89	5565.00	445.05	10.05	8.01	1748.76
Bonnie	11	100-yr	1.96	5333.00	445.69	9.69	0.85	1827.28
Bonnie	12	100-yr	2.03	5333.00	445.58	8.18	8.92	1925.15
Bonnie	13	100-yr	2.08	5333.00	449.13	11.13	5.63	1962.21
Bonnie	198.27	100-yr	2.11	5333.00	450.69	12.44	10.97	1987.63
Bonnie	198.29	100-yr	2.11	5333.00	450.71	12.46	10.95	1987.65
Bonnie	198.45		Bridge					
Bonnie	198.61	100-yr	2.11	5333.00	451.09	12.84	10.50	1988.02
Bonnie	198.63	100-yr	2.11	5333.00	451.11	12.86	10.48	1988.04
Bonnie	199.50	100-yr	2.11	5333.00	452.06	12.46	9.94	1989.27
Bonnie	205.10	100-yr	2.13	5823.00	454.58	8.58	4.36	2019.84
Bonnie	219.30	100-yr	2.21	5823.00	458.89	5.39	6.51	2080.71
Bonnie	226.35	100-yr	2.24	5823.00	459.20	6.70	4.38	2120.10

APPENDIX C

Cross Sections

Galum Creek Reach


BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum Station 497+40 RS = 497.40 Galum Reach - Water Surface Profile
.14
.083
.065
.14
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
0
200
400
600
800
1000
1200
Station (ft)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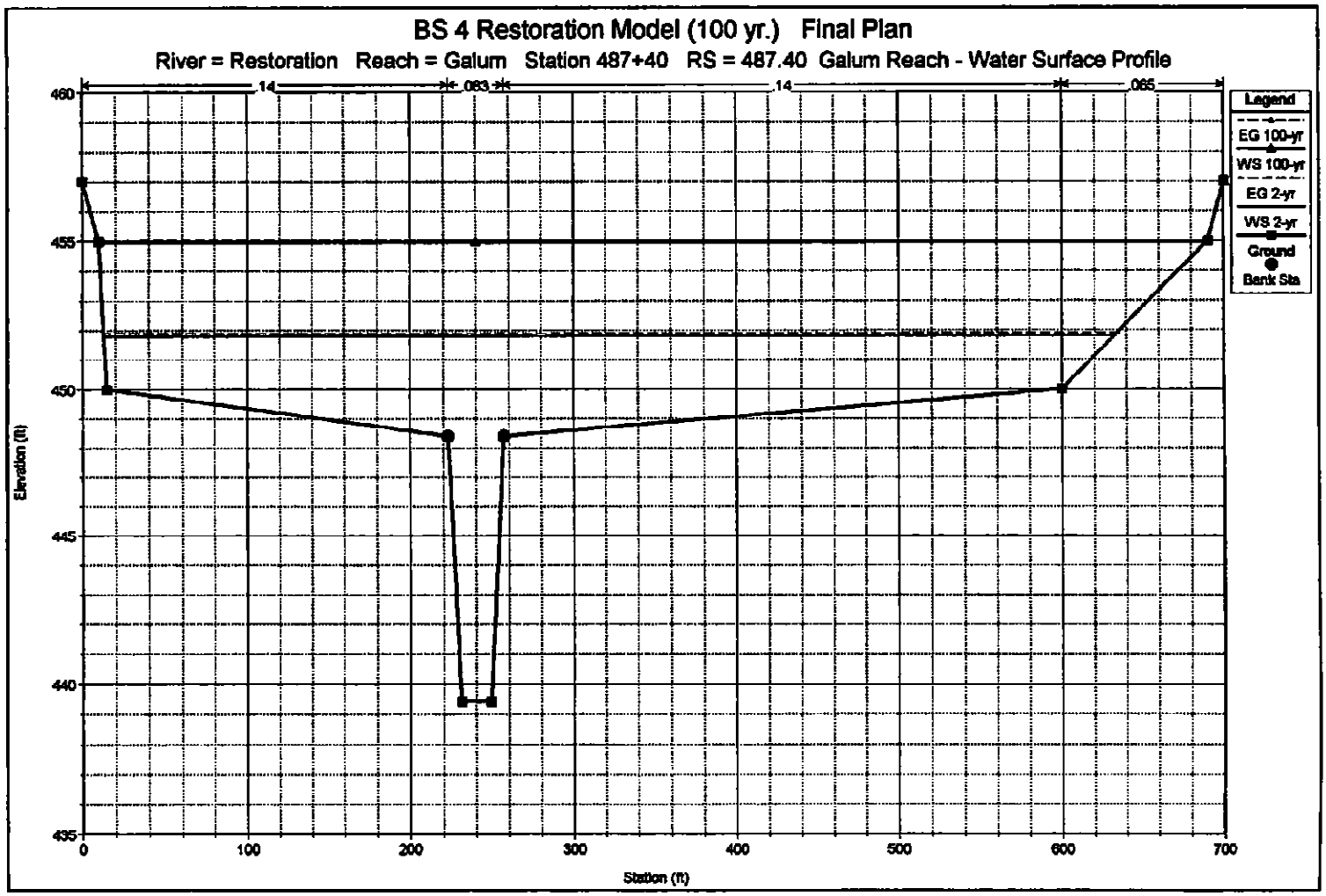
.14
.083
.14
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
458
456
454
452
450
448
446
444
442
440
438
0
100
200
300
400
500
600
700
Station (ft)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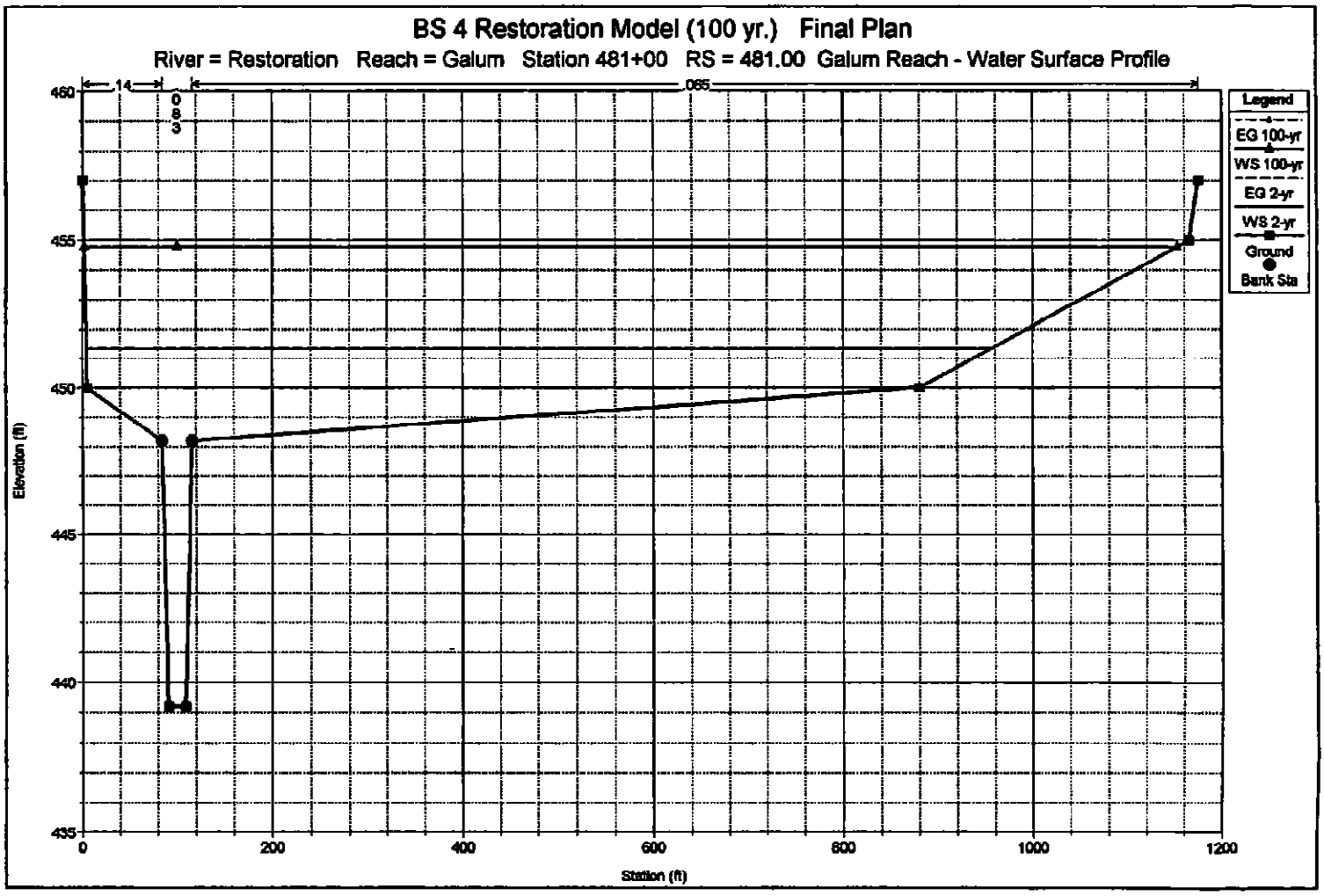
River = Restoration Reach = Galum Station 487+40 RS = 487.40 Galum Reach - Water Surface Profile
.14
.083
.14
.065
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
435
0
100
200
300
400
500
600
700
Station (ft)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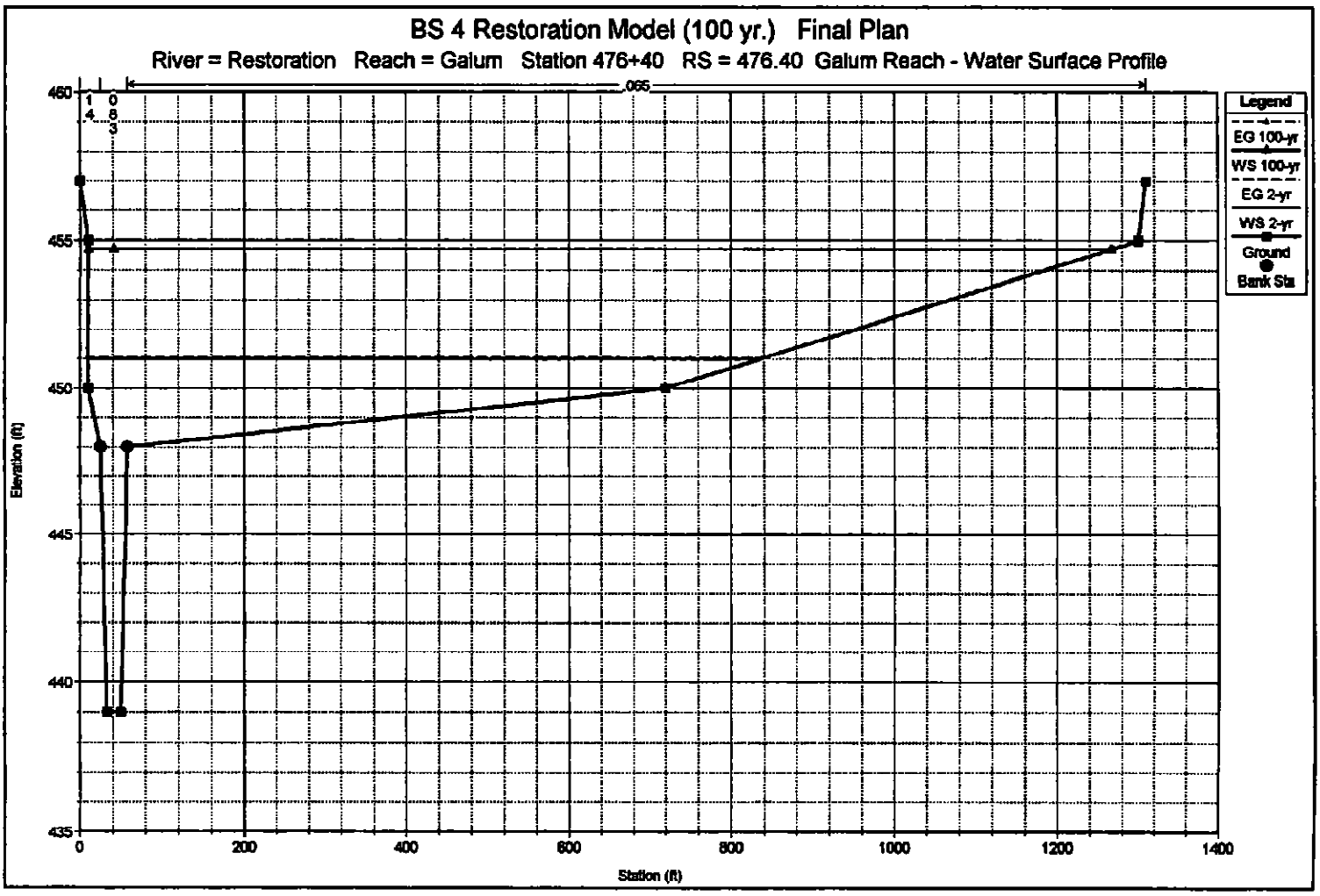
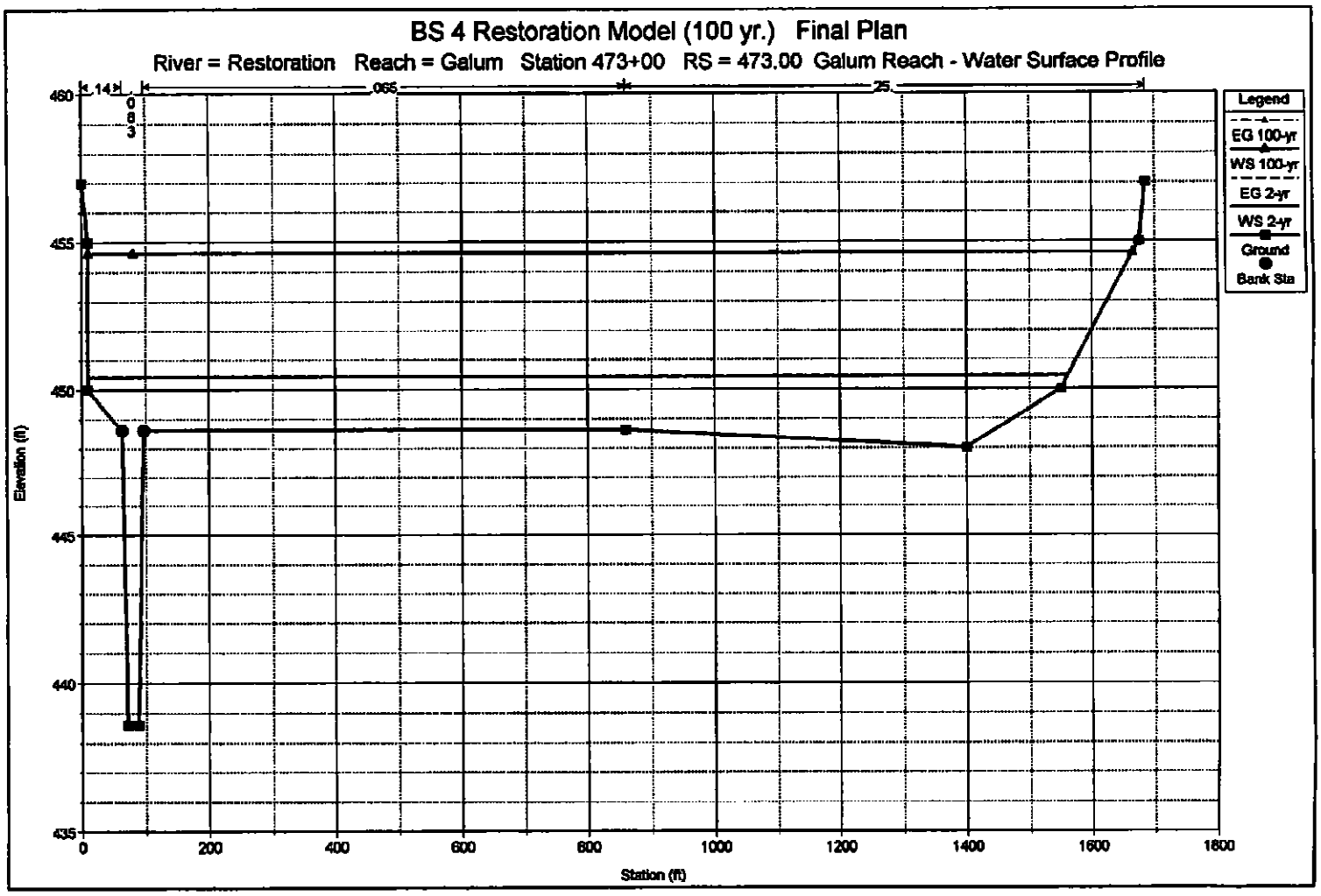
River = Restoration Reach = Galum Station 481+00 RS = 481.00 Galum Reach - Water Surface Profile
14
083
065
460
455
450
445
440
435
Elevation (ft)
0
200
400
600
800
1000
1200
Station (ft)
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta


BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum Station 476+40 RS = 476.40 Galum Reach - Water Surface Profile
.065
1 0
4 8
3
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
435
0
200
400
600
800
1000
1200
1400
Station (ft)


BS 4 Restoration Model (100 yr.) Final Plan
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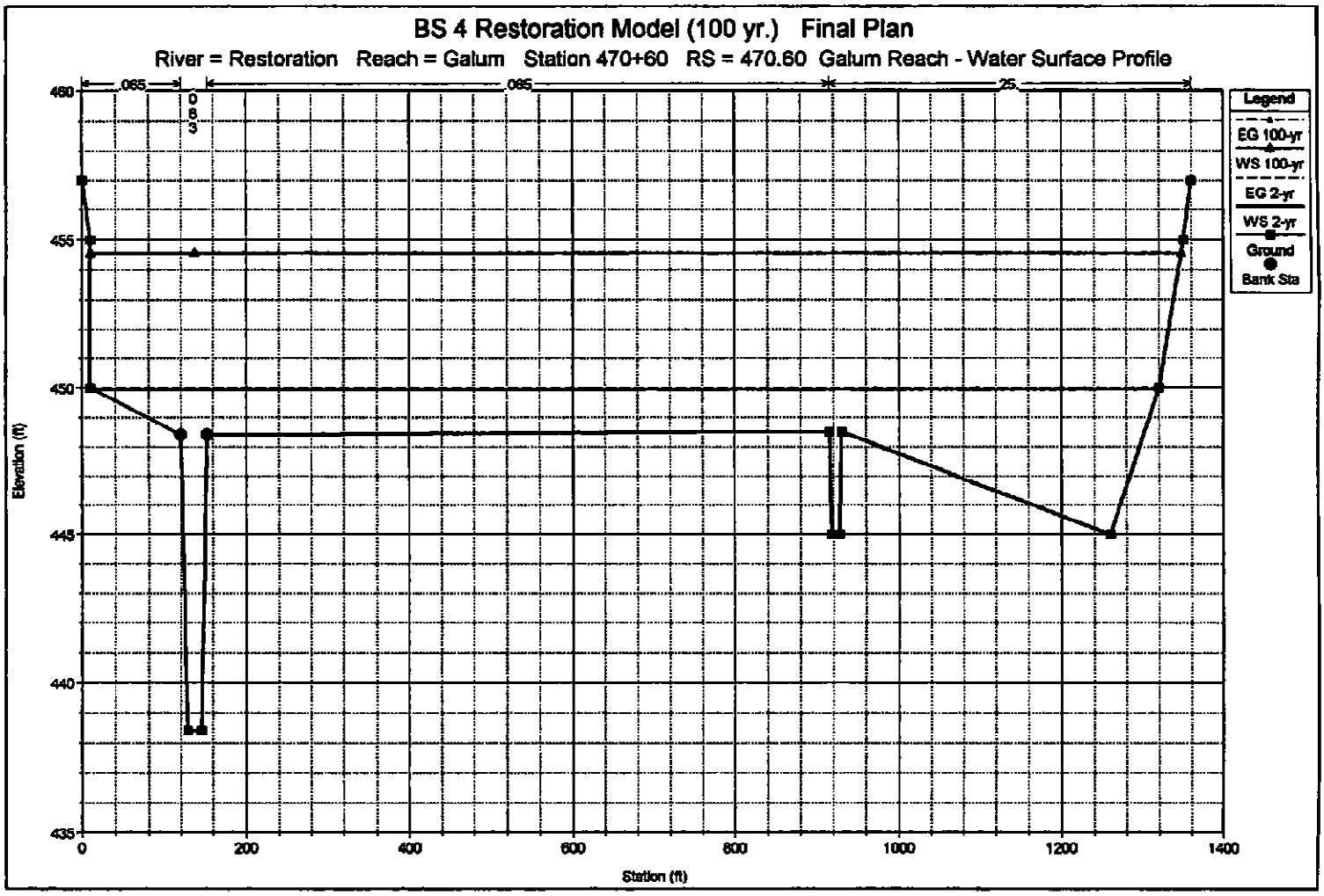
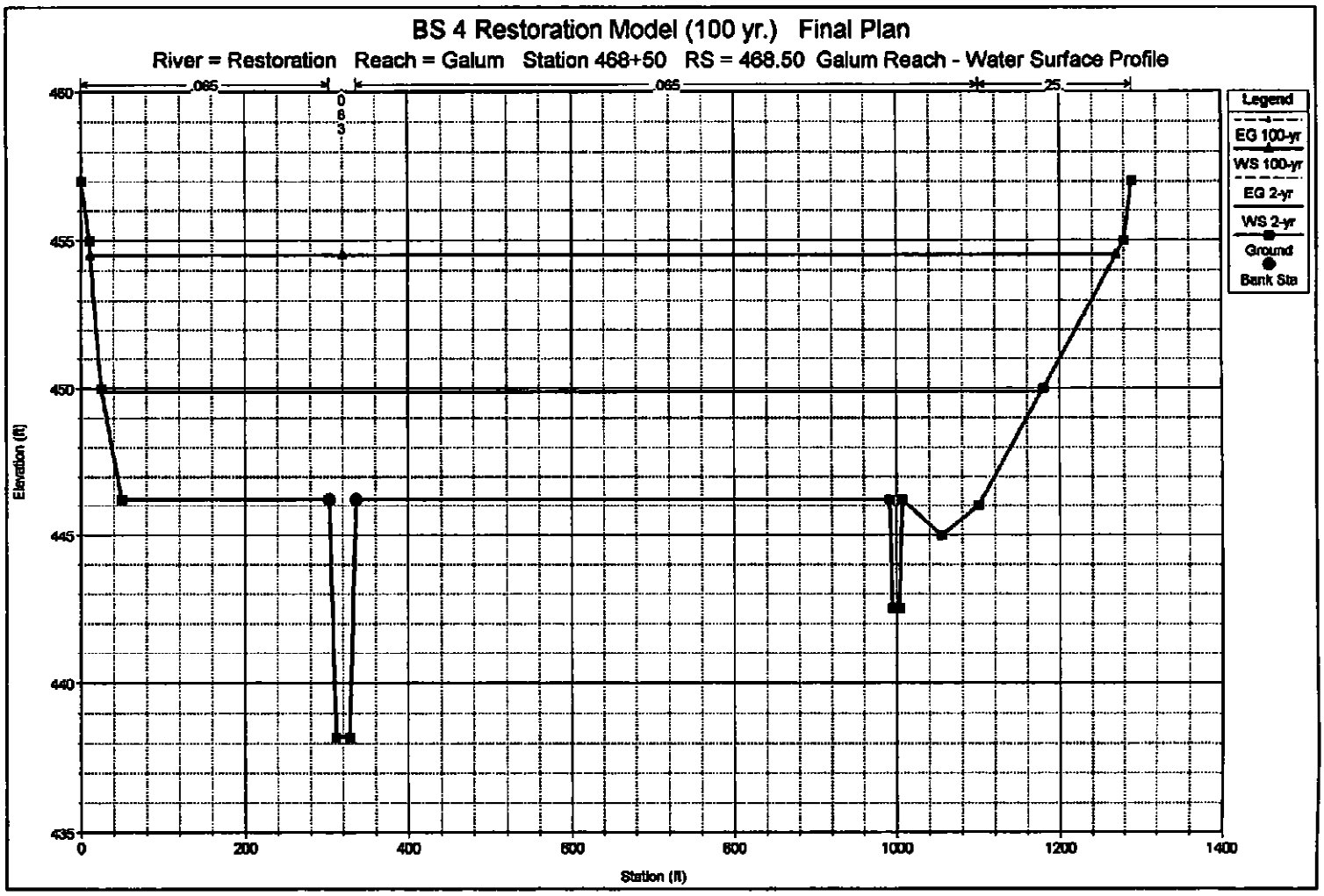
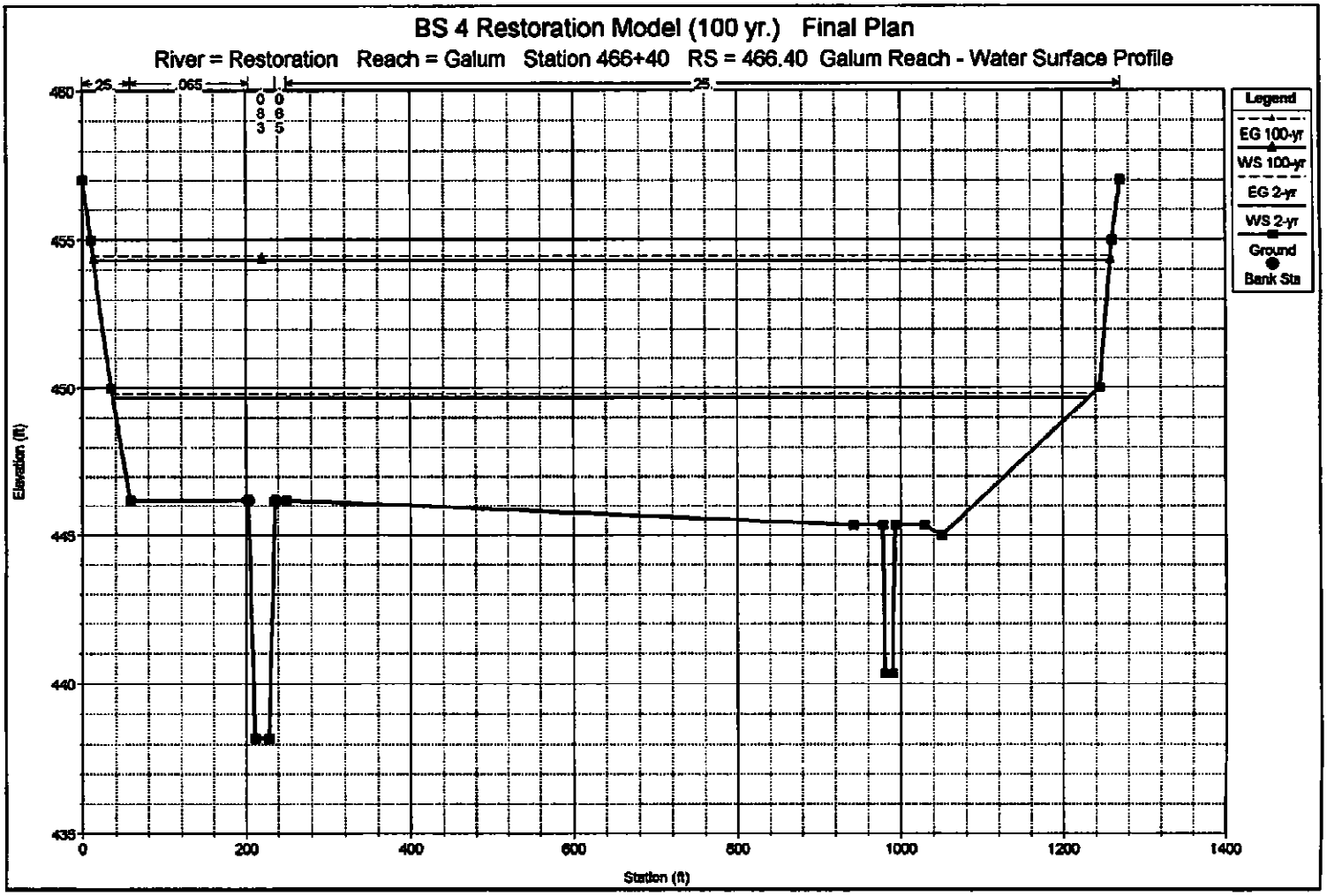
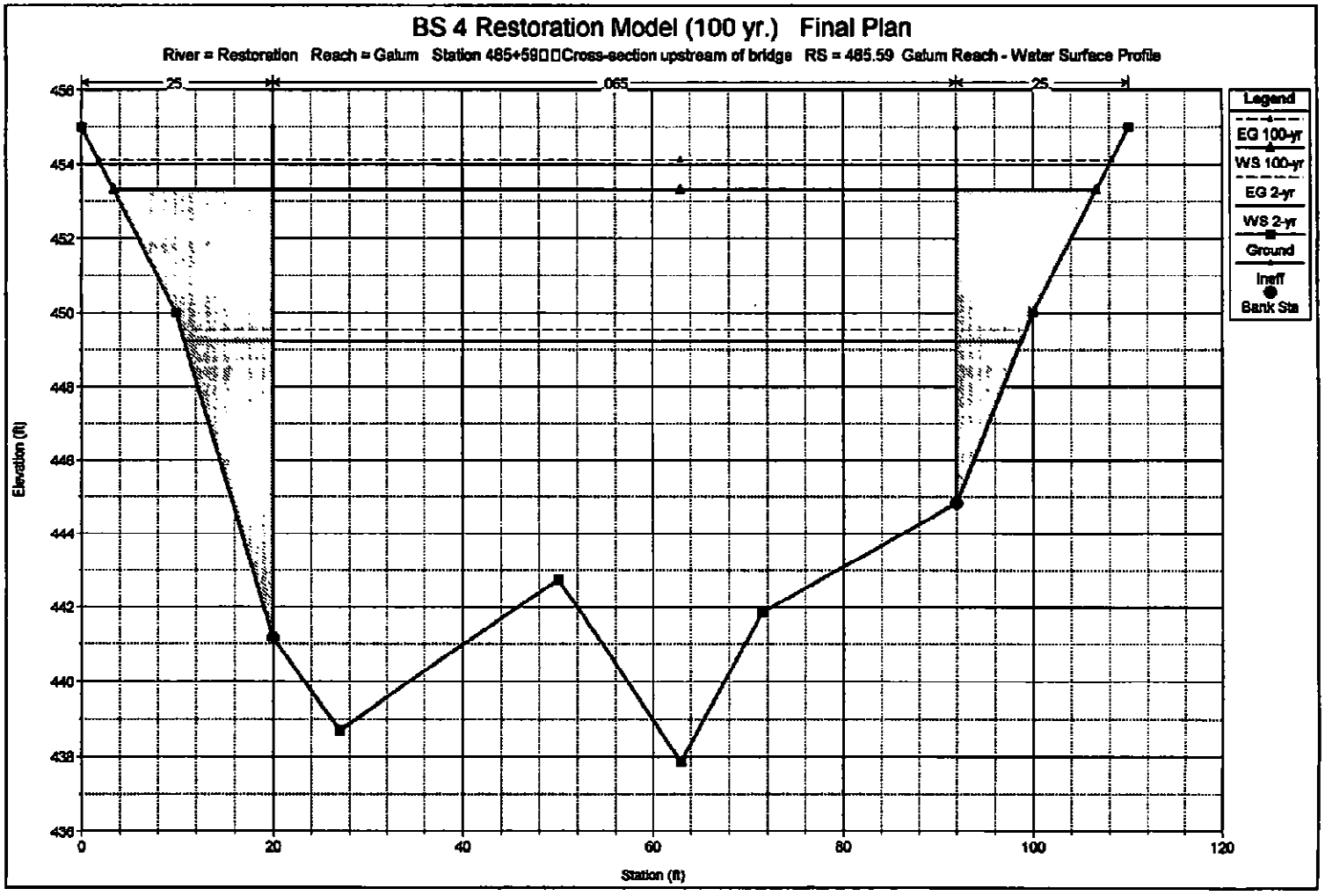
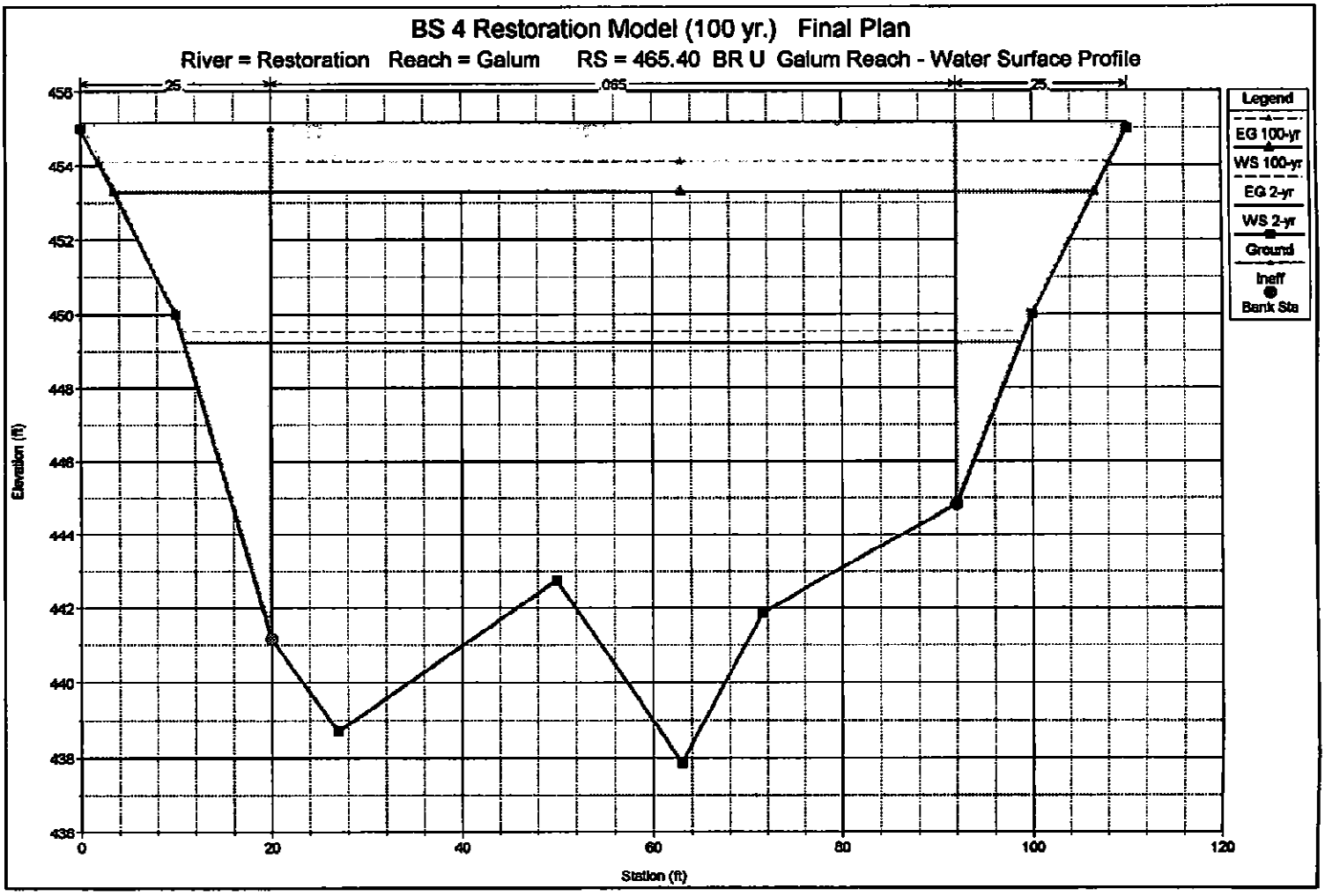
.14
.065
.025
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
460
455
450
445
440
435
0
200
400
600
800
1000
1200
1400
1600
1800

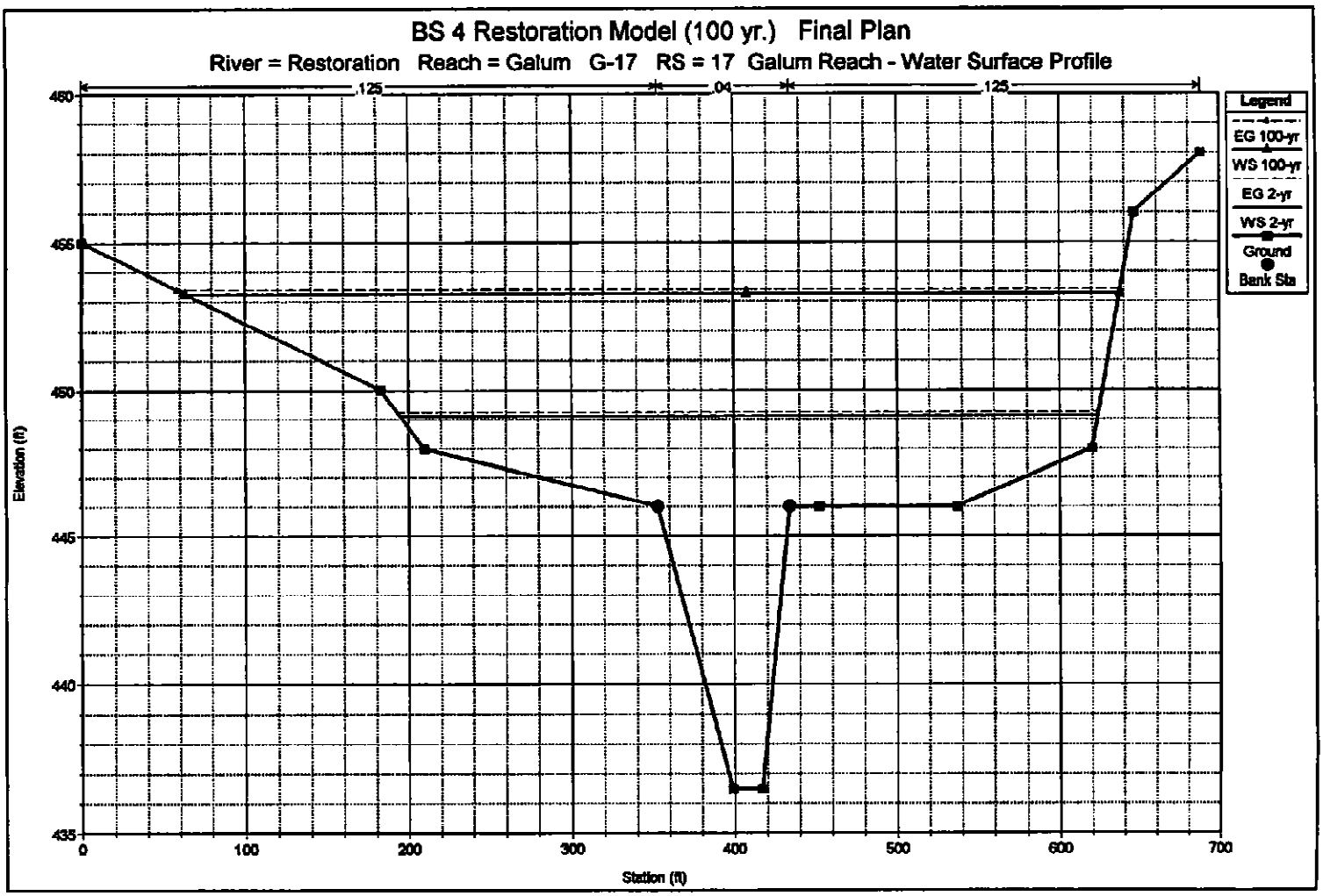

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum Station 470+60 RS = 470.60 Galum Reach - Water Surface Profile
.065
.065
.25
OB3
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
435
0
200
400
600
800
1000
1200
1400
Station (ft)

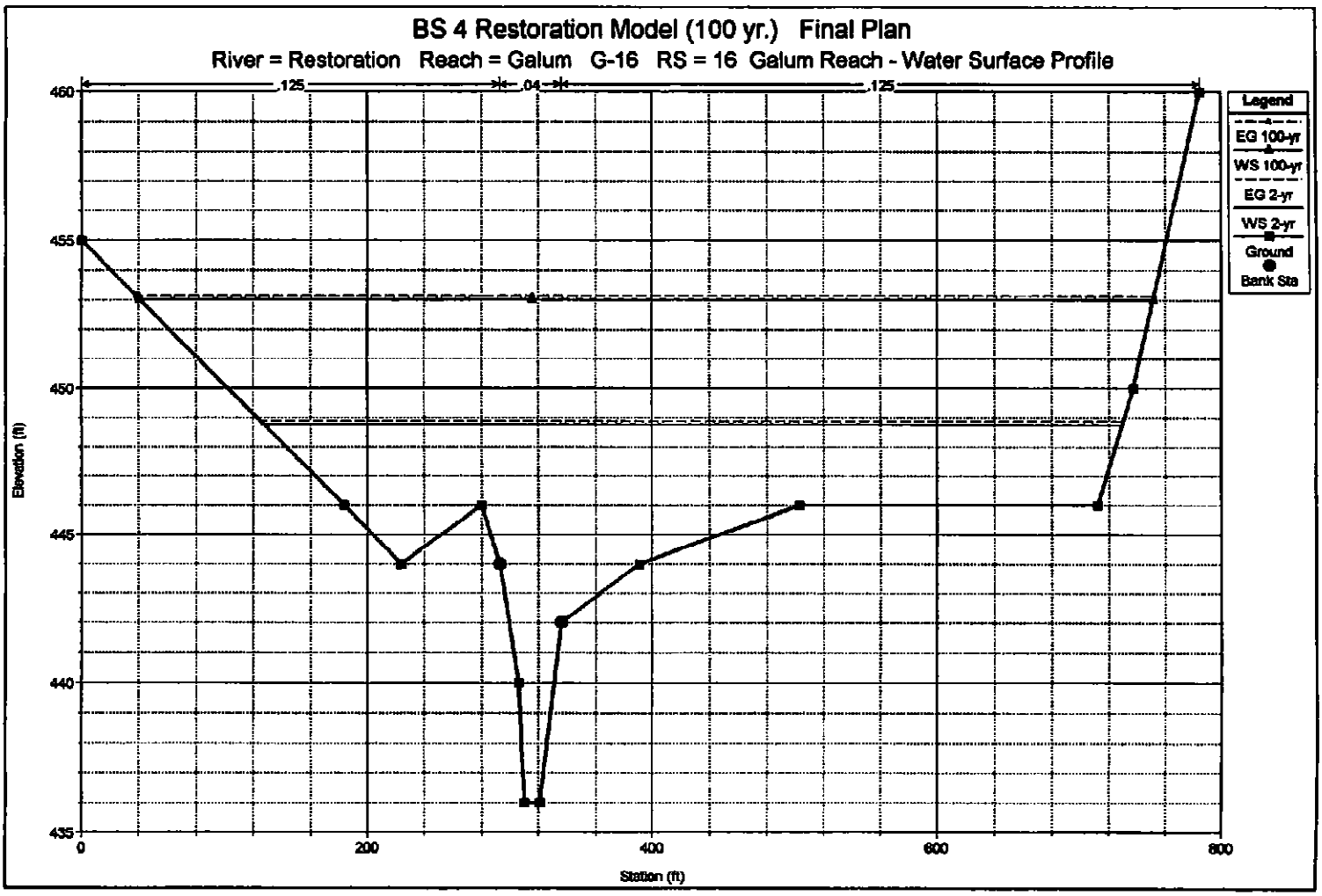

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum Station 468+50 RS = 468.50 Galum Reach - Water Surface Profile
.085
.085
.25
.063
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
460
455
450
445
440
435
0
200
400
600
800
1000
1200
1400

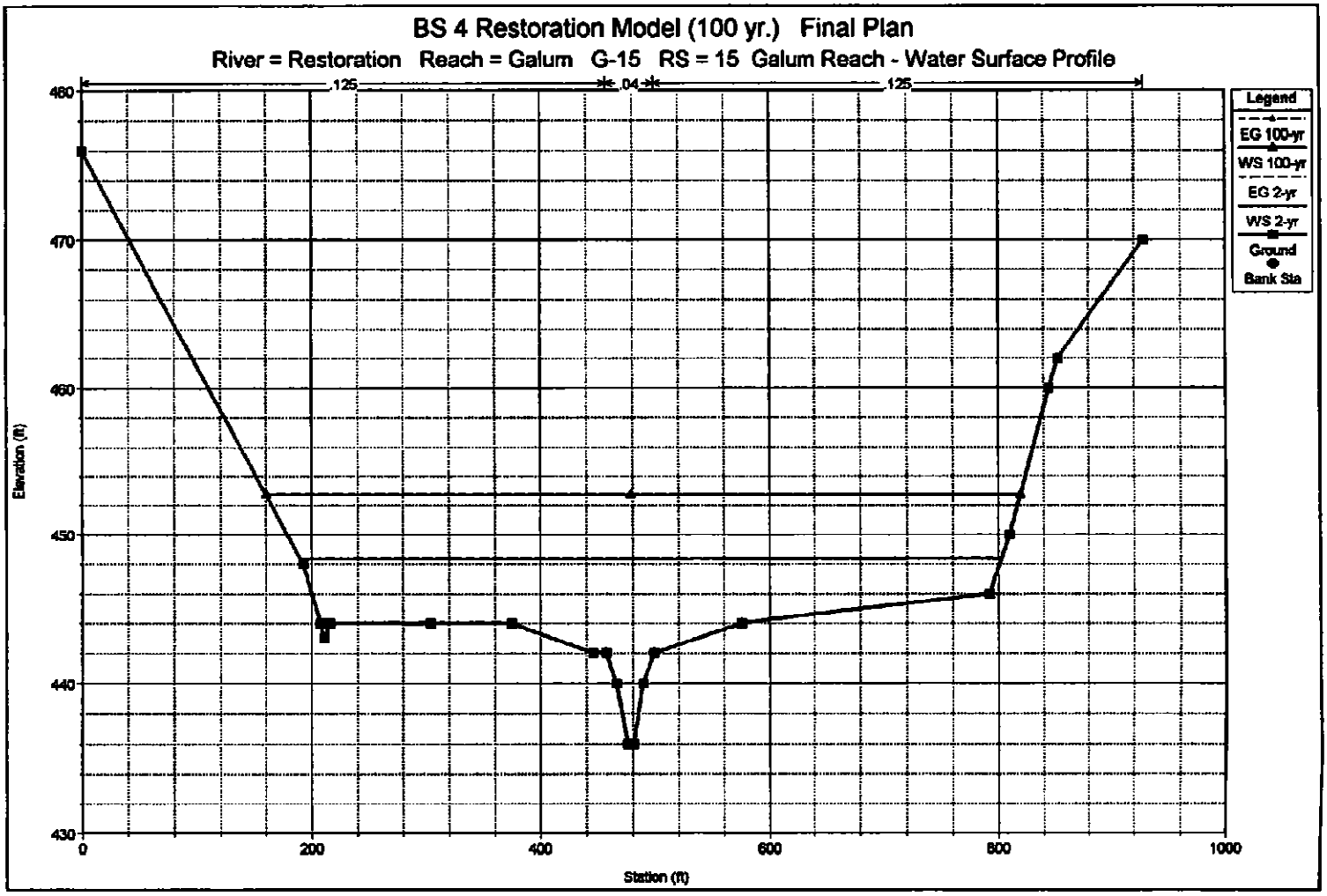

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum Station 466+40 RS = 466.40 Galum Reach - Water Surface Profile
.25
.065
.08
.08
.35
.25
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
460
455
450
445
440
435
Elevation (ft)
0
200
400
600
800
1000
1200
1400
Station (ft)

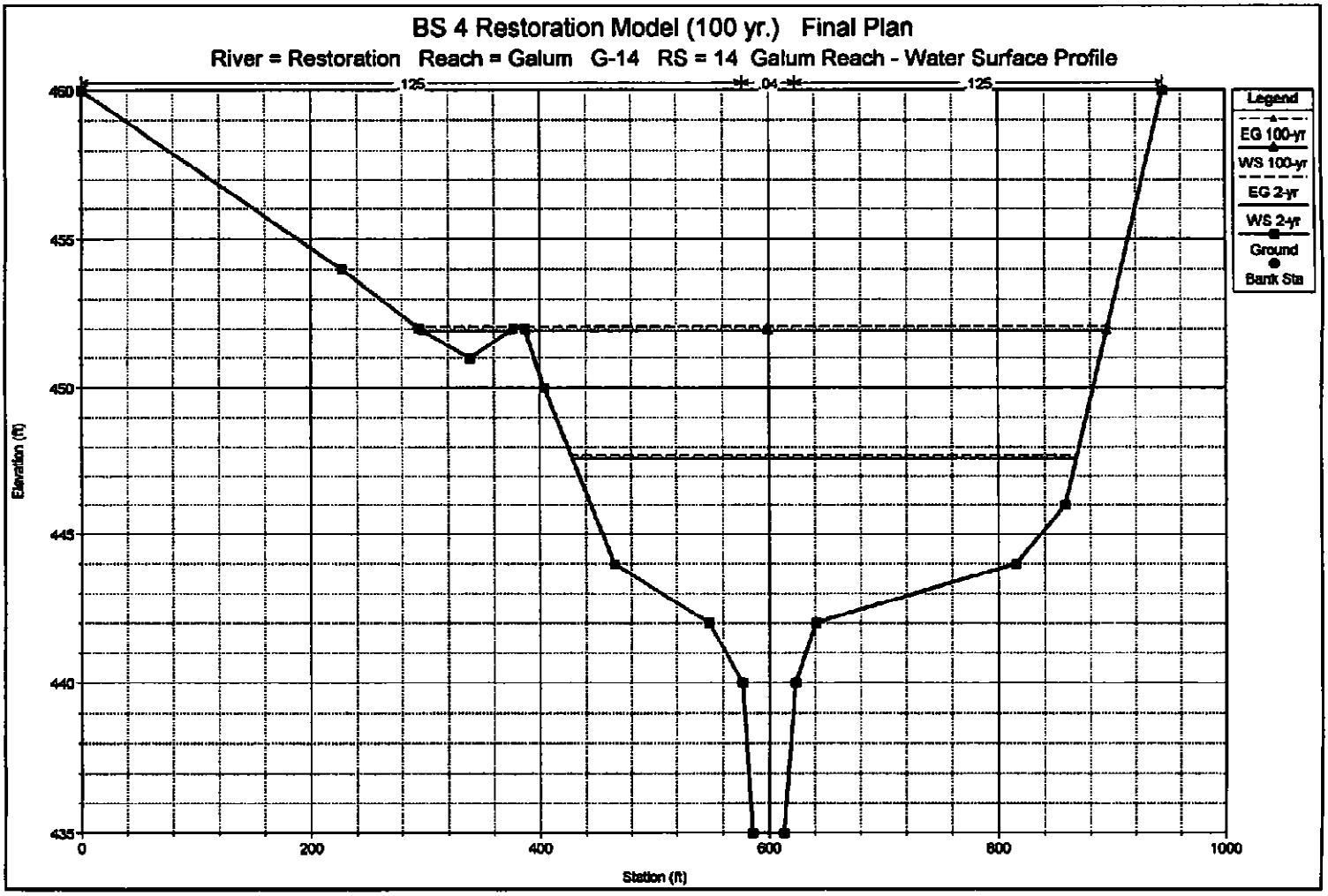

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Gatum Station 485+59□□Cross-section upstream of bridge RS = 485.59 Gatum Reach - Water Surface Profile
25
065
25
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
456
454
452
450
448
446
444
442
440
438
436
0
20
40
60
80
100
120

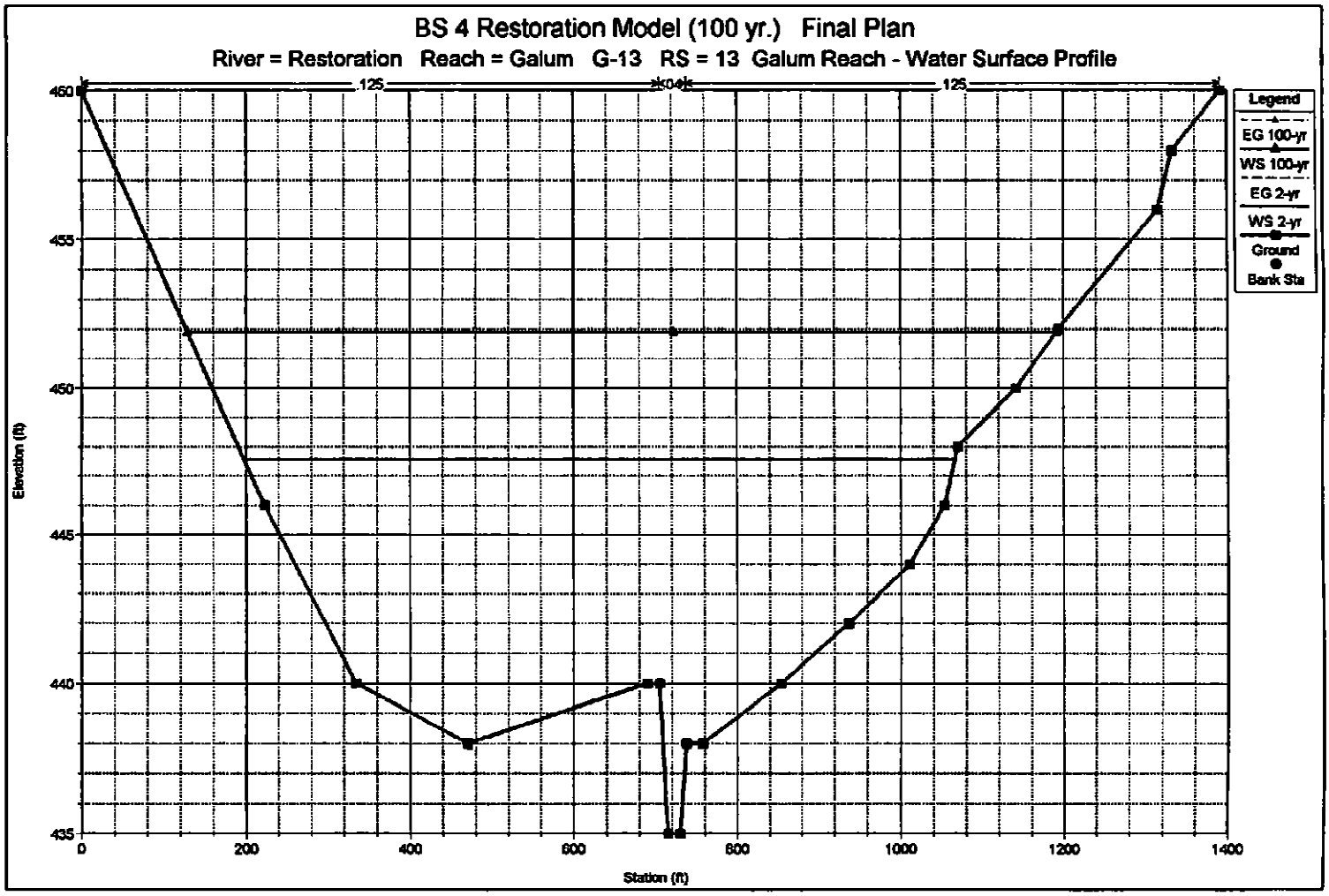

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum RS = 465.40 BR U Galum Reach - Water Surface Profile
25
065
25
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
456
454
452
450
448
446
444
442
440
438
436
0
20
40
60
80
100
120

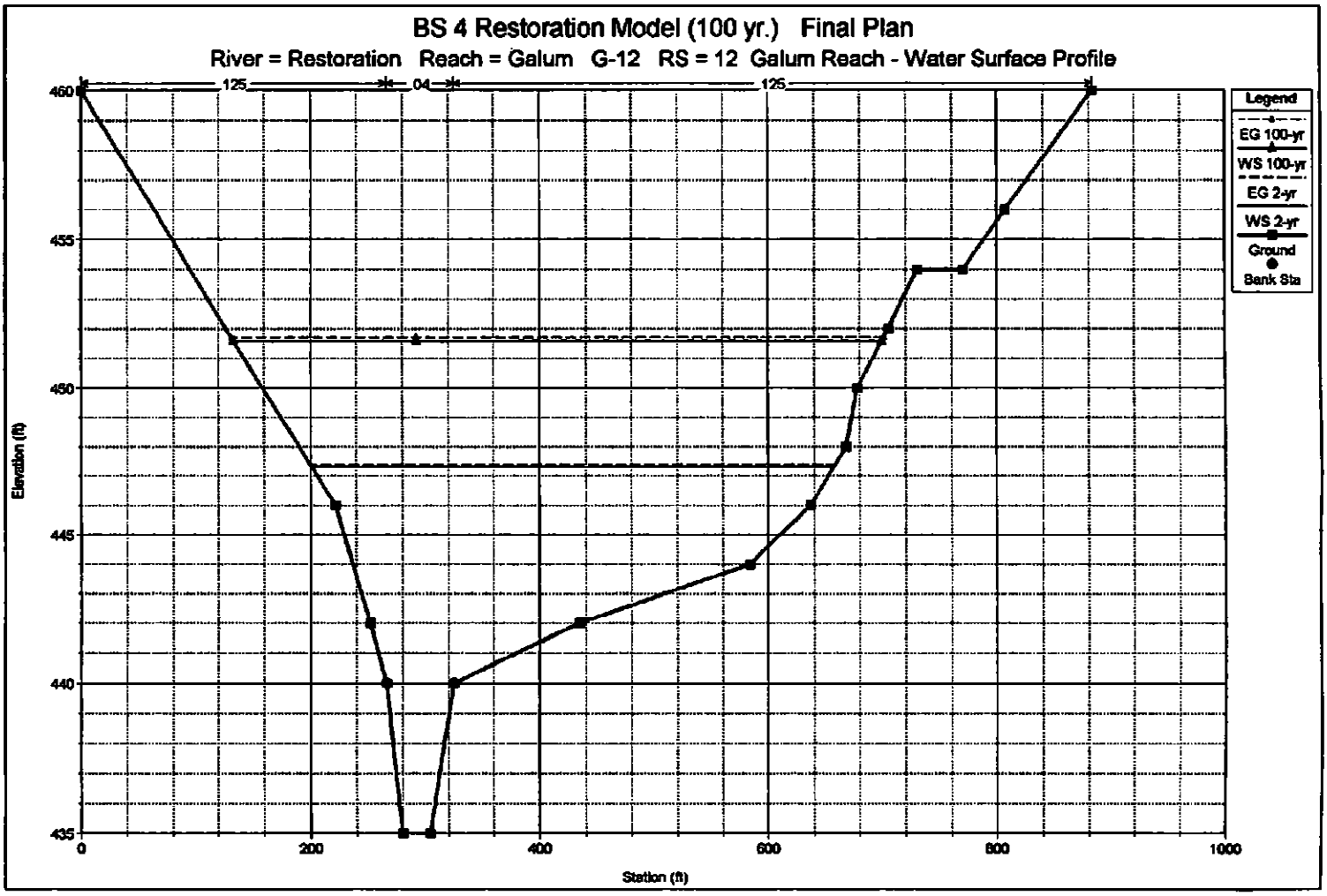

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-17 RS = 17 Galum Reach - Water Surface Profile
.125
.04
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
435
0
100
200
300
400
500
600
700
Station (ft)

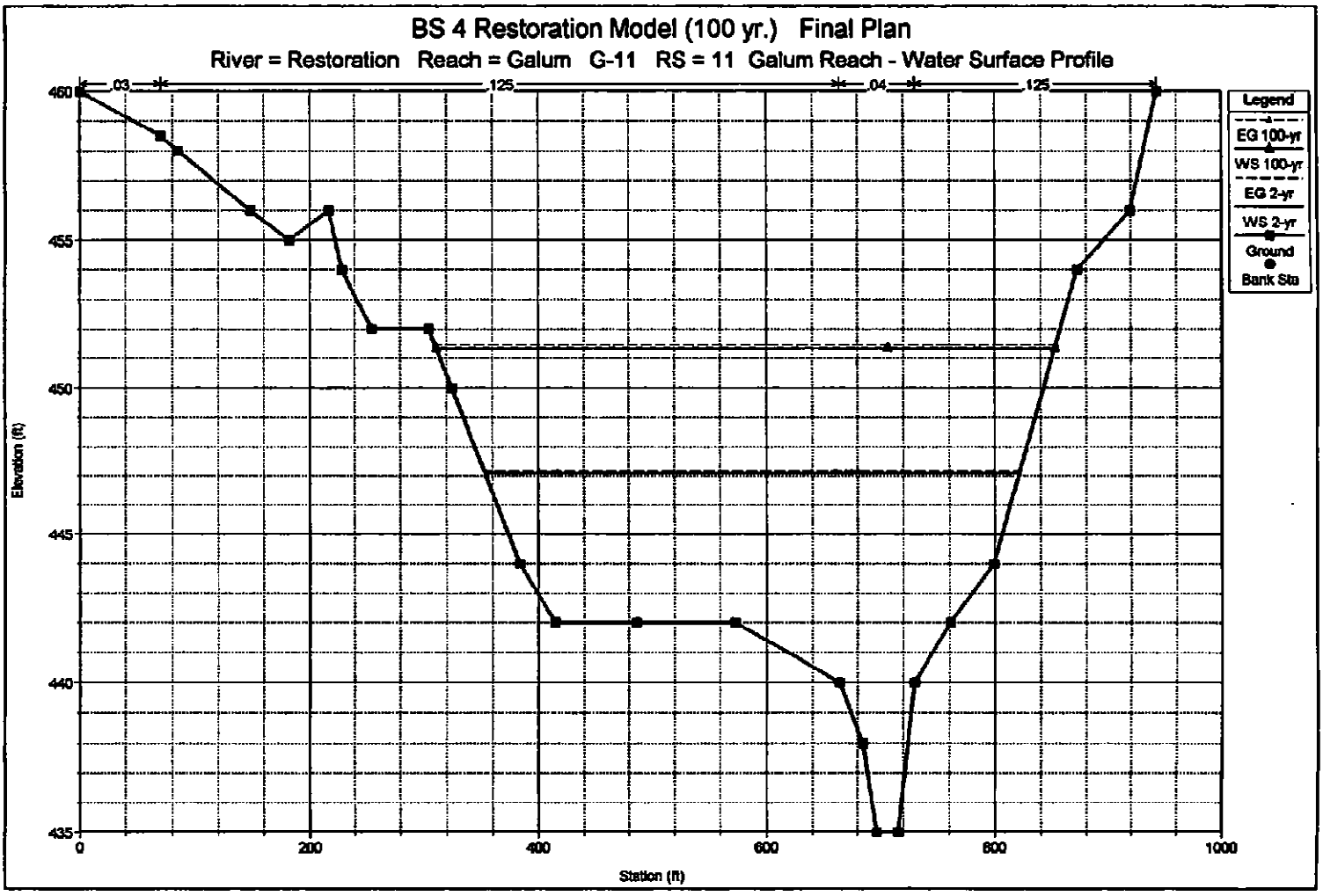

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-16 RS = 16 Galum Reach - Water Surface Profile
.125
.04
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
435
0
200
400
600
800
Station (ft)

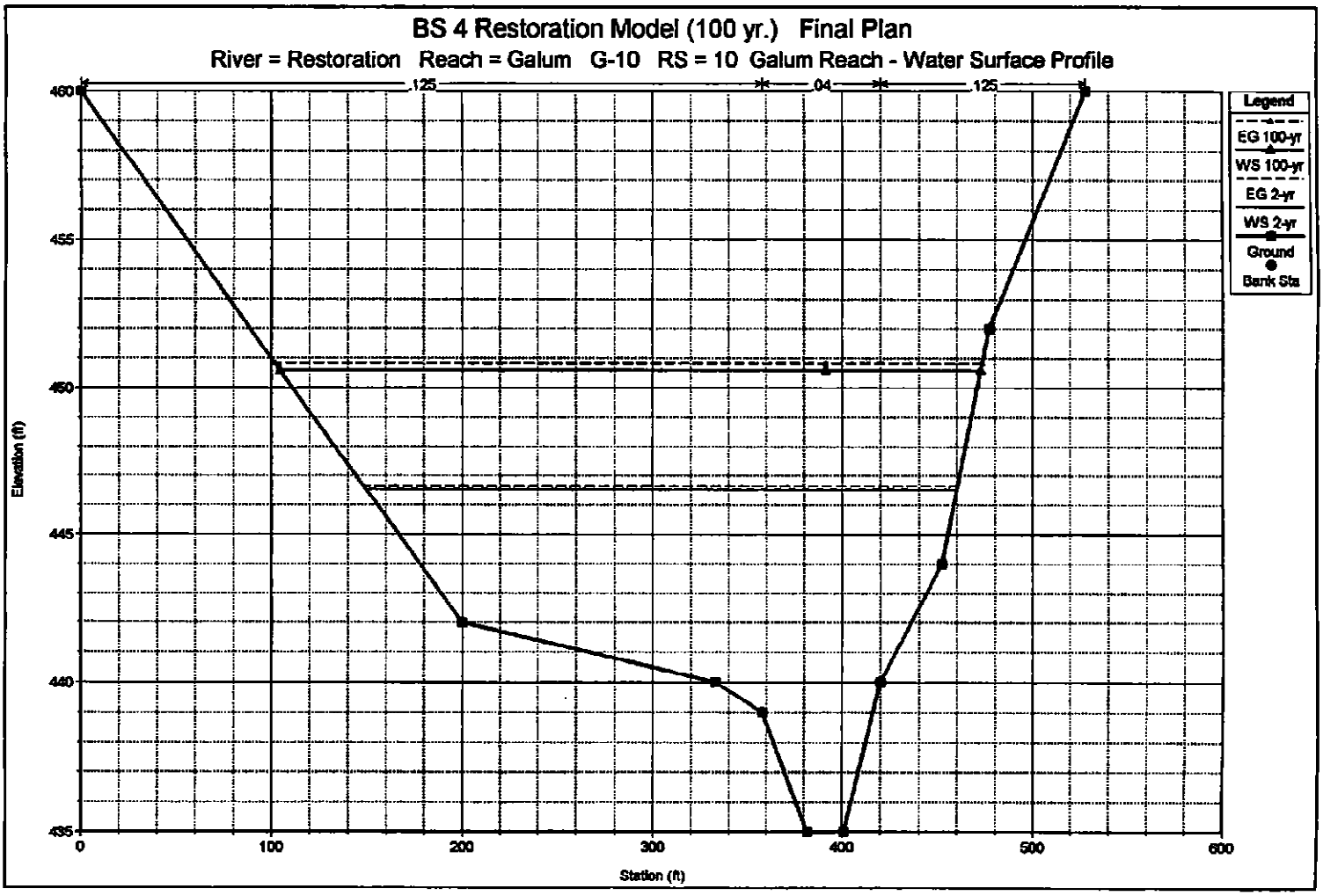

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-15 RS = 15 Galum Reach - Water Surface Profile
125
.04
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
480
470
460
450
440
430
0
200
400
600
800
1000

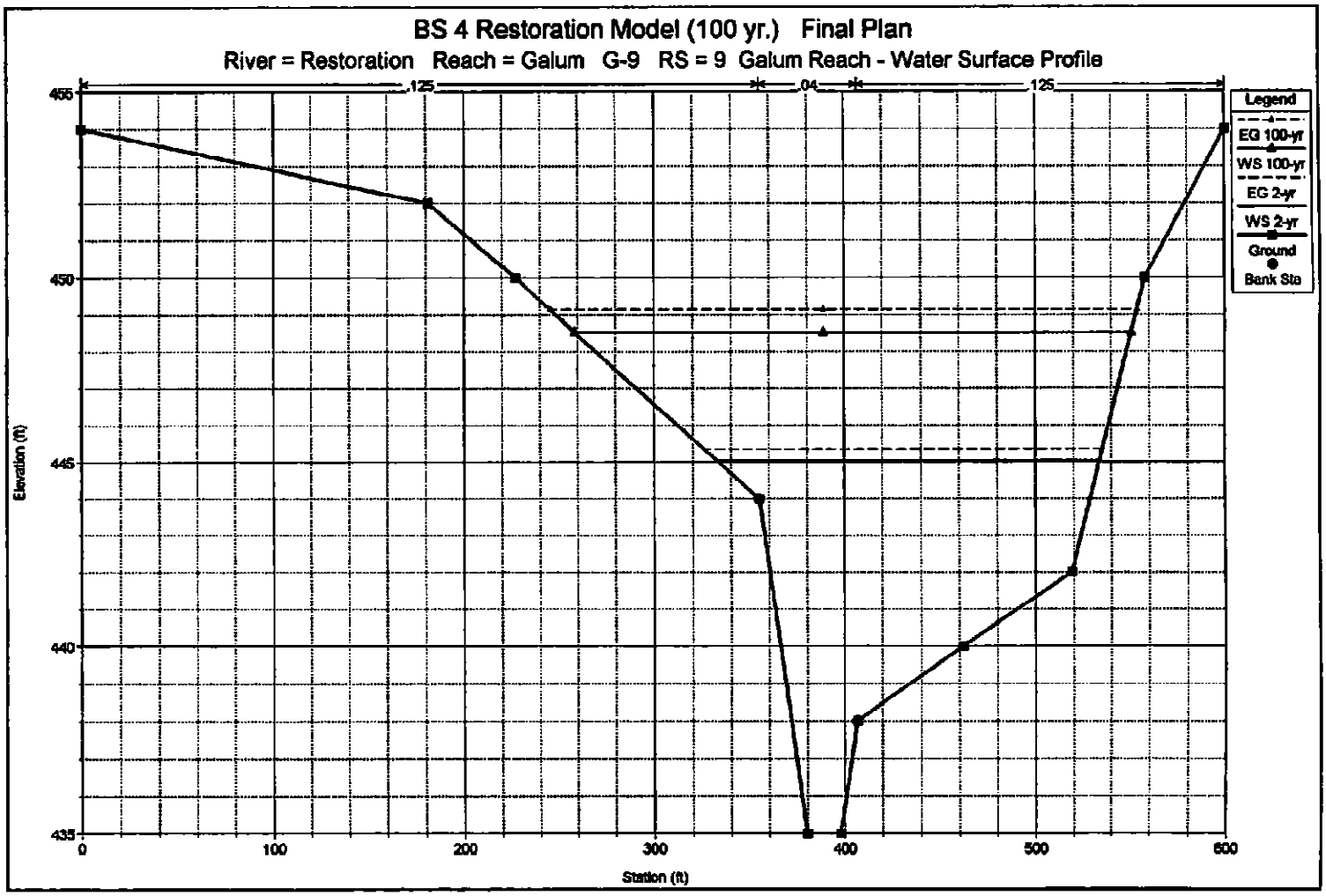

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-14 RS = 14 Galum Reach - Water Surface Profile
125
04
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
460
455
450
445
440
435
Elevation (ft)
0
200
400
600
800
1000
Station (ft)

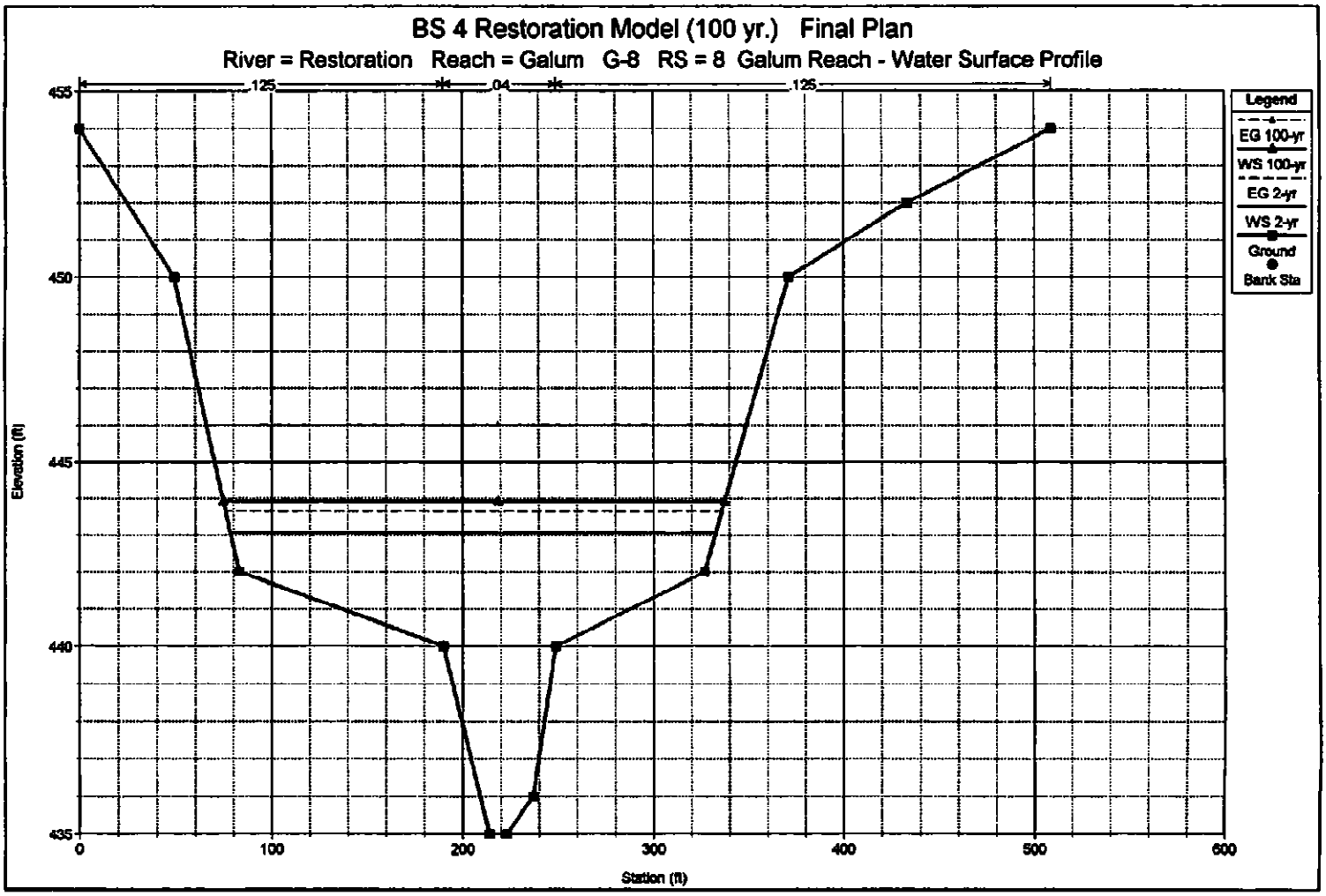

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-13 RS = 13 Galum Reach - Water Surface Profile
125
400
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
435
0
200
400
600
800
1000
1200
1400
Station (ft)

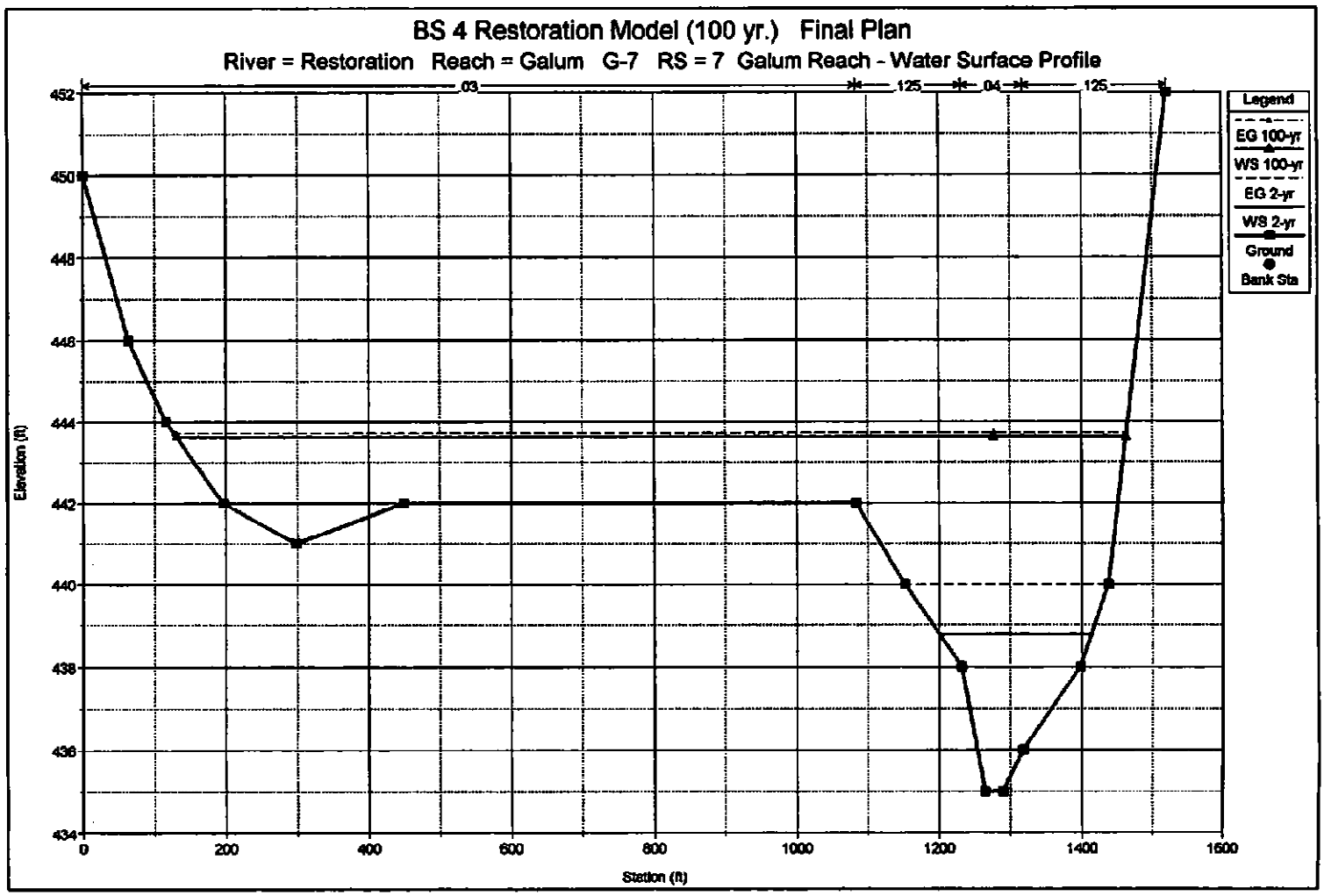

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-12 RS = 12 Galum Reach - Water Surface Profile
125
04
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
460
455
450
445
440
435
0
200
400
600
800
1000

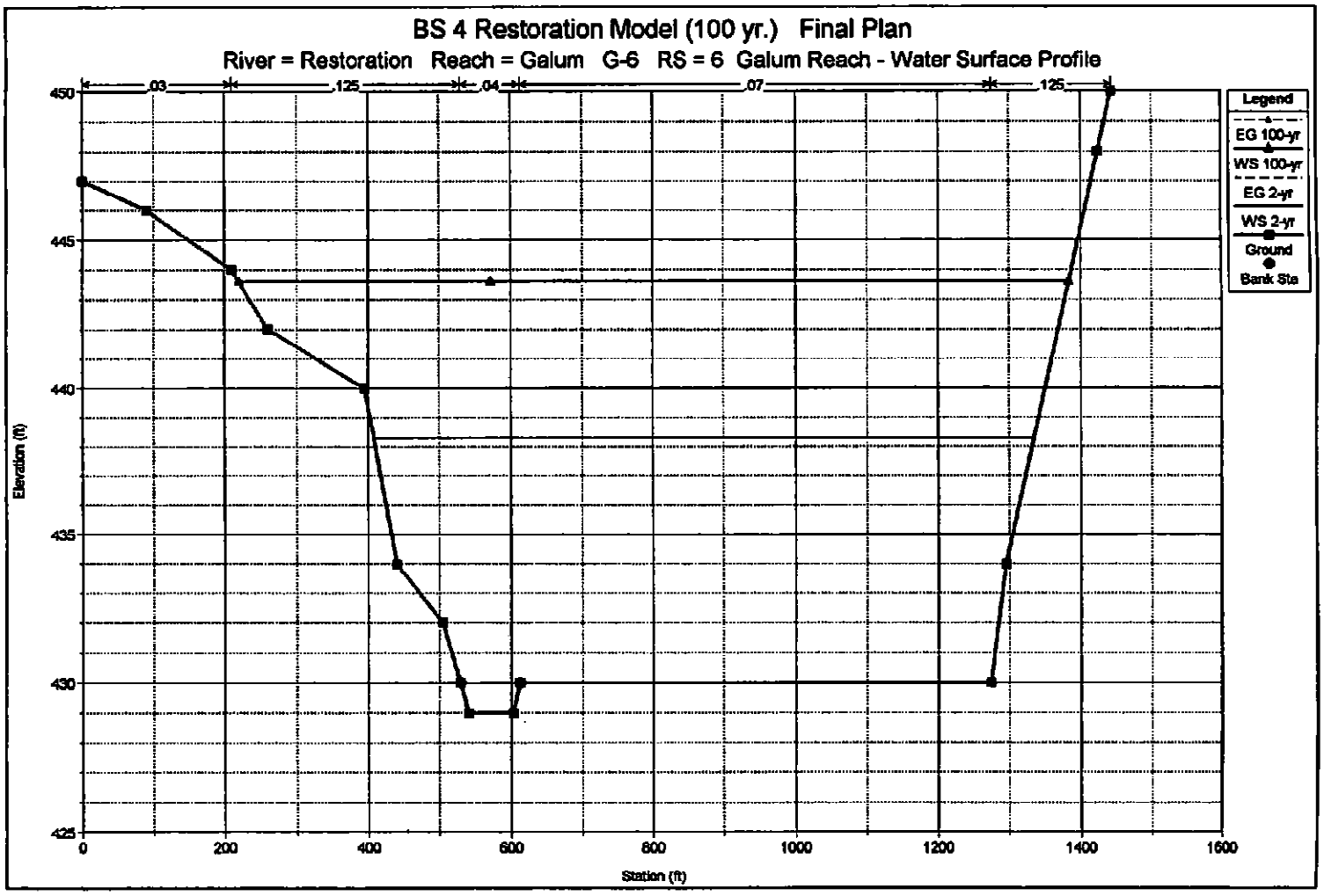

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-11 RS = 11 Galum Reach - Water Surface Profile
.03
.125
.04
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
460
455
450
445
440
435
Elevation (ft)
0
200
400
600
800
1000
Station (ft)

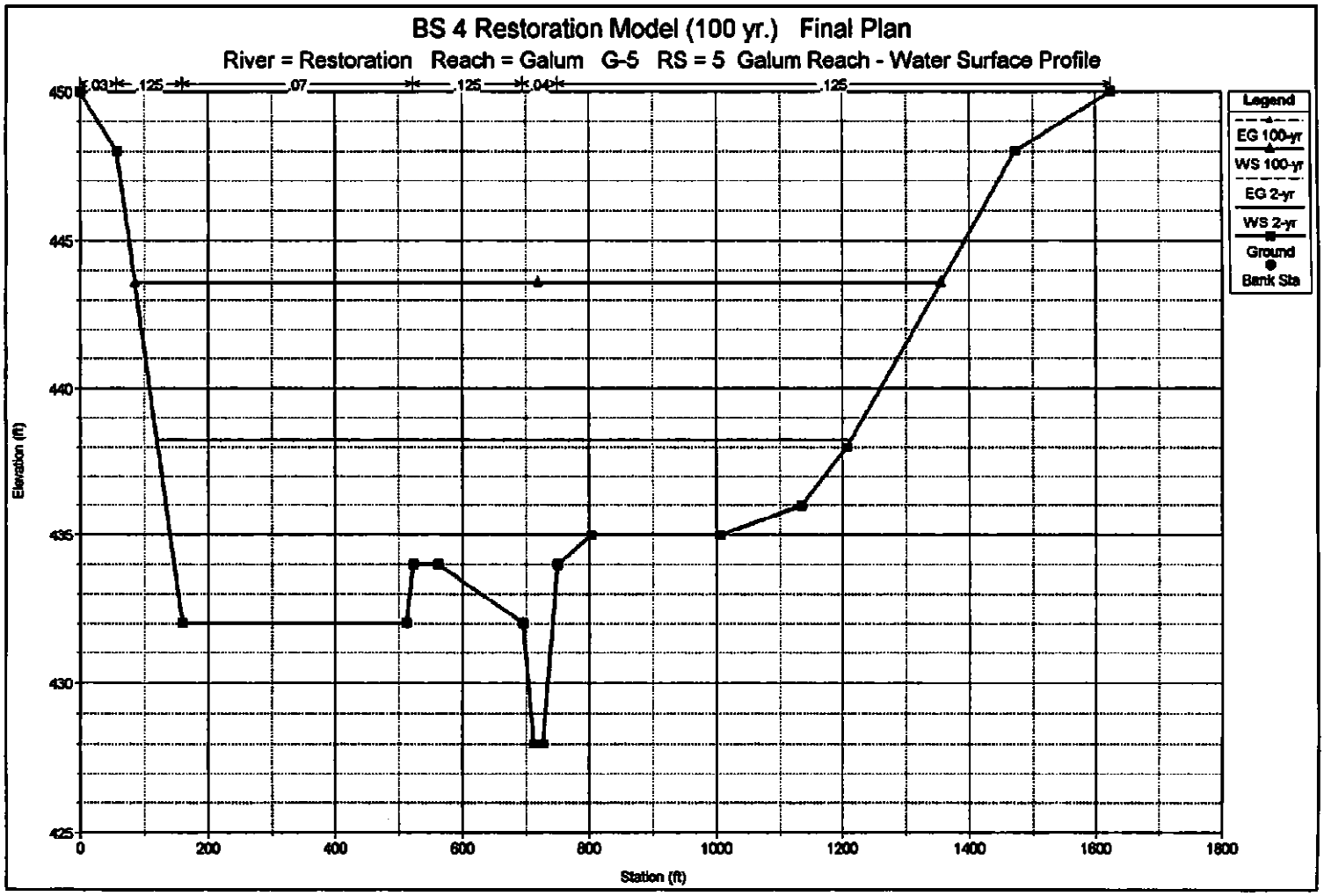

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-10 RS = 10 Galum Reach - Water Surface Profile
.125
.04
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
435
0
100
200
300
400
500
600
Station (ft)

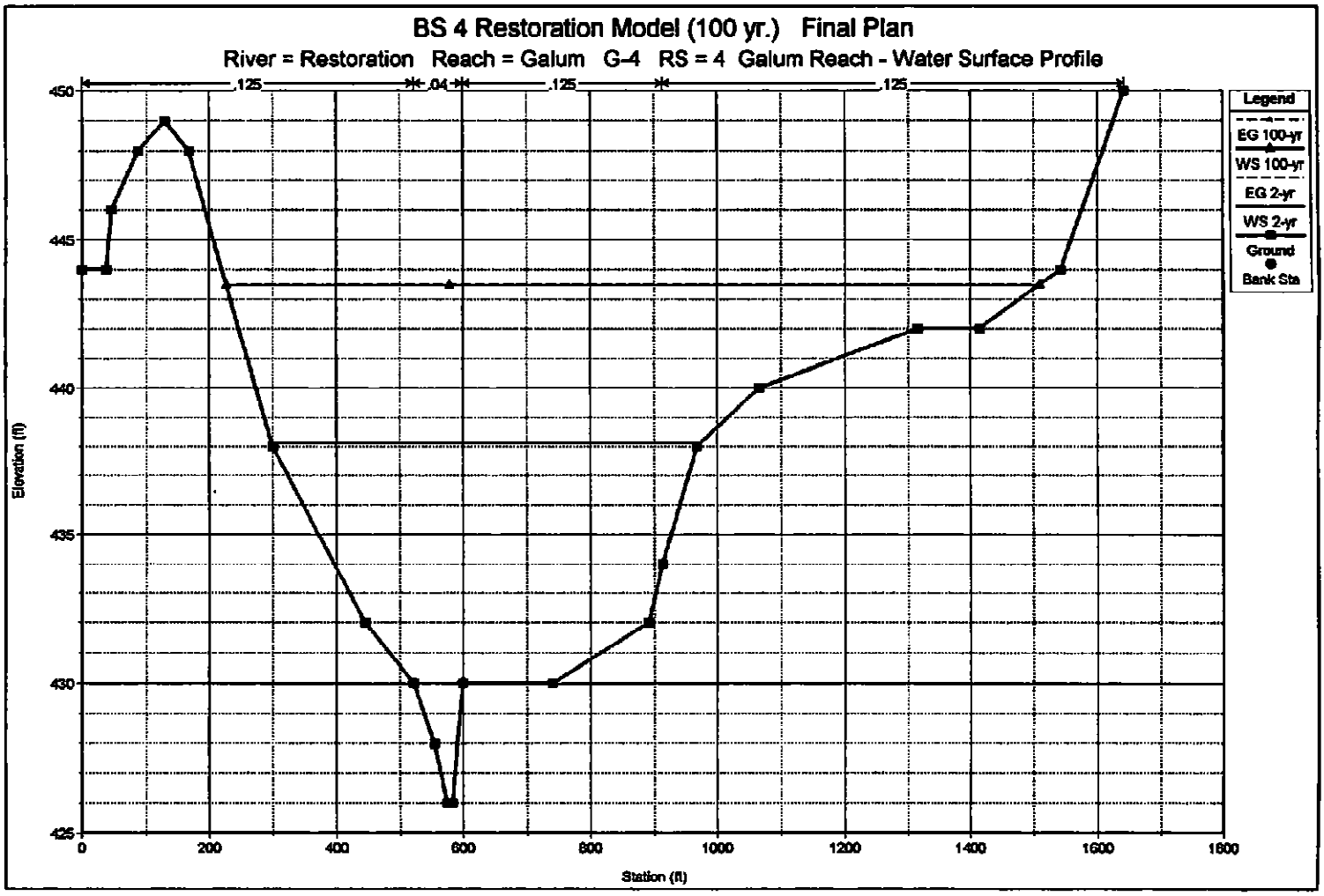

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-9 RS = 9 Galum Reach - Water Surface Profile
125
04
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
455
450
445
440
435
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)

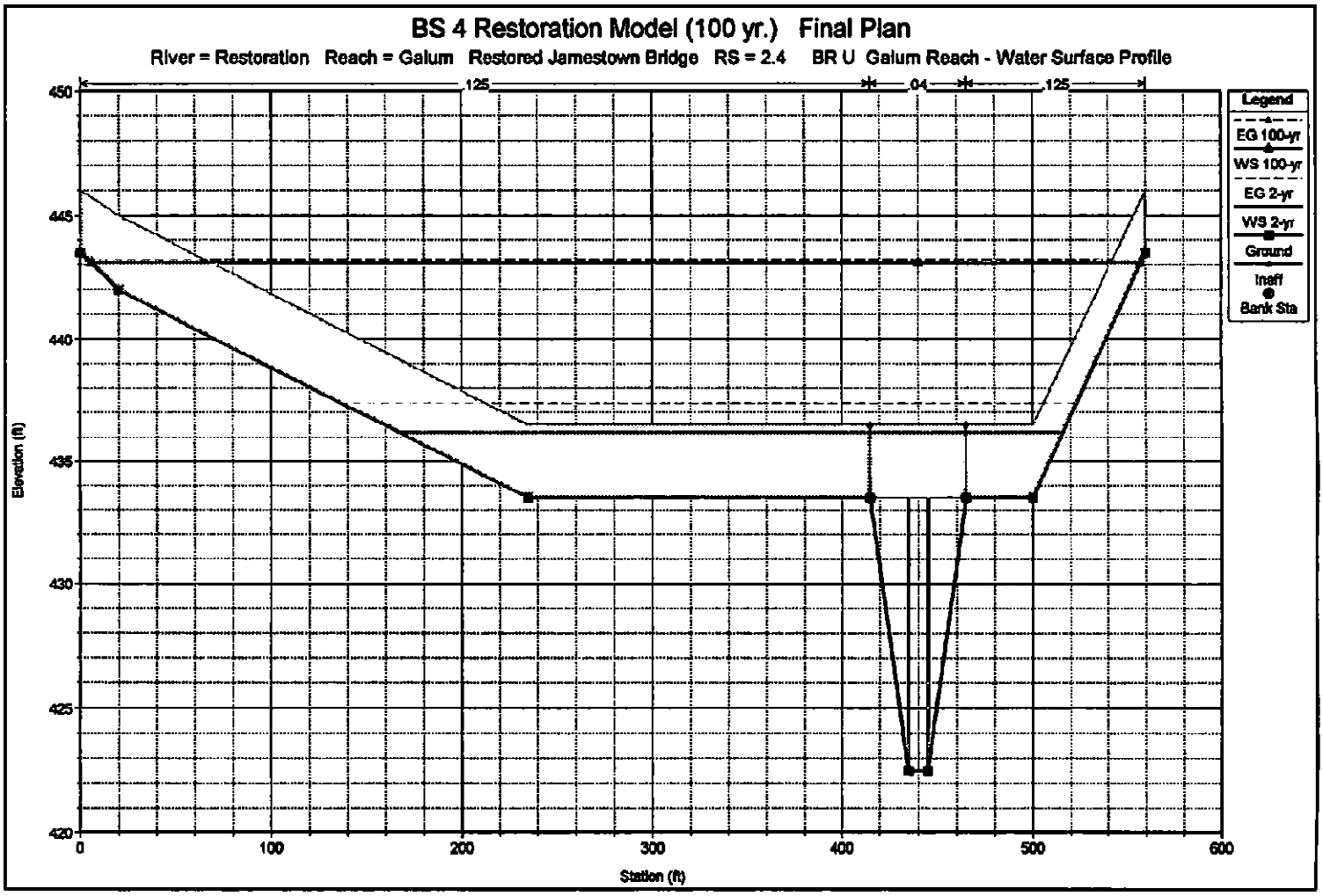

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-8 RS = 8 Galum Reach - Water Surface Profile
125
04
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
455
450
445
440
435
0
100
200
300
400
500
600
Station (ft)

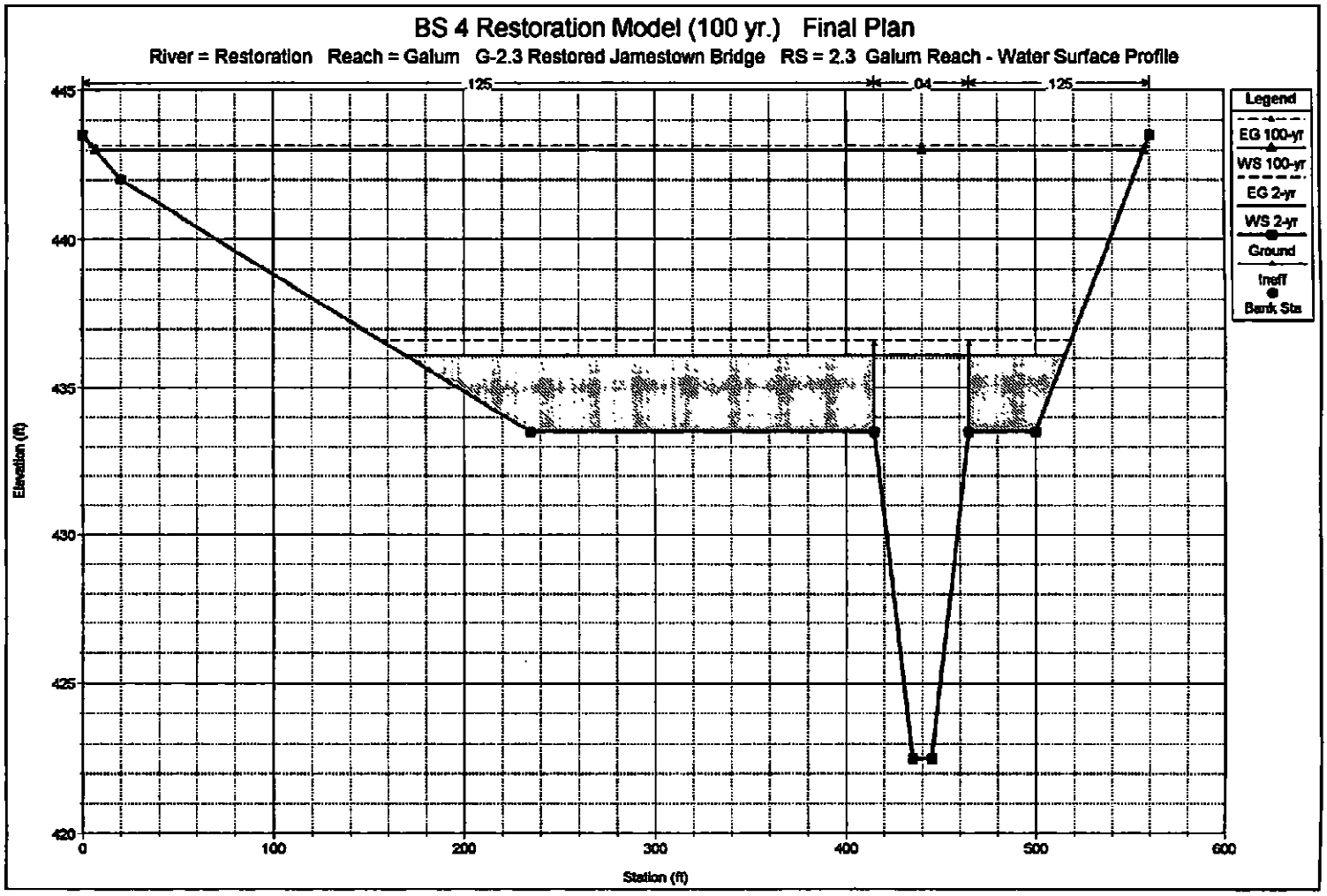

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-7 RS = 7 Galum Reach - Water Surface Profile
.03
125
.04
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
452
450
448
446
444
442
440
438
436
434
0
200
400
600
800
1000
1200
1400
1600
Station (ft)

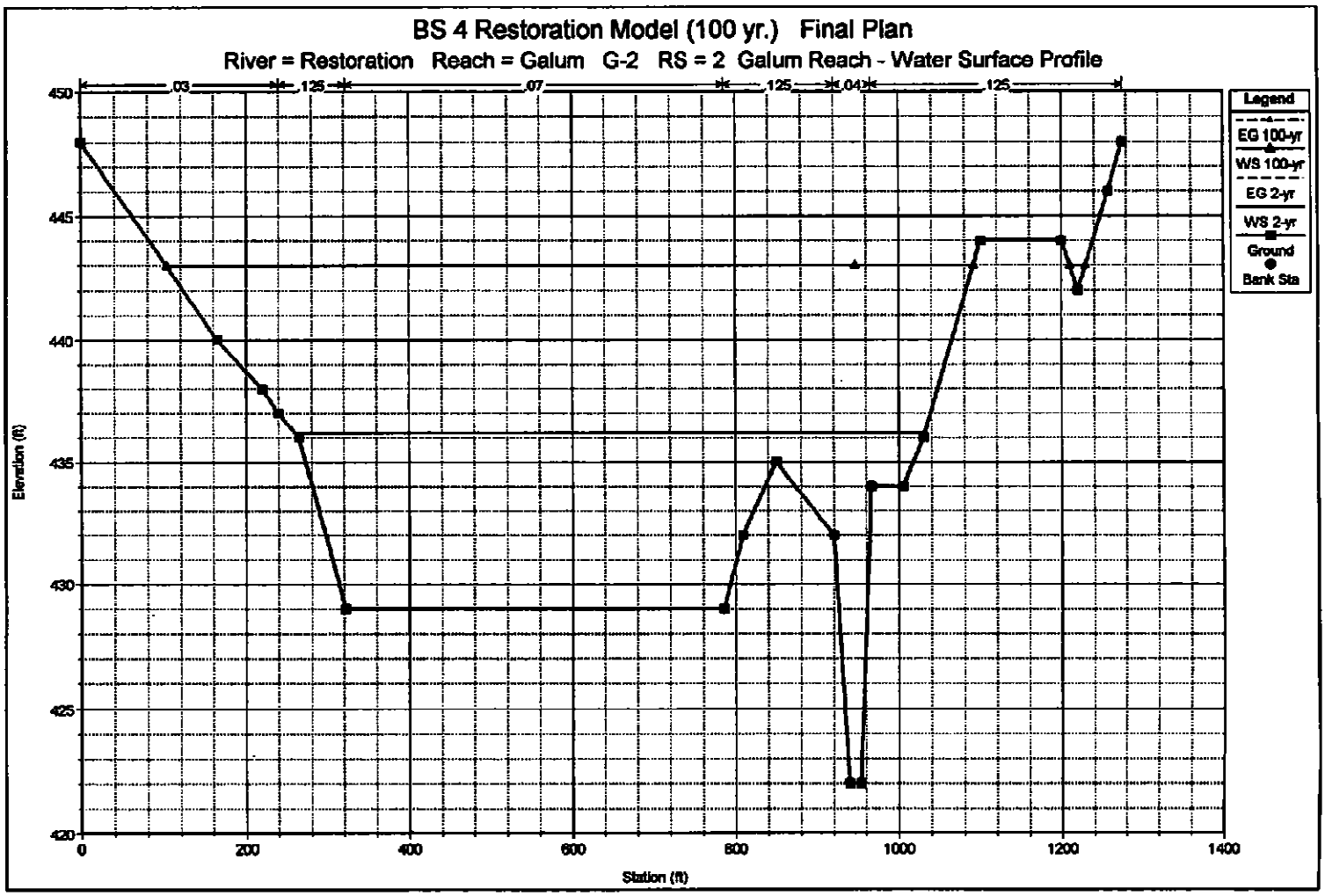

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-6 RS = 6 Galum Reach - Water Surface Profile
.03
.125
.04
.07
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
0
200
400
600
800
1000
1200
1400
1600
Station (ft)

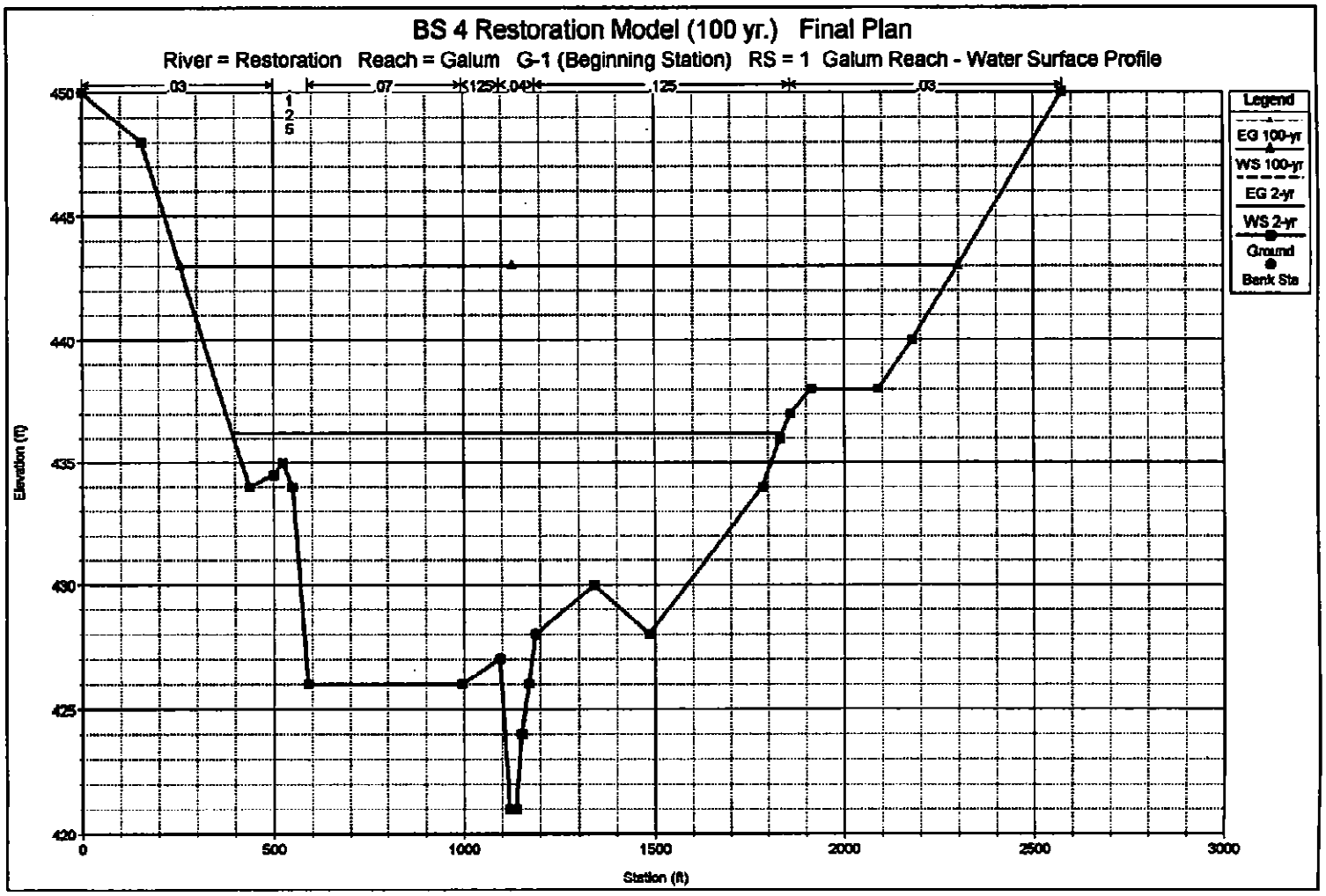

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-5 RS = 5 Galum Reach - Water Surface Profile
.03
.125
.07
.125
.04
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)


BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-4 RS = 4 Galum Reach - Water Surface Profile
.125
.04
.125
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)

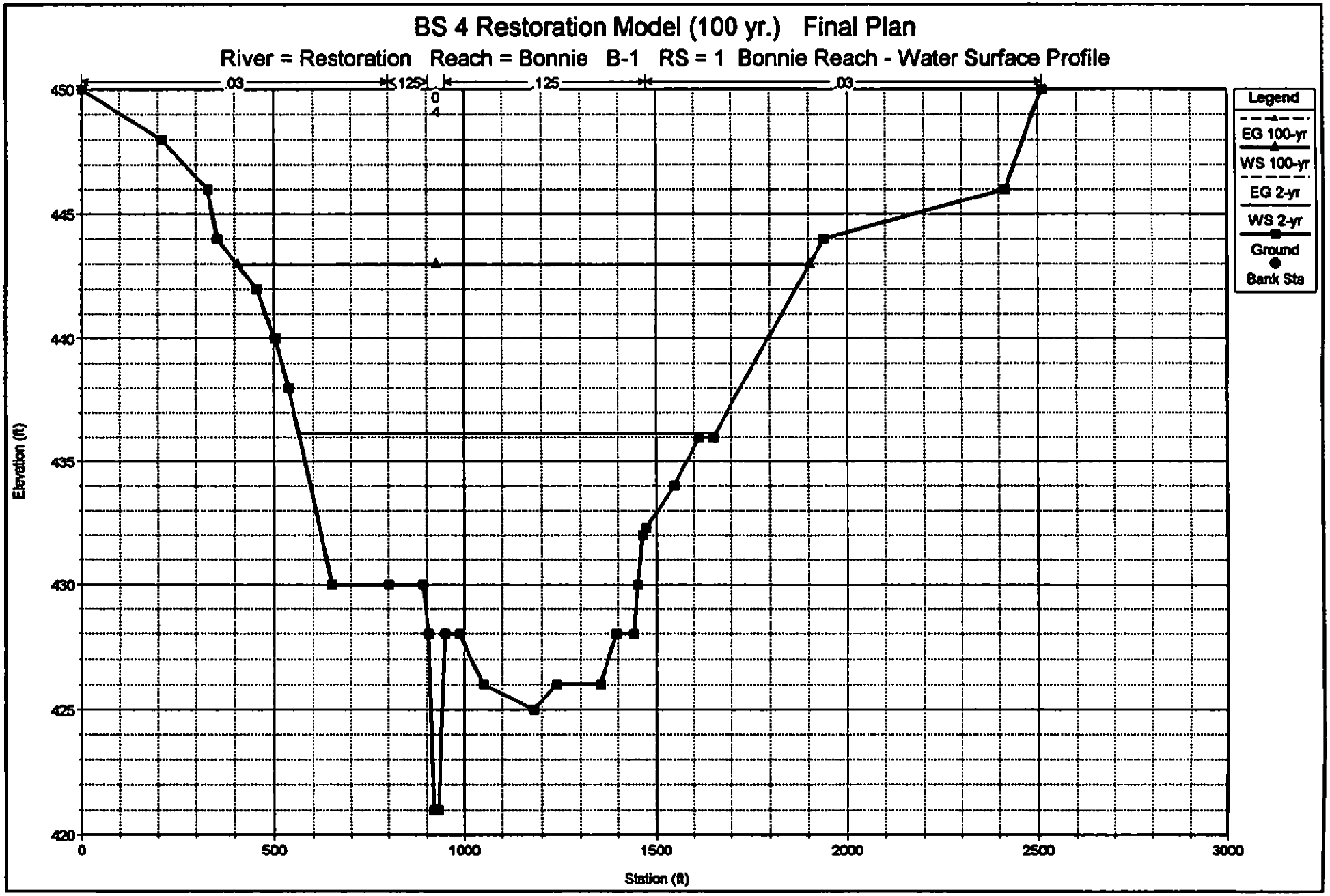

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum Restored Jamestown Bridge RS = 2.4 BR U Galum Reach - Water Surface Profile
.125
.04
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
450
445
440
435
430
425
420
0
100
200
300
400
500
600
Station (ft)

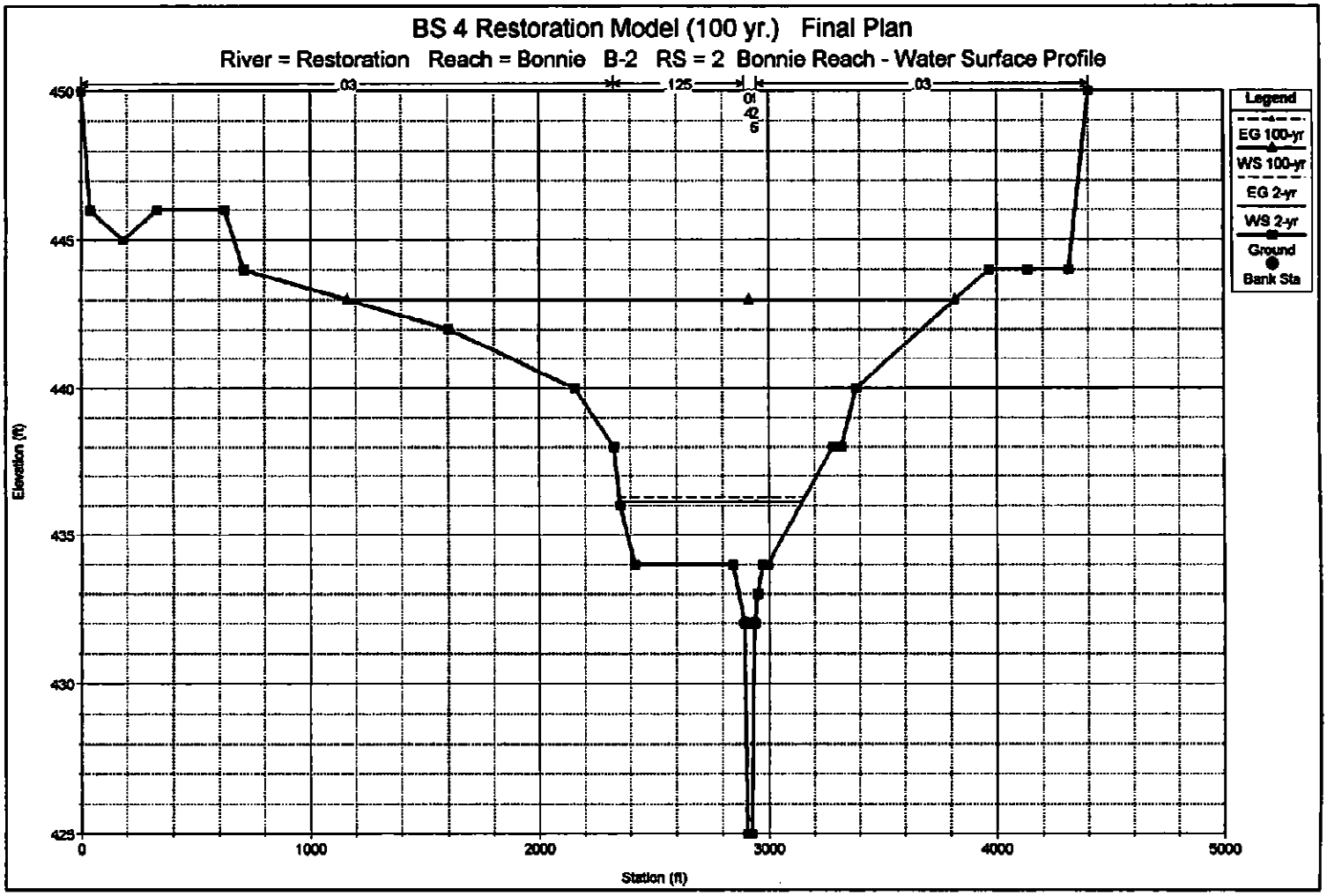

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-2.3 Restored Jamestown Bridge RS = 2.3 Galum Reach - Water Surface Profile
125
04
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
445
440
435
430
425
420
0
100
200
300
400
500
600
Station (ft)

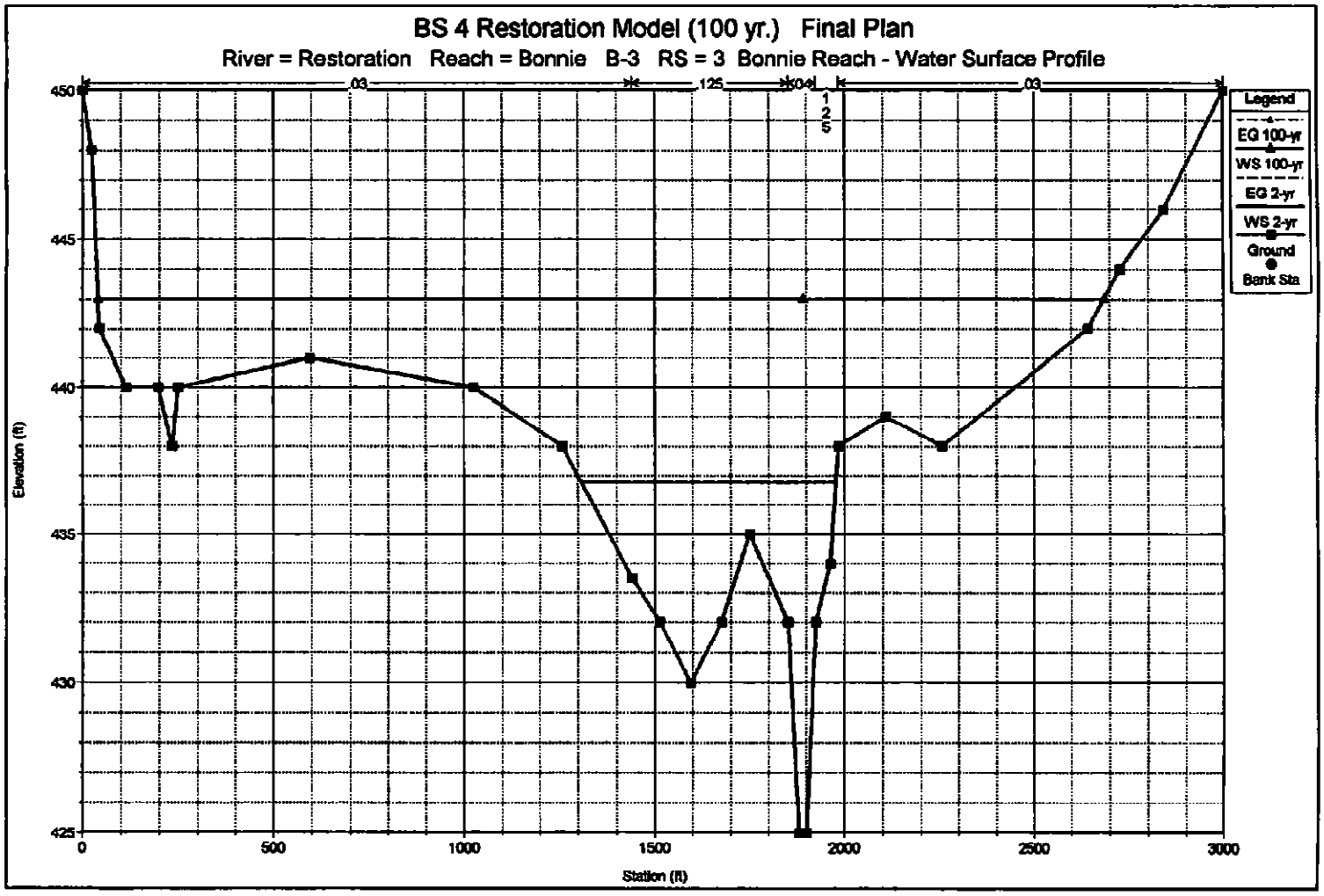

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-2 RS = 2 Galum Reach - Water Surface Profile
.03
.125
.07
.125
.04
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
420
0
200
400
600
800
1000
1200
1400
Station (ft)

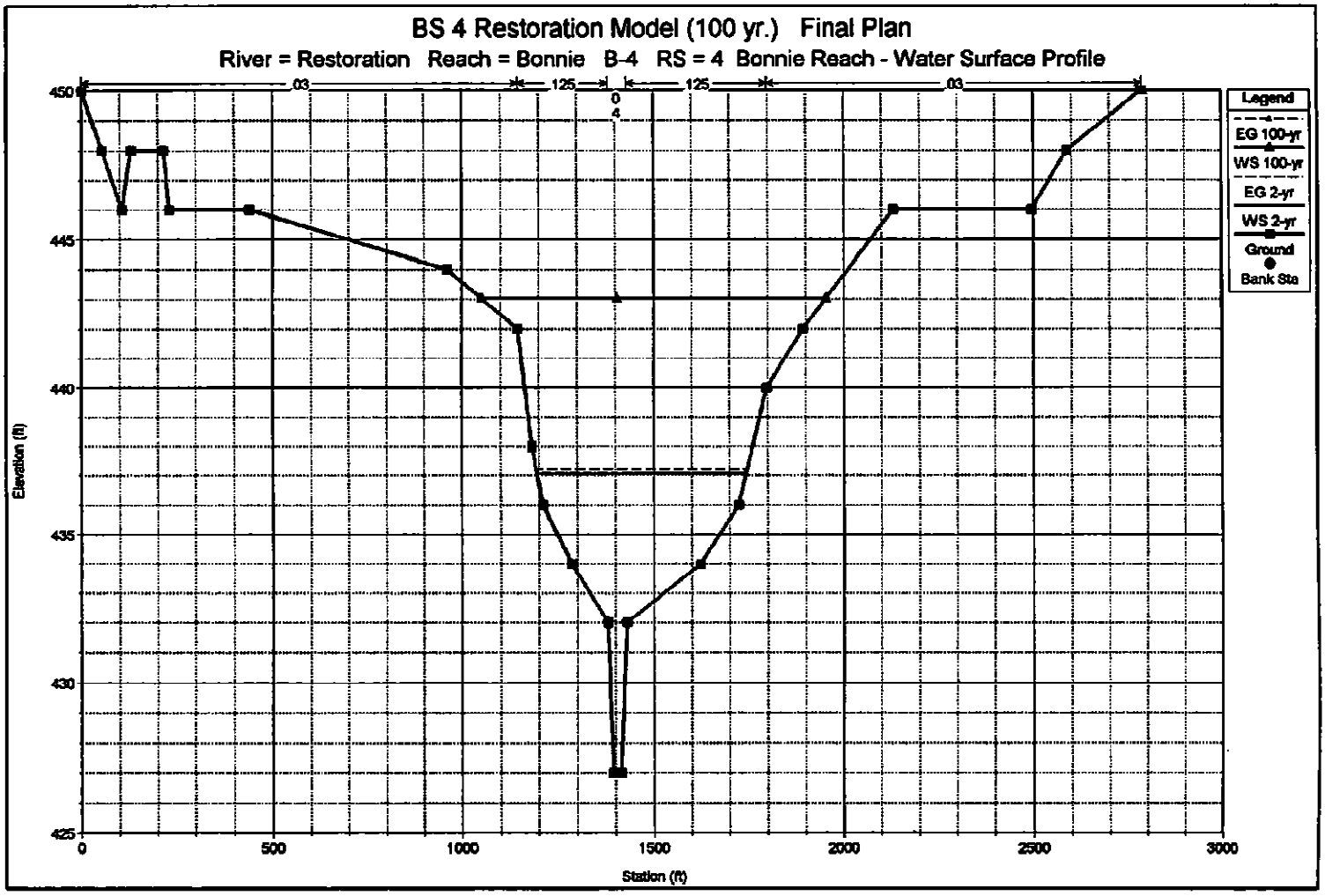

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Galum G-1 (Beginning Station) RS = 1 Galum Reach - Water Surface Profile
.03
.07
.125
.04
.125
.03
1
2
5
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
420
0
500
1000
1500
2000
2500
3000
Station (ft)

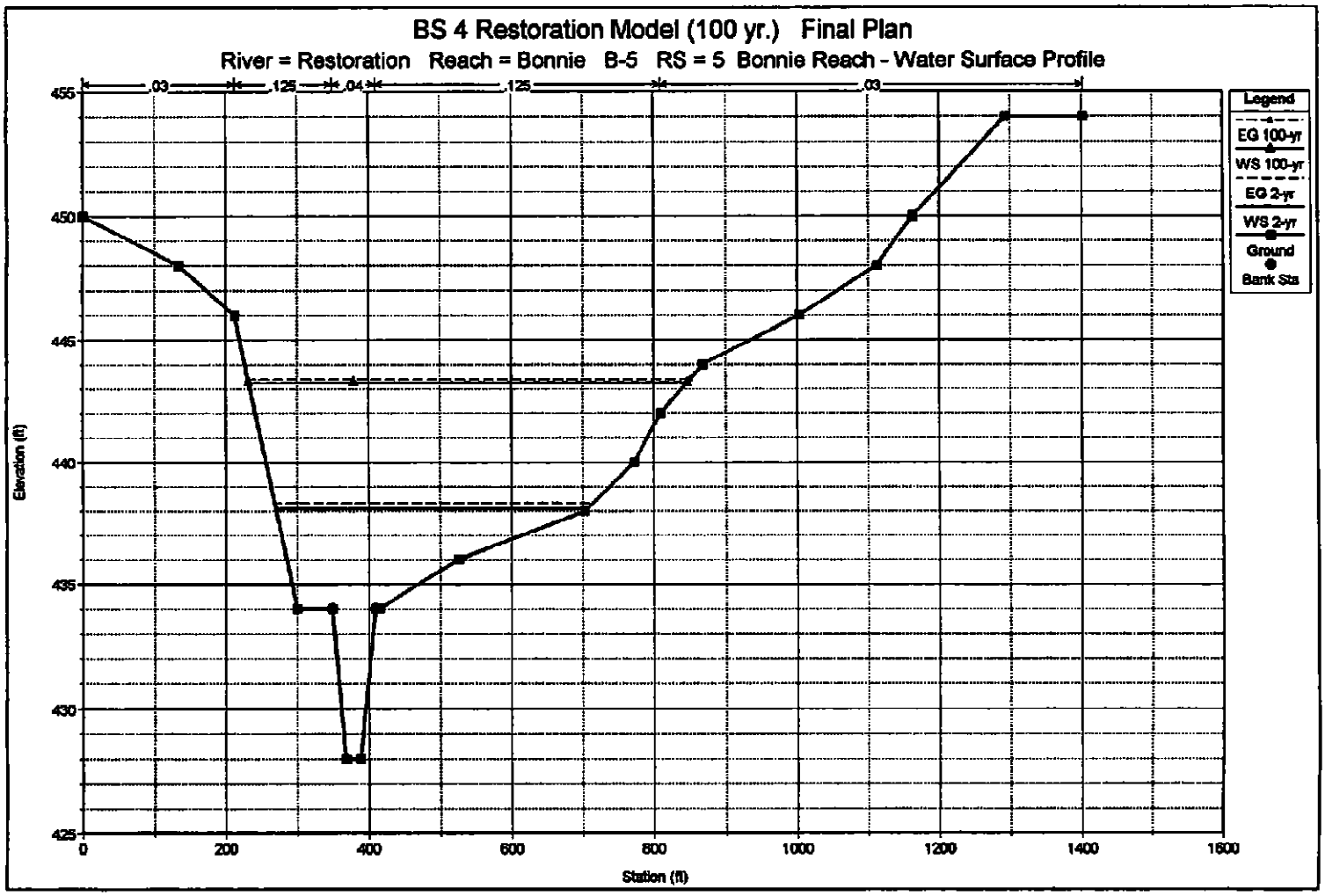
Bonnie Creek Reach

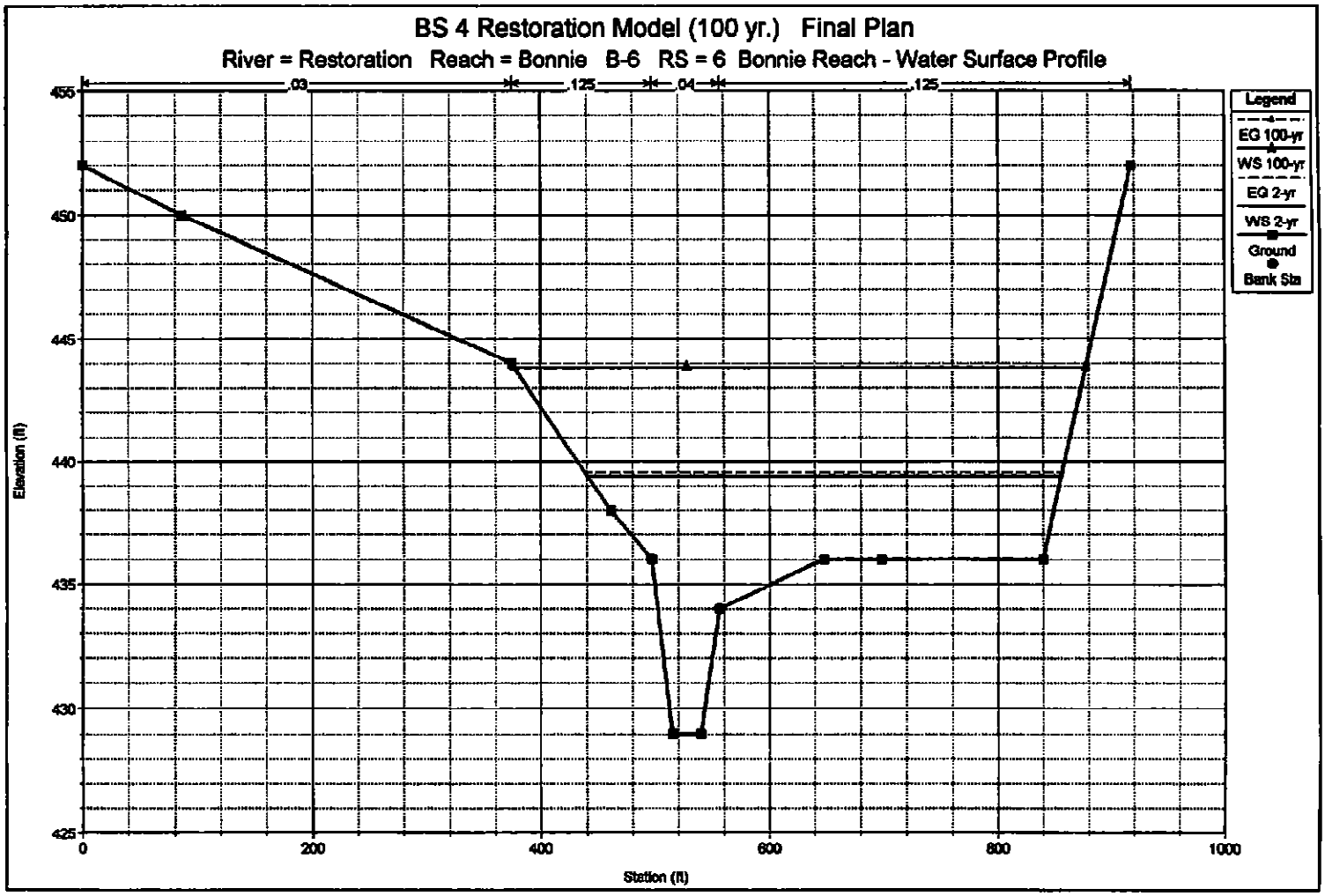

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-1 RS = 1 Bonnie Reach - Water Surface Profile
.03
.125
0
.4
.125
.03
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
420
0
500
1000
1500
2000
2500
3000
Station (ft)

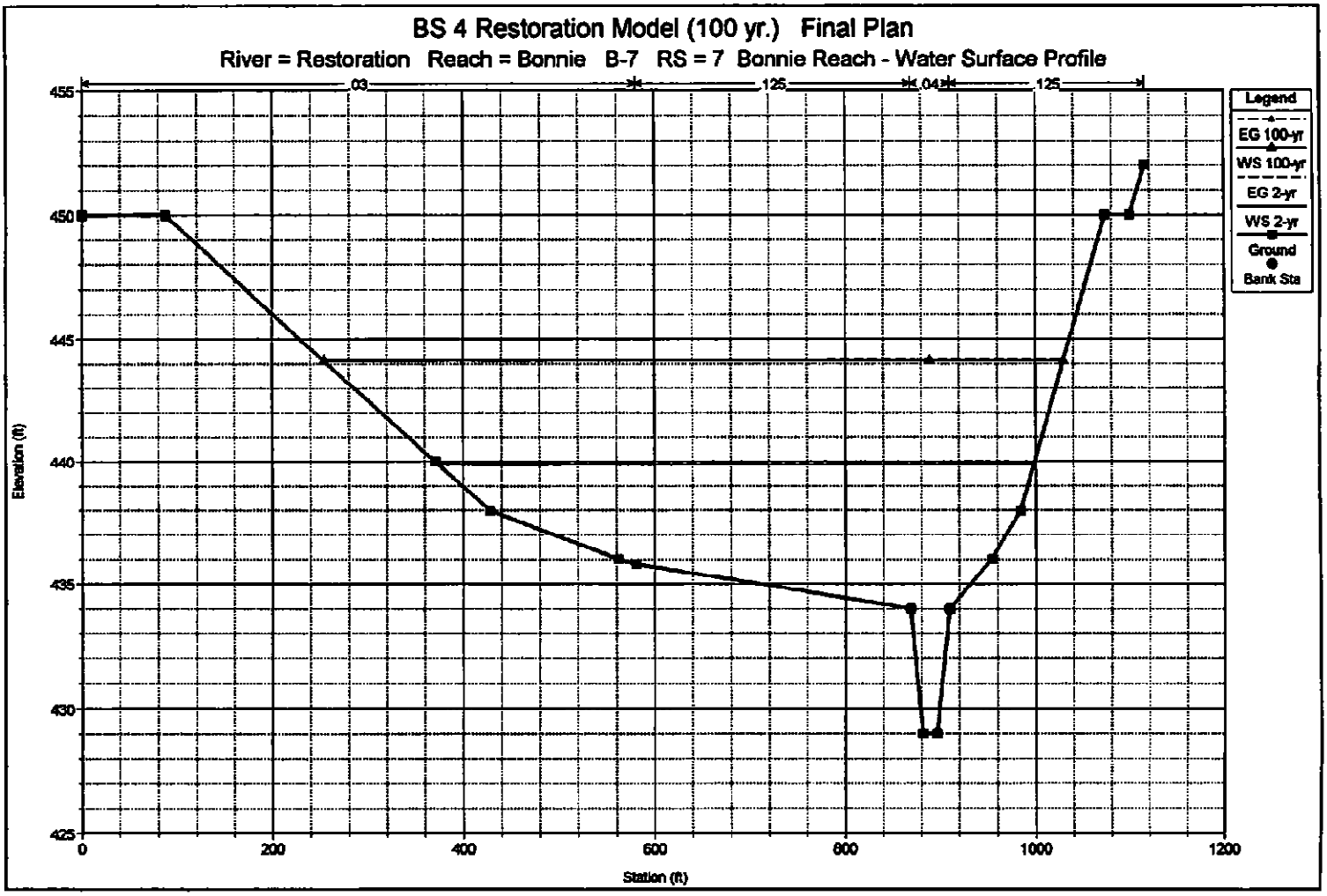

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-2 RS = 2 Bonnie Reach - Water Surface Profile
.03
.125
.01
.42
.5
.03
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
0
1000
2000
3000
4000
5000
Station (ft)

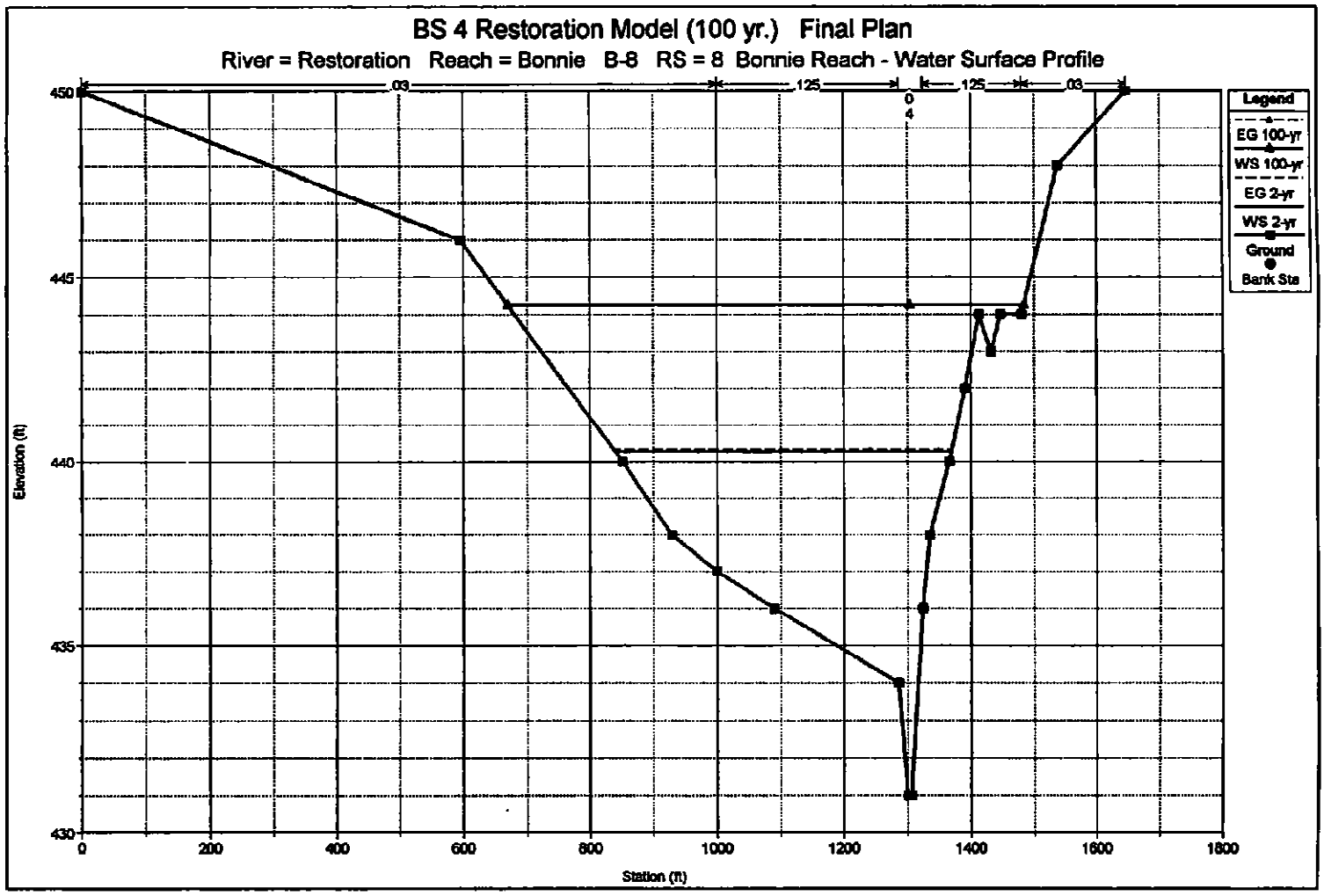

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-3 RS = 3 Bonnie Reach - Water Surface Profile
.03
.125
.04
.03
1
2
5
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
0
500
1000
1500
2000
2500
3000
Station (ft)

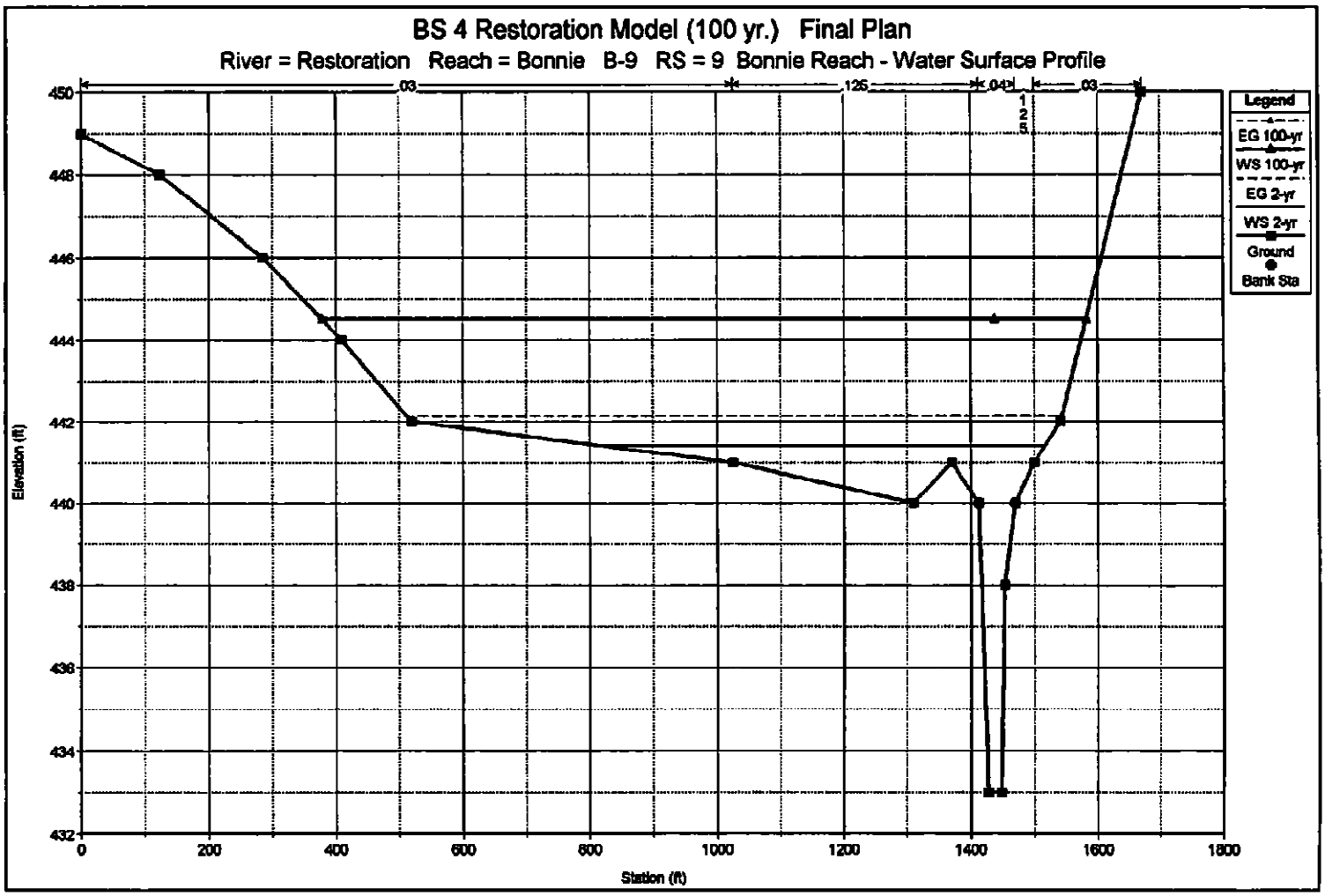

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-4 RS = 4 Bonnie Reach - Water Surface Profile
03
125
0
4
125
03
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
0
500
1000
1500
2000
2500
3000
Station (ft)

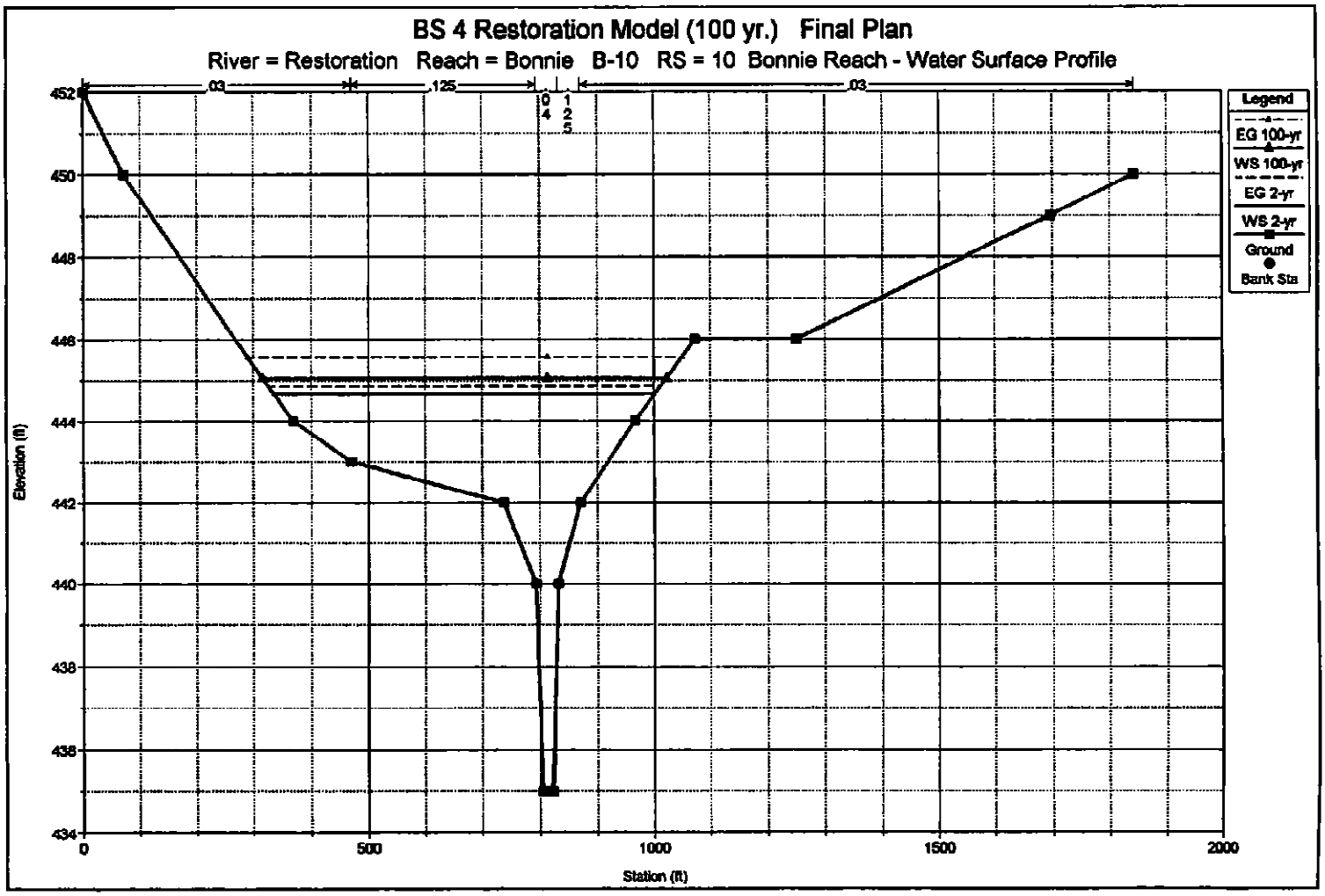

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-5 RS = 5 Bonnie Reach - Water Surface Profile
.03
.125
.04
.125
.03
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
455
450
445
440
435
430
425
0
200
400
600
800
1000
1200
1400
1600
Station (ft)

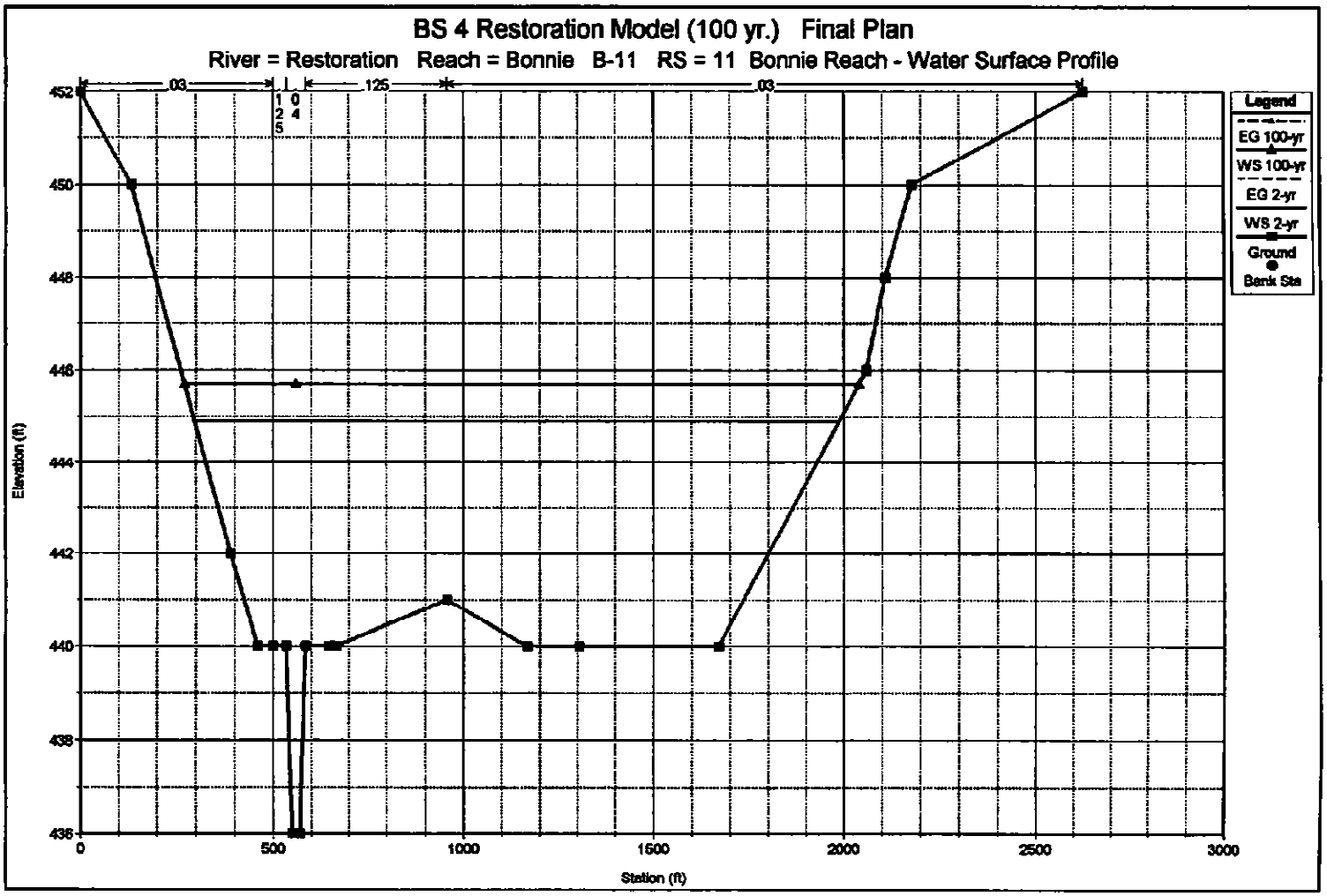

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-6 RS = 6 Bonnie Reach - Water Surface Profile
.03
.125
.04
.125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
455
450
445
440
435
430
425
0
200
400
600
800
1000
Station (ft)

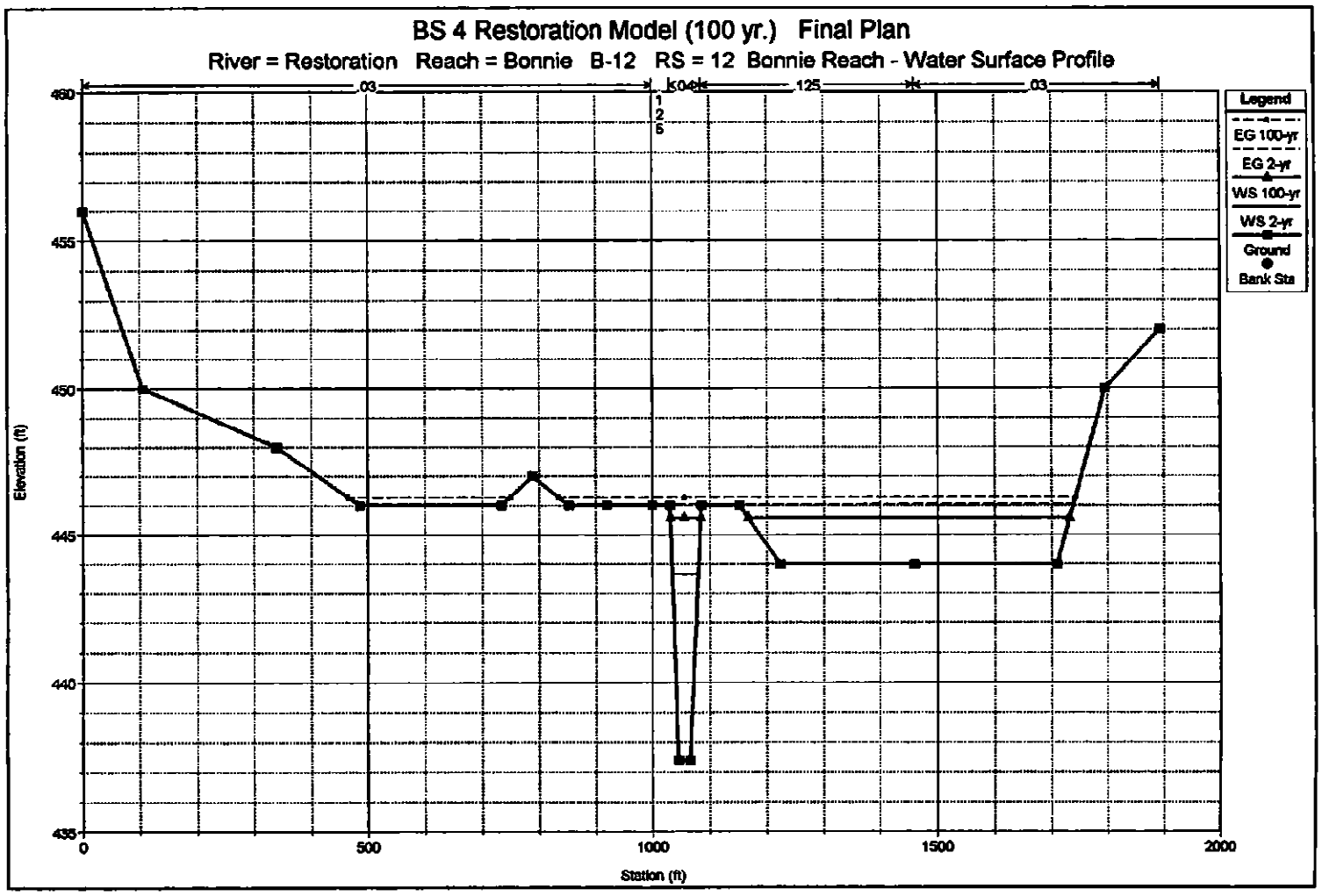

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-7 RS = 7 Bonnie Reach - Water Surface Profile
03
125
04
125
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
455
450
445
440
435
430
425
0
200
400
600
800
1000
1200
Station (ft)

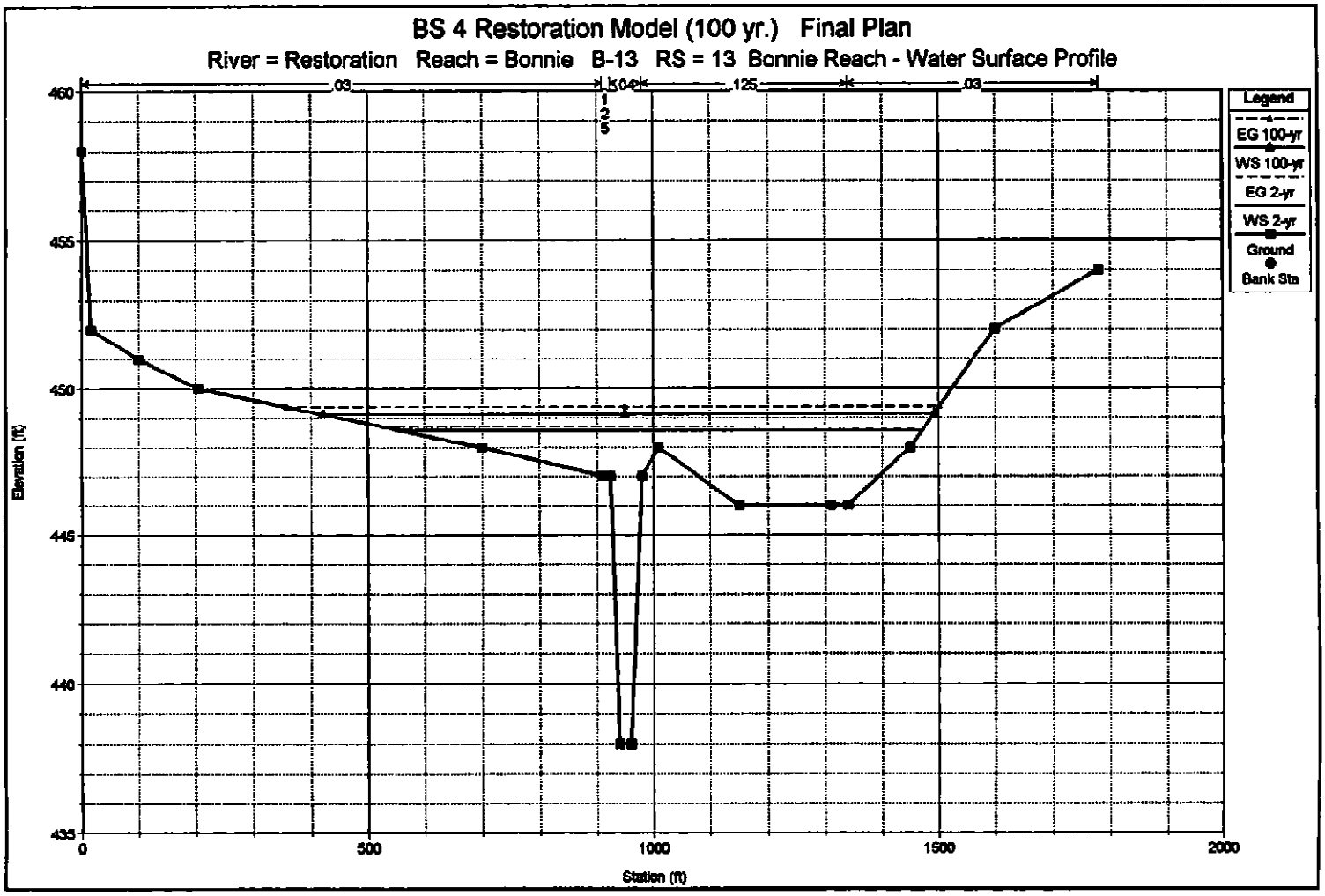

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-8 RS = 8 Bonnie Reach - Water Surface Profile
.03
.125
0
4
.125
.03
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)

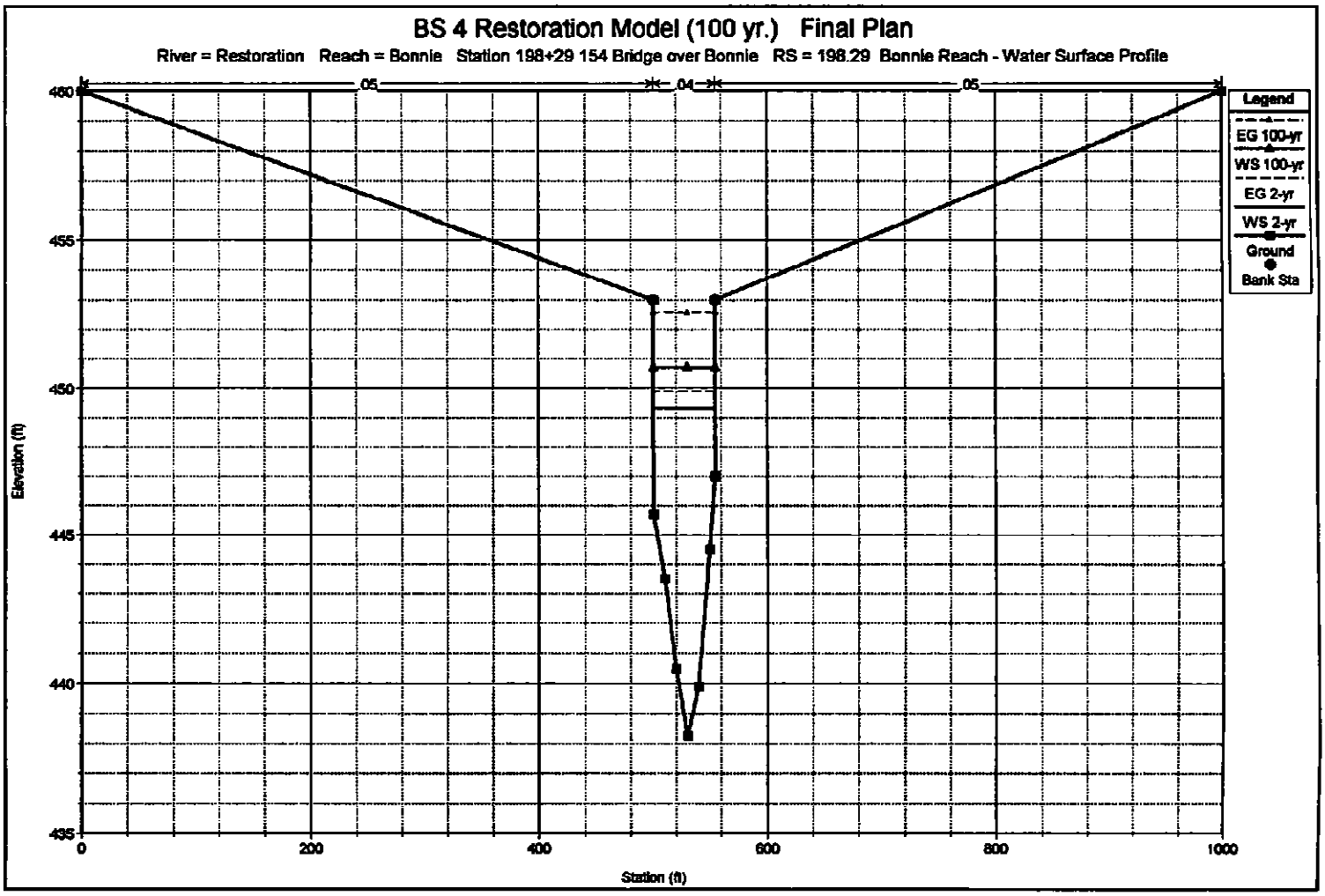

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-9 RS = 9 Bonnie Reach - Water Surface Profile
.03
.126
.04
.03
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
450
448
446
444
442
440
438
436
434
432
0
200
400
600
800
1000
1200
1400
1600
1800

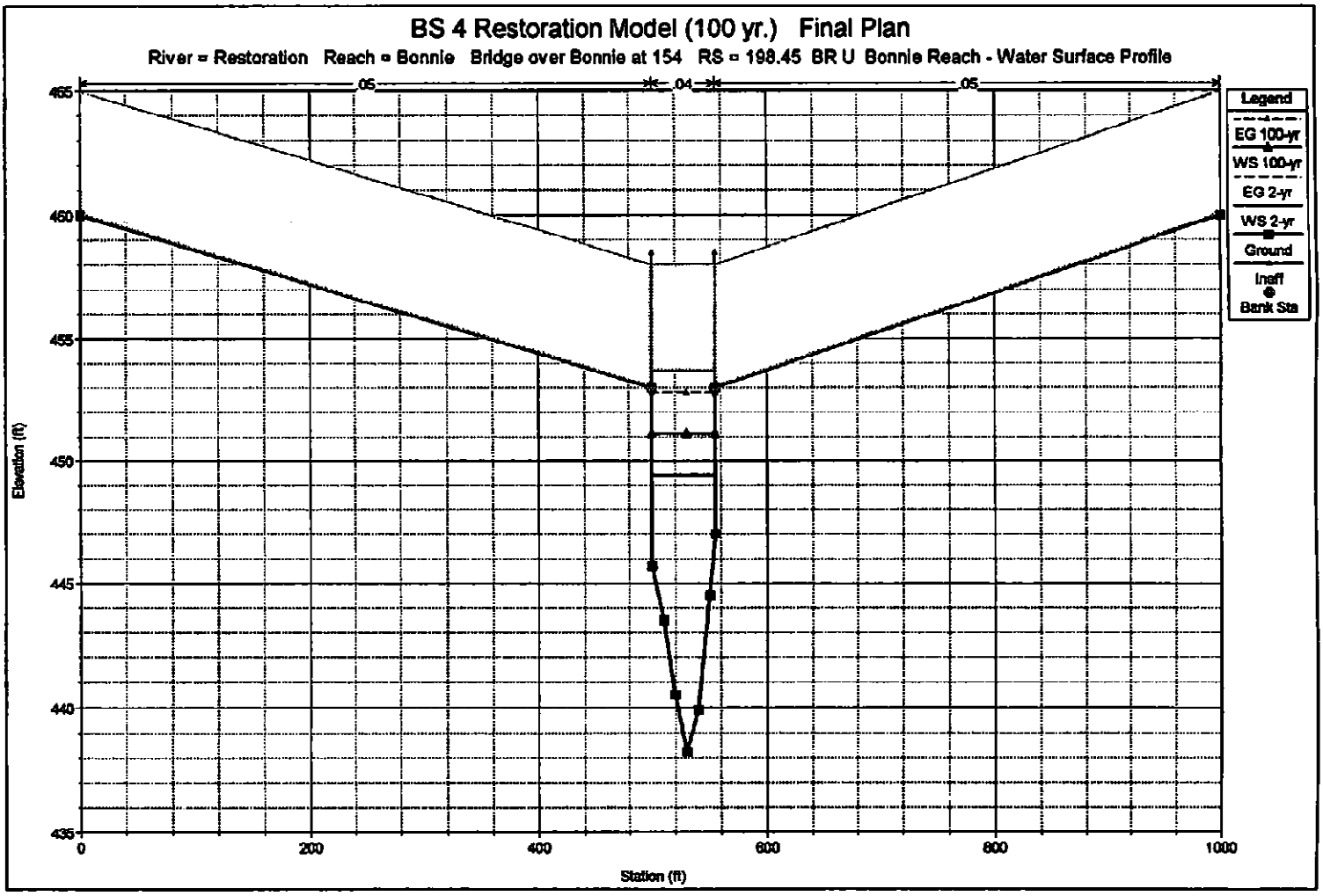

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-10 RS = 10 Bonnie Reach - Water Surface Profile
.03
.125
.03
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
452
450
448
446
444
442
440
438
436
434
0
500
1000
1500
2000

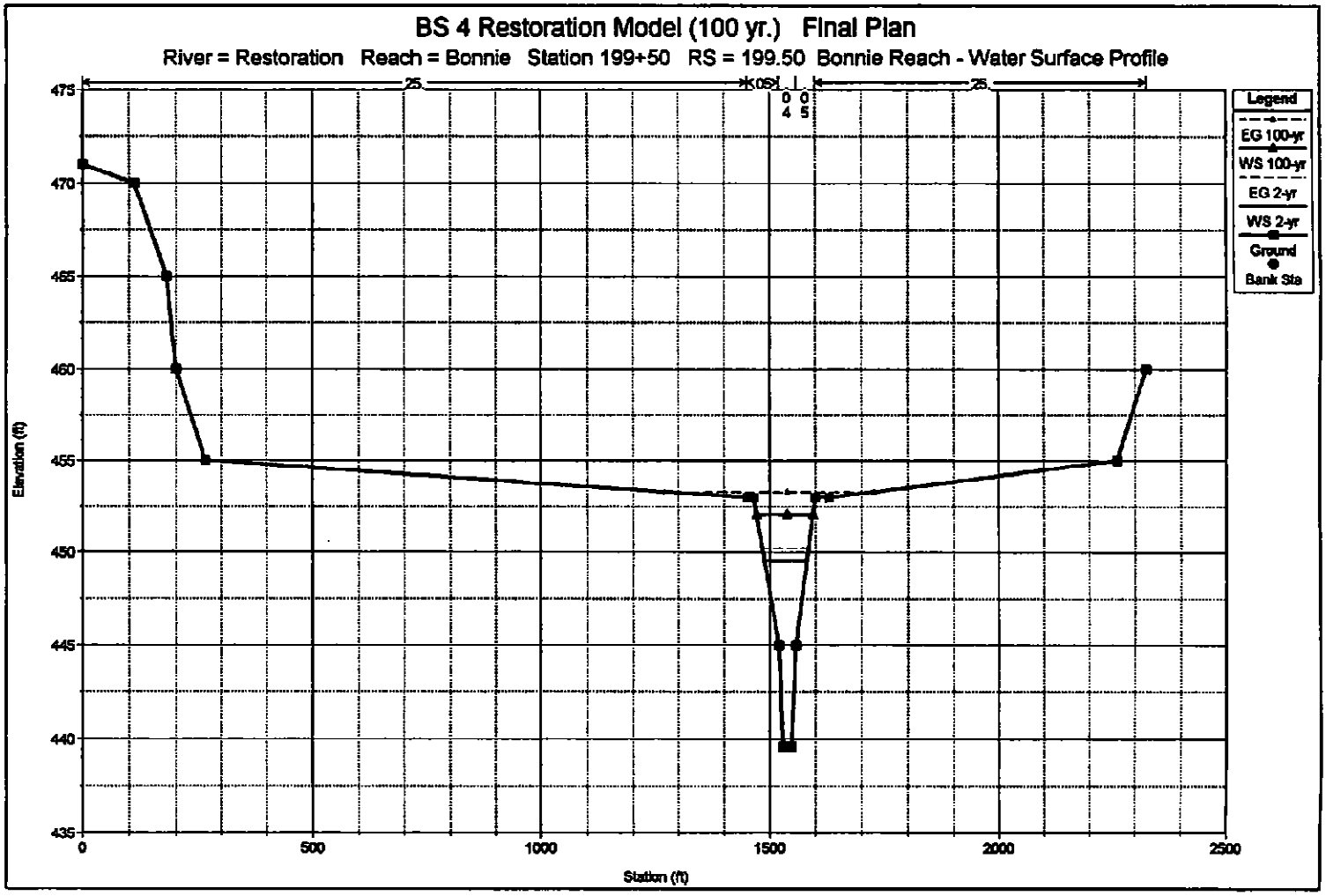

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-11 RS = 11 Bonnie Reach - Water Surface Profile
.03
.125
.03
1 0
2 4
5
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
452
450
448
446
444
442
440
438
436
0
500
1000
1500
2000
2500
3000
Station (ft)

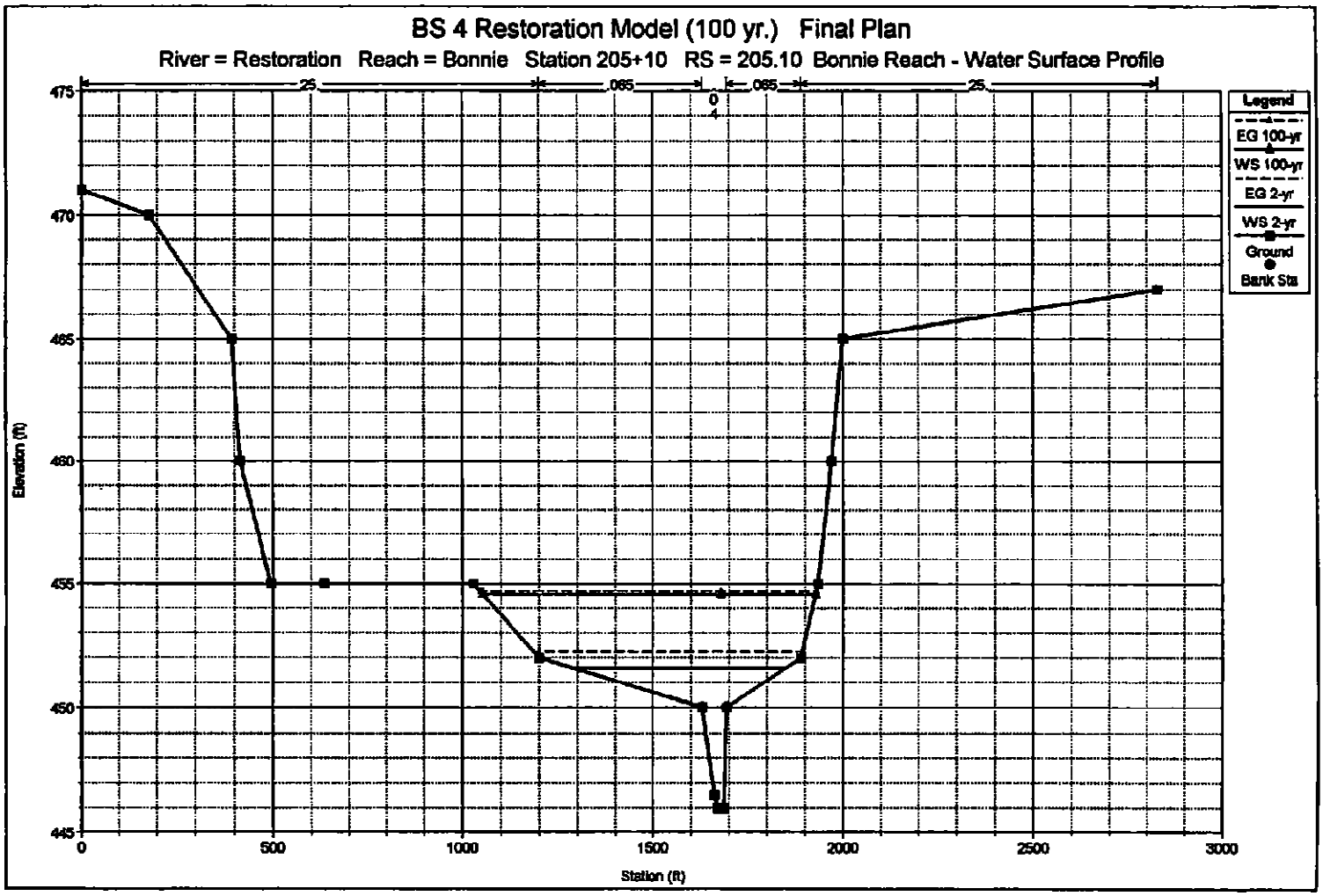

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-12 RS = 12 Bonnie Reach - Water Surface Profile
.03
.04
.125
.03
1
2
5
Legend
EG 100-yr
EG 2-yr
WS 100-yr
WS 2-yr
Ground
Bank Sta
460
455
450
445
440
435
Elevation (ft)
0
500
1000
1500
2000
Station (ft)

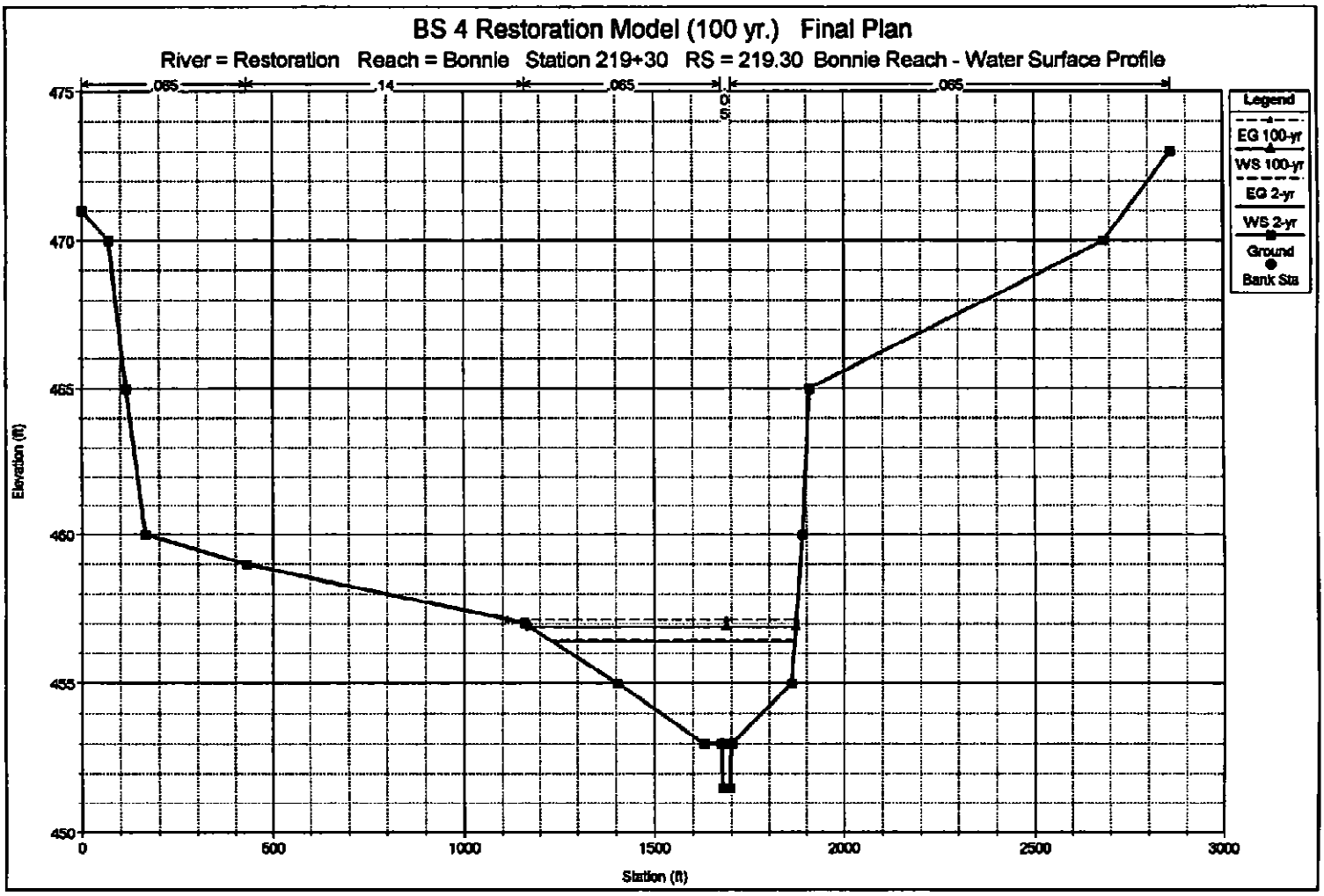

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie B-13 RS = 13 Bonnie Reach - Water Surface Profile
.03
.04
.125
.03
1
2
5
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
460
455
450
445
440
435
Elevation (ft)
0
500
1000
1500
2000
Station (ft)

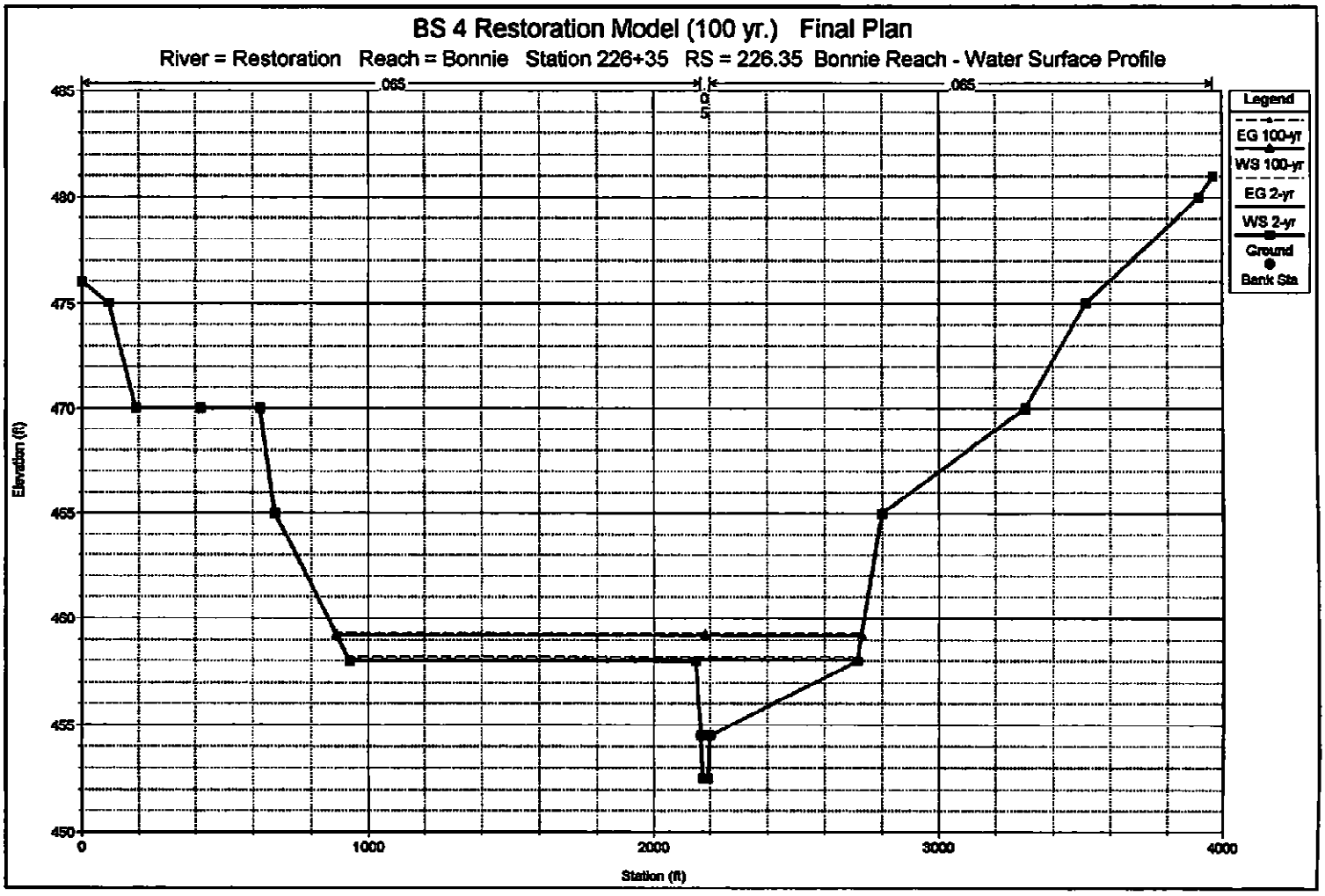

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie Station 198+29 154 Bridge over Bonnie RS = 198.29 Bonnie Reach - Water Surface Profile
.05
.04
.05
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
460
455
450
445
440
435
0
200
400
600
800
1000
Station (ft)


BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie Bridge over Bonnie at 154 RS = 198.45 BR U Bonnie Reach - Water Surface Profile
.05
.04
.05
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
465
460
455
450
445
440
435
0
200
400
600
800
1000
Station (ft)

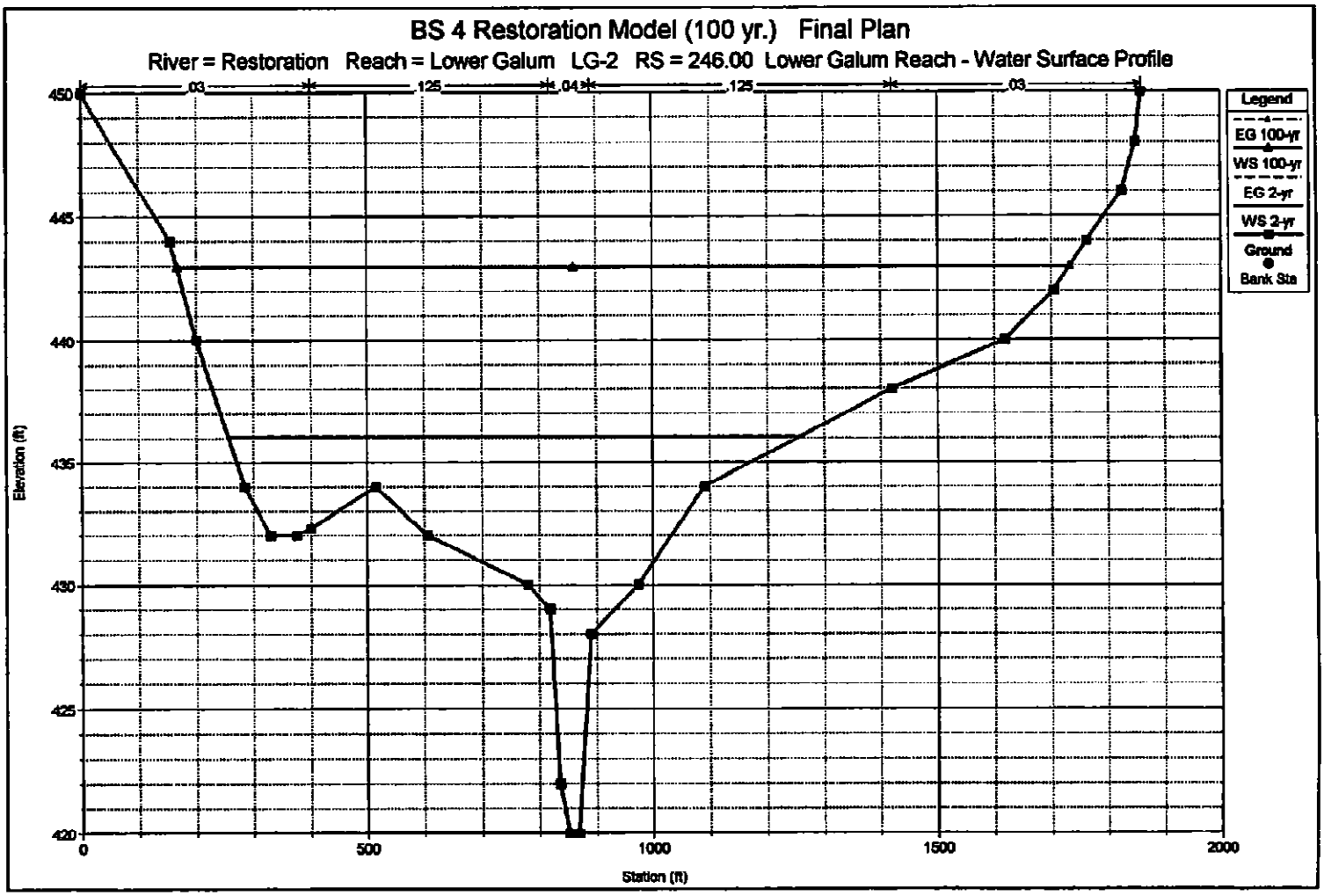

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie Station 199+50 RS = 199.50 Bonnie Reach - Water Surface Profile
25
0.05
0 0
4 5
25
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
475
470
465
460
455
450
445
440
435
0
500
1000
1500
2000
2500
Station (ft)

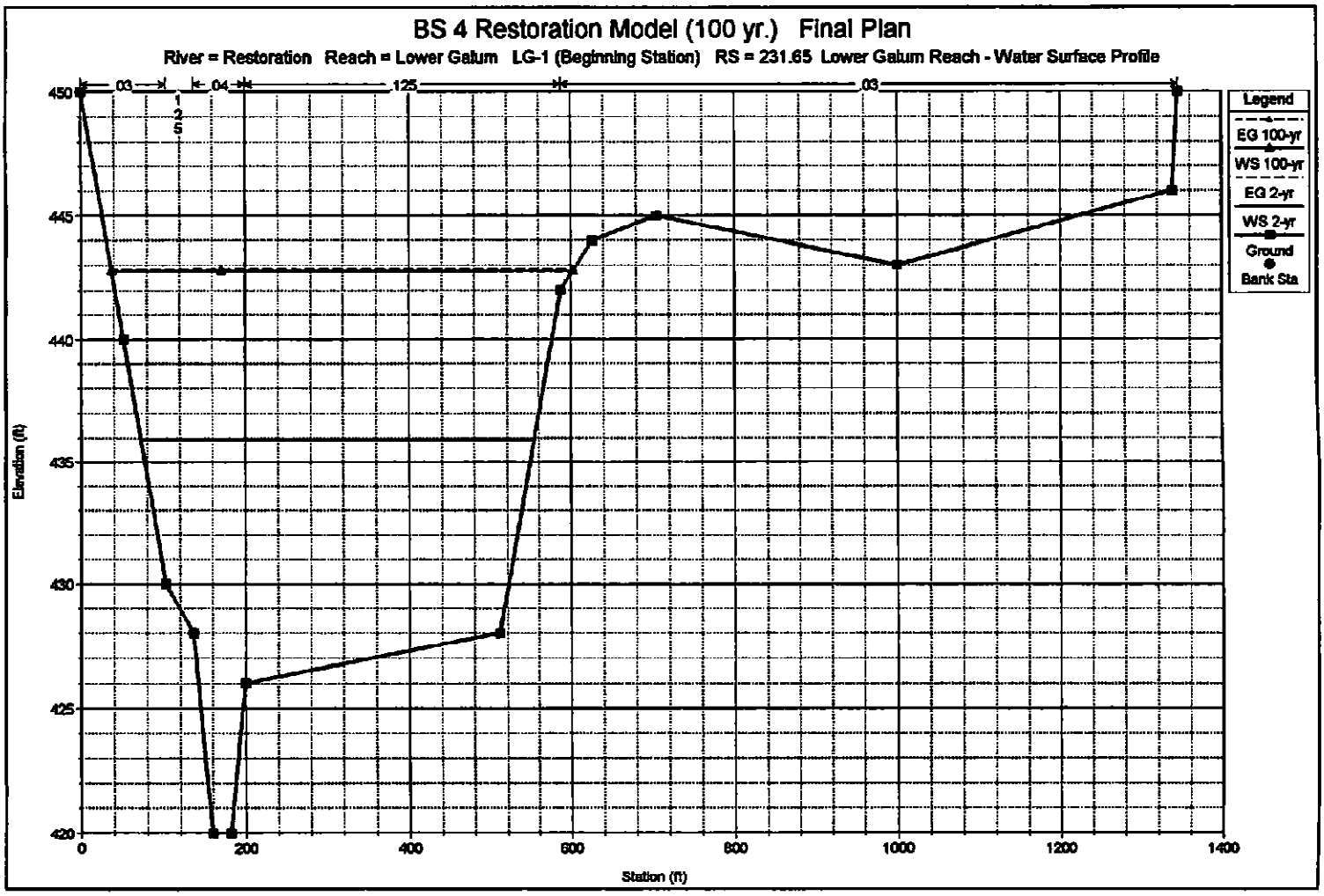

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie Station 205+10 RS = 205.10 Bonnie Reach - Water Surface Profile
25
.065
0
.065
25
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
475
470
465
460
455
450
445
0
500
1000
1500
2000
2500
3000
Station (ft)

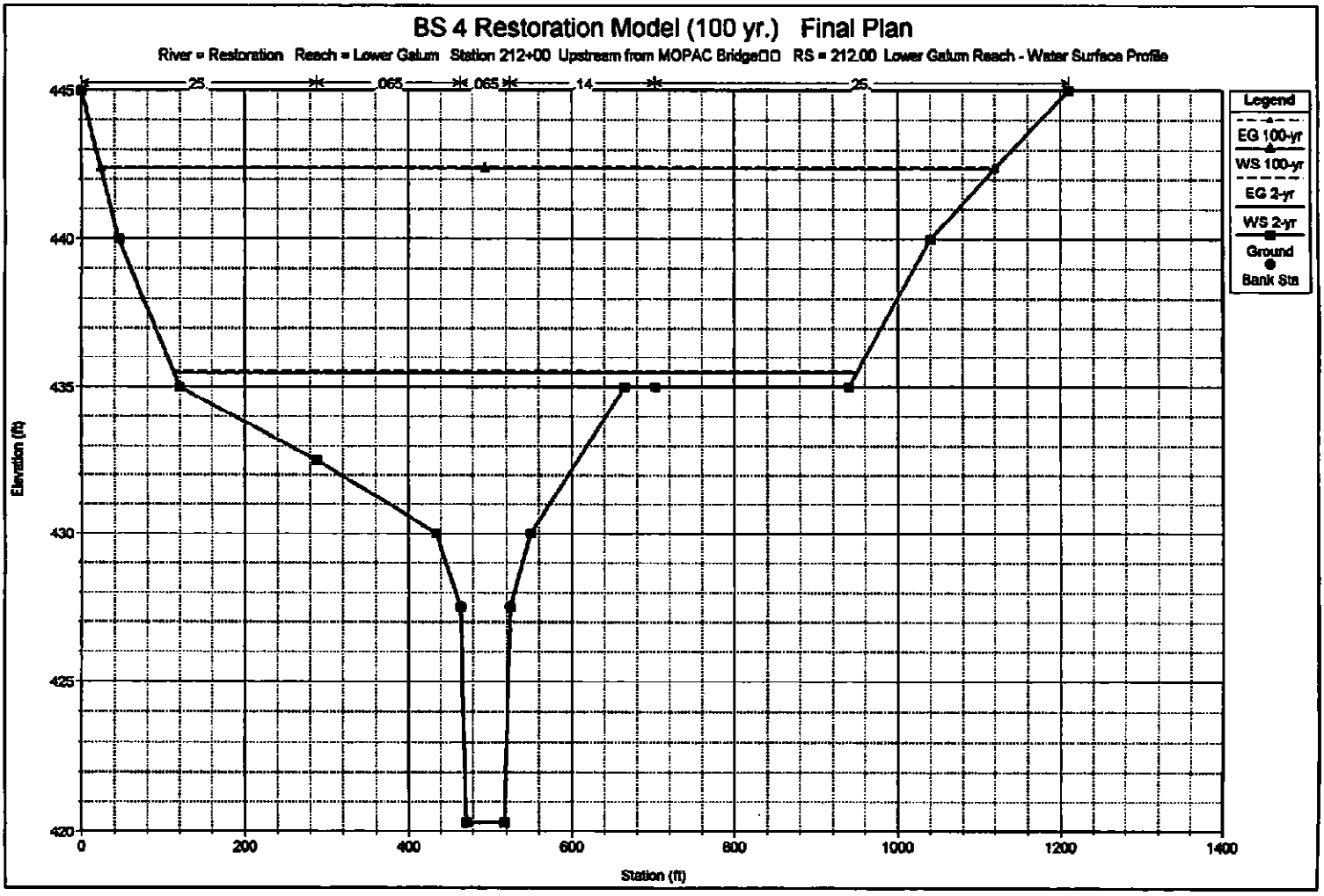

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie Station 219+30 RS = 219.30 Bonnie Reach - Water Surface Profile
.065
.14
.065
.05
.065
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
475
470
465
460
455
450
0
500
1000
1500
2000
2500
3000

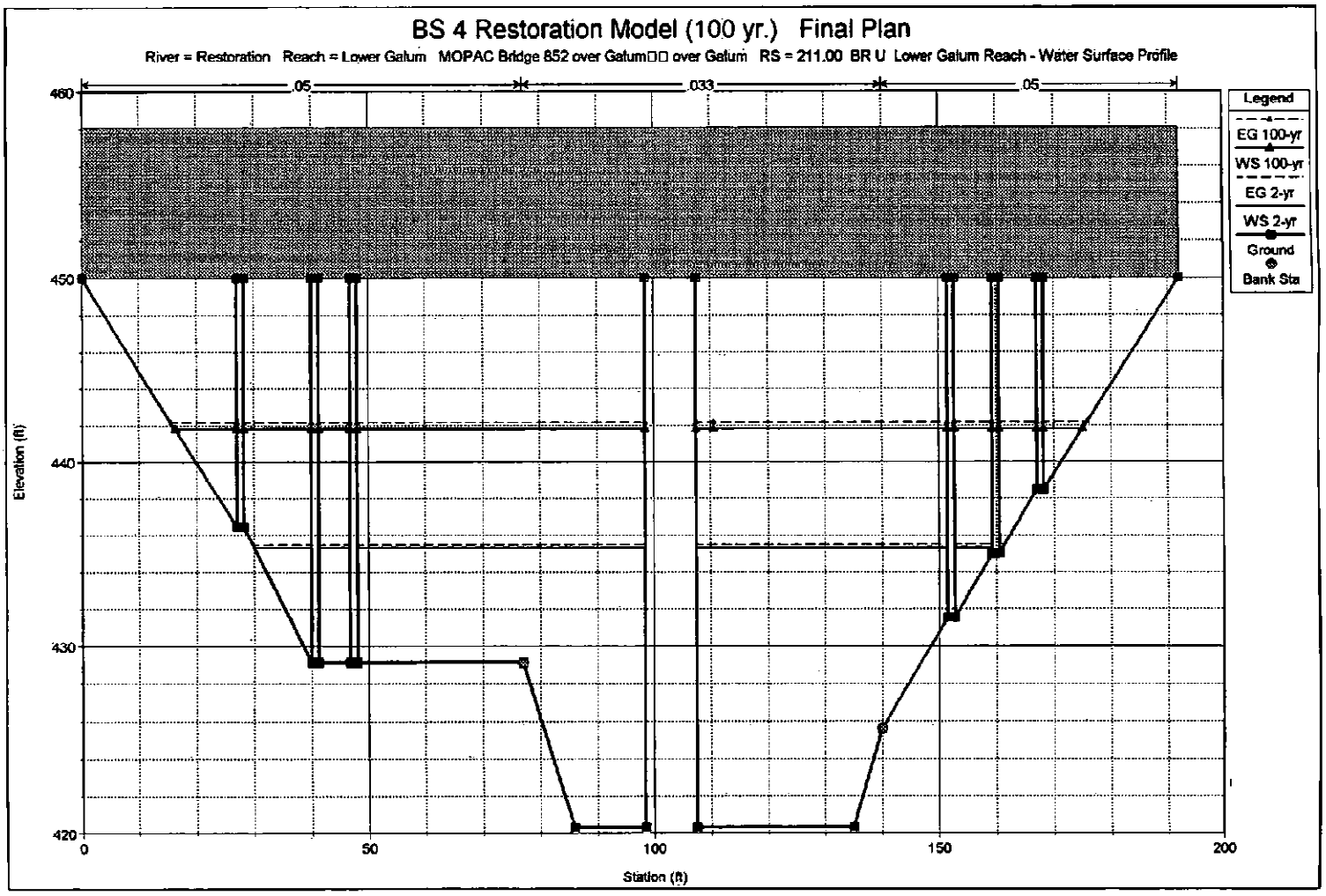

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Bonnie Station 226+35 RS = 226.35 Bonnie Reach - Water Surface Profile
.065
.065
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
485
480
475
470
465
460
455
450
0
1000
2000
3000
4000

Lower Galum Reach


BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Lower Galum LG-2 RS = 246.00 Lower Galum Reach - Water Surface Profile
.03
.125
.04
.125
.03
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
450
445
440
435
430
425
420
0
500
1000
1500
2000
Station (ft)

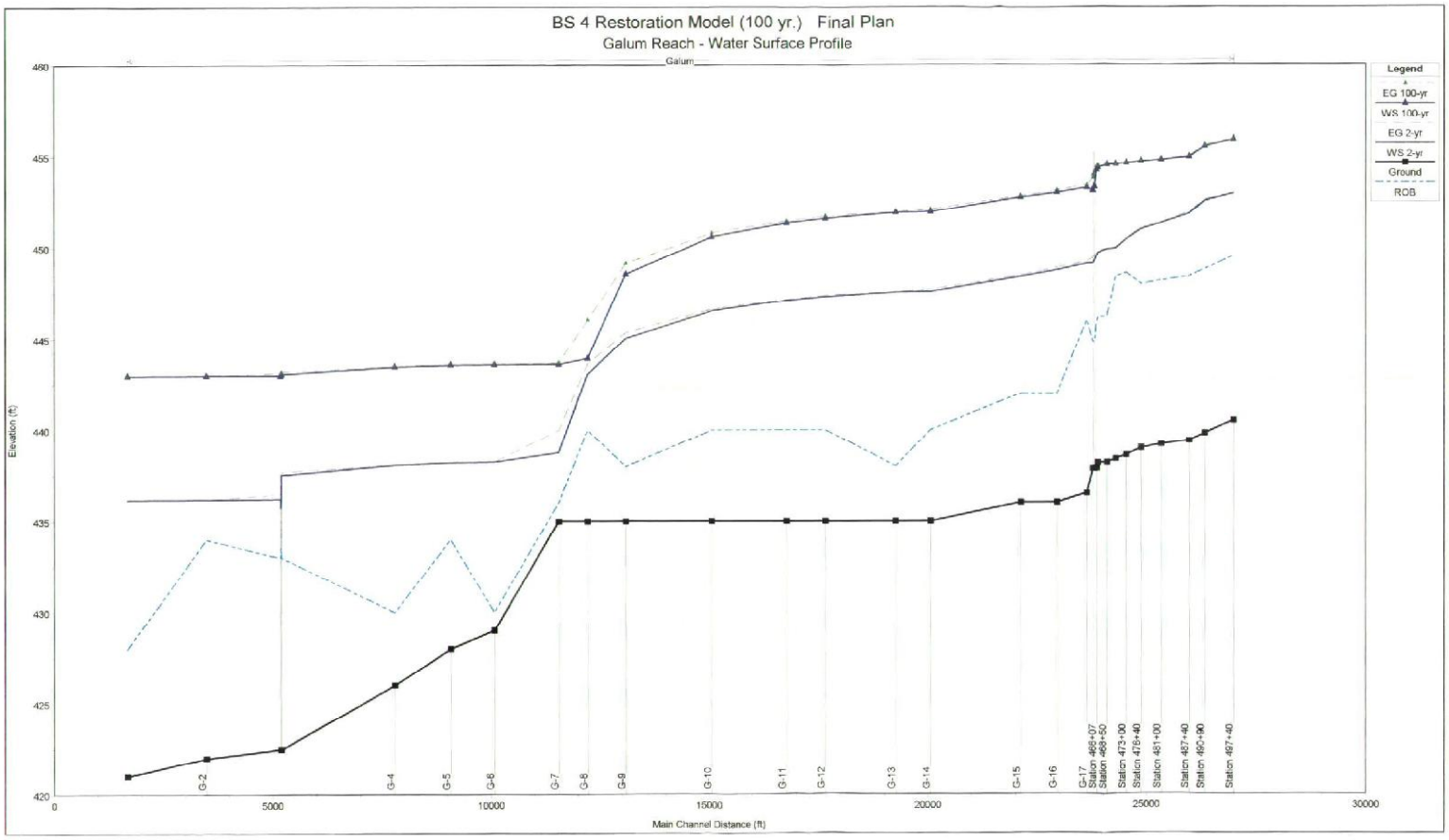

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Lower Galum LG-1 (Beginning Station) RS = 231.65 Lower Galum Reach - Water Surface Profile
.03
.04
.125
.03
1
2
5
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
450
445
440
435
430
425
420
0
200
400
600
800
1000
1200
1400

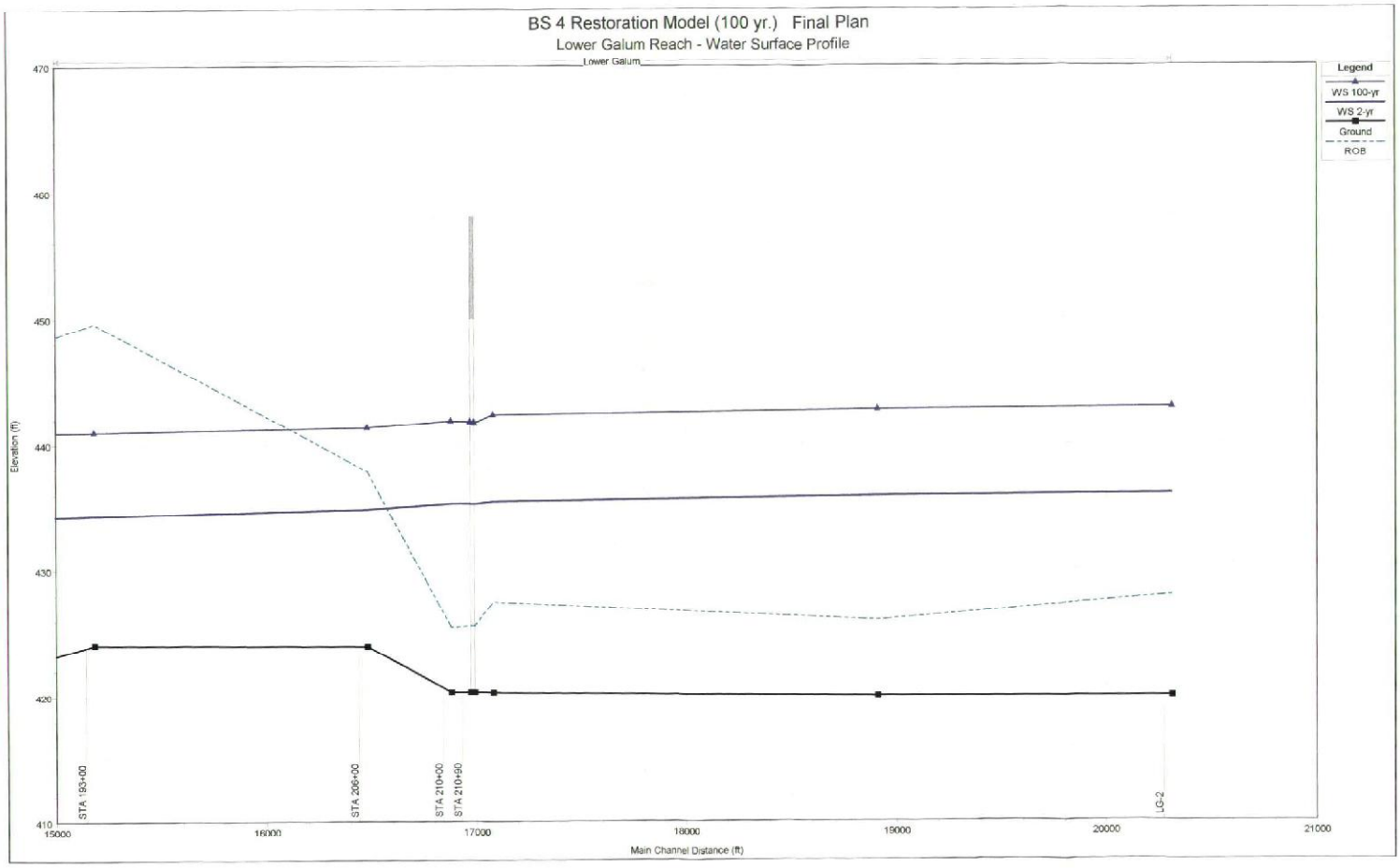

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Lower Gatum Station 212+00 Upstream from MOPAC Bridge RS = 212.00 Lower Gatum Reach - Water Surface Profile
25
.065
.065
.14
25
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
445
440
435
430
425
420
0
200
400
600
800
1000
1200
1400
Station (ft)

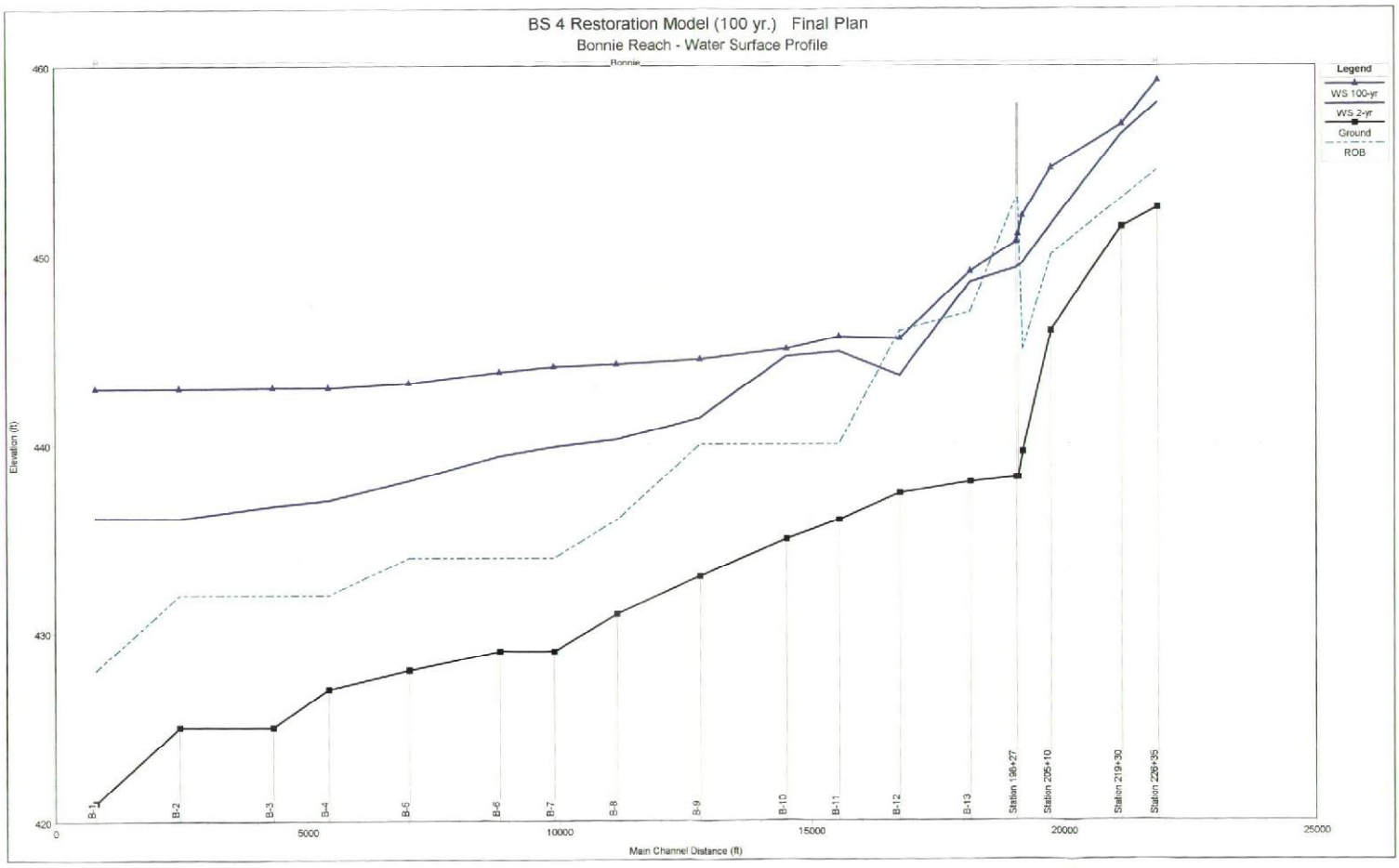

BS 4 Restoration Model (100 yr.) Final Plan
River = Restoration Reach = Lower Galum MOPAC Bridge 852 over Galum over Galum RS = 211.00 BR U Lower Galum Reach - Water Surface Profile
.05
.033
.05
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
460
450
440
430
420
Elevation (ft)
0
50
100
150
200
Station (ft)

APPENDIX D

Water Surface Profiles


BS 4 Restoration Model (100 yr.) Final Plan
Galum Reach - Water Surface Profile
Galum
Legend
EG 100-yr
WS 100-yr
EG 2-yr
WS 2-yr
Ground
ROB
Elevation (ft)
460
455
450
445
440
435
430
425
420
0
5000
10000
15000
20000
25000
30000
Main Channel Distance (ft)
G-2
G-4
G-5
G-6
G-7
G-8
G-9
G-10
G-11
G-12
G-13
G-14
G-15
G-16
G-17
Station 468+07
Station 468+50
Station 473+00
Station 475+40
Station 481+00
Station 487+40
Station 490+90
Station 497+40


BS 4 Restoration Model (100 yr.) Final Plan
Lower Galum Reach - Water Surface Profile
Lower Galum
Legend
WS 100-yr
WS 2-yr
Ground
ROB
Elevation (ft)
470
460
450
440
430
420
410
STA 193+00
STA 206+00
STA 210+00
STA 210+90
LG-2
15000
16000
17000
18000
19000
20000
21000
Main Channel Distance (ft)


BS 4 Restoration Model (100 yr.) Final Plan
Bonnie Reach - Water Surface Profile
Bonnie
Legend
WS 100-yr
WS 2-yr
Ground
ROB
Elevation (ft)
460
450
440
430
420
0
5000
10000
15000
20000
25000
Main Channel Distance (ft)
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
B-11
B-12
B-13
Station 196+27
Station 205+10
Station 219+30
Station 229+35

APPENDIX E

Maps

Map A – Cross-Section Location Map
Map B – Flood-Prone Area Map

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject CONSOLIDATION COAL CO. - BURNING STAR #4
Data NORTH FIELD (IL0052795)
Reviewed by L. CRIVALIC Date 1-6-95

Page 1/2

ADDENDUM TO NOTES ON NPDES PERMIT RENEWAL:

- DURING 15 DAY REVIEW AND 30 DAY PUBLIC NOTICE PERIOD, APPLICANT CONTACTED THE AGENCY REGARDING DISAGREEMENT WITH PERMITTED ACREAGE OF 518.6 ACRES. THIS ACREAGE WAS CARRIED FORWARD FROM PREVIOUS PERMIT.

- A REVIEW OF FILES PROVIDED THE FOLLOWING:

  - IDNR PERMIT #73 WAS FOR 907 ACRES. OF THIS TOTAL, 753 ACRES WERE PERMITTED UNDER THE SOUTH FIELD PERMIT. THIS LEFT 154 ACRES PERMITTED UNDER NORTH FIELD PERMIT NO. IL0052795.

    IT APPEARS THIS WAS INCORRECTLY PERMITTED AS 254 ACRES. TO THE 254 ACRES, A SUBSEQUENT SUPPLEMENTAL C.A. ADDED AN ADDITIONAL 60 ACRES WHICH WAS INDICATED AS OVERLOOKED IN ORIGINAL APPROVAL OF 254 ACRES.

    ALTHOUGH THIS REVIEWER COULD NOT SPECIFICALLY IDENTIFY THE 60 ACRES AT THIS TIME, IT IS ASSUMED TO BE CORRECT. HOWEVER, THE TOTAL AREA PERMITTED UNDER THE NORTH FIELD PERMIT FROM IDNR PERMIT #73 SHOULD BE: 154 + 60 = 214 ACRES

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

NOV 10 2015

REVIEWER: JKS

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject CONSOLIDATION COAL CO. - BURNING STAR No. 4
Date NORTH FIELD (IL0052785)
Reviewed by L. CRISLIP Date 1-6-95

Page 2/2

- IDMM PERMIT #74 ADDED TO THE NORTH FIELD 2828 acres

- IDMM PERMIT #152 ADDED TO THE NORTH FIELD 2044 acres

NOTE: IDMM PERMITS #74 AND #152 INCLUDED VARIOUS IBR'S AND INCIDENTAL SMALLER PERMITS (SUCH AS PERMIT #118 AND #120).

THEREFORE, TOTAL PERMIT ACREAGE HAS BEEN DETERMINED TO BE:

214
2828
2044

5086 acres

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject _____

Date _____

Reviewed by _____ Date _____

2044

DOMM #152 — ~~[illegible]~~ acres

1921 acres in C.1

accounts for overlap with 118

all of #118 included in 74 & 152

JAN. 1987 NPDES → 5186 acres

5186

2951
1921
4872
72
4944

126
2828
158
72
2044
5088

5258
5186
72

314
2828

121 +5 ?

2828
72
2044
4944
121

5186
-4944
242

2
121
2828
128
72
1921
5065 — 121

314
2828
72
2044
5258

4872
314
5186

5186
4872
314
186

#74 - 2828
#152 - 2044
4872

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject 254 + 60

Data

Reviewed by Date

314

1982

121 126

Support Facilities 874 ac. + IBR for 6123-82 S.F. + 5.0 ac.

IDMM #73 907 acres Area split - 753 acres to South Field

North Field

IDMM #74 — 2828 acres + 15.8 IBR

5070-83 - Permit 393 acres - IDMM #118 partially overlaps Permit #74 area

C.A. incorporating 5070-83 brought total to 2951 acres which appears to have accounted for overlap.

Sub. D Per. 1985-HO-3104 added 12 acres.

July 84 NPDES still lists 2828 acres

IDMM #120 ⟹ 72 acres

Copy to Region 6-22-94
CR

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject Consolidation Coal Co. - Burning Star #4

Date

Reviewed by L. Crisup Date

Page 1/2

NPDES Permit No. IL0052795
Renewal Review Summary

Log # 5002-93 => NPDES Permit Renewal

— Complete —

Log # 9128-89 => Temporary interior ditch - no permit action required.

— Complete —

Log # 6067-92 => Revised drainage control plan (Phase IV)
— Incorporated into NPDES renewal —

— Complete —

Log # 6067-92-A => Same as #6067-92 - no permit action required

— Complete —

Log # 6067-92-B => Revised pond designs for #6067-92
— Incorporated into NPDES renewal —

— Complete —

Log # 6174-92 => Same as #6067-92-B - no permit action required.

— Complete —

DIVISION OF RECORDS MANAGEMENT
RELEASABLE
NOV 10 2015
REVIEWER: JKS

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject CONSOLIDATION COAL CO. - BURNING STAR #4

Date

Reviewed by L. CRISLIP Date

Log # 5004-93 => SAME AS #5299-93 - NO PERMIT ACTION REQUIRED.

— COMPLETE —

Log # 5108-93 => INTERIOR DITCH & CULVERT - NO PERMIT ACTION REQUIRED

— COMPLETE —

Log # 5299-93 => RE-ESTABLISH RECLAMATION POND 033 - - INCORPORATED IN NPDES RENEWAL

— COMPLETE —

Log # 5330-93 => MID-TERM REVIEW - NO PERMIT ACTION REQUIRED.

— COMPLETE —

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject CONSOLIDATION COAL CO. - BURNING STAR #4

Date

Reviewed by L. CRISLIP Date 3-28-94

Page 1/2

NPDES PERMIT NO. IL0052795 (BS4-9 → NORTH FIELD)

Log #5002-93 ⇒ NPDES PERMIT RENEWAL

GENERAL FORM 1 ⇒ COMPLETE

FORM 2C —

OUTFALLS INCLUDED:

001A, 001, 002, 008, 017,
021, 023, 023A, 025B, 033,
034, 035A, 035B, 035C, 036,
037, 040, 043, 044 AND
045 (FUTURE OUTFALL)

Note: EFFLUENT DISINFECTION EXEMPTION REQUEST FORM INCLUDED FOR SEWAGE TREATMENT PLANT OUTFALL 001A.

OUTFALL 008 IS DISCHARGE FROM SLURRY IMPOUNDMENT INTO ARCHER COAL CO. - CAPTAIN MINE POND 022. CONSOL ALSO USES POND 022 AS FRESHWATER LAKE FOR PREP PLANT.

ALL OUTFALLS LOCATED ON MAPS (EXCEPT 040)

RESEARCH OUTFALLS ON MAP, NOT ON RENEWAL:
006, 008A, 022, ~~032~~, ~~033A~~, ~~035A~~,
~~033B~~, ~~033C~~, ~~033D~~, ~~033E~~, ~~033F (A-B)~~,
~~038~~, 039, ~~041~~, 042

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject Consolidation Coal Co. - Burning Star #4

Data 5002-93

Reviewed by L. Crislip Date 3-28-94

Page 2/2

Log #5002-93 => NPDES Permit Renewal

Permit No. IL0052795 (BS4-9 => North Field)

General Form 1 => Included and complete.

Form 2C => Outfalls included for renewal:

001, 001A, 002, 008, 017, 021, 023, 023A, 025B, 033, 034, 035A, 035B, 035C, 036, 037, 040, 043, 044 and 045 (future outfall)

Note: Effluent disinfection exemption form included for sewage treatment plant outfall 001A. Form sent to Scott Tomkins, Planning Section, on 3-28-94.

All outfalls indicated for renewal are located on maps with exception of 001A and 040. However, coordinates provided allowed reviewer to locate points. Location confirmed by G. Minton, Inspector.

Comment: Discussion with G. Minton, IEPA Inspector, confirmed that all outfalls indicated on maps which were not requested for renewal have either been mined through or sampling requirements have been eliminated.

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
AOM 39
054-002

Subject CONSOLIDATION COAL CO. - BURNING STAR #4

Data

Reviewed by L. CRISLIP Date 3-28-94

THE FOLLOWING PROJECTS WERE REVIEWED FOR THE NPDES PERMIT NO. IL0052795 RENEWAL (LOG #5002-93)

LOG #9128-89 => INSTALL TEMPORARY DITCH CS ON EASTERN BOUNDARY OF CEMETERY WITHIN IDNM PERMIT #74 AREA.

- STRUCTURE INTERCEPTS RUNOFF FROM BOXCUT SPOIL AND CONVEYS TO ABANDONED INCLINE. PROJECT PROPOSES NO CHANGE OR MODIFICATION TO ANY SEDIMENTATION PONDS.

* DESIGN CALCULATIONS ARE ACCEPTABLE. HOWEVER, SINCE NO CHANGES ARE MADE TO PONDS OR DISCHARGE STRUCTURES, NO MODIFICATION IS REQUIRED TO NPDES PERMIT.

LOG #6067-92 => REVISION TO PHASE IV OF DRAINAGE CONTROL PLAN (DIRECT SUBMITTAL)

* COPY OF REVISION RECEIVED FROM IDNM WAS ASSIGNED LOG #6067-92-A - IDENTICAL SUBMITTAL.

- REPLACE DITCHES F & G WITH MULTIPLE DITCH SYSTEM.

* DITCH DESIGNS ARE ACCEPTABLE.

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject CONSOLIDATION COAL CO. - BURNING STAR #4

Data

Reviewed by L. CRISLIP Date 3-28-94

- RE-DESIGN PONDS 035 A THRU 035 E (ELIMINATE TWO OUTFALLS LEAVING PONDS 035A THRU 035 C)

* POND DESIGNS ARE ACCEPTABLE. PONDS 035A, 035B AND 035 C ARE REQUESTED TO HAVE PUMP DISCHARGES IN ADDITION TO PIPE.

- RE-DESIGN PONDS 036 AND 037

* POND DESIGNS ARE ACCEPTABLE. PONDS 036 AND 037 ARE REQUESTED TO HAVE PUMP DISCHARGES IN ADDITION TO PIPE.

- AS-BUILT DRAWINGS OF PONDS 043 (CELL A), 043 (CELL B), 044 (CELL A) AND 044 (CELL B). ALSO REQUEST TO HAVE PUMP DISCHARGE FROM PONDS 043 (CELL A), 043 (CELL B) AND 044 (CELL B).

* ACCEPTABLE

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 38
054-002

Subject CONSOLIDATION COAL CO. - BURNING STAR #4

Data

Reviewed by L. CRISLIP Date 3-28-94

Page 3/5

Log # 6067-92-A => SAME AS Log #6067-92. COPY FROM IDMM.

Log # 6067-92-B => REVISION TO PHASE IV OF DRAINAGE CONTROL PLAN (DIRECT SUBMITTAL)

- RE-DESIGN POND 035 A
  (TO PROVIDE SEDIMENTATION CONTROL FOR LARGER WATERSHED THAN WAS PROPOSED IN Log #6067-92)

* POND DESIGN INFORMATION IS ACCEPTABLE. AS INDICATED IN Log # 6067-92, THIS BASIN IS REQUESTED TO HAVE PUMP DISCHARGE AS WELL AS PIPE.

Log #6174-92 => SAME AS Log #6067-92-B. COPY FROM IDMM.

Log # 5004-93 => SAME AS Log # 5299-93. Log #5004-93 WAS A DIRECT SUBMITTAL. SEE BELOW FOR Log #5299-93.

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject CONSOLIDATION COAL CO. - BURNING STAR #4

Data

Reviewed by L. CRISLIP Date 3-28-94

Page 4/5

LOG #5108-93 => CONSTRUCT DIVERSION DITCH, PLUG AND INSTALL CORRUGATED METAL PIPE CULVERT

- PROPOSAL IS TO TEMPORARILY DIVERT FLOW FROM NORTHERN PERIMETER DITCH INTO FINAL CUT ON NORTHWEST CORNER OF MINED AREA. THIS WILL ASSIST IN FILLING IMPOUNDMENT AND RE-ESTABLISHING SHALLOW GROUNDWATER TABLE PRIOR TO DIVERTING FLOW BACK INTO RESTORED GALUM CREEK CHANNEL.

* THIS PROPOSAL HAS NO AFFECT ON ANY OUTFALLS. THE AREA DISTURBED SHOULD BE MULCHED & SEEDED AS SOON AS POSSIBLE FOLLOWING DISTURBANCE. OTHERWISE, NO PERMIT ACTION IS REQUIRED.

LOG #5299-93 => RE-ESTABLISH POND 033

- POND 033 WAS ORIGINALLY AN OPERATIONS POND WHICH WAS MINED THROUGH. FOLLOWING THE PIT ADVANCEMENT BEYOND THE INITIAL LOCATION, A DEPRESSION REMAINED IN THE SAME LOCATION. THIS PROPOSAL IS TO RE-ESTABLISH A POND IN BASICALLY THE SAME LOCATION WITH THE SAME OUTFALL NUMBER. SINCE THIS IS ACTUALLY A DIFFERENT POND THAN THE OPERATIONS POND, NEW DESIGNS ARE PROVIDED. HOWEVER, THE SAME DISCHARGE STRUCTURE WILL BE UTILIZED.

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY

IL 532-0357
ADM 39
054-002

Subject Consolidation Coal Co. - Burning Star #4

Data

Reviewed by L. Crislip Date 3-29-94

Page 5/5

* Pond and discharge structure designs are acceptable. As proposed, pond should be eligible for reclamation standards. However, since pump discharge is requested in addition to CMP's - can reclamation standards apply? Check!

Log # 5330-93 => Mid-term review for Permit # 152, Renewal #1

* No comments contained in the mid-term review warrants further investigation.

No Permit Action Required on Log # 5330-93

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
Division of Water Pollution Control
Planning Section

IEPA-DIVISION OF RECORDS MANAGEMENT RELEASABLE

NOV 1 0 2015

REVIEWER: JKS

Effluent Disinfection Exemption Request Form for 35 Ill. Adm. Code 378

Request for: [ ] Seasonal Exemption [X] Year Round Exemption

Section I: General

A. Name and Address of discharge facility:

Consolidation Coal Company
Burning Star #4 Mine
Rural Route, Cutler, Illinois 62238
Phone: (618) 497-2176

B. Name and address of discharge facility owner:

Note: This person will be notified of the results of this request. The contact person should be authorized under 35 Ill. Adm. Code 309.103(e) and must sign this form below.

Contact person: Grayson G. Heard

Title: Senior Vice President

Consolidation Coal Company
12755 Olive Boulevard
St. Louis, MO 63141
Phone: (314) 275-2300

C. Name and address of person completing form:

Richard Denning
Consolidation Coal Company
12755 Olive Boulevard
St. Louis, MO 63141
Phone: (314) 275-2300

I attest that this form has been completed by me or by others under my direct supervision and that the information contained herein is to the best of my knowledge, true and complete.

Grayson Heard — 1/05/93
Signature — Date

Section II: Facility Data

A. Location: St. Hwy. 150 Near Cutler, IL

(1) County: Perry

(2) (a) USGS Quadrangle Map name: Percy

(b) USGS Coordinates: N 679, 950 E 501, 050

Qtr. Section	Section	Township	Range	P.M.
NE	4	T6S	R5W	3rd

(c) Latitude 38° 02' 30" Longitude 89° 32' 22"

B. Facility design and operating data:

(1) Attach, as Exhibit 1 to this application, a process flow sketch of the facility. The sketch must clearly show at least the following: the raw waste influent line(s), each wastewater treatment unit process; any system bypass or unit process bypass on the plant grounds; the effluent line(s) from the last unit process to the point of discharge to the receiving stream; if the effluent line(s) crosses the plant grounds property line before it reaches the receiving stream, label that line(s) as either an underground conduit or an open channel. Also indicate sampling point for NPDES compliance and the point at which the samples for Section II.B(4)(e) were collected.

(2) NPDES permit number issued for this facility's discharge:

ILOO 5 2 7 9 5

Date permit issued: August 19, 1988

Date permit last modified: February 27, 1989

Date permit expires: July 1, 1993

Outfall number for which exemption is requested (excess flow outfalls are not eligible): 001A

Final Discharge limitations contained in NPDES Permit for this outfall:

BOD_5 or $CBOD_5$ (monthly average) 25 mg/l

Suspended Solids (monthly average) 30 mg/l

Fecal Coliform (daily maximum) 400 #/100 ml

Total Residual Chlorine Not Applicable mg/l

(3) Design average flow for the facility — MGD

Design maximum flow for the facility .005775 MGD

Average daily flow received at the facility during the most recent operating year Not Available MGD

(4) Treated effluent quality during the past 12 months:

(a) BOD_5 or $CBOD_5$: Range 4.0 - 13.2 mg/l; Mean 8.6 mg/l; Number of samples 2

(b) Suspended Solids: Range 7 - 29 mg/l; Mean 18 mg/l; Number of samples 2

(c) Total Residual Chlorine: Range ____ mg/l; Mean ____ mg/l; Number of samples ____

(d) Fecal Coliform after disinfection: Range 0 - 511 #/100 ml; Mean 256 #/100 ml; Number of samples ____

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 1/2, Section 1039. Disclosure of this information is required under Section [illegible]. Failure to do so may prevent this form from being processed and could result in the application being denied. This form has been approved by the Forms Management Center.

(e) Fecal Coliform (immediately prior to disinfection) Attach the sample dates and final results as Exhibit 2 to this application or use the lines given below.

Note: If undisinfected effluent data for the past 12 months is not available, the Agency will accept the results from a minimum of 4 samples taken one week apart. FOR EXISTING FACILITIES THE AGENCY MAY NOT BE ABLE TO PROCESS THIS APPLICATION WITHOUT THIS INFORMATION.

DATE	RESULTS	
7-31-91	6900	#/100 ml
8-21-91	9500	#/100 ml
8-29-91	8200	#/100 ml
9-19-91	7400	#/100 ml
		#/100 ml

Range 6900-9500 #/100 ml
Mean 8000 #/100 ml
Number of samples 4

Section III: Fecal Coliform Die-off Calculations

A. In accordance with the instructions of Appendix B, Part 378 provide a sketch of the receiving stream as Exhibit 3 to this application.

B. Provide the location of the nearest downstream withdrawal point for water used for drinking or food processing purposes:

See Below

Distance downstream of outfall: _____ ft. or mi. (circle one)

C. All applicants whose mean undisinfected fecal count (Section II.B(4)(e)) is greater than 2000/100 ml. should complete sections (1) through (5). Applicants for year-round exemption should also complete section (6) if the mean undisinfected fecal count is greater than 200/100 ml or any one sample exceeds 400/100 ml.

Also provide the following information for each stream segment at the required discharge recurrence frequencies (if more than three segments are required, provide the required information on a continuation sheet):

Discharge established by: _____ Stream gage data*
_____ ISWS Eq.**
_____ Other (specify below***)

Velocity established by: _____ Manning Eq.****
_____ ISWS Eq.*****

**For stream gage data, provide the gage station number and location. Provide calculations as Exhibit 4 to this application.*

***For ISWS equations, provide upstream drainage area (in square miles) and segment end drainage area (in square miles). Provide calculations as Exhibit 4 to this application.*

****Provide calculations as Exhibit 4 to this application.*

*****Provide A (in square feet), R_h (in feet), P (in feet), S, and n for each segment at each return frequency. Provide calculations as Exhibit 4 to this application.*

******Provide the drainage area (in square miles) used for determining the velocity. Provide calculations as Exhibit 4 to this application.*

III B. No known users exist on the receiving streams as far downstream as the confluence of Beaucoup Cr. with the Big Muddy River.

Segment Number 1

Name of Receiving Water Unnamed Drainage Ditch

Starting Point Outfall 001A

Ending Point Outfall 001

Length 1.1 ft. or mi. (circle one)

Segment Number 2

Name of Receiving Water Galum Cr.

Starting Point Outfall 001 Confluence

Ending Point L. Galum Cr. Confluence

Length 10.5 ft. or mi. (circle one)

Segment Number 3

Name of Receiving Water Galum Cr.

Starting Point L. Galum Cr. Confluence

Ending Point Goose Cr. Confluence

Length 1.1 ft. or mi. (circle one)

Note: If N_t is greater than 2000/100 ml. at the end of any segment, modeling must continue for additional segments for that return frequency.

(1) 10% Recurrence Frequency (during winter):

(a) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(b) N_e _____ #/100 ml (segment 1)
N_e _____ #/100 ml (segment 2)
N_e _____ #/100 ml (segment 3)
(c) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(d) Q_e _____ cfs (segment 1)
Q_e _____ cfs (segment 2)
Q_e _____ cfs (segment 3)
(e) Q_t _____ cfs (segment 1)
Q_t _____ cfs (segment 2)
Q_t _____ cfs (segment 3)
(f) d _____ (segment 1)
d _____ (segment 2)
d _____ (segment 3)
(g) V _____ fps (segment 1)
V _____ fps (segment 2)
V _____ fps (segment 3)
(h) t _____ hours (segment 1)
t _____ hours (segment 2)
t _____ hours (segment 3)
(i) k _____ 1/hours (segment 1)
k _____ 1/hours (segment 2)
k _____ 1/hours (segment 3)
(j) N_t _____ #/100 ml (segment 1)
N_t _____ #/100 ml (segment 2)
N_t _____ #/100 ml (segment 3)

(2) 30% Recurrence Frequency (during winter):

(a) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)

(d) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(e) Q_i _____ cfs (segment 1)
Q_i _____ cfs (segment 2)
Q_i _____ cfs (segment 3)
(f) d _____ (segment 1)
d _____ (segment 2)
d _____ (segment 3)
(g) V _____ fps (segment 1)
V _____ fps (segment 2)
V _____ fps (segment 3)
(h) t _____ hours (segment 1)
t _____ hours (segment 2)
t _____ hours (segment 3)
(i) k _____ 1/hours (segment 1)
k _____ 1/hours (segment 2)
k _____ 1/hours (segment 3)
(j) N_i _____ #/100 ml (segment 1)
N_i _____ #/100 ml (segment 2)
N_i _____ #/100 ml (segment 3)

Section IV: Recreational Use Assessment

Please Refer to Exhibit 4

Note: This section need only be completed for year-round applicants. However, year-round exemptions can not be granted without adequately completing this section. The description provided in this Section will aid the Agency in determining the "protected status" of the affected stream reach.

In adopting the disinfection exemption process, the Illinois Pollution Control Board stated, "Explicitly included within the definition [of protected waters] are all waters 'which presently support or have the physical characteristics to support primary contact' or which 'flow through or adjacent to parks or residential areas.'" The Agency can grant year-round exemptions only when the affected waters can be classified as "unprotected".

Pursuant to the results obtained in Section III.B(6) of this application, a recreational assessment must be completed for the entire stream reach where summer instream fecal coliform concentrations are predicted to exceed 200/100 ml. This use assessment is to be conducted as outlined in Title 35, Section 378.204, Assessment of Waters for Protected Status. Note that waters to be classified as "unprotected" must possess at least one of the characteristics listed in Section 378.203. Privately owned adjacent land does not necessarily preclude access.

Provide a description of each segment in subpart (4) below. Describe such items as water depth, steepness of banks, vegetation on banks, accessibility of water, obstacles which might render the water unsuitable for primary contact activities, and whether the water is currently being used for primary contact activities. Also, answer the questions for each segment (see Part 378, Sections 378.203 and 378.204). If more space is required (or if more than three segments are utilized), please use a continuation sheet.

A. Segment One

(1) Are water depths in this segment normally two feet or less (with no pronounced deep pools) during the summer?
☐ Yes ☐ No
(2) Does the water in this segment contain physical obstacles sufficient to preclude access or prevent primary contact activities?
☐ Yes ☐ No If Yes, describe in (4) below.
(3) Are adjacent land uses for the waters in this segment sufficient to discourage primary contact activities?
☐ Yes ☐ No If Yes, describe in (4) below.
(4) If any question from (1) through (3) applies only to a portion of the segment, please indicate below to what portion the question applies.

_____
_____

B. Segment Two

(1) Are water depths in this segment normally two feet or less (with no pronounced deep pools) during the summer?
☐ Yes ☐ No
(2) Does the water in this segment contain physical obstacles sufficient to preclude access or prevent primary contact activities?
☐ Yes ☐ No If Yes, describe in (4) below.
(3) Are adjacent land uses for the waters in this segment sufficient to discourage primary contact activities?
☐ Yes ☐ No If Yes, describe in (4) below.
(4) If any question from (1) through (3) applies only to a portion of the segment, please indicate below to what portion the question applies.

_____
_____
_____
_____
_____
_____

C. Segment Three

(1) Are water depths in this segment normally two feet or less (with no pronounced deep pools) during the summer?
☐ Yes ☐ No
(2) Does the water in this segment contain physical obstacles sufficient to preclude access or prevent primary contact activities?
☐ Yes ☐ No If Yes, describe in (4) below.
(3) Are adjacent land uses for the waters in this segment sufficient to discourage primary contact activities?
☐ Yes ☐ No If Yes, describe in (4) below.
(4) If any question from (1) through (3) applies only to a portion of the segment, please indicate below to what portion the question applies.

_____
_____
_____
_____
_____
_____

Section V: Other Information (Optional)

Any information on optional stream-specific investigations (dye tracer, studies, die off constant studies, etc.) should be attached as additional exhibits to this application.

Completed applications should be mailed to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Planning Section
2200 Churchill Road
Post Office Box 19276
Springfield, Illinois 62794-9276

(b) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(c) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(d) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(e) Q_i _____ cfs (segment 1)
Q_i _____ cfs (segment 2)
Q_i _____ cfs (segment 3)
(f) d _____ (segment 1)
d _____ (segment 2)
d _____ (segment 3)
(g) V _____ fps (segment 1)
V _____ fps (segment 2)
V _____ fps (segment 3)
(h) t _____ hours (segment 1)
t _____ hours (segment 2)
t _____ hours (segment 3)
(i) k _____ 1/hours (segment 1)
k _____ 1/hours (segment 2)
k _____ 1/hours (segment 3)
(j) N_i _____ #/100 ml (segment 1)
N_i _____ #/100 ml (segment 2)
N_i _____ #/100 ml (segment 3)

(3) 50% Recurrence Frequency (during winter):

(a) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(b) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(c) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(d) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(e) Q_i _____ cfs (segment 1)
Q_i _____ cfs (segment 2)
Q_i _____ cfs (segment 3)
(f) d _____ (segment 1)
d _____ (segment 2)
d _____ (segment 3)
(g) V _____ fps (segment 1)
V _____ fps (segment 2)
V _____ fps (segment 3)
(h) t _____ hours (segment 1)
t _____ hours (segment 2)
t _____ hours (segment 3)
(i) k _____ 1/hours (segment 1)
k _____ 1/hours (segment 2)
k _____ 1/hours (segment 3)
(j) N_i _____ #/100 ml (segment 1)
N_i _____ #/100 ml (segment 2)
N_i _____ #/100 ml (segment 3)

(4) 70% Recurrence Frequency (during winter):

(a) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(b) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(c) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(d) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(e) Q_i _____ cfs (segment 1)
Q_i _____ cfs (segment 2)
Q_i _____ cfs (segment 3)
(f) d _____ (segment 1)
d _____ (segment 2)
d _____ (segment 3)
(g) V _____ fps (segment 1)
V _____ fps (segment 2)
V _____ fps (segment 3)
(h) t _____ hours (segment 1)
t _____ hours (segment 2)
t _____ hours (segment 3)
(i) k _____ 1/hours (segment 1)
k _____ 1/hours (segment 2)
k _____ 1/hours (segment 3)
(j) N_i _____ #/100 ml (segment 1)
N_i _____ #/100 ml (segment 2)
N_i _____ #/100 ml (segment 3)

(5) 90% Recurrence Frequency (during winter):

(a) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(b) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(c) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(d) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)
(e) Q_i _____ cfs (segment 1)
Q_i _____ cfs (segment 2)
Q_i _____ cfs (segment 3)
(f) d _____ (segment 1)
d _____ (segment 2)
d _____ (segment 3)
(g) V _____ fps (segment 1)
V _____ fps (segment 2)
V _____ fps (segment 3)
(h) t _____ hours (segment 1)
t _____ hours (segment 2)
t _____ hours (segment 3)
(i) k _____ 1/hours (segment 1)
k _____ 1/hours (segment 2)
k _____ 1/hours (segment 3)
(j) N_i _____ #/100 ml (segment 1)
N_i _____ #/100 ml (segment 2)
N_i _____ #/100 ml (segment 3)

Applicants for year-round exemption should complete

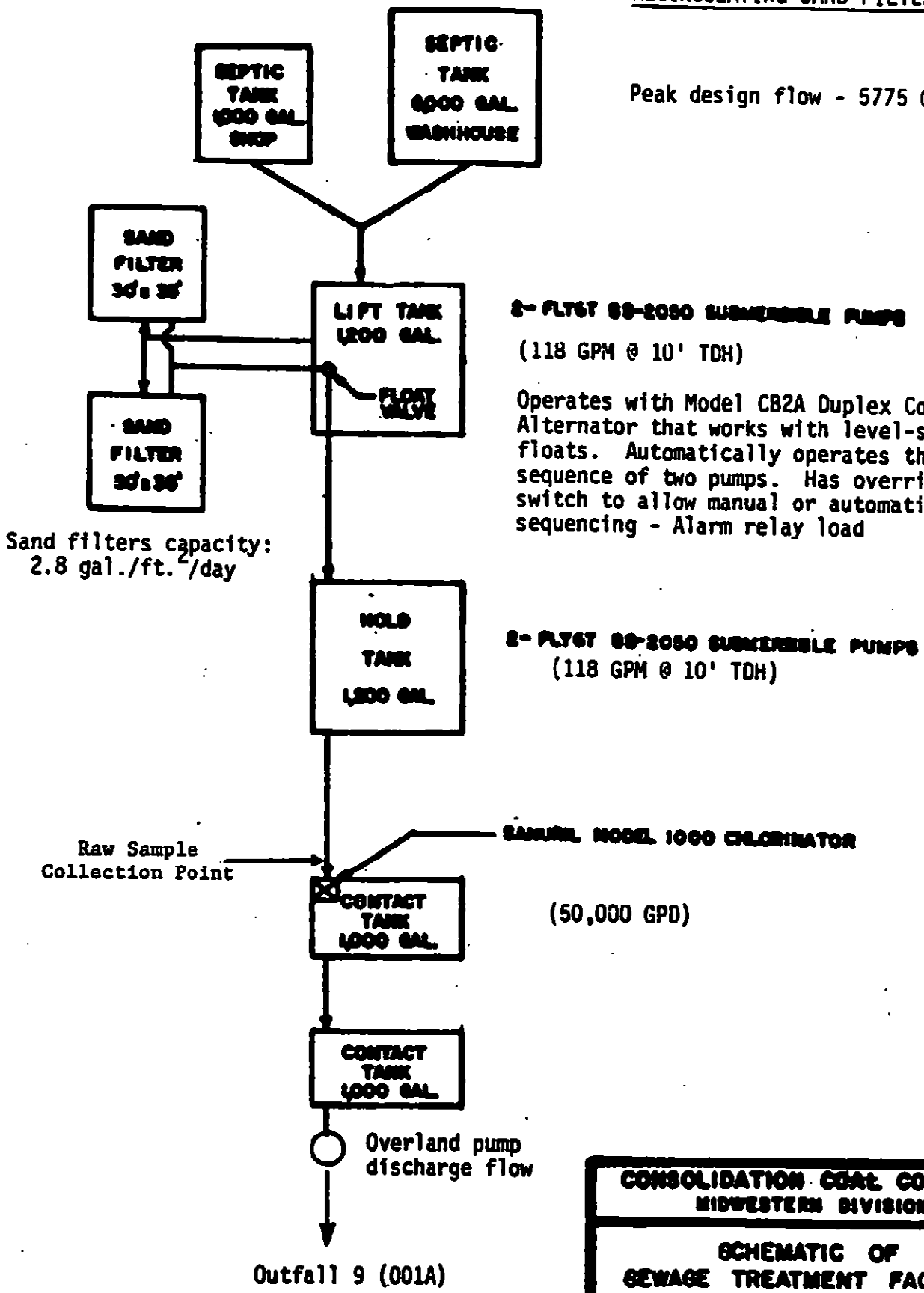
(6) 50% Recurrence Frequency (during summer):

Note: If N_i is greater than 200/100 ml. at the end of any segment, modeling must continue for additional segments.

(a) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(b) N_o _____ #/100 ml (segment 1)
N_o _____ #/100 ml (segment 2)
N_o _____ #/100 ml (segment 3)
(c) Q_o _____ cfs (segment 1)
Q_o _____ cfs (segment 2)
Q_o _____ cfs (segment 3)

RECIRCULATING SAND FILTER SYSTEM

Peak design flow - 5775 GPD

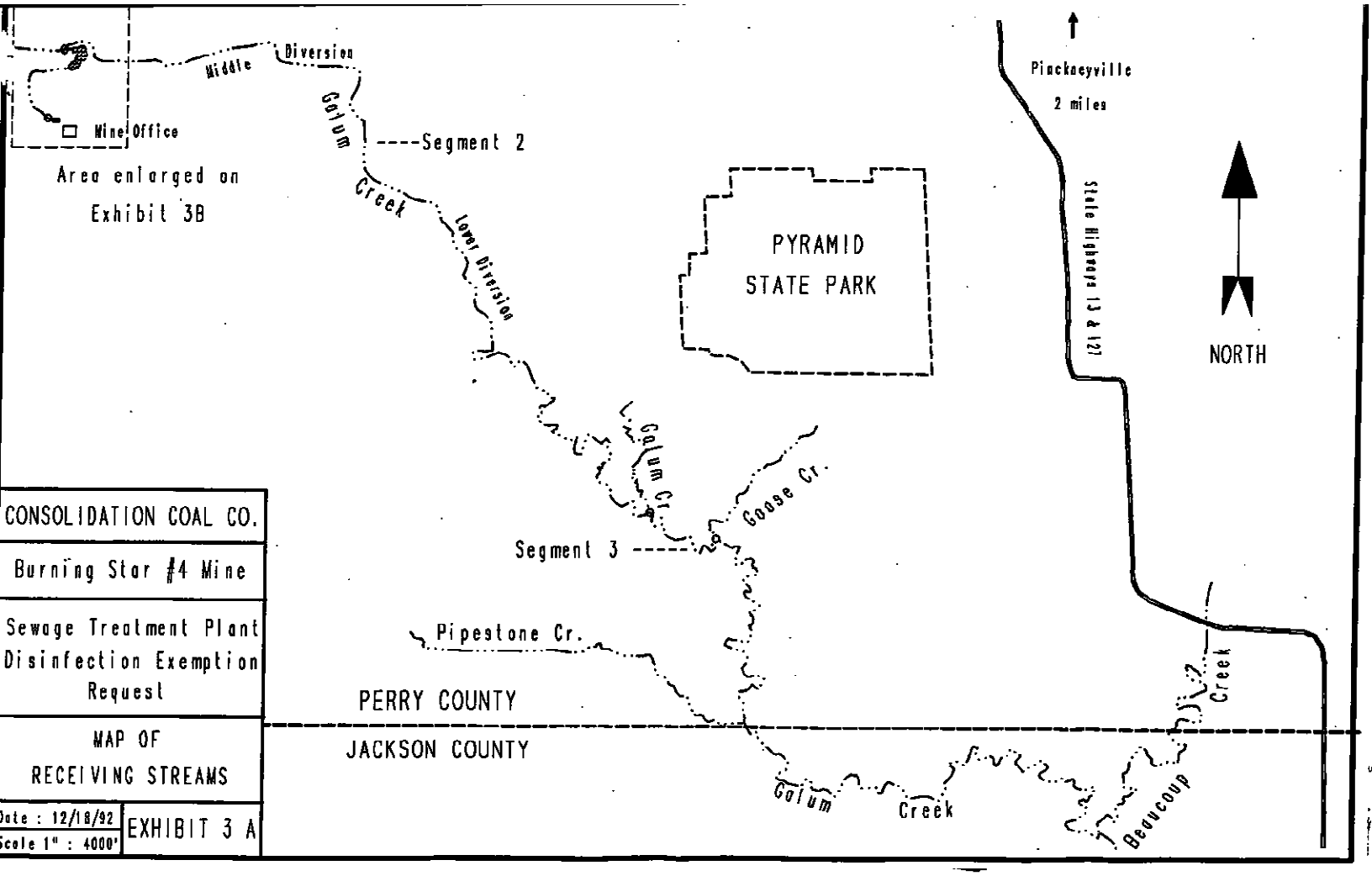


CONSOLIDATION COAL COMPANY
MIDWESTERN DIVISION

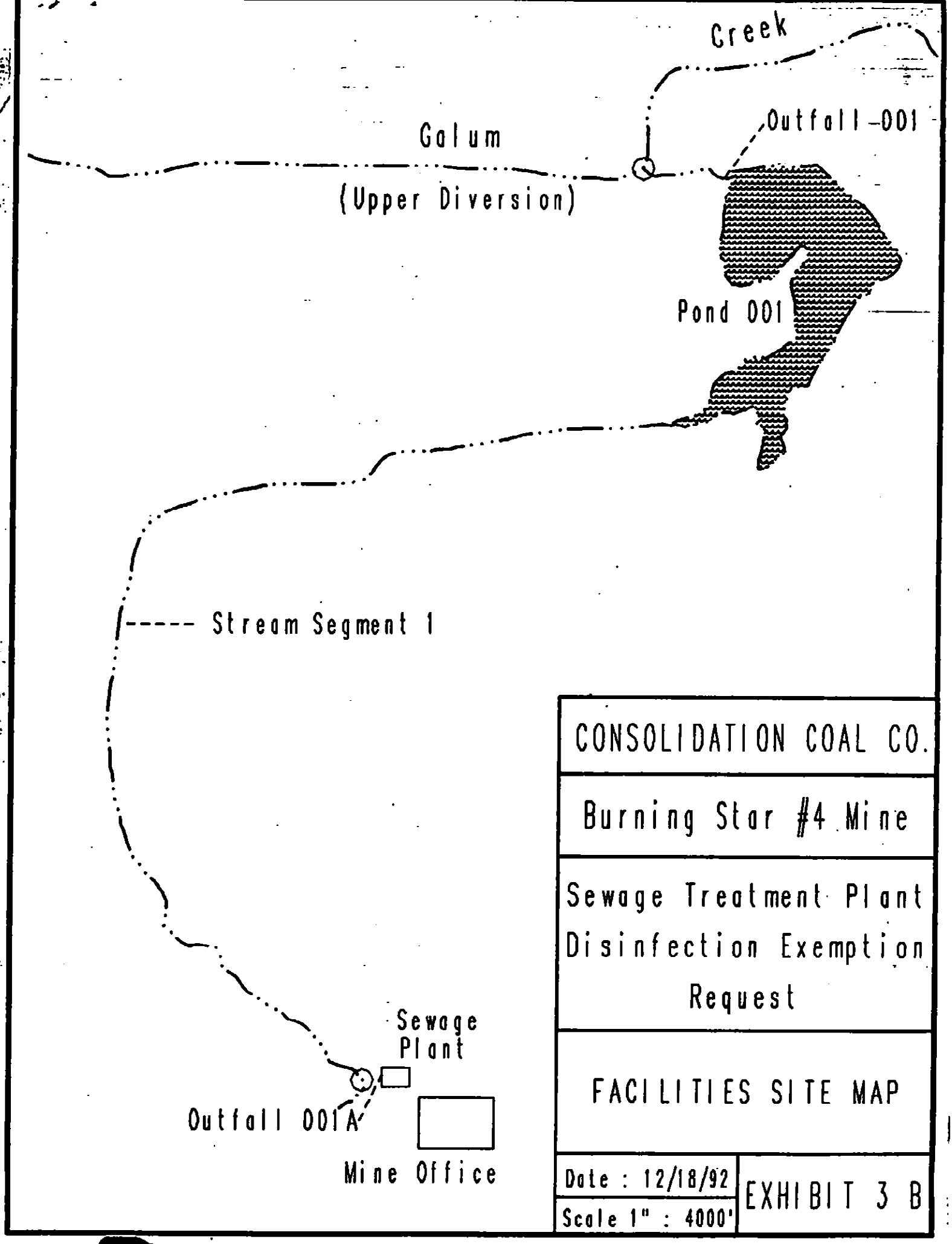
SCHEMATIC OF SEWAGE TREATMENT FACILITY BURNING STAR NO. 4

DATE February 1989	SCALE NONE
DWG	REV.
APPD	DRAWING NO.

EXHIBIT 1



CONSOLIDATION COAL CO.	
Burning Star #4 Mine	
Sewage Treatment Plant Disinfection Exemption Request	
MAP OF RECEIVING STREAMS	
Date : 12/18/92 Scale 1" : 4000'	EXHIBIT 3 A


Creek
Outfall-001
Galum
(Upper Diversion)
Pond 001
Stream Segment 1
Sewage
Plant
Outfall 001A
Mine Office
CONSOLIDATION COAL CO.
Burning Star #4 Mine
Sewage Treatment Plant
Disinfection Exemption
Request
FACILITIES SITE MAP
Date : 12/18/92
Scale 1" : 4000'
EXHIBIT 3 B

BURNING STAR NO. 4 MINE
SEWAGE TREATMENT PLANT
DOWNSTREAM DRAINAGE DESCRIPTION
EXHIBIT 4

The Burning Star #4 Sewage Treatment Plant (STP) discharges to an unnamed ditch that drains into Pond 001, which is itself a permitted NPDES discharge point. The pond at normal pool contains approximately 19 acre feet of water and is used as a sedimentation pond and also as a source of water for haulroad dust control purposes. Due to water usage for dust control activities at the mine, the pond, during dry summer months, discharges only in response to major precipitation events. This is evident by the lack of samples collected during the summer at Pond 001. The NPDES sampling frequency for Pond 001 requires that a minimum of 9 samples be collected every calendar quarter. This requirement is a mixture of baseflow and rainfall samples. The table below shows that the pond discharged during 5 out of a possible 20 months for the June thru October time period during the past four years. Of the 8 samples collected 5 resulted from storm runoff. Primary contact activities in Galum Creek downstream of Pond 001 is unlikely during such pond discharges due to high creek stages and water turbidity caused by storm runoff.

Pond 001 Sampling Occurrences
From June - October for 1989 - 1992

Month/Sample Type*	1989		1990		1991		1992	
	B	R	B	R	B	R	B	R
June	0	0	2	1	0	0	1	1
July	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0
September	0	0	0	1	0	1	0	0
October	0	0	0	0	0	1	0	0

* B = Baseflow R = Rainfall

Galum Creek downstream of Pond 001 travels for approximately 22.5 miles to its confluence with Beaucoup Creek through surface mined lands, bottomland forests and farmlands. No residential areas border the creek channel. Most of the area is remote and inaccessible, however evidence of fishing activities has been observed in shallow pools (less than 3 feet deep) occurring in the Middle Diversion which is shown on Exhibit 3A. Although creek banks are steep in this stream segment it is paralleled for 3 miles by gravelled public highways which provides access to fishermen. Downstream of the Middle Diversion stream access is limited to four bridge crossings.

Filmore File

ILLINOIS DEPARTMENT OF MINES AND MINERALS

Richard R. Shockley
Director

9/28-89

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970

RECEIVED
JUN 19 1989
MINE POLLUTION CONTROL PROGRAM

MEMORANDUM

TO: Steve Chard, Department of Agriculture
Patrick Malone, Department of Conservation
Ron Barganz, Environmental Protection Agency
Ron Barganz, Environmental Protection Agency
David Boyce, Department of Transportation
Thomas E. Emerson, Ill. Historic Preservation Agency

FROM: Ernest Ashby, Permit Coordinator
Land Reclamation Division

NEEDS Log # CAN'T LONG GONE 3/15/94

DATE: June 15, 1989

RE: Surface Mining Interagency Committee

Enclosed please find information regarding an operations plan change approved by the Department for Consolidation Coal Company, Burning Star #4 Mine, Permit #74. This revision grants approval to construct a temporary ditch.

Insignificant operations revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Insignificant reclamation revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Incidental boundary revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(d). Exemptions from the use of a sediment pond are approved pursuant to 62 Ill. Adm. Code 1816.41(d)(1)/1817.41(d)(1).

Enclosure

cc: OSM
T. Johnson-ENR
P. Ehret
D. Livesay
W. Runnels - SCS

IDNR-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
NOV 10 2015
REVIEWER: JKS

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JUN 27 1989

ILLINOIS DEPARTMENT OF MINES AND MINERALS
Richard R. Shockley
Director

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970

June 6, 1989

Mr. Marc Tidquist
Consolidation Coal Company
12755 Olive Boulevard
St. Louis, Missouri 63141

Dear Mr. Tidquist:

RE: Insignificant Revision #25
Permit #74

The appropriate Department technical staff have reviewed the proposed mining operations plan change dated May 15, 1989, submitted by Consolidation Coal Company for Burning Star #4 Mine. Consolidation Coal Company has requested approval to construct a temporary ditch along the eastern edge of the southern cemetery's buffer zone. This ditch will be constructed to convey the drainage from the southern boxcut spoil to the old #1 incline. Since this operation is not currently approved, it will constitute a mining operations change. Such insignificant revisions are allowed by 62 Ill. Adm. Code 1774.13(b)(2)(D) if the proposed changes:

1. are described in writing.

2. will not have a significant potential adverse impact on the achievement of final reclamation plans or upon the surrounding area.

The Department has determined the proposed change is in compliance with 62 Ill. Adm. Code 1700-1850, is insignificant and will not change the final reclamation plan for this permit and hereby exempts Consolidation Coal Company from submitting a permit revision application in accordance with 62 Ill. Adm. Code 1774.13(b)(2)(D). The Department grants permission to construct the ditch as per the submitted plan. Please submit ten (10) additional copies of your request letter(s) and maps to this office.

IDPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

NOV 1 0 2015

REVIEWER: JKS

xc: IAC ✓
Co

All conditions and provisions contained in the original permit approval also apply to this revision. Approval from this agency does not relieve Consolidation Coal Company from obtaining approval from other agencies requiring such. Should you have any questions, please contact M. Dean Livesay at our Southern District Office.

Sincerely,

Paul J. Ehret, Supervisor
Land Reclamation Division

PJE:MDL:mc

cc: J. Fulton
M.D. Livesay

CONSOL

Consolidation Coal Company
Mid-Continent Region
12755 Olive Boulevard
St. Louis, Missouri 63141
(314) 275-2300

May 15, 1989

Mr. Paul Ehret, Supervisor
Illinois Department of Mines & Minerals
Land Reclamation Division
300 West Jefferson, Suite 300
P. O. Box 10197
Springfield, IL 62791-0197

RECEIVED
SPRINGFIELD
JUN 13 1989
DEPT. OF MINES AND MINERALS
LAND RECLAMATION DIV.

Mr. Ron Barganz
Illinois Environmental Protection Agency
Mining Program
2200 Churchill Road
Springfield, IL 62706

Re: Insignificant Revision to Burning Star #4, Permit #74
(Addition of Temporary Ditch CS)

Dear Sirs:

In accordance with Rule 1774.13(b)(1), we are proposing an insignificant mining operations plan change to the above referenced permit.

The requested revision involves excavating a temporary ditch along the eastern boundary of the southern cemetery located in Permit #74. The ditch will convey the drainage, from the southern boxcut spoil, to the old #1 incline.

Included with this revision is an updated page from Volume I of Permit 74, Revision 1. Revised page IV-8 will replace page IV-8. The design for Ditch CS will be the first entry into Attachment F, Volume II. Attachment F should follow Attachment E.

Enclosed is the appropriate design information. If there are any questions, please contact this office.

Sincerely,

Marc Tidquist

Marc Tidquist
Project Engineer

/vls
cc: D. Livesay

Enclosure

IDPA-DIVISION OF RECORDS MANAGEMENT
RELEASED
NOV 10 2015
REVIEWER: JKS

Grayson G. Heard
Senior Vice President

Consolidation Coal Company
Mid-Continent Region
12755 Olive Boulevard
St. Louis, Missouri 63141
(314) 275-2305

May 15, 1989

Mr. R. M. Barganz
Manager, Permit Section - Mine Pollution Control Program
Illinois Environmental Protection Agency
2200 Churchill Road
P. O. Box 19276
Springfield, Illinois 62794-9276

SUBJECT: Insignificant Revision to Permit No. 74

Dear Mr. Barganz:

As per the requirements in Title 35 of the Illinois Administrative Code, Subtitle D, Chapter 1, a signature of a principal executive officer of at least the level of vice president, is required by Section 404.105. The above referenced Application for Permit is hereby authorized by my signature below.

Sincerely,

Grayson Heard

Grayson G. Heard

GGH:bld:FORMS

attachment

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements was done by me or under by direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations.

☐ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

☐ Whereas the operation proposes disposal of spoil or waste materials in areas other than mine workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

☒ Certification for Illinois Environmental Protection Agency - 35 Ill. Admin. Code 405.104(a) Permit. In my professional judgement, the plans, and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc., are accurate insofar as they represent existing conditions.

Ervin A. Anderson Name	062-0038535 Illinois Registration Number (Seal)
Consolidation Coal Company Firm	314-275-2414 Phone Number
12755 Olive Blvd., Address	St. Louis, MO 63141
Ervin Anderson Signature	5-17-89 Date

Temporary Ditch CS

Temporary Ditch CS will convey drainage along the eastern perimeter of the Southern Cemetary located in Permit #74. Ditch CS's tributary drainage area is equal to 13.3 Ac.

For 13.3 Acres, CN 80 (Steep), 2 yr/6 hr storm, 2.6"

Q peak = 12.3 cfs[1]

This ditch was designed for 12.3 cfs. Using Manning's Open Channel Flow Equation, where

Bottom Width = 6 ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal
n = 0.030
s = 0.003 ft/ft

@ 0.6' $Q = \frac{1.49}{0.030}(4.32)(0.50)^{.67}(0.003)^{.5}$

$= 7.4$ cfs

$Q = Av$
$7.4 = 4.3v$
1.7 f/s $= v$

@ 0.8' $Q = \frac{1.49}{0.030}(6.08)(0.63)^{.67}(0.003)^{.5}$

$= 12.1$ cfs

$Q = Av$
$12.1 = 6.1v$
2.0 f/s $= v$

@ 1.0' $Q = \frac{1.49}{0.030}(8.00)(0.76)^{.67}(0.003)^{.5}$

$= 18.1$ cfs

$Q = Av$
$18.1 = 8.0v$
2.3 f/s $= v$

As can be seen from the above information, at a flow depth of 0.8 feet, Ditch CS can convey 12.1 cfs at a velocity of 2.0 fps.

Ditch spoil will be graded and maintained at a height less than 6 feet and will be seeded as soon as possible. This ditch will be backfilled in accordance with the approved reclamation plan.

(1) Qpeak for this watershed was generated using SEDIMOT II. The design storm used was a 2 year-6 hour event. The rainfall distribution used was the (SCS) NEH-4. Since this ditch does not act in concert with any other structures but merely provides outlet drainage, the 2 year-6 hour storm was felt to be an appropriate design standard.

FLOWLINE PROFILE

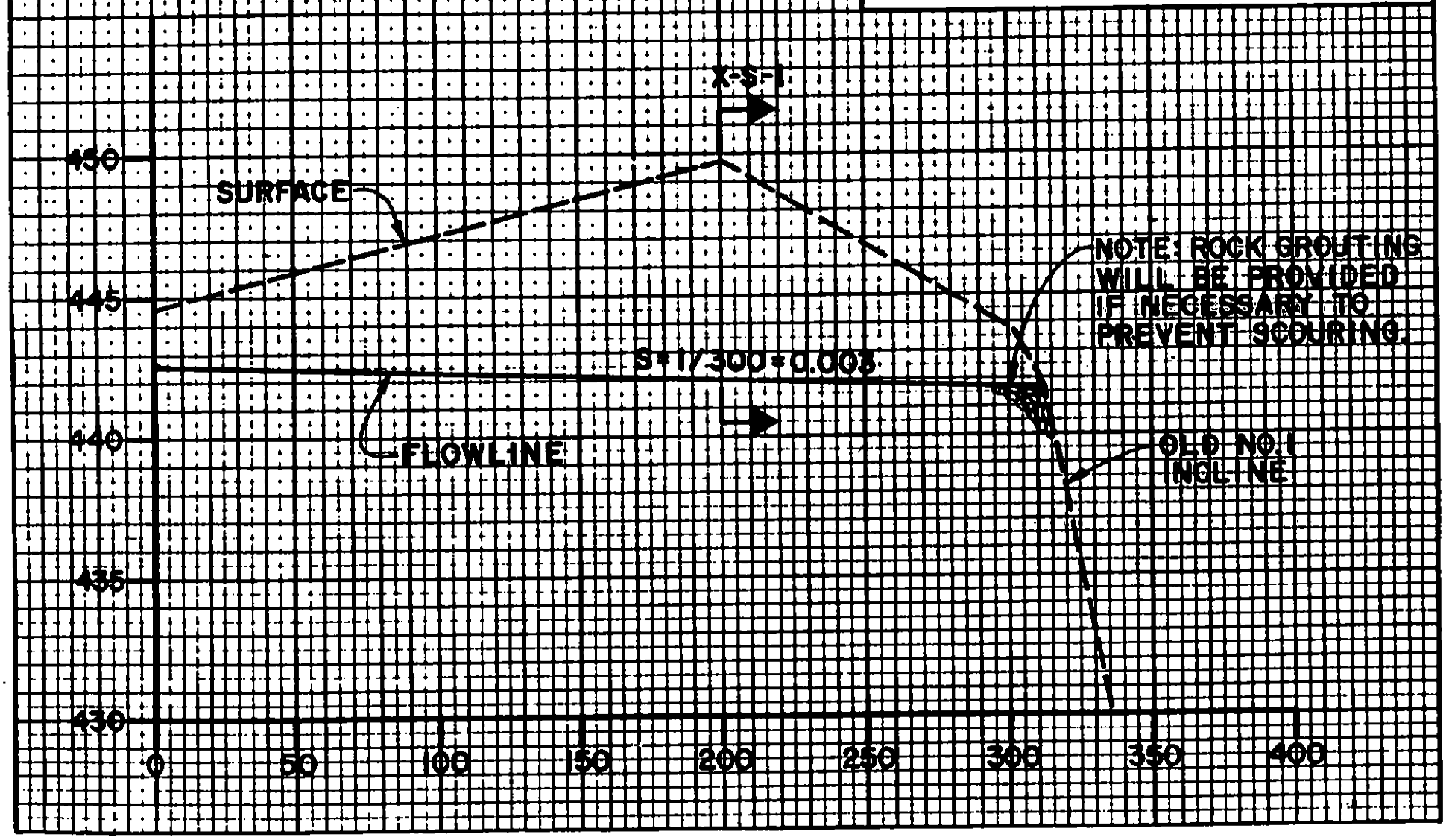
DITCH CS (TEMPORARY)

PERMIT NO. 74

MINE B.S. NO. 4

DESIGNED BY: M.A.T. DATE: 5/89

DRAWN BY: A.B.B.



CROSS SECTION S-X-1

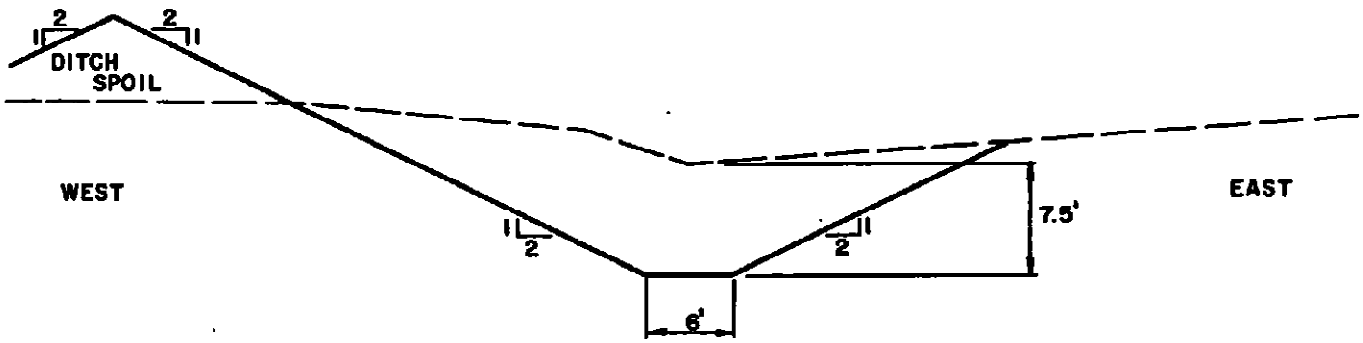
DITCH CS (TEMPORARY)

PERMIT NO. 74

MINE B.S. NO. 4

DESIGNED BY: M.A.T. DATE: 5/89

DRAWN BY: A.B.B.



D. Overland Flow Diversions

Refer to Permit 74 for Part D.

Temporary Ditch CS can be found in Volume II, Attachment F.

For all diversions of overland flow, shallow ground water flow, and ephemeral streams which divert surface water around the mining area, and all collection drains that transport affected area runoff into water-treatment facilities, provide the following:

1. Typical cross sections showing bottom width, side slopes and depth.

2. Proposed flow line slope.

3. Runoff diversion capacity calculations.

4. Details of proposed erosion and sediment control measures to be employed.

For permanent diversions also include:

1. Watershed limits upstream from the diversion

2. Plan profile drawings of the proposed diversion showing existing gradeline, proposed diversion bottom gradeline and water surface at design storm.

E. Sedimentation Pond Design:

Refer to Permit 74
Ponds 023, 023A, 025B & 042 can be found in Volume II, Attachment E.

F. 1. Discuss the design for the sediment pond(s) calculations.

Refer to Permit 74
Ponds 023, 023A, 025B & 042 can be found in Volume II, Attachment E.

2. Submit a typical section of the embankment(s), details of the principal and emergency spillways and a plan view of each pond at a scale of 1 inch = 200 ft. or larger showing pond bottom contours and points of inflow.

Refer to Permit 74
Ponds 023, 023A, 025B, & 042 can be found in Volume II, Attachment E.

Revised 4/14/89
Revised 5/15/89

ILLINOIS DEPARTMENT OF MINES AND MINERALS
Ronald E. Morse
Director

PROTECTING OUR RESOURCES

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

6067-92-A SAME AS 6067-92

6067-92-A

REVIEW AS 6067-92

RECEIVED
JUL 31 1992
BUREAU OF WATER

M E M O R A N D U M

TO: Steve Chard, Department of Agriculture
Patrick Malone, Department of Conservation
Kurt D. Neibergall, Environmental Protection Agency
Kurt D. Neibergall, Environmental Protection Agency
David Boyce, Department of Transportation
Thomas E. Emerson, Illinois Historic Preservation Agency

RECEIVED
JUL 31 1992
MINE POLLUTION CONTROL PROGRAM

FROM: Ernest Ashby, Permit Coordinator
Land Reclamation Division

DATE: July 30, 1992

RE: Surface Mining Interagency Committee

Enclosed please find Insignificant Permit Revision No. 30 approved by the Department for Consolidation Coal Company, Burning Star No. 4 Mine, Permit No. 152. This revision grants approval to implement Phase IV Drainage Control Plan.

Insignificant operations revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Insignificant permit revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Incidental boundary revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(d). Exemptions from the use of a sediment pond are approved pursuant to 62 Ill. Adm. Code 1816.41(d)(1)/1817.41(d)(1).

Enclosure
cc: D.McKay-ISGS
W.Runnels-SCS
D.Martin
OSMRE

Action Req'd 1/14/93

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
NOV 10 2015
REVIEWER: JKS

RECEIVED
AUG 04 1992
IL EPA
MARION REGIONAL OFFICE

ILLINOIS DEPARTMENT OF MINES AND MINERALS

Ronald E. Morse
Director

PROTECTING OUR RESOURCES

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

July 9, 1992

Mr. Ervin Anderson
Consolidation Coal Company
12755 Olive Boulevard
St. Louis, Missouri 63141

Dear Mr. Anderson:

Re: Insignificant Revision No. 30
Permit No. 152

The appropriate Department technical staff have reviewed the proposed mining operations plan change dated May 21, 1992, submitted by Consolidation Coal Company for Burning Star No. 4 Mine. Consolidation Coal Company has requested approval to update the Phase IV Drainage Control Plan by revising roads, sediment ponds, drainage ditches and the alignment of inclines. Since this operation is not currently approved, it will constitute a mining operations change. Section 1774.13(b)(2)(D) of Title 62 of the Illinois Administrative Code allows such insignificant revisions if the proposed changes:

1. Are described in writing.

2. Will not have a significant potential adverse impact on the achievement of final reclamation plans or upon the surrounding area.

The Department has determined the proposed change is in compliance with 62 Ill. Adm. Code 1700 - 1850, is insignificant and will not change the final reclamation plan for this permit and hereby exempts Consolidation Coal Company from submitting a permit revision application in accordance with Section 1774.13(b)(2)(D). The Department grants permission to implement the Phase IV Drainage Control Plan, as proposed in the aforementioned submittal, and in accordance with the condition detailed below. Please submit ten (10) additional copies of your request letter(s) and maps to this office.

The following condition shall apply to the approved insignificant revision:

Section 1816.46(b)(2) of 62 Ill. Adm. Code requires that all surface drainage from the disturbed area shall be passed through a siltation structure before leaving the permit area. The operation plan indicates the pit advancing eastward and eventually mining through the existing and proposed sediment

xc: IAC
Co.

AUG 04 1992
MARION REGIONAL OFFICE

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control facilities. It is not clear from the drainage control map how affected runoff from behind the pit will be controlled during this phase. In order to demonstrate compliance with the above regulation, the operator shall submit to the Department a plan to address how this drainage will be controlled. The plan shall be submitted within sixty (60) days of the date of this approval letter.

All conditions and provisions contained in the original permit approval also apply to this revision. Approval from this agency does not relieve Consolidation Coal Company from obtaining approval from other agencies requiring such. Should you have any questions, please contact Darin Martin at our Carterville office (618-985-6525).

Sincerely,

Fred K. Bowman

Fred K. Bowman, Supervisor
Land Reclamation Division

FKB:DM:mc
cc: D.Martin
OSMRE

Consolidation Coal Company
Mid-Continent Region
12755 Olive Boulevard
St. Louis, Missouri 63141
(314) 275-2300

May 21, 1992 60 67 92

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MAY 26 1992
MINE POLLUTION
CONTROL PROGRAM

Mr. Fred K. Bowman, Supervisor
Illinois Department of Mines & Minerals
Land Reclamation Division
300 West Jefferson, Suite 300
P. O. Box 10197
Springfield, IL 62791-0197

Re: Burning Star #4, Permit #152
Phase IV Drainage and Road Profile Changes

Dear Mr. Bowman:

In accordance with Rule 1774.13(b)(2)(D&E), Consol is requesting an insignificant mining operations plan change to the above referenced permit.

This request involves a revision to the Surface Drainage Control Plan (Phase IV).

Phase IV is designed to accommodate drainage concerns until Bonnie Creek has been restored. The Bonnie Creek Diversion can then be mined into, completing mining within Permit #152. The primary revisions within this request are as follows: the replacement of Ditches F & G with a multiple ditch system, the redesign of Ponds 036 and 037, the redesign of Ponds 035A through 035E (two outfalls were eliminated yielding Ponds 035A through 035C). The appropriate lateral and service road drawings have been revised to indicate newly proposed culvert locations, road widths and alignments, and existing field conditions. The configurations of Ponds 043 (Cells A & B) and 044 (Cells A & B) have also been updated to reflect as-built conditions. (Note: Phase IV is shown on Drawing PH4-1.)

It is also requested that pump outfalls be allowed in addition to the approved outfalls for Ponds 043 (Cells A & B) and Pond 044B. This would allow for pumping from the ponds during non-rainfall periods, thus providing additional treatment volume during storm events. Pumps would also be used to dewater the ponds as the pit advances toward them. Pumping would be done so as not to disturb bottom sediments.

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MAY 29 1992
IL ENVIRONMENTAL PROTECTION AGENCY
MARION REGIONAL OFFICE

Following is a list of the revised and additional information to be included in Permit 152.

Design & Narrative Pages

Replace Ponds 035 A-E design pages with new Ponds 035 A-C design pages.

Replace Ditches F & G designs with the Phase IV Ditch designs.

Maps & Drawings

New Plan/Profile sheets for Ponds 035 A-C, 036 and 037 (2 Sheets total).

New Plan/Profile sheets for Phase IV ditches (2 sheets total).

Revised Surface Drainage Control Map F.

Revised Mine Operations Plan Map D.

Revised Profile/X-Section Drawings LR1, LR2, LR3 (Laterals 1 thru 11).

Revised Profile/X-Section Drawings S2 (Service Road 3).

If you have any questions, please call Marc Tidquist.

Sincerely,

Ervin Anderson
Supervisor - Design & Construction

EA;mt/vls

Enclosures

cc: D. Martin, IDMM - Carterville (w/sealed maps)
J. Munie, IEPA - Springfield (w/sealed maps)

NPDES CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in the attached document; and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Grayson Heard

Grayson G. Heard
Senior Vice President
Mid-Continent Region

5/20/92
Date

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements was done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules, and regulations.

☐ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans conform to applicable accepted standards for adequate land stability, drainage vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

☐ Whereas the operation proposes disposal of spoil or waste materials in areas other than mine workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

☒ Certification of Illinois Environmental Protection Agency - 35 Ill. Admin. Code 405.104(a) Permit. In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

Marc A. Tidquist Name	062-045997 Illinois Registration Number (Seal)
Consolidation Coal Company Firm	314-835-2337 A. Phone Number
12755 Olive Blvd., Address	St. Louis, MO 63141 Business Address
Marc A. Tidquist Signature	1-9-92 Date

MARC A. TIDQUIST
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

(Revised 7/25/88)

Burning Star No. 4
Phase IV Ditch Designs

Summary

There are seventeen temporary ditches being proposed within Permit #152, Phase IV. These ditches consist of roadside, sump and contour ditches. The roadside and contour ditches will convey surface runoff and pit pumpage. The sump ditches will be used primarily to aid in the dewatering of the Phase III ponds. Small access roads to the sump locations are proposed. These roads would be used infrequently for pump operations and maintenance. The pump sumps will be excavated with two horizontal to one vertical sideslopes, with dimensions varying from location to location. If the inflow rate to the sumps exceeds the pump rate, runoff will be contained within the Phase IV road system with no unauthorized discharges occurring.

A 2 year-24 hour storm was used as the design storm. All ditches will have 2 to 1 sideslopes, with bottom widths varying from 6 to 10 feet. The ditches as well as any ditch spoil will be dressed and seeded as soon as is practical. The ditches are all projected to be mined through.

The specific ditch designs are contained on the following pages. The ditch plan views, profiles and cross sections can be found on Drawings PH4-1 Ditches A-F, and PH4-2 Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Ditch A

Ditch A conveys surface runoff and pumpage to Pond 037. Ditch A's tributary drainage is equal to 4.1 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 12.21.

For 4.1 Acres, CN 80 (Moderate), 2 yr/24 hr storm, 3.5"

Q peak = 10 cfs + 1.3 cfs (pumpage)

= 11.3 cfs

This ditch was designed for 12 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.002 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

<u>Flow Depth</u>

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.002)^{.5}$ $Q = Av$

$3.9 = 3.5v$

= 3.9 cfs 1.1 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(5.52)(0.52)^{.67}(0.002)^{.5}$ $Q = Av$

$7.9 = 5.5v$

= 7.9 cfs 1.4 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(7.68)(0.66)^{.67}(0.002)^{.5}$ $Q = Av$

$12.9 = 7.7v$

= 12.9 cfs 1.7 f/s = v

As can be seen from the above information, at a flow depth of 0.8 feet, Ditch A can convey 12.9 cfs at a velocity of 1.7 fps. (Minimum channel depth available is 1.3 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Ditch A, can be found on Drawing PH4-1, Ditches A-F, Profiles and Cross Sections.

Phase IV
Temporary Ditch B

Ditch B conveys surface runoff and pumpage to Pond 037. Ditch B's tributary drainage is equal to 3.1 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 12.21.

For 3.1 Acres, CN 80 (Moderate), 2 yr/24 hr storm, 3.5"

Q peak = 7 cfs + 1.3 cfs (pumpage)

= 8.3 cfs

This ditch was designed for 9 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.002 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.002)^{.5}$ $Q = Av$

$3.9 = 3.5v$

= 3.9 cfs 1.1 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(5.52)(0.52)^{.67}(0.002)^{.5}$ $Q = Av$

$7.9 = 5.5v$

= 7.9 cfs 1.4 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(7.68)(0.66)^{.67}(0.002)^{.5}$ $Q = Av$

$12.9 = 7.7v$

= 12.9 cfs 1.7 f/s = v

As can be seen from the above information, at a flow depth of 0.8 feet, Ditch B can convey 12.9 cfs at a velocity of 1.7 fps. (Minimum channel depth available is 2 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Ditch B, can be found on Drawing PH4-1, Ditches A-F, Profiles and Cross Sections.

Phase IV
Temporary Ditch C

Ditch C conveys surface runoff and pumpage to Pond 037. Ditch C's tributary drainage is equal to 12.8 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 12.8 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 16 cfs + 1.3 cfs (pumpage)

= 17.3 cfs

This ditch was designed for 18 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.002 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.002)^{.5}$ $Q = Av$

$3.9 = 3.5v$

= 3.9 cfs 1.1 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(5.52)(0.52)^{.67}(0.002)^{.5}$ $Q = Av$

$7.9 = 5.5v$

= 7.9 cfs 1.4 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(10.00)(0.80)^{.67}(0.002)^{.5}$ $Q = Av$

$19.1 = 10.0v$

= 19.1 cfs 1.9 f/s = v

As can be seen from the above information, at a flow depth of 1.0 feet, Ditch C can convey 19.1 cfs at a velocity of 1.9 fps. (Minimum channel depth available is 2 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Ditch C, can be found on Drawing PH4-1, Ditches A-F, Profiles and Cross Sections.

Phase IV
Temporary Ditch D

Ditch D conveys surface runoff and pumpage to Pond 036. Ditch D's tributary drainage is equal to 17.8 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 17.8 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 19 cfs + 1.3 cfs (pumpage)

= 20.3 cfs

This ditch was designed for 21 cfs. Using Manning's Open Channel Flow Equation, where

Width = 10 ft
n = 0.030
s = 0.0006 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

<u>Flow Depth</u>

@ 0.6' $Q = \frac{1.49}{0.030}(6.72)(0.53)^{.67}(0.0006)^{.5}$ $Q = Av$

$5.3 = 6.7v$

= 5.3 cfs 0.8 f/s = v

@ 1.2' $Q = \frac{1.49}{0.030}(14.88)(0.97)^{.67}(0.0006)^{.5}$ $Q = Av$

$17.7 = 14.9v$

= 17.7 cfs 1.2 f/s = v

@ 1.4' $Q = \frac{1.49}{0.030}(17.92)(1.10)^{.67}(0.0006)^{.5}$ $Q = Av$

$23.2 = 17.9v$

= 23.2 cfs 1.3 f/s = v

As can be seen from the above information, at a flow depth of 1.4 feet, Ditch D can convey 23.2 cfs at a velocity of 1.3 fps. (Minimum channel depth available is 1.6 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Ditch D, can be found on Drawing PH4-1, Ditches A-F, Profiles and Cross Sections.

Phase IV
Temporary Road Ditch E

Road Ditch E conveys surface runoff and pumpage to Pond 036. Ditch E's tributary drainage is equal to 6.7 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 6.7 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 9.5 cfs + 1.3 cfs (pumpage)

= 10.8 cfs

This ditch was designed for 11 cfs. Using Manning's Open Channel Flow Equation, where

Width = 10 ft
n = 0.030
s = 0.0016 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(2.72)(0.35)^{.67}(0.0016)^{.5}$ $Q = Av$

$2.7 = 2.7v$

= 2.7 cfs 1.0 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(4.32)(0.50)^{.67}(0.0016)^{.5}$ $Q = Av$

$5.4 = 4.3v$

= 5.4 cfs 1.3 f/s = v

@ 1.0' $Q = \frac{1.49}{0.030}(8.00)(0.76)^{.67}(0.0016)^{.5}$ $Q = Av$

$13.2 = 8.0v$

= 13.2 cfs 1.7 f/s = v

As can be seen from the above information, at a flow depth of 1.0 feet, Road Ditch E can convey 13.2 cfs at a velocity of 1.7 fps. (Minimum channel depth available is 1.0 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Road Ditch E, can be found on Drawing PH4-1, Ditches A-F, Profiles and Cross Sections.

Phase IV
Temporary Road Ditch F

Road Ditch F conveys surface runoff and pumpage to Pond 036. Ditch F's tributary drainage is equal to 3.2 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 3.2 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 5 cfs + 1.3 cfs (pumpage)

= 6.3 cfs

This ditch was designed for 7 cfs. Using Manning's Open Channel Flow Equation, where

Width = 6 ft
n = 0.030
s = 0.004 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

<u>Flow Depth</u>

@ 0.4' $Q = \frac{1.49}{0.030}(2.72)(0.35)^{.67}(0.004)^{.5}$ $Q = Av$

$4.2 = 2.7v$

= 4.2 cfs 1.6 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(4.32)(0.50)^{.67}(0.004)^{.5}$ $Q = Av$

$8.5 = 4.3v$

= 8.5 cfs 2.0 f/s = v

As can be seen from the above information, at a flow depth of 0.6 feet, Road Ditch F can convey 8.5 cfs at a velocity of 2.0 fps. (Minimum channel depth available is 1.2 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Road Ditch F, can be found on Drawing PH4-1, Ditches A-F, Profiles and Cross Sections.

Phase IV
Temporary Road Ditch G

Road Ditch G conveys surface runoff and pumpage to Pond 035C. Ditch G's tributary drainage is equal to 3.8 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 3.8 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 5.5 cfs + 1.3 cfs (pumpage)

= 6.8 cfs

This ditch was designed for 7 cfs. Using Manning's Open Channel Flow Equation, where

Width = 6 ft
n = 0.030
s = 0.001 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(2.72)(0.35)^{.67}(0.001)^{.5}$ = 2.1 cfs

Q = Av
2.1 = 2.7v
0.8 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(4.32)(0.50)^{.67}(0.001)^{.5}$ = 4.3 cfs

Q = Av
4.3 = 4.3v
1.0 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(6.08)(0.63)^{.67}(0.001)^{.5}$ = 7.0 cfs

Q = Av
7.0 = 6.1v
1.1 f/s = v

As can be seen from the above information, at a flow depth of 0.8 feet, Road Ditch G can convey 7.0 cfs at a velocity of 1.1 fps. (Minimum channel depth available is 1.0 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Road Ditch G, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Road Ditch H

Road Ditch H conveys surface runoff and pumpage to Pond 035C. Ditch H's tributary drainage is equal to 8.0 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 8.0 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 11 cfs + 1.3 cfs (pumpage)

= 12.3 cfs

This ditch was designed for 13 cfs. Using Manning's Open Channel Flow Equation, where

Width = 10 ft
n = 0.030
s = 0.0008 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

<u>Flow Depth</u>

@ 0.4' $Q = \frac{1.49}{0.030}(4.32)(0.37)^{.67}(0.0008)^{.5}$ $Q = Av$

$3.1 = 4.3v$

= 3.1 cfs $0.7 \text{ f/s} = v$

@ 1.0' $Q = \frac{1.49}{0.030}(12.00)(0.83)^{.67}(0.0008)^{.5}$ $Q = Av$

$14.9 = 12.0v$

= 14.9 cfs $1.2 \text{ f/s} = v$

As can be seen from the above information, at a flow depth of 1.0 feet, Road Ditch H can convey 14.9 cfs at a velocity of 1.2 fps. (Minimum channel depth available is 1.0 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Road Ditch H, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Road Ditch I

Road Ditch I conveys surface runoff and pumpage to Pond 035C. Ditch H's tributary drainage is equal to 3.6 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 3.6 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 5.5 cfs + 1.3 cfs (pumpage)

= 6.8 cfs

This ditch was designed for 7 cfs. Using Manning's Open Channel Flow Equation, where

Width = 6 ft
n = 0.030
s = 0.0015 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(2.72)(0.35)^{.67}(0.0015)^{.5}$ $Q = Av$

$2.6 = 2.7v$

= 2.6 cfs 1.0 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(4.32)(0.50)^{.67}(0.0015)^{.5}$ $Q = Av$

$5.3 = 4.3v$

= 5.3 cfs 1.2 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(6.08)(0.63)^{.67}(0.0015)^{.5}$ $Q = Av$

$8.6 = 6.1v$

= 8.6 cfs 1.4 f/s = v

As can be seen from the above information, at a flow depth of 0.8 feet, Road Ditch I can convey 8.6 cfs at a velocity of 1.4 fps. (Minimum channel depth available is 1.2 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Road Ditch I, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Road Ditch J

Road Ditch J conveys surface runoff and pumpage to Pond 035B. Ditch J's tributary drainage is equal to 4.3 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 4.3 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 7 cfs + 1.3 cfs (pumpage)

= 8.3 cfs

This ditch was designed for 9 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.0012 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.0012)^{.5}$ $Q = Av$

$3.1 = 3.5v$

= 3.1 cfs 0.9 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(5.52)(0.52)^{.67}(0.0012)^{.5}$ $Q = Av$

$6.1 = 5.5v$

= 6.1 cfs 1.1 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(7.68)(0.66)^{.67}(0.0012)^{.5}$ $Q = Av$

$10.0 = 7.7v$

= 10.0 cfs 1.3 f/s = v

As can be seen from the above information, at a flow depth of 0.8 feet, Road Ditch J can convey 10.0 cfs at a velocity of 1.3 fps. (Minimum channel depth available is 1.0 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Road Ditch J, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Road Ditch K

Road Ditch K conveys surface runoff and pumpage to Pond 035A. Ditch K's tributary drainage is equal to 4.0 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 4.0 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 6 cfs + 1.3 cfs (pumpage)

= 7.3 cfs

This ditch was designed for 8 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.0037 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.0037)^{.5}$

= 5.4 cfs

$Q = Av$
$5.4 = 3.5v$
$1.5 \text{ f/s} = v$

@ 0.6' $Q = \frac{1.49}{0.030}(5.52)(0.52)^{.67}(0.0037)^{.5}$

= 10.7 cfs

$Q = Av$
$10.7 = 5.5v$
$1.9 \text{ f/s} = v$

As can be seen from the above information, at a flow depth of 0.6 feet, Road Ditch K can convey 10.7 cfs at a velocity of 1.9 fps. (Minimum channel depth available is 2.0 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Road Ditch K, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Sump Ditch L

Ditch L conveys surface runoff and pumpage to a collection sump. The water will then be pumped to Pond 037. Ditch L's tributary drainage is equal to 7.7 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 12.21.

For 7.7 Acres, CN 80 (Moderate), 2 yr/24 hr storm, 3.5"

Q peak = 15 cfs + 1.3 cfs (pumpage)

= 16.3 cfs

This ditch was designed for 17 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.0015 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.0015)^{.5}$ $Q = Av$

$3.4 = 3.5v$

= 3.4 cfs $1.0 \text{ f/s} = v$

@ 0.8' $Q = \frac{1.49}{0.030}(7.68)(0.66)^{.67}(0.0015)^{.5}$ $Q = Av$

$7.9 = 5.5v$

= 7.9 cfs $1.4 \text{ f/s} = v$

@ 1.0' $Q = \frac{1.49}{0.030}(10.00)(0.80)^{.67}(0.0015)^{.5}$ $Q = Av$

$16.6 = 10.0v$

= 16.6 cfs $1.7 \text{ f/s} = v$

As can be seen from the above information, at a flow depth of 1.0 feet, Sump Ditch L can convey 17 cfs at a velocity of 1.7 fps. (Minimum channel depth available is 2.0 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Sump Ditch L, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Sump Ditch M

Ditch M conveys surface runoff and pumpage to a collection sump. The water will then be pumped to Ditch C and conveyed to Pond 037. Ditch M's tributary drainage area is equal to 8.1 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 8.1 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 11 cfs + 1.3 cfs (pumpage)

= 12.3 cfs

This ditch was designed for 13 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.0015 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

<u>Flow Depth</u>

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.0015)^{.5}$ $Q = Av$

$3.4 = 3.5v$

= 3.4 cfs 1.0 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(7.68)(0.66)^{.67}(0.0015)^{.5}$ $Q = Av$

$11.2 = 7.7v$

= 11.2 cfs 1.5 f/s = v

@ 1.2' $Q = \frac{1.49}{0.030}(12.48)(0.93)^{.67}(0.0015)^{.5}$ $Q = Av$

$22.9 = 12.5v$

= 22.9 cfs 1.8 f/s = v

As can be seen from the above information, at a flow depth of 1.2 feet, Sump Ditch M can convey 22.9 cfs at a velocity of 1.8 fps. (Minimum channel depth available is 2.0 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Sump Ditch M, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Sump Ditch N

Ditch N conveys surface runoff and pumpage to a collection sump. The water will then be pumped to Ditch D and conveyed to Pond 036. Ditch N's tributary drainage area is equal to 10.4 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 10.4 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 13 cfs + 1.3 cfs (pumpage)

= 14.3 cfs

This ditch was designed for 15 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.0011 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.0011)^{.5}$ $Q = Av$

$2.9 = 3.5v$

= 2.9 cfs 0.8 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(7.68)(0.66)^{.67}(0.0011)^{.5}$ $Q = Av$

$9.6 = 7.7v$

= 9.6 cfs 1.2 f/s = v

@ 1.2' $Q = \frac{1.49}{0.030}(12.48)(0.93)^{.67}(0.0011)^{.5}$ $Q = Av$

$19.6 = 12.5v$

= 19.6 cfs 1.6 f/s = v

As can be seen from the above information, at a flow depth of 1.2 feet, Sump Ditch N can convey 19.6 cfs at a velocity of 1.6 fps. (Minimum channel depth available is 1.2 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Sump Ditch N, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Sump Ditch O

Ditch O conveys surface runoff and pumpage to a collection sump. The water will then be pumped to Pond 036. Ditch O's tributary drainage is equal to 16.0 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 16.0 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 18 cfs + 1.3 cfs (pumpage)

= 19.3 cfs

This ditch was designed for 20 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.0014 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.0014)^{.5}$ $Q = Av$

$3.3 = 3.5v$

= 3.3 cfs 0.9 f/s = v

@ 1.0' $Q = \frac{1.49}{0.030}(10.00)(0.80)^{.67}(0.0014)^{.5}$ $Q = Av$

$16.0 = 10.0v$

= 16.0 cfs 1.6 f/s = v

@ 1.2' $Q = \frac{1.49}{0.030}(12.48)(0.93)^{.67}(0.0014)^{.5}$ $Q = Av$

$22.1 = 12.5v$

= 22.1 cfs 1.8 f/s = v

As can be seen from the above information, at a flow depth of 1.2 feet, Sump Ditch O can convey 22.1 cfs at a velocity of 1.8 fps. (Minimum channel depth available is 1.2 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Sump Ditch O, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Sump Ditch P

Ditch P conveys surface runoff and pumpage to a collection sump. The water will then be pumped to Road Ditch G and conveyed to Pond 035C. Ditch P's tributary drainage is equal to 14.0 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 5.21.

For 14.0 Acres, CN 80 (Flat), 2 yr/24 hr storm, 3.5"

Q peak = 16 cfs + 1.3 cfs (pumpage)

= 17.3 cfs

This ditch was designed for 18 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.0022 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.0022)^{.5}$ $Q = Av$

$4.1 = 3.5v$

= 4.1 cfs 1.2 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(7.68)(0.66)^{.67}(0.0022)^{.5}$ $Q = Av$

$13.5 = 7.7v$

= 13.5 cfs 1.7 f/s = v

@ 1.0' $Q = \frac{1.49}{0.030}(10.00)(0.80)^{.67}(0.0022)^{.5}$ $Q = Av$

$20.1 = 10.0v$

= 20.1 cfs 2.0 f/s = v

As can be seen from the above information, at a flow depth of 1.0 feet, Sump Ditch P can convey 20.1 cfs at a velocity of 2.0 fps. (Minimum channel depth available is 1.2 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Road Ditch P, can be found on Drawing PH4-2, Ditches G-Q, Profiles and Cross Sections.

Phase IV
Temporary Ditch Q

Ditch Q conveys surface runoff and pumpage to Ditch C which reports to Pond 037. Ditch Q's tributary drainage is equal to 3.9 acres. From the SCS Enginering Field Manual, Chapter 2, Section 10, Page 12.21.

For 3.9 Acres, CN 80 (Flat), 2 yr/24 hr stor m, 3.5"

Q peak = 7 cfs + 1.3 cfs (pumpage)

= 8.3 cfs

This ditch was designed for 9 cfs. Using Manning's Open Channel Flow Equation, where

Width = 8 ft
n = 0.030
s = 0.001 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.4' $Q = \frac{1.49}{0.030}(3.52)(0.36)^{.67}(0.001)^{.5}$ $Q = Av$

$2.8 = 3.5v$

= 2.8 cfs 0.8 f/s = v

@ 0.6' $Q = \frac{1.49}{0.030}(5.52)(0.52)^{.67}(0.001)^{.5}$ $Q = Av$

$5.6 = 5.5v$

= 5.6 cfs 1.0 f/s = v

@ 0.8' $Q = \frac{1.49}{0.030}(7.68)(0.66)^{.67}(0.001)^{.5}$ $Q = Av$

$9.1 = 7.7v$

= 9.1 cfs 1.2 f/s = v

As can be seen from the above information, at a flow depth of 0.8 feet, Ditch Q can convey 9.1 cfs at a velocity of 1.2 fps. (Minimum channel depth available is 0.8 feet.)

This ditch will be mined through as the pit advances.

Cross Sections and Profile, for Ditch Q, can be found on Drawing PH4-1, Ditches G-Q, Profiles and Cross Sections.

Burning Star #4
Road Culverts - Phase IV

Culvert No.	Watershed	Qpeak Includes (Any Pumpage)	Pipe Dia.	Head Req'd	Routed Stage	Head Available
1) C1	200.6 ac.	277 cfs	36 in.	--	2.6 ft.	9.0 ft.
C2	5.1 ac.	2) 11 cfs	24 in.	1.9 ft.	--	9.0 ft.
C3	4.1 ac.	2) 12 cfs	24 in.	2.0 ft.	--	8.0 ft.
C4	11.1 ac.	14 cfs	24 in.	2.3 ft.	--	8.0 ft.
1) C5	125.2 ac.	188 cfs	36 in.	--	2.5 ft.	6.0 ft.
C6	3.9 ac.	7 cfs	24 in.	1.4 ft.	--	4.0 ft.
C7	11.2 ac.	14 cfs	24 in.	2.3 ft.	--	6.5 ft.
C8	11.6 ac.	14 cfs	24 in.	2.3 ft.	--	5.0 ft.
1) C9	73.8 ac.	204 cfs	36 in.	--	2.7 ft.	11.5 ft.
1) C10	10.6 ac.	37 cfs	36 in.	--	1.2 ft.	5.0 ft.
C11	3.2 ac.	7 cfs	24 in.	1.4 ft.	--	5.5 ft.
1) C12	9.5 ac.	33 cfs	36 in.	--	2.5 ft.	6.0 ft.
C13	3.8 ac.	7 cfs	24 in.	1.4 ft.	--	7.5 ft.
C14	2.0 ac.	4 cfs	24 in.	1.0 ft.	--	3.5 ft.
1) C15	117.6 ac.	234 cfs	36 in.	--	1.8 ft.	9.0 ft.
1) C16	159.8 ac.	149 cfs	36 in.	--	1.9 ft.	4.5 ft.
1) C17	180.0 ac.	72 cfs	36 in.	--	1.9 ft.	10.0 ft.
C18	6.0 ac.	9 cfs	24 in.	1.7 ft.	--	7.0 ft.

Notes: 1) Due to the cumulative effect of these culverts watersheds and their proximity within ponds, the SEDIMOT II computer model was used to estimate discharge requirements. A 25 yr-24 hr storm was used to size these culverts. (Watersheds given are prior to establishment of the Phase IV ditch system; i.e., worst case.)

2) Peak inflows were estimated using the following parameters: CN-80 (Moderate), 2 yr-24 hr storm, 3.5 inches pcp, SCS Engineering Field Manual, Chapter 2, Section 10. All other peak inflows, not calculated by SEDIMOT II, were determined using the above parameters with the exception of CN-80 (Flat).

Copies of the computer models are available upon request.

Pond Summary

Pond 035A (formerly designated as Ponds 035A and 035B) is being proposed as temporary. It will treat 29.0 acres. The pond is cross valley, and has been sized to treat a 10 yr-24 hour storm as well as provide sediment volume for the site life of two years. We request this pond have a pump and/or pipe discharge. Pumping will only be done during non-rainfall periods, with a minimum of two feet of pool depth being maintained to prevent resuspension of bottom sediments. The primary spillway will be a 36 inch corrugated metal pipe decant with an 18 inch corrugated metal pipe serving as the emergency spillway. The peak pool increase is 0.8 feet for a 25 yr-24 hr storm with the peak discharge being 21.2 cfs. The inflow points for this pond have been situated to utilize treatment length available within the pond.

The design of this pond entails: providing a treatment volume equal to 10/24 of the total runoff volume, sediment volume equal to the sediment yield for two years of life as predicted by the Universal Soil Loss Equation, and an outlet performance verification as routed using the SEDIMOT II computer model.

The specific pond design can be found on the following pages. The pond plan view, profile and cross section are located on Drawing PH4-3.

TEMPORARY IMPOUNDMENT POND (035A)

Drainage Area	:	29.0 ac.
Design Event - Normal Pool	:	10 yr/24 hr (4.9 inches)
Design Event - Spillway Performance	:	25 yr/24 hr (5.6 inches)
Storm Type	:	SCS Type II
Hydrologic Soil Group	:	C
Curve Number - CN	:	80 (Flat)

I. Pond Sizing Calculations

A. Total Runoff Volume (Vt):

From Illinois Exhibit 2-4, Engineering Field Manual - Notice 10, 6/74. Runoff Depth - 2.81 inches

Vt = Runoff Volume + Pumpage Volume

$$Vt = \frac{(29.0\ ac)(2.81\ inches)}{12\ in/ft} + \frac{1200\ gpm\ (60\ min/hr)(24\ hrs/day)}{7.48\ gal/ft^3\ (43560\ ft^2/ac)}$$

Vt = 6.8 ac-ft + 5.3 ac-ft

= 12.1 ac-ft

B. Pool Volume:

Consol proposes constructing the sediment pond such that the pond volume provides 10/24 of the total runoff volume. This should allow sufficient detention time to effectively treat the water.

$$\text{Design Pool Volume} = \frac{10}{24}\ (12.1\ ac\text{-}ft) = 5.0\ ac\text{-}ft$$

C. Sediment Storage Volume:

The following are sediment yield calculations as predicted by the Universal Soil Loss Equation (USLE) for an estimated life of 2 years. Using the Universal Soil Loss Equation;

A = (R)(K)(LS)(CP) where:

A = Average Soil Loss (tons/ac-yr)
R = Rainfall Erosivity Factor (Annual) = 240
K = Soil Erodibility Factor - 0.43
(SCS Soils Interpretation Record)
*LS = Slope Length and Steepness Factor
**CP = Control Practice Factor

The following USLE Parameters charts illustrate the Control Practice Factor (CP) and topographic characteristics of the watershed for specific time intervals during the estimated 2 year life of the pond. Weighted averages of the USLE Parameters are then applied to the Universal Soil Loss Equation for the period of time specified to predict the sediment yield.

USLE Parameters

During the life of the pond, the area is expected to be disturbed as follows:

Location	Area (ac)	Activity	Avg. Slope (%)	CP
Entire Watershed Area	29.0	Disturbed	2.0	1.00
		S = 2.0 *LS = 0.20	**CP = 1.00	

A = (240)(0.43)(0.20)(1.00)
A = 20.6 tons/ac-yr

Sediment Yield = (20.6 tons/ac-yr) (29.0 ac) (2 yr)

= 1194.8 tons

* Topographic Factor, LS "Applied Hydrology and Sedimentology for Disturbed Areas" p. 334, LS is derived using an Average Slope Length = 100 ft. and an area weighted avg. slope, S.

** Control Practice Factor CP "Applied Hydrology and Sedimentology for Disturbed Areas" p. 390, Appendix 5A.
CP represents the area weighted average of the CP values.

$$\text{Sediment Volume} = (1194.8 \text{ tons}) \left(\frac{2000 \text{ lb}}{\text{tons}}\right)\left(\frac{*\text{ft}^3}{78 \text{ lbs}}\right)\left(\frac{\text{ac}}{43560 \text{ ft}^2}\right)$$

$$= 0.7 \text{ ac-ft}$$

If pond life exceeds 2 years and water quality necessitates, the pond will be cleaned out to provide the appropriate treatment volume.

E. Total Pond Volume (Normal Pool):

Total Pond Volume = Design Pond Volume + Design Sediment Volume
= 5.0 ac-ft + 0.7 ac-ft
= 5.7 ac-ft

This pond will be constructed to provide 7.7 ac-ft of volume at normal pool which exceeds the minimum design requirement of 5.7 ac-ft. Please see the following page for storage volume calculations.

* This unit weight for sediment is based on a bulk submerged specific gravity of 1.25 multiplied by the unit weight of water which is 62.4 lbs/ft^3. This bulk submerged specific gravity is representative for soil distributions obtained from field samples. The sediment composition indicated by these samples is medium fine to fine. (Refer to page 71, Table 13, Sedimot II Users Manual.)

II. Outflow and Routing Calculations

A. Outlet Design:

Listed below is the stage-storage relationship for this pond:

Pond 035A
Stage Vs. Storage Chart

Elevation (ft)	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Cum. Volume (ac-ft)
439	0.00				0.00
		0.80	1.0	0.80	
440	1.60				0.80
		3.90	5.0	19.50	
445	6.20				20.30

Pond (035A) has been designed to provide 7.7 ac-ft of normal pool volume. This volume can be obtained at an elevation of 442.5 feet.

B. Outlet Verification: (See Drawing PH4-3)

A SEDIMOT II computer routing was performed to confirm peak discharge and peak stage values for the 25 yr/24 hr storm event. The outlet consists of a 36" decant as the primary spillway and an 18" CMP as the emergency spillway. (The emergency spillway was set at the 10 year-24 hour peak stage elevation.) The results were as follows:

Peak Inflow	=	98.7 cfs
Peak Discharge	=	21.2 cfs
Peak Stage Elev.	=	443.3 ft
Normal Pool Elev.	=	442.5 ft

Pond Summary

Pond 035B (formerly designated as Ponds 035C and 035D) is being proposed as temporary. It will treat 25.8 acres. The pond is cross valley, and has been sized to treat a 10 yr-24 hour storm as well as provide sediment volume for the site life of two years. We request this pond have a pump and/or pipe discharge. Pumping will only be done during non-rainfall periods, with a minimum of two feet of pool depth being maintained to prevent resuspension of bottom sediments. The primary spillway will be a 36 inch corrugated metal pipe decant with an 18 inch corrugated metal pipe serving as the emergency spillway. The peak pool increase is 1.0 feet for a 25 yr-24 hr storm with the peak discharge being 25.2 cfs. The inflow points for this pond have been situated to utilize treatment length available within the pond.

The design of this pond entails: providing a treatment volume equal to 10/24 of the total runoff volume, sediment volume equal to the sediment yield for two years of life as predicted by the Universal Soil Loss Equation, and an outlet performance verification as routed using the SEDIMOT II computer model.

The specific pond design can be found on the following pages. The pond plan view, profile and cross section are located on Drawing PH4-3.

TEMPORARY IMPOUNDMENT POND (035B)

Drainage Area	:	25.8 ac.
Design Event - Normal Pool	:	10 yr/24 hr (4.9 inches)
Design Event - Spillway Performance	:	25 yr/24 hr (5.6 inches)
Storm Type	:	SCS Type II
Hydrologic Soil Group	:	C
Curve Number - CN	:	80 (Flat)

I. Pond Sizing Calculations

A. Total Runoff Volume (Vt):

From Illinois Exhibit 2-4, Engineering Field Manual - Notice 10, 6/74. Runoff Depth - 2.81 inches

Vt = Runoff Volume + Pumpage Volume

$$Vt = \frac{(25.8\ ac)(2.81\ inches)}{12\ in/ft} + \frac{1200\ gpm\ (60\ min/hr)(24\ hrs/day)}{7.48\ gal/ft^3\ (43560\ ft^2/ac)}$$

Vt = 6.0 ac-ft + 5.3 ac-ft

= 11.3 ac-ft

B. Pool Volume:

Consol proposes constructing the sediment pond such that the pond volume provides 10/24 of the total runoff volume. This should allow sufficient detention time to effectively treat the water.

$$\text{Design Pool Volume} = \frac{10}{24}\ (11.3\ ac\text{-}ft) = 4.7\ ac\text{-}ft$$

C. Sediment Storage Volume:

The following are sediment yield calculations as predicted by the Universal Soil Loss Equation (USLE) for an estimated life of 2 years. Using the Universal Soil Loss Equation;

A = (R)(K)(LS)(CP) where:

A = Average Soil Loss (tons/ac-yr)
R = Rainfall Erosivity Factor (Annual) = 240
K = Soil Erodibility Factor - 0.43
(SCS Soils Interpretation Record)
*LS = Slope Length and Steepness Factor
**CP = Control Practice Factor

The following USLE Parameters charts illustrate the Control Practice Factor (CP) and topographic characteristics of the watershed for specific time intervals during the estimated 2 year life of the pond. Weighted averages of the USLE Parameters are then applied to the Universal Soil Loss Equation for the period of time specified to predict the sediment yield.

USLE Parameters

During the life of the pond, the area is expected to be disturbed as follows:

Location	Area (ac)	Activity	Avg. Slope (%)	CP
Entire Watershed Area	25.8	Disturbed	2.0	1.00
		S = 2.0 *LS = 0.20	**CP = 1.00	

A = (240)(0.43)(0.20)(1.00)
A = 20.6 tons/ac-yr

Sediment Yield = (20.6 tons/ac-yr) (25.8 ac) (2 yr)

= 1063.0 tons

* Topographic Factor, LS "Applied Hydrology and Sedimentology for Disturbed Areas" p. 334, LS is derived using an Average Slope Length = 100 ft. and an area weighted avg. slope, S.

** Control Practice Factor CP "Applied Hydrology and Sedimentology for Disturbed Areas" p. 390, Appendix 5A.
CP represents the area weighted average of the CP values.

$$\text{Sediment Volume} = (1063.0 \text{ tons})\left(\frac{2000 \text{ lb}}{\text{tons}}\right)\left(\frac{*\text{ft}^3}{78 \text{ lbs}}\right)\left(\frac{\text{ac}}{43560 \text{ ft}^2}\right)$$

$$= 0.6 \text{ ac-ft}$$

If pond life exceeds 2 years and water quality necessitates, the pond will be cleaned out to provide the appropriate treatment volume.

E. Total Pond Volume (Normal Pool):

Total Pond Volume = Design Pond Volume + Design Sediment Volume
= 4.7 ac-ft + 0.6 ac-ft
= 5.3 ac-ft

This pond will be constructed to provide 7.0 ac-ft of volume at normal pool which exceeds the minimum design requirement of 5.3 ac-ft. Please see the following page for storage volume calculations.

* This unit weight for sediment is based on a bulk submerged specific gravity of 1.25 multiplied by the unit weight of water which is 62.4 lbs/ft^3. This bulk submerged specific gravity is representative for soil distributions obtained from field samples. The sediment composition indicated by these samples is medium fine to fine. (Refer to page 71, Table 13, Sedimot II Users Manual.)

II. Outflow and Routing Calculations

A. Outlet Design:

Listed below is the stage-storage relationship for this pond:

Pond 035B
Stage Vs. Storage Chart

Elevation (ft)	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Cum. Volume (ac-ft)
439	0.00				0.00
		0.03	1.0	0.03	
440	0.05				0.03
		0.98	5.0	4.90	
445	1.90				4.93
		3.35	5.0	16.75	
450	4.80				21.68

Pond (035B) has been designed to provide 7.0 ac-ft of normal pool volume. This volume can be obtained at an elevation of 446.0 feet.

B. Outlet Verification: (See Drawing PH4-3)

A SEDIMOT II computer routing was performed to confirm peak discharge and peak stage values for the 25 yr/24 hr storm event. The outlet consists of a 36" decant as the primary spillway and an 18" CMP as the emergency spillway. (The emergency spillway was set at the 10 year-24 hour peak stage elevation.) The results were as follows:

Peak Inflow	=	87.8 cfs
Peak Discharge	=	25.2 cfs
Peak Stage Elev.	=	447.0 ft
Normal Pool Elev.	=	446.0 ft

Pond Summary

Pond 035C (formerly designated as Pond 035E) is being proposed as temporary. It will treat 31.8 acres. The pond is incised, and has been sized to treat a 10 yr-24 hour storm as well as provide sediment volume for the site life of two years. We request this pond have a pump and/or pipe discharge. Pumping will only be done during non-rainfall periods, with a minimum of two feet of pool depth being maintained to prevent resuspension of bottom sediments. The primary spillway will be a 36 inch corrugated metal pipe with an 18 inch corrugated metal pipe serving as the emergency spillway. The peak pool increase is 3.3 feet for a 25 yr-24 hr storm with the peak discharge being 32.6 cfs. The inflow points for this pond have been situated to utilize treatment length available within the pond.

The design of this pond entails: providing a treatment volume equal to 10/24 of the total runoff volume, sediment volume equal to the sediment yield for two years of life as predicted by the Universal Soil Loss Equation, and an outlet performance verification as routed using the SEDIMOT II computer model.

The specific pond design can be found on the following pages. The pond plan view, profile and cross section are located on Drawing PH4-3.

TEMPORARY IMPOUNDMENT POND (035C)

Drainage Area	:	31.8 ac.
Design Event - Normal Pool	:	10 yr/24 hr (4.9 inches)
Design Event - Spillway Performance	:	25 yr/24 hr (5.6 inches)
Storm Type	:	SCS Type II
Hydrologic Soil Group	:	C
Curve Number - CN	:	80 (Flat)

I. Pond Sizing Calculations

A. Total Runoff Volume (Vt):

From Illinois Exhibit 2-4, Engineering Field Manual - Notice 10, 6/74. Runoff Depth - 2.81 inches

Vt = Runoff Volume + Pumpage Volume

$$Vt = \frac{(31.8\ ac)(2.81\ inches)}{12\ in/ft} + \frac{1200\ gpm\ (60\ min/hr)(24\ hrs/day)}{7.48\ gal/ft^3\ (43560\ ft^2/ac)}$$

Vt = 7.4 ac-ft + 5.3 ac-ft

= 12.7 ac-ft

B. Pool Volume:

Consol proposes constructing the sediment pond such that the pond volume provides 10/24 of the total runoff volume. This should allow sufficient detention time to effectively treat the water.

$$\text{Design Pool Volume} = \frac{10}{24}\ (12.7\ ac\text{-}ft) = 5.3\ ac\text{-}ft$$

C. Sediment Storage Volume:

The following are sediment yield calculations as predicted by the Universal Soil Loss Equation (USLE) for an estimated life of 2 years. Using the Universal Soil Loss Equation;

A = (R)(K)(LS)(CP) where:

A = Average Soil Loss (tons/ac-yr)
R = Rainfall Erosivity Factor (Annual) = 240
K = Soil Erodibility Factor - 0.43
(SCS Soils Interpretation Record)
*LS = Slope Length and Steepness Factor
**CP = Control Practice Factor

The following USLE Parameters charts illustrate the Control Practice Factor (CP) and topographic characteristics of the watershed for specific time intervals during the estimated 2 year life of the pond. Weighted averages of the USLE Parameters are then applied to the Universal Soil Loss Equation for the period of time specified to predict the sediment yield.

USLE Parameters

During the life of the pond, the area is expected to be disturbed as follows:

Location	Area (ac)	Activity	Avg. Slope (%)	CP
Entire Watershed Area	31.8	Disturbed	2.0	1.00
		S = 2.0 *LS = 0.20	**CP = 1.00	

A = (240)(0.43)(0.20)(1.00)
A = 20.6 tons/ac-yr

Sediment Yield = (20.6 tons/ac-yr) (31.8 ac) (2 yr)

= 1310.2 tons

* Topographic Factor, LS "Applied Hydrology and Sedimentology for Disturbed Areas" p. 334, LS is derived using an Average Slope Length = 100 ft. and an area weighted avg. slope, S.

** Control Practice Factor CP "Applied Hydrology and Sedimentology for Disturbed Areas" p. 390, Appendix 5A.
CP represents the area weighted average of the CP values.

$$\text{Sediment Volume} = (1310.2\ \text{tons})\frac{(2000\ \text{lb})}{\text{tons}}\frac{(*\text{ft}^3)}{78\ \text{lbs}}\frac{\text{ac}}{43560\ \text{ft}^2}$$

$$= 0.8\ \text{ac-ft}$$

If pond life exceeds 2 years and water quality necessitates, the pond will be cleaned out to provide the appropriate treatment volume.

E. Total Pond Volume (Normal Pool):

Total Pond Volume = Design Pond Volume + Design Sediment Volume
= 5.3 ac-ft + 0.8 ac-ft
= 6.1 ac-ft

This pond will be constructed to provide 6.4 ac-ft of volume at normal pool which exceeds the minimum design requirement of 6.1 ac-ft. Please see the following page for storage volume calculations.

* This unit weight for sediment is based on a bulk submerged specific gravity of 1.25 multiplied by the unit weight of water which is 62.4 lbs/ft^3. This bulk submerged specific gravity is representative for soil distributions obtained from field samples. The sediment composition indicated by these samples is medium fine to fine. (Refer to page 71, Table 13, Sedimot II Users Manual.)

II. Outflow and Routing Calculations

A. Outlet Design:

Listed below is the stage-storage relationship for this pond:

Pond 035C
Stage Vs. Storage Chart

Elevation (ft)	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Cum. Volume (ac-ft)
435	0.70				0.00
		0.80	5.0	4.00	
440	0.90				4.00
		1.00	5.0	5.00	
445	1.10				9.00
		1.45	5.0	7.25	
450	1.80				16.25

Pond (035C) has been designed to provide 6.4 ac-ft of normal pool volume. This volume can be obtained at an elevation of 442.5 feet.

B. Outlet Verification: (See Drawing PH4-3)

A SEDIMOT II computer routing was performed to confirm peak discharge and peak stage values for the 25 yr/24 hr storm event. The outlet consists of a 36" CMP as the primary spillway and an 18" CMP as the emergency spillway. (The emergency spillway was set at the 10 year-24 hour peak stage elevation.) The results were as follows:

Peak Inflow	=	108.2 cfs
Peak Discharge	=	32.6 cfs
Peak Stage Elev.	=	445.8 ft
Normal Pool Elev.	=	442.5 ft

Pond Summary

Pond 036 is being proposed as temporary. It will treat 44.8 acres. The pond is cross valley, and has been sized to treat a 10 yr-24 hour storm as well as provide sediment volume for the site life of two years. We request this pond have a pump and/or pipe discharge. Pumping will only be done during non-rainfall periods, with a minimum of two feet of pool depth being maintained to prevent resuspension of bottom sediments. The primary spillway will be a 36 inch corrugated metal pipe with an 18 inch corrugated metal pipe serving as the emergency spillway. The peak pool increase is 1.6 feet for a 25 yr-24 hr storm with the peak discharge being 12.0 cfs. The inflow points for this pond have been situated to utilize treatment length available within the pond.

The design of this pond entails: providing a treatment volume equal to 10/24 of the total runoff volume, sediment volume equal to the sediment yield for two years of life as predicted by the Universal Soil Loss Equation, and an outlet performance verification as routed using the SEDIMOT II computer model.

The specific pond design can be found on the following pages. The pond plan view, profile and cross section are located on Drawing PH4-4.

TEMPORARY IMPOUNDMENT POND (036)

Drainage Area	:	44.8 ac.
Design Event - Normal Pool	:	10 yr/24 hr (4.9 inches)
Design Event - Spillway Performance	:	25 yr/24 hr (5.6 inches)
Storm Type	:	SCS Type II
Hydrologic Soil Group	:	C
Curve Number - CN	:	80 (Flat)

I. Pond Sizing Calculations

A. Total Runoff Volume (Vt):

From Illinois Exhibit 2-4, Engineering Field Manual - Notice 10, 6/74. Runoff Depth - 2.81 inches

Vt = Runoff Volume + Pumpage Volume

$$Vt = \frac{(44.8\ ac)(2.81\ inches)}{12\ in/ft} + \frac{1200\ gpm\ (60\ min/hr)(24\ hrs/day)}{7.48\ gal/ft^3\ (43560\ ft^2/ac)}$$

Vt = 10.5 ac-ft + 5.3 ac-ft

= 15.8 ac-ft

B. Pool Volume:

Consol proposes constructing the sediment pond such that the pond volume provides 10/24 of the total runoff volume. This should allow sufficient detention time to effectively treat the water.

$$\text{Design Pool Volume} = \frac{10}{24}\ (15.8\ ac\text{-}ft) = 6.6\ ac\text{-}ft$$

C. Sediment Storage Volume:

The following are sediment yield calculations as predicted by the Universal Soil Loss Equation (USLE) for an estimated life of 2 years. Using the Universal Soil Loss Equation;

A = (R)(K)(LS)(CP) where:

A = Average Soil Loss (tons/ac-yr)
R = Rainfall Erosivity Factor (Annual) = 240
K = Soil Erodibility Factor - 0.43
(SCS Soils Interpretation Record)
*LS = Slope Length and Steepness Factor
**CP = Control Practice Factor

The following USLE Parameters charts illustrate the Control Practice Factor (CP) and topographic characteristics of the watershed for specific time intervals during the estimated 2 year life of the pond. Weighted averages of the USLE Parameters are then applied to the Universal Soil Loss Equation for the period of time specified to predict the sediment yield.

USLE Parameters

During the life of the pond, the area is expected to be disturbed as follows:

Location	Area (ac)	Activity	Avg. Slope (%)	CP
Entire Watershed Area	44.8	Disturbed	5.0	1.00

S = 5.0 **CP = 1.00
*LS = 0.53

A = (240)(0.43)(0.53)(1.00)
A = 54.7 tons/ac-yr

Sediment Yield = (54.7 tons/ac-yr) (44.8 ac) (2 yr)

= 4901.1 tons

* Topographic Factor, LS "Applied Hydrology and Sedimentology for Disturbed Areas" p. 334, LS is derived using an Average Slope Length = 100 ft. and an area weighted avg. slope, S.

** Control Practice Factor CP "Applied Hydrology and Sedimentology for Disturbed Areas" p. 390, Appendix 5A.
CP represents the area weighted average of the CP values.

$$\text{Sediment Volume} = (4901.1 \text{ tons})\left(\frac{2000 \text{ lb}}{\text{tons}}\right)\left(\frac{*\text{ft}^3}{78 \text{ lbs}}\right)\left(\frac{\text{ac}}{43560 \text{ ft}^2}\right)$$

$$= 2.9 \text{ ac-ft}$$

If pond life exceeds 2 years and water quality necessitates, the pond will be cleaned out to provide the appropriate treatment volume.

E. Total Pond Volume (Normal Pool):

Total Pond Volume = Design Pond Volume + Design Sediment Volume
= 6.6 ac-ft + 2.9 ac-ft
= 9.5 ac-ft

This pond will be constructed to provide 10.5 ac-ft of volume at normal pool which exceeds the minimum design requirement of 9.5 ac-ft. Please see the following page for storage volume calculations.

* This unit weight for sediment is based on a bulk submerged specific gravity of 1.25 multiplied by the unit weight of water which is 62.4 lbs/ft^3. This bulk submerged specific gravity is representative for soil distributions obtained from field samples. The sediment composition indicated by these samples is medium fine to fine. (Refer to page 71, Table 13, Sedimot II Users Manual.)

II. Outflow and Routing Calculations

A. Outlet Design:

Listed below is the stage-storage relationship for this pond:

Pond 036
Stage Vs. Storage Chart

Elevation (ft)	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Cum. Volume (ac-ft)
445	0.00				0.00
		2.10	5.0	10.50	
450	4.20				10.50
		5.25	5.0	26.25	
455	6.30				36.75

Pond (036) has been designed to provide 10.5 ac-ft of normal pool volume. This volume can be obtained at an elevation of 450.0 feet.

B. Outlet Verification: (See Drawing PH4-4)

A SEDIMOT II computer routing was performed to confirm peak discharge and peak stage values for the 25 yr/24 hr storm event. The outlet consists of a 36" CMP as the primary spillway and an 18" CMP as the emergency spillway. (The emergency spillway was set at the 10 year-24 hour peak stage elevation.) The results were as follows:

Peak Inflow	=	152.5 cfs
Peak Discharge	=	12.0 cfs
Peak Stage Elev.	=	451.6 ft
Normal Pool Elev.	=	450.0 ft

Pond Summary

Pond 037 is being proposed as temporary. It will treat 47.3 acres. The pond is cross valley, and has been sized to treat a 10 yr-24 hour storm as well as provide sediment volume for the site life of two years. We request this pond have a pump and/or pipe discharge. Pumping will only be done during non-rainfall periods, with a minimum of two feet of pool depth being maintained to prevent resuspension of bottom sediments. The primary spillway will be a 36 inch corrugated metal pipe with an 18 inch corrugated metal pipe serving as the emergency spillway. The peak pool increase is 1.6 feet for a 25 yr-24 hr storm with the peak discharge being 13.8 cfs. The inflow points for this pond have been situated to utilize treatment length available within the pond.

The design of this pond entails: providing a treatment volume equal to 10/24 of the total runoff volume, sediment volume equal to the sediment yield for two years of life as predicted by the Universal Soil Loss Equation, and an outlet performance verification as routed using the SEDIMOT II computer model.

The specific pond design can be found on the following pages. The pond plan view, profile and cross section are located on Drawing PH4-4.

TEMPORARY IMPOUNDMENT POND (037)

Drainage Area	:	47.3 ac.
Design Event - Normal Pool	:	10 yr/24 hr (4.9 inches)
Design Event - Spillway Performance	:	25 yr/24 hr (5.6 inches)
Storm Type	:	SCS Type II
Hydrologic Soil Group	:	C
Curve Number - CN	:	80 (Moderate)

I. Pond Sizing Calculations

A. Total Runoff Volume (Vt):

From Illinois Exhibit 2-4, Engineering Field Manual - Notice 10, 6/74. Runoff Depth - 2.81 inches

Vt = Runoff Volume + Pumpage Volume

$$Vt = \frac{(47.3\ ac)(2.81\ inches)}{12\ in/ft} + \frac{1200\ gpm\ (60\ min/hr)(24\ hrs/day)}{7.48\ gal/ft^3\ (43560\ ft^2/ac)}$$

Vt = 11.1 ac-ft + 5.3 ac-ft

= 16.4 ac-ft

B. Pool Volume:

Consol proposes constructing the sediment pond such that the pond volume provides 10/24 of the total runoff volume. This should allow sufficient detention time to effectively treat the water.

$$\text{Design Pool Volume} = \frac{10}{24}\ (16.4\ ac\text{-}ft) = 6.8\ ac\text{-}ft$$

C. Sediment Storage Volume:

The following are sediment yield calculations as predicted by the Universal Soil Loss Equation (USLE) for an estimated life of 2 years. Using the Universal Soil Loss Equation;

A = (R)(K)(LS)(CP) where:

A = Average Soil Loss (tons/ac-yr)
R = Rainfall Erosivity Factor (Annual) = 240
K = Soil Erodibility Factor - 0.43
(SCS Soils Interpretation Record)
*LS = Slope Length and Steepness Factor
**CP = Control Practice Factor

The following USLE Parameters charts illustrate the Control Practice Factor (CP) and topographic characteristics of the watershed for specific time intervals during the estimated 2 year life of the pond. Weighted averages of the USLE Parameters are then applied to the Universal Soil Loss Equation for the period of time specified to predict the sediment yield.

USLE Parameters

During the life of the pond, the area is expected to be disturbed as follows:

Location	Area (ac)	Activity	Avg. Slope (%)	CP
Entire Watershed Area	47.3	Disturbed	7.0	1.00
		S = 7.0 *LS = 0.82	**CP = 1.00	

A = (240)(0.43)(0.82)(1.00)
A = 84.6 tons/ac-yr

Sediment Yield = (84.6 tons/ac-yr) (47.3 ac) (2 yr)

= 8003.2 tons

* Topographic Factor, LS "Applied Hydrology and Sedimentology for Disturbed Areas" p. 334, LS is derived using an Average Slope Length = 100 ft. and an area weighted avg. slope, S.

** Control Practice Factor CP "Applied Hydrology and Sedimentology for Disturbed Areas" p. 390, Appendix 5A.
CP represents the area weighted average of the CP values.

$$\text{Sediment Volume} = (8003.2\ \text{tons})\left(\frac{2000\ \text{lb}}{\text{tons}}\right)\left(\frac{*\text{ft}^3}{78\ \text{lbs}}\right)\left(\frac{\text{ac}}{43560\ \text{ft}^2}\right)$$

$$= 4.7\ \text{ac-ft}$$

If pond life exceeds 2 years and water quality necessitates, the pond will be cleaned out to provide the appropriate treatment volume.

E. Total Pond Volume (Normal Pool):

Total Pond Volume = Design Pond Volume + Design Sediment Volume
= 6.8 ac-ft + 4.7 ac-ft
= 11.5 ac-ft

This pond will be constructed to provide 11.6 ac-ft of volume at normal pool which meets the minimum design requirement of 11.5 ac-ft. Please see the following page for storage volume calculations.

* This unit weight for sediment is based on a bulk submerged specific gravity of 1.25 multiplied by the unit weight of water which is 62.4 lbs/ft^3. This bulk submerged specific gravity is representative for soil distributions obtained from field samples. The sediment composition indicated by these samples is medium fine to fine. (Refer to page 71, Table 13, Sedimot II Users Manual.)

II. Outflow and Routing Calculations

A. Outlet Design:

Listed below is the stage-storage relationship for this pond:

Pond 037
Stage Vs. Storage Chart

Elevation (ft)	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Cum. Volume (ac-ft)
449	0.00				0.00
		0.05	1.0	0.05	
450	0.10				0.05
		1.00	5.0	5.00	
455	1.90				5.05
		4.35	5.0	21.75	
460	6.80				26.80

Pond (037) has been designed to provide 11.6 ac-ft of normal pool volume. This volume can be obtained at an elevation of 457.2 feet.

B. Outlet Verification: (See Drawing PH4-4)

A SEDIMOT II computer routing was performed to confirm peak discharge and peak stage values for the 25 yr/24 hr storm event. The outlet consists of a 36" CMP as the primary spillway and an 18" CMP as the emergency spillway. (The emergency spillway was set at the 10 year-24 hour peak stage elevation.) The results were as follows:

Peak Inflow	=	161.0 cfs
Peak Discharge	=	13.8 cfs
Peak Stage Elev.	=	458.8 ft
Normal Pool Elev.	=	457.2 ft

ILLINOIS DEPARTMENT OF MINES AND MINERALS

Ronald E. Morse
Director

PROTECTING OUR RESOURCES

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

SAME AS 6067-92-B

Log #6174-92

REVIEW AS 6067-92-B

MEMORANDUM

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
NOV 10 2015
REVIEWER: JKS

TO: Steve Chard, Department of Agriculture
Patrick Malone, Department of Conservation
Kurt D. Neibergall, Environmental Protection Agency
Kurt D. Neibergall, Environmental Protection Agency
David Boyce, Department of Transportation
Thomas E. Emerson, Illinois Historic Preservation Agency

RECEIVED
NOV 20 1992
MINE POLLUTION CONTROL PROGRAM

DATE: November 19, 1992

FROM: Ernest Ashby, Permit Coordinator
Land Reclamation Division

RE: Surface Mining Interagency Committee

Enclosed please find Insignificant Permit Revision No. 31 approved by the Department for Consolidation Coal Company, Burning Star No. 4 Mine, Permit No. 152. This revision grants approval to revise the drainage plan, on pond and roads.

Insignificant operations revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Insignificant permit revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Incidental boundary revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(d). Exemptions from the use of a sediment pond are approved pursuant to 62 Ill. Adm. Code 1816.41(d)(1)/ 1817.41(d)(1).

Enclosure
cc: C.Treworgy - ISGS
W.Runnels - SCS
D.Martin
OSMRE

ACTION Req'd 12/2/92 GLM

RECEIVED
NOV 24 1992
IL ENVIRONMENTAL PROTECTION AGENCY
MANAGEMENT ADMINISTRATION

F

ILLINOIS DEPARTMENT OF MINES AND MINERALS

Ronald E. Morse
Director

PROTECTING OUR RESOURCES

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

October 22, 1992

Mr. Ervin Anderson
Consolidation Coal Company
12755 Olive Boulevard
St. Louis, Missouri 63141

IDPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

NOV 1 0 2015

REVIEWER: JKS

Dear Mr. Anderson:

Re: Insignificant Revision No. 31
Permit No. 152

The appropriate Department technical staff have reviewed the proposed mining operations plan change dated September 14, 1992, submitted by Consolidation Coal Company for Burning Star No. 4 Mine. Consolidation Coal Company has requested approval to revise the Phase IV Surface Drainage Control Plan, Sediment Pond 035A, Lateral Roads L-1, L-2 and Service Road S-3. Since this operation is not currently approved, it will constitute a mining operations change. Section 1774.13(b)(2)(D) of Title 62 of the Illinois Administrative Code allows such insignificant revisions if the proposed changes:

1. Are described in writing.

2. Will not have a significant potential adverse impact on the achievement of final reclamation plans or upon the surrounding area.

The Department has determined the proposed change is in compliance with 62 Ill. Adm. Code 1700 - 1850, is insignificant and will not change the final reclamation plan for this permit and hereby exempts Consolidation Coal Company from submitting a permit revision application in accordance with Section 1774.13(b)(2)(D). The Department grants permission to revise the Phase IV drainage plan, Pond 035A, the lateral roads, and service road, as proposed in the aforementioned submittal. Please submit ten (10) additional copies of your request letter(s) and maps to this office.

All conditions and provisions contained in the original permit approval also apply to this revision. Approval from this agency does not relieve Consolidation Coal Company from obtaining approval

xc: IAC
Co.

from other agencies requiring such. Should you have any questions, please contact Darin Martin at our Carterville office (618-985-6525).

Sincerely,

Fred K. Bowman

Fred K. Bowman, Supervisor
Land Reclamation Division

FKB:DM:mc
cc: D.Martin
OSMRE

6067B-92

Consolidation Coal Company
Mid-Continent Region
12755 Olive Boulevard
St. Louis, Missouri 63141
(314) 275-2300

September 14, 1992

IEPA-DIVISION OF RECORDS MANAGEMENT
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NOV 10 2015
REVIEWER: JKS

RECEIVED
SEP 16 1992
MINE POLLUTION
CONTROL PROGRAM

Mr. Fred K. Bowman, Supervisor
Illinois Department of Mines & Minerals
Land Reclamation Division
300 West Jefferson, Suite 300
P. O. Box 10197
Springfield, IL 62791-0197

Re: Burning Star #4, Permit #152
Phase IV Drainage Revision and Road Change

Dear Mr. Bowman:

In accordance with Rule 1774.13(b)(2)(D&E), Consol is requesting an insignificant mining operations plan change to the above referenced permit.

This request involves a revision to Phase IV of the Surface Drainage Control Plan at Burning Star #4.

Pond 035A is being revised to accommodate a larger watershed area. In addition, we are revising Lateral Roads L-1, L-2 and Service Road S-3.

Following is a list of the revised and additional information to be included in Permit 152.

<u>Design & Narrative Pages</u>

Replace Pond 035A design pages with new Pond 035A design pages.

Add Road Ditch R design to Phase IV design pages.

Add Silt Trap information to Phase IV design pages.

Action Req'd 1/14/93

RECEIVED
SEP 17 1992
IL ENVIRONMENTAL PROTECTION AGENCY
MARION REGIONAL OFFICE

Maps and Drawings

Revised Drawings PH4-1, 2, 3, LR1 and S2.

Revised Surface Drainage Control Map F.

Revised Mine Operations Plan Map D.

If you have any questions, please call Marc Tidquist at 314-275-2337.

Sincerely,

Ervin Anderson
Supervisor - Design & Construction

EA;mt/vls

Enclosures

cc: D. Martin, IDMM - Carterville (w/sealed maps)
K. Niebergall, IEPA - Springfield, (w/sealed maps)

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements was done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules, and regulations.

☐ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans conform to applicable accepted standards for adequate land stability, drainage vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

☐ Whereas the operation proposes disposal of spoil or waste materials in areas other than mine workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

☒ Certification of Illinois Environmental Protection Agency - 35 Ill. Admin. Code 405.104(a) Permit. In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

Marc A. Tidquist Name	062-045997 Illinois Registration Number (Seal)
Consolidation Coal Company Firm	314-275-2337 Phone Number
12755 Olive Blvd., Address	St. Louis, MO 63141
Marc A. Tidquist Signature	9-11-92 Date

(Revised 7/25/88)

NPDES CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in the attached document; and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Grayson Heard

Grayson G. Heard
Senior Vice President
Mid-Continent Region

9/12/92
Date

Pond Summary

Pond 035A is being proposed as temporary. It will treat a watershed area of 44.5 acres. The pond is cross valley, and has been sized to treat a 10 yr-24 hour storm as well as provide sediment volume for the site life of two years. We request this pond have a pump and/or pipe discharge. Pumping will only be done during non-rainfall periods, with a minimum of two feet of pool depth being maintained to prevent resuspension of bottom sediments. The primary spillway will be a 36 inch corrugated metal pipe decant with an 18 inch corrugated metal pipe serving as the emergency spillway. The peak pool increase is 1.4 feet for a 25 yr-24 hr storm with the peak discharge being 28.6 cfs. The inflow points for this pond have been situated to utilize treatment length available within the pond.

The design of this pond entails: providing a treatment volume equal to 10/24 of the total runoff volume, sediment volume equal to the sediment yield for two years of life as predicted by the Universal Soil Loss Equation, and an outlet performance verification as routed using the SEDIMOT II computer model.

The specific pond design can be found on the following pages. The pond plan view, profile and cross section are located on Drawing PH4-3.

TEMPORARY IMPOUNDMENT POND (035A)

Drainage Area	:	44.5 ac.
Design Event - Normal Pool	:	10 yr/24 hr (4.9 inches)
Design Event - Spillway Performance	:	25 yr/24 hr (5.6 inches)
Storm Type	:	SCS Type II
Hydrologic Soil Group	:	C
Curve Number - CN	:	80 (Flat)

I. Pond Sizing Calculations (Normal Pool)

A. Total Runoff Volume (Vt):

From Illinois Exhibit 2-4, Engineering Field Manual - Notice 10, 6/74. Runoff Depth for 10 yr/24 hr storm is 2.81 inches.

Vt = Runoff Volume + Pumpage Volume

$$Vt = \frac{(44.5\ ac)(2.81\ inches)}{12\ in/ft} + \frac{1200\ gpm\ (60\ min/hr)(24\ hrs/day)}{7.48\ gal/ft^3\ (43560\ ft^2/ac)}$$

Vt = 10.4 ac-ft + 5.3 ac-ft

= 15.7 ac-ft

B. Pool Volume:

Consol proposes constructing the sediment pond such that the pond volume provides 10/24 of the total runoff volume. This should allow sufficient detention time to effectively treat the water.

$$\text{Design Pool Volume} = \frac{10}{24}\ (15.7\ ac\text{-}ft) = 6.5\ ac\text{-}ft$$

C. Sediment Storage Volume:

The following are sediment yield calculations as predicted by the Universal Soil Loss Equation (USLE) for an estimated life of 2 years. Using the Universal Soil Loss Equation;

A = (R)(K)(LS)(CP) where:

A = Average Soil Loss (tons/ac-yr)
R = Rainfall Erosivity Factor (Annual) = 240
K = Soil Erodibility Factor - 0.43
(SCS Soils Interpretation Record)
*LS = Slope Length and Steepness Factor
**CP = Control Practice Factor

The following USLE Parameters charts illustrate the Control Practice Factor (CP) and topographic characteristics of the watershed for specific time intervals during the estimated 2 year life of the pond. Weighted averages of the USLE Parameters are then applied to the Universal Soil Loss Equation for the period of time specified to predict the sediment yield.

USLE Parameters

During the life of the pond, the area is expected to be disturbed as follows:

Location	Area (ac)	Activity	Avg. Slope (%)	CP
Entire Watershed Area	44.5	Disturbed	2.0	1.00
		S = 2.0 *LS = 0.20	**CP = 1.00	

A = (240)(0.43)(0.20)(1.00)
A = 20.6 tons/ac-yr

Sediment Yield = (20.6 tons/ac-yr) (44.5 ac) (2 yr)

= 1833.4 tons

* Topographic Factor, LS "Applied Hydrology and Sedimentology for Disturbed Areas" p. 334, LS is derived using an Average Slope Length = 100 ft. and an area weighted avg. slope, S.

** Control Practice Factor CP "Applied Hydrology and Sedimentology for Disturbed Areas" p. 390, Appendix 5A.
CP represents the area weighted average of the CP values.

$$\text{Sediment Volume} = (1833.4 \text{ tons}) \left(\frac{2000 \text{ lb}}{\text{tons}}\right)\left(\frac{*\text{ft}^3}{78 \text{ lbs}}\right)\left(\frac{\text{ac}}{43560 \text{ ft}^2}\right)$$

$$= 1.1 \text{ ac-ft}$$

If pond life exceeds 2 years and water quality necessitates, the pond will be cleaned out to provide the appropriate treatment volume.

E. Total Pond Volume (Normal Pool):

Total Pond Volume = Design Pond Volume + Design Sediment Volume
= 6.5 ac-ft + 1.1 ac-ft
= 7.6 ac-ft

This pond will be constructed to provide 8.7 ac-ft of volume at normal pool which exceeds the minimum design requirement of 7.6 ac-ft. Please see the following page for storage volume calculations.

* This unit weight for sediment is based on a bulk submerged specific gravity of 1.25 multiplied by the unit weight of water which is 62.4 lbs/ft^3. This bulk submerged specific gravity is representative for soil distributions obtained from field samples. The sediment composition indicated by these samples is medium fine to fine. (Refer to page 71, Table 13, Sedimot II Users Manual.)

II. Outflow and Routing Calculations

A. Outlet Design:

Listed below is the stage-storage relationship for this pond:

Pond 035A
Stage Vs. Storage Chart

Elevation (ft)	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Cum. Volume (ac-ft)
432.5	0.00				0.00
		1.15	2.5	2.88	
435	2.30				2.88
		3.80	5.0	19.00	
440	5.30				21.88
		7.80	5.0	39.00	
445	10.3				60.88

Pond (035A) has been designed to provide 8.7 ac-ft of normal pool volume. This volume can be obtained at an elevation of 437.0 feet.

B. Outlet Verification: (See Drawing PH4-3)

A SEDIMOT II computer routing was performed to confirm peak discharge and peak stage values for the 25 yr/24 hr storm event. The outlet consists of a 36" decant as the primary spillway and an 18" CMP as the emergency spillway. (The emergency spillway was set at the 10 year-24 hour peak stage elevation of 438.1 feet.) The results were as follows:

Peak Inflow	=	151.4 cfs
Peak Discharge	=	28.6 cfs
Peak Stage Elev.	=	438.4 ft
Normal Pool Elev.	=	437.0 ft

SILT TRAP

A small Silt Trap is proposed within the watershed of Pond 035A. This silt trap will have a surface area of approximately 0.4 acres at a depth of 1-2 feet. It will be maintained at a pool elevation of 442.5'. The Silt Trap will have a trapezoidal open channel outlet which will discharge to Pond 035A. The outlet channel will be approximately 700 feet long with 5.5 feet of drop. The resultant flowline gradient will be 0.008 ft/ft. The maximum and minimum depths available in the channel will be 9 feet and 2 feet respectively. It is important to note that the Silt Trap and associated outlet channel are included within the design watershed of Pond 035A. The Silt Trap will be providing additional upstream treatment volume for Pond 035A's inflow, therefore, no specific size is required. The location of this small Silt Trap is provided on Drawings PH4-1, 3 and Surface Drainage Control Map F. Below is a brief outlet size determination.

OUTLET CHANNEL SIZING

The Silt Trap will receive surface runoff as well as pumpage and discharge it to Pond 035A. The Silt Trap's tributary drainage is equal to 7.8 acres. From the SCS Engineering Field Manual, Chapter 2, Section 10, Page 5.21.

For 7.8 Acres, CN 80, 2 yr/24 hr storm, 3.5"

Q peak = 11 cfs (+ 1 cfs pumpage)

= 12 cfs

This ditch was designed for 12 cfs. Using Manning's Open Channel Flow Equation, where

Width = 6 ft
n = 0.030
s = 0.008 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

Flow Depth

@ 0.6' $Q = \frac{1.49}{0.030} (4.32) (0.50)^{.67} (0.008)^{.5}$

= 12.1 cfs

$Q = Av$
$12.1 = 4.3v$

2.8 f/s = v

As can be seen from the above information, at a flow depth of 0.6 feet, the Silt Trap's outlet can convey 12.1 cfs at a velocity of 2.8 fps.

Temporary Road Ditch R

Ditch R will receive surface runoff as well as pumpage and direct it to Pond 035A. Ditch R's tributary drainage is equal to 3.9 acres. From the SCS Engineering Field Manual, Chapter 2, Section 10, Page 5.21.

For 3.9 Acres, CN 80, 2 yr/24 hr storm, 3.5"

Q peak = 6 cfs (+ 1 cfs pumpage)

= 7 cfs

This ditch was designed for 7 cfs. Using Manning's Open Channel Flow Equation, where

Width = 6 ft
n = 0.030
s = 0.0035 ft/ft
Sideslope = 2H to 1V
Channel Geometry = Trapezoidal

<u>Flow Depth</u>

@ 0.6' $Q = \frac{1.49}{0.030}(4.32)(0.50)^{.67}(0.0035)^{.5}$

= 8.0 cfs

$Q = Av$

$8.0 = 4.3v$

1.9 f/s = v

As can be seen from the above information, at a flow depth of 0.4' feet, Ditch R can convey 8.0 cfs at a velocity of 1.9 fps.

Plan View, Cross Sections and Profile, for Ditch R, can be found on Drawings PH4-1 & 2.

ILLINOIS DEPARTMENT OF MINES AND MINERALS

Ronald E. Morse
Director

PROTECTING OUR RESOURCES

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

MEMORANDUM

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
NOV 10 2015
REVIEWER: JKS

TO: Steve Chard, Department of Agriculture
Patrick Malone, Department of Conservation
Kurt D. Neibergall, Environmental Protection Agency
Kurt D. Neibergall, Environmental Protection Agency
David Boyce, Department of Transportation
Thomas E. Emerson, Illinois Historic Preservation Agency

DATE: December 29, 1992

RECEIVED
DEC 30 1992
MINE POLLUTION CONTROL PROGRAM

FROM: Ernest Ashby, Permit Coordinator
Land Reclamation Division

RE: Surface Mining Interagency Committee

Enclosed please find Insignificant Permit Revision No. 34 approved by the Department for Consolidation Coal Company, Burning Star No. 4 Mine, Permit No. 74. This revision grants approval to construct a diversion ditch, plug and CMP.

Insignificant operations revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Insignificant permit revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Incidental boundary revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(d). Exemptions from the use of a sediment pond are approved pursuant to 62 Ill. Adm. Code 1816.41(d)(1)/ 1817.41(d)(1).

RECEIVED
JAN 04 1993
Environmental Protection Agency
MARION REGIONAL OFFICE

Enclosure
cc: C.Treworgy - ISGS
W.Runnels - SCS
D.Martin
OSMRE

Action Rep 16 5/10/93 GLM

ILLINOIS DEPARTMENT OF MINES AND MINERALS

Ronald E. Morse
Director

PROTECTING OUR RESOURCES

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

December 7, 1992

IEPA-DIVISION OF RECORDS MANAGEMENT
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NOV 1 0 2015

REVIEWER: JKS

RECEIVED

JAN 0 4 1993

Environmental Protection Agency
MARION REGIONAL OFFICE

Mr. Ervin A. Anderson
Consolidation Coal Company
12755 Olive Boulevard
St. Louis, Missouri 63141

Dear Mr. Anderson:

Re: Insignificant Revision No. 34
Permit No. 74

The appropriate Department technical staff have reviewed the proposed mining operations plan change dated November 6, 1992, submitted by Consolidation Coal Company for Burning Star No. 4 Mine. Consolidation Coal Company has requested approval to construct a temporary diversion ditch, and a temporary plug and 48" CMP, to begin filling the Final Cut Lake "J". Since this operation is not currently approved, it will constitute a mining operations change. Section 1774.13(b)(2)(D) of Title 62 of the Illinois Administrative Code allows such insignificant revisions if the proposed changes:

1. Are described in writing.

2. Will not have a significant potential adverse impact on the achievement of final reclamation plans or upon the surrounding area.

The Department has determined the proposed change is in compliance with 62 Ill. Adm. Code 1700 - 1850, is insignificant and will not change the final reclamation plan for this permit and hereby exempts Consolidation Coal Company from submitting a permit revision application in accordance with Section 1774.13(b)(2)(D). The Department grants permission to construct the diversion ditch, plug and 48" CMP, as temporary measures to begin filling the Final Cut Lake "J", as proposed in the aforementioned submittal. Please submit ten (10) additional copies of your request letter(s) and maps to this office.

The Department has determined that no additional bond will be required for the proposed operations plan revision. The Department presently holds adequate surety bond to ensure reclamation of this small area.

xc: IAC
Co.

All conditions and provisions contained in the original permit approval also apply to this revision. Approval from this agency does not relieve Consolidation Coal Company from obtaining approval from other agencies requiring such.

Should you have any questions, please contact Darin Martin at our Carterville office (618-985-6525).

Sincerely,

Fred K. Bowman

Fred K. Bowman, Supervisor
Land Reclamation Division

FKB:DM:mc
cc: D.Martin
OSMRE

Consolidation Coal Company
Mid-Continent Region
12755 Olive Boulevard
St. Louis, Missouri 63141
(314) 275-2300

November 6, 1992

Mr. Fred W. Bowman, Supervisor
Illinois Department of Mines & Minerals
Land Reclamation Division
300 West Jefferson, Suite 300
P. O. Box 10197
Springfield, IL 62791-0197

IDPH-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

NOV 1 0 2015

REVIEWER: JKS

Re: Request for Insignificant Revision
Permit No. 74, Burning Star No. 4 Mine

Dear Mr. Bowman:

In accordance with Rule 1774.13, we are requesting an insignificant revision to the surface drainage control plan and Mining Operations Plan Map of Permit #74 at Burning Star No. 4 Mine. Our request involves diverting drainage into Final Cut Lake "J" located adjacent to the west side of the Huggins Cemetery. The objective of our request is to begin filling the final cut lake and reestablishing the ground water table of the surrounding reclaimed land prior to returning flows into the reconstructed Galum channel and floodplain.

The Northern Diversion shall be temporarily plugged averting flow into a section of the restored Galum Channel which is planned to be constructed during the 4th quarter of 1992. In order to direct flow into the channel restoration, a short section of ditch (approximately 275 feet in length) will be required. This section of ditch is proposed as temporary and shall be excavated in accordance with the configuration and dimensions (10 ft. bottom width and side slope of 2H:1V) of the Northern Diversion. The temporary plug shall be built to tie into the top elevation of the existing levee.

In addition to the conveyance of flow through the Northern Diversion, we request the option to install a 48-inch corrugated metal pipe. This pipe would be used to provide additional flow should the drainage from the Northern Diversion be insufficient to recharge the final cut lake in an adequate time period. The pipe would be placed approximately 4 feet above the bottom of the channel and will be utilized to convey flood water from the Galum Diversion back into the Northern Diversion. The pipe will be equipped with a slide gate on the west end of the pipe and a flap gate installed on the east end of the pipe. Riprap will be placed at the discharge end of the pipe to prevent scouring and erosion of the plug. The plug shall be constructed with 2.5H:1V side slopes and have an over-all minimum top width of 15 feet. A cross-sectional view of the proposed plug is attached. The plug will be vegetated to protect against possible erosion. On completion of recharging the final cut lake, the temporary section of ditch will be backfilled and the Northern Diversion reopened.

The location of the Northern Diversion is incorrectly delineated on the Mining Operations Plan Map D approved under Revision #1 to Permit 74. The attached Mining Operations Plan Map has been modified by shifting the small arrows delineating the Northern Diversion approximately 50 feet to the south. The location of proposed temporary berm has also been delineated on the map.

These proposed changes will not alter the reclamation plan for Permit No. 74 approved under Revision #1. An Engineering Certification. Surface Drainage Control Map are also attached for this proposed insignificant revision to the surface drainage control plan under Permit No. 74.

If you have any questions concerning this request, please contact this office.

Sincerely,

Ervin Anderson

Ervin A. Anderson
Supervisor - Design & Construction

EAA;tdk/vls

Attachments

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements was done by me or under by direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules and regulations.

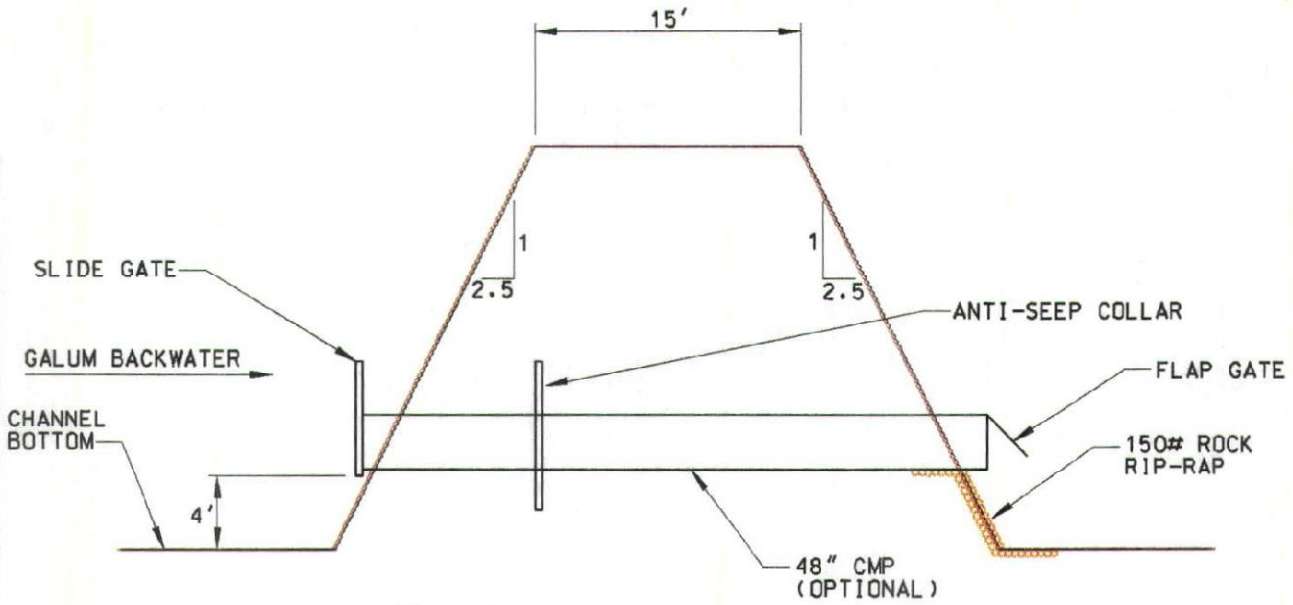
☐ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans conform to applicable accepted standards for adequate land stability, drainage, vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

☐ Whereas the operation proposes disposal of spoil or waste materials in areas other than mine workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

☐ Certification for Illinois Environmental Protection Agency - 35 Ill. Admin. Code 405.104(a) Permit. In my professional judgement, the plans, and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc., are accurate insofar as they represent existing conditions.

Ervin A. Anderson Name	062-0038535 Illinois Registration Number (Seal)
Consolidation Coal Company Firm	314-275-2414 Phone Number
12755 Olive Blvd., Address	St. Louis, MO 63141
Ervin A. Anderson Signature	11-6-92 Date

ERVIN A. ANDERSON
062-0038535
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS



RECEIVED
JAN 0 4 1993
Environmental Protection Agency
MARION REGIONAL OFFICE

CROSS SECTION
NORTHERN DIVERSION PLUG

NO SCALE 10-19-92
T.D.K. B.S. NO. 4, •74

ILLINOIS DEPARTMENT OF MINES AND MINERALS
Ronald E. Morse
Director

PROTECTING OUR RESOURCES

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

5299 / 03
Due: 3/1/93

RECEIVED
JAN 14 1993
MINE POLLUTION CONTROL PROGRAM

MEMORANDUM

TO: Steve Chard, Department of Agriculture
Patrick Malone, Department of Conservation
Kurt D. Neibergall, Environmental Protection Agency
Kurt D. Neibergall, Environmental Protection Agency
David Boyce, Department of Transportation
Thomas E. Emerson, Illinois Historic Preservation Agency

DATE: January 13, 1993

FROM: Ernest Ashby, Permit Coordinator
Land Reclamation Division

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
NOV 10 2015
REVIEWER: JKS

RE: Surface Mining Interagency Committee

Enclosed please find Insignificant Permit Revision No. 32 approved by the Department for Consolidation Coal Company, Burning Star No. 4 Mine, Permit No. 152. This revision grants approval to re-establish pond no. 033.

Insignificant operations revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Insignificant permit revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(b)(2). Incidental boundary revisions are approved pursuant to 62 Ill. Adm. Code 1774.13(d). Exemptions from the use of a sediment pond are approved pursuant to 62 Ill. Adm. Code 1816.41(d)(1)/ 1817.41(d)(1).

Enclosure
cc: C.Treworgy - ISGS
W.Runnels - SCS
D.Martin
OSMRE

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JAN 19 1993
Environmental Protection Agency
REGIONAL OFFICE

ILLINOIS DEPARTMENT OF MINES AND MINERALS

Ronald E. Morse
Director

PROTECTING OUR RESOURCES

LAND RECLAMATION DIVISION
300 WEST JEFFERSON STREET - SUITE 300
P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

Log # 5299-93
Due: 3/1/93

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MINE POLLUTION CONTROL PROGRAM

MEMORANDUM

TO: Steve Chard, Department of Agriculture
Patrick Malone, Department of Conservation
Kurt D. Neibergall, Environmental Protection Agency
Kurt D. Neibergall, Environmental Protection Agency
David Boyce, Department of Transportation
Thomas E. Emerson, Illinois Historic Preservation Agency

DATE: January 13, 1993

FROM: Ernest Ashby, Permit Coordinator
Land Reclamation Division

RE: Surface Mining Interagency Committee

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Enclosure
cc: C.Treworgy - ISGS
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D.Martin
OSMRE

IDPA-DIVISION OF RECORDS MANAGEMENT
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REVIEWER: JKS

ILLINOIS DEPARTMENT OF MINES AND MINERALS

Ronald E. Morse
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P.O. BOX 10197
SPRINGFIELD, ILLINOIS 62791-0197
TELEPHONE: (217) 782-4970
FAX: (217) 524-4819

January 5, 1993

Mr. Ervin Anderson
Consolidation Coal Company
12755 Olive Boulevard
St. Louis, Missouri 63141

IDPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

NOV 1 0 2015

REVIEWER: JKS

Dear Mr. Anderson:

Re: Insignificant Revision No. 32
Permit No. 152

The appropriate Department technical staff have reviewed the proposed mining operations plan change dated December 7, 1992, submitted by Consolidation Coal Company for Burning Star No. 4. Consolidation Coal Company has requested approval to re-establish a new Pond 033, in the same location as former Pond 033, which has been mined through. Since this operation is not currently approved, it will constitute a mining operations change. Section 1774.13(b)(2)(D) of Title 62 of the Illinois Administrative Code allows such insignificant revisions if the proposed changes:

1. Are described in writing.

2. Will not have a significant potential adverse impact on the achievement of final reclamation plans or upon the surrounding area.

The Department has determined the proposed change is in compliance with 62 Ill. Adm. Code 1700 - 1850, is insignificant and will not change the final reclamation plan for this permit and hereby exempts Consolidation Coal Company from submitting a permit revision application in accordance with Section 1774.13(b)(2)(D). The Department grants permission to re-establish a new Pond 033, as proposed in the aforementioned submittal. Please submit ten (10) additional copies of your request letter(s) and maps to this office.

All conditions and provisions contained in the original permit approval also apply to this revision. Approval from this agency does not relieve Consolidation Coal Company from obtaining approval from other agencies requiring such.

xc: IAC
Co.

Should you have any questions, please contact Darin Martin at our Carterville office (618) 985-6525.

Sincerely,

Fred K. Bowman

Fred K. Bowman, Supervisor
Land Reclamation Division

FKB:DM:mc
cc: D.Martin
OSMRE

NOV 1 0 2015
REVIEWER: JKS

Consolidation Coal Company
Mid-Continent Region
12755 Olive Boulevard
St. Louis, Missouri 63141
(314) 275-2300

December 7, 1992

Mr. Fred K. Bowman, Supervisor
Illinois Department of Mines & Minerals
Land Reclamation Division
300 West Jefferson, Suite 300
P. O. Box 10197
Springfield, IL 62791-0197

Mr. Kurt Neibergall
Illinois Environmental Protection Agency
Mining Program
2200 Churchill Road
P. O. Box 19276
Springfield, IL 62794-9276

IDNR-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

NOV 1 0 2015

REVIEWER: JKS

Re: Burning Star #4, Permit #152
Revision to Pond 033

Dear Mr. Bowman:

In accordance with Rule 1774.13(b)(2)(D&E), Consol is requesting an insignificant mining operations plan change to the above referenced permit.

This request involves a revision to Pond 033 of the Surface Drainage Control Plan at Burning Star #4.

Former Pond 033 has been mined through. It is proposed to re-establish a new Pond 033, in the same location, reflecting the post-mining topography. This revision will not affect the reclamation plan.

Following is a list of the revised and additional information to be included in Permit 152.

Design & Narrative Pages

Replace Pond 033 design pages with new Pond 033 design pages.

Maps & Drawings

Add Drawing RD-1

Replace Surface Drainage Control Map F with the Revised Map F.

If there are any questions, please contact Marc Tidquist at 314-275-2337.

Sincerely,

Ervin Anderson
Supervisor - Design & Construction

cc: D. Martin - IDMM, Carterville

EA;mat/vls

ENGINEERING CERTIFICATION

I hereby certify the engineering design used in preparation of this application, attachments, and supplements was done by me or under my direct supervision.

I further certify to the best of my knowledge all such design is in accordance with all applicable local, state and federal laws, rules, and regulations.

☐ Whereas the Reclamation Plan calls for an alternative land use, I also certify the plans conform to applicable accepted standards for adequate land stability, drainage vegetative cover, and aesthetic design appropriate for the post-mining use of the site.

☐ Whereas the operation proposes disposal of spoil or waste materials in areas other than mine workings or excavations, I also certify such fills are designed in accordance with recognized professional standards and all applicable laws.

☒ Certification of Illinois Environmental Protection Agency - 35 Ill. Admin. Code 405.104(a) Permit. In my professional judgment, the plans and specifications submitted as part of this application describe an operation which will meet all applicable effluent and water quality standards. I certify that I am familiar with all of the plans, specifications, reports, and maps submitted as part of this application and that said plans, etc. are accurate insofar as they represent existing conditions.

Marc A. Tidquist Name	062-045997 Illinois Registration Number (Seal)
Consolidation Coal Company Firm	314-275-2337 Phone Number
12755 Olive Blvd., Address	St. Louis, MO 63141
Marc A. Tidquist Signature	12-7-92 Date

MARC A. TIDQUIST 062-045997 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

(Revised 7/25/88)

Pond Summary

Former Pond 033 has been mined through. It is proposed to re-establish a new Pond 033 in the same location using the former ponds outlet structure. Pond 033 is being proposed as temporary. It will treat 54.3* acres. The pond is incised being comprised of a portion of restored Galum Channel and an adjacent depression area. The two features will be connected by an equalization channel. This pond is of sufficient size to treat a 10 yr-24 hour storm as well as provide sediment volume for the site life of three years. We request that both portions of this pond have a pump discharge. Pumping will only be done during non-rainfall periods, with a minimum of two feet of pool depth being maintained to prevent resuspension of bottom sediments. We request the depression area (downstream) have a pipe discharge as well. There are (2) existing 48 inch cmp's with gate valves proposed as the primary spillway. The gates will prevent Galum Creek floodwaters from backing into the system. (Note: Former Pond 033 had no emergency spillway. The addition of an emergency spillway for new Pond 033 is not being proposed. If this is not acceptable please advise.) The peak pool increase is 1.1 feet for a 25 yr-24 hr storm with the peak discharge being 24.5 cfs. The inflow points for this pond have been situated to utilize treatment length available within the pond.

The design of this pond entails: providing a treatment volume equal to 10/24 of the total runoff volume, sediment volume equal to the sediment yield for three years of life as predicted by the Universal Soil Loss Equation, and an outlet performance verification as routed using the SEDIMOT II computer model.

The specific pond design can be found on the following pages. The pond plan view, profile and cross section are located on Drawing RD-1.

* As restoration efforts link additional segments of channel, the watershed may increase.

TEMPORARY IMPOUNDMENT POND (033)

Drainage Area	:	54.3 ac.
Design Event - Normal Pool	:	10 yr/24 hr (4.9 inches)
Design Event - Spillway Performance	:	25 yr/24 hr (5.6 inches)
Storm Type	:	SCS Type II
Hydrologic Soil Group	:	C
Curve Number - CN	:	80 (Flat)

I. Pond Sizing Calculations

A. Total Runoff Volume (Vt):

From Illinois Exhibit 2-4, Engineering Field Manual - Notice 10, 6/74. Runoff Depth - 2.81 inches

$$Vt = \text{Runoff Volume} + \text{Pumpage Volume}$$

$$Vt = \frac{(54.3\ ac)(2.81\ inches)}{12\ in/ft} + \frac{600\ gpm\ (60\ min/hr)(24\ hrs/day)}{7.48\ gal/ft^3\ (43560\ ft^2/ac)}$$

$$Vt = 12.7\ ac\text{-}ft + 2.7\ ac\text{-}ft$$

$$Vt = 15.4\ ac\text{-}ft$$

B. Pool Volume:

Consol proposes constructing the sediment pond such that the pond volume provides 10/24 of the total runoff volume. This should allow sufficient detention time to effectively treat the water.

$$\text{Design Pool Volume} = \frac{10}{24}\ (15.4\ ac\text{-}ft) = 6.4\ ac\text{-}ft$$

C. Sediment Storage Volume:

The following are sediment yield calculations as predicted by the Universal Soil Loss Equation (USLE) for an estimated life of 3 years. Using the Universal Soil Loss Equation;

A = (R)(K)(LS)(CP) where:

A = Average Soil Loss (tons/ac-yr)
R = Rainfall Erosivity Factor (Annual) = 240
K = Soil Erodibility Factor - 0.43
(SCS Soils Interpretation Record)
*LS = Slope Length and Steepness Factor
**CP = Control Practice Factor

The following USLE Parameters charts illustrate the Control Practice Factor (CP) and topographic characteristics of the watershed for specific time intervals during the estimated 3 year life of the pond. Weighted averages of the USLE Parameters are then applied to the Universal Soil Loss Equation for the period of time specified to predict the sediment yield.

USLE Parameters

During the life of the pond, the area is expected to be disturbed as follows:

Location	Area (ac)	Activity	Avg. Slope (%)	CP
Entire Watershed Area	54.3	Seeded	5.0	0.10
		S = 5.0 *LS = 0.53	**CP = 0.10	

A - (240)(0.43)(0.53)(0.10)
A = 5.5 tons/ac-yr

Sediment Yield = (5.5 tons/ac-yr) (54.3 ac) (3 yr)

= 895.9 tons

* Topographic Factor, LS "Applied Hydrology and Sedimentology for Disturbed Areas" p. 334, LS is derived using an Average Slope Length = 100 ft. and an area weighted avg. slope, S.

** Control Practice Factor CP "Applied Hydrology and Sedimentology for Disturbed Areas" p. 390, Appendix 5A.
CP represents the area weighted average of the CP Values.

$$\text{Sediment Volume} = (895.9 \text{ tons}) \left(\frac{2000 \text{ lb}}{\text{tons}}\right) \left(\frac{*\text{ft}^3}{78 \text{ lbs}}\right) \left(\frac{\text{ac}}{43560 \text{ ft}^2}\right)$$

$$= 0.5 \text{ ac-ft}$$

If pond life exceeds 3 years and water quality necessitates, the pond will be cleaned out to provide the appropriate treatment volume.

E. Total Pond Volume (Normal Pool):

Total Pond Volume = Design Pond Volume + Design Sediment Volume
= 6.4 ac-ft + 0.5 ac-ft
= 6.9 ac-ft

This pond will provide **16.4 ac-ft of volume at normal pool which exceeds the minimum design requirement of 6.9 ac-ft. Please see the following page for storage volume calculations.

* This unit weight for sediment is based on a bulk submerged specific gravity of 1.25 multiplied by the unit weight of water which is 62.4 lbs/ft^3. This bulk submerged specific gravity is representative for soil distributions obtained from field samples. The sediment composition indicated by these samples is medium fine to fine. (Refer to page 71, Table 13, Sedimot II Users Manual.)

** This volume is more a reflection of the elevation of former Pond 033's outlet structure than the design requirements. This pond as proposed could reasonably treat an additional 70-80 acres.

II. Outflow and Routing Calculations

A. Outlet Design:

Listed below is the stage-storage relationship for this pond:

Pond 033
Stage Vs. Storage Chart

Elevation (ft)	Area (ac)	Avg. Area (ac)	Depth (ft)	Volume (ac-ft)	Cum. Volume (ac-ft)
418	0.00				0.00
		0.05	2.0	0.10	
420	0.11				0.10
		0.63	1.0	0.63	
421	1.14				0.73
		1.43	3.0	4.29	
424	1.72				5.02
		3.09	4.00	12.36	
428	4.45				17.38
		8.00	2.00	16.00	
430	11.56				33.38

Pond (033) will provide 16.4 ac-ft of normal pool volume. This volume is obtained at an elevation of 427.7 feet.

B. Outlet Verification: (See Drawing RD-1)

A SEDIMOT II computer routing was performed to confirm peak discharge and peak stage values for the 25 yr/24 hr storm event. The outlet consists of two 48" cmp's as the primary spillway. The results were as follows:

Peak Inflow	=	184.8 cfs
Peak Discharge	=	24.5 cfs
Peak Stage Elev.	=	428.8 ft
Normal Pool Elev.	=	427.7 ft

5004 /93

Consolidation Coal Company
Mid-Continent Region
12755 Olive Boulevard
St. Louis, Missouri 63141
(314) 275-2300

SAME AS 5299-93

December 7, 1992

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JAN 19 1993
Environmental Protection Agency
MARION REGIONAL OFFICE

Mr. Fred K. Bowman, Supervisor
Illinois Department of Mines & Minerals
Land Reclamation Division
300 West Jefferson, Suite 300
P. O. Box 10197
Springfield, IL 62791-0197

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DEC 15 1992
MINE POLLUTION
CONTROL PROGRAM

Mr. Kurt Neibergall
Illinois Environmental Protection Agency
Mining Program
2200 Churchill Road
P. O. Box 19276
Springfield, IL 62794-9276

IEPA DIVISION OF RECORDS MANAGEMENT
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NOV 10 2015
REVIEWER: JKS

Re: Burning Star #4, Permit #152
Revision to Pond 033

Dear Mr. Bowman:

In accordance with Rule 1774.13(b)(2)(D&E), Consol is requesting an insignificant mining operations plan change to the above referenced permit.

This request involves a revision to Pond 033 of the Surface Drainage Control Plan at Burning Star #4.

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MINE POLLUTION
CONTROL PROGRAM

Needs Action
1/11/93
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5002 · / 93-A
Due Date: 9-28-94

Consolidation Coal Company
Mid-Continent Region
12755 Olive Boulevard
St. Louis, Missouri 63141
(314) 275-2300

August 15, 1994

Mr. Larry Crislip, P.E.
Illinois Environmental Protection Agency
Manager, Permit Section
2309 West Main
Marion, IL 62950

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE
NOV 1 0 2015
REVIEWER: JKS

Re: Burning Star No. 4 Mine -
NPDES Permit Nos. IL0026492 (South Field)
& IL0052795 (North Field)

Dear Mr. Crislip:

Enclosed are three copies of Burning Star #4, NPDES boundary map delineating Permit Nos. IL0026492 (South Field) and IL0052795 (North Field) drainage areas. NPDES Permit No. IL0026492 covers approximately 2,073 acres while IL0052795 approaches nearly 5,033 acres.

If you have any questions, comments, or require additional information, please contact me at (314) 275-2424.

Sincerely,

Scott Adkins

Scott A. Adkins
Permit Coordinator

/vms

CRISLIP4.MAP

Enclosures

cc: J. Gefferth
E. Settle
File

RECEIVED
AUG 1 6 1994
IL Environmental Protection Agency
MARION REGIONAL OFFICE

SEE LARGE FORMAT MAP OR PLAN SHEET

DESCRIPTION:

W1458990016
Consolidation Coal Burng Star4
16 7/19/2010
Permit ID IL0052795 Doc ID 2567689

	Type or Description	SEE COLOR	Date of Plan	Figure
1.	Galum/ Bonnie Stream Restoration, Cross section location map	Y	11/97	MAP A
2.	Galum/ Bonnie Stream Restoration, Flood Prone Area Map	Y	11/97	Map B
3.	Surface Drainage Control Permit 74 Revision I	N	9/25/87	Map D-2
4.	Surface Drainage Control Map	Y	NA	Map F
5.	Ditches A thru F, Profiles & Cross Sections Phase IV	Y	5/92	PH 4-1
6.	Ditches G thru O, Profiles & Cross Sections Phase IV	N	5/92	PH 4-2
7.	Ponds 035A, 035B,035C, Plan Views & Profiles Phase IV	N	2/92	PH4-3
8.	Ponds 036 & 037, Plan Views & Profiles Phase IV	N	5/92	PH4-4
9.	Lateral Roads L-1 thru L-5	N	7/90	LR1
10	Lateral Roads L-6 thru L-9	N	7/90	LR2
11.	Lateral Road L-10 & L-11	N	7/90	LR3
12.	Service Road S-3	N	7/90	S2
13.	North Field/ East Mining Operations Map	N	7/90	Map D
14.	Ditches A thru F, Profiles & Cross Sections Phase IV	Y	5/92	PH 4-1

15.	Ditches G thru O, Profiles & Cross Sections Phase IV	N	5/92	PH 4-2
16.	Ponds 035A, 035B,035C, Plan Views & Profiles Phase IV	N	2/92	PH4-3
17.	Lateral Roads L-1 thru L-5	N	7/90	LR1
18.	Service Road S-3	N	7/90	S2
19.	Surface Drainage Control Map	Y	NA	Map F
20.	North Field/ East Mining Operations Map	N	7/90	Map D
21.	Mining Operations Map Permit 74 Revision I	N	7/90	Map D
22.	Surface Drainage Control Permit 74 Revision I	N	9/25/87	Map D-2
23.	Pond 033 (Revised) Plan/Profile	Y	11/92	RD-1
24.	NPDES Boundary Map	Y	8/1/94	NA