



Department of Development Services

Major Projects Team

500 S Grand Central Pky 1st Fl • Box 551749 • Las Vegas NV 89155-1749
(702) 455-3256 • Fax (702) 455-3271

Phil Rosenquist, Director

March 2, 2007

Carter-Burgess
6655 Bermuda Road
Las Vegas, Nevada 89119

SUBJECT: Clark County Development Services Dept.
Major Project Division
Letter of Map Revision Application for the Pahrnagat Wash
Study Dated: February 22, 2007
Location: NEC US 93 and SR 168
(Sec. 21, 22, and 23, T. 13 S., R. 63 E.)
HTE# 07-4040

RFCD
2007 MAR 30 AM 11:16

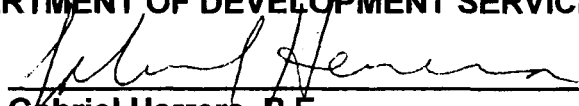
The referenced **Letter of Map Revision Application** has been reviewed and is accepted with the following comments:

1. The Application must be submitted to FEMA;
2. Regional Flood Control District (RFCD) concurrence is required. Concurrent submittal to FEMA and RFCD is acceptable;
3. As a condition of final approval, the Application submitted for this project requires the following modifications prior to further agency submittal:
 - a. Verify all needed signatures are on forms

The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and beyond the minimum codes for issues of public safety and impacts to upstream, downstream and adjacent properties. The County assumes no liability for information data, designs or conclusions of the Engineer of Record;

DEPARTMENT OF DEVELOPMENT SERVICES

BY:



Gabriel Herrera, P.E.
Principal Engineer
Major Projects Division

BOARD OF COUNTY COMMISSIONERS

RORY REID, Chairman • CHIP MAXFIELD, Vice Chair
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VIRGINIA VALENTINE, P.E., County Manager

**LETTER OF MAP REVISION APPLICATION FOR
THE PAHRANAGAT WASH**

JOB #241408.044

Clark County, Nevada

Prepared by:

Carter::Burgess

**6655 Bermuda Road
Las Vegas, Nevada 89119**

Submitted to:

**Michael Baker Jr., Inc.
3601 Eisenhower Avenue
Alexandria, Virginia 22304-6425**

FEBRUARY, 2007

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: LOMR for the Pahranaagat Wash Date: February 22, 2007

Location of Development: a) Descriptive (Cross Streets): North/South US HWY 93 East/West NV HWY 168
b) Sect. 21, 22, & 23 Twn. 13S Rng. 63E

Name of Owner: Coyote Springs Investment, LLC Assessors Parcel Number: 009-00-001-018

Telephone Number: (702) 382-2818 Facsimile Number: (702) 676-1241

Address: 300 S. 4th Street Suite 1406 Las Vegas, NV 89101

Contact Person - Name: Alex Kingston, E.I. Telephone Number: (702) 938-5453

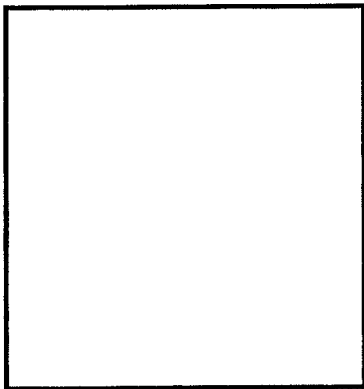
Firm: Carter & Burgess, Inc.

Address: 6655 Bermuda Road, Las Vegas, NV 89119

Type of Land Development/Land Disturbance Process:

☐	Rezoning	☐	Subdivision Map	☒	Clearing and Grading Only
☐	Parcel Map	☐	Planned Unit Development	☐	Other (Please specify below)
☐	Large Parcel Map	☐	Building Permit	☐	

- Total Owned Land Area: At site: 12,800 acres Being Developed/Disturbed: ± 5 acres
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? : YES* NO
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control Master Plan Facility? : YES* NO
- Proposed type of development (Residential, Commercial, Etc.): LOMR
- Approximate upstream land area which drains to the subject site: 580 Acres
- Has the site been evaluated in the past? YES NO If yes, please identify documentation:
Update #2 for the Coyote Springs Conceptual Drainage Study by G.C. Wallace
- If known, please identify the proposed point(s) of runoff from the site: N/A
- Briefly describe your proposed schedule for the subject project: ASAP



Submit this form as part of the required drainage study to the local entity which has jurisdiction over the property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

* Review and concurrence of the Clark County Regional Flood Control District is required.

Revisions	Date

Local Entity File Number

Engineer's Seal

REFERENCE:

STANDARD FORM 1

February 13, 2007

**Mr. Sacha Tohme, CFM
Federal Emergency Management Agency
C/o Michael Baker Jr., Inc
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304**

**Re: Application for a Letter of Map Revision for the Pahrnagat Wash
Clark County, Nevada
Carter & Burgess, Inc. Job #241408.044**

Dear Mr. Tohme:

Attached is an application for a Letter of Map Revision (LOMR) for the Pahrnagat Wash. This LOMR is being submitted to the Federal Emergency Management Agency (FEMA) for review and acceptance. The Pahrnagat Wash Special Flood Hazard Area (SFHA) Zone A is located within the existing Pahrnagat Wash Floodplain area – located within Clark County, Nevada. The FEMA Flood Insurance Rate Map (FIRM) No. 320003C225E, Panel Number 225 of 4090, effective September 27, 2002, shows the exact location of the LOMR and the Pahrnagat Wash are shown on the attached Flood Insurance Rate Map (FIRM).

The following has been included in this application:

- MT-2 - Form 1 – Revision Requestor and Community Official Form
- MT-2 - Form 2 – Riverine Hydraulic Analysis Form
- Figure 2 Effective FIRM
- Figure 2A Annotated FIRM
- Proposed Conditions HEC-RAS output (File:.PRJ)

Also the entire copy of the “Storm Centering Study for Pahranagat Valley – Upstream of Moapa, Nevada,” prepared by James C.Y. Guo, PhD, P.E. for VTN Nevada, Inc.

SITE DESCRIPTION

The site is located in North Clark County, Nevada. The existing floodzone is caused by the outfall of the 862 square miles drainage basins, which includes Kane Springs Valley basin and the Pahranagat Wash Valley tributary basin area between *Pahranagat Wild Life Refugee Area* and the City of Moapa, Nevada, as defined within the “Storm Centering Study for Pahranagat Valley – Upstream of Moapa, Nevada,” by VTN Nevada, Inc. Please see Vicinity and Location Map, enclosed in the appendix.

HYDROLOGY

The “Storm Centering Study for Pahranagat Valley – Upstream of Moapa, Nevada,” determined the 100-year flow rates for the Pahranagat Wash. The main wash is modeled with a 100-year flow rate of 12,100 cfs, a Western Tributary is contributing a 100-year flow rate of 10,000 cfs, together the two combine to create a 100-year flow rate of 15,871 cfs – South of State Route 168. The 100-year flow rates were determined using Storm Centering Analysis, channel routing, and attenuation.

HYDRAULICS

The HEC-RAS computer program was used to determine the depths of flow in the Pahranagat Wash. The HEC-RAS analysis and the HEC-RAS Cross-Section Exhibits are provided in the Appendix. The HEC-RAS analysis determined the Water Surface Elevation (WSEL) for the existing Pahranagat Wash from the Clark /Lincoln County line, South to Arrow Canyon.

DISCUSSION

This Letter of Map Revision is being submitted to establish the extent of flooding condition and redefining the Pahranagat Wash existing floodplain. In researching the Pahranagat Wash – no information could be obtained from local sources on how the Pahranagat Wash floodplain was determined or what models were used to generate the Hydrology or Hydraulic analysis. Carter & Burgess is submitting an updated Hydrology and Hydraulic analysis based on new data and existing information.

The land between the Clark/Lincoln County line and State Route 168, including the Pahranagat Valley is owner or leased by Coyote Springs Inc. The land surrounding the Pahranagat Valley is being developed into a Major Master Planned Community. The establishment of the Pahranagat Wash 100-year floodplain will help the Coyote Spring development to establish encroachment limits into the revised SFHA Zone A. This LOMR will set 100-year flow depths, velocities and top widths associated with the Pahranagat Wash.

The “Storm Centering Study for Pahranagat Valley – Upstream of Moapa, Nevada,” was written by Dr. James C.Y. Guo, P.E. an International renowned expert in the field of hydrology and Hydraulics. Dr. Guo is a Professor in the Department of Civil Engineering – Collage of Engineering and Applied Science – University of Colorado at Denver and also a Consulting Engineer. Dr. Guo specializes in Watershed Modeling – Fluid Flow Modeling - Flash Flood – Floodplain Management – Flood Protection, Risk and Optimization. Dr. Guo is recognized as an expert in the field of Hydrology and Hydraulics by Clark County Public Works and Clark County Regional Flood Control District.

The LOMR Application for the Pahranagat Wash is enclosed within the appendix of this report.

Thank You for your time in reviewing this LOMR application. If I can be of further assistance, or if you have any questions, I will be available. Please do not hesitate to contact me at (702) 938-5453.

Sincerely,
Carter::Burgess, Inc.

Alexander Kingston. E.I.T.
Senior Hydrologist

FEDERAL EMERGENCY MANAGEMENT AGENCY
OVERVIEW & CONCURRENCE FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

- ☐ CLOMR: A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).
- ☒ LOMR: A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See Parts 60 & 65 of the NFIP Regulations.)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
20003	Clark County	NV	32003C	225E	09/27/02

2. Flooding Source: 862 Square Miles Total - Pahrnagat Valley - consisting of the Kane Springs Wash Basin and the Pahrnagat Wash Basin

3. Project Name/Identifier: Pahrnagat Wash

4. FEMA zone designations affected: A (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

- ☐ Physical Change ☒ Improved Methodology/Data
- ☐ Regulatory Floodway Revision ☐ Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following types of flooding and structures (check all that apply)

- Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)
- ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)
- Structures: ☐ Channelization ☐ Levee/Floodwall ☐ Bridge/Culvert
- ☐ Dam ☐ Fill ☐ Other, Attach Description

C. REVIEW FEE

Has the review fee for the appropriate request category been included?

☐ Yes

Fee amount: \$0

☒ No, Attach Explanation

Please see the FEMA Web site at http://www.fema.gov/fhm/fm_fees.shtm for Fee Amounts and Exemptions.

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Alexander Kingston

Company: Carter & Burgess

Mailing Address:
6655 Bermuda Road
Las Vegas, NV 89119-3605

Daytime Telephone No.:
1-702-938-5400

Fax No.:
1-702-938-5454

E-Mail Address: Alex.Kingston@c-b.com

Signature of Requester (required):

Date:

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title:

Telephone No.:
(702) 633-1200

Community Name: Clark County, Nevada

Community Official's Signature (required):

Date:

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Edward J. Thurnbeck, P.E.

License No.: 16593

Expiration Date:
6/30/2008

Company Name: Carter & Burgess

Telephone No.: 1-702-938-5400

Fax No.:
1-702-938-5454

Signature:

Date:

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)

Required if ...

- ☒ Riverine Hydrology and Hydraulics Form (Form 2) New or revised discharges or water-surface elevations
- ☐ Riverine Structures Form (Form 3) Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
- ☐ Coastal Analysis Form (Form 4) New or revised coastal elevations
- ☐ Coastal Structures Form (Form 5) Addition/revision of coastal structure
- ☐ Alluvial Fan Flooding Form (Form 6) Flood control measures on alluvial fans

Seal (Optional)

FEDERAL EMERGENCY MANAGEMENT AGENCY
RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Pahrnagat Wash
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

- ☐ Not revised (skip to section 2) ☐ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
North of State Route 168	862	12,100	
South of State Route 168	862	15,871	
Western Tributary	862	10,000	

3. Methodology for New Hydrologic Analysis (check all that apply)

- ☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☒ Other (please attach description) **- PLEASE SEE STORM CENTERING ANALYSIS - ENCLOSED**

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtml.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.)	
			Effective	Proposed/Revised
Downstream Limit	Arrow Canyon	7115		2157.93
Upstream Limit	Cross-section @ Clark/Lincoln County Line	36400		2256.05

2. Hydraulic Method Used

Hydraulic Analysis HEC-RAS [HEC-2, HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/fhm/fhm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☐ Yes ☒ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name:	Floodway File Name:
Revised or Post-Project Conditions Model	Natural File Name: exist.PRJ	Floodway File Name:
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); *current community easements and boundaries*; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach a **copy of the effective FIRM and/or FBFM**, annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☐ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:

- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

1.0' North American Vertical Datum (NAVD), users of this FIRM aware that coastal flood elevations may also be provided in the of Stillwater Elevations table in the Flood Insurance Study report for unity. Elevations shown in the Summary of Stillwater Elevations table used for construction, and/or floodplain management purposes when her than the elevations shown on this FIRM.

of the floodway were computed at cross sections and interpolated cross sections. The floodways were based on hydraulic considerations f to requirements of the National Flood Insurance Program. Floodway f other pertinent floodway data are provided in the Flood Insurance rt for this jurisdiction.

as not in Special Flood Hazard Areas may be protected by flood insurance. Refer to Section 2.4 "Flood Protection Measures" of Insurance Study report for information on flood control structures diction.

ction used in the preparation of this map is Universal Transverse (UTM) Zone 11. The horizontal datum is NAD83, GRS1980 Differences in datum, spheroid, projection or UTM zones used in tion of FIRMs for adjacent jurisdictions may result in slight positional i in map features across jurisdiction boundaries. These differences at the accuracy of the FIRM.

ations on this map are referenced to the North American Vertical 1988. These flood elevations must be compared to structure and ivations referenced to the same vertical datum. For information conversion between the National Geodetic Vertical Datum of 1929 orth American Vertical Datum of 1988, visit the National Geodetic site at www.ngs.noaa.gov or contact the National Geodetic Survey wing address:

work Branch, N/C13
odetic Survey, NOAA
ig Metro Center 3
West Highway
g, Maryland 20910
3191

urrent elevation, description, and/or location information for bench marks this map, please contact the Information Services Branch of the eodetic Survey at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

Information shown on this FIRM was provided in digital format by nty Regional Flood Control District. This information was converted ophotography, dated 1999 or newer, and GBF/DIME data. Segments ted off of the orthophotography based on center of pavement.

imits shown on this map are based on the best data available of publication. Because changes due to annexations or de-annexations occurred after this map was published, map users should contact community officials to verify current corporate limit locations.

re to the separately printed Map Index for an overview map showing of map panels for this jurisdiction.

ipanying Flood Insurance Study report, Letters of Map Revision or Map Amendment revising portions of this panel, and digital versions NLE may be available. Contact the FEMA Map Service Center at ing phone numbers and Internet address for information on all related available from FEMA;

3-358-9616
358-9620
www.fema.gov

re questions about this map or questions concerning the National rance Program in general, please call 1-877-FEMA-MAP (1-877-336- visit the FEMA website at www.fema.gov.

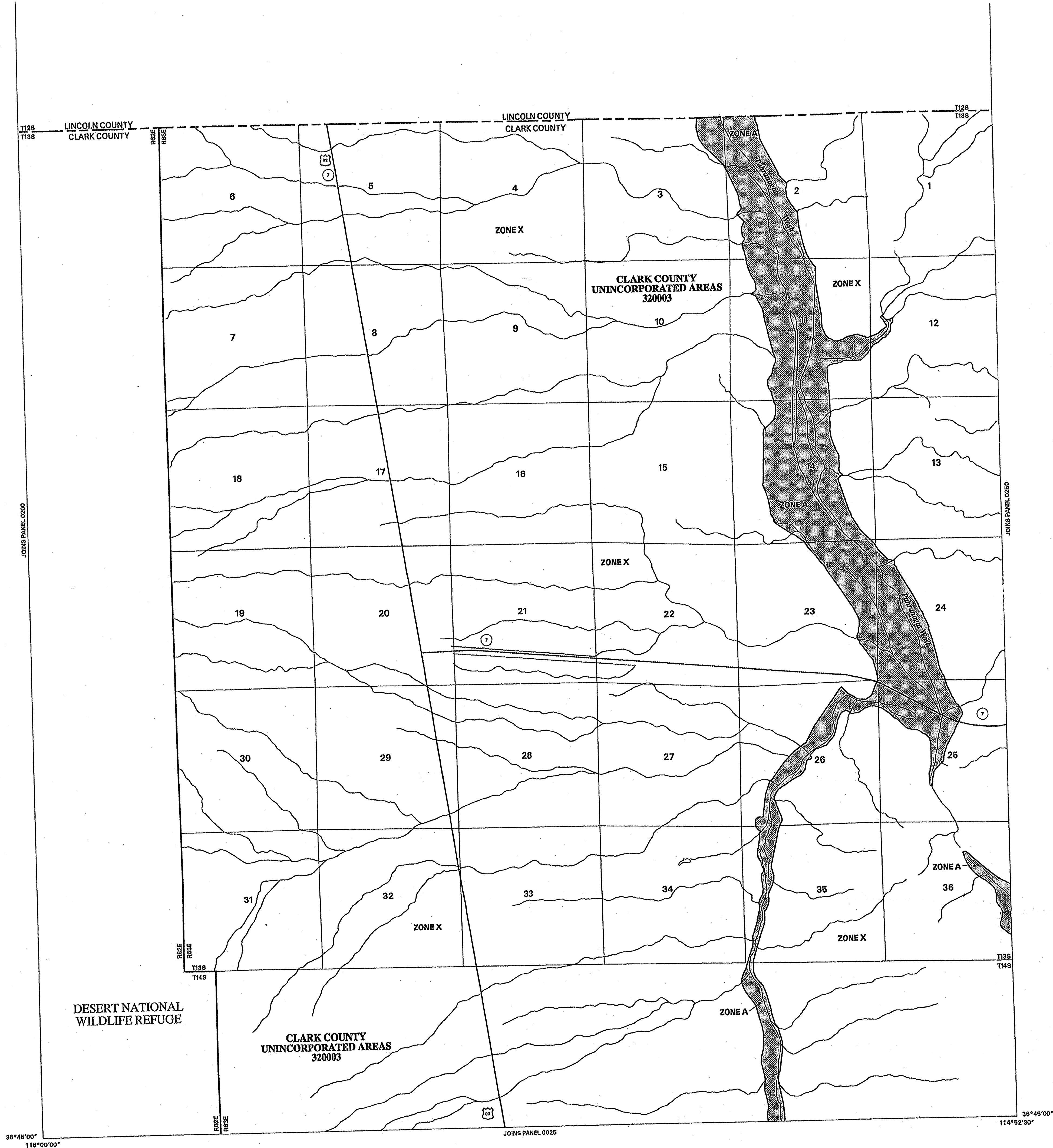
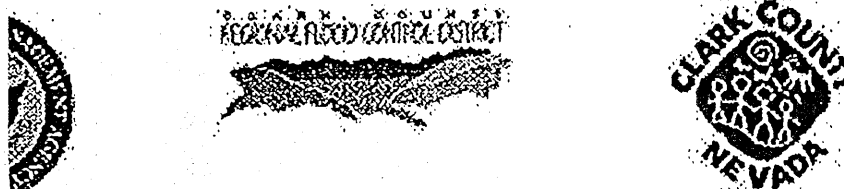
reflects more detailed and up-to-date stream channel configurations a shown on the previous FIRM for this jurisdiction. The floodplains ways that were transferred from the previous FIRM may have been to conform to these new stream channel configurations. As a s Flood Profiles and Floodway Data tables in the Flood Insurance ort may reflect stream channel distances that differ from what is this map.

al Flood Insurance Rate Map (DFIRM) was produced through a rtnership between Clark County and the Federal Emergency nt Agency (FEMA). Clark County has developed a long-term approach of management to decrease the costs associated with flooding. This rated by the Clark County commitment to share and maintain floodplain in their Geographic Information System Management Office (GISMO).

IRM reflects several innovative features. These include:
Nevada GIS-Cooperation among local governmental agencies throughout nty. The foundation of cooperation is the GIS Interlocal Agreements tween fourteen regional participants. In part, the agreements specify ark County GIS Management Office (GISMO) will be responsible for g a GIS data warehouse and associated Southern Nevada GIS Metadata.

SMO's responsibilities go beyond maintaining the GIS data warehouse. o maintains the Street Centerline Database used by 911 dispatch services, fine database serves as the base map for this DFIRM.

ATA AVAILABILITY: <http://www.co.clark.nv.us/cel/gismo/gismo.htm>



decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.

ZONE A99 Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no base flood elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain Boundary
Floodway Boundary
Zone D Boundary
Coastal Barrier Boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or velocities.
Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*
Cross Section Line
Transsect Line
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4276000M
600000 FT
4276000M
600000 FT
Bench mark (see explanation in Notes to Users section of this FIRM panel).
River Mile
MAP REPOSITORY
X XX XXX XXXX XXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXX XXX XX X
XXXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXX
INITIAL IDENTIFICATION

FLOOD HAZARD BOUNDARY MAP REVISIONS
None
FLOOD INSURANCE RATE MAP EFFECTIVE
AUGUST 16, 1999
FLOOD INSURANCE RATE MAP REVISIONS
September 27, 2002: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to delete special flood hazard areas, to change zone designations, to add roads and road names, to incorporate previously issued letters of map revision, to incorporate previously issued letters of map amendment, and to change floodway.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.

MAP SCALE 1" = 2000'
1000 0 2000 4000
FET
600 0 600 1200
METERS

PANEL 0225 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA
(UNINCORPORATED AREAS)

PANEL 225 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
CLARK COUNTY,
UNINCORPORATED AREAS 320003 0225 E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
3200030225 E
MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

FIGURE 2

The seal of Clark County, Nevada, is a circular emblem. It features a central shield with a spiral design at the top, a sunburst in the middle, and a mountain range at the bottom. The words "CLARK COUNTY" are arched over the top of the shield, and "NEVADA" is arched below it.

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FIRM

FLOOD INSURANCE RATE MAP

CLARK COUNTY, NEVADA

(UNINCORPORATED AREAS)

PANEL 225 OF 4090

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

<u>CONTAINS:</u>	<u>NUMBER</u>	<u>PANEL</u>	<u>SUFFIX</u>
CLARK COUNTY, UNINCORPORATED AREAS	320003	0225	E

Notice to User: The Map Number shown below will be used when planning map orders. The Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER
3200030225 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

FIGURE 2A

Pwashexisting

Plan: Plan 02

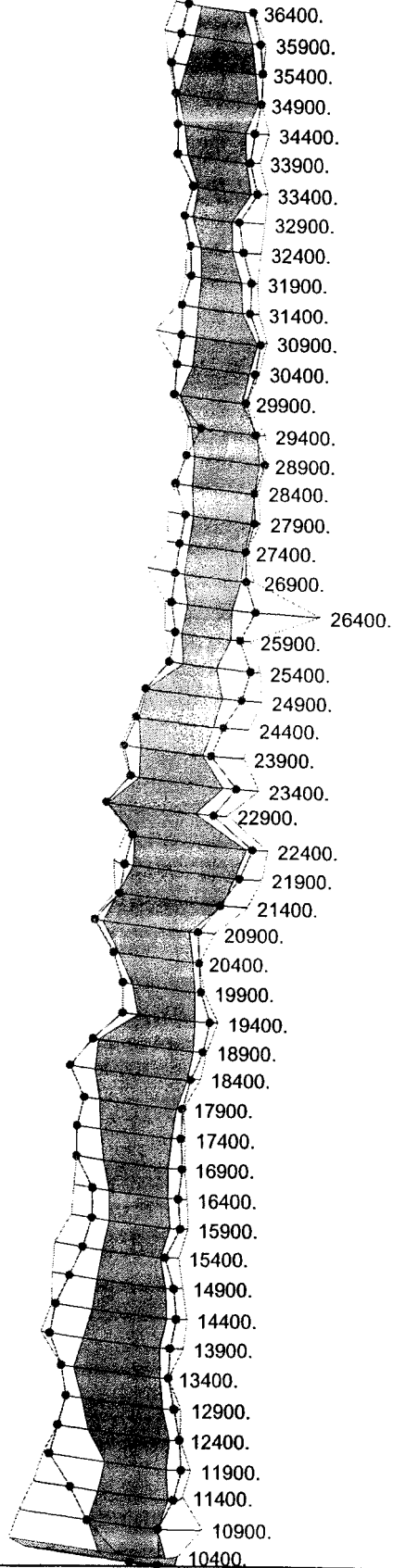
2/21/2007

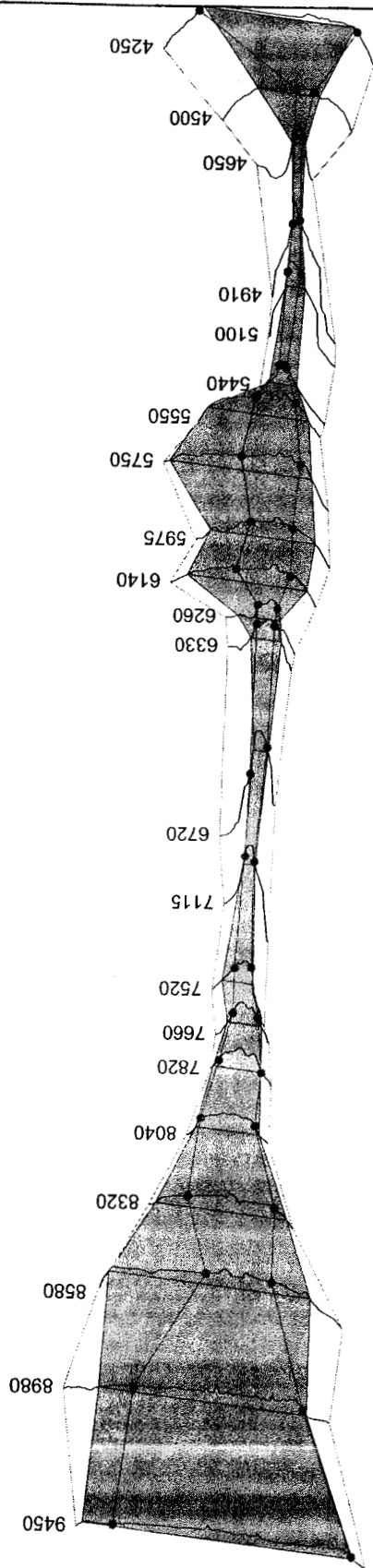
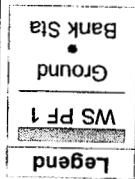
Legend

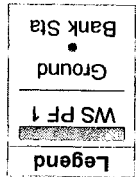
WS PF 1

Ground

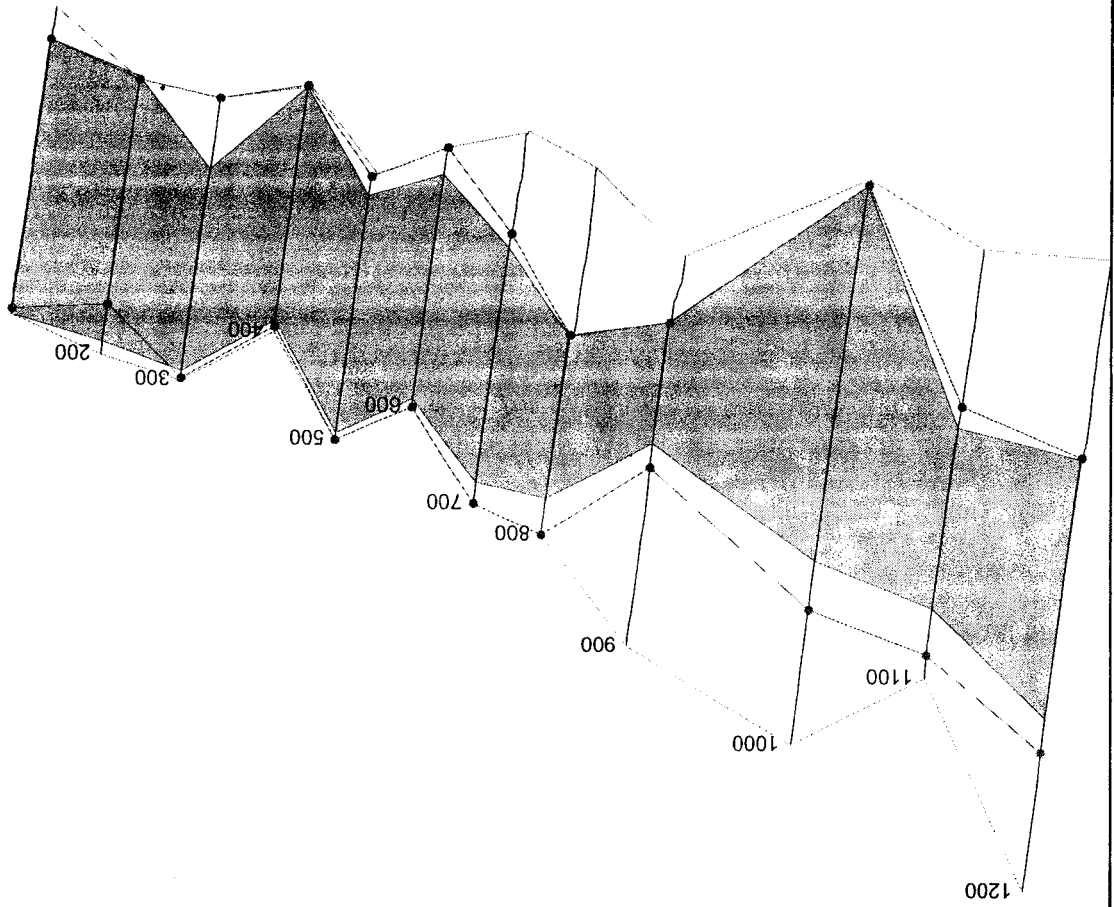
Bank Sta





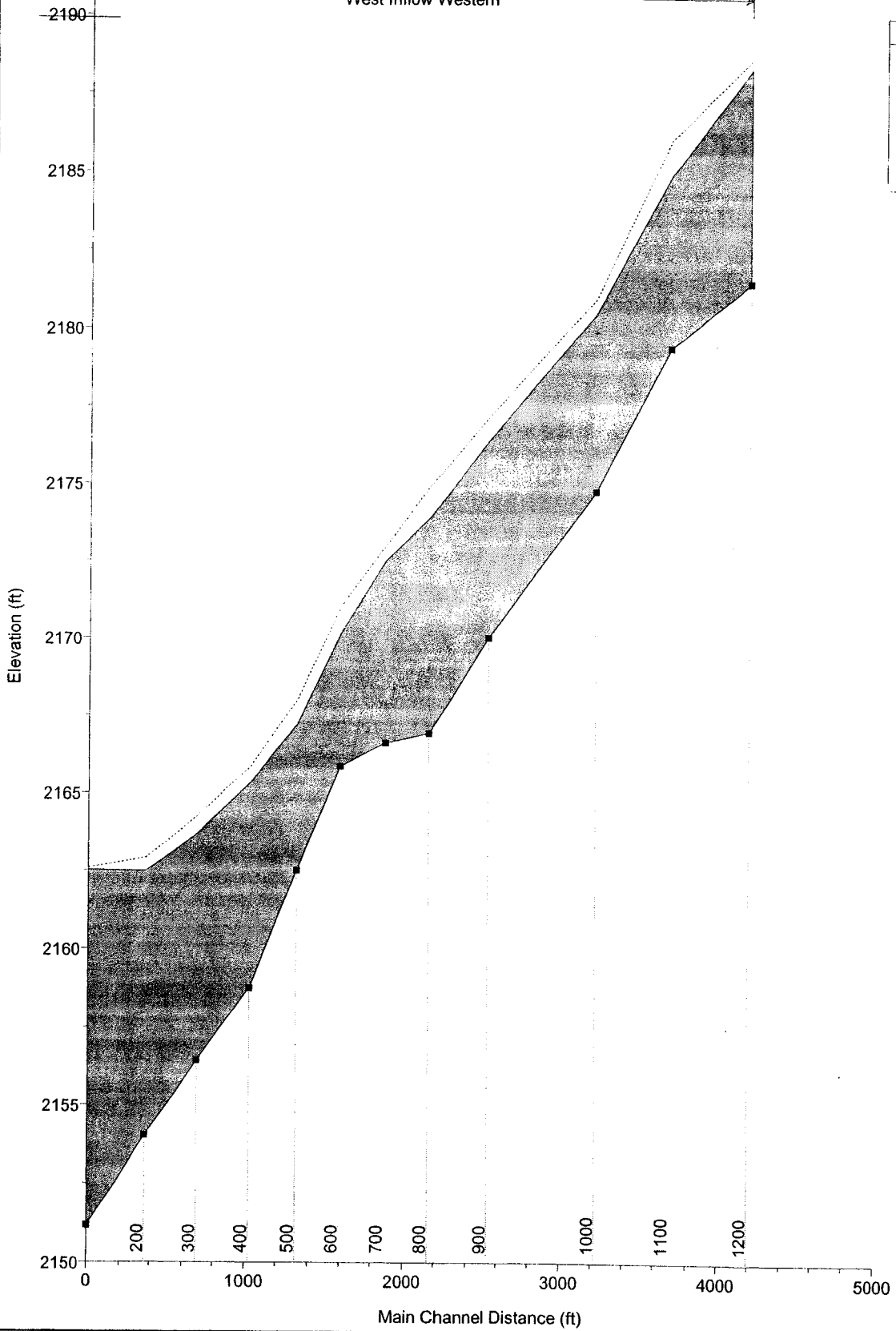


Pwasheexisting Plan: Plan 02 2/21/2007



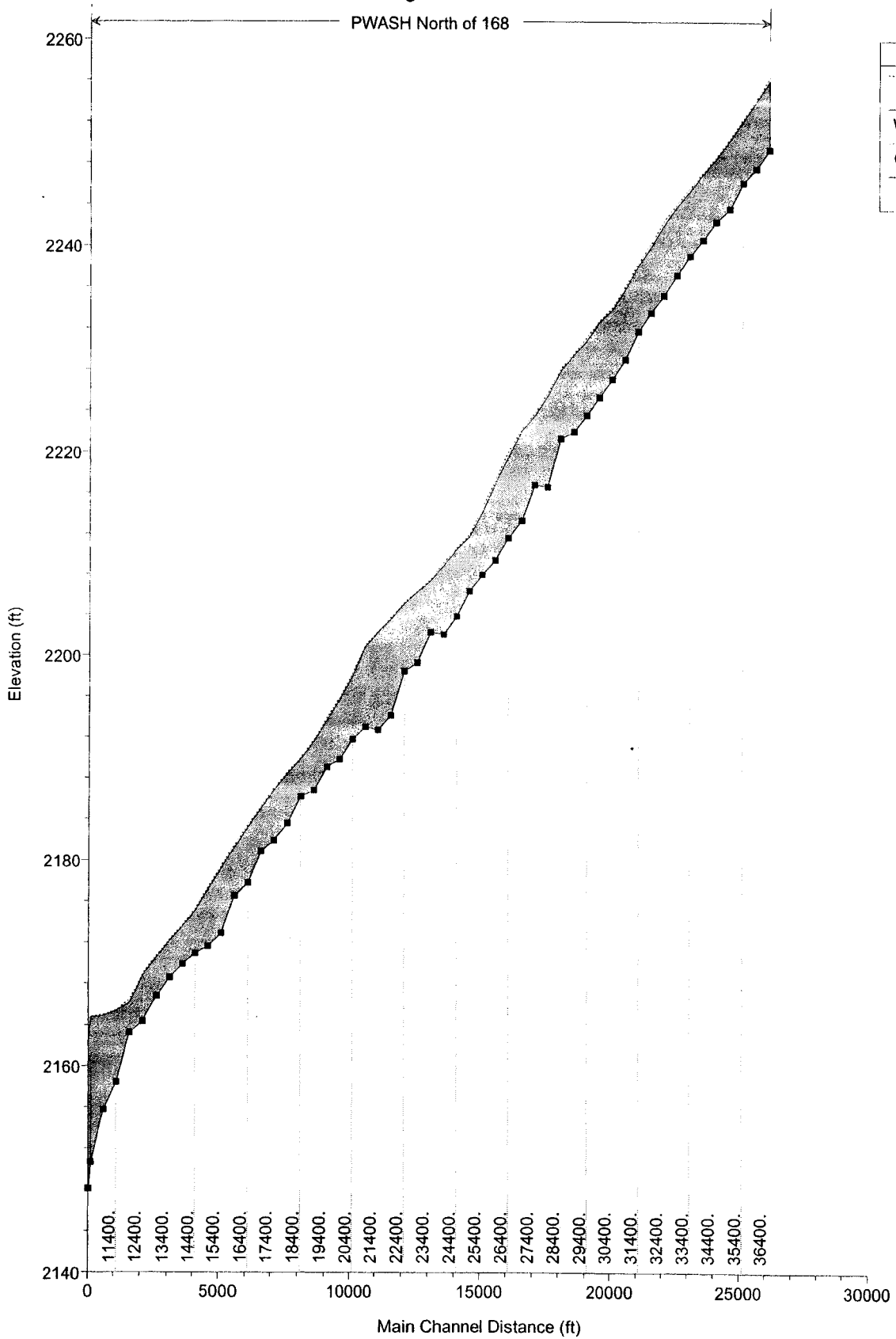
Pwashexisting Plan: Plan 02 2/21/2007

West Inflow Western



Pwashexisting Plan: Plan 02 2/21/2007

PWASH North of 168



Legend

EG PF 1

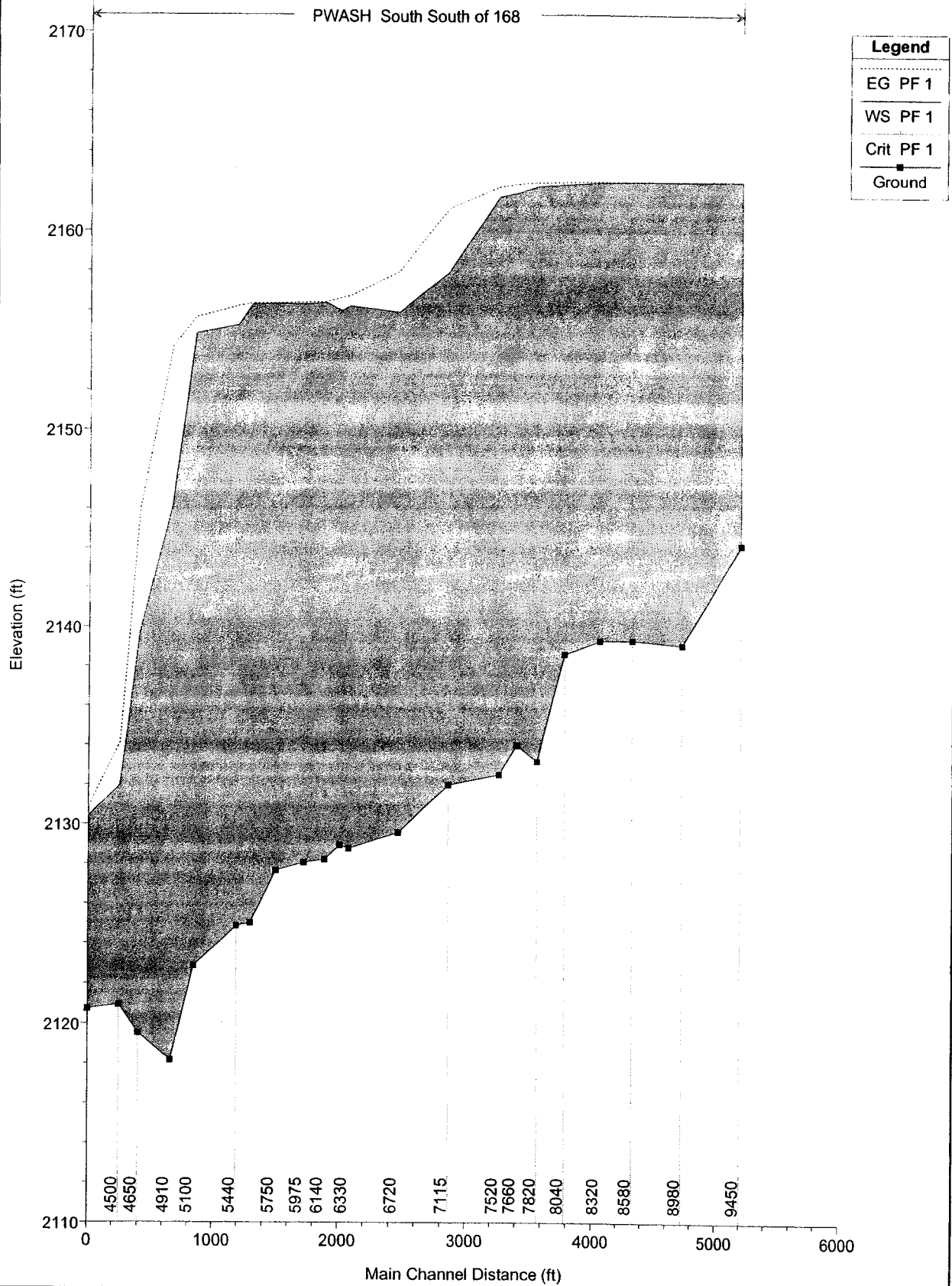
WS PF 1

Crit PF 1

Ground

Pwashexisting Plan: Plan 02 2/21/2007

PWASH South South of 168



HEC-RAS Plan Plan 02 Profile: PF 1

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
West Inflow	Western	1200	PF 1	11975.00	2188.49	2188.31		2188.63	0.002638	4.56	2625.29	709.74	0.42
West Inflow	Western	1100	PF 1	11975.00	2179.39	2184.90	2184.62	2188.04	0.013375	8.58	1395.85	494.39	0.90
West Inflow	Western	1000	PF 1	11975.00	2174.78	2180.48	2179.87	2180.95	0.008137	5.52	2168.51	1024.88	0.67
West Inflow	Western	900	PF 1	11975.00	2170.00	2176.37		2177.14	0.004011	7.01	1709.38	331.49	0.54
West Inflow	Western	800	PF 1	11975.00	2166.92	2173.89		2174.90	0.009343	8.05	1487.41	441.74	0.77
West Inflow	Western	700	PF 1	11975.00	2166.61	2172.51		2173.00	0.004481	5.57	2150.17	840.36	0.54
West Inflow	Western	600	PF 1	11975.00	2165.86	2170.16		2171.02	0.011323	7.47	1602.53	815.16	0.82
West Inflow	Western	500	PF 1	11975.00	2162.51	2167.21		2168.00	0.010489	7.15	1875.02	649.91	0.78
West Inflow	Western	400	PF 1	11975.00	2158.76	2165.32		2165.83	0.006033	5.77	2073.97	839.27	0.56
West Inflow	Western	300	PF 1	11975.00	2156.43	2163.69		2164.28	0.004452	6.01	1990.87	524.63	0.54
West Inflow	Western	200	PF 1	11975.00	2154.04	2162.49		2162.91	0.003649	5.27	2324.15	725.30	0.49
West Inflow	Western	100	PF 1	11975.00	2151.18	2162.52		2162.59	0.000230	2.16	5541.36	745.23	0.14
PWASH South	South of 168	9450	PF 1	15871.00	2144.19	2162.53		2162.55	0.000052	1.25	12907.99	1416.14	0.07
PWASH South	South of 168	8980	PF 1	15871.00	2139.10	2162.51		2162.53	0.000036	1.26	13041.34	1088.00	0.06
PWASH South	South of 168	8580	PF 1	15871.00	2138.34	2162.48		2162.52	0.000038	1.51	12711.14	1054.59	0.06
PWASH South	South of 168	8320	PF 1	15871.00	2138.31	2162.46		2162.51	0.000051	1.75	9813.77	888.18	0.07
PWASH South	South of 168	8040	PF 1	15871.00	2138.62	2162.36		2162.48	0.000111	2.82	5796.57	330.55	0.11
PWASH South	South of 168	7820	PF 1	15871.00	2133.18	2162.25		2162.44	0.000180	3.54	4551.28	249.52	0.14
PWASH South	South of 168	7680	PF 1	15871.00	2133.99	2161.90		2162.38	0.000888	5.49	3029.29	175.94	0.21
PWASH South	South of 168	7520	PF 1	15871.00	2132.50	2161.70		2162.23	0.000902	6.16	2983.54	161.41	0.21
PWASH South	South of 168	7115	PF 1	15871.00	2131.99	2157.93		2161.12	0.008880	14.42	1136.28	61.93	0.54
PWASH South	South of 168	6720	PF 1	15871.00	2129.57	2155.90		2157.95	0.005898	11.51	1389.16	76.23	0.46
PWASH South	South of 168	6330	PF 1	15871.00	2128.76	2156.21		2156.72	0.000973	6.11	2931.43	159.96	0.22
PWASH South	South of 168	6260	PF 1	15871.00	2128.93	2155.97		2156.63	0.001246	8.64	2599.29	182.69	0.25
PWASH South	South of 168	6140	PF 1	15871.00	2128.21	2156.36		2156.41	0.000117	1.95	9378.40	623.72	0.08
PWASH South	South of 168	5975	PF 1	15871.00	2128.05	2156.31		2156.39	0.000166	2.45	7571.33	520.48	0.09
PWASH South	South of 168	5750	PF 1	15871.00	2127.66	2156.32		2156.35	0.000055	1.47	12567.49	742.73	0.05
PWASH South	South of 168	5550	PF 1	15871.00	2125.00	2156.29		2156.34	0.000078	1.87	9949.84	527.21	0.06
PWASH South	South of 168	5440	PF 1	15871.00	2124.85	2155.24		2156.22	0.001941	9.07	2274.80	151.06	0.30
PWASH South	South of 168	5100	PF 1	15871.00	2122.86	2154.84		2155.64	0.001277	7.35	2331.07	105.99	0.25
PWASH South	South of 168	4910	PF 1	15871.00	2118.16	2146.19	2146.19	2154.22	0.039717	22.89	709.84	49.32	0.98
PWASH South	South of 168	4650	PF 1	15871.00	2119.53	2139.67	2139.67	2145.99	0.020524	20.78	838.47	70.35	0.90
PWASH South	South of 168	4500	PF 1	15871.00	2120.93	2131.94	2131.94	2134.11	0.008629	13.61	1499.53	326.12	0.85
PWASH South	South of 168	4250	PF 1	15871.00	2120.73	2130.43	2128.77	2130.87	0.003465	5.34	2972.99	777.03	0.48
PWASH North	North of 168	36400	PF 1	12100.00	2249.36	2256.05		2256.42	0.005651	4.84	2501.68	1096.90	0.56
PWASH North	North of 168	35900	PF 1	12100.00	2247.49	2254.04		2254.25	0.003298	3.64	3322.34	1488.57	0.43
PWASH North	North of 168	35400	PF 1	12100.00	2246.12	2252.16		2252.37	0.004300	3.68	3284.19	1764.44	0.48
PWASH North	North of 168	34900	PF 1	12100.00	2243.60	2250.28		2250.44	0.003466	3.25	3722.57	2053.86	0.43
PWASH North	North of 168	34400	PF 1	12100.00	2242.39	2248.45		2248.66	0.003621	3.66	3308.25	1580.14	0.45
PWASH North	North of 168	33900	PF 1	12100.00	2240.61	2246.99		2247.17	0.002490	3.33	3632.05	1507.02	0.38
PWASH North	North of 168	33400	PF 1	12100.00	2239.02	2245.36		2245.60	0.003987	3.99	3032.73	1366.41	0.47
PWASH North	North of 168	32900	PF 1	12100.00	2237.15	2243.84		2244.07	0.002435	3.86	3132.41	1022.86	0.39
PWASH North	North of 168	32400	PF 1	12100.00	2235.19	2242.03		2242.43	0.004560	5.09	2377.95	822.44	0.53
PWASH North	North of 168	31900	PF 1	12100.00	2233.51	2239.92		2240.24	0.004119	4.51	2685.59	1033.42	0.49
PWASH North	North of 168	31400	PF 1	12100.00	2231.67	2238.09		2238.35	0.003428	4.08	2965.06	1152.73	0.45
PWASH North	North of 168	30900	PF 1	12100.00	2228.93	2235.82		2236.11	0.006046	4.36	2776.13	1494.76	0.56
PWASH North	North of 168	30400	PF 1	12100.00	2227.05	2233.78		2233.98	0.003104	3.62	3343.55	1444.70	0.42
PWASH North	North of 168	29900	PF 1	12100.00	2225.24	2232.60		2232.74	0.001979	3.03	3992.04	1604.66	0.34
PWASH North	North of 168	29400	PF 1	12100.00	2223.52	2230.82		2231.14	0.005876	4.59	2721.27	1551.10	0.56
PWASH North	North of 168	28900	PF 1	12100.00	2221.94	2229.44		2229.59	0.001815	3.06	3950.09	1464.29	0.33
PWASH North	North of 168	28400	PF 1	12100.00	2221.27	2227.91		2228.16	0.005047	4.03	2999.63	1585.31	0.52
PWASH North	North of 168	27900	PF 1	12100.00	2216.54	2225.41		2225.69	0.004830	4.29	2823.55	1318.39	0.52
PWASH North	North of 168	27400	PF 1	12100.00	2216.73	2223.48		2223.72	0.003218	3.97	3050.64	1179.70	0.43
PWASH North	North of 168	26900	PF 1	12100.00	2213.27	2222.04		2222.22	0.002732	3.47	3489.03	1458.00	0.40
PWASH North	North of 168	26400	PF 1	12100.00	2211.56	2219.49		2220.01	0.008077	5.79	2090.59	911.29	0.67
PWASH North	North of 168	25900	PF 1	12100.00	2209.36	2216.92		2217.18	0.003989	4.12	2936.78	1259.65	0.48
PWASH North	North of 168	25400	PF 1	12100.00	2207.92	2214.08		2214.58	0.006897	5.66	2138.06	860.05	0.63
PWASH North	North of 168	24900	PF 1	12100.00	2206.29	2211.74		2211.93	0.003946	3.48	3480.23	1913.11	0.45
PWASH North	North of 168	24400	PF 1	12100.00	2203.81	2210.45		2210.57	0.001933	2.82	4291.17	1891.23	0.33
PWASH North	North of 168	23900	PF 1	12100.00	2202.05	2208.89		2209.16	0.004423	4.21	2875.78	1292.21	0.50
PWASH North	North of 168	23400	PF 1	12100.00	2202.26	2207.37		2207.51	0.002456	3.03	3996.98	1894.52	0.37
PWASH North	North of 168	22900	PF 1	12100.00	2199.26	2206.24		2206.38	0.002140	2.74	4421.72	2198.34	0.34
PWASH North	North of 168	22400	PF 1	12100.00	2198.43	2205.13		2205.23	0.002349	2.54	4755.52	2829.14	0.35
PWASH North	North of 168	21900	PF 1	12100.00	2194.09	2203.56		2203.72	0.004031	3.11	3885.35	2558.00	0.45
PWASH North	North of 168	21400	PF 1	12100.00	2192.65	2202.29		2202.39	0.001835	2.47	4915.79	2615.45	0.31
PWASH North	North of 168	20900	PF 1	12100.00	2192.96	2200.85		2201.03	0.004316	3.40	3560.53	2165.70	0.47
PWASH North	North of 168	20400	PF 1	12100.00	2191.72	2198.00		2198.29	0.007214	4.31	2804.81	1753.96	0.60
PWASH North	North of 168	19900	PF 1	12100.00	2189.75	2195.66		2195.86	0.003399	3.60	3358.99	1565.51	0.43
PWASH North	North of 168	19400	PF 1	12100.00	2189.03	2193.64		2193.90	0.004575	4.10	2951.96	1416.12	0.50
PWASH North	North of 168	18900	PF 1	12100.00	2186.76	2191.56		2191.72	0.004055	3.21	3767.49	2381.56	0.45
PWASH North	North of 168	18400	PF 1	12100.00	2186.14	2189.84		2189.98	0.002999	2.97	4077.04	2313.74	0.39
PWASH North	North of 168	17900	PF 1	12100.00	2183.55	2188.42		2188.56	0.002661	3.08	3932.63	1932.18	0.38
PWASH North	North of 168	17400	PF 1	12100.00	2181.90	2186.79		2186.99	0.003781	3.53	3424.66	1780.18	0.45
PWASH North	North of 168	16900	PF 1	12100.00	2180.87	2185.03		2185.22	0.003322	3.53	3429.15	1620.54	0.43
PWASH North	North of 168	16400	PF 1	12100.00	2177.77	2183.24		2183.46	0.003701	3.78	3200.32	1478.55	0.45
PWASH North	North of 168	15900	PF 1	12100.00	2176.53	2181.29		2181.52	0.004091	3.85	3144.99	1526.21	0.47
PWASH North	North of 168	15400	PF 1	12100.00	2172.88	2179.22		2179.46	0.004152	3.93	3079.87	1464.02	0.48
PWASH North	North of 168	14900	PF 1	12100.00	2171.61	2177.13		2177.34	0.004310	3.71	3261.61	1736.98	0.48
PWASH North	North of 168	14400	PF 1	12100.00	2170.90	2175.12		2175.31	0.003803	3.46	3499.21	1886.61	0.45
PWASH North	North of 168	13900	PF 1	12100.00	2169.85	2173.57		2173.71	0.002680	3.08	3929.16	1939.10	0.38
PWASH North	North of 168	13400	PF 1	12100.00	2168.58	2172.19		2172.33	0.002883	3.00	4039.71	2194.90	0.39
PWASH North	North of 168	12900	PF 1	12100.00	2166.82	2170.57		21					

HEC-RAS Plan: Plan 02 River: PWASH South Reach: South of 168 Profile: PF 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
South of 168	9450	PF 1	15871.00	2144.19	2162.53		2162.55	0.000052	1.25	12907.99	1416.14	0.07
South of 168	8900	PF 1	15871.00	2139.10	2162.51		2162.53	0.000036	1.26	13041.34	1088.00	0.06
South of 168	8580	PF 1	15871.00	2139.34	2162.49		2162.52	0.000038	1.51	12711.14	1054.59	0.06
South of 168	8320	PF 1	15871.00	2139.31	2162.46		2162.51	0.000051	1.75	9813.77	688.18	0.07
South of 168	8040	PF 1	15871.00	2138.62	2162.36		2162.48	0.000111	2.82	5796.57	330.55	0.11
South of 168	7820	PF 1	15871.00	2133.18	2162.25		2162.44	0.000180	3.54	4551.28	249.52	0.14
South of 168	7660	PF 1	15871.00	2133.99	2161.90		2162.36	0.000888	5.49	3029.29	175.94	0.21
South of 168	7520	PF 1	15871.00	2132.50	2161.70		2162.23	0.000902	6.16	2983.54	161.41	0.21
South of 168	7115	PF 1	15871.00	2131.99	2157.93		2161.12	0.008880	14.42	1136.28	61.93	0.54
South of 168	6720	PF 1	15871.00	2129.57	2155.90		2157.95	0.005898	11.51	1389.16	76.23	0.46
South of 168	6330	PF 1	15871.00	2128.76	2156.21		2156.72	0.000973	6.11	2931.43	159.96	0.22
South of 168	6260	PF 1	15871.00	2128.93	2155.97		2156.63	0.001246	6.64	2599.29	182.69	0.25
South of 168	6140	PF 1	15871.00	2128.21	2156.36		2156.41	0.000117	1.95	9378.40	623.72	0.08
South of 168	5975	PF 1	15871.00	2128.05	2156.31		2156.39	0.000166	2.45	7571.33	520.48	0.09
South of 168	5750	PF 1	15871.00	2127.66	2156.32		2156.35	0.000055	1.47	12567.49	742.73	0.05
South of 168	5550	PF 1	15871.00	2125.00	2156.29		2156.34	0.000078	1.87	9949.64	527.21	0.06
South of 168	5440	PF 1	15871.00	2124.85	2155.24		2156.22	0.001941	9.07	2274.80	151.06	0.30
South of 168	5100	PF 1	15871.00	2122.86	2154.84		2155.64	0.001277	7.35	2331.07	105.99	0.25
South of 168	4910	PF 1	15871.00	2118.16	2146.19	2146.19	2154.22	0.039717	22.89	709.84	49.32	0.98
South of 168	4650	PF 1	15871.00	2119.53	2139.67	2139.67	2145.99	0.020524	20.78	838.47	70.35	0.90
South of 168	4500	PF 1	15871.00	2120.93	2131.94	2131.94	2134.11	0.008629	13.61	1499.53	326.12	0.85
South of 168	4250	PF 1	15871.00	2120.73	2130.43	2128.77	2130.87	0.003465	5.34	2972.99	777.03	0.48

HEC-RAS Plan: Plan 02 River: West Inflow Reach: Western Profile: PF 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnfr (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Western	1200	PF 1	11975.00	2181.49	2188.31		2188.63	0.002638	4.56	2625.29	709.74	0.42
Western	1100	PF 1	11975.00	2179.39	2184.90	2184.62	2186.04	0.013375	8.58	1395.85	494.39	0.90
Western	1000	PF 1	11975.00	2174.76	2180.48	2179.87	2180.95	0.008137	5.52	2168.51	1024.88	0.67
Western	900	PF 1	11975.00	2170.00	2176.37		2177.14	0.004011	7.01	1709.38	331.49	0.54
Western	800	PF 1	11975.00	2166.92	2173.89		2174.90	0.009343	8.05	1487.41	441.74	0.77
Western	700	PF 1	11975.00	2166.61	2172.51		2173.00	0.004481	5.57	2150.17	640.36	0.54
Western	600	PF 1	11975.00	2165.86	2170.16		2171.02	0.011323	7.47	1602.53	615.16	0.82
Western	500	PF 1	11975.00	2162.51	2167.21		2168.00	0.010489	7.15	1675.02	649.91	0.78
Western	400	PF 1	11975.00	2158.76	2165.32		2165.83	0.005033	5.77	2073.97	639.27	0.56
Western	300	PF 1	11975.00	2156.43	2163.69		2164.26	0.004452	6.01	1990.87	524.63	0.54
Western	200	PF 1	11975.00	2154.04	2162.49		2162.91	0.003649	5.27	2324.15	725.30	0.49
Western	100	PF 1	11975.00	2151.18	2162.52		2162.59	0.000230	2.16	5541.36	745.23	0.14

Plan: Plan 02 PWASH North of 168 RS: 36400. Profile: PF 1

E.G. Elev (ft)	2256.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.		0.040	
W.S. Elev (ft)	2256.05	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2501.68	
E.G. Slope (ft/ft)	0.005651	Area (sq ft)		2501.68	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1096.90	Top Width (ft)		1096.90	
Vel Total (ft/s)	4.84	Avg. Vel. (ft/s)		4.84	
Max Chl Dpth (ft)	6.69	Hydr. Depth (ft)		2.28	
Conv. Total (cfs)	160960.5	Conv. (cfs)		160960.5	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1097.50	
Min Ch El (ft)	2249.36	Shear (lb/sq ft)		0.80	
Alpha	1.00	Stream Power (lb/ft s)		3.89	
Frctn Loss (ft)	2.12	Cum Volume (acre-ft)	7.16	2200.65	21.09
C & E Loss (ft)	0.05	Cum SA (acres)	2.34	990.66	7.36

Plan: Plan 02 PWASH North of 168 RS: 35900. Profile: PF 1

E.G. Elev (ft)	2254.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.040	
W.S. Elev (ft)	2254.04	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3322.34	
E.G. Slope (ft/ft)	0.003298	Area (sq ft)		3322.34	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1488.57	Top Width (ft)		1488.57	
Vel Total (ft/s)	3.64	Avg. Vel. (ft/s)		3.64	
Max Chl Dpth (ft)	6.55	Hydr. Depth (ft)		2.23	
Conv. Total (cfs)	210712.3	Conv. (cfs)		210712.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1489.29	
Min Ch El (ft)	2247.49	Shear (lb/sq ft)		0.46	
Alpha	1.00	Stream Power (lb/ft s)		1.67	
Frctn Loss (ft)	1.87	Cum Volume (acre-ft)	7.16	2167.23	21.09
C & E Loss (ft)	0.00	Cum SA (acres)	2.34	975.82	7.36

Plan: Plan 02 PWASH North of 168 RS: 35400. Profile: PF 1

E.G. Elev (ft)	2252.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.040	
W.S. Elev (ft)	2252.16	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3284.19	
E.G. Slope (ft/ft)	0.004300	Area (sq ft)		3284.19	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1764.44	Top Width (ft)		1764.44	
Vel Total (ft/s)	3.68	Avg. Vel. (ft/s)		3.68	
Max Chl Dpth (ft)	6.04	Hydr. Depth (ft)		1.86	
Conv. Total (cfs)	184527.2	Conv. (cfs)		184527.2	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1765.56	
Min Ch El (ft)	2246.12	Shear (lb/sq ft)		0.50	
Alpha	1.00	Stream Power (lb/ft s)		1.84	
Frctn Loss (ft)	1.92	Cum Volume (acre-ft)	7.16	2129.31	21.09
C & E Loss (ft)	0.01	Cum SA (acres)	2.34	957.15	7.36

Plan: Plan 02 PWASH North of 168 RS: 34900. Profile: PF 1

E.G. Elev (ft)	2250.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.040	
W.S. Elev (ft)	2250.28	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3722.57	
E.G. Slope (ft/ft)	0.003466	Area (sq ft)		3722.57	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2053.86	Top Width (ft)		2053.86	
Vel Total (ft/s)	3.25	Avg. Vel. (ft/s)		3.25	
Max Chl Dpth (ft)	6.68	Hydr. Depth (ft)		1.81	
Conv. Total (cfs)	205520.1	Conv. (cfs)		205520.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2054.61	
Min Ch El (ft)	2243.60	Shear (lb/sq ft)		0.39	
Alpha	1.00	Stream Power (lb/ft s)		1.27	
Frctn Loss (ft)	1.77	Cum Volume (acre-ft)	7.16	2089.10	21.09
C & E Loss (ft)	0.00	Cum SA (acres)	2.34	935.24	7.36

Plan: Plan 02 PWASH North of 168 RS: 34400. Profile: PF 1

E.G. Elev (ft)	2248.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.040	
W.S. Elev (ft)	2248.45	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3308.25	
E.G. Slope (ft/ft)	0.003621	Area (sq ft)		3308.25	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1580.14	Top Width (ft)		1580.14	
Vel Total (ft/s)	3.66	Avg. Vel. (ft/s)		3.66	
Max Chl Dpth (ft)	6.06	Hydr. Depth (ft)		2.09	
Conv. Total (cfs)	201083.1	Conv. (cfs)		201083.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1580.65	
Min Ch El (ft)	2242.39	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.73	
Frctn Loss (ft)	1.49	Cum Volume (acre-ft)	7.16	2048.74	21.09
C & E Loss (ft)	0.01	Cum SA (acres)	2.34	914.38	7.36

Plan: Plan 02 PWASH North of 168 RS: 33900. Profile: PF 1

E.G. Elev (ft)	2247.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.040	
W.S. Elev (ft)	2246.99	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3632.05	
E.G. Slope (ft/ft)	0.002490	Area (sq ft)		3632.05	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1507.02	Top Width (ft)		1507.02	
Vel Total (ft/s)	3.33	Avg. Vel. (ft/s)		3.33	
Max Chl Dpth (ft)	6.38	Hydr. Depth (ft)		2.41	
Conv. Total (cfs)	242475.2	Conv. (cfs)		242475.2	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1507.58	
Min Ch El (ft)	2240.61	Shear (lb/sq ft)		0.37	
Alpha	1.00	Stream Power (lb/ft s)		1.25	
Frctn Loss (ft)	1.55	Cum Volume (acre-ft)	7.16	2008.91	21.09
C & E Loss (ft)	0.01	Cum SA (acres)	2.34	896.66	7.36

Plan: Plan 02 PWASH North of 168 RS: 33400. Profile: PF 1

E.G. Elev (ft)	2245.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.040	
W.S. Elev (ft)	2245.36	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3032.73	
E.G. Slope (ft/ft)	0.003987	Area (sq ft)		3032.73	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1366.41	Top Width (ft)		1366.41	
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)		3.99	
Max Chl Dpth (ft)	6.34	Hydr. Depth (ft)		2.22	
Conv. Total (cfs)	191637.1	Conv. (cfs)		191637.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1367.00	
Min Ch El (ft)	2239.02	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		2.20	
Frctn Loss (ft)	1.53	Cum Volume (acre-ft)	7.16	1970.66	21.09
C & E Loss (ft)	0.00	Cum SA (acres)	2.34	880.17	7.36

Plan: Plan 02 PWASH North of 168 RS: 32900. Profile: PF 1

E.G. Elev (ft)	2244.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.		0.040	
W.S. Elev (ft)	2243.84	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3132.41	
E.G. Slope (ft/ft)	0.002435	Area (sq ft)		3132.41	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1022.86	Top Width (ft)		1022.86	
Vel Total (ft/s)	3.86	Avg. Vel. (ft/s)		3.86	
Max Chl Dpth (ft)	6.69	Hydr. Depth (ft)		3.06	
Conv. Total (cfs)	245221.5	Conv. (cfs)		245221.5	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1023.91	
Min Ch El (ft)	2237.15	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.80	
Frctn Loss (ft)	1.63	Cum Volume (acre-ft)	7.16	1935.28	21.09
C & E Loss (ft)	0.02	Cum SA (acres)	2.34	866.46	7.36

Plan: Plan 02 PWASH North of 168 RS: 32400. Profile: PF 1

E.G. Elev (ft)	2242.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.		0.040	
W.S. Elev (ft)	2242.03	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2377.95	
E.G. Slope (ft/ft)	0.004560	Area (sq ft)		2377.95	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	822.44	Top Width (ft)		822.44	
Vel Total (ft/s)	5.09	Avg. Vel. (ft/s)		5.09	
Max Chl Dpth (ft)	6.84	Hydr. Depth (ft)		2.89	
Conv. Total (cfs)	179179.4	Conv. (cfs)		179179.4	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		823.14	
Min Ch El (ft)	2235.19	Shear (lb/sq ft)		0.82	
Alpha	1.00	Stream Power (lb/ft s)		4.19	
Frctn Loss (ft)	2.17	Cum Volume (acre-ft)	7.16	1903.65	21.09
C & E Loss (ft)	0.03	Cum SA (acres)	2.34	855.87	7.36

Plan: Plan 02 PWASH North of 168 RS: 31900. Profile: PF 1

E.G. Elev (ft)	2240.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.		0.040	
W.S. Elev (ft)	2239.92	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2685.59	
E.G. Slope (ft/ft)	0.004119	Area (sq ft)		2685.59	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1033.42	Top Width (ft)		1033.42	
Vel Total (ft/s)	4.51	Avg. Vel. (ft/s)		4.51	
Max Chl Dpth (ft)	6.41	Hydr. Depth (ft)		2.60	
Conv. Total (cfs)	188531.4	Conv. (cfs)		188531.4	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1033.77	
Min Ch El (ft)	2233.51	Shear (lb/sq ft)		0.67	
Alpha	1.00	Stream Power (lb/ft s)		3.01	
Frctn Loss (ft)	1.87	Cum Volume (acre-ft)	7.16	1874.59	21.09
C & E Loss (ft)	0.02	Cum SA (acres)	2.34	845.22	7.36

Plan: Plan 02 PWASH North of 168 RS: 31400. Profile: PF 1

E.G. Elev (ft)	2238.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.040	
W.S. Elev (ft)	2238.09	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2965.06	
E.G. Slope (ft/ft)	0.003428	Area (sq ft)		2965.06	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1152.73	Top Width (ft)		1152.73	
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)		4.08	
Max Chl Dpth (ft)	6.42	Hydr. Depth (ft)		2.57	
Conv. Total (cfs)	206653.0	Conv. (cfs)		206653.0	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1153.79	
Min Ch El (ft)	2231.67	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		2.24	
Frctn Loss (ft)	2.23	Cum Volume (acre-ft)	7.16	1842.16	21.09
C & E Loss (ft)	0.00	Cum SA (acres)	2.34	832.67	7.36

Plan: Plan 02 PWASH North of 168 RS: 30900. Profile: PF 1

E.G. Elev (ft)	2236.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.		0.040	
W.S. Elev (ft)	2235.82	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2776.13	
E.G. Slope (ft/ft)	0.006046	Area (sq ft)		2776.13	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1494.76	Top Width (ft)		1494.76	
Vel Total (ft/s)	4.36	Avg. Vel. (ft/s)		4.36	
Max Chl Dpth (ft)	6.89	Hydr. Depth (ft)		1.86	
Conv. Total (cfs)	155621.3	Conv. (cfs)		155621.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1497.61	
Min Ch El (ft)	2228.93	Shear (lb/sq ft)		0.70	
Alpha	1.00	Stream Power (lb/ft s)		3.05	
Frctn Loss (ft)	2.11	Cum Volume (acre-ft)	7.16	1809.21	21.09
C & E Loss (ft)	0.03	Cum SA (acres)	2.34	817.48	7.36

Plan: Plan 02 PWASH North of 168 RS: 30400. Profile: PF 1

E.G. Elev (ft)	2233.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.040	
W.S. Elev (ft)	2233.78	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3343.55	
E.G. Slope (ft/ft)	0.003104	Area (sq ft)		3343.55	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1444.70	Top Width (ft)		1444.70	
Vel Total (ft/s)	3.62	Avg. Vel. (ft/s)		3.62	
Max Chl Dpth (ft)	6.73	Hydr. Depth (ft)		2.31	
Conv. Total (cfs)	217191.8	Conv. (cfs)		217191.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1445.96	
Min Ch El (ft)	2227.05	Shear (lb/sq ft)		0.45	
Alpha	1.00	Stream Power (lb/ft s)		1.62	
Frctn Loss (ft)	1.22	Cum Volume (acre-ft)	7.16	1774.09	21.09
C & E Loss (ft)	0.02	Cum SA (acres)	2.34	800.61	7.36

Plan: Plan 02 PWASH North of 168 RS: 29900. Profile: PF 1

E.G. Elev (ft)	2232.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.040	
W.S. Elev (ft)	2232.60	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3992.04	
E.G. Slope (ft/ft)	0.001979	Area (sq ft)		3992.04	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1604.66	Top Width (ft)		1604.66	
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)		3.03	
Max Chl Dpth (ft)	7.36	Hydr. Depth (ft)		2.49	
Conv. Total (cfs)	271996.5	Conv. (cfs)		271996.5	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1607.11	
Min Ch El (ft)	2225.24	Shear (lb/sq ft)		0.31	
Alpha	1.00	Stream Power (lb/ft s)		0.93	
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	7.16	1731.99	21.09
C & E Loss (ft)	0.02	Cum SA (acres)	2.34	783.11	7.36

Plan: Plan 02 PWASH North of 168 RS: 29400. Profile: PF 1

E.G. Elev (ft)	2231.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2230.82	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)	13.14	2589.13	119.01
E.G. Slope (ft/ft)	0.005876	Area (sq ft)	13.14	2589.13	119.01
Q Total (cfs)	12100.00	Flow (cfs)	20.59	11874.96	204.45
Top Width (ft)	1551.10	Top Width (ft)	32.16	1264.98	253.96
Vel Total (ft/s)	4.45	Avg. Vel. (ft/s)	1.57	4.59	1.72
Max Chl Dpth (ft)	7.30	Hydr. Depth (ft)	0.41	2.05	0.47
Conv. Total (cfs)	157852.0	Conv. (cfs)	268.6	154916.2	2667.2
Length Wtd. (ft)	500.00	Wetted Per. (ft)	32.17	1266.60	253.96
Min Ch El (ft)	2223.52	Shear (lb/sq ft)	0.15	0.75	0.17
Alpha	1.05	Stream Power (lb/ft s)	0.23	3.44	0.30
Frctn Loss (ft)	1.50	Cum Volume (acre-ft)	7.08	1694.22	20.41
C & E Loss (ft)	0.05	Cum SA (acres)	2.16	766.64	5.91

Plan: Plan 02 PWASH North of 168 RS: 28900. Profile: PF 1

E.G. Elev (ft)	2229.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.040	
W.S. Elev (ft)	2229.44	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3950.09	
E.G. Slope (ft/ft)	0.001815	Area (sq ft)		3950.09	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1464.29	Top Width (ft)		1464.29	
Vel Total (ft/s)	3.06	Avg. Vel. (ft/s)		3.06	
Max Chl Dpth (ft)	7.50	Hydr. Depth (ft)		2.70	
Conv. Total (cfs)	284018.1	Conv. (cfs)		284018.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1466.90	
Min Ch EI (ft)	2221.94	Shear (lb/sq ft)		0.31	
Alpha	1.00	Stream Power (lb/ft s)		0.93	
Frctn Loss (ft)	1.42	Cum Volume (acre-ft)	7.01	1656.69	19.73
C & E Loss (ft)	0.01	Cum SA (acres)	1.98	750.97	4.45

Plan: Plan 02 PWASH North of 168 RS: 28400. Profile: PF 1

E.G. Elev (ft)	2228.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.040	
W.S. Elev (ft)	2227.91	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2999.63	
E.G. Slope (ft/ft)	0.005047	Area (sq ft)		2999.63	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1585.31	Top Width (ft)		1585.31	
Vel Total (ft/s)	4.03	Avg. Vel. (ft/s)		4.03	
Max Chl Dpth (ft)	6.64	Hydr. Depth (ft)		1.89	
Conv. Total (cfs)	170318.1	Conv. (cfs)		170318.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1587.38	
Min Ch EI (ft)	2221.27	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.40	
Frctn Loss (ft)	2.47	Cum Volume (acre-ft)	7.01	1616.80	19.73
C & E Loss (ft)	0.00	Cum SA (acres)	1.98	733.47	4.45

Plan: Plan 02 PWASH North of 168 RS: 27900. Profile: PF 1

E.G. Elev (ft)	2225.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.		0.040	
W.S. Elev (ft)	2225.41	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2823.55	
E.G. Slope (ft/ft)	0.004830	Area (sq ft)		2823.55	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1318.39	Top Width (ft)		1318.39	
Vel Total (ft/s)	4.29	Avg. Vel. (ft/s)		4.29	
Max Chl Dpth (ft)	8.87	Hydr. Depth (ft)		2.14	
Conv. Total (cfs)	174105.6	Conv. (cfs)		174105.6	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1320.30	
Min Ch EI (ft)	2216.54	Shear (lb/sq ft)		0.64	
Alpha	1.00	Stream Power (lb/ft s)		2.76	
Frctn Loss (ft)	1.95	Cum Volume (acre-ft)	7.01	1583.38	19.73
C & E Loss (ft)	0.01	Cum SA (acres)	1.98	716.81	4.45

Plan: Plan 02 PWASH North of 168 RS: 27400. Profile: PF 1

E.G. Elev (ft)	2223.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.040	
W.S. Elev (ft)	2223.48	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3050.64	
E.G. Slope (ft/ft)	0.003218	Area (sq ft)		3050.64	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1179.70	Top Width (ft)		1179.70	
Vel Total (ft/s)	3.97	Avg. Vel. (ft/s)		3.97	
Max Chl Dpth (ft)	6.75	Hydr. Depth (ft)		2.59	
Conv. Total (cfs)	213296.8	Conv. (cfs)		213296.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1181.42	
Min Ch EI (ft)	2216.73	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		2.06	
Frctn Loss (ft)	1.48	Cum Volume (acre-ft)	7.01	1549.67	19.73
C & E Loss (ft)	0.02	Cum SA (acres)	1.98	702.47	4.45

Plan: Plan 02 PWASH North of 168 RS: 26900. Profile: PF 1

E.G. Elev (ft)	2222.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.040	
W.S. Elev (ft)	2222.04	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3489.03	
E.G. Slope (ft/ft)	0.002732	Area (sq ft)		3489.03	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1458.00	Top Width (ft)		1458.00	
Vel Total (ft/s)	3.47	Avg. Vel. (ft/s)		3.47	
Max Chl Dpth (ft)	8.77	Hydr. Depth (ft)		2.39	
Conv. Total (cfs)	231477.1	Conv. (cfs)		231477.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1461.85	
Min Ch EI (ft)	2213.27	Shear (lb/sq ft)		0.41	
Alpha	1.00	Stream Power (lb/ft s)		1.41	
Frctn Loss (ft)	2.18	Cum Volume (acre-ft)	7.01	1512.14	19.73
C & E Loss (ft)	0.03	Cum SA (acres)	1.98	687.33	4.45

Plan: Plan 02 PWASH North of 168 RS: 26400. Profile: PF 1

E.G. Elev (ft)	2220.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.		0.040	
W.S. Elev (ft)	2219.49	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2090.59	
E.G. Slope (ft/ft)	0.008077	Area (sq ft)		2090.59	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	911.29	Top Width (ft)		911.29	
Vel Total (ft/s)	5.79	Avg. Vel. (ft/s)		5.79	
Max Chl Dpth (ft)	7.93	Hydr. Depth (ft)		2.29	
Conv. Total (cfs)	134639.3	Conv. (cfs)		134639.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		915.84	
Min Ch EI (ft)	2211.56	Shear (lb/sq ft)		1.15	
Alpha	1.00	Stream Power (lb/ft s)		6.66	
Frctn Loss (ft)	2.75	Cum Volume (acre-ft)	7.01	1480.12	19.73
C & E Loss (ft)	0.08	Cum SA (acres)	1.98	673.73	4.45

Plan: Plan 02 PWASH North of 168 RS: 25900. Profile: PF 1

E.G. Elev (ft)	2217.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.040	
W.S. Elev (ft)	2216.92	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2936.78	
E.G. Slope (ft/ft)	0.003989	Area (sq ft)		2936.78	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1259.65	Top Width (ft)		1259.65	
Vel Total (ft/s)	4.12	Avg. Vel. (ft/s)		4.12	
Max Chl Dpth (ft)	7.56	Hydr. Depth (ft)		2.33	
Conv. Total (cfs)	191575.4	Conv. (cfs)		191575.4	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1262.03	
Min Ch El (ft)	2209.36	Shear (lb/sq ft)		0.58	
Alpha	1.00	Stream Power (lb/ft s)		2.39	
Frctn Loss (ft)	2.57	Cum Volume (acre-ft)	7.01	1451.26	19.73
C & E Loss (ft)	0.02	Cum SA (acres)	1.98	661.27	4.45

Plan: Plan 02 PWASH North of 168 RS: 25400. Profile: PF 1

E.G. Elev (ft)	2214.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.		0.040	
W.S. Elev (ft)	2214.08	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2138.06	
E.G. Slope (ft/ft)	0.006897	Area (sq ft)		2138.06	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	860.05	Top Width (ft)		860.05	
Vel Total (ft/s)	5.66	Avg. Vel. (ft/s)		5.66	
Max Chl Dpth (ft)	6.16	Hydr. Depth (ft)		2.49	
Conv. Total (cfs)	145694.8	Conv. (cfs)		145694.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		860.57	
Min Ch El (ft)	2207.92	Shear (lb/sq ft)		1.07	
Alpha	1.00	Stream Power (lb/ft s)		6.05	
Frctn Loss (ft)	2.56	Cum Volume (acre-ft)	7.01	1422.14	19.73
C & E Loss (ft)	0.09	Cum SA (acres)	1.98	649.11	4.45

Plan: Plan 02 PWASH North of 168 RS: 24900. Profile: PF 1

E.G. Elev (ft)	2211.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.040	
W.S. Elev (ft)	2211.74	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3480.23	
E.G. Slope (ft/ft)	0.003946	Area (sq ft)		3480.23	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1913.11	Top Width (ft)		1913.11	
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)		3.48	
Max Chl Dpth (ft)	5.45	Hydr. Depth (ft)		1.82	
Conv. Total (cfs)	192612.3	Conv. (cfs)		192612.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1913.79	
Min Ch El (ft)	2206.29	Shear (lb/sq ft)		0.45	
Alpha	1.00	Stream Power (lb/ft s)		1.56	
Frctn Loss (ft)	1.34	Cum Volume (acre-ft)	7.01	1389.89	19.73
C & E Loss (ft)	0.02	Cum SA (acres)	1.98	633.19	4.45

Plan: Plan 02 PWASH North of 168 RS: 24400. Profile: PF 1

E.G. Elev (ft)	2210.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.040	
W.S. Elev (ft)	2210.45	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		4291.17	
E.G. Slope (ft/ft)	0.001933	Area (sq ft)		4291.17	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1891.23	Top Width (ft)		1891.23	
Vel Total (ft/s)	2.82	Avg. Vel. (ft/s)		2.82	
Max Chl Dpth (ft)	6.64	Hydr. Depth (ft)		2.27	
Conv. Total (cfs)	275214.7	Conv. (cfs)		275214.7	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1891.62	
Min Ch El (ft)	2203.81	Shear (lb/sq ft)		0.27	
Alpha	1.00	Stream Power (lb/ft s)		0.77	
Frctn Loss (ft)	1.40	Cum Volume (acre-ft)	7.01	1345.29	19.73
C & E Loss (ft)	0.02	Cum SA (acres)	1.98	611.36	4.45

Plan: Plan 02 PWASH North of 168 RS: 23900. Profile: PF 1

E.G. Elev (ft)	2209.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.		0.040	
W.S. Elev (ft)	2208.89	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2875.78	
E.G. Slope (ft/ft)	0.004423	Area (sq ft)		2875.78	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1292.21	Top Width (ft)		1292.21	
Vel Total (ft/s)	4.21	Avg. Vel. (ft/s)		4.21	
Max Chl Dpth (ft)	6.84	Hydr. Depth (ft)		2.23	
Conv. Total (cfs)	181943.6	Conv. (cfs)		181943.6	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1293.85	
Min Ch El (ft)	2202.05	Shear (lb/sq ft)		0.61	
Alpha	1.00	Stream Power (lb/ft s)		2.58	
Frctn Loss (ft)	1.61	Cum Volume (acre-ft)	7.01	1304.16	19.73
C & E Loss (ft)	0.04	Cum SA (acres)	1.98	593.09	4.45

Plan: Plan 02 PWASH North of 168 RS: 23400. Profile: PF 1

E.G. Elev (ft)	2207.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.040	
W.S. Elev (ft)	2207.37	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3996.98	
E.G. Slope (ft/ft)	0.002456	Area (sq ft)		3996.98	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1894.52	Top Width (ft)		1894.52	
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)		3.03	
Max Chl Dpth (ft)	5.11	Hydr. Depth (ft)		2.11	
Conv. Total (cfs)	244148.2	Conv. (cfs)		244148.2	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1895.63	
Min Ch El (ft)	2202.26	Shear (lb/sq ft)		0.32	
Alpha	1.00	Stream Power (lb/ft s)		0.98	
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	7.01	1264.71	19.73
C & E Loss (ft)	0.01	Cum SA (acres)	1.98	574.80	4.45

Plan: Plan 02 PWASH North of 168 RS: 22900. Profile: PF 1

E.G. Elev (ft)	2206.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.040	
W.S. Elev (ft)	2206.24	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		4421.72	
E.G. Slope (ft/ft)	0.002140	Area (sq ft)		4421.72	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2198.34	Top Width (ft)		2198.34	
Vel Total (ft/s)	2.74	Avg. Vel. (ft/s)		2.74	
Max Chl Dpth (ft)	6.98	Hydr. Depth (ft)		2.01	
Conv. Total (cfs)	261542.6	Conv. (cfs)		261542.6	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2200.73	
Min Ch El (ft)	2199.26	Shear (lb/sq ft)		0.27	
Alpha	1.00	Stream Power (lb/ft s)		0.73	
Frctn Loss (ft)	1.12	Cum Volume (acre-ft)	7.01	1216.40	19.73
C & E Loss (ft)	0.00	Cum SA (acres)	1.98	551.31	4.45

Plan: Plan 02 PWASH North of 168 RS: 22400. Profile: PF 1

E.G. Elev (ft)	2205.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.		0.040	
W.S. Elev (ft)	2205.13	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		4755.52	
E.G. Slope (ft/ft)	0.002349	Area (sq ft)		4755.52	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2829.14	Top Width (ft)		2829.14	
Vel Total (ft/s)	2.54	Avg. Vel. (ft/s)		2.54	
Max Chl Dpth (ft)	6.70	Hydr. Depth (ft)		1.68	
Conv. Total (cfs)	249633.4	Conv. (cfs)		249633.4	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2831.02	
Min Ch El (ft)	2198.43	Shear (lb/sq ft)		0.25	
Alpha	1.00	Stream Power (lb/ft s)		0.63	
Frctn Loss (ft)	1.51	Cum Volume (acre-ft)	7.01	1163.73	19.73
C & E Loss (ft)	0.01	Cum SA (acres)	1.98	522.45	4.45

Plan: Plan 02 PWASH North of 168 RS: 21900. Profile: PF 1

E.G. Elev (ft)	2203.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.040	
W.S. Elev (ft)	2203.56	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3885.35	
E.G. Slope (ft/ft)	0.004031	Area (sq ft)		3885.35	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2558.00	Top Width (ft)		2558.00	
Vel Total (ft/s)	3.11	Avg. Vel. (ft/s)		3.11	
Max Chl Dpth (ft)	9.47	Hydr. Depth (ft)		1.52	
Conv. Total (cfs)	190572.2	Conv. (cfs)		190572.2	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2560.88	
Min Ch El (ft)	2194.09	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		1.19	
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	7.01	1114.14	19.73
C & E Loss (ft)	0.02	Cum SA (acres)	1.98	491.54	4.45

Plan: Plan 02 PWASH North of 168 RS: 21400. Profile: PF 1

E.G. Elev (ft)	2202.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2202.29	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)	5.74	4905.80	4.25
E.G. Slope (ft/ft)	0.001835	Area (sq ft)	5.74	4905.80	4.25
Q Total (cfs)	12100.00	Flow (cfs)	2.26	12095.77	1.97
Top Width (ft)	2615.45	Top Width (ft)	46.65	2541.79	27.02
Vel Total (ft/s)	2.46	Avg. Vel. (ft/s)	0.39	2.47	0.46
Max Chl Dpth (ft)	9.64	Hydr. Depth (ft)	0.12	1.93	0.16
Conv. Total (cfs)	282449.7	Conv. (cfs)	52.8	282350.9	46.1
Length Wtd. (ft)	500.00	Wetted Per. (ft)	46.65	2543.86	27.02
Min Ch El (ft)	2192.65	Shear (lb/sq ft)	0.01	0.22	0.02
Alpha	1.00	Stream Power (lb/ft s)	0.01	0.54	0.01
Frctn Loss (ft)	1.34	Cum Volume (acre-ft)	6.97	1063.68	19.70
C & E Loss (ft)	0.01	Cum SA (acres)	1.71	462.27	4.29

Plan: Plan 02 PWASH North of 168 RS: 20900. Profile: PF 1

E.G. Elev (ft)	2201.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.		0.040	
W.S. Elev (ft)	2200.85	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3560.53	
E.G. Slope (ft/ft)	0.004316	Area (sq ft)		3560.53	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2165.70	Top Width (ft)		2165.70	
Vel Total (ft/s)	3.40	Avg. Vel. (ft/s)		3.40	
Max Chl Dpth (ft)	7.89	Hydr. Depth (ft)		1.64	
Conv. Total (cfs)	184187.0	Conv. (cfs)		184187.0	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2166.71	
Min Ch El (ft)	2192.96	Shear (lb/sq ft)		0.44	
Alpha	1.00	Stream Power (lb/ft s)		1.50	
Frctn Loss (ft)	2.74	Cum Volume (acre-ft)	6.94	1015.09	19.68
C & E Loss (ft)	0.01	Cum SA (acres)	1.44	435.25	4.14

Plan: Plan 02 PWASH North of 168 RS: 20400. Profile: PF 1

E.G. Elev (ft)	2198.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.		0.040	
W.S. Elev (ft)	2198.00	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2804.81	
E.G. Slope (ft/ft)	0.007214	Area (sq ft)		2804.81	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1753.96	Top Width (ft)		1753.96	
Vel Total (ft/s)	4.31	Avg. Vel. (ft/s)		4.31	
Max Chl Dpth (ft)	6.28	Hydr. Depth (ft)		1.60	
Conv. Total (cfs)	142465.3	Conv. (cfs)		142465.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1754.28	
Min Ch El (ft)	2191.72	Shear (lb/sq ft)		0.72	
Alpha	1.00	Stream Power (lb/ft s)		3.11	
Frctn Loss (ft)	2.39	Cum Volume (acre-ft)	6.94	978.56	19.68
C & E Loss (ft)	0.03	Cum SA (acres)	1.44	412.76	4.14

Plan: Plan 02 PWASH North of 168 RS: 19900. Profile: PF 1

E.G. Elev (ft)	2195.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.040	
W.S. Elev (ft)	2195.66	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3358.99	
E.G. Slope (ft/ft)	0.003399	Area (sq ft)		3358.99	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1565.51	Top Width (ft)		1565.51	
Vel Total (ft/s)	3.60	Avg. Vel. (ft/s)		3.60	
Max Chl Dpth (ft)	5.91	Hydr. Depth (ft)		2.15	
Conv. Total (cfs)	207554.8	Conv. (cfs)		207554.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1565.76	
Min Ch El (ft)	2189.75	Shear (lb/sq ft)		0.46	
Alpha	1.00	Stream Power (lb/ft s)		1.64	
Frctn Loss (ft)	1.96	Cum Volume (acre-ft)	6.94	943.18	19.68
C & E Loss (ft)	0.01	Cum SA (acres)	1.44	393.70	4.14

Plan: Plan 02 PWASH North of 168 RS: 19400. Profile: PF 1

E.G. Elev (ft)	2193.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.040	
W.S. Elev (ft)	2193.64	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2951.96	
E.G. Slope (ft/ft)	0.004575	Area (sq ft)		2951.96	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1416.12	Top Width (ft)		1416.12	
Vel Total (ft/s)	4.10	Avg. Vel. (ft/s)		4.10	
Max Chl Dpth (ft)	4.61	Hydr. Depth (ft)		2.08	
Conv. Total (cfs)	178894.9	Conv. (cfs)		178894.9	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1416.72	
Min Ch El (ft)	2189.03	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.44	
Frctn Loss (ft)	2.15	Cum Volume (acre-ft)	6.94	906.96	19.68
C & E Loss (ft)	0.03	Cum SA (acres)	1.44	376.59	4.14

Plan: Plan 02 PWASH North of 168 RS: 18900. Profile: PF 1

E.G. Elev (ft)	2191.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.040	
W.S. Elev (ft)	2191.56	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3767.49	
E.G. Slope (ft/ft)	0.004055	Area (sq ft)		3767.49	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2381.56	Top Width (ft)		2381.56	
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)		3.21	
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)		1.58	
Conv. Total (cfs)	190004.8	Conv. (cfs)		190004.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2381.69	
Min Ch El (ft)	2186.76	Shear (lb/sq ft)		0.40	
Alpha	1.00	Stream Power (lb/ft s)		1.29	
Frctn Loss (ft)	1.73	Cum Volume (acre-ft)	6.94	868.40	19.68
C & E Loss (ft)	0.01	Cum SA (acres)	1.44	354.80	4.14

Plan: Plan 02 PWASH North of 168 RS: 18400. Profile: PF 1

E.G. Elev (ft)	2189.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.040	
W.S. Elev (ft)	2189.84	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		4077.04	
E.G. Slope (ft/ft)	0.002999	Area (sq ft)		4077.04	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2313.74	Top Width (ft)		2313.74	
Vel Total (ft/s)	2.97	Avg. Vel. (ft/s)		2.97	
Max Chl Dpth (ft)	3.70	Hydr. Depth (ft)		1.76	
Conv. Total (cfs)	220949.4	Conv. (cfs)		220949.4	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2313.81	
Min Ch El (ft)	2186.14	Shear (lb/sq ft)		0.33	
Alpha	1.00	Stream Power (lb/ft s)		0.98	
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	6.94	823.38	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	327.85	4.14

Plan: Plan 02 PWASH North of 168 RS: 17900. Profile: PF 1

E.G. Elev (ft)	2188.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.040	
W.S. Elev (ft)	2188.42	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3932.63	
E.G. Slope (ft/ft)	0.002661	Area (sq ft)		3932.63	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1932.18	Top Width (ft)		1932.18	
Vel Total (ft/s)	3.08	Avg. Vel. (ft/s)		3.08	
Max Chl Dpth (ft)	4.87	Hydr. Depth (ft)		2.04	
Conv. Total (cfs)	234573.8	Conv. (cfs)		234573.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1932.81	
Min Ch El (ft)	2183.55	Shear (lb/sq ft)		0.34	
Alpha	1.00	Stream Power (lb/ft s)		1.04	
Frctn Loss (ft)	1.57	Cum Volume (acre-ft)	6.94	777.41	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	303.48	4.14

Plan: Plan 02 PWASH North of 168 RS: 17400. Profile: PF 1

E.G. Elev (ft)	2186.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.040	
W.S. Elev (ft)	2186.79	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3424.66	
E.G. Slope (ft/ft)	0.003781	Area (sq ft)		3424.66	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1780.18	Top Width (ft)		1780.18	
Vel Total (ft/s)	3.53	Avg. Vel. (ft/s)		3.53	
Max Chl Dpth (ft)	4.89	Hydr. Depth (ft)		1.92	
Conv. Total (cfs)	196768.0	Conv. (cfs)		196768.0	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1780.39	
Min Ch El (ft)	2181.90	Shear (lb/sq ft)		0.45	
Alpha	1.00	Stream Power (lb/ft s)		1.60	
Frctn Loss (ft)	1.77	Cum Volume (acre-ft)	6.94	735.18	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	282.17	4.14

Plan: Plan 02 PWASH North of 168 RS: 16900. Profile: PF 1

E.G. Elev (ft)	2185.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.040	
W.S. Elev (ft)	2185.03	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3429.15	
E.G. Slope (ft/ft)	0.003322	Area (sq ft)		3429.15	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1620.54	Top Width (ft)		1620.54	
Vel Total (ft/s)	3.53	Avg. Vel. (ft/s)		3.53	
Max Chl Dpth (ft)	4.15	Hydr. Depth (ft)		2.12	
Conv. Total (cfs)	209941.8	Conv. (cfs)		209941.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1620.76	
Min Ch El (ft)	2180.87	Shear (lb/sq ft)		0.44	
Alpha	1.00	Stream Power (lb/ft s)		1.55	
Frctn Loss (ft)	1.75	Cum Volume (acre-ft)	6.94	695.85	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	262.66	4.14

Plan: Plan 02 PWASH North of 168 RS: 16400. Profile: PF 1

E.G. Elev (ft)	2183.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.		0.040	
W.S. Elev (ft)	2183.24	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3200.32	
E.G. Slope (ft/ft)	0.003701	Area (sq ft)		3200.32	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1478.55	Top Width (ft)		1478.55	
Vel Total (ft/s)	3.78	Avg. Vel. (ft/s)		3.78	
Max Chl Dpth (ft)	5.47	Hydr. Depth (ft)		2.16	
Conv. Total (cfs)	198900.9	Conv. (cfs)		198900.9	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1478.88	
Min Ch El (ft)	2177.77	Shear (lb/sq ft)		0.50	
Alpha	1.00	Stream Power (lb/ft s)		1.89	
Frctn Loss (ft)	1.94	Cum Volume (acre-ft)	6.94	657.80	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	244.87	4.14

Plan: Plan 02 PWASH North of 168 RS: 15900. Profile: PF 1

E.G. Elev (ft)	2181.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.		0.040	
W.S. Elev (ft)	2181.29	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3144.99	
E.G. Slope (ft/ft)	0.004091	Area (sq ft)		3144.99	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1526.21	Top Width (ft)		1526.21	
Vel Total (ft/s)	3.85	Avg. Vel. (ft/s)		3.85	
Max Chl Dpth (ft)	4.76	Hydr. Depth (ft)		2.06	
Conv. Total (cfs)	189167.1	Conv. (cfs)		189167.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1526.45	
Min Ch El (ft)	2176.53	Shear (lb/sq ft)		0.53	
Alpha	1.00	Stream Power (lb/ft s)		2.02	
Frctn Loss (ft)	2.06	Cum Volume (acre-ft)	6.94	621.38	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	227.63	4.14

Plan: Plan 02 PWASH North of 168 RS: 15400. Profile: PF 1

E.G. Elev (ft)	2179.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.040	
W.S. Elev (ft)	2179.22	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3079.87	
E.G. Slope (ft/ft)	0.004152	Area (sq ft)		3079.87	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1464.02	Top Width (ft)		1464.02	
Vel Total (ft/s)	3.93	Avg. Vel. (ft/s)		3.93	
Max Chl Dpth (ft)	6.34	Hydr. Depth (ft)		2.10	
Conv. Total (cfs)	187775.7	Conv. (cfs)		187775.7	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1464.79	
Min Ch El (ft)	2172.88	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		2.14	
Frctn Loss (ft)	2.12	Cum Volume (acre-ft)	6.94	585.66	19.68
C & E Loss (ft)	0.01	Cum SA (acres)	1.44	210.46	4.14

Plan: Plan 02 PWASH North of 168 RS: 14900. Profile: PF 1

E.G. Elev (ft)	2177.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.040	
W.S. Elev (ft)	2177.13	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3261.61	
E.G. Slope (ft/ft)	0.004310	Area (sq ft)		3261.61	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1736.98	Top Width (ft)		1736.98	
Vel Total (ft/s)	3.71	Avg. Vel. (ft/s)		3.71	
Max Chl Dpth (ft)	5.52	Hydr. Depth (ft)		1.88	
Conv. Total (cfs)	184308.3	Conv. (cfs)		184308.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1738.47	
Min Ch El (ft)	2171.61	Shear (lb/sq ft)		0.50	
Alpha	1.00	Stream Power (lb/ft s)		1.87	
Frctn Loss (ft)	2.02	Cum Volume (acre-ft)	6.94	549.26	19.68
C & E Loss (ft)	0.01	Cum SA (acres)	1.44	192.09	4.14

Plan: Plan 02 PWASH North of 168 RS: 14400. Profile: PF 1

E.G. Elev (ft)	2175.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.040	
W.S. Elev (ft)	2175.12	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3499.21	
E.G. Slope (ft/ft)	0.003803	Area (sq ft)		3499.21	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1886.61	Top Width (ft)		1886.61	
Vel Total (ft/s)	3.46	Avg. Vel. (ft/s)		3.46	
Max Chl Dpth (ft)	4.22	Hydr. Depth (ft)		1.85	
Conv. Total (cfs)	196221.2	Conv. (cfs)		196221.2	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1886.73	
Min Ch El (ft)	2170.90	Shear (lb/sq ft)		0.44	
Alpha	1.00	Stream Power (lb/ft s)		1.52	
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	6.94	510.46	19.68
C & E Loss (ft)	0.01	Cum SA (acres)	1.44	171.30	4.14

Plan: Plan 02 PWASH North of 168 RS: 13900. Profile: PF 1

E.G. Elev (ft)	2173.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.040	
W.S. Elev (ft)	2173.57	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3929.16	
E.G. Slope (ft/ft)	0.002680	Area (sq ft)		3929.16	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1939.10	Top Width (ft)		1939.10	
Vel Total (ft/s)	3.08	Avg. Vel. (ft/s)		3.08	
Max Chl Dpth (ft)	3.72	Hydr. Depth (ft)		2.03	
Conv. Total (cfs)	233712.7	Conv. (cfs)		233712.7	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1939.22	
Min Ch El (ft)	2169.85	Shear (lb/sq ft)		0.34	
Alpha	1.00	Stream Power (lb/ft s)		1.04	
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)	6.94	467.83	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	149.34	4.14

Plan: Plan 02 PWASH North of 168 RS: 13400. Profile: PF 1

E.G. Elev (ft)	2172.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.040	
W.S. Elev (ft)	2172.19	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		4039.71	
E.G. Slope (ft/ft)	0.002883	Area (sq ft)		4039.71	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2194.90	Top Width (ft)		2194.90	
Vel Total (ft/s)	3.00	Avg. Vel. (ft/s)		3.00	
Max Chl Dpth (ft)	3.61	Hydr. Depth (ft)		1.84	
Conv. Total (cfs)	225364.0	Conv. (cfs)		225364.0	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2195.08	
Min Ch El (ft)	2168.58	Shear (lb/sq ft)		0.33	
Alpha	1.00	Stream Power (lb/ft s)		0.99	
Frctn Loss (ft)	1.59	Cum Volume (acre-ft)	6.94	422.09	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	125.61	4.14

Plan: Plan 02 PWASH North of 168 RS: 12900. Profile: PF 1

E.G. Elev (ft)	2170.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.040	
W.S. Elev (ft)	2170.57	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		3699.46	
E.G. Slope (ft/ft)	0.003529	Area (sq ft)		3699.46	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2050.19	Top Width (ft)		2050.19	
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)		3.27	
Max Chl Dpth (ft)	3.75	Hydr. Depth (ft)		1.80	
Conv. Total (cfs)	203681.5	Conv. (cfs)		203681.5	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2050.32	
Min Ch El (ft)	2166.82	Shear (lb/sq ft)		0.40	
Alpha	1.00	Stream Power (lb/ft s)		1.30	
Frctn Loss (ft)	1.80	Cum Volume (acre-ft)	6.94	377.68	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	101.25	4.14

Plan: Plan 02 PWASH North of 168 RS: 12400. Profile: PF 1

E.G. Elev (ft)	2168.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.040	
W.S. Elev (ft)	2168.76	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2167.70	Flow Area (sq ft)		3649.22	
E.G. Slope (ft/ft)	0.003693	Area (sq ft)		3649.22	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	2049.16	Top Width (ft)		2049.16	
Vel Total (ft/s)	3.32	Avg. Vel. (ft/s)		3.32	
Max Chl Dpth (ft)	4.41	Hydr. Depth (ft)		1.78	
Conv. Total (cfs)	199117.1	Conv. (cfs)		199117.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		2049.93	
Min Ch El (ft)	2164.35	Shear (lb/sq ft)		0.41	
Alpha	1.00	Stream Power (lb/ft s)		1.36	
Frctn Loss (ft)	2.45	Cum Volume (acre-ft)	6.94	335.50	19.68
C & E Loss (ft)	0.01	Cum SA (acres)	1.44	77.72	4.14

Plan: Plan 02 PWASH North of 168 RS: 11900. Profile: PF 1

E.G. Elev (ft)	2166.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.040	
W.S. Elev (ft)	2166.15	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		2705.85	
E.G. Slope (ft/ft)	0.006821	Area (sq ft)		2705.85	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1537.60	Top Width (ft)		1537.60	
Vel Total (ft/s)	4.47	Avg. Vel. (ft/s)		4.47	
Max Chl Dpth (ft)	2.88	Hydr. Depth (ft)		1.76	
Conv. Total (cfs)	146512.1	Conv. (cfs)		146512.1	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1537.63	
Min Ch El (ft)	2163.27	Shear (lb/sq ft)		0.75	
Alpha	1.00	Stream Power (lb/ft s)		3.35	
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	6.94	299.03	19.68
C & E Loss (ft)	0.07	Cum SA (acres)	1.44	57.14	4.14

Plan: Plan 02 PWASH North of 168 RS: 11400. Profile: PF 1

E.G. Elev (ft)	2165.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.040	
W.S. Elev (ft)	2165.37	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		5317.34	
E.G. Slope (ft/ft)	0.000866	Area (sq ft)		5317.34	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1768.96	Top Width (ft)		1768.96	
Vel Total (ft/s)	2.28	Avg. Vel. (ft/s)		2.28	
Max Chl Dpth (ft)	6.91	Hydr. Depth (ft)		3.01	
Conv. Total (cfs)	411232.2	Conv. (cfs)		411232.2	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1770.14	
Min Ch El (ft)	2158.46	Shear (lb/sq ft)		0.16	
Alpha	1.00	Stream Power (lb/ft s)		0.37	
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)	6.94	252.98	19.68
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	38.16	4.14

Plan: Plan 02 PWASH North of 168 RS: 10900. Profile: PF 1

E.G. Elev (ft)	2164.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.040	
W.S. Elev (ft)	2164.88	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		4948.94	
E.G. Slope (ft/ft)	0.001088	Area (sq ft)		4948.94	
Q Total (cfs)	12100.00	Flow (cfs)		12100.00	
Top Width (ft)	1755.05	Top Width (ft)		1755.05	
Vel Total (ft/s)	2.44	Avg. Vel. (ft/s)		2.44	
Max Chl Dpth (ft)	9.12	Hydr. Depth (ft)		2.82	
Conv. Total (cfs)	366766.3	Conv. (cfs)		366766.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		1756.31	
Min Ch El (ft)	2155.75	Shear (lb/sq ft)		0.19	
Alpha	1.00	Stream Power (lb/ft s)		0.47	
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	6.94	194.06	19.68
C & E Loss (ft)	0.02	Cum SA (acres)	1.44	17.94	4.14

Plan: Plan 02 PWASH North of 168 RS: 10400. Profile: PF 1

E.G. Elev (ft)	2164.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2164.75	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2159.44	Flow Area (sq ft)	212.44	6834.28	1104.78
E.G. Slope (ft/ft)	0.000150	Area (sq ft)	212.44	6834.28	1104.78
Q Total (cfs)	12100.00	Flow (cfs)	113.74	11013.83	972.43
Top Width (ft)	1665.19	Top Width (ft)	166.43	1025.01	473.75
Vel Total (ft/s)	1.48	Avg. Vel. (ft/s)	0.54	1.61	0.88
Max Chl Dpth (ft)	14.08	Hydr. Depth (ft)	1.28	6.67	2.33
Conv. Total (cfs)	987170.0	Conv. (cfs)	9279.4	898555.9	79334.6
Length Wtd. (ft)	100.00	Wetted Per. (ft)	166.62	1026.40	473.81
Min Ch El (ft)	2150.67	Shear (lb/sq ft)	0.01	0.06	0.02
Alpha	1.10	Stream Power (lb/ft s)	0.01	0.10	0.02
Frctn Loss (ft)		Cum Volume (acre-ft)	5.72	126.43	13.34
C & E Loss (ft)		Cum SA (acres)	0.48	1.98	1.42

Plan: Plan 02 PWASH North of 168 RS: 10300. Profile: PF 1

E.G. Elev (ft)	2162.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2162.56	Reach Len. (ft)	532.29	532.29	532.29
Crit W.S. (ft)		Flow Area (sq ft)	557.80	5676.98	1656.46
E.G. Slope (ft/ft)	0.000148	Area (sq ft)	557.80	5676.98	1656.46
Q Total (cfs)	12100.00	Flow (cfs)	424.13	10306.95	1368.92
Top Width (ft)	1719.86	Top Width (ft)	255.68	700.84	763.34
Vel Total (ft/s)	1.53	Avg. Vel. (ft/s)	0.76	1.82	0.83
Max Chl Dpth (ft)	14.43	Hydr. Depth (ft)	2.18	8.10	2.17
Conv. Total (cfs)	993991.9	Conv. (cfs)	34841.3	846696.4	112454.2
Length Wtd. (ft)	532.29	Wetted Per. (ft)	255.84	705.67	763.40
Min Ch El (ft)	2148.12	Shear (lb/sq ft)	0.02	0.07	0.02
Alpha	1.24	Stream Power (lb/ft s)	0.02	0.14	0.02
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	4.84	112.07	10.17
C & E Loss (ft)	0.01	Cum SA (acres)			

Plan: Plan 02 PWASH South South of 168 RS: 9450 Profile: PF 1

E.G. Elev (ft)	2162.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2162.53	Reach Len. (ft)	470.00	470.00	470.00
Crit W.S. (ft)		Flow Area (sq ft)	233.99	12665.95	8.05
E.G. Slope (ft/ft)	0.000052	Area (sq ft)	233.99	12665.95	8.05
Q Total (cfs)	15871.00	Flow (cfs)	81.18	15787.73	2.09
Top Width (ft)	1416.14	Top Width (ft)	158.19	1249.85	8.10
Vel Total (ft/s)	1.23	Avg. Vel. (ft/s)	0.35	1.25	0.26
Max Chl Dpth (ft)	18.34	Hydr. Depth (ft)	1.48	10.13	0.99
Conv. Total (cfs)	2204203.0	Conv. (cfs)	11274.7	2192638.0	290.2
Length Wtd. (ft)	470.00	Wetted Per. (ft)	158.39	1259.06	8.42
Min Ch El (ft)	2144.19	Shear (lb/sq ft)	0.00	0.03	0.00
Alpha	1.02	Stream Power (lb/ft s)	0.00	0.04	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	122.65	525.75	45.16
C & E Loss (ft)	0.00	Cum SA (acres)	14.28	34.29	4.90

Plan: Plan 02 PWASH South South of 168 RS: 8980 Profile: PF 1

E.G. Elev (ft)	2162.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2162.51	Reach Len. (ft)	400.00	400.00	400.00
Crit W.S. (ft)		Flow Area (sq ft)	860.44	12116.07	64.83
E.G. Slope (ft/ft)	0.000036	Area (sq ft)	860.44	12116.07	64.83
Q Total (cfs)	15871.00	Flow (cfs)	545.34	15294.46	31.20
Top Width (ft)	1088.00	Top Width (ft)	180.37	888.13	19.50
Vel Total (ft/s)	1.22	Avg. Vel. (ft/s)	0.63	1.26	0.48
Max Chl Dpth (ft)	23.41	Hydr. Depth (ft)	4.77	13.64	3.32
Conv. Total (cfs)	2632984.0	Conv. (cfs)	90471.7	2537336.0	5176.5
Length Wtd. (ft)	400.00	Wetted Per. (ft)	180.69	905.19	20.57
Min Ch El (ft)	2139.10	Shear (lb/sq ft)	0.01	0.03	0.01
Alpha	1.05	Stream Power (lb/ft s)	0.01	0.04	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	116.74	392.05	44.76
C & E Loss (ft)	0.00	Cum SA (acres)	12.46	22.75	4.75

Plan: Plan 02 PWASH South South of 168 RS: 8580 Profile: PF 1

E.G. Elev (ft)	2162.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2162.49	Reach Len. (ft)	260.00	260.00	260.00
Crit W.S. (ft)		Flow Area (sq ft)	4935.85	5862.32	1912.98
E.G. Slope (ft/ft)	0.000038	Area (sq ft)	4935.85	5862.32	1912.98
Q Total (cfs)	15871.00	Flow (cfs)	5130.38	8833.29	1907.33
Top Width (ft)	1054.59	Top Width (ft)	506.13	341.17	207.29
Vel Total (ft/s)	1.25	Avg. Vel. (ft/s)	1.04	1.51	1.00
Max Chl Dpth (ft)	23.15	Hydr. Depth (ft)	9.75	17.18	9.23
Conv. Total (cfs)	2581644.0	Conv. (cfs)	834529.1	1436860.0	310254.9
Length Wtd. (ft)	260.00	Wetted Per. (ft)	508.33	345.90	209.70
Min Ch El (ft)	2139.34	Shear (lb/sq ft)	0.02	0.04	0.02
Alpha	1.11	Stream Power (lb/ft s)	0.02	0.06	0.02
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	90.13	309.51	35.68
C & E Loss (ft)	0.00	Cum SA (acres)	9.30	17.11	3.71

Plan: Plan 02 PWASH South South of 168 RS: 8320 Profile: PF 1

E.G. Elev (ft)	2162.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2162.46	Reach Len. (ft)	280.00	280.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	1586.73	7763.93	463.11
E.G. Slope (ft/ft)	0.000051	Area (sq ft)	1586.73	7763.93	463.11
Q Total (cfs)	15871.00	Flow (cfs)	1876.86	13561.01	433.13
Top Width (ft)	688.18	Top Width (ft)	166.61	453.41	68.16
Vel Total (ft/s)	1.62	Avg. Vel. (ft/s)	1.18	1.75	0.94
Max Chl Dpth (ft)	23.15	Hydr. Depth (ft)	9.52	17.12	6.79
Conv. Total (cfs)	2230155.0	Conv. (cfs)	263732.5	1905561.0	60861.9
Length Wtd. (ft)	280.00	Wetted Per. (ft)	167.65	457.16	69.60
Min Ch EI (ft)	2139.31	Shear (lb/sq ft)	0.03	0.05	0.02
Alpha	1.07	Stream Power (lb/ft s)	0.04	0.09	0.02
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	70.66	268.84	28.59
C & E Loss (ft)	0.01	Cum SA (acres)	7.30	14.74	2.88

Plan: Plan 02 PWASH South South of 168 RS: 8040 Profile: PF 1

E.G. Elev (ft)	2162.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2162.36	Reach Len. (ft)	220.00	220.00	220.00
Crit W.S. (ft)		Flow Area (sq ft)	172.42	5499.38	124.77
E.G. Slope (ft/ft)	0.000111	Area (sq ft)	172.42	5499.38	124.77
Q Total (cfs)	15871.00	Flow (cfs)	230.26	15508.22	132.52
Top Width (ft)	330.55	Top Width (ft)	24.02	281.31	25.21
Vel Total (ft/s)	2.74	Avg. Vel. (ft/s)	1.34	2.82	1.06
Max Chl Dpth (ft)	23.74	Hydr. Depth (ft)	7.18	19.55	4.95
Conv. Total (cfs)	1505208.0	Conv. (cfs)	21837.9	1470802.0	12568.3
Length Wtd. (ft)	220.00	Wetted Per. (ft)	27.39	284.68	27.94
Min Ch EI (ft)	2138.62	Shear (lb/sq ft)	0.04	0.13	0.03
Alpha	1.04	Stream Power (lb/ft s)	0.06	0.38	0.03
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	65.01	226.22	26.70
C & E Loss (ft)	0.01	Cum SA (acres)	6.68	12.38	2.58

Plan: Plan 02 PWASH South South of 168 RS: 7820 Profile: PF 1

E.G. Elev (ft)	2162.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.040	0.040	
W.S. Elev (ft)	2162.25	Reach Len. (ft)	160.00	160.00	160.00
Crit W.S. (ft)		Flow Area (sq ft)	109.09	4442.20	
E.G. Slope (ft/ft)	0.000180	Area (sq ft)	109.09	4442.20	
Q Total (cfs)	15871.00	Flow (cfs)	127.10	15743.90	
Top Width (ft)	249.52	Top Width (ft)	29.39	220.13	
Vel Total (ft/s)	3.49	Avg. Vel. (ft/s)	1.17	3.54	
Max Chl Dpth (ft)	29.07	Hydr. Depth (ft)	3.71	20.18	
Conv. Total (cfs)	1182470.0	Conv. (cfs)	9469.5	1173000.0	
Length Wtd. (ft)	160.00	Wetted Per. (ft)	30.54	234.40	
Min Ch EI (ft)	2133.18	Shear (lb/sq ft)	0.04	0.21	
Alpha	1.03	Stream Power (lb/ft s)	0.05	0.76	
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	64.30	201.11	26.39
C & E Loss (ft)	0.03	Cum SA (acres)	6.55	11.11	2.52

Plan: Plan 02 PWASH South South of 168 RS: 7660 Profile: PF 1

E.G. Elev (ft)	2162.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2161.90	Reach Len. (ft)	140.00	140.00	140.00
Crit W.S. (ft)		Flow Area (sq ft)	129.91	2819.98	79.40
E.G. Slope (ft/ft)	0.000888	Area (sq ft)	129.91	2819.98	79.40
Q Total (cfs)	15871.00	Flow (cfs)	243.61	15487.74	139.65
Top Width (ft)	175.94	Top Width (ft)	27.85	129.73	18.36
Vel Total (ft/s)	5.24	Avg. Vel. (ft/s)	1.88	5.49	1.76
Max Chl Dpth (ft)	27.91	Hydr. Depth (ft)	4.66	21.74	4.33
Conv. Total (cfs)	532478.8	Conv. (cfs)	8173.2	519620.3	4685.3
Length Wtd. (ft)	140.00	Wetted Per. (ft)	32.08	138.95	21.59
Min Ch El (ft)	2133.99	Shear (lb/sq ft)	0.22	1.13	0.20
Alpha	1.08	Stream Power (lb/ft s)	0.42	6.18	0.36
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	63.86	187.77	26.24
C & E Loss (ft)	0.01	Cum SA (acres)	6.44	10.47	2.49

Plan: Plan 02 PWASH South South of 168 RS: 7520 Profile: PF 1

E.G. Elev (ft)	2162.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2161.70	Reach Len. (ft)	405.00	405.00	405.00
Crit W.S. (ft)		Flow Area (sq ft)	601.17	2190.62	191.75
E.G. Slope (ft/ft)	0.000902	Area (sq ft)	601.17	2190.62	191.75
Q Total (cfs)	15871.00	Flow (cfs)	1898.06	13485.10	487.84
Top Width (ft)	161.41	Top Width (ft)	65.88	85.93	9.59
Vel Total (ft/s)	5.32	Avg. Vel. (ft/s)	3.16	6.16	2.54
Max Chl Dpth (ft)	29.20	Hydr. Depth (ft)	9.12	25.49	19.99
Conv. Total (cfs)	528387.8	Conv. (cfs)	63191.5	448954.8	16241.5
Length Wtd. (ft)	405.00	Wetted Per. (ft)	68.75	92.02	30.32
Min Ch El (ft)	2132.50	Shear (lb/sq ft)	0.49	1.34	0.36
Alpha	1.19	Stream Power (lb/ft s)	1.56	8.25	0.91
Frctn Loss (ft)	0.84	Cum Volume (acre-ft)	62.69	179.72	25.81
C & E Loss (ft)	0.27	Cum SA (acres)	6.29	10.12	2.44

Plan: Plan 02 PWASH South South of 168 RS: 7115 Profile: PF 1

E.G. Elev (ft)	2161.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.19	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2157.93	Reach Len. (ft)	395.00	395.00	395.00
Crit W.S. (ft)		Flow Area (sq ft)	32.59	1085.35	18.33
E.G. Slope (ft/ft)	0.008880	Area (sq ft)	32.59	1085.35	18.33
Q Total (cfs)	15871.00	Flow (cfs)	147.86	15650.84	72.30
Top Width (ft)	61.93	Top Width (ft)	6.40	49.13	6.40
Vel Total (ft/s)	13.97	Avg. Vel. (ft/s)	4.54	14.42	3.94
Max Chl Dpth (ft)	25.94	Hydr. Depth (ft)	5.09	22.09	2.86
Conv. Total (cfs)	168419.3	Conv. (cfs)	1569.1	166083.0	767.2
Length Wtd. (ft)	395.00	Wetted Per. (ft)	12.03	70.66	8.35
Min Ch El (ft)	2131.99	Shear (lb/sq ft)	1.50	8.52	1.22
Alpha	1.05	Stream Power (lb/ft s)	6.82	122.79	4.80
Frctn Loss (ft)	2.83	Cum Volume (acre-ft)	59.74	164.49	24.83
C & E Loss (ft)	0.34	Cum SA (acres)	5.96	9.49	2.37

Plan: Plan 02 PWASH South South of 168 RS: 6720 Profile: PF 1

E.G. Elev (ft)	2157.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.05	Wt. n-Val.		0.060	0.060
W.S. Elev (ft)	2155.90	Reach Len. (ft)	390.00	390.00	390.00
Crit W.S. (ft)		Flow Area (sq ft)		1374.69	14.47
E.G. Slope (ft/ft)	0.005898	Area (sq ft)		1374.69	14.47
Q Total (cfs)	15871.00	Flow (cfs)		15829.18	41.82
Top Width (ft)	76.23	Top Width (ft)		71.08	5.15
Vel Total (ft/s)	11.42	Avg. Vel. (ft/s)		11.51	2.89
Max Chl Dpth (ft)	26.33	Hydr. Depth (ft)		19.34	2.81
Conv. Total (cfs)	206651.5	Conv. (cfs)		206107.0	544.5
Length Wtd. (ft)	390.00	Wetted Per. (ft)		92.29	7.72
Min Ch El (ft)	2129.57	Shear (lb/sq ft)		5.49	0.69
Alpha	1.01	Stream Power (lb/ft s)		63.16	1.99
Frctn Loss (ft)	0.77	Cum Volume (acre-ft)	59.59	153.34	24.68
C & E Loss (ft)	0.46	Cum SA (acres)	5.93	8.95	2.31

Plan: Plan 02 PWASH South South of 168 RS: 6330 Profile: PF 1

E.G. Elev (ft)	2156.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2156.21	Reach Len. (ft)	70.00	70.00	70.00
Crit W.S. (ft)		Flow Area (sq ft)	251.79	2087.20	592.43
E.G. Slope (ft/ft)	0.000973	Area (sq ft)	251.79	2087.20	592.43
Q Total (cfs)	15871.00	Flow (cfs)	712.98	12757.56	2400.46
Top Width (ft)	159.96	Top Width (ft)	29.73	90.92	39.30
Vel Total (ft/s)	5.41	Avg. Vel. (ft/s)	2.83	6.11	4.05
Max Chl Dpth (ft)	27.45	Hydr. Depth (ft)	8.47	22.96	15.07
Conv. Total (cfs)	508766.6	Conv. (cfs)	22855.6	408961.0	76950.0
Length Wtd. (ft)	70.00	Wetted Per. (ft)	35.88	93.79	49.32
Min Ch El (ft)	2128.76	Shear (lb/sq ft)	0.43	1.35	0.73
Alpha	1.12	Stream Power (lb/ft s)	1.21	8.26	2.96
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	58.47	137.84	21.96
C & E Loss (ft)	0.01	Cum SA (acres)	5.80	8.22	2.12

Plan: Plan 02 PWASH South South of 168 RS: 6260 Profile: PF 1

E.G. Elev (ft)	2156.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2155.97	Reach Len. (ft)	120.00	120.00	120.00
Crit W.S. (ft)		Flow Area (sq ft)	191.19	2269.98	138.12
E.G. Slope (ft/ft)	0.001246	Area (sq ft)	191.19	2269.98	138.12
Q Total (cfs)	15871.00	Flow (cfs)	393.10	15078.93	398.97
Top Width (ft)	182.69	Top Width (ft)	63.93	102.72	16.04
Vel Total (ft/s)	6.11	Avg. Vel. (ft/s)	2.06	6.64	2.89
Max Chl Dpth (ft)	27.04	Hydr. Depth (ft)	2.99	22.10	8.61
Conv. Total (cfs)	449533.0	Conv. (cfs)	11134.3	427098.3	11300.4
Length Wtd. (ft)	120.00	Wetted Per. (ft)	71.84	108.40	23.00
Min Ch El (ft)	2128.93	Shear (lb/sq ft)	0.21	1.63	0.47
Alpha	1.13	Stream Power (lb/ft s)	0.43	10.82	1.35
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	58.11	134.34	21.38
C & E Loss (ft)	0.18	Cum SA (acres)	5.72	8.07	2.07

Plan: Plan 02 PWASH South South of 168 RS: 6140 Profile: PF 1

E.G. Elev (ft)	2156.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2156.36	Reach Len. (ft)	165.00	165.00	165.00
Crit W.S. (ft)		Flow Area (sq ft)	2720.02	5695.77	962.62
E.G. Slope (ft/ft)	0.000117	Area (sq ft)	2720.02	5695.77	962.62
Q Total (cfs)	15871.00	Flow (cfs)	3532.02	11089.30	1249.69
Top Width (ft)	623.72	Top Width (ft)	250.66	285.19	87.87
Vel Total (ft/s)	1.69	Avg. Vel. (ft/s)	1.30	1.95	1.30
Max Chl Dpth (ft)	28.15	Hydr. Depth (ft)	10.85	19.97	10.96
Conv. Total (cfs)	1466020.0	Conv. (cfs)	326255.7	1024330.0	115434.8
Length Wtd. (ft)	165.00	Wetted Per. (ft)	255.19	291.06	90.60
Min Ch El (ft)	2128.21	Shear (lb/sq ft)	0.08	0.14	0.08
Alpha	1.10	Stream Power (lb/ft s)	0.10	0.28	0.10
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	54.10	123.37	19.86
C & E Loss (ft)	0.00	Cum SA (acres)	5.29	7.53	1.93

Plan: Plan 02 PWASH South South of 168 RS: 5975 Profile: PF 1

E.G. Elev (ft)	2156.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2156.31	Reach Len. (ft)	225.00	225.00	225.00
Crit W.S. (ft)		Flow Area (sq ft)	1533.33	4769.27	1268.73
E.G. Slope (ft/ft)	0.000166	Area (sq ft)	1533.33	4769.27	1268.73
Q Total (cfs)	15871.00	Flow (cfs)	2264.51	11677.41	1929.08
Top Width (ft)	520.48	Top Width (ft)	179.68	220.46	120.34
Vel Total (ft/s)	2.10	Avg. Vel. (ft/s)	1.48	2.45	1.52
Max Chl Dpth (ft)	28.26	Hydr. Depth (ft)	8.53	21.63	10.54
Conv. Total (cfs)	1230951.0	Conv. (cfs)	175634.8	905697.0	149618.7
Length Wtd. (ft)	225.00	Wetted Per. (ft)	182.37	224.61	122.10
Min Ch El (ft)	2128.05	Shear (lb/sq ft)	0.09	0.22	0.11
Alpha	1.14	Stream Power (lb/ft s)	0.13	0.54	0.16
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	46.04	103.55	15.64
C & E Loss (ft)	0.02	Cum SA (acres)	4.47	6.58	1.53

Plan: Plan 02 PWASH South South of 168 RS: 5750 Profile: PF 1

E.G. Elev (ft)	2156.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2156.32	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)		Flow Area (sq ft)	4716.87	7112.78	737.85
E.G. Slope (ft/ft)	0.000055	Area (sq ft)	4716.87	7112.78	737.85
Q Total (cfs)	15871.00	Flow (cfs)	4715.50	10461.02	694.48
Top Width (ft)	742.73	Top Width (ft)	370.77	311.77	60.19
Vel Total (ft/s)	1.26	Avg. Vel. (ft/s)	1.00	1.47	0.94
Max Chl Dpth (ft)	28.66	Hydr. Depth (ft)	12.72	22.81	12.26
Conv. Total (cfs)	2131111.0	Conv. (cfs)	633183.5	1404675.0	93252.5
Length Wtd. (ft)	200.00	Wetted Per. (ft)	373.77	315.86	64.00
Min Ch El (ft)	2127.66	Shear (lb/sq ft)	0.04	0.08	0.04
Alpha	1.10	Stream Power (lb/ft s)	0.04	0.11	0.04
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	29.90	72.86	10.45
C & E Loss (ft)	0.00	Cum SA (acres)	3.05	5.20	1.07

Plan: Plan 02 PWASH South South of 168 RS: 5550 Profile: PF 1

E.G. Elev (ft)	2156.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2156.29	Reach Len. (ft)	110.00	110.00	110.00
Crit W.S. (ft)		Flow Area (sq ft)	3633.79	5388.74	927.11
E.G. Slope (ft/ft)	0.000078	Area (sq ft)	3633.79	5388.74	927.11
Q Total (cfs)	15871.00	Flow (cfs)	4741.91	10058.28	1070.80
Top Width (ft)	527.21	Top Width (ft)	246.17	208.55	72.48
Vel Total (ft/s)	1.60	Avg. Vel. (ft/s)	1.30	1.87	1.15
Max Chl Dpth (ft)	31.29	Hydr. Depth (ft)	14.76	25.84	12.79
Conv. Total (cfs)	1802752.0	Conv. (cfs)	538623.5	1142498.0	121630.2
Length Wtd. (ft)	110.00	Wetted Per. (ft)	248.16	215.13	76.04
Min Ch El (ft)	2125.00	Shear (lb/sq ft)	0.07	0.12	0.06
Alpha	1.10	Stream Power (lb/ft s)	0.09	0.23	0.07
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	10.73	44.16	6.63
C & E Loss (ft)	0.09	Cum SA (acres)	1.63	4.01	0.76

Plan: Plan 02 PWASH South South of 168 RS: 5440 Profile: PF 1

E.G. Elev (ft)	2156.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2155.24	Reach Len. (ft)	340.00	340.00	340.00
Crit W.S. (ft)		Flow Area (sq ft)	457.83	1183.90	633.07
E.G. Slope (ft/ft)	0.001941	Area (sq ft)	457.83	1183.90	633.07
Q Total (cfs)	15871.00	Flow (cfs)	1928.95	10736.73	3205.31
Top Width (ft)	151.06	Top Width (ft)	52.59	40.84	57.63
Vel Total (ft/s)	6.98	Avg. Vel. (ft/s)	4.21	9.07	5.06
Max Chl Dpth (ft)	30.39	Hydr. Depth (ft)	8.70	28.99	10.99
Conv. Total (cfs)	360263.7	Conv. (cfs)	43786.3	243718.5	72758.9
Length Wtd. (ft)	340.00	Wetted Per. (ft)	60.33	49.40	63.32
Min Ch El (ft)	2124.85	Shear (lb/sq ft)	0.92	2.90	1.21
Alpha	1.29	Stream Power (lb/ft s)	3.87	26.33	6.13
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)	5.56	35.86	4.66
C & E Loss (ft)	0.05	Cum SA (acres)	1.26	3.69	0.60

Plan: Plan 02 PWASH South South of 168 RS: 5100 Profile: PF 1

E.G. Elev (ft)	2155.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.80	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2154.84	Reach Len. (ft)	190.00	190.00	190.00
Crit W.S. (ft)		Flow Area (sq ft)	78.21	2033.02	219.84
E.G. Slope (ft/ft)	0.001277	Area (sq ft)	78.21	2033.02	219.84
Q Total (cfs)	15871.00	Flow (cfs)	173.26	14940.11	757.63
Top Width (ft)	105.99	Top Width (ft)	8.87	75.16	21.96
Vel Total (ft/s)	6.81	Avg. Vel. (ft/s)	2.22	7.35	3.45
Max Chl Dpth (ft)	31.98	Hydr. Depth (ft)	8.82	27.05	10.01
Conv. Total (cfs)	444186.7	Conv. (cfs)	4849.1	418133.5	21204.0
Length Wtd. (ft)	190.00	Wetted Per. (ft)	19.74	84.95	28.60
Min Ch El (ft)	2122.86	Shear (lb/sq ft)	0.32	1.91	0.61
Alpha	1.11	Stream Power (lb/ft s)	0.70	14.02	2.11
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	3.47	23.31	1.33
C & E Loss (ft)	0.72	Cum SA (acres)	1.02	3.24	0.29

Plan: Plan 02 PWASH South South of 168 RS: 4910 Profile: PF 1

E.G. Elev (ft)	2154.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	8.02	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2146.19	Reach Len. (ft)	260.00	260.00	260.00
Crit W.S. (ft)	2146.19	Flow Area (sq ft)	0.14	681.15	28.55
E.G. Slope (ft/ft)	0.039717	Area (sq ft)	0.14	681.15	28.55
Q Total (cfs)	15871.00	Flow (cfs)	0.23	15594.67	276.10
Top Width (ft)	49.32	Top Width (ft)	0.55	40.08	8.69
Vel Total (ft/s)	22.36	Avg. Vel. (ft/s)	1.62	22.89	9.67
Max Chl Dpth (ft)	28.03	Hydr. Depth (ft)	0.26	16.99	3.28
Conv. Total (cfs)	79637.2	Conv. (cfs)	1.1	78250.6	1385.4
Length Wtd. (ft)	260.00	Wetted Per. (ft)	0.75	68.18	10.41
Min Ch El (ft)	2118.16	Shear (lb/sq ft)	0.47	24.77	6.80
Alpha	1.03	Stream Power (lb/ft s)	0.75	567.17	65.78
Frctn Loss (ft)	7.22	Cum Volume (acre-ft)	3.30	17.39	0.79
C & E Loss (ft)	0.51	Cum SA (acres)	1.00	2.99	0.22

Plan: Plan 02 PWASH South South of 168 RS: 4650 Profile: PF 1

E.G. Elev (ft)	2145.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	6.33	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	2139.67	Reach Len. (ft)	150.00	150.00	150.00
Crit W.S. (ft)	2139.67	Flow Area (sq ft)	72.12	711.29	55.06
E.G. Slope (ft/ft)	0.020524	Area (sq ft)	72.12	711.29	55.06
Q Total (cfs)	15871.00	Flow (cfs)	683.31	14780.47	407.22
Top Width (ft)	70.35	Top Width (ft)	12.87	42.84	14.64
Vel Total (ft/s)	18.93	Avg. Vel. (ft/s)	9.47	20.78	7.40
Max Chl Dpth (ft)	20.14	Hydr. Depth (ft)	5.60	16.60	3.76
Conv. Total (cfs)	110782.8	Conv. (cfs)	4769.7	103170.7	2842.5
Length Wtd. (ft)	150.00	Wetted Per. (ft)	16.53	50.18	18.29
Min Ch El (ft)	2119.53	Shear (lb/sq ft)	5.59	18.16	3.86
Alpha	1.14	Stream Power (lb/ft s)	52.97	377.40	28.52
Frctn Loss (ft)	1.91	Cum Volume (acre-ft)	3.09	13.23	0.54
C & E Loss (ft)	1.25	Cum SA (acres)	0.96	2.74	0.15

Plan: Plan 02 PWASH South South of 168 RS: 4500 Profile: PF 1

E.G. Elev (ft)	2134.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.17	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2131.94	Reach Len. (ft)	250.00	250.00	250.00
Crit W.S. (ft)	2131.94	Flow Area (sq ft)	645.16	757.13	97.24
E.G. Slope (ft/ft)	0.008629	Area (sq ft)	645.16	757.13	97.24
Q Total (cfs)	15871.00	Flow (cfs)	4802.54	10303.49	764.97
Top Width (ft)	326.12	Top Width (ft)	203.44	95.27	27.41
Vel Total (ft/s)	10.58	Avg. Vel. (ft/s)	7.44	13.61	7.87
Max Chl Dpth (ft)	11.01	Hydr. Depth (ft)	3.17	7.95	3.55
Conv. Total (cfs)	170850.5	Conv. (cfs)	51699.1	110916.6	8234.8
Length Wtd. (ft)	250.00	Wetted Per. (ft)	203.63	96.68	28.25
Min Ch El (ft)	2120.93	Shear (lb/sq ft)	1.71	4.22	1.85
Alpha	1.25	Stream Power (lb/ft s)	12.71	57.41	14.59
Frctn Loss (ft)	1.30	Cum Volume (acre-ft)	1.85	10.70	0.28
C & E Loss (ft)	0.52	Cum SA (acres)	0.58	2.50	0.08

Plan: Plan 02 PWASH South South of 168 RS: 4250 Profile: PF 1

E.G. Elev (ft)	2130.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.040	
W.S. Elev (ft)	2130.43	Reach Len. (ft)			
Crit W.S. (ft)	2128.77	Flow Area (sq ft)		2972.99	
E.G. Slope (ft/ft)	0.003465	Area (sq ft)		2972.99	
Q Total (cfs)	15871.00	Flow (cfs)		15871.00	
Top Width (ft)	777.03	Top Width (ft)		777.03	
Vel Total (ft/s)	5.34	Avg. Vel. (ft/s)		5.34	
Max Chl Dpth (ft)	9.70	Hydr. Depth (ft)		3.83	
Conv. Total (cfs)	269619.8	Conv. (cfs)		269619.8	
Length Wtd. (ft)		Wetted Per. (ft)		779.40	
Min Ch El (ft)	2120.73	Shear (lb/sq ft)		0.83	
Alpha	1.00	Stream Power (lb/ft s)		4.40	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Plan: Plan 02 West Inflow Western RS: 1200 Profile: PF 1

E.G. Elev (ft)	2188.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.		0.040	
W.S. Elev (ft)	2188.31	Reach Len. (ft)	496.68	496.68	496.68
Crit W.S. (ft)		Flow Area (sq ft)		2625.29	
E.G. Slope (ft/ft)	0.002638	Area (sq ft)		2625.29	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	709.74	Top Width (ft)		709.74	
Vel Total (ft/s)	4.56	Avg. Vel. (ft/s)		4.56	
Max Chl Dpth (ft)	6.82	Hydr. Depth (ft)		3.70	
Conv. Total (cfs)	233130.2	Conv. (cfs)		233130.2	
Length Wtd. (ft)	496.68	Wetted Per. (ft)		710.31	
Min Ch El (ft)	2181.49	Shear (lb/sq ft)		0.61	
Alpha	1.00	Stream Power (lb/ft s)		2.78	
Frctn Loss (ft)	2.51	Cum Volume (acre-ft)	1.30	250.04	0.05
C & E Loss (ft)	0.08	Cum SA (acres)	0.83	59.56	0.02

Plan: Plan 02 West Inflow Western RS: 1100 Profile: PF 1

E.G. Elev (ft)	2186.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.14	Wt. n-Val.		0.040	
W.S. Elev (ft)	2184.90	Reach Len. (ft)	475.72	475.72	475.72
Crit W.S. (ft)	2184.62	Flow Area (sq ft)		1395.85	
E.G. Slope (ft/ft)	0.013375	Area (sq ft)		1395.85	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	494.39	Top Width (ft)		494.39	
Vel Total (ft/s)	8.58	Avg. Vel. (ft/s)		8.58	
Max Chl Dpth (ft)	5.51	Hydr. Depth (ft)		2.82	
Conv. Total (cfs)	103543.3	Conv. (cfs)		103543.3	
Length Wtd. (ft)	475.72	Wetted Per. (ft)		494.67	
Min Ch El (ft)	2179.39	Shear (lb/sq ft)		2.36	
Alpha	1.00	Stream Power (lb/ft s)		20.21	
Frctn Loss (ft)	4.89	Cum Volume (acre-ft)	1.30	227.11	0.05
C & E Loss (ft)	0.20	Cum SA (acres)	0.83	52.70	0.02

Plan: Plan 02 West Inflow Western RS: 1000 Profile: PF 1

E.G. Elev (ft)	2180.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.		0.040	
W.S. Elev (ft)	2180.48	Reach Len. (ft)	684.49	684.49	684.49
Crit W.S. (ft)	2179.87	Flow Area (sq ft)		2168.51	
E.G. Slope (ft/ft)	0.008137	Area (sq ft)		2168.51	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	1024.88	Top Width (ft)		1024.88	
Vel Total (ft/s)	5.52	Avg. Vel. (ft/s)		5.52	
Max Chl Dpth (ft)	5.72	Hydr. Depth (ft)		2.12	
Conv. Total (cfs)	132748.7	Conv. (cfs)		132748.7	
Length Wtd. (ft)	684.49	Wetted Per. (ft)		1025.09	
Min Ch El (ft)	2174.76	Shear (lb/sq ft)		1.07	
Alpha	1.00	Stream Power (lb/ft s)		5.93	
Frctn Loss (ft)	3.79	Cum Volume (acre-ft)	1.30	207.65	0.05
C & E Loss (ft)	0.03	Cum SA (acres)	0.83	44.40	0.02

Plan: Plan 02 West Inflow Western RS: 900 Profile: PF 1

E.G. Elev (ft)	2177.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.		0.040	
W.S. Elev (ft)	2176.37	Reach Len. (ft)	378.66	378.66	378.66
Crit W.S. (ft)		Flow Area (sq ft)		1709.38	
E.G. Slope (ft/ft)	0.004011	Area (sq ft)		1709.38	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	331.49	Top Width (ft)		331.49	
Vel Total (ft/s)	7.01	Avg. Vel. (ft/s)		7.01	
Max Chl Dpth (ft)	6.37	Hydr. Depth (ft)		5.16	
Conv. Total (cfs)	189084.7	Conv. (cfs)		189084.7	
Length Wtd. (ft)	378.66	Wetted Per. (ft)		332.67	
Min Ch El (ft)	2170.00	Shear (lb/sq ft)		1.29	
Alpha	1.00	Stream Power (lb/ft s)		9.01	
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)	1.30	177.18	0.05
C & E Loss (ft)	0.02	Cum SA (acres)	0.83	33.74	0.02

Plan: Plan 02 West Inflow Western RS: 800 Profile: PF 1

E.G. Elev (ft)	2174.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.01	Wt. n-Val.		0.040	
W.S. Elev (ft)	2173.89	Reach Len. (ft)	278.47	278.47	278.47
Crit W.S. (ft)		Flow Area (sq ft)		1487.41	
E.G. Slope (ft/ft)	0.009343	Area (sq ft)		1487.41	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	441.74	Top Width (ft)		441.74	
Vel Total (ft/s)	8.05	Avg. Vel. (ft/s)		8.05	
Max Chl Dpth (ft)	6.97	Hydr. Depth (ft)		3.37	
Conv. Total (cfs)	123891.7	Conv. (cfs)		123891.7	
Length Wtd. (ft)	278.47	Wetted Per. (ft)		443.01	
Min Ch El (ft)	2166.92	Shear (lb/sq ft)		1.96	
Alpha	1.00	Stream Power (lb/ft s)		15.77	
Frctn Loss (ft)	1.74	Cum Volume (acre-ft)	1.30	163.29	0.05
C & E Loss (ft)	0.16	Cum SA (acres)	0.83	30.38	0.02

Plan: Plan 02 West Inflow Western RS: 700 Profile: PF 1

E.G. Elev (ft)	2173.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.		0.040	
W.S. Elev (ft)	2172.51	Reach Len. (ft)	286.29	286.29	286.29
Crit W.S. (ft)		Flow Area (sq ft)		2150.17	
E.G. Slope (ft/ft)	0.004481	Area (sq ft)		2150.17	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	640.36	Top Width (ft)		640.36	
Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)		5.57	
Max Chl Dpth (ft)	5.90	Hydr. Depth (ft)		3.36	
Conv. Total (cfs)	178897.5	Conv. (cfs)		178897.5	
Length Wtd. (ft)	286.29	Wetted Per. (ft)		641.47	
Min Ch El (ft)	2166.61	Shear (lb/sq ft)		0.94	
Alpha	1.00	Stream Power (lb/ft s)		5.22	
Frctn Loss (ft)	1.93	Cum Volume (acre-ft)	1.30	151.66	0.05
C & E Loss (ft)	0.04	Cum SA (acres)	0.83	26.93	0.02

Plan: Plan 02 West Inflow Western RS: 600 Profile: PF 1

E.G. Elev (ft)	2171.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.		0.040	
W.S. Elev (ft)	2170.16	Reach Len. (ft)	275.50	275.50	275.50
Crit W.S. (ft)		Flow Area (sq ft)		1602.53	
E.G. Slope (ft/ft)	0.011323	Area (sq ft)		1602.53	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	615.16	Top Width (ft)		615.16	
Vel Total (ft/s)	7.47	Avg. Vel. (ft/s)		7.47	
Max Chl Dpth (ft)	4.30	Hydr. Depth (ft)		2.61	
Conv. Total (cfs)	112536.5	Conv. (cfs)		112536.5	
Length Wtd. (ft)	275.50	Wetted Per. (ft)		616.56	
Min Ch El (ft)	2165.86	Shear (lb/sq ft)		1.84	
Alpha	1.00	Stream Power (lb/ft s)		13.73	
Frctn Loss (ft)	3.00	Cum Volume (acre-ft)	1.30	139.33	0.05
C & E Loss (ft)	0.02	Cum SA (acres)	0.83	22.80	0.02

Plan: Plan 02 West Inflow Western RS: 500 Profile: PF 1

E.G. Elev (ft)	2168.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.		0.040	
W.S. Elev (ft)	2167.21	Reach Len. (ft)	296.35	296.35	296.35
Crit W.S. (ft)		Flow Area (sq ft)		1675.02	
E.G. Slope (ft/ft)	0.010489	Area (sq ft)		1675.02	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	649.91	Top Width (ft)		649.91	
Vel Total (ft/s)	7.15	Avg. Vel. (ft/s)		7.15	
Max Chl Dpth (ft)	4.70	Hydr. Depth (ft)		2.58	
Conv. Total (cfs)	116926.6	Conv. (cfs)		116926.6	
Length Wtd. (ft)	296.35	Wetted Per. (ft)		650.26	
Min Ch El (ft)	2162.51	Shear (lb/sq ft)		1.69	
Alpha	1.00	Stream Power (lb/ft s)		12.06	
Frctn Loss (ft)	2.08	Cum Volume (acre-ft)	1.30	128.96	0.05
C & E Loss (ft)	0.08	Cum SA (acres)	0.83	18.80	0.02

Plan: Plan 02 West Inflow Western RS: 400 Profile: PF 1

E.G. Elev (ft)	2165.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.		0.040	
W.S. Elev (ft)	2165.32	Reach Len. (ft)	332.85	332.85	332.85
Crit W.S. (ft)		Flow Area (sq ft)		2073.97	
E.G. Slope (ft/ft)	0.005033	Area (sq ft)		2073.97	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	639.27	Top Width (ft)		639.27	
Vel Total (ft/s)	5.77	Avg. Vel. (ft/s)		5.77	
Max Chl Dpth (ft)	6.56	Hydr. Depth (ft)		3.24	
Conv. Total (cfs)	168788.0	Conv. (cfs)		168788.0	
Length Wtd. (ft)	332.85	Wetted Per. (ft)		639.59	
Min Ch El (ft)	2158.76	Shear (lb/sq ft)		1.02	
Alpha	1.00	Stream Power (lb/ft s)		5.88	
Frctn Loss (ft)	1.57	Cum Volume (acre-ft)	1.30	116.21	0.05
C & E Loss (ft)	0.00	Cum SA (acres)	0.83	14.41	0.02

Plan: Plan 02 West Inflow Western RS: 300 Profile: PF 1

E.G. Elev (ft)	2164.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.		0.040	
W.S. Elev (ft)	2163.69	Reach Len. (ft)	323.80	323.80	323.80
Crit W.S. (ft)		Flow Area (sq ft)		1990.87	
E.G. Slope (ft/ft)	0.004452	Area (sq ft)		1990.87	
Q Total (cfs)	11975.00	Flow (cfs)		11975.00	
Top Width (ft)	524.63	Top Width (ft)		524.63	
Vel Total (ft/s)	6.01	Avg. Vel. (ft/s)		6.01	
Max Chl Dpth (ft)	7.26	Hydr. Depth (ft)		3.79	
Conv. Total (cfs)	179467.5	Conv. (cfs)		179467.5	
Length Wtd. (ft)	323.80	Wetted Per. (ft)		526.66	
Min Ch El (ft)	2156.43	Shear (lb/sq ft)		1.05	
Alpha	1.00	Stream Power (lb/ft s)		6.32	
Frctn Loss (ft)	1.30	Cum Volume (acre-ft)	1.30	100.68	0.05
C & E Loss (ft)	0.04	Cum SA (acres)	0.83	9.97	0.02

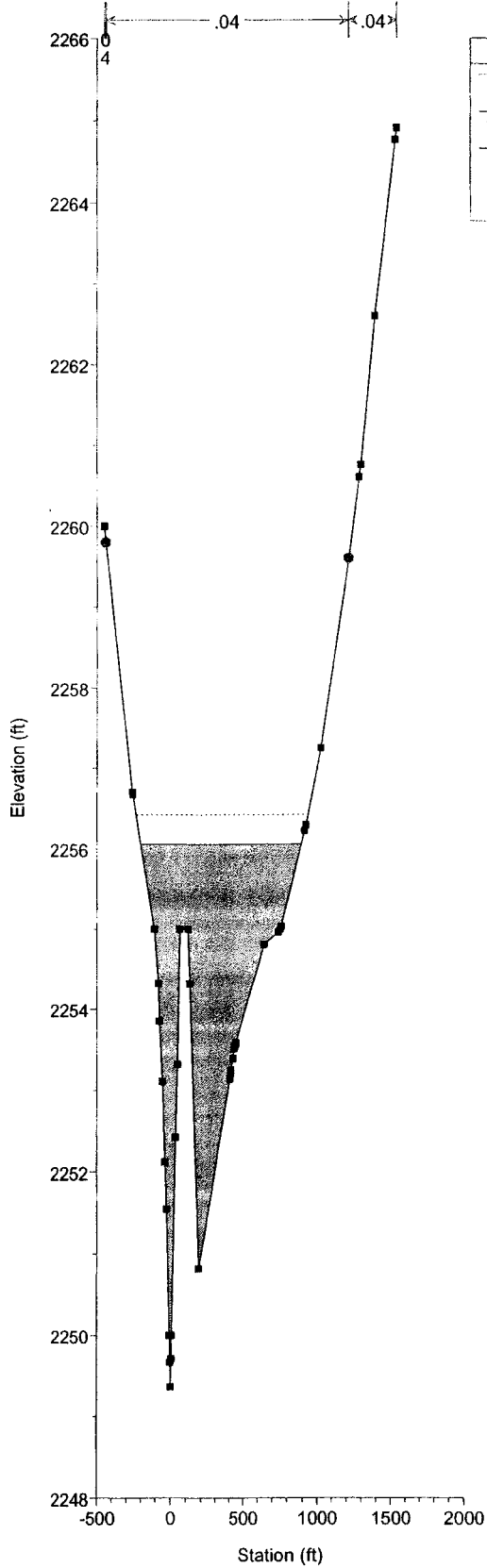
Plan: Plan 02 West Inflow Western RS: 200 Profile: PF 1

E.G. Elev (ft)	2162.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.	0.040	0.040	
W.S. Elev (ft)	2162.49	Reach Len. (ft)	366.13	366.13	366.13
Crit W.S. (ft)		Flow Area (sq ft)	77.51	2246.64	
E.G. Slope (ft/ft)	0.003649	Area (sq ft)	77.51	2246.64	
Q Total (cfs)	11975.00	Flow (cfs)	145.01	11829.99	
Top Width (ft)	725.30	Top Width (ft)	101.24	624.06	
Vel Total (ft/s)	5.15	Avg. Vel. (ft/s)	1.87	5.27	
Max Chl Dpth (ft)	8.45	Hydr. Depth (ft)	0.77	3.60	
Conv. Total (cfs)	198243.0	Conv. (cfs)	2400.6	195842.4	
Length Wtd. (ft)	366.13	Wetted Per. (ft)	101.82	624.99	
Min Ch El (ft)	2154.04	Shear (lb/sq ft)	0.17	0.82	
Alpha	1.03	Stream Power (lb/ft s)	0.32	4.31	
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	1.01	84.93	0.05
C & E Loss (ft)	0.11	Cum SA (acres)	0.46	5.70	0.02

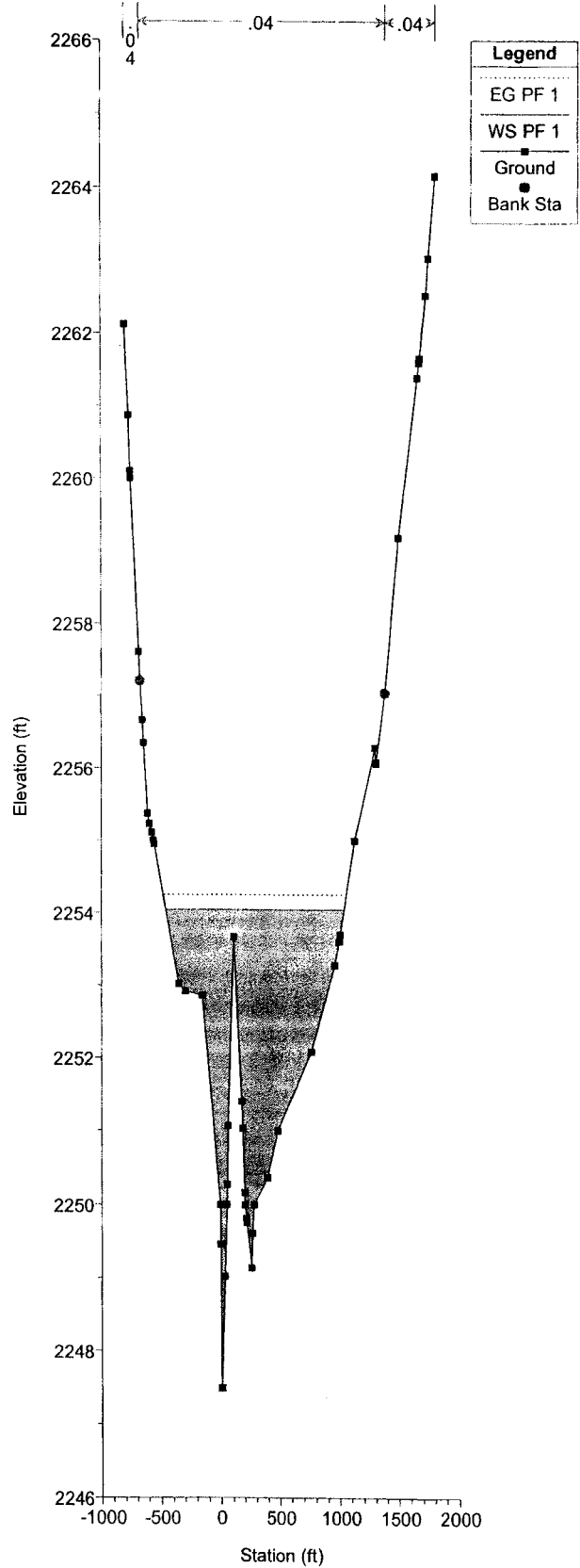
Plan: Plan 02 West Inflow Western RS: 100 Profile: PF 1

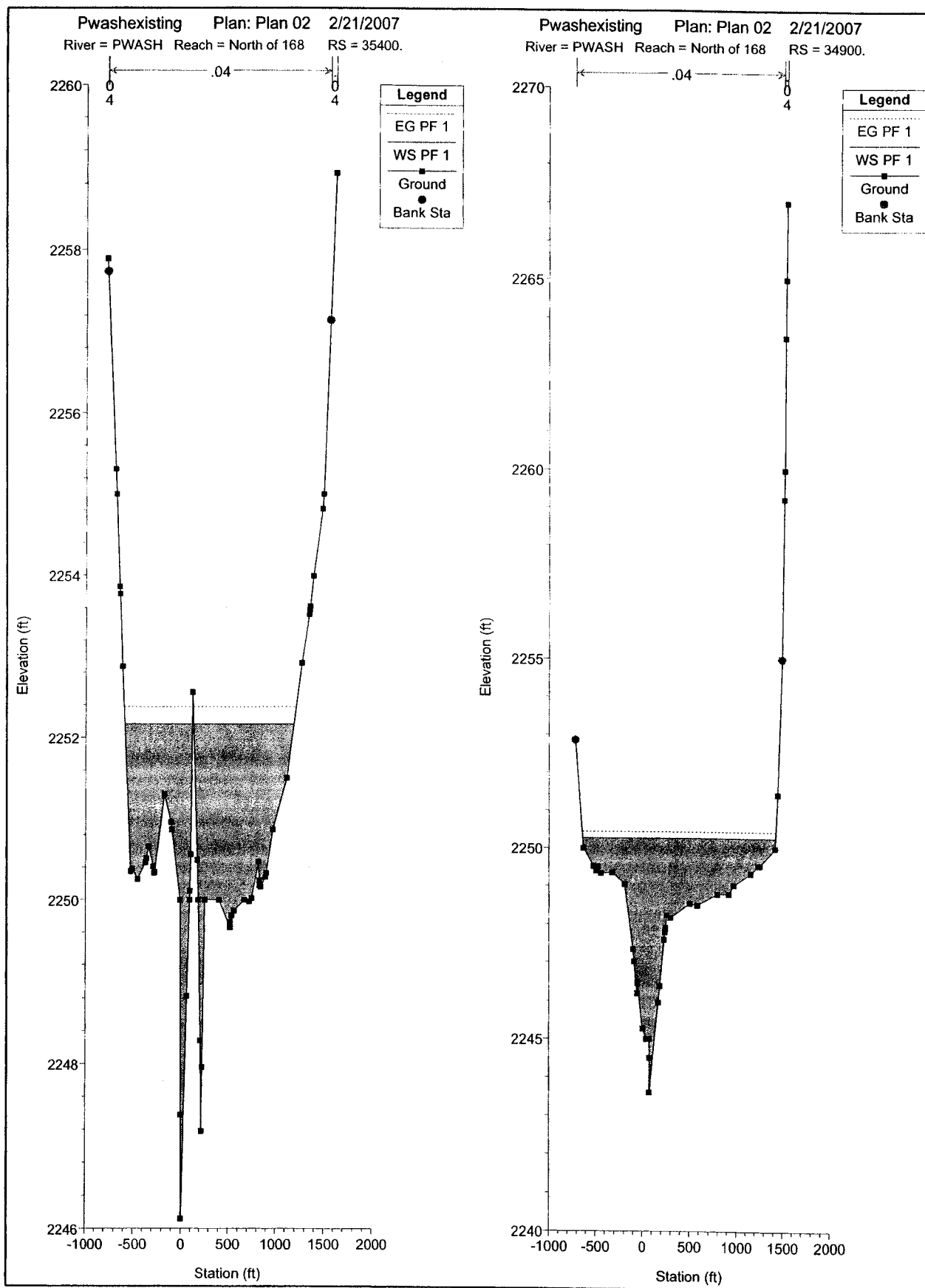
E.G. Elev (ft)	2162.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	2162.52	Reach Len. (ft)	250.00	250.00	250.00
Crit W.S. (ft)		Flow Area (sq ft)	2.43	5534.86	4.07
E.G. Slope (ft/ft)	0.000230	Area (sq ft)	2.43	5534.86	4.07
Q Total (cfs)	11975.00	Flow (cfs)	0.78	11972.44	1.78
Top Width (ft)	745.23	Top Width (ft)	7.87	731.66	5.70
Vel Total (ft/s)	2.16	Avg. Vel. (ft/s)	0.32	2.16	0.44
Max Chl Dpth (ft)	11.34	Hydr. Depth (ft)	0.31	7.56	0.71
Conv. Total (cfs)	789613.7	Conv. (cfs)	51.2	789445.0	117.5
Length Wtd. (ft)	250.00	Wetted Per. (ft)	7.99	735.68	5.95
Min Ch El (ft)	2151.18	Shear (lb/sq ft)	0.00	0.11	0.01
Alpha	1.00	Stream Power (lb/ft s)	0.00	0.23	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	0.68	52.23	0.03
C & E Loss (ft)	0.01	Cum SA (acres)			

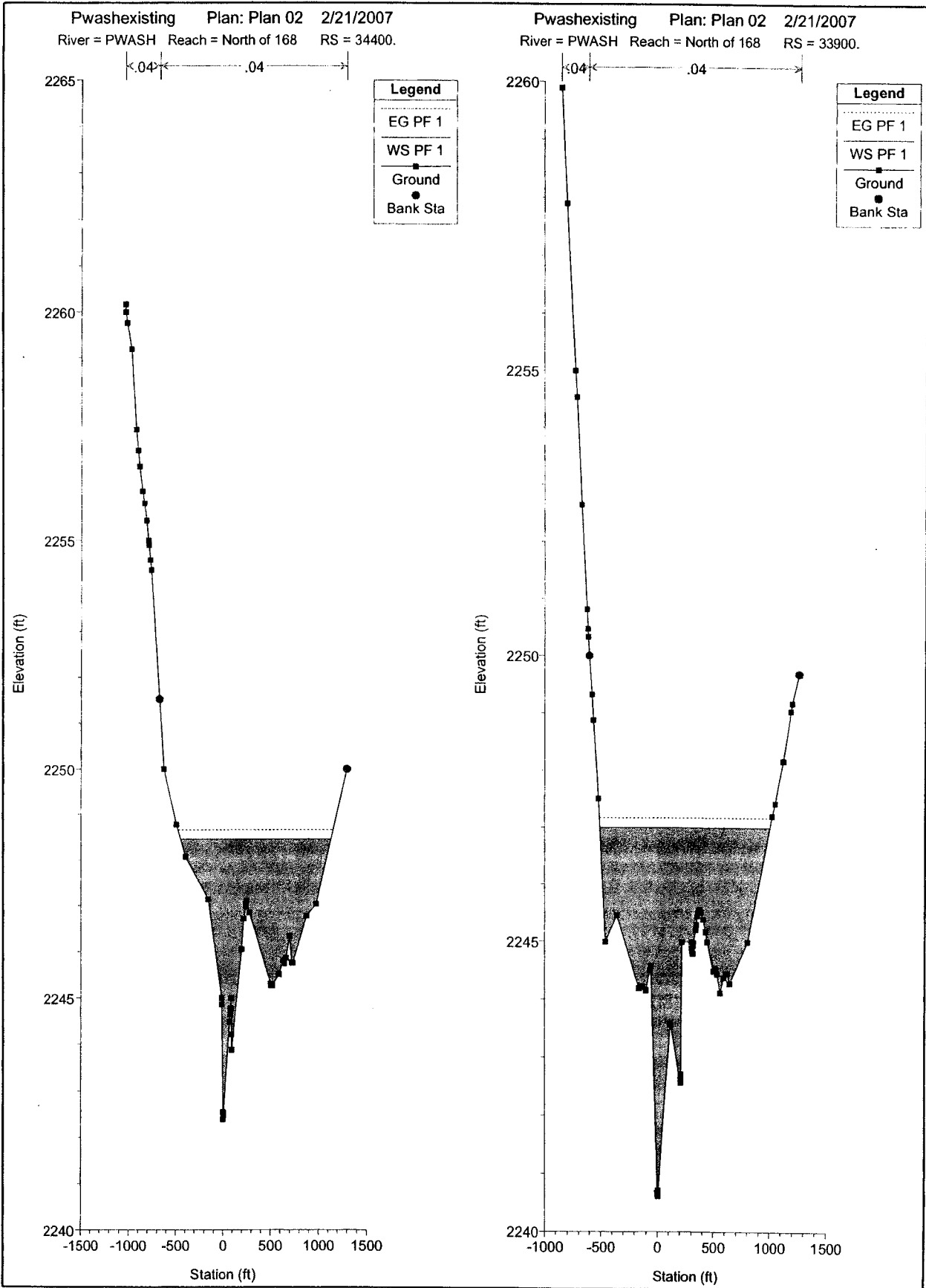
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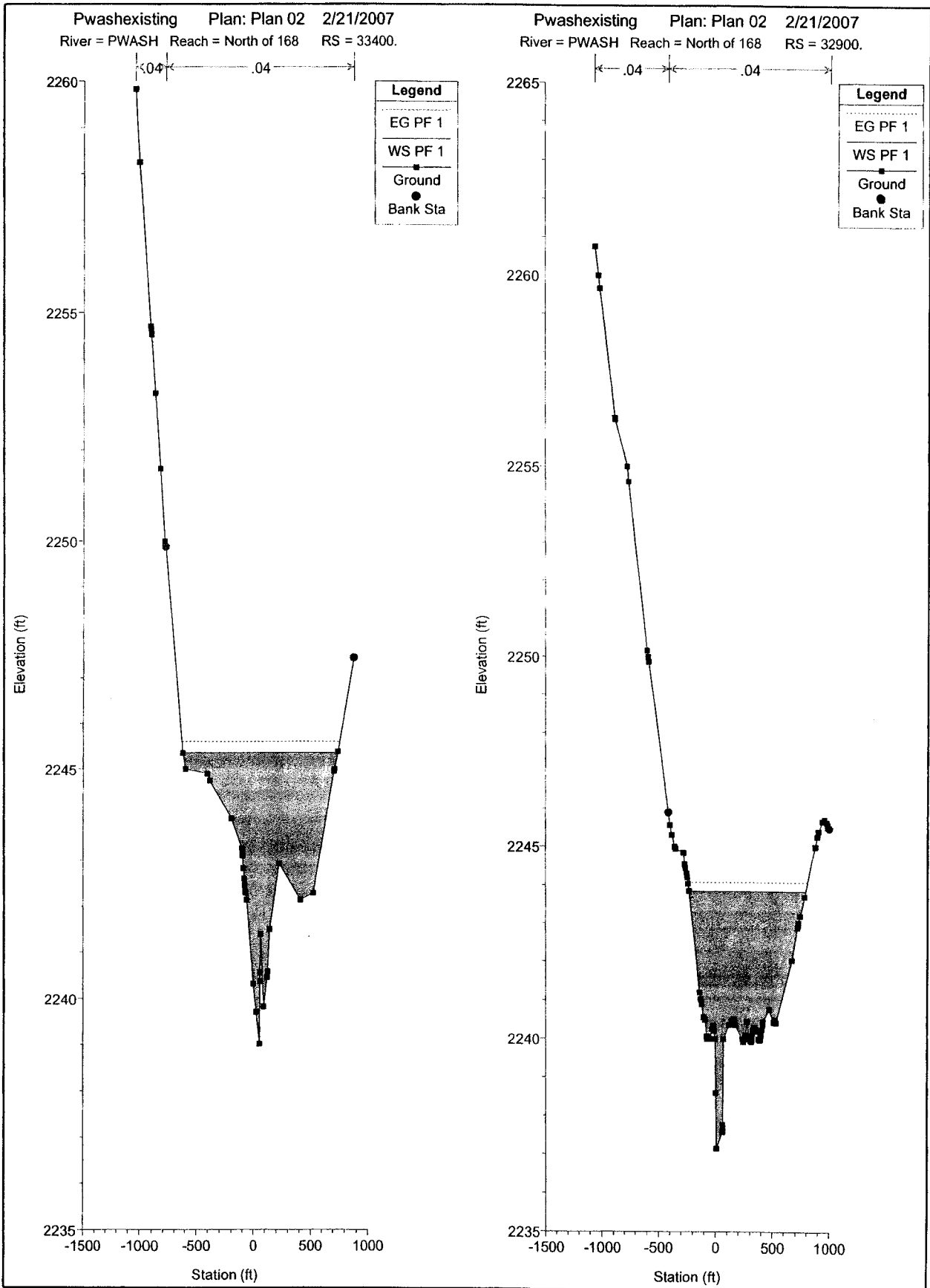


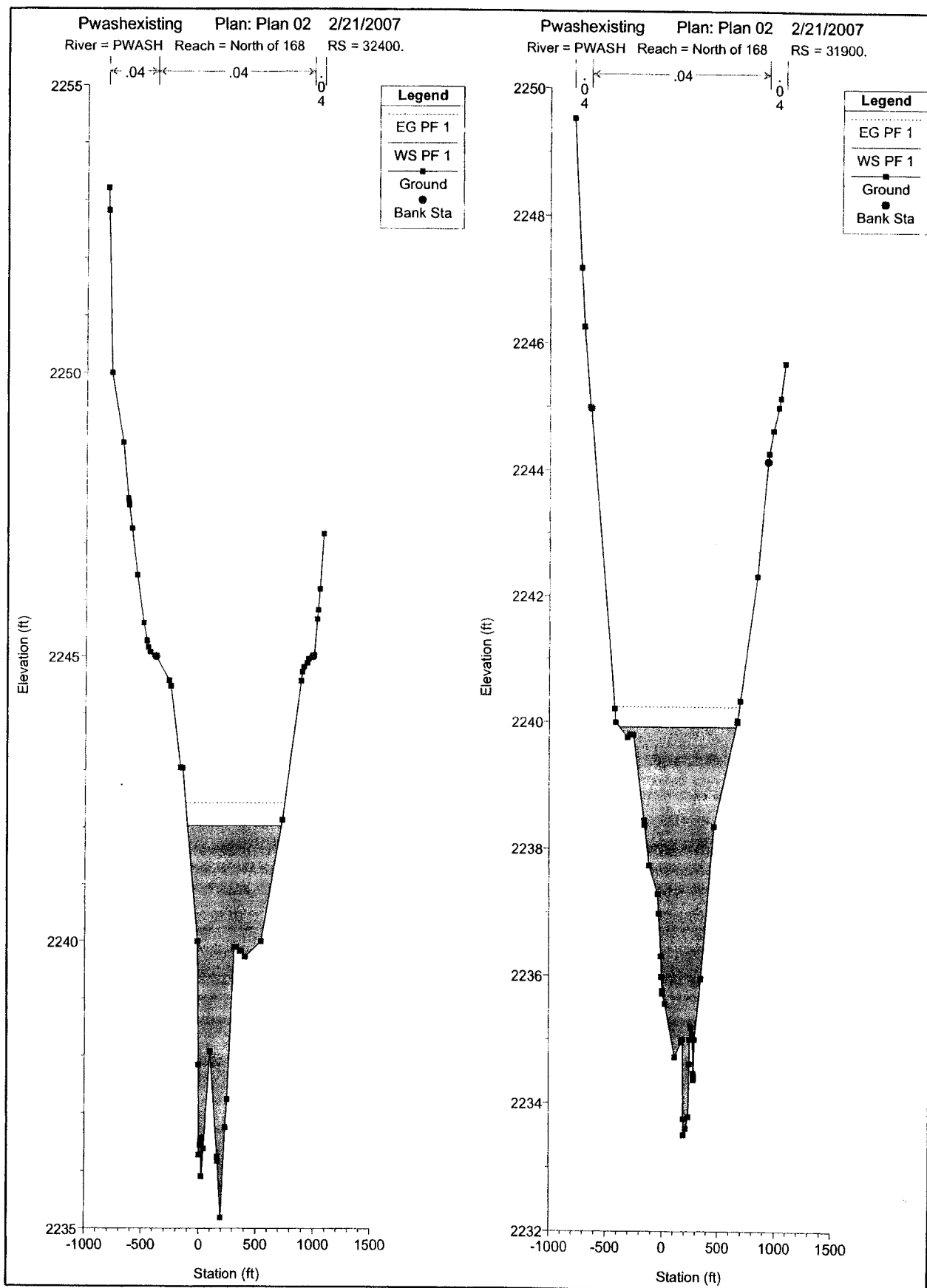
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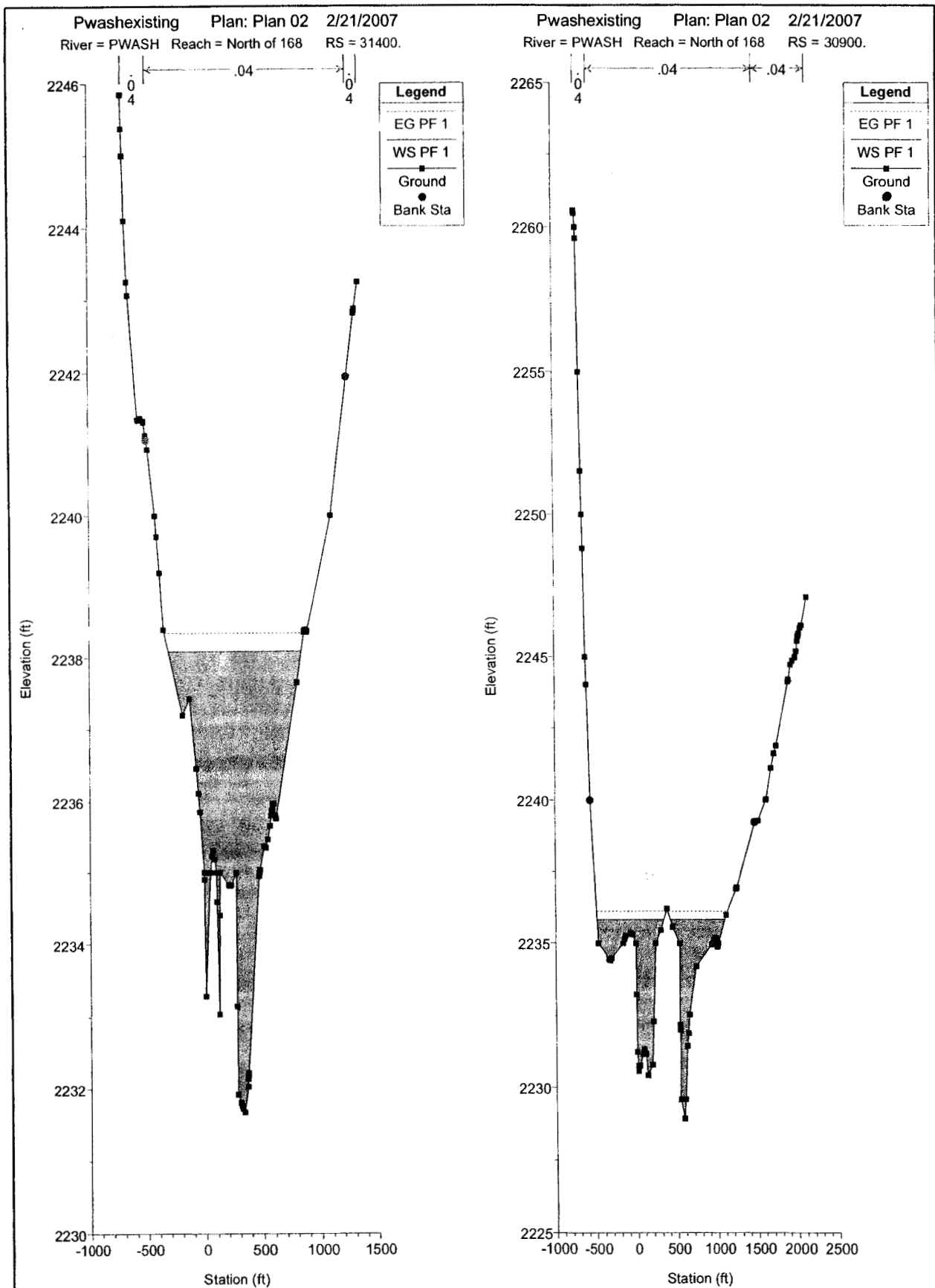


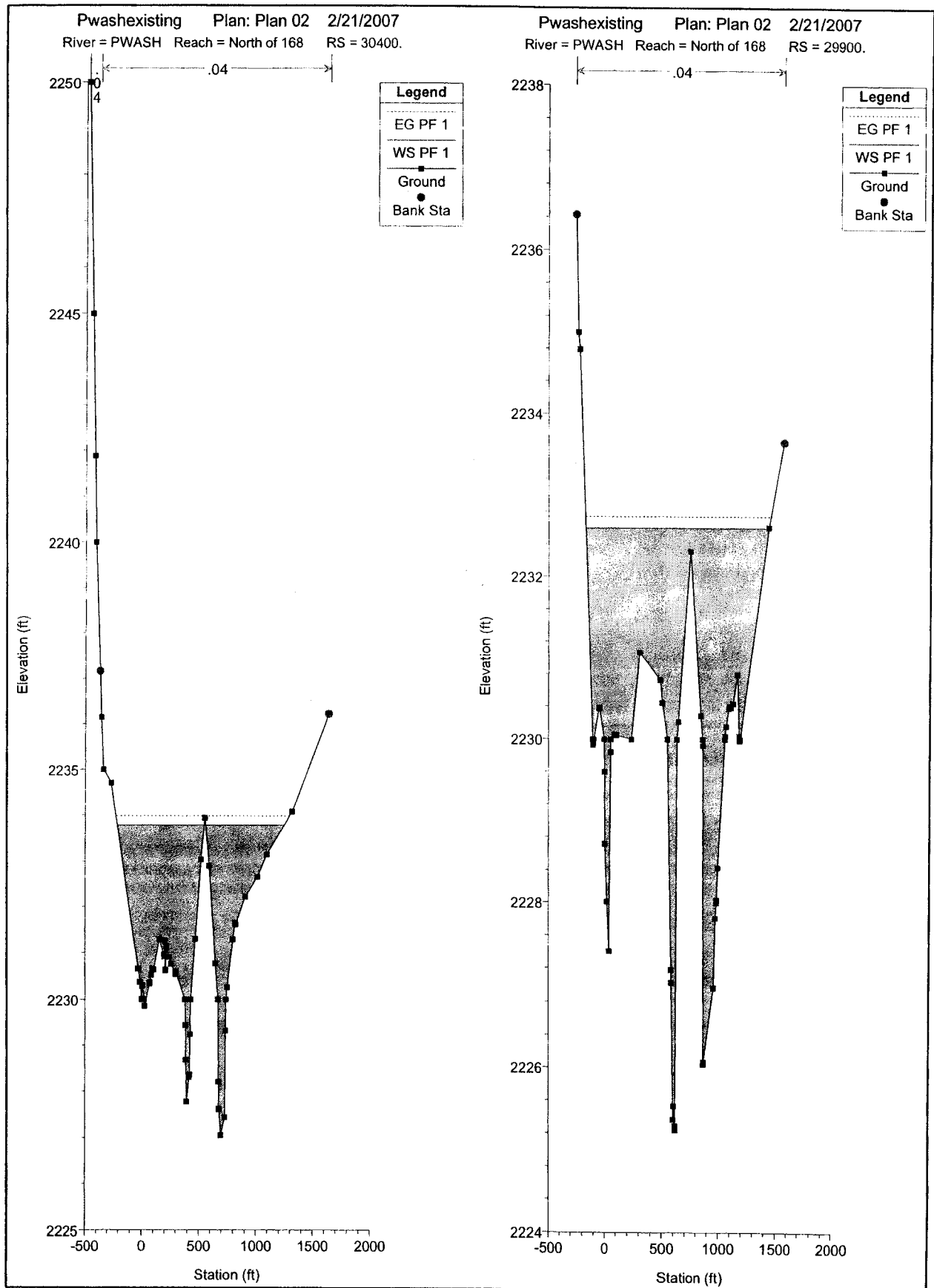


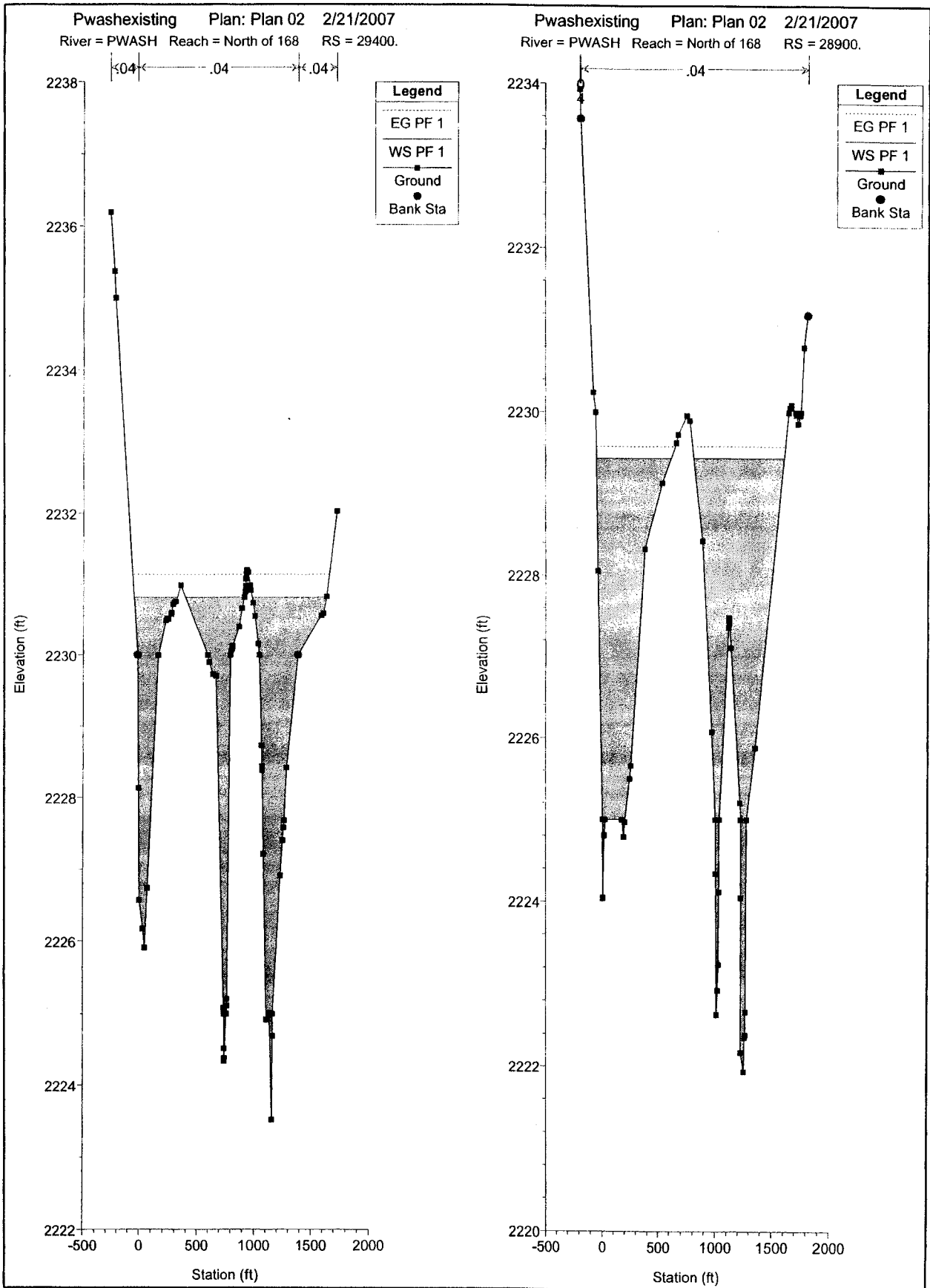




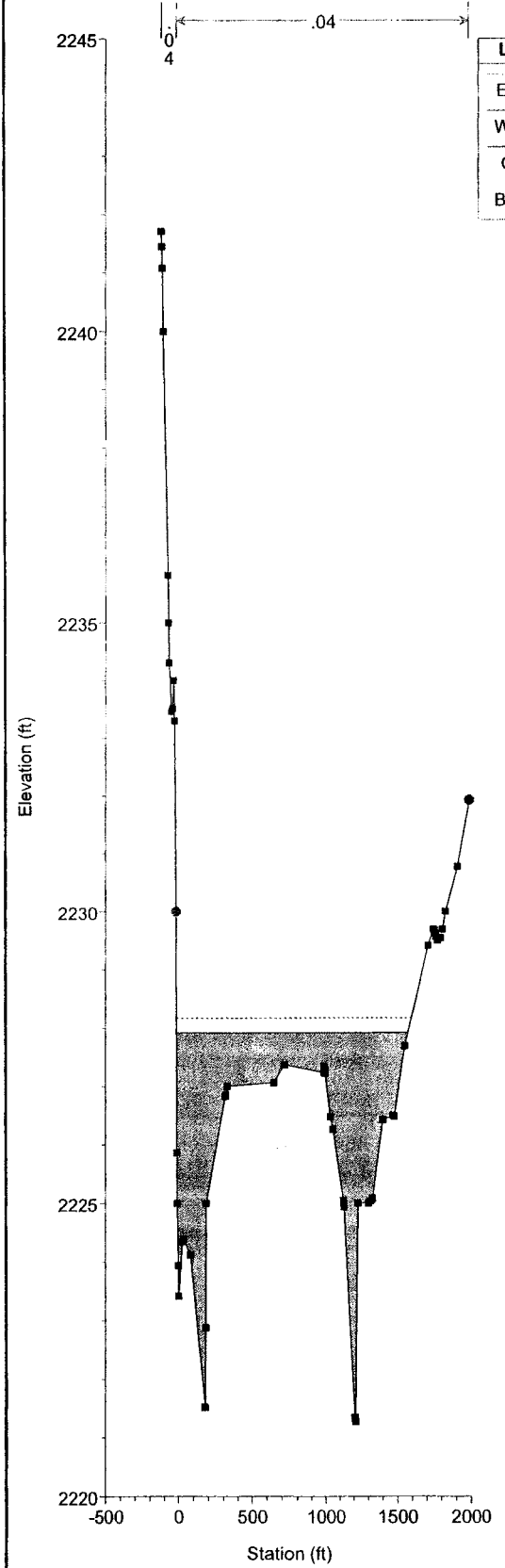




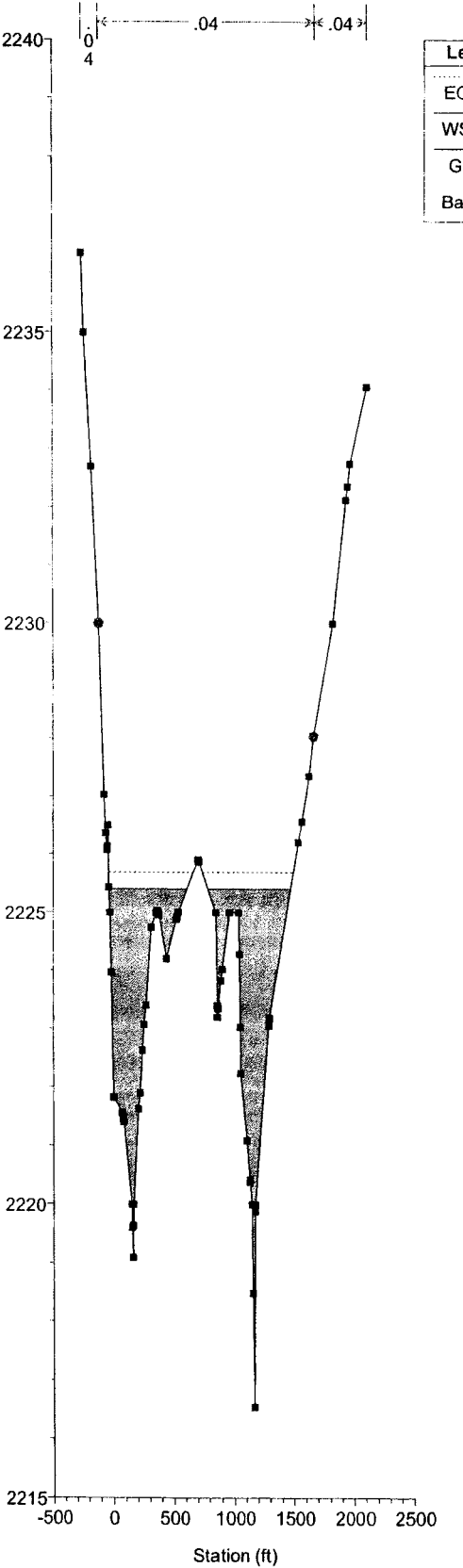


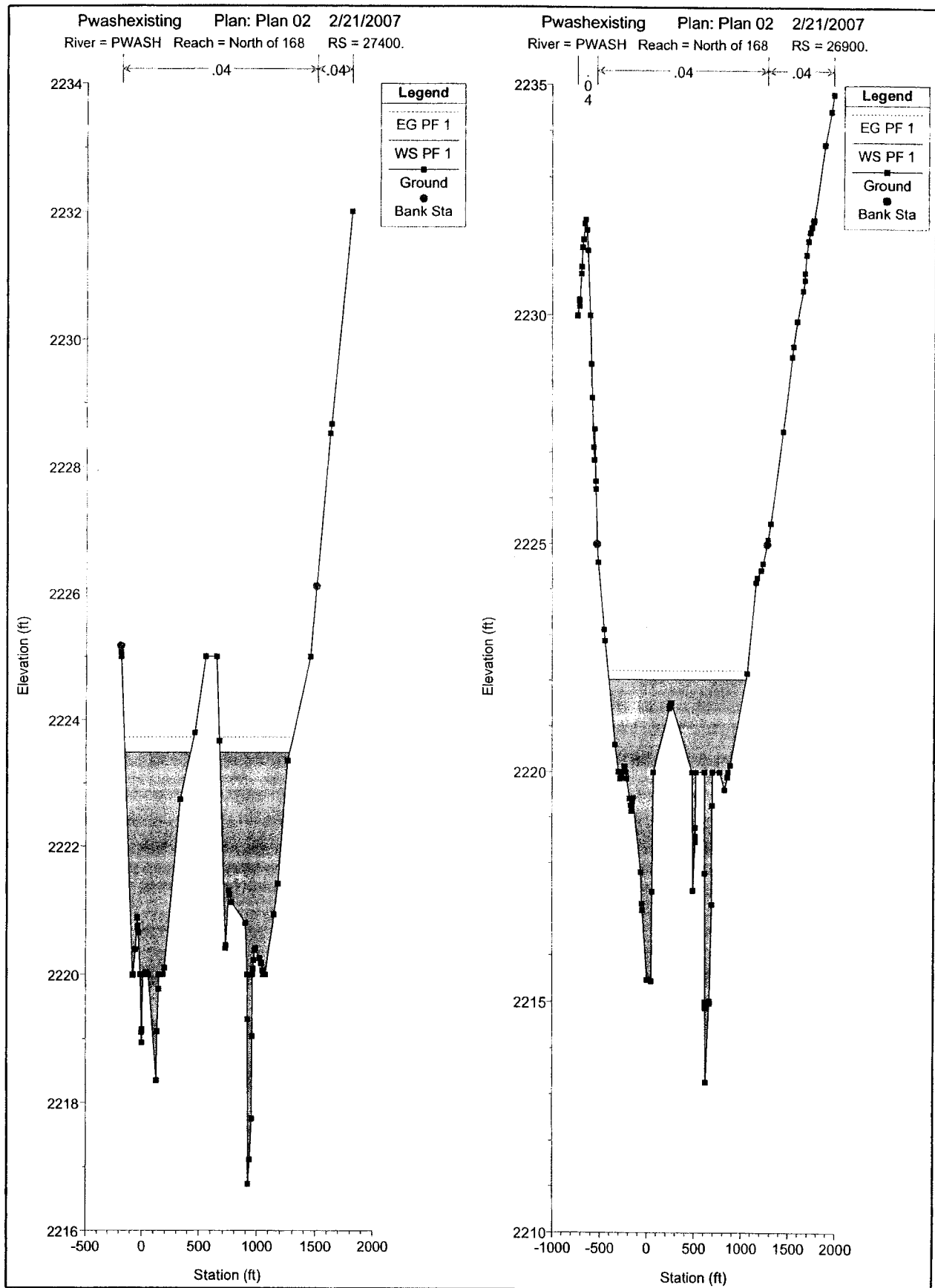


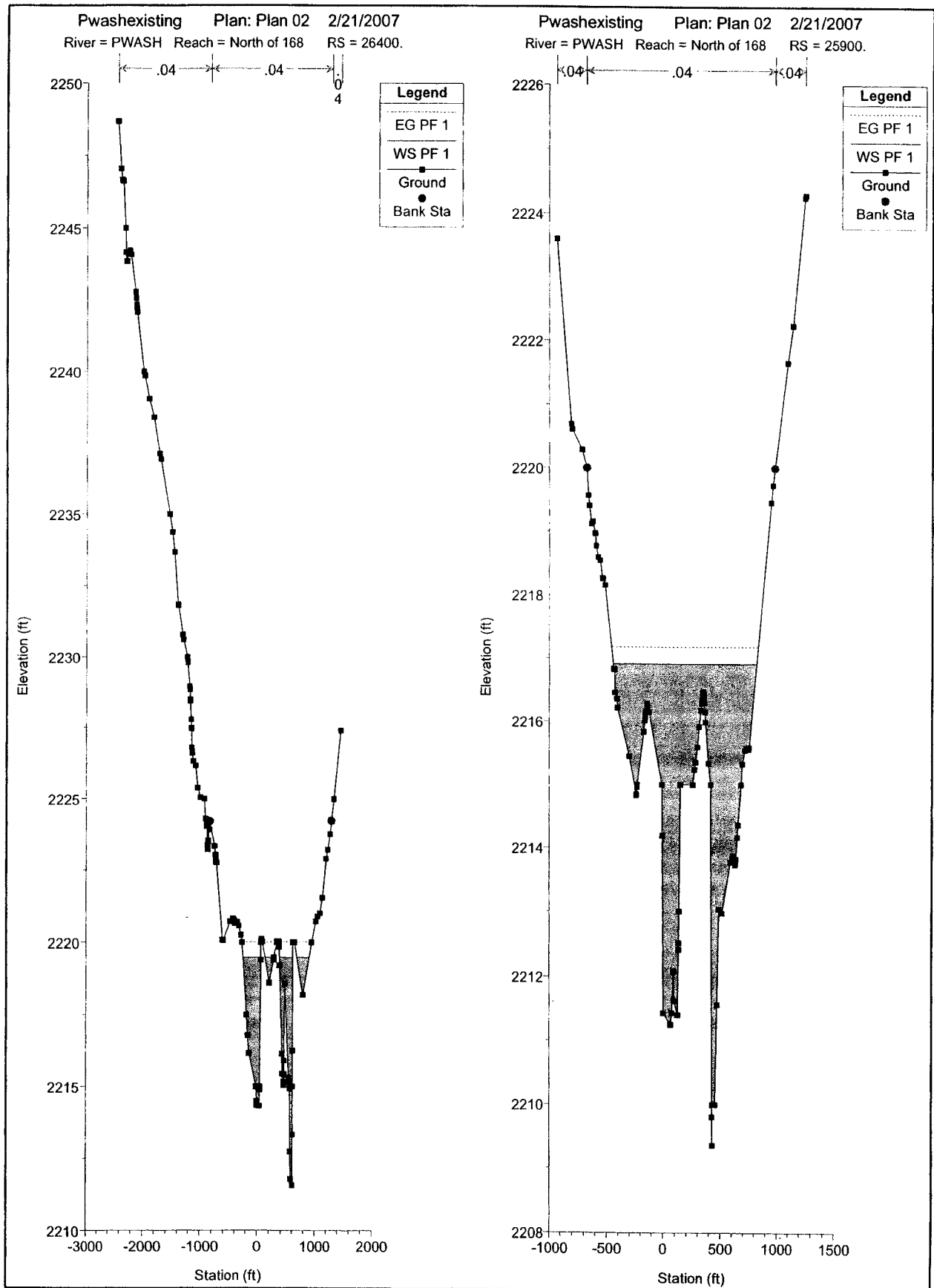
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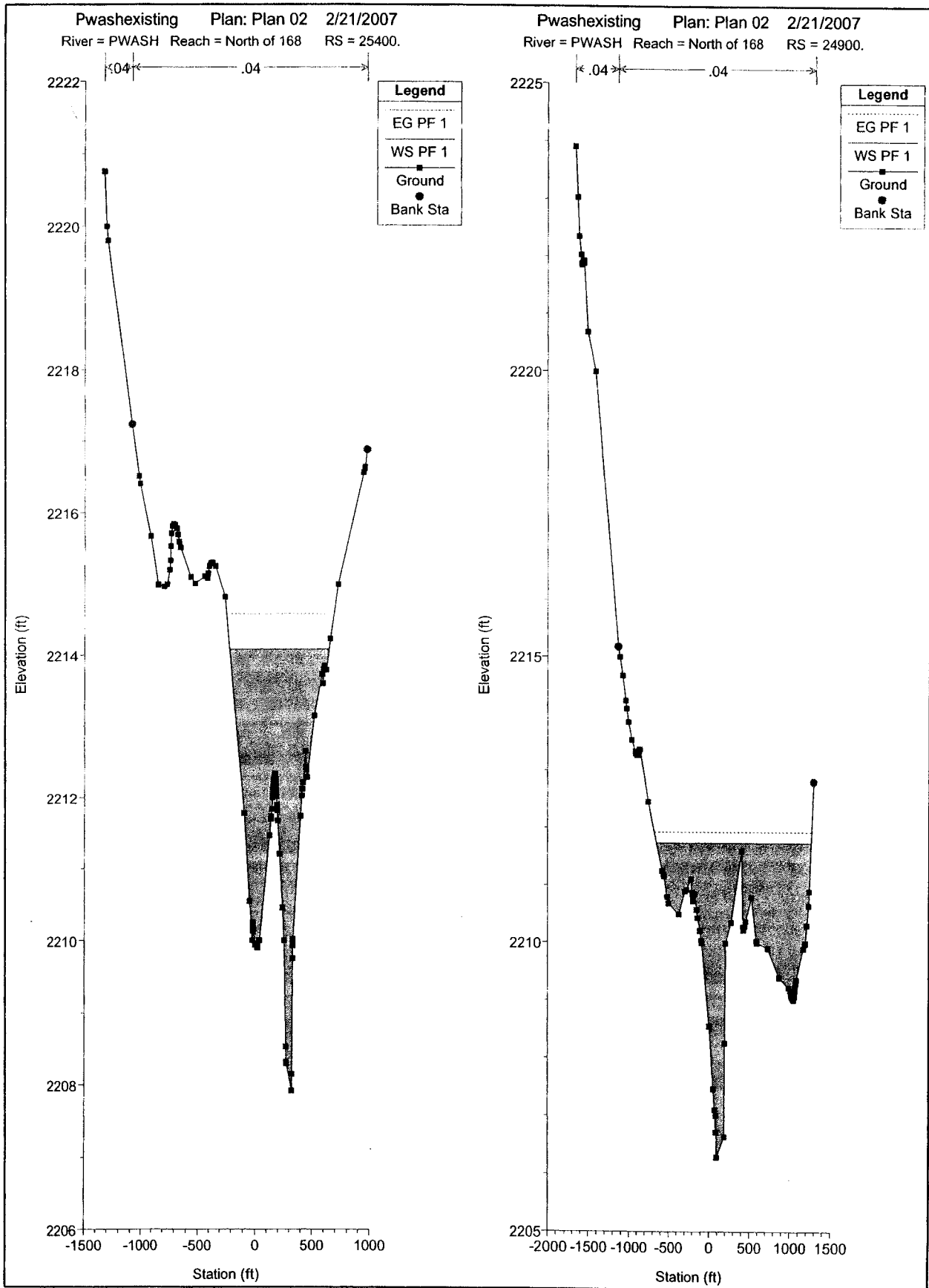


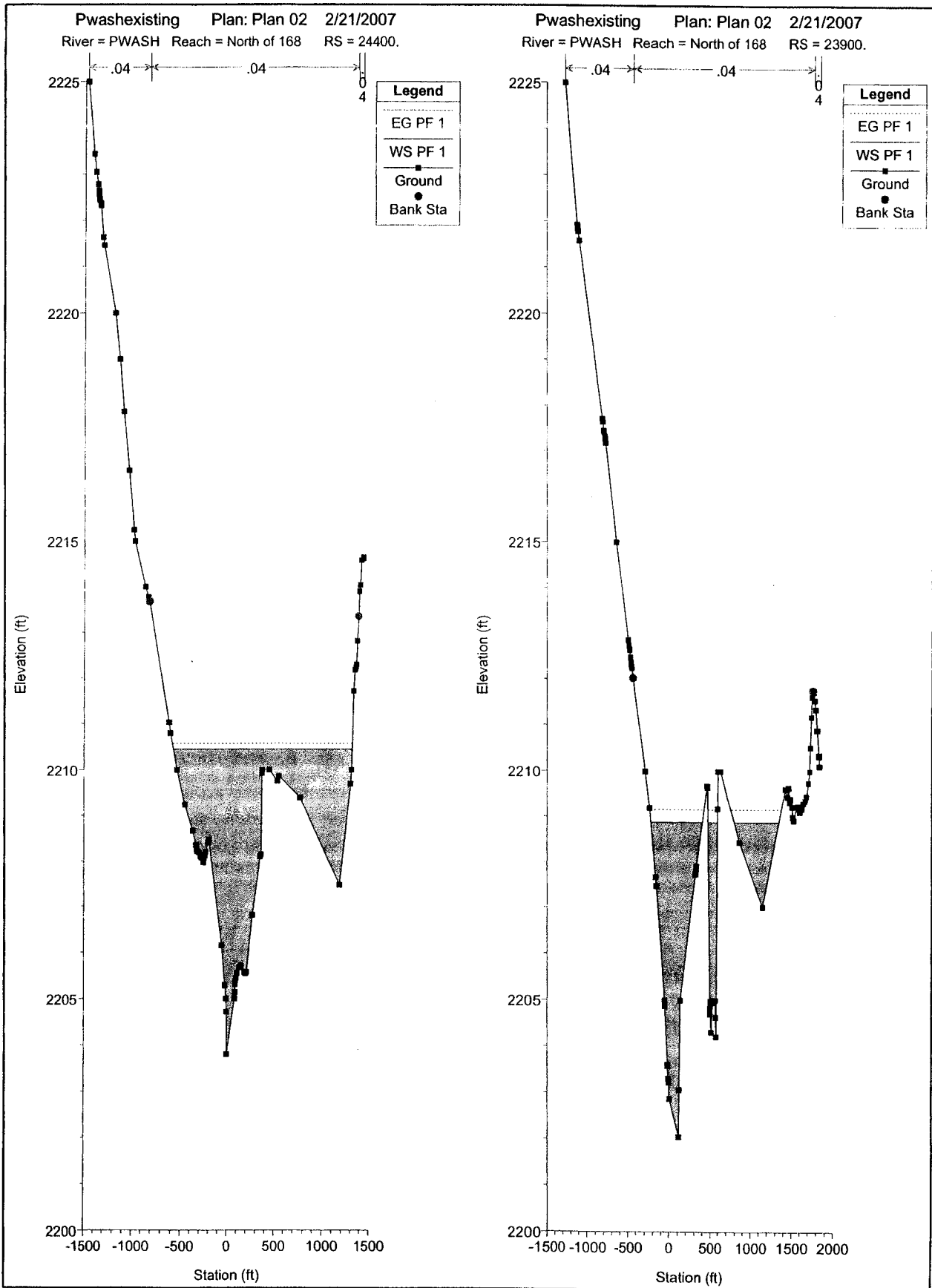
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 River = PWASH Reach = North of 168 RS = 27900.



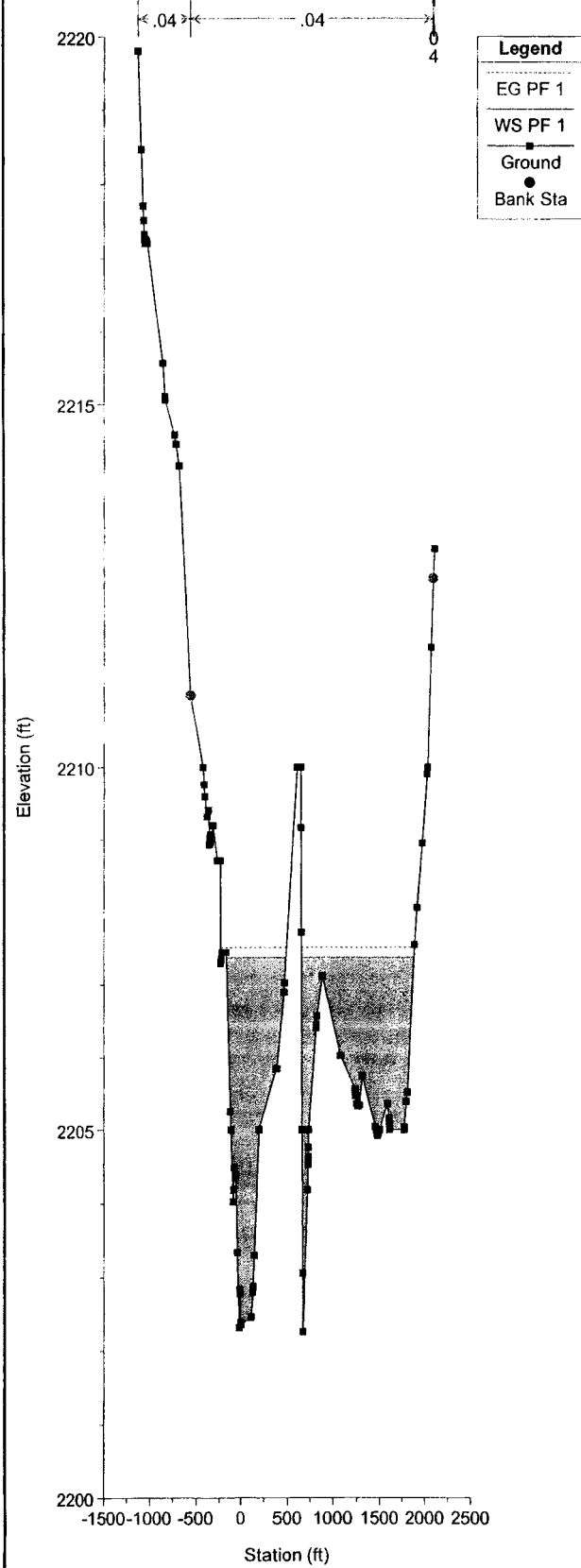




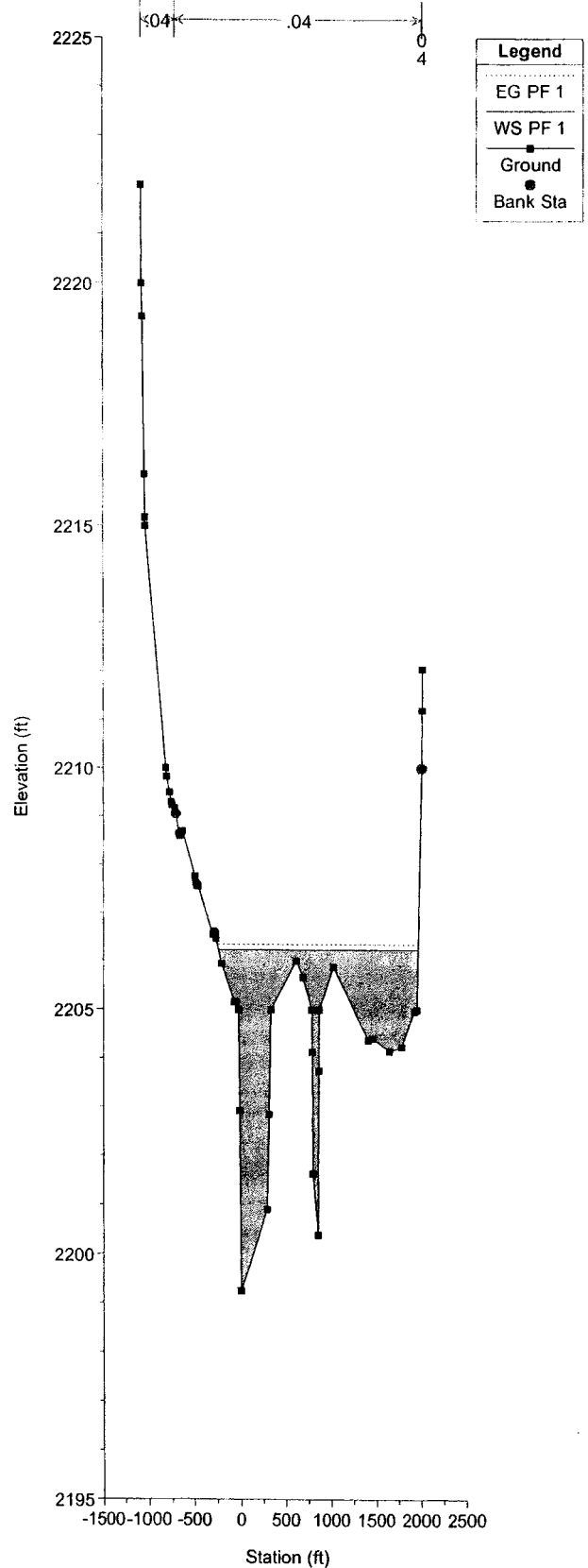


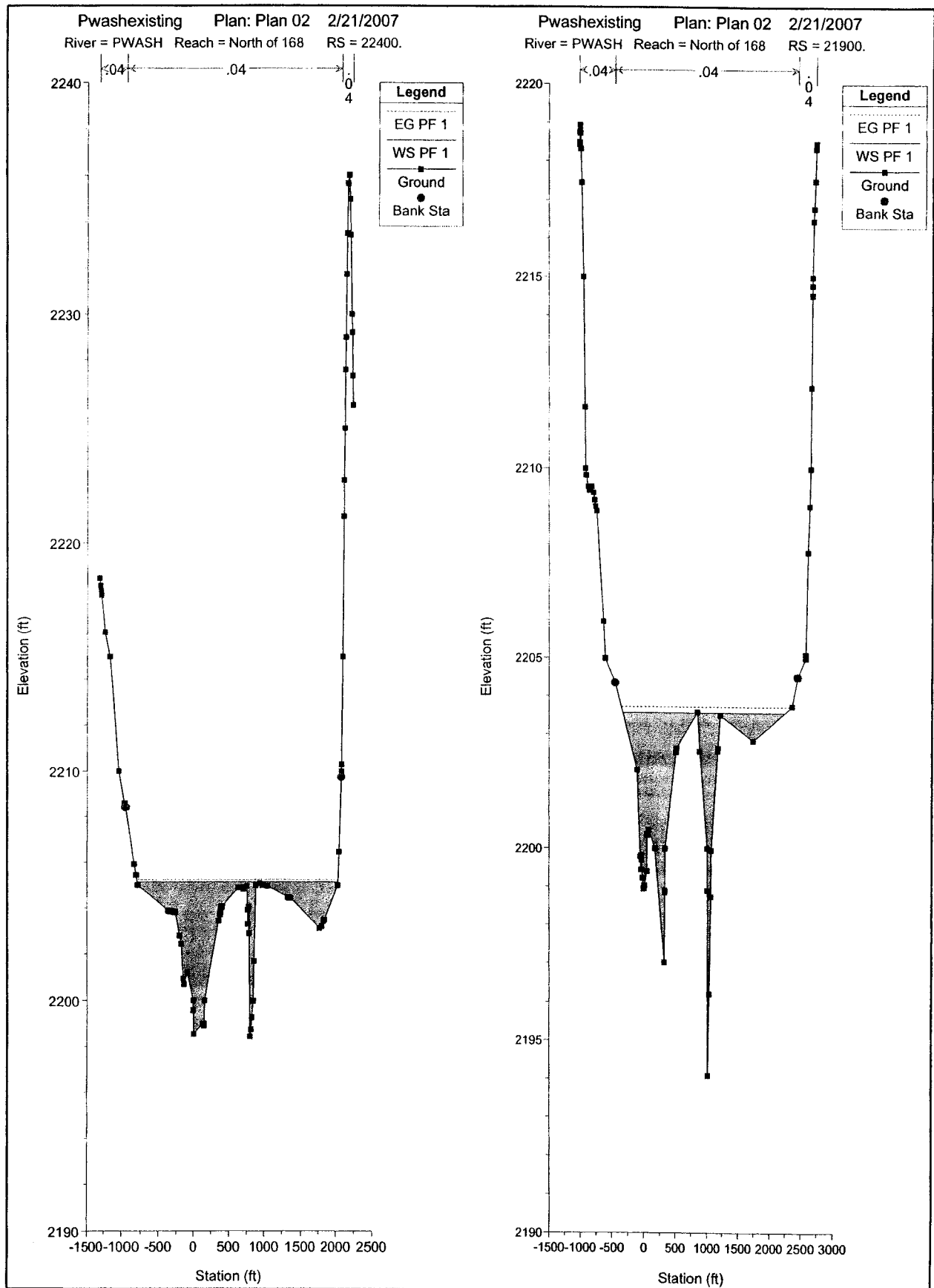


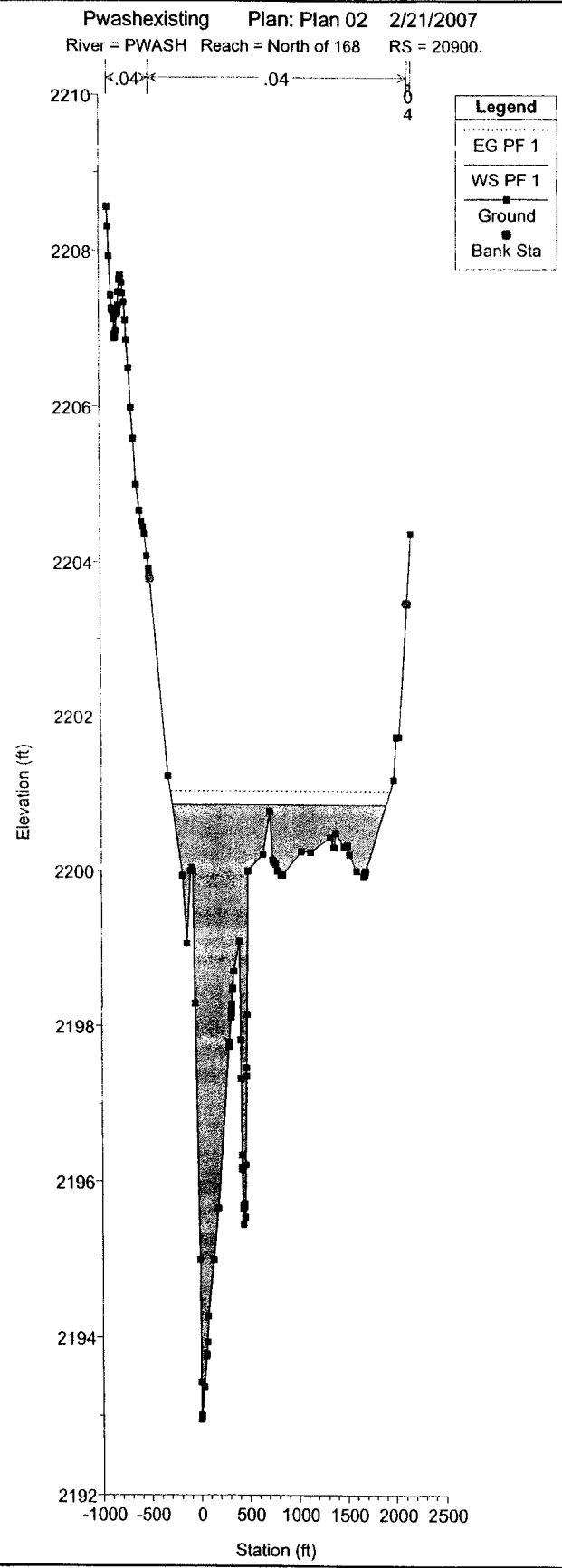
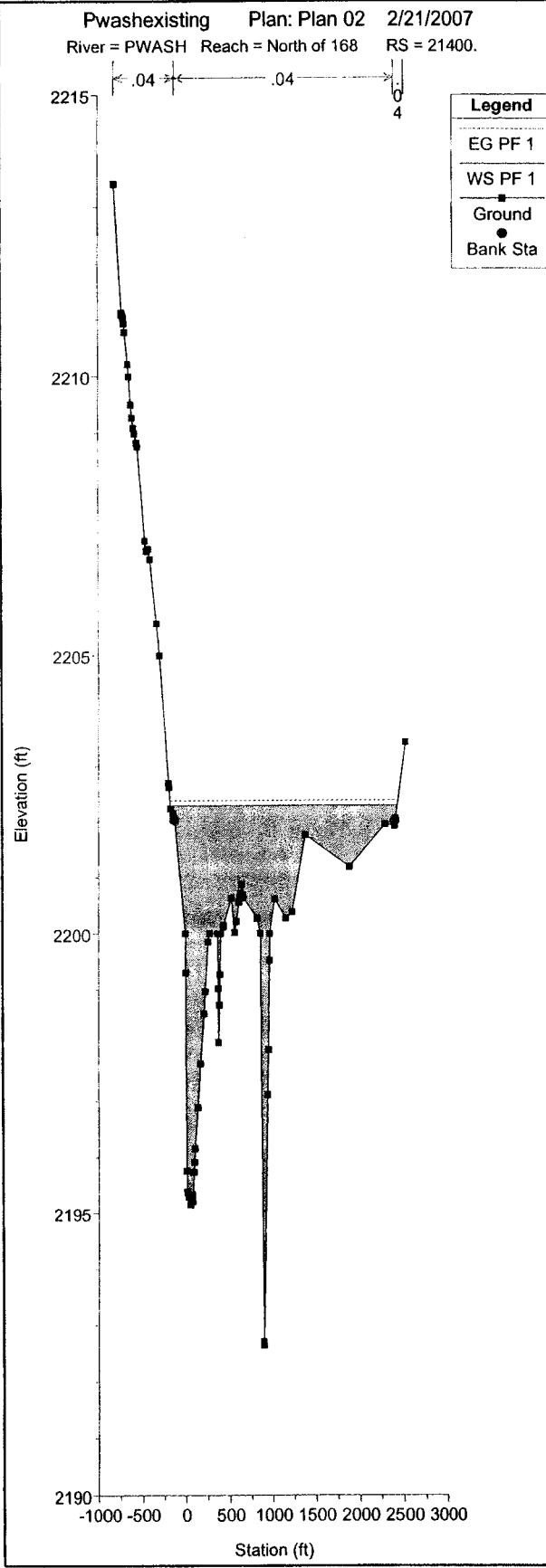
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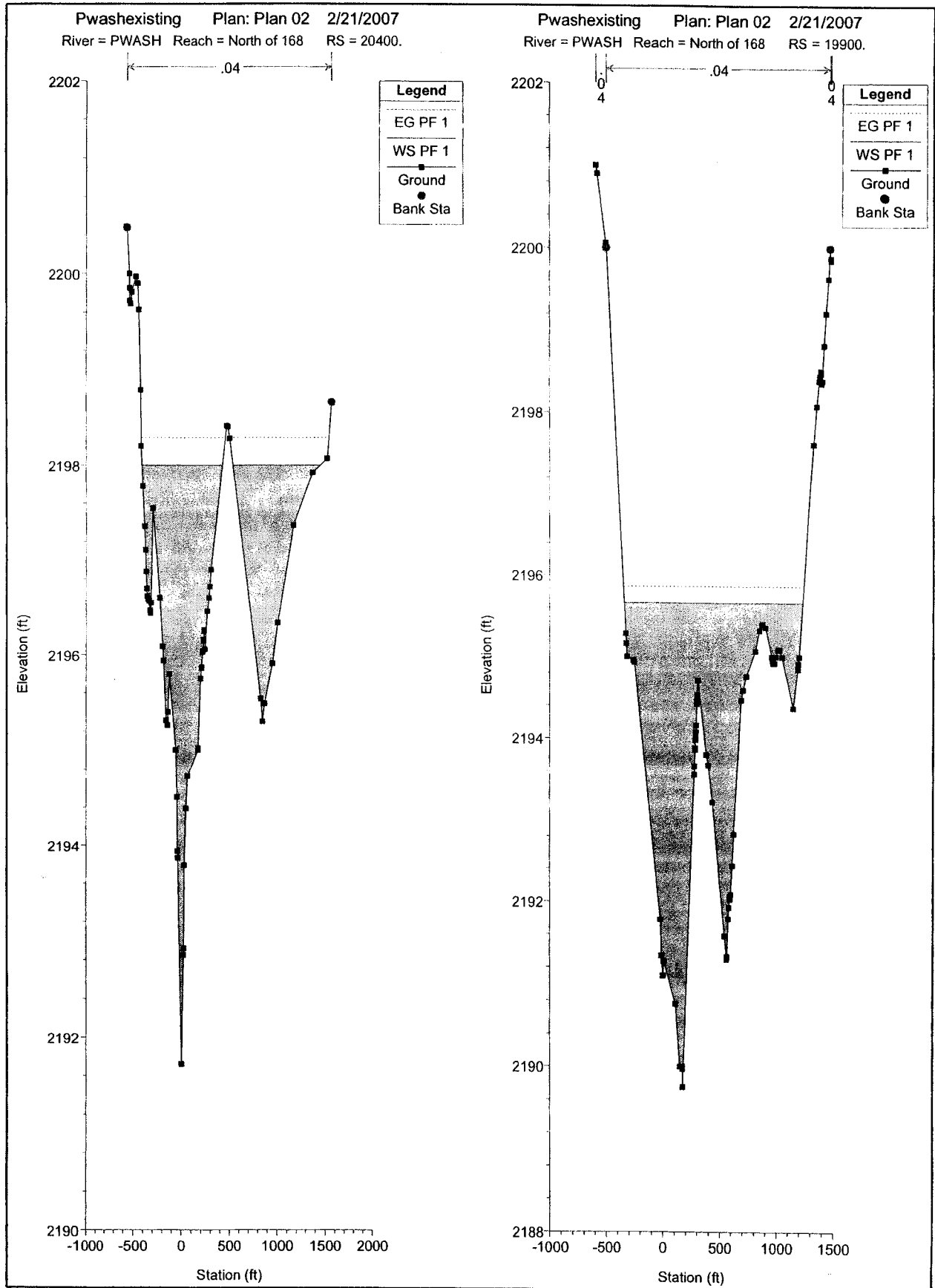


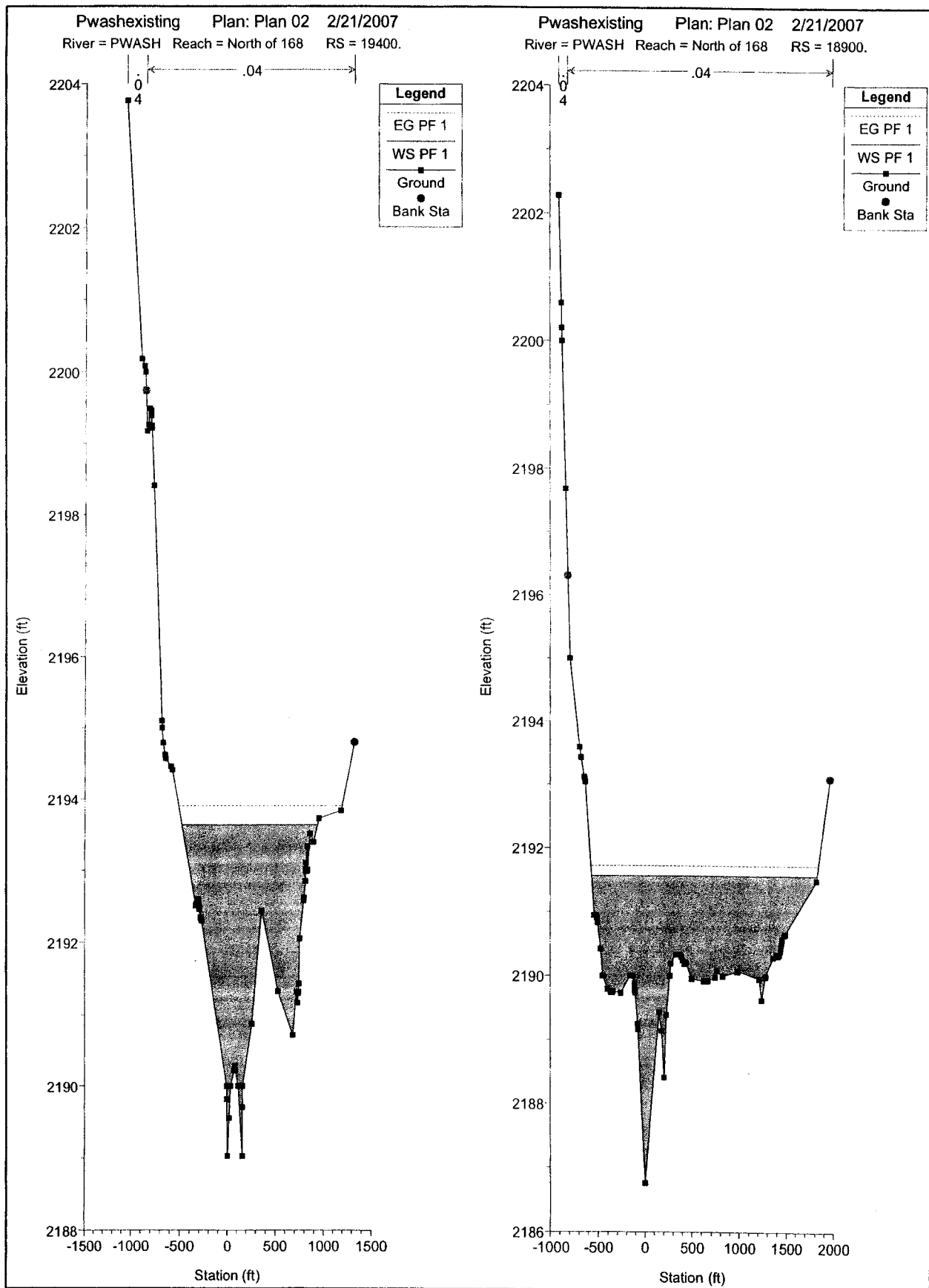
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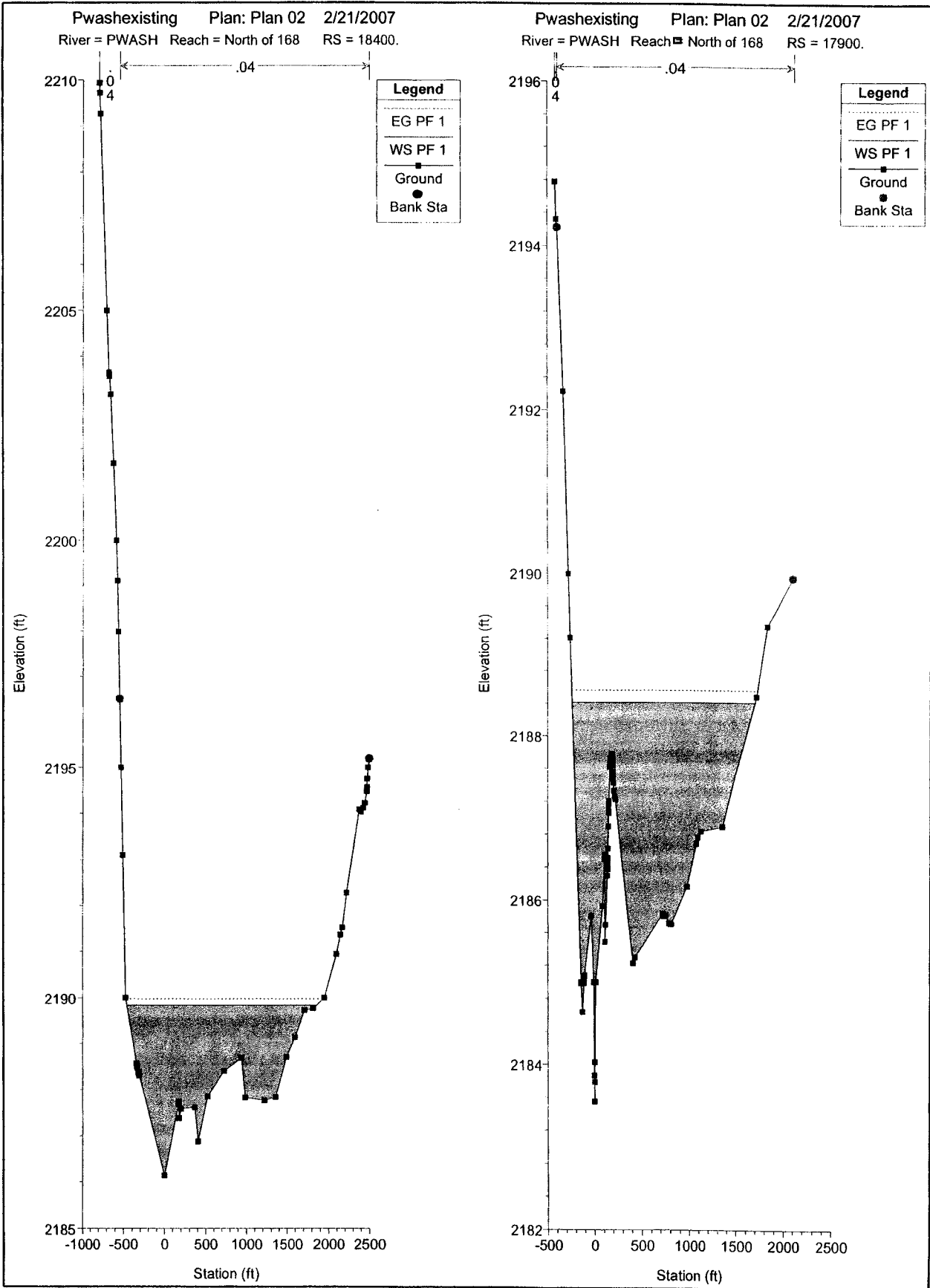


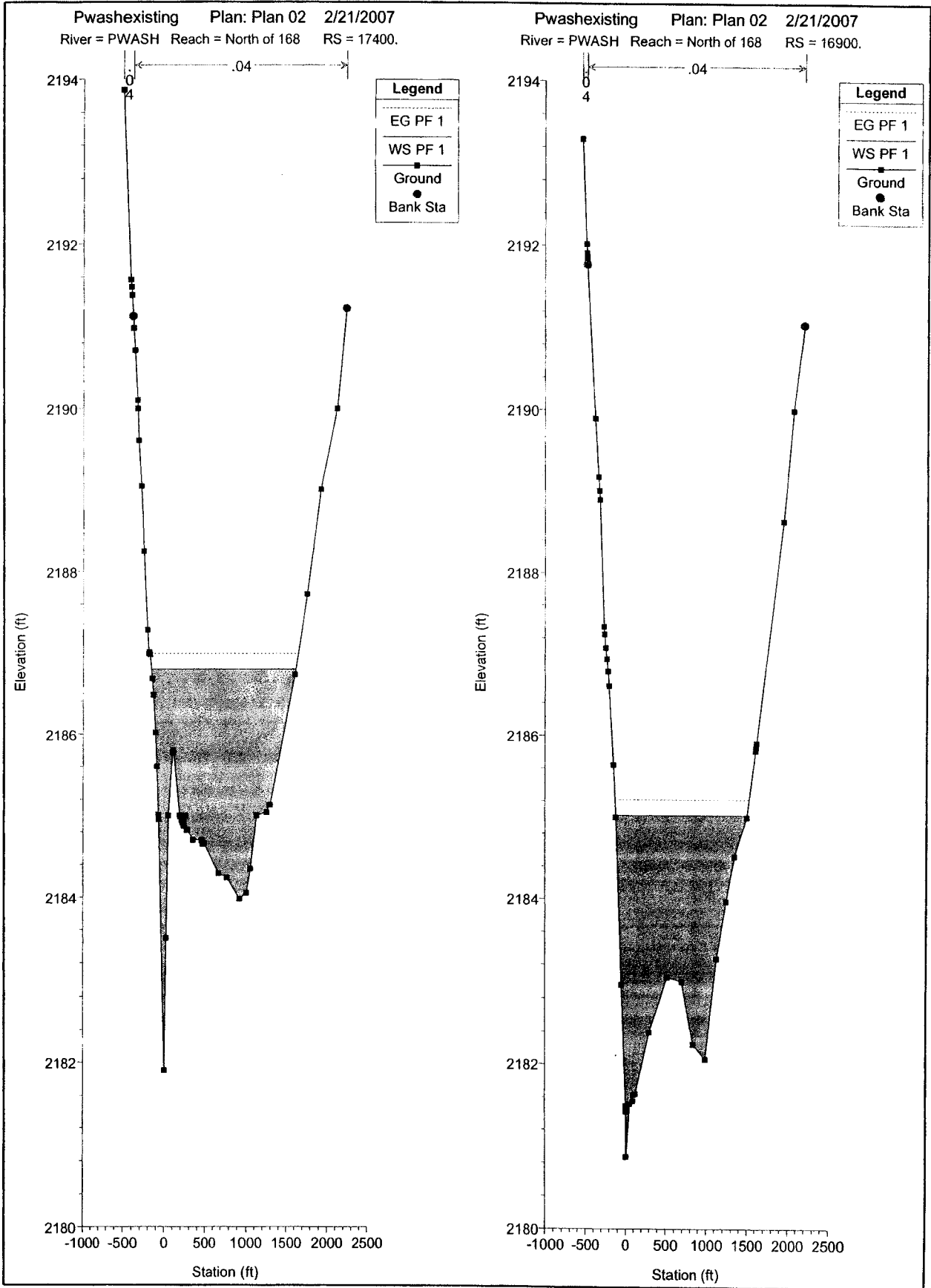


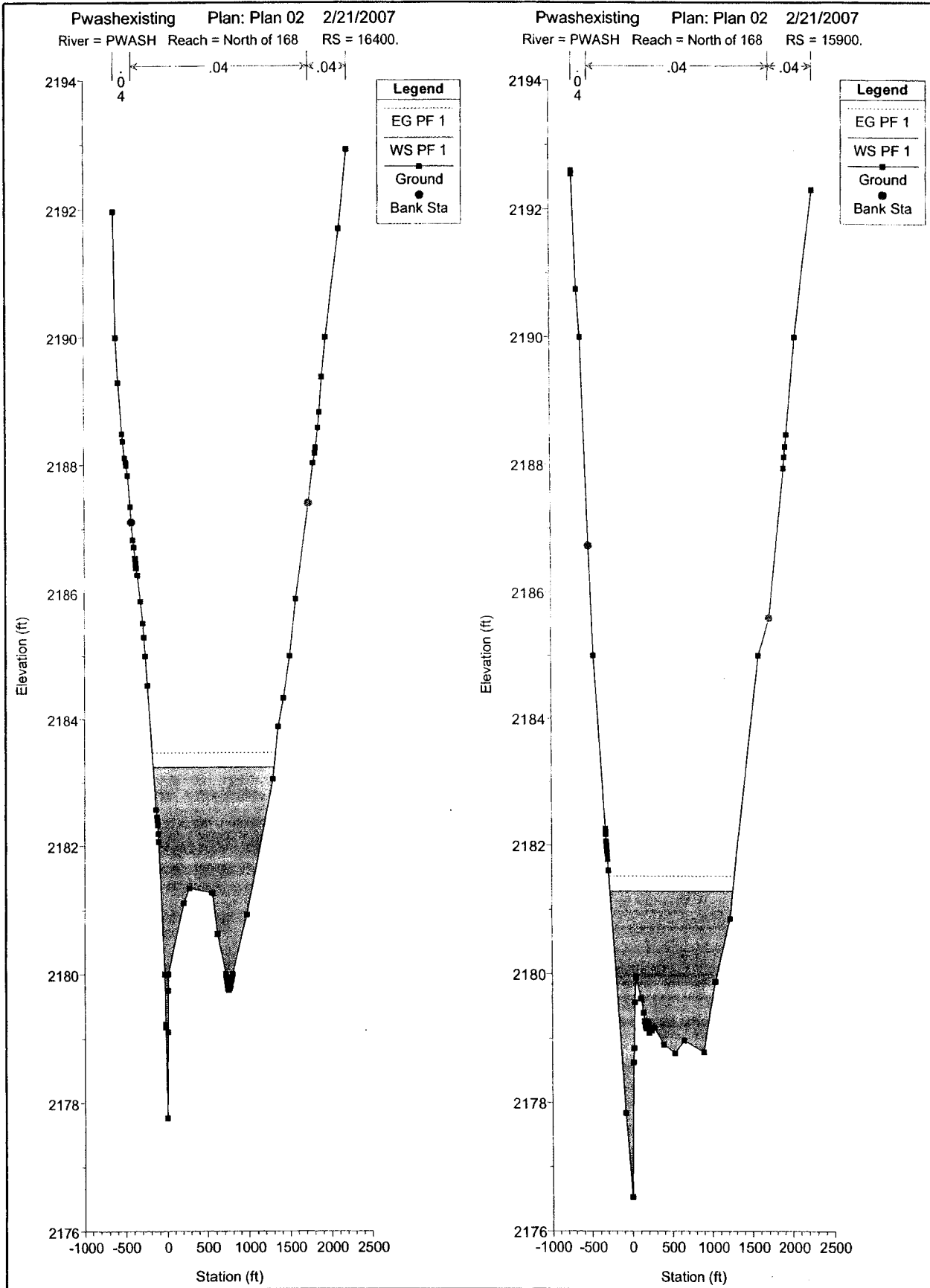




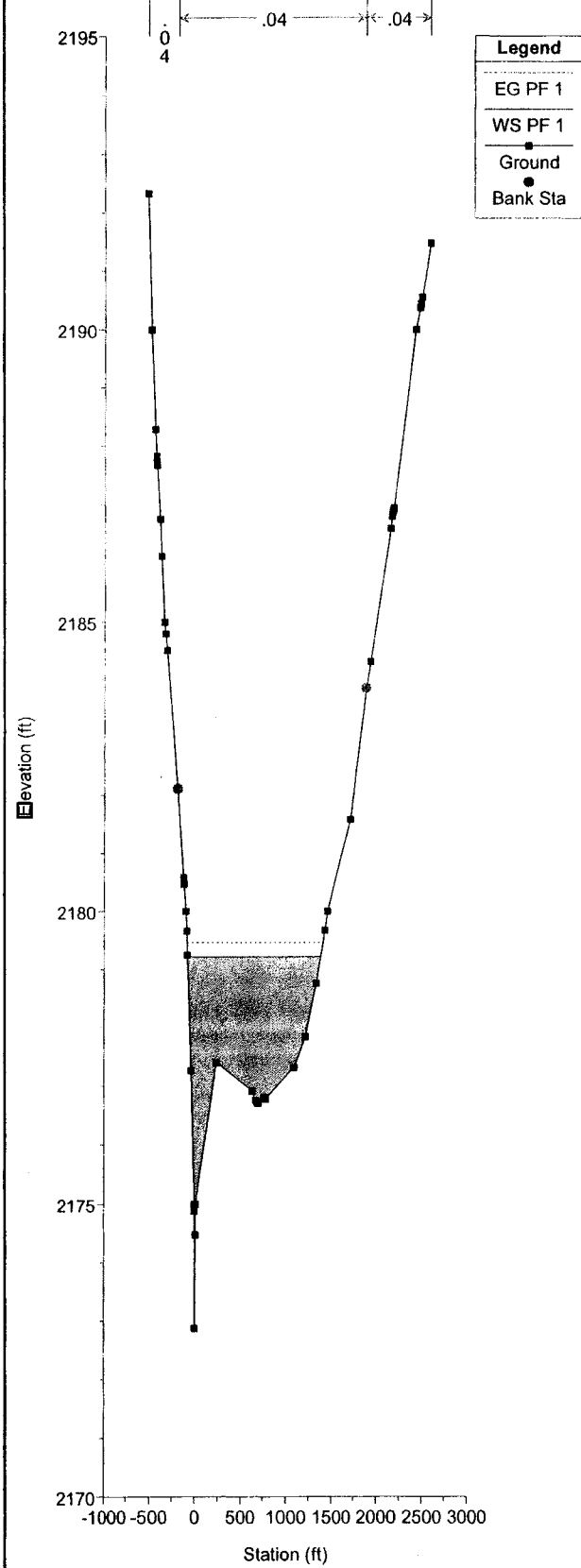




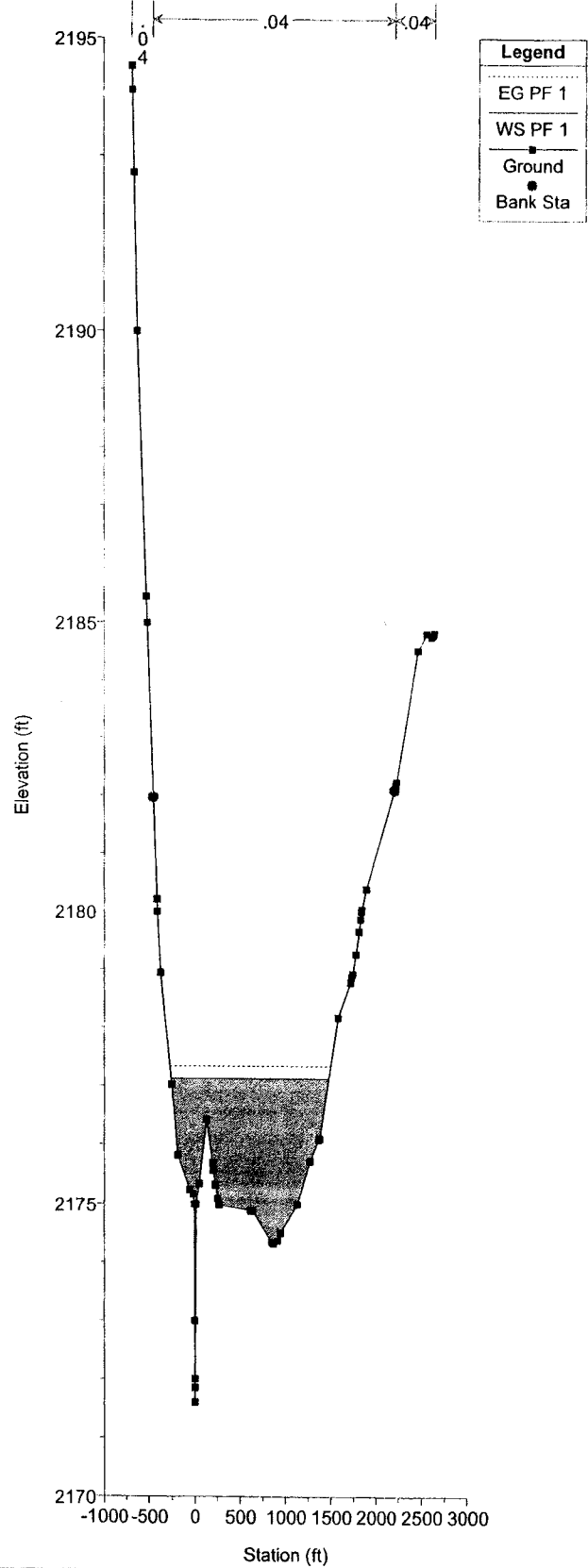


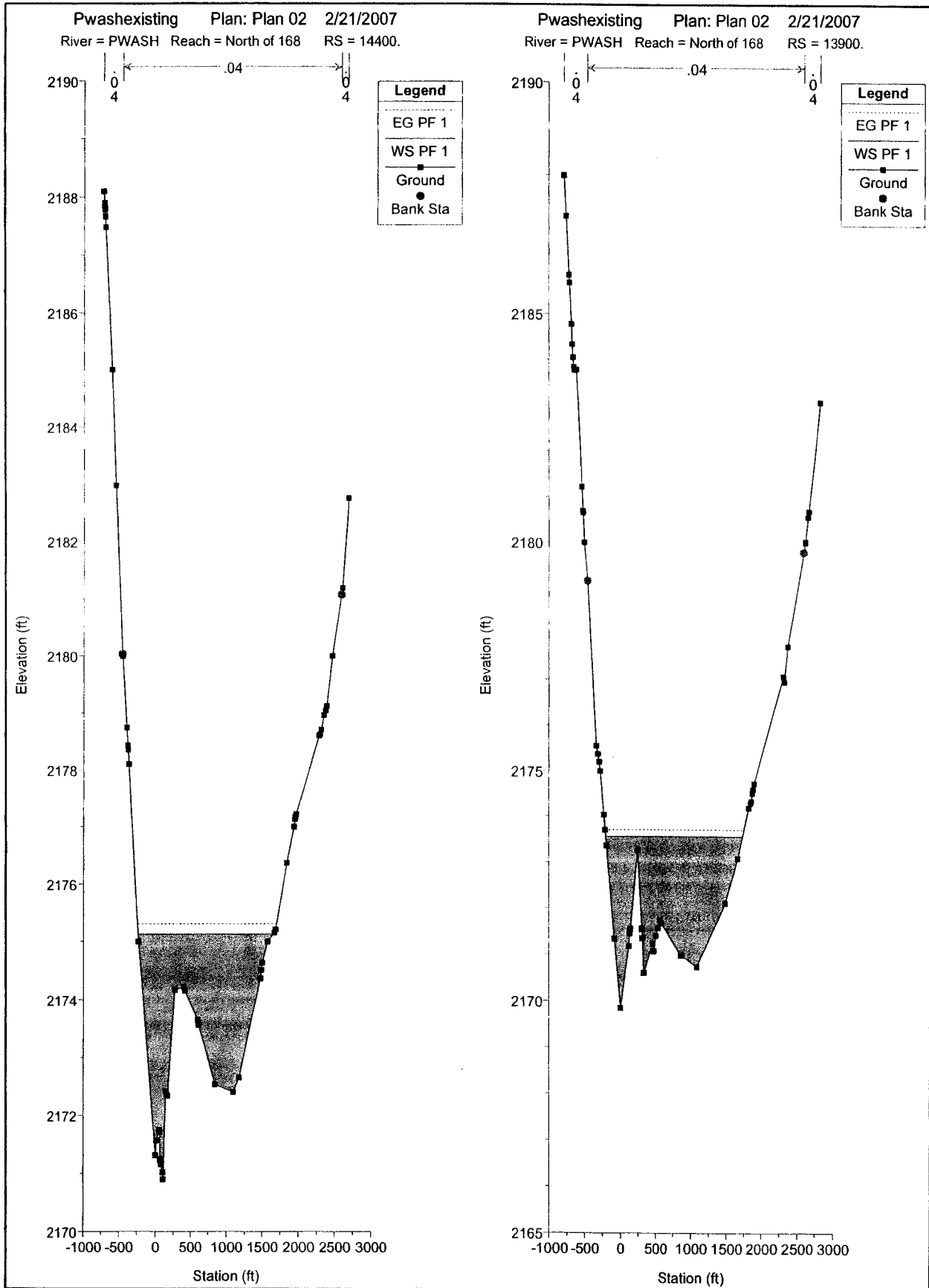


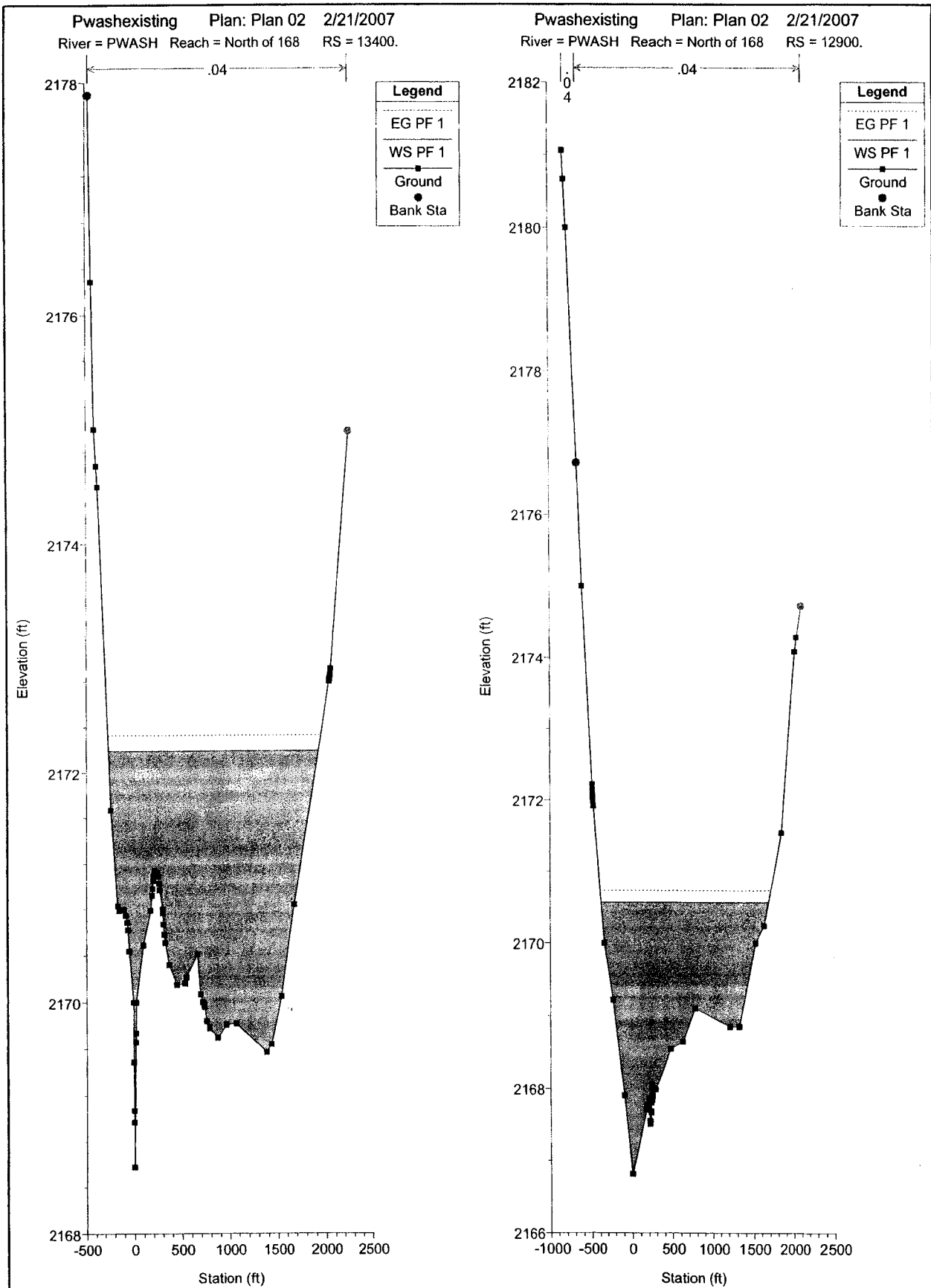
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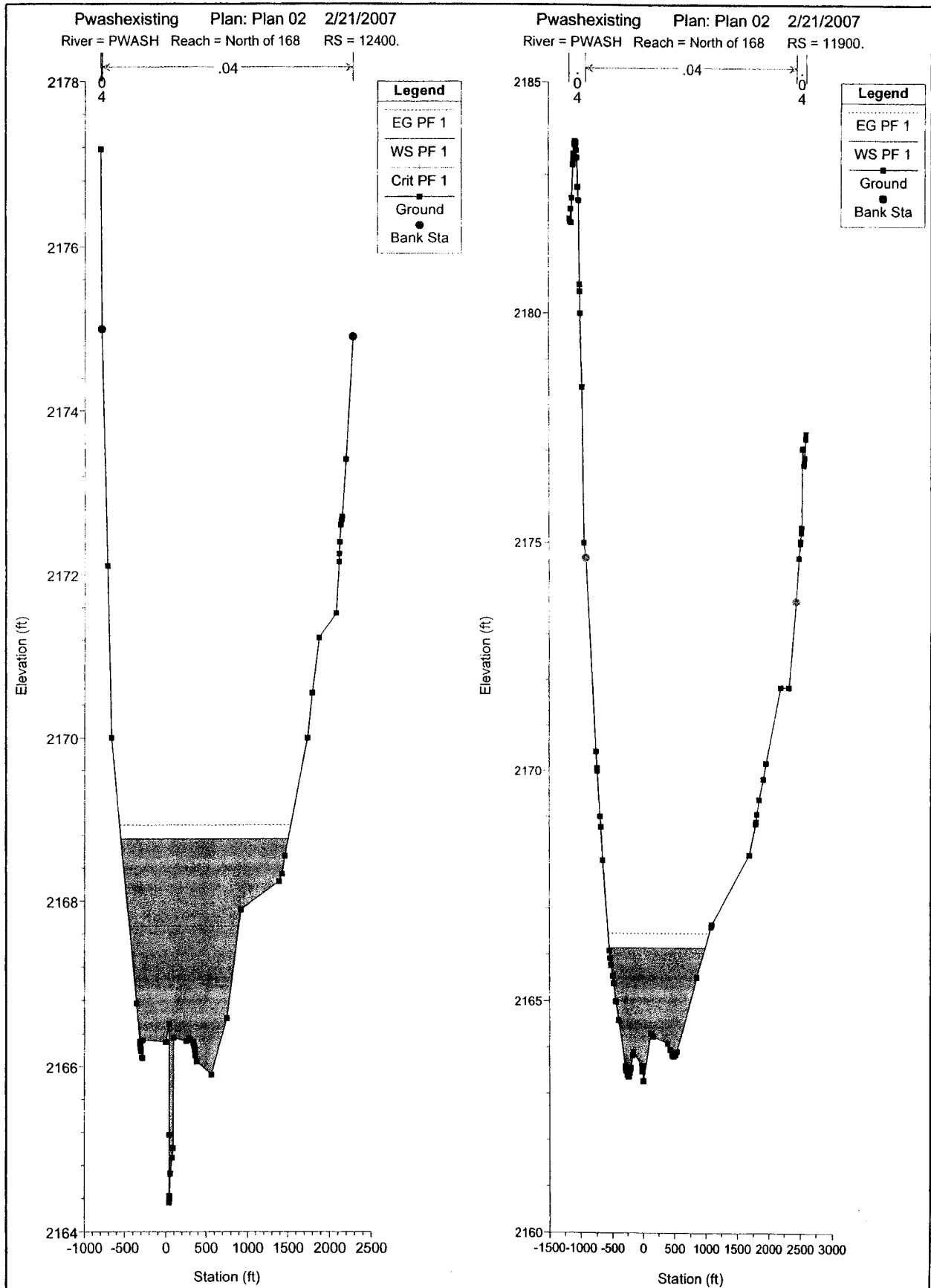


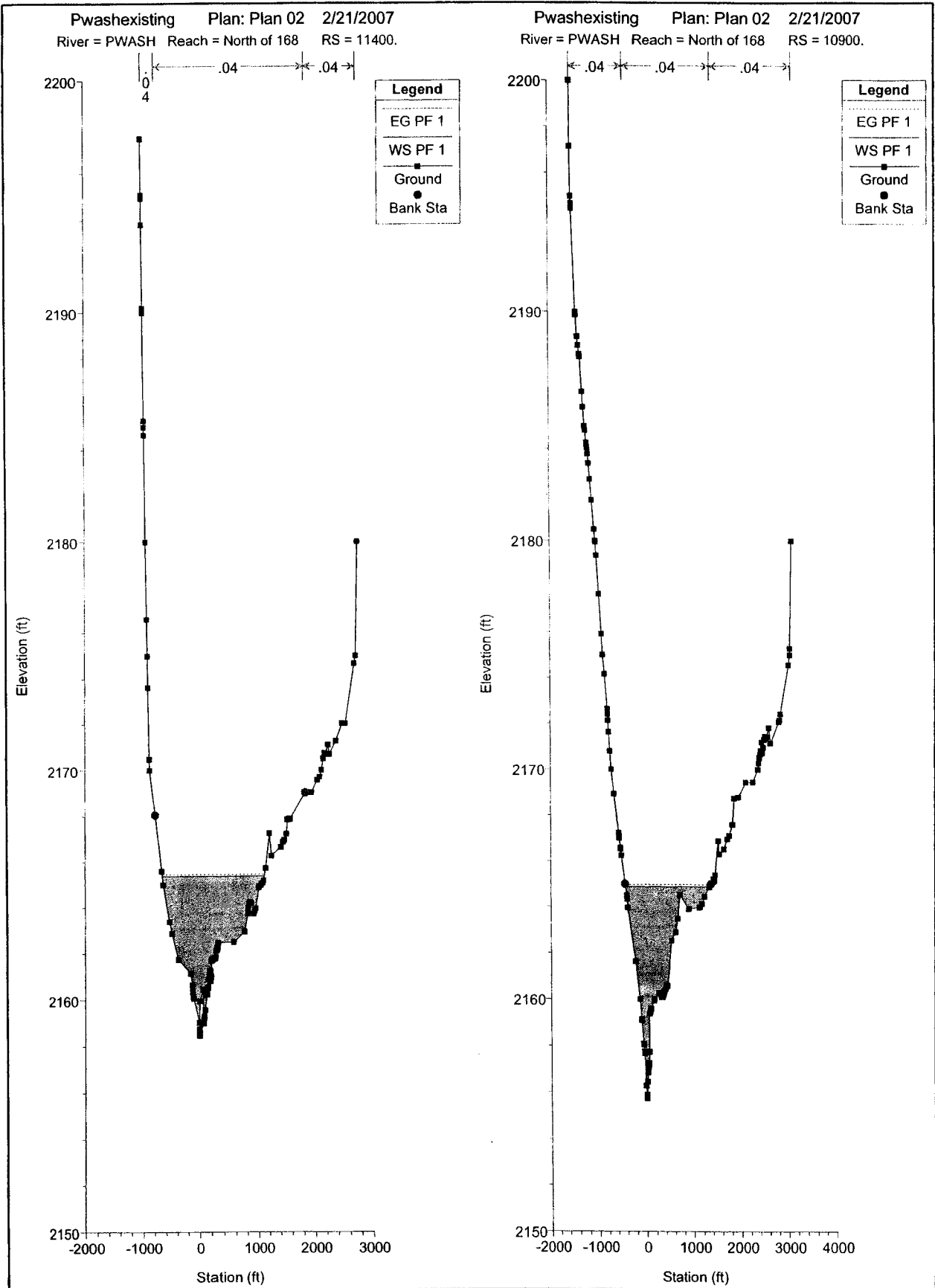
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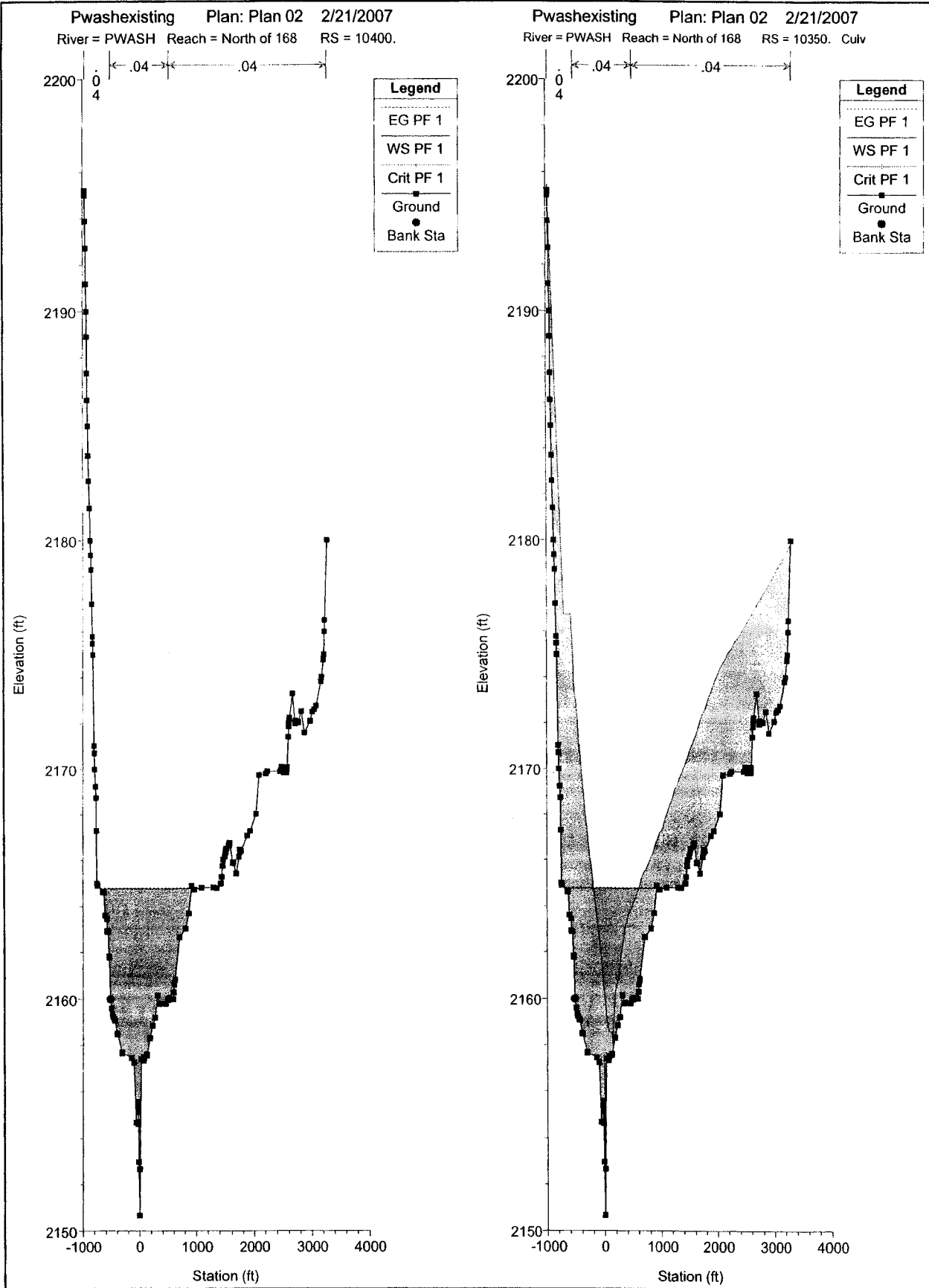


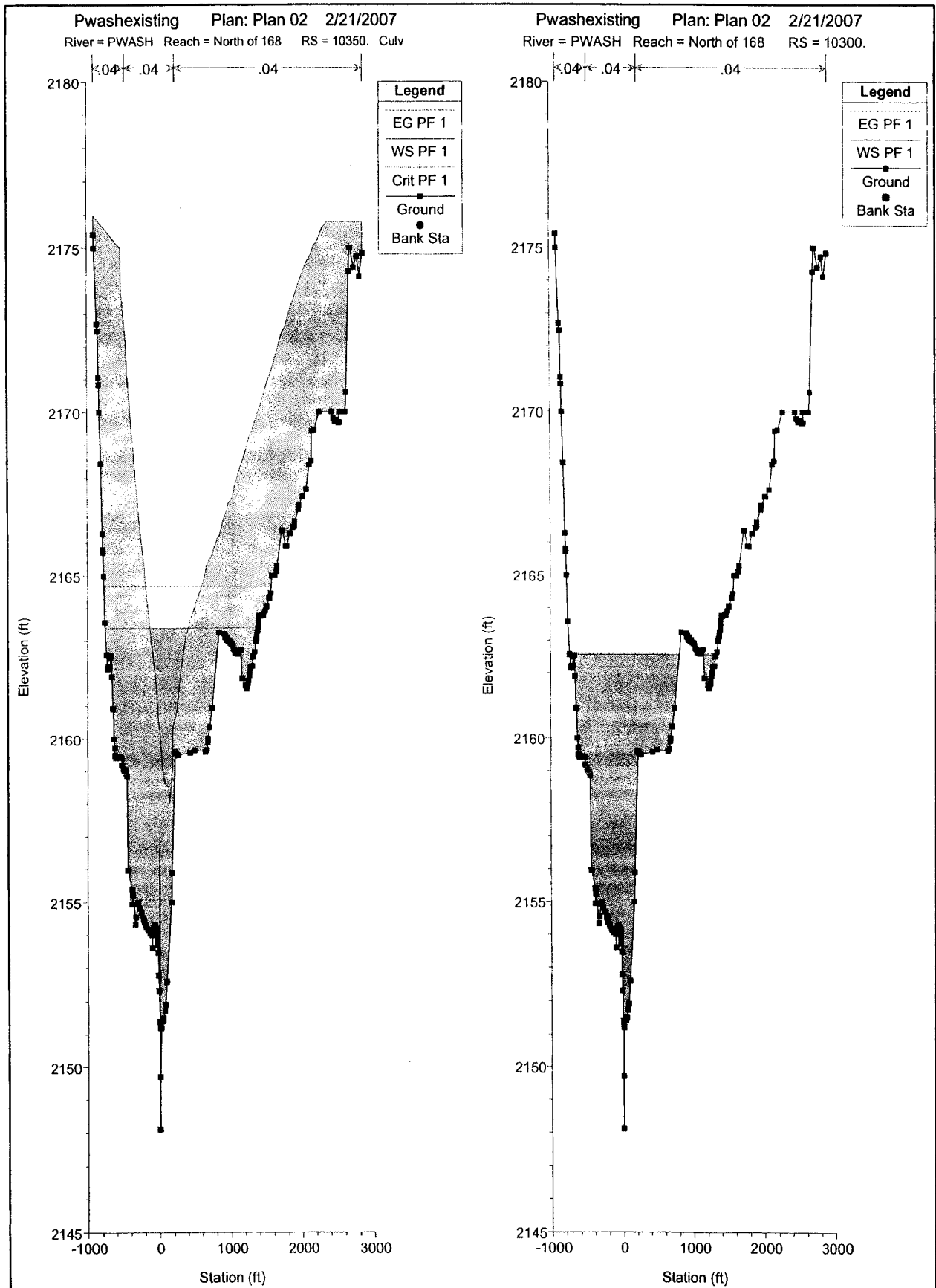


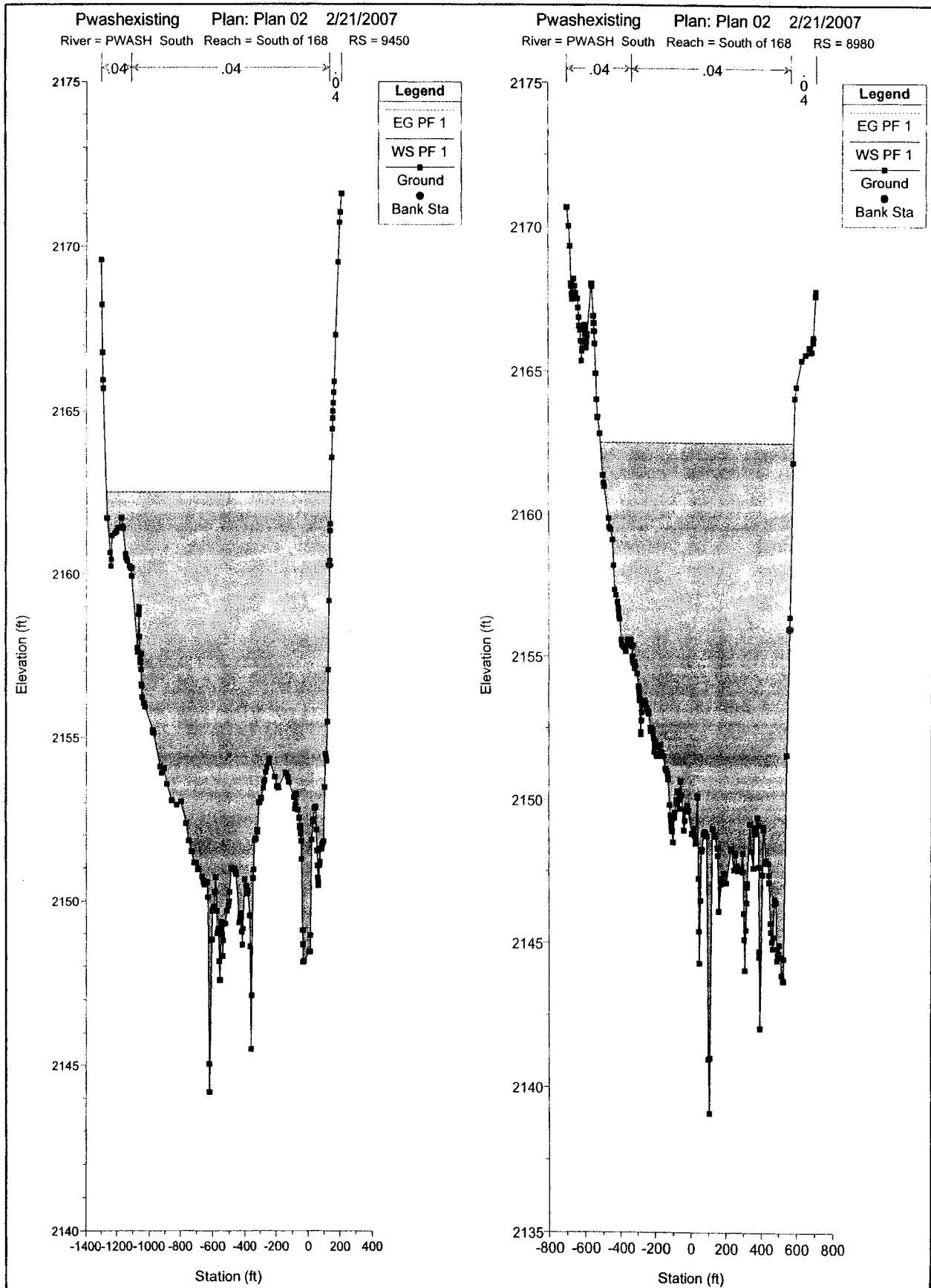


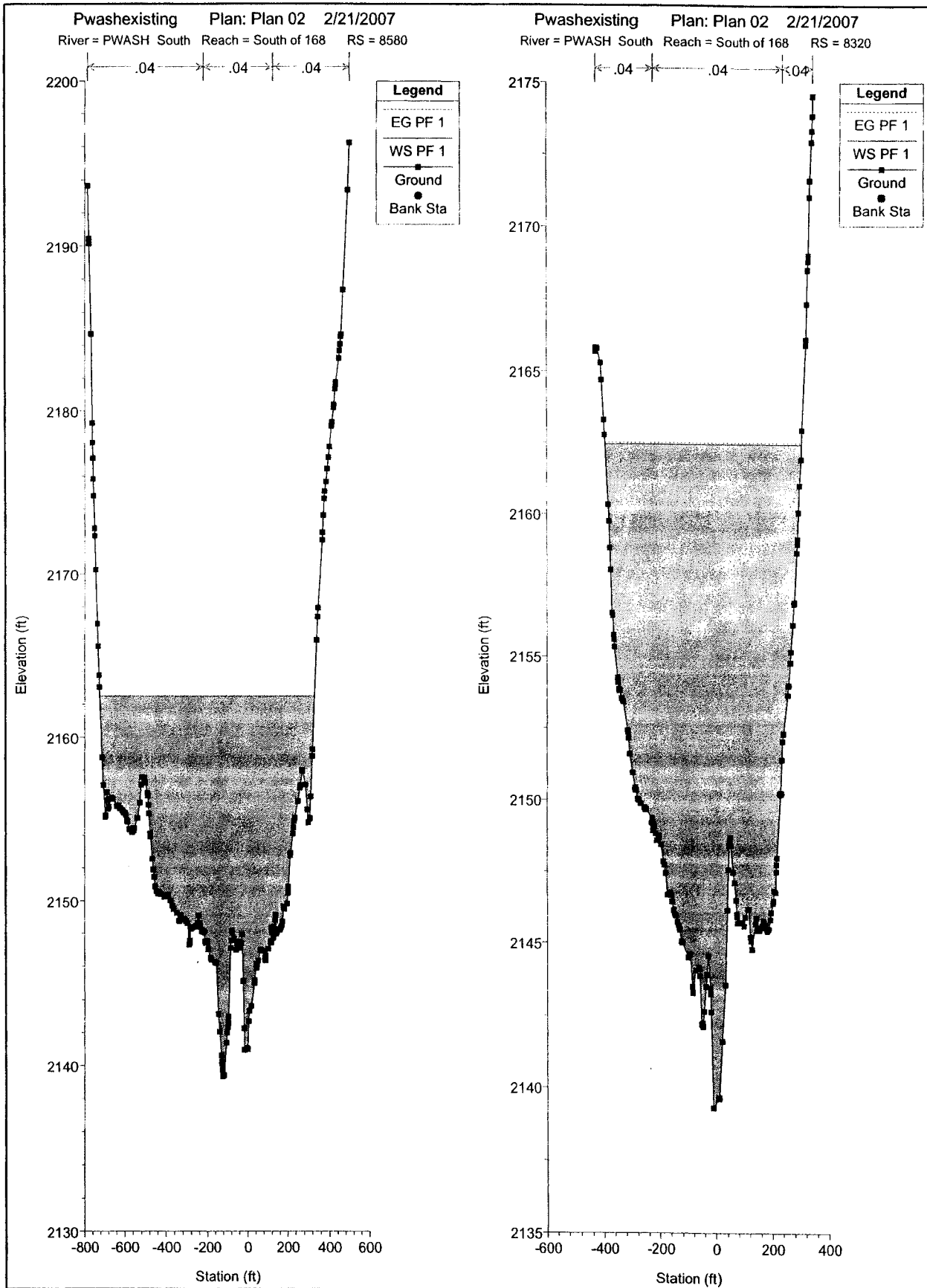


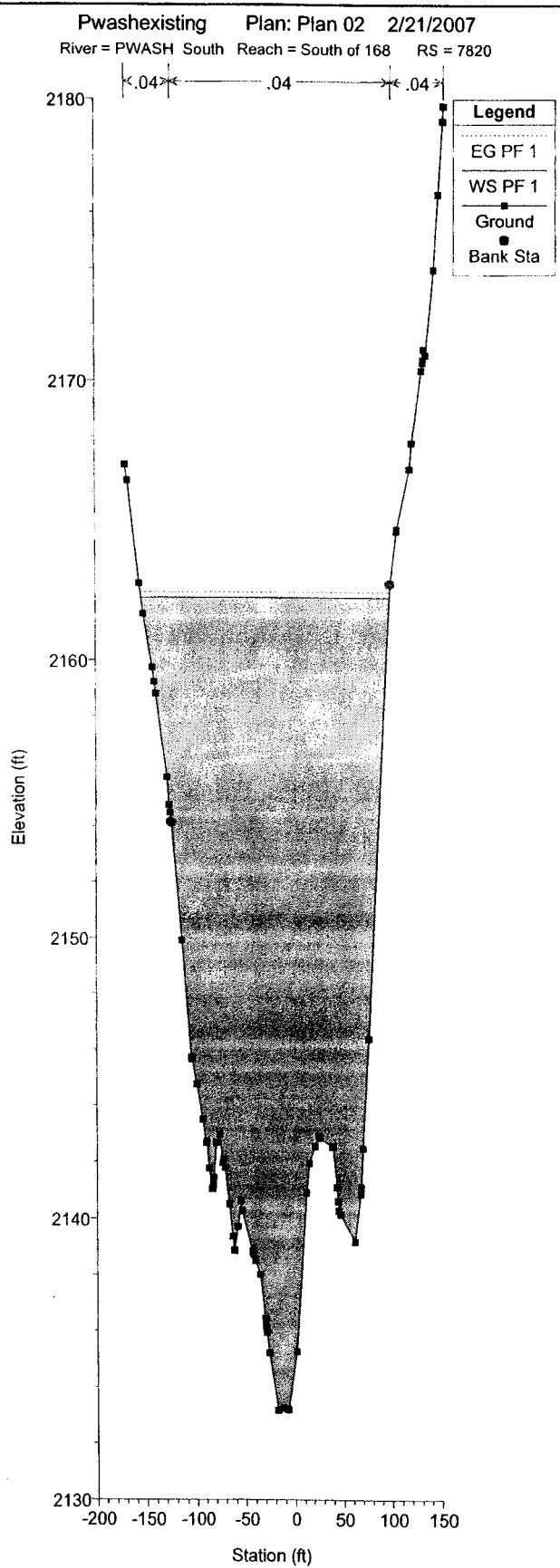
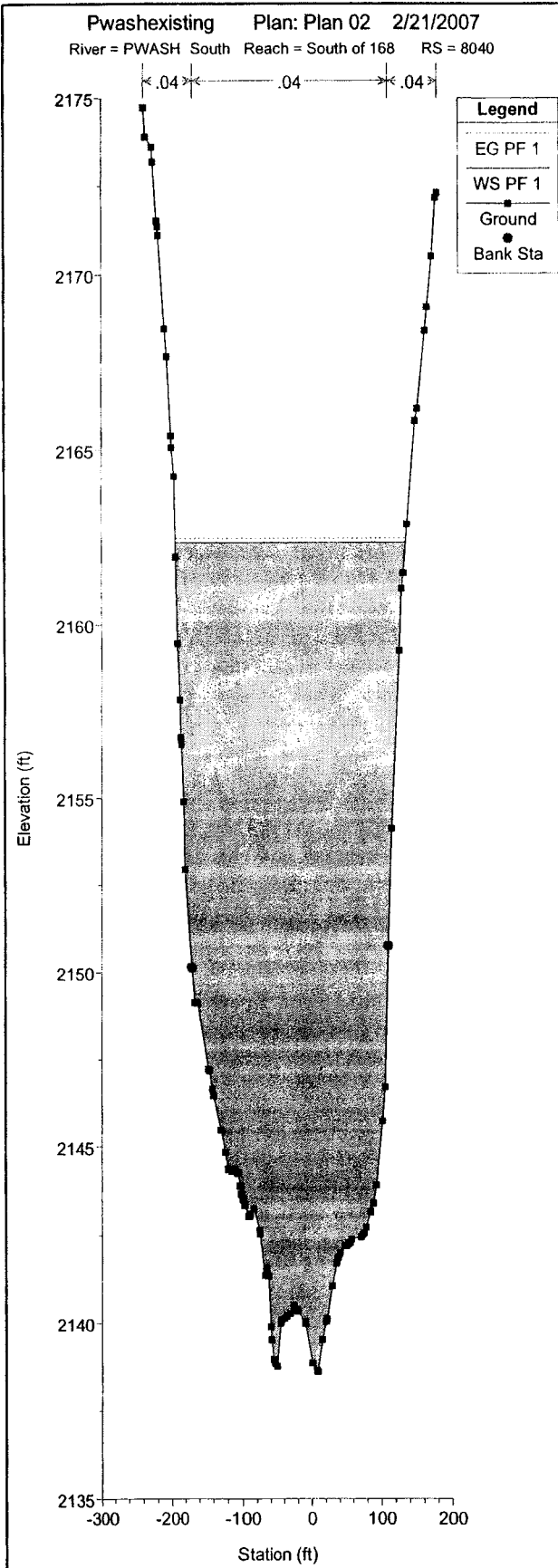


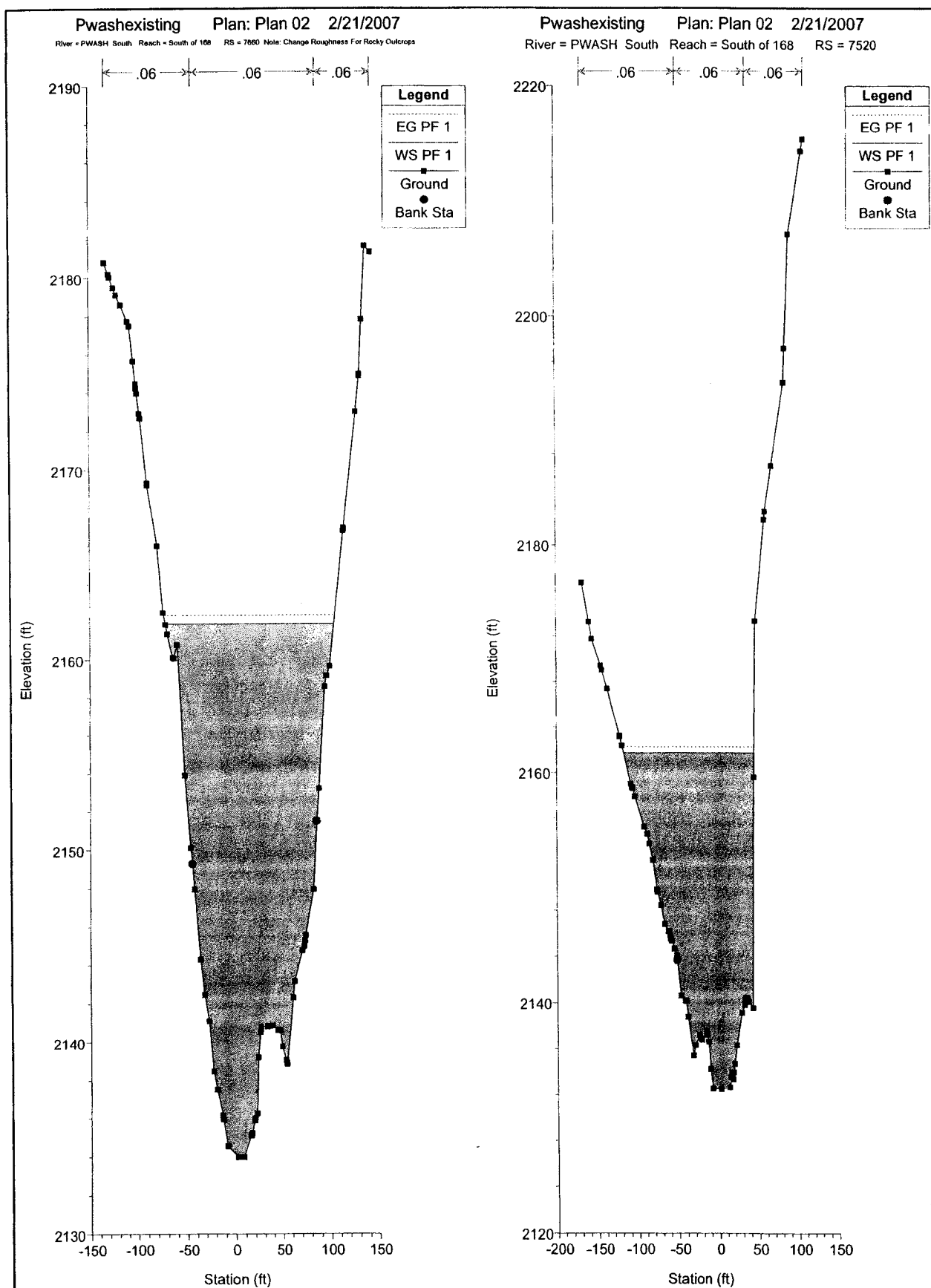


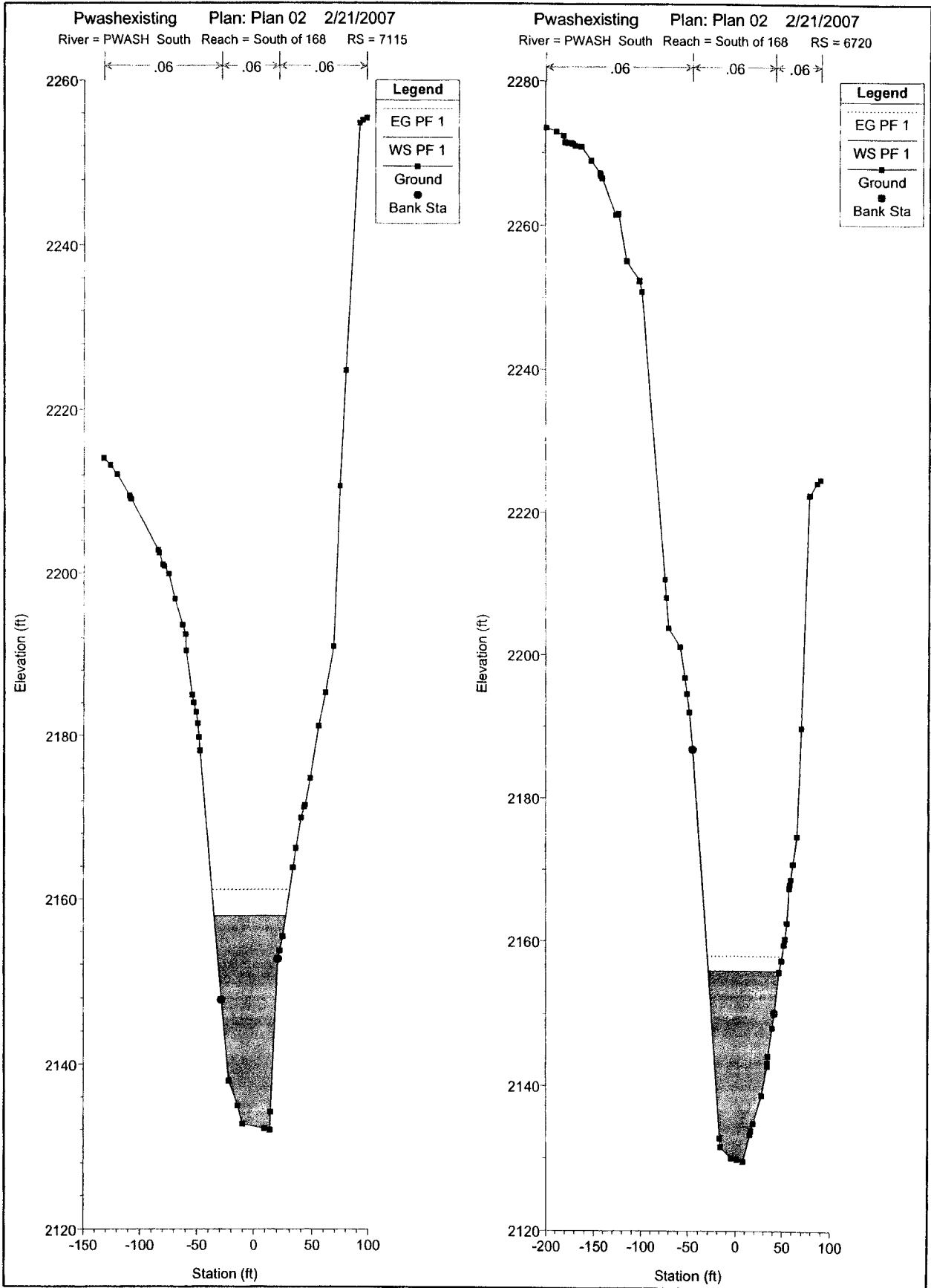


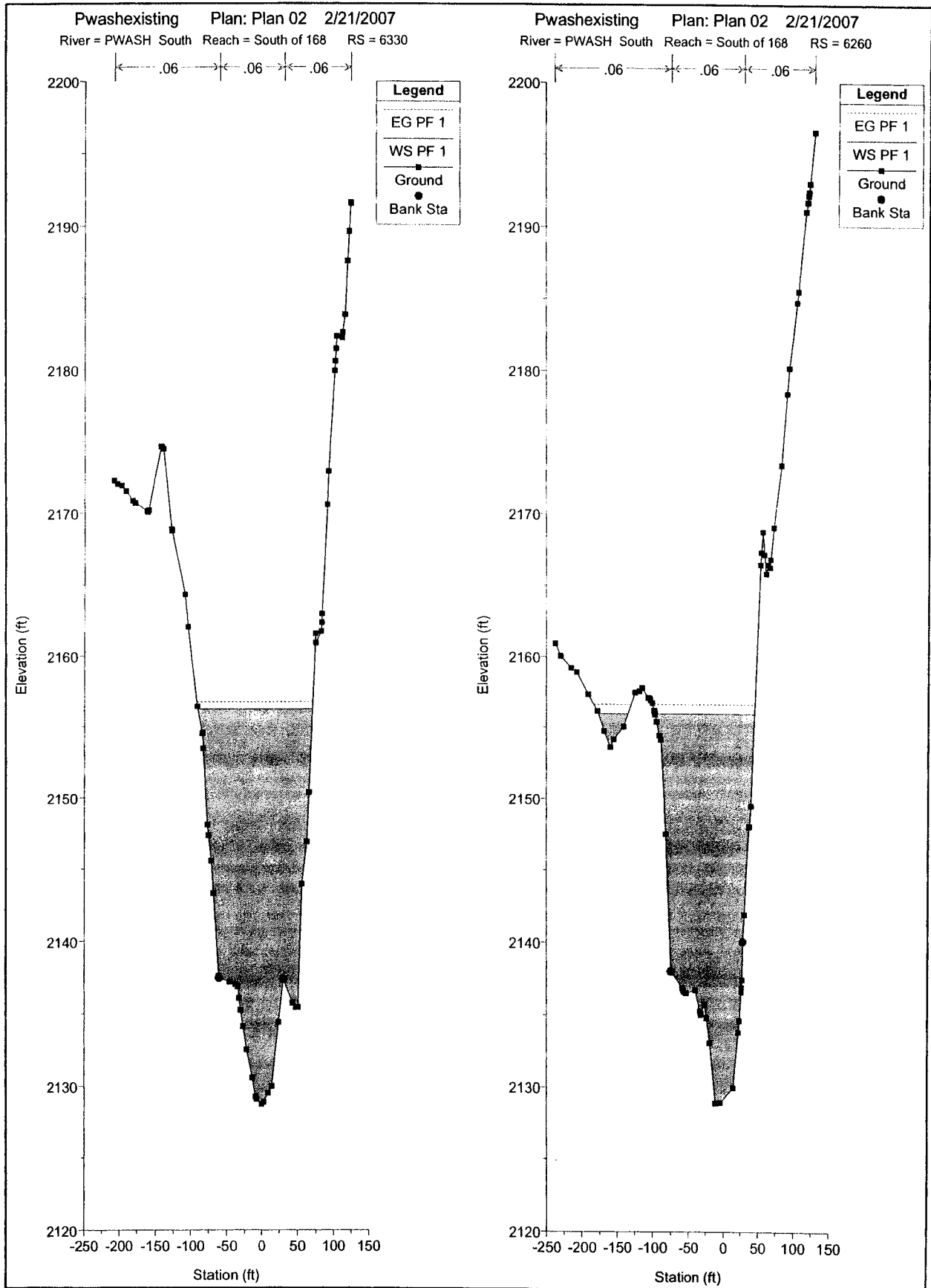


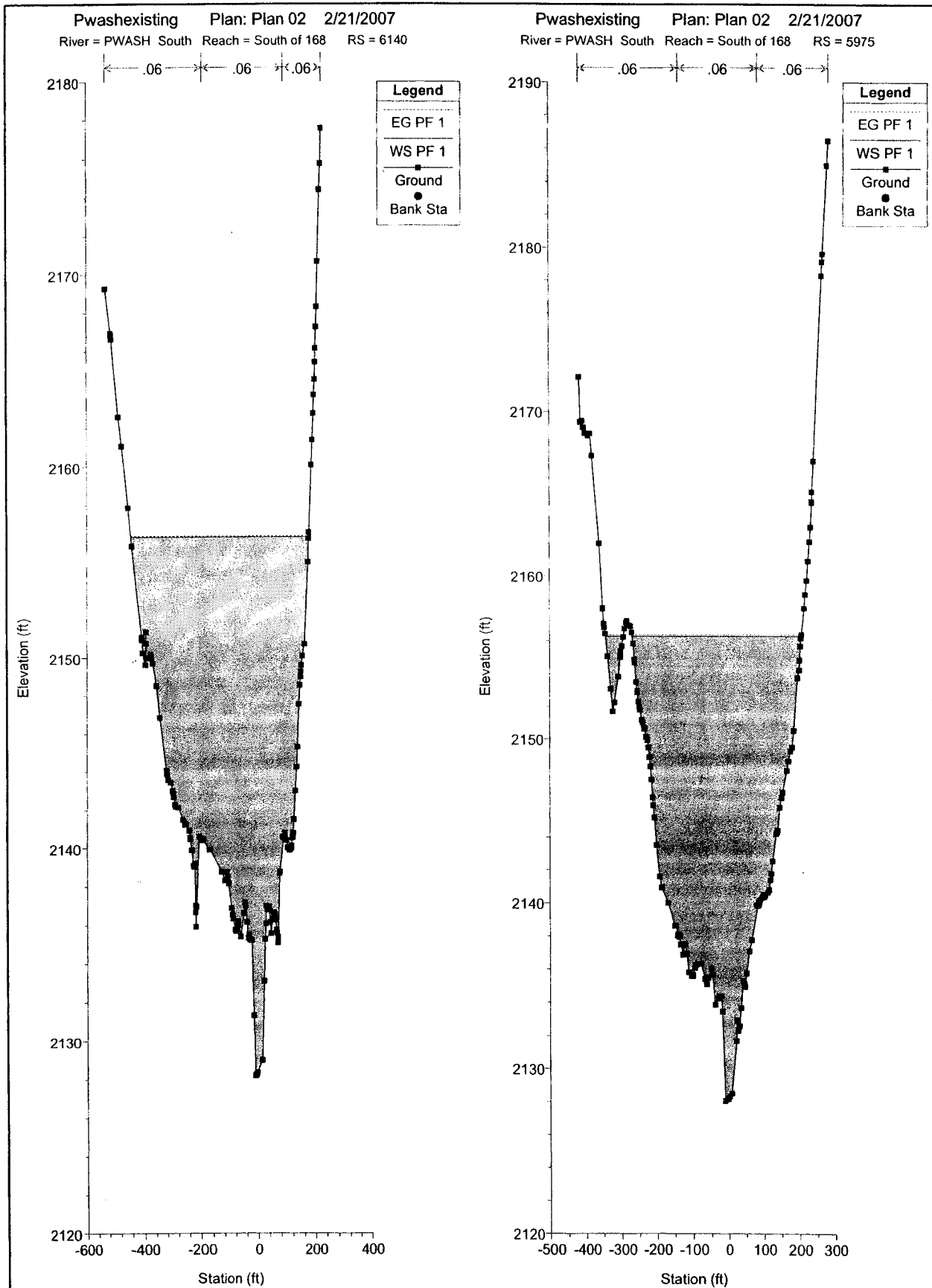


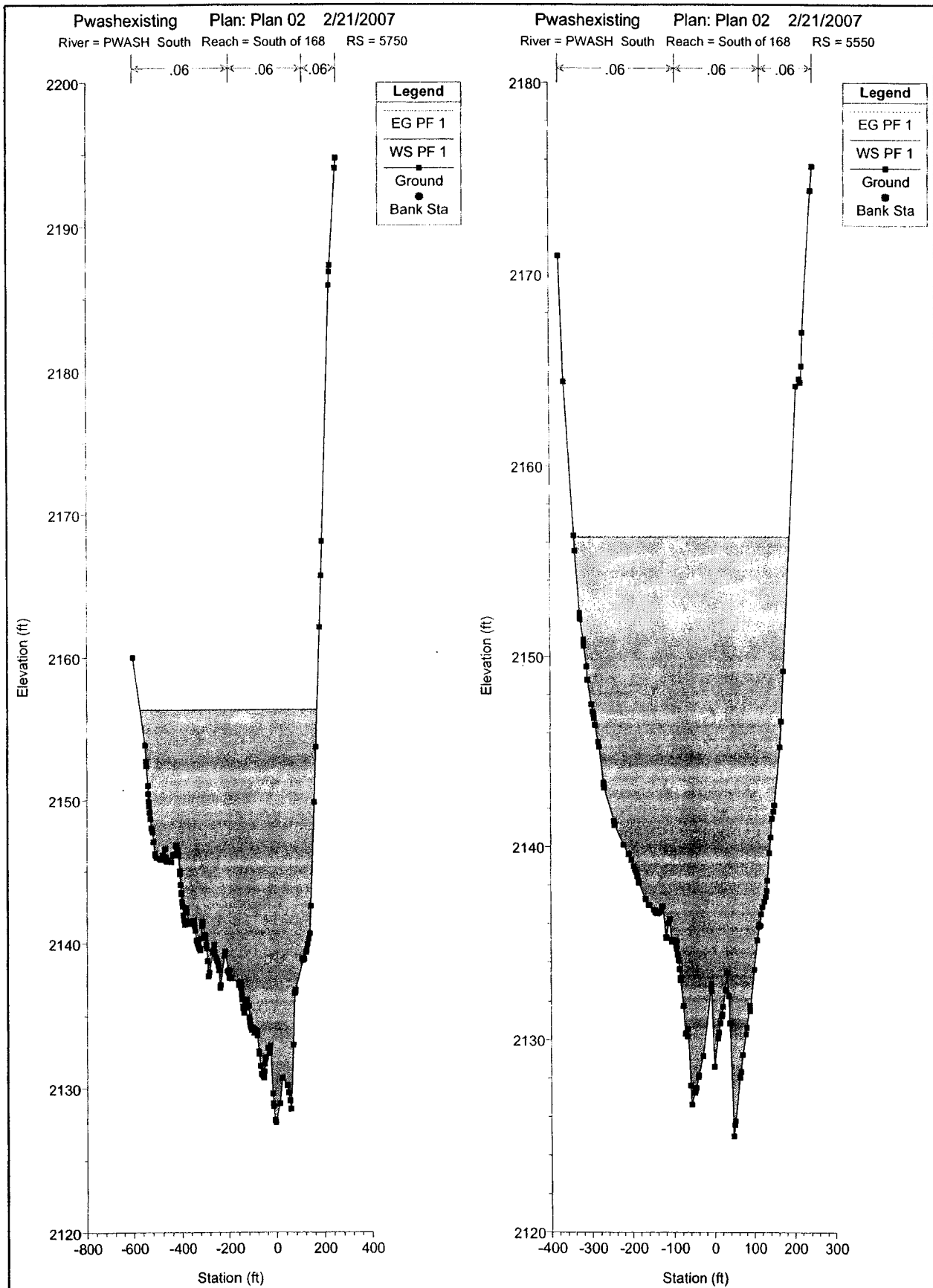


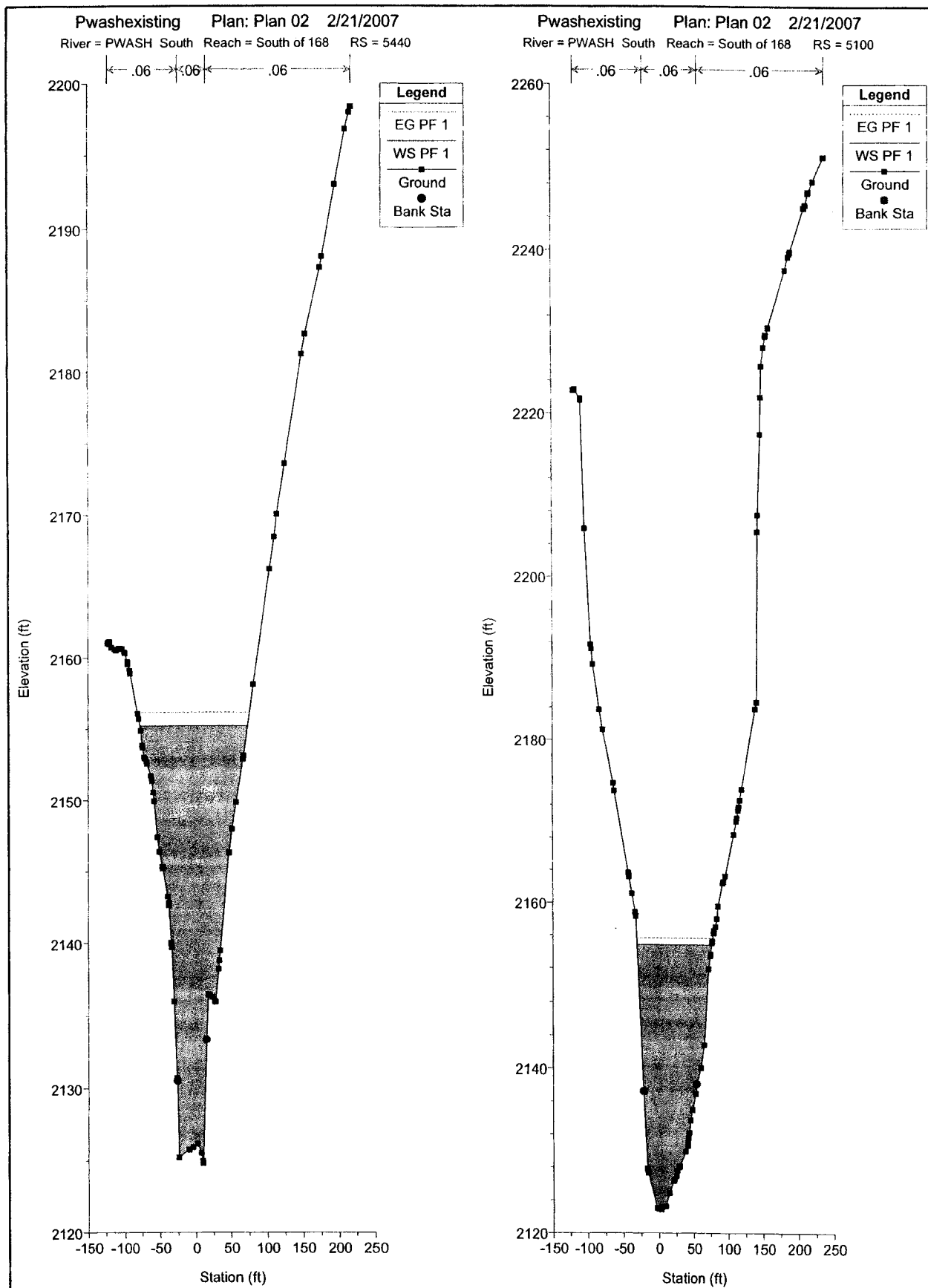


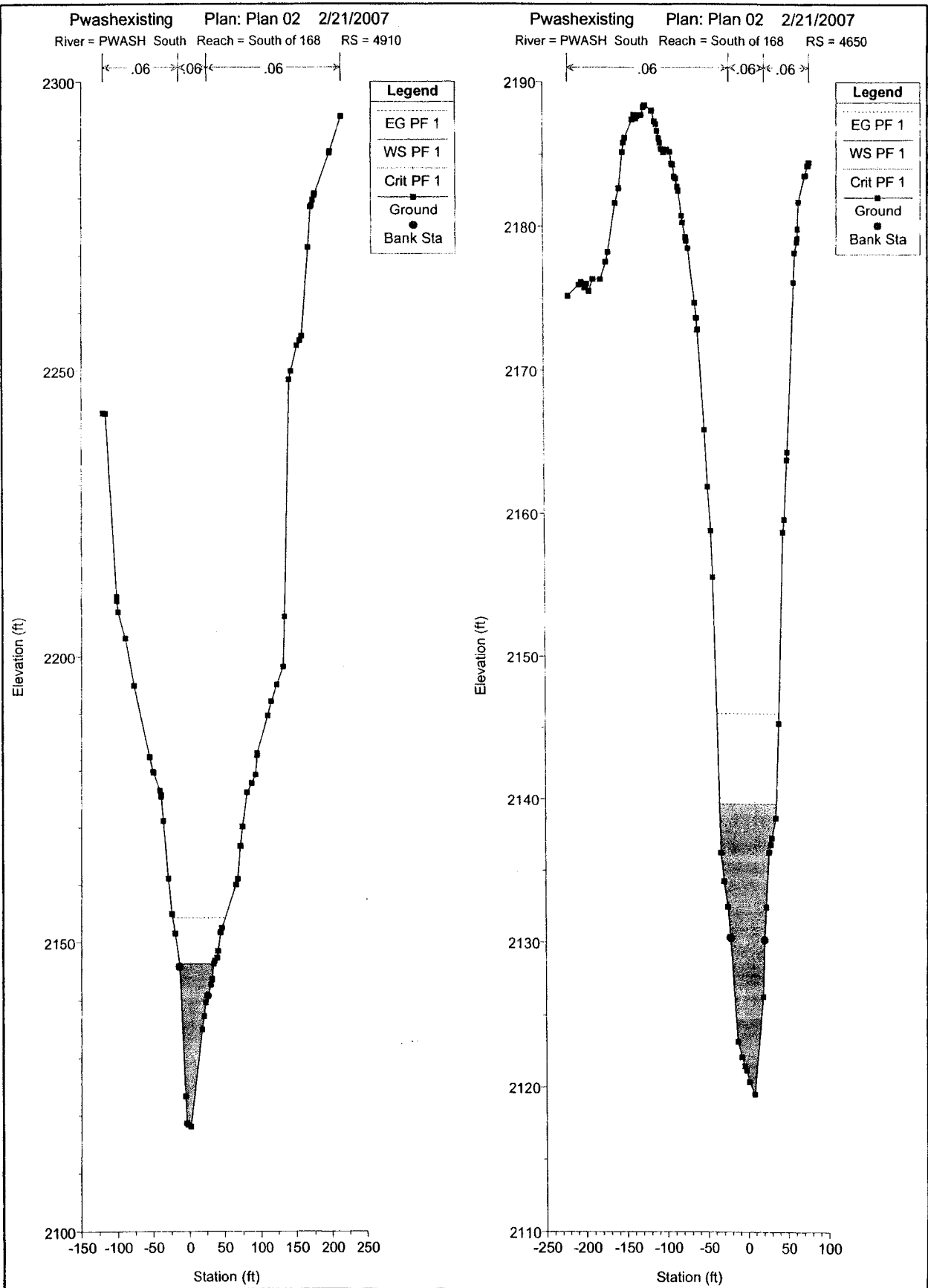




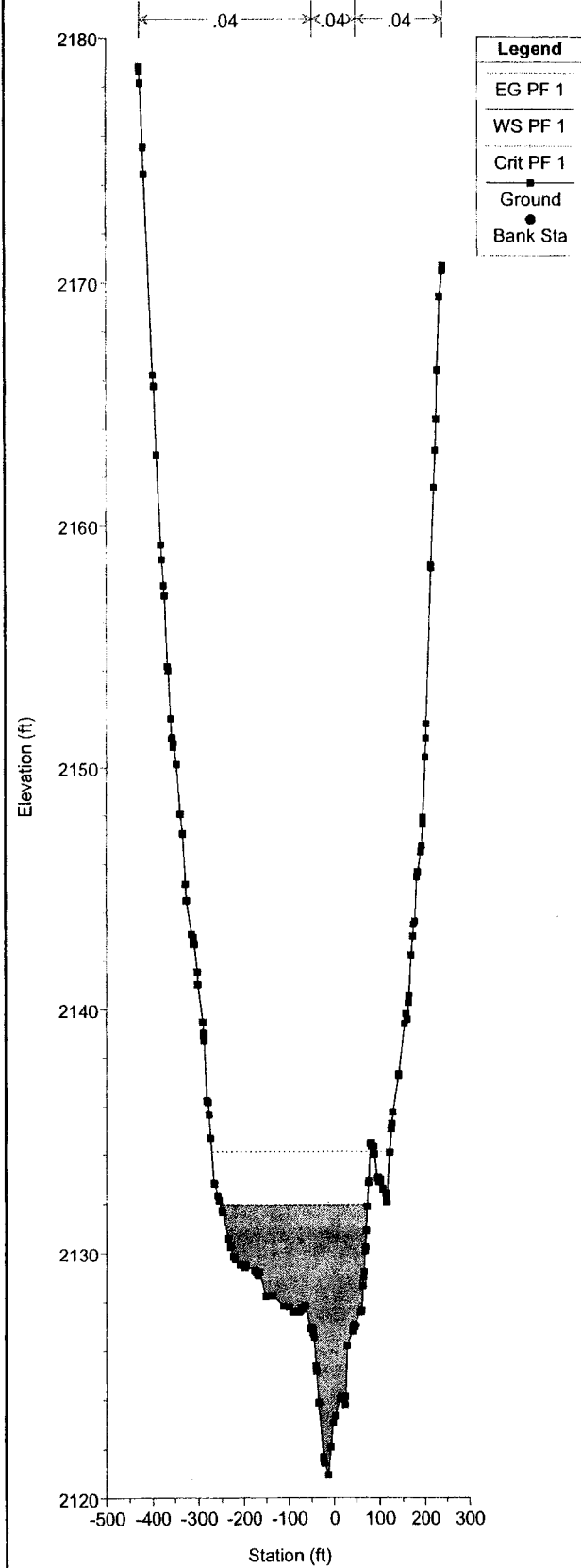




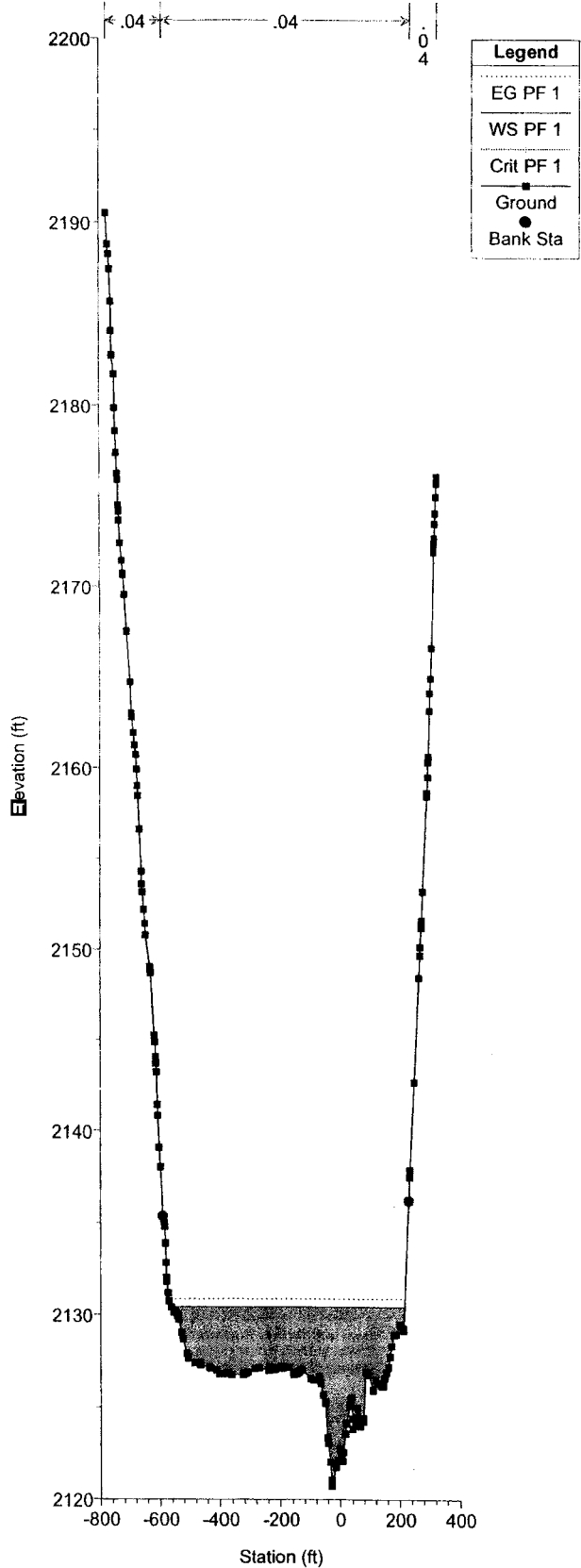


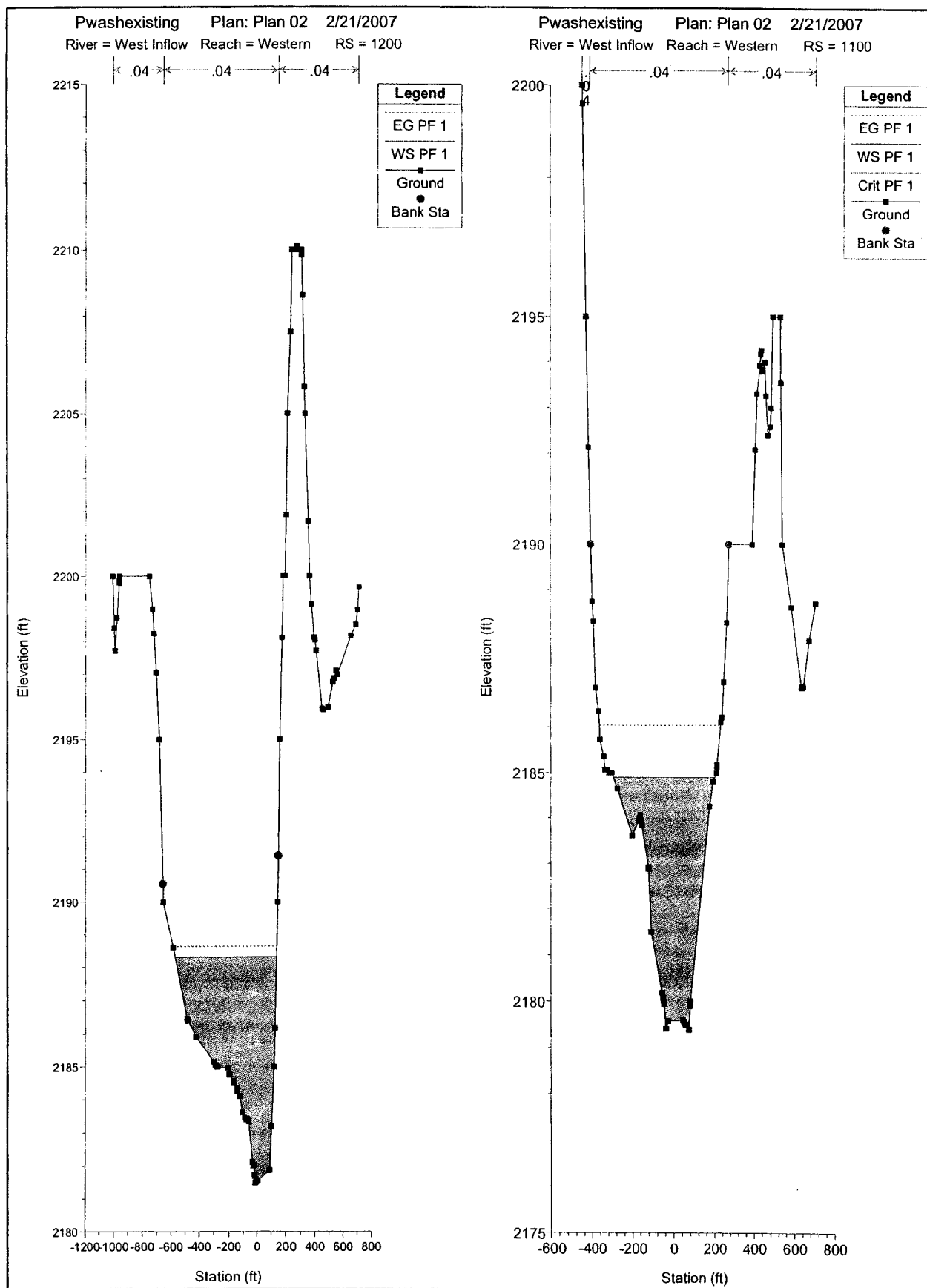


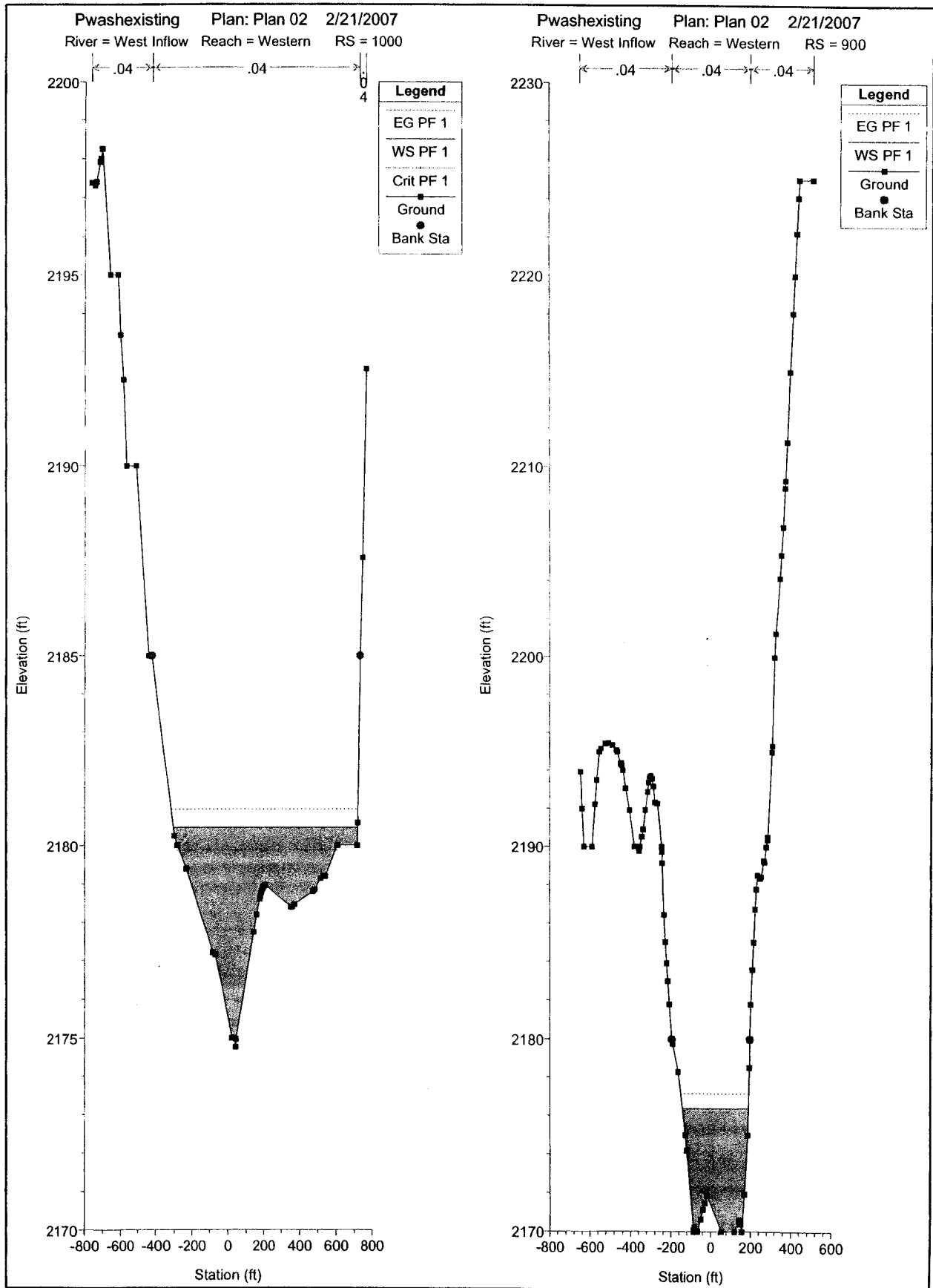
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River = PWASH South Reach = South of 168 RS = 4500



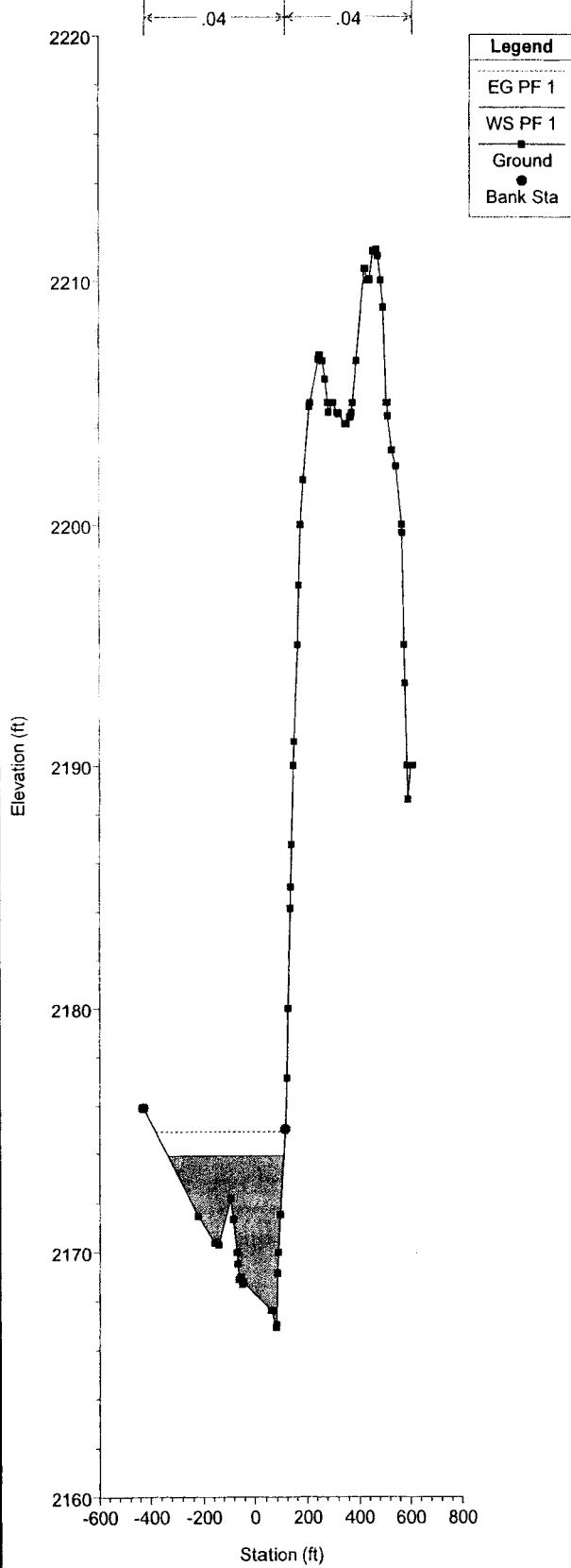
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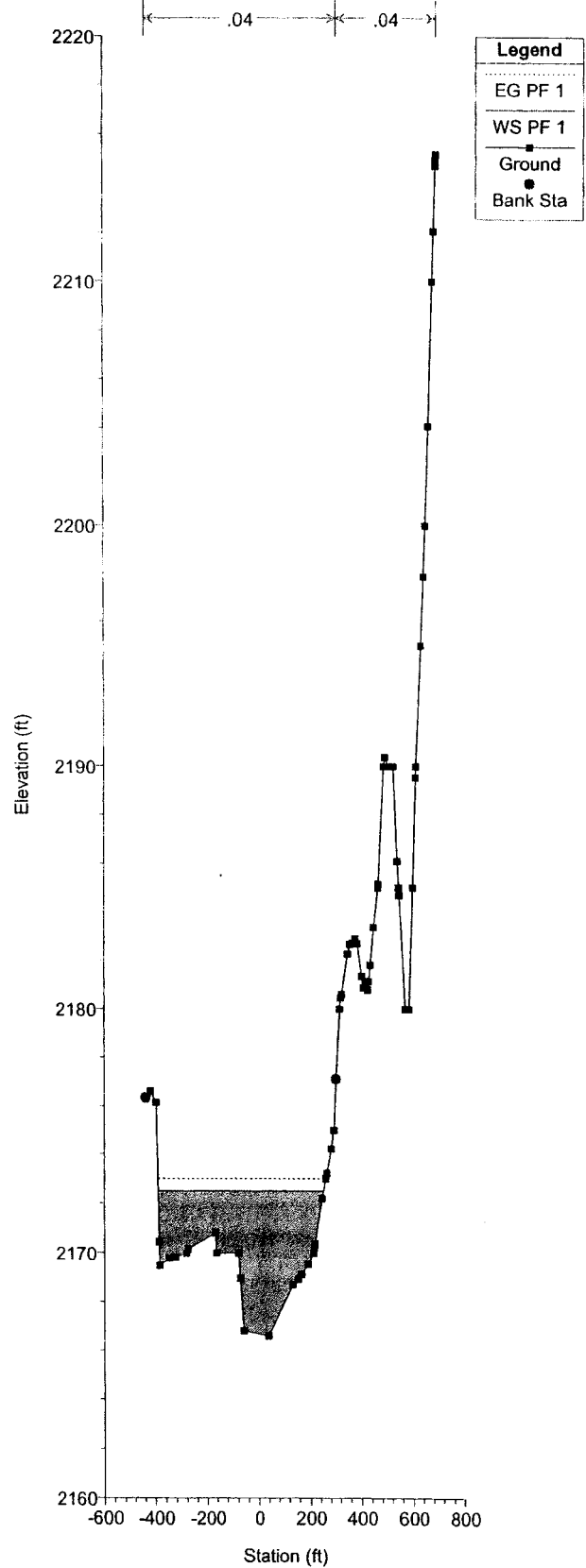




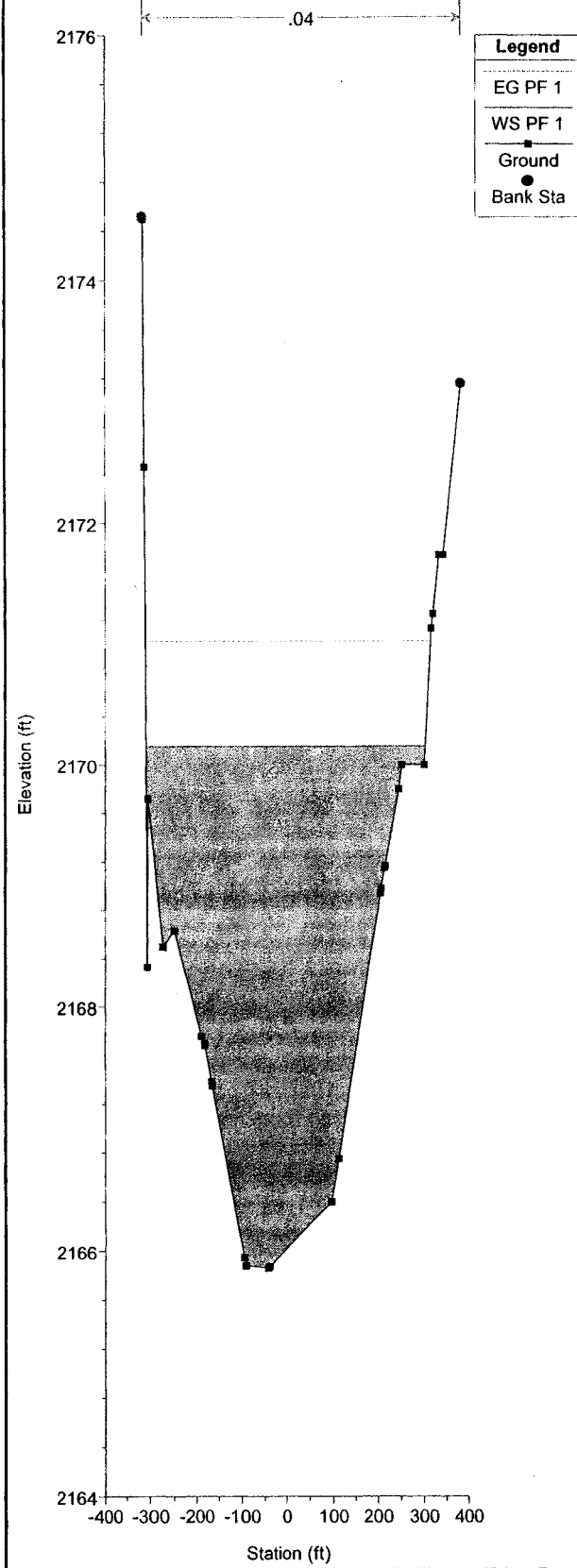
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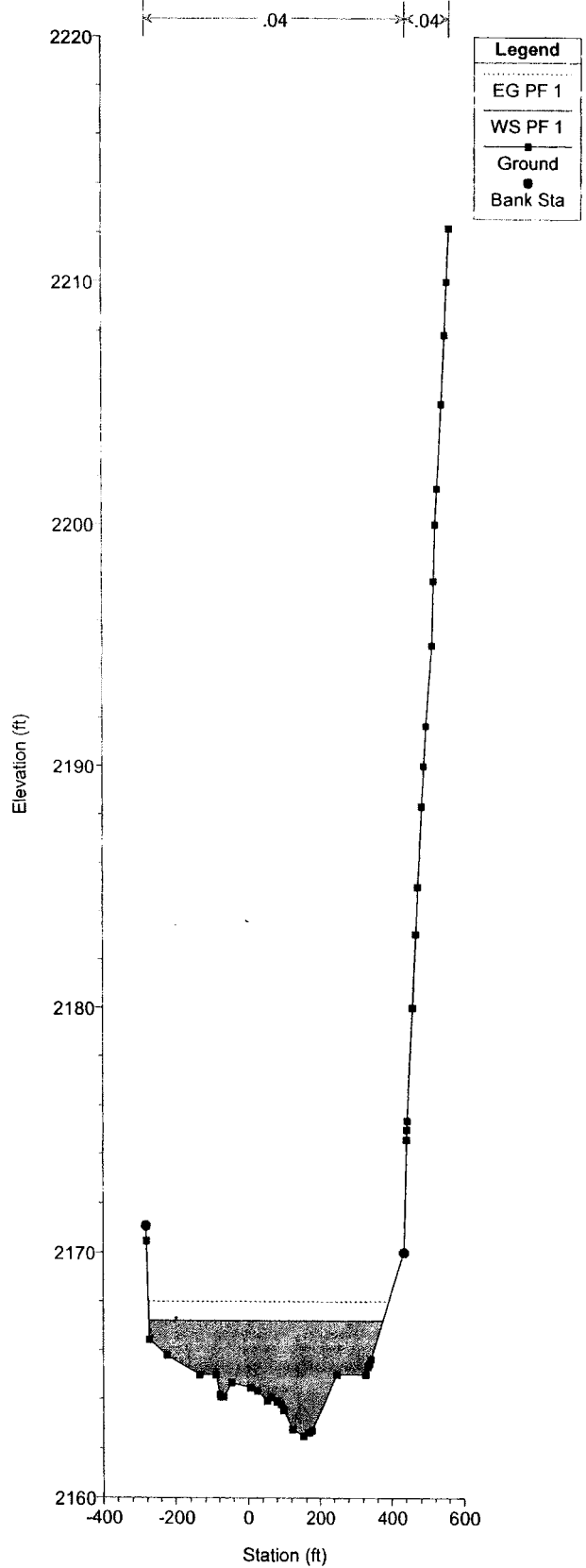
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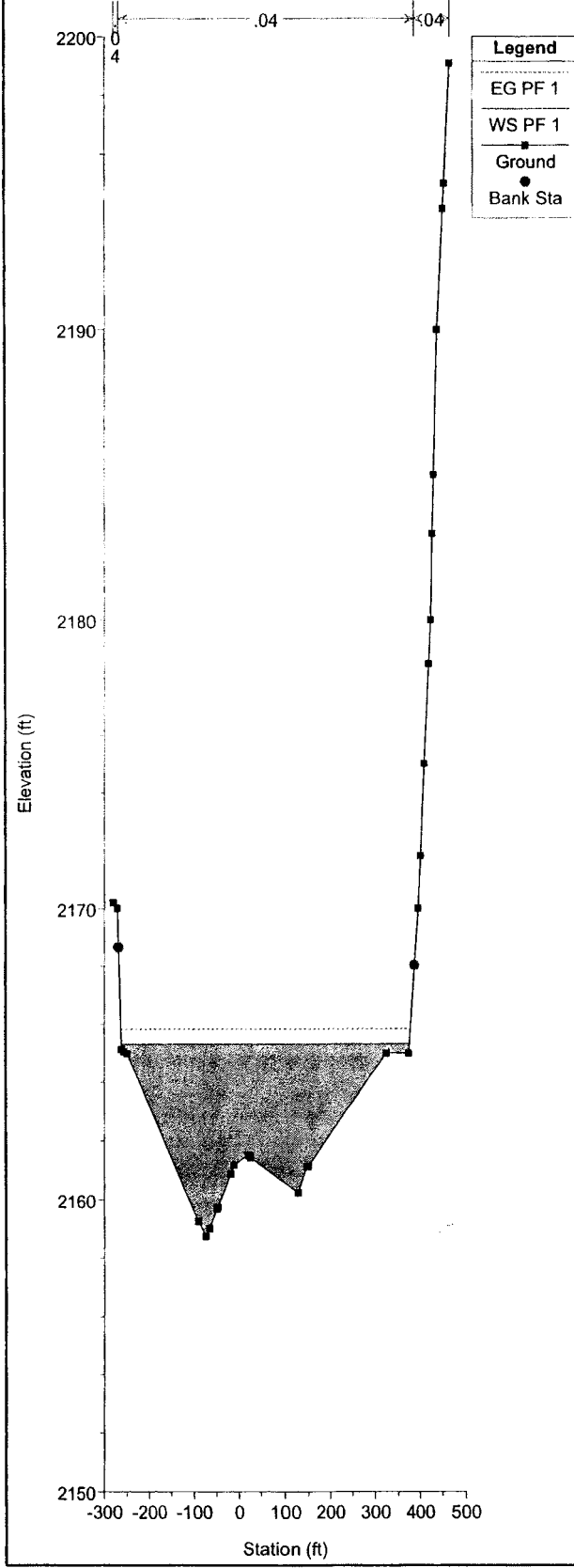
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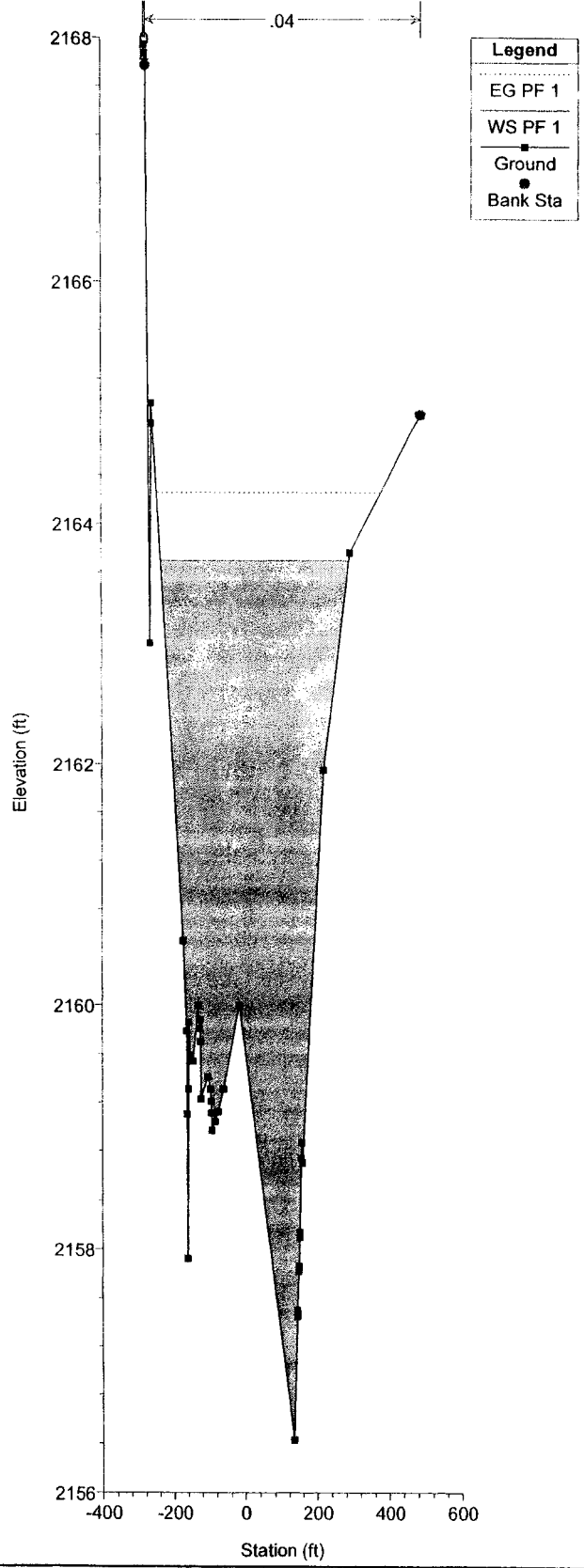
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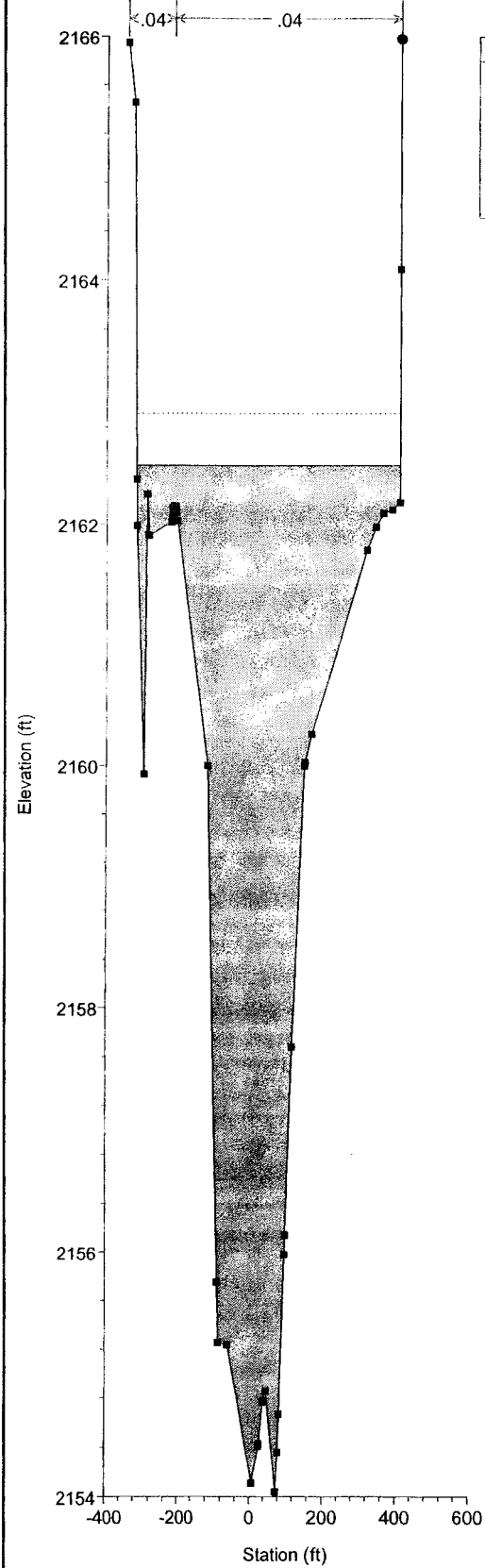
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River = West Inflow Reach = Western RS = 300

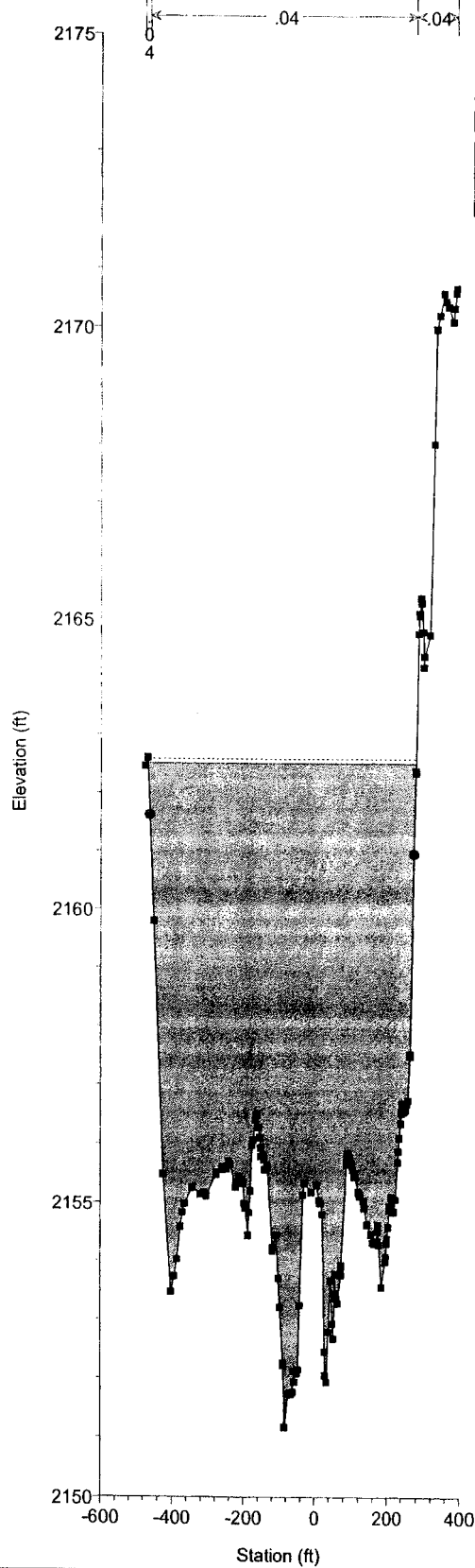


Pwashexisting Plan: Plan 02 2/21/2007
River = West Inflow Reach = Western RS = 200



Legend
EG PF 1
WS PF 1
Ground
Bank Sta

Pwashexisting Plan: Plan 02 2/21/2007
River = West Inflow Reach = Western RS = 100



Legend
EG PF 1
WS PF 1
Ground
Bank Sta



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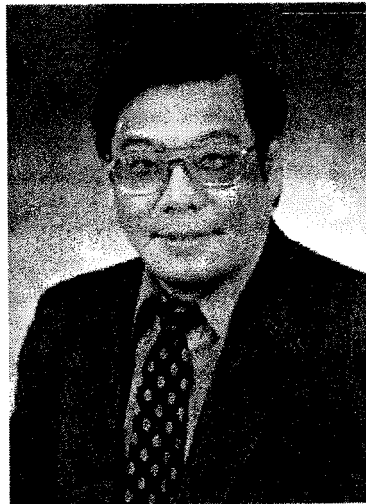
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James C.Y. Guo

Professor

Department of Civil Engineering

Campus Box 113

P.O. Box 173364

Denver, CO 80217-3364

Voicemail: 303-556-2849

Fax: 303-556-2368

Email: jguo@carbon.cudenver.edu

Web site: carbon.cudenver.edu/~jguo/index.html

Courses Taught:

Analytical mechanics, statics and dynamics

Theoretical Fluid Mechanics

Applied Hydrology

Design of Storm Water Systems

Open Channel Hydraulics

Unsteady Open Channel Hydraulics

Storm Water Modeling

Hydraulic Design

Urban Watershed Modeling

Storm Sewer and Street Inlet Design

Storm Water BMP's and Detention Design

Research Interests:

Flood Protection, Risk and Optimization

Watershed Modeling

Storm Water BMP's

Fluid Flow Modeling

Consulting Interests:

Flash Flood

Detention System

Flood Plain Management

Highway Drainage

Urban Drainage

**STORM CENTERING STUDY
FOR
PAHRANAGAT VALLEY
UPSTREAM OF MOAPA, NEVADA**

**prepared
by**

James C.Y. Guo, PhD, P.E.

for

**VTN-nevada
2727 South Rainbow Blvd.
Lad Vegas, NV 89102**

February 2000

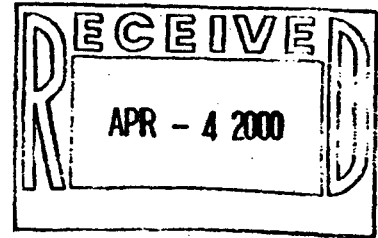
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THE Louis Berger Group, INC.

500 Amigo Court, Suite 100, Las Vegas, Nevada 89119
Tel 702 736 6632 Fax 702 736 0704 www.louisberger.com



March 28, 2000

James L. Fitzpatrick, P.E.
VTN - Nevada
2727 South Rainbow Boulevard
Las Vegas, NV 89102

Re: **STORM CENTERING STUDY FOR COYOTE SPRINGS**
Study Dated: March 5, 2000
Location: Northeast and southeast of the NV Highway 168 and US HWY 93
intersection
Section 01, T. 13 S., R. 63 E.
NPM-0049-13
HTE# 00-7110

Dear Mr. Fitzpatrick:

The staff at The Louis Berger Group, Inc. have conducted an initial review of the above-referenced **Storm Centering Drainage Study** and have the following comments:

1. The County requires the following figures with a report:
 - a. Vicinity map with north arrow and indication of scale, or not-to-scale;
 - b. A Flood Insurance Rate Map (FIRM) with: panel number, north arrow and bar scale, and site delineation;
 - c. The CCRFCD Master Plan Figure with north arrow, bar scale, and site delineation;
 - d. Design Manual Standard Form 1 signed and sealed by a professional engineer;
2. The study must use equation 613, in accordance with Section 606.3 of the (CCRFCD) *Hydrologic Criteria and Drainage Design Manual*, to determine the TLAG for the larger basins.



James L. Fitzpatrick, P.E.

Coyote Springs

March 28, 2000

Page 2 of 4

3. The study states "approximately 2750 square miles of this area are upstream of the Pahrangat National Wild Life Refugee Area (PNWLRA) which has sufficient capacity to contain flood flows without overflow." Please provide information and calculations in support of the storage capacity of the depression/detention area.
4. The study use kinematic wave routing for the HEC-1 models. Muskingham routing should be used in accordance with section 608 of the CCRFCD Design Manual. Please revise accordingly.
5. Provide precipitation isohyets maps with site delineation and point precipitation depth calculation in accordance with Section 500 in the CCRFCD Design Manual.
6. The DARF's used in the HEC-1 model do not correspond to the values recommended in the CCRFCD Design Manual. Please revise the HEC-1 model accordingly.
7. Most of the 100-year flow rates listed and discussed in the conclusion section of the report do not appear in the HEC-1 model output. If these values were interpolated please provide calculations.
8. Provide supporting data and exhibits for the stage/storage relationships and HEC-RAS information presented in Table 2 of the report.
9. The study's cover letter by VTN (stamped by James Fitzpatrick) states that "the purpose of this study is to establish the peak flow rates for the Pahrangat Wash as it crosses through this project." Dr. James Guo states in the study that "results of this study are derived from limited information and may only serve for preliminary investigations." Please clarify the purpose of this study.
10. The study concludes that the critical storm size is 250 square miles, although the final flow value for Arrow Canyon was based on a 360 square mile storm. Please explain.
11. Provide topographic data and/or available information in support of the channel routing geometry used in the HEC-1 analysis.
12. It is unclear how the Storm Centering Test HEC-1 analysis (in Appendix A) was utilized. Please provide discussion.
13. A Technical Drainage Study will be required for future development of the site.
14. The title on the cover of the drainage study differs from the title given on the Standard Form 1. Please revise and resubmit accordingly.



James L. Fitzpatrick, P.E.
Coyote Springs
March 28, 2000
Page 3 of 4

15. Site delineation must be accurately shown on the drainage maps. Please revise and resubmit accordingly.
16. Resubmit drainage map showing concentration points, cumulative flows, velocity and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows. The following needs to be added on the topographic map insert:
 - Provide a Figure number
 - Provide a north arrow
 - Basin K7 needs to be labeled
 - Provide contour intervals
17. The conceptual drainage study must correspond to the 1999 Updated Clark County Hydrologic Criteria and Design Manual, rather than the 1996 manual as stated on Page 4, paragraph 3 of the report.

~~The drainage plan has been red-lined and returned to the engineer. The red-lined drainage plan must be re-submitted with the revised drawings.~~

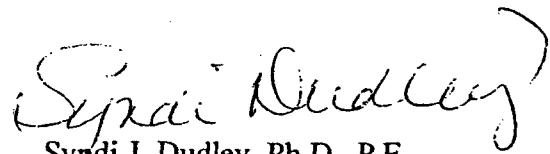
The items listed herein must be addressed. Addenda and revised plans must be submitted directly to Clark County for the necessary log-in procedures.

If you have any questions concerning the comments, please contact The Louis Berger Group, Inc. to schedule a study review meeting.

Sincerely,

THE LOUIS BERGER GROUP, INC.


Amanda L. Gonzales
Hydrologist


Syndi J. Dudley, Ph.D., P.E.
Director of Water Resources



James L. Fitzpatrick, P.E.
Coyote Springs
March 28, 2000
Page 4 of 4

CONCURRENCE BY CLARK COUNTY PUBLIC WORKS:

Steve Baum 03/31/00
Signature Date

COMMENTS: _____

cc: Coyote Springs, Inc.



CONSULTING ENGINEERS • PLANNERS • SURVEYORS
PROVIDING QUALITY PROFESSIONAL
SERVICES SINCE 1960

March 9, 2000
W.O. #5685

Clark County
Department of Public Works
500 S. Grand Central Parkway
Las Vegas, Nevada 89155-4000

Attention: Mr. Steve Parrish, P.E.
Community Development

RE: HYDROLOGIC ANALYSIS FOR COYOTE SPRINGS PROJECT

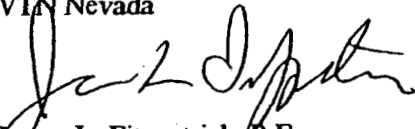
Mr. Parrish:

This letter is being written to submit the attached study prepared by Dr. James Guo, P.E. The purpose of his study is to establish the peak flow rates for the Pahrnagat Wash as it crosses through this project.

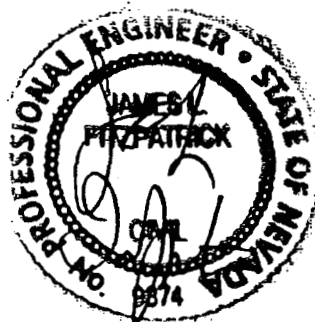
We ask for your review and approval of his study in order that that information can be utilized for the design of this project.

Sincerely,

VIN Nevada


James L. Fitzpatrick, P.E.
Senior Associate

/mjg



3/1/00

STORM CENTERING STUDY FOR PAHRANAGAT VALLEY UPSTREAM OF MOAPA, NEVADA

List of Figures

Figure 1 Brief Watershed Map (USGS MAP in Pocket)

Figure 2 Critical Storm Cover Area of 450 sq Miles without Valley Storage

Figure 3 Critical Storm Cover Area of 250 sq Miles with Valley Storage

List of Tables

Table 1 Hydrologic parameters for Subareas

Table 2 Stage-Storage-Outflow Characteristics at Arrow Valley

Table 3 Depth Area Reduction Factors

Table 4 Locations of Storm Centers

Table 5 Selection of Maximal Peak Discharge at Design Points

List of Appendices

Appendix A Storm Centering Tests

(File Name: STRMTEST.DAT)

Appendix B The HEC-1 Model Developed for Kane Springs Valley

(File Name: BSN1.DAT)

Appendix C The HEC-1 Model Developed for Pahrnagat Valley North of Point A

(File Name: BSN2.DAT)

Appendix D The HEC-1 Model Developed for Pahrnagat Valley South of Point A

(File Name: BSN35.DAT)

Appendix E The HEC-1 Model Developed for All Areas of 862 square miles.

(File Name: ALLAREA.DAT).

The 100-year floodplain in this area is typically within 800 feet of the wash channels. The development of flood plains in this area is limited. Immediately upstream of the gage station, a large storage capacity exists in Arrow Canyon. The historical record has shown that the largest flow of record was as low as 5100 cfs occurred on September 7, 1967. According to the 1988 Flood Control Master Plan for Moapa Valley, the peak flow data does not have any outliers and the 100-year peak discharge was estimated to be 6510 cfs at the gauge station on the Muddy River.

In this study, the total drainage area is approximately 862 square miles which includes the tributary areas downstream of PNWLRA to the north of the entrance of Arrow Canyon. As shown in Figure 1, this area is divided into

- (1) Basin 1 of 249 square miles for Kane Springs Wash Basin,
- (2) Basin 2 of 253.5 square miles for Pahrangat Wash Basin upstream of Point A
- (3) Basin 3 of 155.0 square miles for the area between of Points A and B, and
- (4) Basin 5 of 204.50 square miles for the area south of Point B.

Each basin is further divided into subareas based on the natural drainage network. The hydrologic parameters for subareas are listed in Table 1. The previous studies recommended that the curve number is 85 for the type of soil found in this area (Mark Group 1988, Corps 1988). In this study, the lag time was calculated by both USBR method (USBR 1987) with a Manning's n of 0.042 and the SCS lag time formula. In comparison, the USBR lag times were shorter. As a result, the USBR lag times were coded into the HEC-1 model for runoff calculations as recommended by the 1996 Clark County Hydrologic Criteria and Design Manual.

The storage capacity at Arrow Canyon is approximated by the elevation contours upstream of the narrowest section located at Station 80+6 used in the 100-year floodplain delineation study. This section is approximated by a trapezoid with side slopes of 1V:3H and 1V:4H. With limited information, the outflow rates through this section are estimated by Manning's formula with a roughness coefficient of 0.042 and ground slope of 0.001. The stage-storage-outflow characteristics at Arrow Canyon are derived with a range of flow rates and the corresponding storage volumes in the valley backed up by the normal depths. This approach is an approximation for a preliminary study, and shall be refined when detailed data become available.

Point Design Rainfall Statistics

The design rainfall statistics for the southern Nevada have been published in *NOAA Atlas 2, Volume VII for Nevada* (1973), and *NOAA Technical Memorandum NWS Hydro-40* for the semi arid southwest United States (1984). The design rainfall depths prepared by the Master Plan for Moappa Valley (1988) were derived from NOAA Atlas 2 with the adjustment recommended by the Clark County Regional Flood Control District (CCRFCD). In this study, the 6-hour design rainfall distribution is adopted with the 6-hour rainfall depths as:

<i>Return Period</i>	<i>in years</i>	<i>25</i>	<i>50</i>	<i>100</i>
<i>Six-hr Rainfall Depth in inches</i>		<i>2.05</i>	<i>2.52</i>	<i>3.00</i>

Depth Area Reduction Factors (DARF)

The DARF's are derived from the areal distribution of observed isohyets. The rainfall volume of a storm event is calculated by its depth and area product which can be accumulated from the center of the storm to a specified area. The areal average rainfall depth is equal to the accumulated depth-area product divided by the area. The DARF's for the Moapa valley were studied by several observed storm events and then compared with NOAA Hydro 40 and Standard Project Storm recommended by Corps of Engineers (Flood Control Master Plan for Moapa Valley, 1988). Table 2 is the average values for DARF's from 10 to 900 square miles developed in this study. These values are then used in the HEC-1 models for runoff calculations.

Storm Centering Tests

Although the total tributary area is 862 square miles, the effective drainage area used in the Flood Control Master Plan for Moapa Valley, Nevada 1988 was assumed to be 200 square miles. During the August 10, 1981 storm event, the one-inch isohyetal line encompasses an area of 280 square miles. In this study, storm centering tests were conducted with a storm center to cover a total drainage area of 588.50 square miles, including Basins 2, 3, 5, and subareas of K6 and K7 from Basin 1. There are two scenarios performed in this study: *with and without consideration of valley storage volumes*. When using channel widths of 20 to 50 feet for kinematic wave routing through the valleys, as shown in Figure 2, the

critical storm cover area is found to be 450 square miles. When a width of 800 feet is used to model the floodplains, the critical storm cover area is reduced to 250 square miles, as shown in Figure 3.

The 1988 Flood Control Master Plan for Moapa Valley has recognized the significant storage capacities available in the valleys. Therefore, the critical storm cover area of 250 square miles is adopted in this study for runoff predictions. Of course, a further refinement is necessary when more detailed information become available.

Based on the natural drainage network and the size of critical storm cover area, four locations of storm centers are further developed for runoff predictions as listed in Table 4. They are:

Case One covers Basin 1.

Case Two covers Basin 2.

Case Three covers Basins 3 and 5.

Case Four covers the entire area of this study.

At a design point, the runoff peak discharges shall be predicted by possible storm centers, and then the maximal value is selected and recommended for designs. For instance, the design flow at Point A is determined as:

$$Q_A = \text{Max (Case One, Case two, Case Four)}$$

At Point B, the design flow shall be the maximal value among the following cases:

$$Q_B = \text{Max (Case One with routing through the downstream valley to Pt B, Case Two with routing through the downstream valley to Pt B, Case Three as the tributary area to Point B Case Four with all tributary areas to Point B.)}$$

Table 5 presents the comparison and selection of the maximal value at various design points.

Conclusions

This study has been conducted based on USGS 15 minutes maps. With the optimal uses of the limited information, the storm centering tests have been investigated for the total drainage area of 862 square miles. It was found that the critical storm cover area is approximately 250 square miles. The maximal peak discharges are predicted as:

Location	Q-25 cfs	Q-50 cfs	Q-100 cfs
Outlet of Basin 1	903	4,357	6,572
Outlet of Basin 2	4,490	7,712	11,771
Outlet of Basin 3	6,371	13,266	15,300
Outlet of Basin 5	4,278	7,248	12,000
Point A	4,490	7,712	11,771
Point B	4,460	7,695	12,793
Gage Station	3,327	6,510	11,277

The range of the 100-year peak discharge downstream of Arrow Canyon is between 8683 to 11277 cfs. The 100-year peak discharge downstream of Arrow Canyon was also predicted to be 6510 cfs by the records at the USGS Gauge 09416000.

Results of this study are derived from limited information and may only serve for preliminary investigations. The HEC-1 models developed shall be refined by more detailed information.

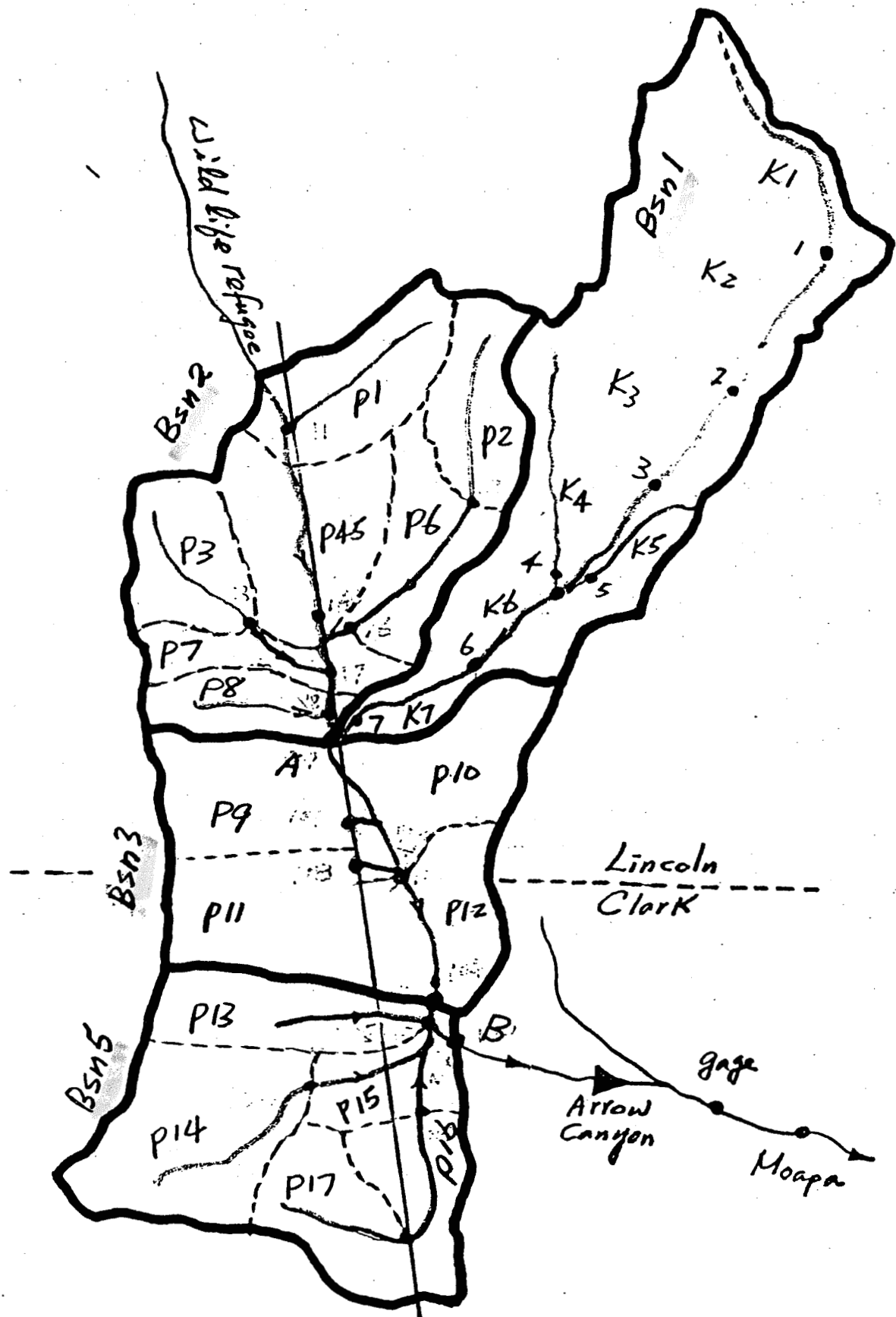


Figure 1 Brief Watershed Map (USGS MAP in Pocket)

Storm Centering Tests for Pahrnagat Valley, Moapa Nevad

Design Point	Accum Area sq miles	Q100 cfs
p11	28.00	4968.00
p12	38.50	5251.00
c44	44.50	7700.00
p145	59.00	8050.00
c145a	87.00	10410.00
c3	146.50	13739.00
c145b	155.50	14416.00
c45	204.50	14370.00
c6	233.00	16088.00
c7	249.00	16956.00
c18	253.00	19184.00
A	298.00	21618.00
c10	380.00	24360.00
c12	453.00	25572.00
c13	495.50	25221.00

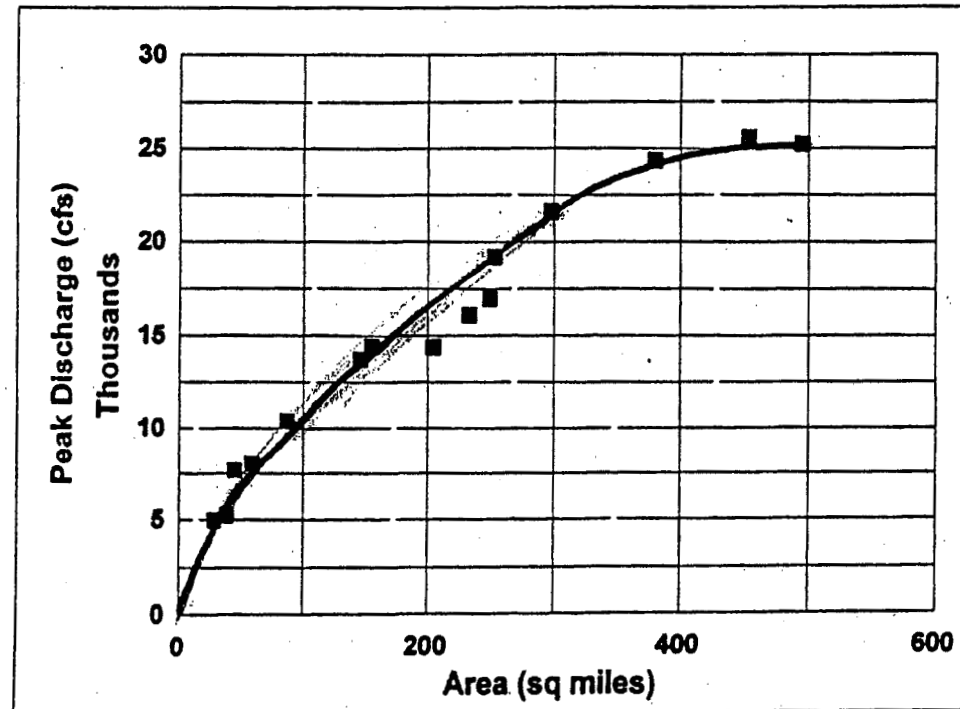
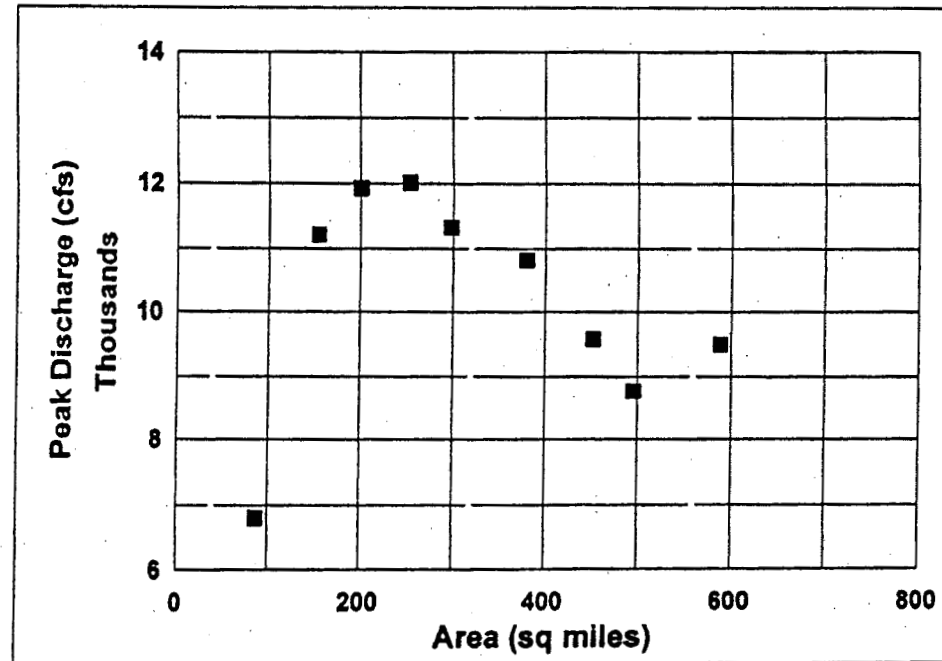


Figure 2 Critical Storm Cover Area of 450 sq Miles without Valley Storage

Figure 3 Storm Centering Tests for Pahrnagat Valley, Moapa Nevada w/ STORAGE

Design Point	Accum Area sq miles	Q100 cfs
c45a	87.00	6790.00
c45b	155.00	11218.00
c7	200.50	11922.00
c18	253.50	12012.50
A	298.00	11331.00
c10	380.50	10813.40
c12	453.00	9578.00
c13	495.50	8764.00
c15	588.50	9484.00



Conclusion:

The critical storm cover area is approximately 250 sq miles determine by this study.
 This conclusion agrees with Master Plan study (200 square miles).
 During the August 10 1981 storm, the area with a rainfall depth of one inch was 280 sq miles.

Table 1 Watershed Parameters for Areas Upstream of Moapa, Nevada

Watershed Area	Subarea	ID Numer	Area Sq mile	Upst Elev meter	Dnst Elev meter	Waterway Length kilometer	Slope percent	Slope ft/mile	Curve Number	Initial Loss	SCS Lag time hours	Roughness n	USBR Lag time hours	Dnst Waterway meter
Kane Springs Basin	K1	1	33.00	2222.00	1250.00	23.00	4.226	20.615	85.000	1.765	4.164	0.042	2.356	0.00
	K2	2	56.50	2250.00	1050.00	31.00	3.871	18.883	85.000	1.765	5.524	0.042	2.911	0.00
	K3	3	57.00	2050.00	1000.00	26.00	4.038	19.700	85.000	1.765	4.699	0.042	2.573	0.00
	K4	4	36.50	1750.00	900.00	54.00	1.574	7.678	85.000	1.765	13.505	0.042	4.870	0.00
	K5	5	21.50	1500.00	900.00	16.00	3.750	18.293	85.000	1.765	3.307	0.042	1.891	0.00
	K6	6	29.00	1250.00	850.00	17.00	2.353	11.478	85.000	1.765	4.382	0.042	2.125	0.00
	K7	7	15.50	1000.00	750.00	17.00	1.471	7.174	85.000	1.765	5.543	0.042	2.297	0.00
	Sum		249.00			184.00								
	Avg						3.040	14.831			5.875		2.718	
Pahranagat Watershed north of Point A	P1	11	28.00	1550.00	1000.00	21.00	2.619	12.776	85.000	1.765	4.918	0.042	2.401	0.00
	P2	12	38.50	1750.00	1250.00	27.00	1.852	9.033	85.000	1.765	7.151	0.042	3.001	17.00
	P3	13	39.50	1500.00	900.00	19.00	3.158	15.404	85.000	1.765	4.134	0.042	2.179	7.00
	P5	145	59.00	1250.00	800.00	23.00	1.957	9.544	85.000	1.765	6.120	0.042	2.675	0.00
	P6	16	30.00	1750.00	800.00	23.00	4.130	20.148	85.000	1.765	4.212	0.042	2.365	3.00
	P7	17	25.50	2245.00	775.00	16.00	9.188	44.817	85.000	1.765	2.113	0.042	1.631	0.00
	P8	18	33.00	2000.00	750.00	18.00	6.944	33.875	85.000	1.765	2.670	0.042	1.846	0.00
	Sum		253.50			147.00								
	Avg						4.264	20.800			4.474		2.300	
Pahranagat Watershed Between A and B	P9	101	32.50	1900.00	775.00	16.50	6.818	33.259	85.000	1.765	2.513	0.042	1.748	3.00
	P10	102	50.00	1500.00	700.00	22.00	3.636	17.738	85.000	1.765	4.332	0.042	2.345	0.00
	P11	103	36.00	2150.00	800.00	17.00	7.941	38.737	85.000	1.765	2.385	0.042	1.739	5.00
	P12	104	36.50	1000.00	650.00	19.00	1.842	8.986	85.000	1.765	5.413	0.042	2.382	0.00
	Sum		155.00			74.50								
	Avg						5.059	24.680			3.661		2.053	
Pahranagat Watershed south Point B	P17	201	42.00	2222.00	825.00	21.50	6.498	31.696	85.000	1.765	3.182	0.042	2.099	0.00
	P16	202	27.00	825.00	725.00	11.50	0.870	4.242	85.000	1.765	5.272	0.042	1.935	10.00
	P14	203	61.00	2500.00	1000.00	24.00	6.250	30.488	85.000	1.765	3.543	0.042	2.271	11.00
	P15	204	32.00	1000.00	650.00	10.00	3.500	17.073	85.000	1.765	2.350	0.042	1.402	2.00
	P13	105	42.50	2000.00	650.00	25.00	5.400	26.341	85.000	1.765	3.938	0.042	2.390	2.00
	Sum		204.50			92.00								
	Avg						4.503	21.968			3.657		2.020	

Total Area

862 sq miles

Table 2 STAGE-STORAGE-OUTFLOW CURVE at ARROW CANYON

HECRAS Section Sta 80+6

X	Y (Elev)
ft	ft
0	2200
80	2180
120	2130
160	2160
220	2133
240	2160
300	2180
400	2260

Cross Section Triangular Section
 Z1=3.0 Z2=4.0
 n = 0.045

Elevation	Contour Area	Storage Volume	Flow Depth	Flowrate S=0.005 n=0.045	Flowrate S=0.001 n=0.045	Flowrate HECRAS Predictions
ft	acres	acre-ft	ft	cfs	cfs	cfs
2133.00	0.00	0.00	0.00	0.00	0	
2140.00	1.10	3.85	7.00	725.00	324	
2150.00	45.55	459.35	17.00	7126.00	3186	9300
2160.00	90.00	914.85	27.00	23957.00	10713	
2170.00	204.00	2384.85	37.00	54978.00	24587	55260
2180.00	320.00	5004.85	47.00	103499.00	46286	

Note: S = 0.005 was predicted by HECRAS under the condition of steady flow
 S = 0.001 is the ground slope upstream of this section, and used in this study.

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Table 3 DARF Developed for Pahrnagat Valley, Nevada

Area	DARF 100-yr	DARF 50-yr	DARF 25-yr	DARF 10-year	DARF 5-year	DARF Average Value
1.000	1.000	1.000	1.000	1.000	1.000	1.000
5.000	0.950	0.960	0.960	0.937	0.932	0.948
10.000	0.900	0.900	0.900	0.873	0.890	0.893
20.000	0.830	0.840	0.840	0.804	0.805	0.824
30.000	0.800	0.780	0.780	0.778	0.771	0.782
40.000	0.750	0.740	0.740	0.759	0.737	0.745
50.000	0.720	0.720	0.720	0.728	0.678	0.713
60.000	0.702	0.700	0.700	0.696	0.669	0.694
70.000	0.684	0.680	0.680	0.665	0.661	0.674
80.000	0.666	0.668	0.668	0.652	0.653	0.661
90.000	0.648	0.652	0.652	0.633	0.644	0.646
100.000	0.630	0.640	0.640	0.614	0.636	0.632
150.000	0.580	0.600	0.600	0.506	0.583	0.574
200.000	0.530	0.560	0.560	0.475	0.530	0.531
300.000	0.500	0.480	0.480	0.449	0.477	0.477
400.000	0.460	0.440	0.440	0.430	0.424	0.439
500.000	0.436	0.400	0.400	0.392	0.407	0.407
600.000	0.412	0.382	0.382	0.380	0.390	0.389
700.000	0.388	0.365	0.365	0.361	0.373	0.370
800.000	0.364	0.347	0.347	0.342	0.356	0.351
900.000	0.340	0.330	0.330	0.323	0.339	0.332
1000.000	0.317	0.312	0.312	0.304	0.322	0.313

Table 4 Locations of Storm Centers

Case	Location of Storm Center	Tributary Basin(s)	Tributary Area sq miles
1	Kane Springs Valley	Basin1	249.00
2	Paharangat Valley North of Pt A	Basin 2	253.50
3	Paharangat Valley South of Pt A	Basins 3+5	359.50
4	Whole Area	Bsn 1+2+3+5	861.50

Table 5 Selection of Maximal Peak Discharges at Design Points

100-year Peak Flowrate at Design Points

Location	Design Point	Case for Storm Centering Test				Maximal Flowrate cfs
		Case 1 cfs/sq mile	Case 2 cfs/sq mile	Case 3 cfs/sq mile	Case 4 cfs/sq mile	
Basin 1 Outlet	C7	6572.0/249.0	—	—	6572.0/249.0	6572
Basin 2 Outlet	C18	—	11771.0/253.5	—	11771.0/253.5	11771
Basin 3 Outlet	C12	—	—	15300.0/155.0	6900.0/657.0	15300
Basin 5 Outlet	C15	—	—	12000.0/162.0	9400.0/162.0	12000
Point A	A	6572.0/249.0	11771.0/253.5	—	7558.0/502.0	11771
Point B	B	1094.0/249.0	11729.0/253.5	12793.0/359.5	7217.0/861.5	12793
Gage Station		0	8883.0/253.5	11277.0/359.5	4942.0/861.5	11277

SITE
UNWARRANTED WITH

UPSTREAM OF CYN.

50-year Peak Flowrate at Design Points

Location	Design Point	Case for Storm Centering Test				Maximal Flowrate cfs
		Case 1 cfs/sq mile	Case 2 cfs/sq mile	Case 3 cfs/sq mile	Case 4 cfs/sq mile	
Basin 1 Outlet	C7	4357.0/249.0	—	—	4357.0/249.0	4357
Basin 2 Outlet	C18	—	7712.0/253.5	—	7712.0/253.5	7712
Basin 3 Outlet	C12	—	—	13265.5/155.0	4734.5/657.0	13265.5
Basin 5 Outlet	C15	—	—	7248.4/162.0	5830.0/162.0	7248.4
Point A	A	4357.0/249.0	7712.0/253.5	—	4707.0/502.0	7712
Point B	B	693.0/249.0	7695.0/253.5	7478.0/359.5	3133.5/861.5	7695
Gage Station		0	3628.0/253.5	6510.0/359.5	2447.5/861.5	6510

25-year Peak Flowrate at Design Points

Location	Design Point	Case for Storm Centering Test				Maximal Flowrate cfs
		Case 1 cfs/sq mile	Case 2 cfs/sq mile	Case 3 cfs/sq mile	Case 4 cfs/sq mile	
Basin 1 Outlet	C7	903.0/249.0	—	—	903.0/249.0	903
Basin 2 Outlet	C18	—	4490.0/253.5	—	4490.0/253.5	4490
Basin 3 Outlet	C12	—	—	6371.5/155.0	1632.0/657.0	6371.5
Basin 5 Outlet	C15	—	—	4278.0/162.0	3494.0/162.0	4278
Point A	A	903.0/249.0	4490.0/253.5	—	2468.0/502	4490
Point B	B	479.0/249.0	4460.0/253.5	3966.0/359.5	1600.0/861.5	4460
Gage Station		0	0	3327.0/359.5	840.0/861.5	3327

Appendix A Storm Centering Test by HEC-1 Model

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.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 29JAN00 TIME 14:54:56
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. U.S. ARMY CORPS OF ENGINEERS
. HYDROLOGIC ENGINEERING CENTER
. 609 SECOND STREET
. DAVIS, CALIFORNIA 95616
. (916) 756-1104
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

1

HEC-1 INPUT

PAGE 1

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1          ID
2          ID
3          ID      *DIAGRAM
4          ID      * STORM CENTERING TEST
5          ID      * for Pahranagat and lower Kane Spring Watersheds
6          ID
7          ID      prepared by VTN-nevada in January 2000
8          ID
9          ID      All tributary area north of Maynard Lake drains into the detention
10         ID      and depression area in Pahranagat National Wild Life Refuge
11         ID
12         ID      JR PREC 0.713 0.632 0.531 0.477 0.439 0.407 0.389 DARP
13         ID      AREA 50 100 200 300 400 500 600 sq miles
14         ID
*** FREE ***
15         IT      5      0      0      150
16         IO      5      0      0
17         IN      5      0      0
18         JR      PREC 0.713 0.632 0.531 0.477 0.439 0.407 0.389
19         KK      p1
20         KM      Subarea p1
21         BA      28.0
22         PB      3.0
23         PC      .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
24         PC      .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
25         PC      .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
26         PC      .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
27         PC      .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
28         PC      .810 .820 .826 .840 .859 .889 .910 .938 .966 .970
29         PC      .974 .979 .981 .983 .985 .989 .990 .992 .993 .996
30         PC      .997 .999 1.00
31         LS      0
32         UD      2.401

```


33 KK R45
 34 KM Route p1 through p45
 35 RK 64515 0.010 0.050 0 TRAP 800 10

 36 KK P45
 37 KM Subarea P45
 38 BA 59.0
 39 LS 0 85
 40 UD 2.675

 41 KK C45a
 42 KM Combine R45 and P45
 43 RC 2

HEC-1 INPUT

PAGE 2

1

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

44 KK P2
 45 KM Subarea P2
 46 BA 38.5
 47 LS 0 85
 48 UD 3.00

 49 KK R6
 50 KM Route p2 through p6
 51 RK 70380 0.010 0.050 0 TRAP 800 10

 52 KK P6
 53 KM Subarea P6
 54 BA 30.0
 55 LS 0 85
 56 UD 2.36

 57 KK C45b
 58 KM Combine R45a, R6 and P6
 59 RC 3

 60 KK R7a
 61 KM Route C45b through P7
 62 RK 26565 0.010 0.050 0 TRAP 800 10

 63 KK P3
 64 KM Subarea P3
 65 BA 39.5
 66 LS 0 85
 67 UD 2.179

 68 KK R7b
 69 KM Route p3 through p7
 70 RK 27600 0.010 0.050 0 TRAP 800 10

 71 KK P7
 72 KM Subarea P7
 73 BA 25.5
 74 LS 0 85
 75 UD 1.631

 76 KK C7
 77 KM Combine R7b, R7a, and P7
 78 RC 3

 79 KK R8
 80 KM Route C7 through p8
 81 RK 15180 0.010 0.050 0 TRAP 800 10

 82 KK P8
 83 KM Subarea P8
 84 BA 33
 85 LS 0 85
 86 UD 1.846

HEC-1 INPUT

PAGE 3

1

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

87 KK C18
 88 KM Combine R8 and P8
 89 RC 2

 90 KK k6
 91 KM Subarea k6
 92 BA 29.0
 93 LS 0 85
 94 UD 2.125

 95 KK Rk7
 96 KM Route c6 through k7
 97 RK 49335 0.010 0.050 0 TRAP 800 10

 98 KK k7
 99 KM Subarea k7
 100 BA 15.5

101	LS	0	85						
102	UD	2.297							
103	KK	C7							
104	KM	Combine Rk7 and k7							
105	HC	2							
106	KK	A							
107	KM	Combine C7 and C18							
108	HC	2							
109	KK	Rk10							
110	KM	Route A through P9/p10							
111	RK	34155	0.010	0.050	0	TRAP	800	10	
112	KK	P9							
113	KM	Subarea P9							
114	BA	32.5							
115	LS	0	85						
116	UD	1.748							
117	KK	p10							
118	KM	Subarea p10							
119	BA	50.0							
120	LS	0	85						
121	UD	2.345							
122	KK	C10							
123	KM	Combine A, P9 and p10							
124	HC	3							
125	KK	Rk12							
126	KM	Route C10 through P11/p12							
127	RK	34155	0.010	0.050	0	TRAP	800	10	

HEC-1 INPUT

PAGE 4

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

128	KK	P11							
129	KM	Subarea P11							
130	BA	36.0							
131	LS	0	85						
132	UD	1.739							
133	KK	p12							
134	KM	Subarea p12							
135	BA	36.5							
136	LS	0	85						
137	UD	2.382							
138	KK	C12							
139	KM	Combine Rk12, p11, and p12							
140	HC	3							
141	KK	P13							
142	KM	Subarea P13							
143	BA	42.5							
144	LS	0	85						
145	UD	2.390							
146	KK	C13							
147	KM	Combine c12 and p13							
148	HC	2							
149	KK	p14							
150	KM	Subarea p14							
151	BA	61.0							
152	LS	0	85						
153	UD	2.271							
154	KK	Rk15							
155	KM	Route p14 through P15							
156	RK	45540	0.01	0.050	0	TRAP	800	10	
157	KK	p15							
158	KM	Subarea p15							
159	BA	32.0							
160	LS	0	85						
161	UD	1.402							
162	KK	C15							
163	KM	Combine Rk15, p15, and c13							
164	HC	3							
165	KK	RDAM							
166	KM	Route c15 THROUGH ARROWHEAD VALLEY							
167	RK	42500	0.01	0.050	0	TRAP	800	10	

HEC-1 INPUT

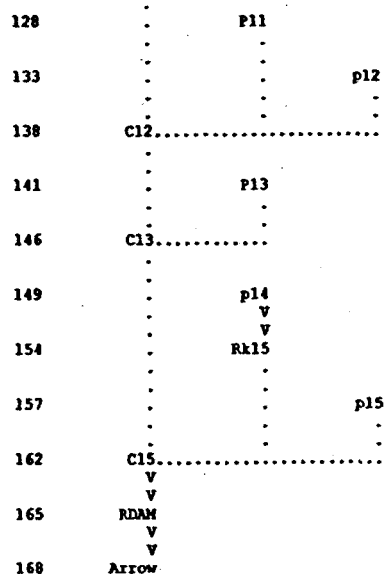
PAGE 5

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

168	KK	Arrow					
169	KM	Arrow Canyon					
170	RS	1	STOR	-1			
171	SV	0	14	460	915	2385	5005
172	SE	2133	2140	2150	2160	2170	2180
173	SQ	0	325	3186	10713	24587	46286
174	ZZ						

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
19	p1 v v	
33	R45	
36	.	P45
41	C45a.....	
44	.	P2 v v
49	.	R6
52	.	P6
57	C45b.....	
60	R7a	
63	.	P3 v v
68	.	R7b
71	.	P7
76	C7.....	
79	R8	
82	.	P8
87	C18.....	
90	.	K6 v v
95	.	Rk7
98	.	K7
103	.	C7.....
106	A.....	
109	Rk10	
112	.	P9
117	.	p10
122	C10.....	
125	Rk12	



 * STORM CENTERING TEST *
 * for Pahranagat and lower Kane Spring Watersheds *

prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention
 and depression area in Pahranagat National Wild Life Refuge

JR PREC 0.713 0.632 0.531 0.477 0.439 0.407 0.389 DARF
 AREA 50 100 200 300 400 500 600 sq miles

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION						
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7
				.71	.63	.53	.48	.44	.41	.39
HYDROGRAPH AT	p1	28.00	1 FLOW	4098.	3315.	2388.	1923.	1610.	1360.	1224.
+			TIME	6.33	6.33	6.42	6.42	6.50	6.50	6.50
ROUTED TO	R45	28.00	1 FLOW	4095.	3310.	2386.	1919.	1610.	1356.	1222.
+			TIME	9.25	9.58	10.08	10.42	10.75	11.17	11.25
HYDROGRAPH AT	P45	59.00	1 FLOW	8022.	6481.	4664.	3750.	3139.	2649.	2383.
+			TIME	6.58	6.58	6.67	6.67	6.75	6.75	6.75
2 COMBINED AT	C45a	87.00	1 FLOW	8022.	6481.	4664.	3750.	3139.	2649.	2383.
+			TIME	6.58	6.58	6.67	6.67	6.75	6.75	6.75
HYDROGRAPH AT	P2	38.50	1 FLOW	4814.	3887.	2791.	2243.	1876.	1582.	1423.
+			TIME	6.83	6.92	7.00	7.00	7.08	7.08	7.08
ROUTED TO	R6	38.50	1 FLOW	4808.	3882.	2787.	2239.	1874.	1579.	1420.
+			TIME	9.92	10.17	10.75	11.08	11.42	11.75	12.00
HYDROGRAPH AT	P6	30.00	1 FLOW	4439.	3593.	2588.	2085.	1747.	1475.	1327.
+			TIME	6.25	6.33	6.33	6.42	6.42	6.42	6.50
3 COMBINED AT	C45b	155.50	1 FLOW	12409.	10027.	7213.	5805.	4860.	4102.	3693.
+			TIME	6.42	6.50	6.58	6.58	6.58	6.67	6.67
ROUTED TO	R7a	155.50	1 FLOW	12402.	10019.	7207.	5799.	4856.	4100.	3687.
+			TIME	7.17	7.25	7.42	7.58	7.67	7.83	7.83

HYDROGRAPH AT	P3	39.50	1	FLOW TIME	6147. 6.08	4976. 6.17	3589. 6.17	2892. 6.25	2425. 6.25	2049. 6.25	1845. 6.33
ROUTED TO	R7b	39.50	1	FLOW TIME	6140. 7.17	4974. 7.25	3583. 7.50	2890. 7.67	2422. 7.75	2047. 7.92	1845. 8.00
HYDROGRAPH AT	P7	25.50	1	FLOW TIME	4605. 5.58	3736. 5.58	2705. 5.67	2185. 5.67	1835. 5.75	1555. 5.75	1403. 5.75
3 COMBINED AT	C7	220.50	1	FLOW TIME	20931. 6.92	16794. 7.08	11922. 7.25	9498. 7.42	7892. 7.58	6611. 7.75	5921. 7.83
ROUTED TO	R8	220.50	1	FLOW TIME	20924. 7.25	16782. 7.42	11913. 7.67	9492. 7.83	7881. 8.08	6608. 8.25	5907. 8.42
HYDROGRAPH AT	P8	33.00	1	FLOW TIME	5629. 5.83	4566. 5.83	3300. 5.83	2663. 5.92	2236. 5.92	1891. 5.92	1705. 6.00
2 COMBINED AT	C10	253.50	1	FLOW TIME	24288. 7.08	19301. 7.17	13459. 7.42	10566. 7.67	8634. 7.92	7158. 8.17	6348. 8.33
HYDROGRAPH AT	k6	29.00	1	FLOW TIME	4581. 6.08	3710. 6.08	2677. 6.17	2158. 6.17	1809. 6.17	1529. 6.25	1378. 6.25
ROUTED TO	Rk7	29.00	1	FLOW TIME	4574. 8.17	3707. 8.42	2672. 8.83	2151. 9.08	1807. 9.33	1527. 9.58	1372. 9.75
HYDROGRAPH AT	k7	15.50	1	FLOW TIME	2334. 6.25	1889. 6.25	1362. 6.33	1097. 6.33	919. 6.33	776. 6.42	699. 6.42
2 COMBINED AT	C7	44.50	1	FLOW TIME	5763. 7.92	4472. 8.42	3140. 8.58	2462. 8.92	2030. 9.17	1687. 9.42	1501. 9.58
2 COMBINED AT	A	298.00	1	FLOW TIME	27505. 7.75	20834. 7.17	14466. 7.42	11331. 8.67	9177. 7.92	7558. 8.17	6673. 8.33
ROUTED TO	Rk10	298.00	1	FLOW TIME	27314. 8.50	20830. 7.92	14441. 8.33	11240. 8.75	9135. 9.08	7523. 9.33	6646. 9.58
HYDROGRAPH AT	P9	32.50	1	FLOW TIME	5693. 5.67	4617. 5.75	3341. 5.75	2696. 5.83	2265. 5.83	1917. 5.83	1728. 5.83
HYDROGRAPH AT	p10	50.00	1	FLOW TIME	7431. 6.25	6012. 6.33	4333. 6.33	3489. 6.42	2924. 6.42	2469. 6.42	2223. 6.42
3 COMBINED AT	C10	380.50	1	FLOW TIME	34029. 7.33	26109. 7.75	17238. 8.25	12963. 8.67	10276. 9.00	8296. 9.33	7233. 9.58
ROUTED TO	Rk12	380.50	1	FLOW TIME	33968. 8.00	26052. 8.42	17161. 9.08	12889. 9.67	10206. 10.08	8245. 10.50	7188. 10.83
HYDROGRAPH AT	P11	36.00	1	FLOW TIME	6321. 5.67	5125. 5.75	3710. 5.75	2993. 5.75	2515. 5.83	2129. 5.83	1919. 5.83
HYDROGRAPH AT	p12	36.50	1	FLOW TIME	5370. 6.33	4344. 6.33	3130. 6.42	2520. 6.42	2111. 6.42	1782. 6.50	1605. 6.50
3 COMBINED AT	C12	453.00	1	FLOW TIME	38659. 8.00	28929. 8.42	18451. 9.08	13578. 9.67	10638. 10.08	8518. 10.50	7383. 10.83
HYDROGRAPH AT	P13	42.50	1	FLOW TIME	6239. 6.33	5047. 6.33	3636. 6.42	2928. 6.42	2452. 6.42	2071. 6.50	1864. 6.50
2 COMBINED AT	C13	495.50	1	FLOW TIME	42288. 7.92	31211. 8.33	19518. 9.08	14170. 9.67	11019. 10.08	8764. 10.50	7562. 10.83
HYDROGRAPH AT	p14	61.00	1	FLOW TIME	9252. 6.17	7488. 6.25	5398. 6.25	4349. 6.33	3646. 6.33	3079. 6.33	2772. 6.42
ROUTED TO											

•	RR15	61.00	1	FLOW TIME	9247. 7.67	7484. 7.83	5393. 8.08	4341. 8.33	3636. 8.50	3074. 8.67	2770. 8.75
HYDROGRAPH AT +	p15	32.00	1	FLOW TIME	6102. 5.25	4947. 5.33	3582. 5.42	2895. 5.42	2436. 5.50	2066. 5.50	1865. 5.58
3 COMBINED AT +	C15	588.50	1	FLOW TIME	52333. 7.92	38755. 8.33	24160. 9.08	17791. 8.33	13779. 8.67	11084. 8.92	9484. 9.17
ROUTED TO +	RDAM	588.50	1	FLOW TIME	51929. 8.58	38546. 9.08	24098. 10.00	17632. 9.42	13604. 9.92	11005. 10.25	9411. 10.58
ROUTED TO +	Arrow	588.50	1	FLOW TIME	40981. 9.67	31268. 10.00	20339. 10.75	15101. 11.33	11856. 11.92	9446. 12.42	7991. 11.25
** PEAK STAGES IN FEET **											
1	1	STAGE			2177.56	2173.08	2166.94	2163.16	2160.82	2158.32	2156.38
		TIME			9.67	10.00	10.75	11.33	11.92	12.42	11.25

Appendix B The HEC-1 Model Developed for Kane Springs Valley (Basin 1)

```

1.....
.....
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*
*   JAN   1997
*
*   VERSION 4.1
*
*
* RUN DATE  30JAN00  TIME  17:00:22
*
*
*.....

```

```

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

```

```

X  X  XXXXXX  XXXX  X
X  X  X      X  X  XX
X  X  X      X  X  X
XXXXXX XXXX  X  XXXX  X
X  X  X      X  X  X
X  X  X      X  X  X
X  X  XXXXXX  XXXX  XXX

```

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

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

HEC-1 INPUT PAGE 1

```

1
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
          *DIAGRAM
1         ID
2         ID
3         ID
4         ID  * BASIN 1 of 249 sq miles
5         ID  * KANE SPRINGS Watershed only
6         ID  * BASINS 1 to Points A
7         ID
8         ID  100-year event with PB=3.0 inches
9         ID
10        ID  prepared by VTN-nevada in January 2000
11        ID
12        ID  All tributary area north of Maynard Lake drains into the detention
13        ID  and depression area in Pahrangat National Wild Life Refuge
14        ID
15        ID  PREC  0.824 0.782 0.745 0.694 0.646 0.574 0.531 0.50
16        ID  AREA   20   30   40   60   90  150  200  250
*** FREE ***
17        IT      5      0      0      150
18        IO      5      0      0
19        IM      5      0      0
20        JR  PREC  0.824 0.782 0.745 0.694 0.646 0.574 0.531 0.500

21        KK      K1
22        KM  Subarea k1
23        BA      33
24        PB      3.0
25        PC      .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
26        PC      .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
27        PC      .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
28        PC      .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
29        PC      .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
30        PC      .810 .820 .826 .840 .859 .889 .910 .938 .966 .970
31        PC      .974 .979 .981 .983 .985 .989 .990 .992 .993 .996
32        PC      .997 .999 1.00
33        LS      0      85
34        UD      2.356

35        KK      Rk2
36        KM  Route k1 through k2
37        RK  50094 0.010 0.050      0  TRAP  800  10

38        KK      k2
39        KM  Subarea k2

```

40 BA 56.5
41 LS 0 85
42 UD 2.911

43 KK C2
44 KM Combine Rk2, and k2
45 HC 2

HEC-1 INPUT

PAGE 2

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

46 KK Rk3
47 KM Route c2 throug k3
48 RK 37950 0.010 0.050 0 TRAP 800 10

49 KK k3
50 KM Subarea k3
51 BA 57.0
52 LS 0 85
53 UD 2.573

54 KK C3
55 KM Combine Rk3, and k3
56 HC 2

57 KK Rk4
58 KM Route c2 throug k3
59 RK 37950 0.010 0.050 0 TRAP 800 10

60 KK k4
61 KM Subarea k4
62 BA 36.5
63 LS 0 85
64 UD 4.87

65 KK k5
66 KM Subarea k5
67 BA 21.5
68 LS 0 85
69 UD 1.891

70 KK C45
71 KM Combine Rk4, K4, and k5
72 HC 3

73 KK Rk6
74 KM Route c45 throug k6
75 RK 34155 0.010 0.050 0 TRAP 800 10

76 KK k6
77 KM Subarea k6
78 BA 29.0
79 LS 0 85
80 UD 2.125

81 KK C6
82 KM Combine Rk6 and k6
83 HC 2

84 KK Rk7
85 KM Route c6 throug k7
86 RK 49335 0.010 0.050 0 TRAP 800 10

HEC-1 INPUT

PAGE 3

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

87 KK k7
88 KM Subarea k7
89 BA 15.5
90 LS 0 85
91 UD 2.297

92 KK C7(pt A)
93 KM Combine Rk7 and k7 (BASIN 1-Kane Springs)
94 HC 2

95 KK B
96 KM Route C7 from A to B
97 RK 52800 0.01 0.050 0 TRAP 800 10

98 KK RDAM(pt B)
99 KM Route B to ARROWHEAD Dam
100 RK 45010 0.01 0.050 0 TRAP 800 10

101 KK Arrow(Gage)
102 KM Arrow Canyon
103 RS 1 STOR -1
104 SV 0 14 460 915 2385 5005
105 SE 2133 2140 2150 2160 2170 2180
106 SQ 0 325 3186 10713 24587 46286
107 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
21	K1	
	V	
35	Rk2	
	.	
38	.	k2
	.	
43	C2.....	
	V	
	V	
46	Rk3	
	.	
49	.	k3
	.	
54	C3.....	
	V	
	V	
57	Rk4	
	.	
60	.	k4
	.	
65	.	k5
	.	
70	C45.....	
	V	
	V	
73	Rk6	
	.	
76	.	k6
	.	
81	C6.....	
	V	
	V	
84	Rk7	
	.	
87	.	k7
	.	
92	C7.....	
	V	
	V	
95	B	
	V	
98	RDAM	
	V	
	V	
101	ARROW	

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

All tributary area north of Maynard Lake drains into the detention
and depression area in Pahrnagat National Wild Life Refuge

PREC	0.824	0.782	0.745	0.694	0.646	0.574	0.531	0.50
AREA	20	30	40	60	90	150	200	250

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION							
				RATIO 1 .82	RATIO 2 .78	RATIO 3 .75	RATIO 4 .69	RATIO 5 .65	RATIO 6 .57	RATIO 7 .53	RATIO 8 .50
HYDROGRAPH AT +	K1	33.00	1 FLOW TIME	6220. 6.25	5711. 6.25	5268. 6.25	4666. 6.25	4115. 6.33	3312. 6.33	2851. 6.33	2528. 6.42
ROUTED TO +	Rk2	33.00	1 FLOW TIME	6216. 8.17	5705. 8.25	5264. 8.33	4664. 8.42	4111. 8.58	3310. 8.83	2848. 9.00	2527. 9.17
HYDROGRAPH AT +	k2	56.50	1 FLOW TIME	9213. 6.75	8452. 6.75	7790. 6.75	6894. 6.83	6071. 6.83	4876. 6.83	4191. 6.92	3714. 6.92
2 COMBINED AT +	C2	89.50	1 FLOW TIME	13618. 7.83	12251. 8.00	10967. 8.17	9555. 8.25	8272. 8.33	6346. 8.58	5211. 8.83	4485. 8.92
ROUTED TO +	Rk3	89.50	1 FLOW TIME	13567. 8.92	12112. 9.08	10966. 9.25	9334. 9.58	8181. 9.67	6182. 10.17	5154. 10.42	4380. 10.75
HYDROGRAPH AT +	k3	57.00	1 FLOW TIME	10134. 6.42	9302. 6.50	8580. 6.50	7600. 6.50	6696. 6.50	5384. 6.58	4634. 6.58	4108. 6.58
2 COMBINED AT +	C3	146.50	1 FLOW TIME	17430. 8.92	15543. 7.33	14185. 7.33	12380. 7.42	10699. 7.58	8295. 7.83	6962. 8.08	6063. 8.17
ROUTED TO +	Rk4	146.50	1 FLOW TIME	17324. 9.83	15526. 8.33	14166. 8.42	12370. 8.50	10692. 8.75	8276. 9.17	6953. 9.42	6020. 9.67
HYDROGRAPH AT +	k4	36.50	1 FLOW TIME	3928. 8.67	3598. 8.67	3311. 8.67	2923. 8.67	2568. 8.75	2055. 8.75	1761. 8.75	1557. 8.83
HYDROGRAPH AT +	k5	21.50	1 FLOW TIME	4600. 5.83	4227. 5.83	3903. 5.83	3462. 5.83	3054. 5.83	2462. 5.92	2123. 5.92	1885. 5.92
3 COMBINED AT +	C45	204.50	1 FLOW TIME	22265. 8.08	20195. 8.17	18404. 8.33	16038. 8.50	13808. 8.75	10617. 9.17	8884. 9.42	7660. 9.67
ROUTED TO +	Rk6	204.50	1 FLOW TIME	22244. 8.83	20177. 9.00	18387. 9.17	16016. 9.33	13769. 9.67	10592. 10.17	8845. 10.58	7614. 10.92
HYDROGRAPH AT +	k6	29.00	1 FLOW TIME	5822. 6.00	5346. 6.00	4933. 6.08	4374. 6.08	3858. 6.08	3107. 6.08	2677. 6.17	2376. 6.17
2 COMBINED AT +	C6	233.50	1 FLOW TIME	23623. 8.75	21313. 8.92	19334. 9.08	16735. 9.33	14266. 9.67	10871. 10.17	9023. 10.58	7738. 10.92
ROUTED TO +	Rk7	233.50	1 FLOW TIME	23580. 9.92	21302. 10.08	19279. 10.33	16683. 10.58	14197. 11.08	10809. 11.75	8966. 12.25	6505. 11.33
HYDROGRAPH AT •	k7	15.50	1 FLOW TIME	2969. 6.17	2725. 6.17	2514. 6.25	2228. 6.25	1965. 6.25	1581. 6.25	1362. 6.33	1208. 6.33
2 COMBINED AT +	C7	249.00	1 FLOW TIME	23992. 9.92	21640. 10.08	19542. 10.33	16881. 10.58	14321. 11.08	10872. 11.75	9005. 12.25	6572. 11.33
ROUTED TO +	B	249.00	1 FLOW TIME	23938. 11.08	21554. 11.33	19502. 11.58	16820. 12.00	12849. 12.42	8174. 12.42	2835. 12.42	1094. 10.75
ROUTED TO +	RDAM	249.00	1 FLOW TIME	23878. 12.08	21458. 12.42	15238. 12.42	0. 12.42	0. .00	0. .00	0. .00	0. .00
ROUTED TO •	Arrow	249.00	1 FLOW TIME	12507. 12.42	6907. 12.42	1894. 12.42	0. 12.42	0. .00	0. .00	0. .00	0. .00
				** PEAK STAGES IN FEET **							
1				1 STAGE	2161.29	2154.94	2145.48	2133.00	2133.00	2133.00	2133.00
				TIME	12.42	12.42	12.42	12.42	.00	.00	.00

Appendix C The HEC-1 Model Developed for Pahranagat Valley North of Point A (Basin 2)

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1*****
*****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 30JAN00 TIME 17:10:02
*****
*****

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

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

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

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

1

HEC-1 INPUT

PAGE 1

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LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*DIAGRAM
1 ID
2 ID *****
3 ID * Pahranagat WATERSHED North of Pt A --- BASIN 2 *
4 ID *****
5 ID 100-year event with PB=3.0 inches
6 ID
7 ID THE CRITICAL STORM COVER AREA IS 250 sq miles
8 ID
9 ID prepared by VTN-nevada in January 2000
10 ID
11 ID PREC 0.824 0.782 0.745 0.694 0.646 0.574 0.510 0.50
12 ID AREA 20 30 40 60 90 150 220 250
*** FREE ***
13 IT 5 0 0 150
14 IO 5 0 0
15 IN 5 0 0
16 JR PREC 0.824 0.782 0.745 0.694 0.646 0.574 0.510 0.500
17 KK pl
18 KM Subarea pl
19 BA 28.0
20 PB 3.0
21 PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
22 PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
23 PC .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
24 PC .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
25 PC .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
26 PC .810 .820 .826 .840 .859 .889 .910 .938 .966 .970
27 PC .974 .979 .981 .983 .985 .989 .990 .992 .993 .996
28 PC .997 .999 1.00
29 LS 0 85
30 UD 2.401

```

31 KK R45
 32 KM Route p11 through p45
 33 RK 64515 0.010 0.050 0 TRAP 800 10

 34 KK P45
 35 KM Subarea P45
 36 BA 59.0
 37 PB 3.0
 38 LS 0 85
 39 UD 2.675

 40 KK C45a
 41 KM Combine R45 and P45
 42 HC 2

 43 KK P2
 44 KM Subarea P2
 45 BA 38.5
 46 PB 3.0
 47 LS 0 85
 48 UD 3.00

HEC-1 INPUT

PAGE 2

1

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

49 KK R6
 50 KM Route p2 through p6
 51 RK 70380 0.010 0.050 0 TRAP 800 10

 52 KK P6
 53 KM Subarea P6
 54 BA 30.0
 55 PB 3.0
 56 LS 0 85
 57 UD 2.36

 58 KK C45b
 59 KM Combine R45a, R6 and P6
 60 HC 3

 61 KK R7a
 62 KM Route C45b through P7
 63 RK 26565 0.010 0.050 0 TRAP 800 10

 64 KK P3
 65 KM Subarea P3
 66 BA 39.5
 67 PB 3.0
 68 LS 0 85
 69 UD 2.179

 70 KK R7b
 71 KM Route p3 through p7
 72 RK 27600 0.010 0.050 0 TRAP 800 10

 73 KK P7
 74 KM Subarea P7
 75 BA 25.5
 76 PB 3.0
 77 LS 0 85
 78 UD 1.631

 79 KK C7
 80 KM Combine R7b, R7a, and P7
 81 HC 3

 82 KK R8
 83 KM Route C7 through p8
 84 RK 15180 0.010 0.050 0 TRAP 800 10

 85 KK P8
 86 KM Subarea P8
 87 BA 33
 88 PB 3.0
 89 LS 0 85
 90 UD 1.846

HEC-1 INPUT

PAGE 3

1

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

91 KK C18(Pt A)
 92 KM Combine R8 and P8(Basin 2 --Prahlangat Watershed north of Point A)
 93 HC 2

 94 KK B
 95 KM Route B to ARROWHEAD VALLEY
 96 RK 52800 0.01 0.050 0 TRAP 800 10

 97 KK RDAH
 98 KM Route c15 THROUGH the Valley to ARROWHEAD VALLEY
 99 RK 42500 0.01 0.050 0 TRAP 800 10

100	MKArrow(Gage)						
101	KM	Arrow Canyon					
102	RS	1	STOR	-1			
103	SV	0	14	460	915	2385	5005
104	SE	2133	2140	2150	2160	2170	2180
105	SQ	0	325	3186	10713	24587	46286
106	ZZ						

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
17	p1	
	v	
31	R45	
	.	
34	.	P45
	.	
40	C45a	
	.	
43	.	P2
	.	v
49	.	R6
	.	
52	.	P6
	.	
58	C45b	
	v	
61	R7a	
	.	
64	.	P3
	.	v
70	.	R7b
	.	
73	.	P7
	.	
79	C7	
	v	
82	R8	
	.	
85	.	P8
	.	
91	C18	
	v	
94	.	
	v	
97	RDAM	
	v	
100	Arrow(Ga	

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

 * Fabranagat WATERSHED North of Pt A --- BASIN 2 *

 100-year event with PB=3.0 inches

THE CRITICAL STORM COVER AREA IS 250 sq miles

prepared by VTN-nevada in January 2000

PREC	0.824	0.782	0.745	0.694	0.646	0.574	0.510	0.50
AREA	20	30	40	60	90	150	220	250

14 10

OUTPUT CONTROL VARIABLES

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

17

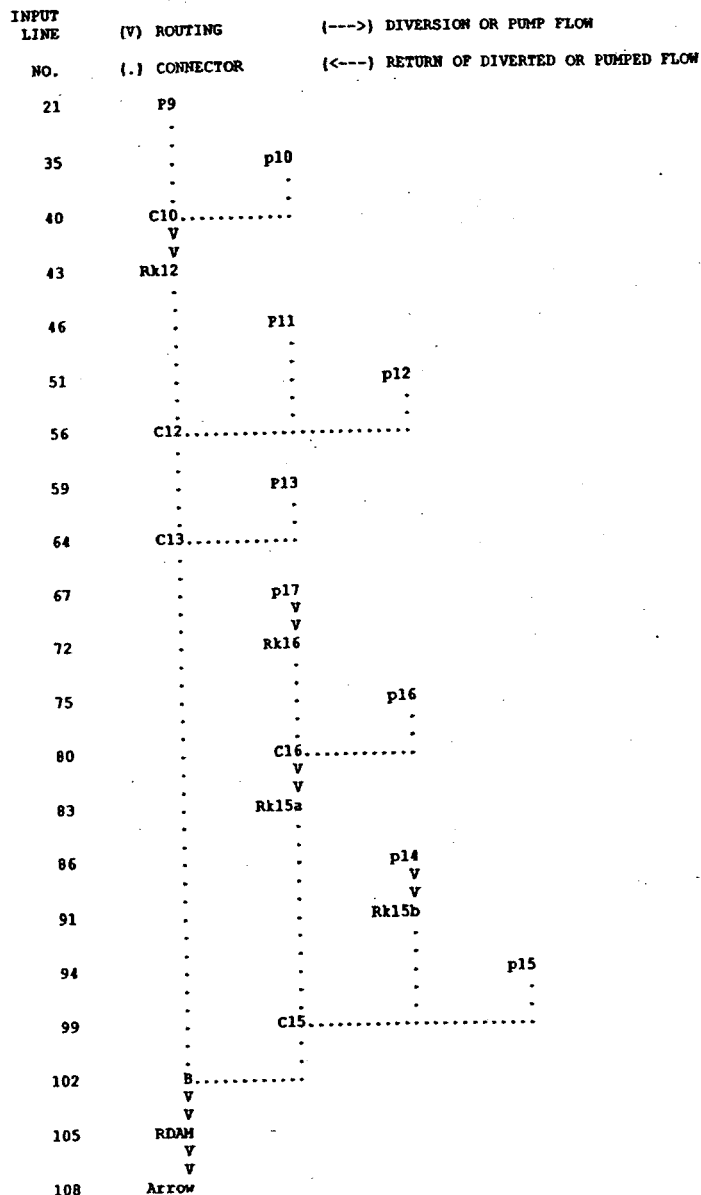
HYDROGRAPH TIME DATA

NMIN	5	MINUTES IN COMPUTATION INTERVAL
------	---	---------------------------------

107	RK	42500	0.01	0.050	0	TRAP	800	10
108	KK	Arrow(Gage)						
109	KM	Arrow Canyon						
110	RS	1	STOR	-1				
111	SV	0	14	460	915	2385	5005	
112	SE	2133	2140	2150	2160	2170	2180	
113	SQ	0	325	3186	10713	24587	46286	
114	ZZ							

1

SCHEMATIC DIAGRAM OF STREAM NETWORK



and depression area in Pahranaget National Wild Life Refuge

PREC	0.824	0.782	0.745	0.713	0.674	0.661	0.632	0.531	0.45
AREA	20	30	40	50	70	80	100	200	360

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION								
				RATIO 1 .82	RATIO 2 .78	RATIO 3 .75	RATIO 4 .71	RATIO 5 .67	RATIO 6 .66	RATIO 7 .63	RATIO 8 .53	RATIO 9 .45
HYDROGRAPH AT +	P9	32.50	1 FLOW TIME	7224. 5.67	6639. 5.67	6129. 5.67	5693. 5.67	5168. 5.75	4997. 5.75	4617. 5.75	3341. 5.75	2388. 5.83
HYDROGRAPH AT +	p10	50.00	1 FLOW TIME	9452. 6.25	8679. 6.25	8006. 6.25	7431. 6.25	6740. 6.25	6512. 6.33	6012. 6.33	4333. 6.33	3085. 6.42
2 COMBINED AT +	C10	82.50	1 FLOW TIME	16282. 5.92	14951. 5.92	13791. 5.92	12799. 5.92	11615. 6.00	11224. 6.00	10362. 6.00	7468. 6.00	5320. 6.08
ROUTED TO +	Rk12	82.50	1 FLOW TIME	16260. 6.75	14930. 6.83	13777. 6.83	12794. 6.92	11605. 6.92	11213. 7.00	10347. 7.00	7461. 7.25	5316. 7.42
HYDROGRAPH AT +	P11	36.00	1 FLOW TIME	8019. 5.67	7370. 5.67	6805. 5.67	6321. 5.67	5739. 5.67	5547. 5.67	5125. 5.75	3710. 5.75	2651. 5.83
HYDROGRAPH AT +	p12	36.50	1 FLOW TIME	6831. 6.25	6271. 6.25	5784. 6.33	5370. 6.33	4872. 6.33	4707. 6.33	4344. 6.33	3130. 6.42	2228. 6.42
3 COMBINED AT +	✓C12	155.00	1 FLOW TIME	29053. 6.42	26555. 6.42	24402. 6.50	22550. 6.50	20327. 6.58	19601. 6.58	18012. 6.58	12633. 6.83	8673. 7.08
HYDROGRAPH AT +	P13	42.50	1 FLOW TIME	7936. 6.25	7285. 6.25	6721. 6.33	6239. 6.33	5660. 6.33	5469. 6.33	5047. 6.33	3636. 6.42	2588. 6.42
2 COMBINED AT +	C13	197.50	1 FLOW TIME	36980. 6.33	33817. 6.42	31096. 6.42	28740. 6.42	25935. 6.50	25010. 6.50	22988. 6.58	16147. 6.75	11009. 7.08
HYDROGRAPH AT +	p17	42.00	1 FLOW TIME	8494. 6.00	7802. 6.00	7199. 6.00	6683. 6.00	6064. 6.08	5861. 6.08	5412. 6.08	3905. 6.08	2786. 6.17
ROUTED TO +	Rk16	42.00	1 FLOW TIME	8479. 7.25	7795. 7.33	7187. 7.33	6674. 7.42	6061. 7.50	5856. 7.50	5403. 7.58	3900. 7.83	2782. 8.17
HYDROGRAPH AT +	p16	27.00	1 FLOW TIME	5710. 5.83	5245. 5.83	4841. 5.83	4495. 5.92	4082. 5.92	3946. 5.92	3644. 5.92	2632. 5.92	1879. 6.00
2 COMBINED AT +	C16	69.00	1 FLOW TIME	12354. 6.83	11227. 6.92	10288. 6.92	9476. 7.00	8488. 7.08	8166. 7.17	7486. 7.17	5151. 7.58	3465. 8.00
ROUTED TO +	Rk15a	69.00	1 FLOW TIME	12340. 8.00	11219. 8.08	10281. 8.17	9465. 8.33	8480. 8.50	8156. 8.50	7467. 8.67	5104. 9.33	3443. 10.00
HYDROGRAPH AT +	p14	61.00	1 FLOW TIME	11767. 6.17	10806. 6.17	9968. 6.17	9252. 6.17	8393. 6.25	8111. 6.25	7488. 6.25	5398. 6.25	3846. 6.33
ROUTED TO •	Rk15b	61.00	1 FLOW TIME	11757. 7.50	10795. 7.58	9963. 7.58	9247. 7.67	8390. 7.75	8101. 7.75	7484. 7.83	5393. 8.08	3838. 8.42
HYDROGRAPH AT +	p15	32.00	1 FLOW TIME	7757. 5.17	7121. 5.17	6571. 5.25	6102. 5.25	5538. 5.33	5354. 5.33	4947. 5.33	3582. 5.42	2567. 5.50
3 COMBINED AT +	✓15	162.00	1 FLOW TIME	25081. 7.75	22633. 7.92	20517. 8.08	18675. 8.25	16547. 8.42	15902. 8.42	14356. 8.58	9380. 9.25	6140. 10.00
2 COMBINED AT +	B	359.50	1 FLOW TIME	52968. 6.92	47712. 7.08	43152. 7.17	39165. 7.25	34574. 7.42	32972. 7.50	29677. 7.58	19797. 8.00	12793. 8.42
ROUTED TO +	RDAM	359.50	1 FLOW TIME	52930. 7.58	47679. 7.75	43043. 7.92	39041. 8.00	34413. 8.17	32896. 8.25	29577. 8.42	19719. 9.00	12707. 9.67
ROUTED TO +	Arrow	359.50	1 FLOW TIME	42116. 9.00	37859. 9.17	34390. 9.25	31148. 9.42	27780. 9.50	26592. 9.58	24067. 9.67	16158. 9.75	11277. 10.17
** PEAK STAGES IN FEET **												
1 STAGE TIME				2178.08 9.00	2176.12 9.17	2174.52 9.25	2173.02 9.42	2171.47 9.50	2170.92 9.58	2169.63 9.67	2163.92 9.75	2160.41 10.17

Appendix E **The HEC-1 Model Developed for Total Area of 861 Square Miles** **Including Basins 1, 2, 3, and 5**

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*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*
* JAN 1997
*
* VERSION 4.1
*
* RUN DATE 29JAN00 TIME 17:09:47
*
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*
* U.S. ARMY CORPS OF ENGINEERS
*
* HYDROLOGIC ENGINEERING CENTER
*
* 609 SECOND STREET
*
* DAVIS, CALIFORNIA 95616
*
* (916) 756-1104
*

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

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

1

HEC-1 INPUT

PAGE 1

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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1          ID
2          ID
3          ID
4          ID * ALL AREAS of 862 sq miles
5          ID * PAHRANAGAT WATERSHED AND KANE SPRINGS
6          ID * BASINS 1, 2, 3, and 5. Points A and B
7          ID
8          ID
9          ID prepared by VTN-nevada in January 2000
10         ID
11         ID All tributary area north of Maynard Lake drains into the detention
12         ID and depression area in Pahranaagat National Wild Life Refuge
13         ID
14         ID PREC 0.531 0.477 0.439 0.407 0.389 0.370 0.351 0.332
15         ID AREA 200 300 400 500 600 700 800 900
*** FREE ***
16         IT 5 0 0 150
17         IO 5 0 0
18         IN 5 0 0
19         JR PREC 0.531 0.477 0.439 0.407 0.389 0.370 0.351 0.332
20         KK pl
21         KM Subarea pl
22         RA 28.0
23         PB 3.0
24         PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
25         PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
26         PC .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
27         PC .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
28         PC .561 .630 .710 .720 .731 .752 .779 .790 .795 .804

```


29	PC	.810	.820	.826	.840	.859	.889	.910	.938	.966	.970
30	PC	.974	.979	.981	.983	.985	.989	.990	.992	.993	.996
31	PC	.997	.999	1.00							
32	LS	0	85								
33	UD	2.401									
34	KK	R45									
35	KM	Route p11 through p45									
36	RK	64515	0.010	0.050	0	TRAP	800	10			
37	KK	P45									
38	KM	Subarea P45									
39	BA	59.0									
40	PB	3.0									
41	LS	0	85								
42	UD	2.675									
43	KK	C45a									
44	KM	Combine R45 and P45									
45	HC	2									

1

HEC-1 INPUT

PAGE 2

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
46	KK P2
47	KM Subarea P2
48	BA 38.5
49	PB 3.0
50	LS 0 85
51	UD 3.00
52	KK R6
53	KM Route p2 throug p6
54	RK 70380 0.010 0.050 0 TRAP 800 10
55	KK P6
56	KM Subarea P6
57	BA 30.0
58	PB 3.0
59	LS 0 85
60	UD 2.36
61	KK C45b
62	KM Combine R45a, R6 and P6
63	HC 3
64	KK R7a
65	KM Route C45b through P7
66	RK 26565 0.010 0.050 0 TRAP 800 10
67	KK P3
68	KM Subarea P3
69	BA 39.5
70	PB 3.0
71	LS 0 85
72	UD 2.179
73	KK R7b
74	KM Route p3 throug p7
75	RK 27600 0.010 0.050 0 TRAP 800 10
76	KK P7
77	KM Subarea P7
78	BA 25.5
79	PB 3.0
80	LS 0 85
81	UD 1.631
82	KK C7
83	KM Combine R7b, R7a, and P7
84	HC 3
85	KK R8
86	KM Route C7 throug p8
87	RK 15180 0.010 0.050 0 TRAP 800 10

1

HEC-1 INPUT

PAGE 3

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
88	KK P8
89	KM Subarea P8
90	BA 33
91	PB 3.0
92	LS 0 85
93	UD 1.846
94	KK C18
95	KM Combine R8 and P8(Basin 2 --Prahrangat Watershed north of Point A)
96	HC 2
97	KK K1

98	KM	Subarea k1							
99	BA	32.5							
100	LS	0	85						
101	UD	2.356							
102	KK	Rk2							
103	KM	Route k1 through k2							
104	RK	50094	0.010	0.050	0	TRAP	800	10	
105	KK	k2							
106	KM	Subarea k2							
107	BA	56.5							
108	LS	0	85						
109	UD	2.911							
110	KK	C2							
111	KM	Combine Rk2, and k2							
112	HC	2							
113	KK	Rk3							
114	KM	Route c2 through k3							
115	RK	37950	0.010	0.050	0	TRAP	800	10	
116	KK	k3							
117	KM	Subarea k3							
118	BA	57.0							
119	LS	0	85						
120	UD	2.573							
121	KK	C3							
122	KM	Combine Rk3, and k3							
123	HC	2							
124	KK	Rk4							
125	KM	Route c2 through k3							
126	RK	37950	0.010	0.050	0	TRAP	800	10	

HEC-1 INPUT

PAGE 4

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

127	KK	k4							
128	KM	Subarea k4							
129	BA	36.5							
130	LS	0	85						
131	UD	4.87							
132	KK	k5							
133	KM	Subarea k5							
134	BA	21.5							
135	LS	0	85						
136	UD	1.891							
137	KK	C45							
138	KM	Combine Rk4, k4, and k5							
139	HC	3							
140	KK	Rk6							
141	KM	Route c45 through k6							
142	RK	34155	0.010	0.050	0	TRAP	800	10	
143	KK	k6							
144	KM	Subarea k6							
145	BA	29.0							
146	LS	0	85						
147	UD	2.125							
148	KK	C6							
149	KM	Combine Rk6 and k6							
150	HC	2							
151	KK	Rk7							
152	KM	Route c6 through k7							
153	RK	49335	0.010	0.050	0	TRAP	800	10	
154	KK	k7							
155	KM	Subarea k7							
156	BA	15.5							
157	LS	0	85						
158	UD	2.297							
159	KK	C7							
160	KM	Combine Rk7 and k7 (Watershed 1-Kane Springs)							
161	HC	2							
162	KK	A							
163	KM	Combine C7 and C18 (Point A)							
164	HC	2							
165	KK	Rk10							
166	KM	Route A through P9/p10							
167	RK	34155	0.010	0.050	0	TRAP	800	10	

HEC-1 INPUT

PAGE 5

LINE	ID	1	2	3	4	5	6	7	8	9	10
168	KK	P9									
169	KM	Subarea p9									
170	BA	32.5									
171	LS	0	85								
172	UD	1.748									
173	KK	p10									
174	KM	Subarea p10									
175	BA	50.0									
176	LS	0	85								
177	UD	2.345									
178	KK	C10									
179	KM	Combine A, P9 and p10									
180	HC	3									
181	KK	Rk12									
182	KM	Route C10 through P11/p12									
183	RK	34155 0.010 0.050	0	TRAP	800	10					
184	KK	P11									
185	KM	Subarea p11									
186	BA	36.0									
187	LS	0	85								
188	UD	1.739									
189	KK	p12									
190	KM	Subarea p12									
191	BA	36.5									
192	LS	0	85								
193	UD	2.382									
194	KK	C12									
195	KM	Combine Rk12, p11, and p12									
196	HC	3									
197	KK	P13									
198	KM	Subarea P13									
199	BA	42.5									
200	LS	0	85								
201	UD	2.390									
202	KK	C13									
203	KM	Combine c12 and p13 (Watershed 3)									
204	HC	2									
205	KK	p17									
206	KM	Subarea p17									
207	BA	42.0									
208	LS	0	85								
209	UD	2.099									

HEC-1 INPUT

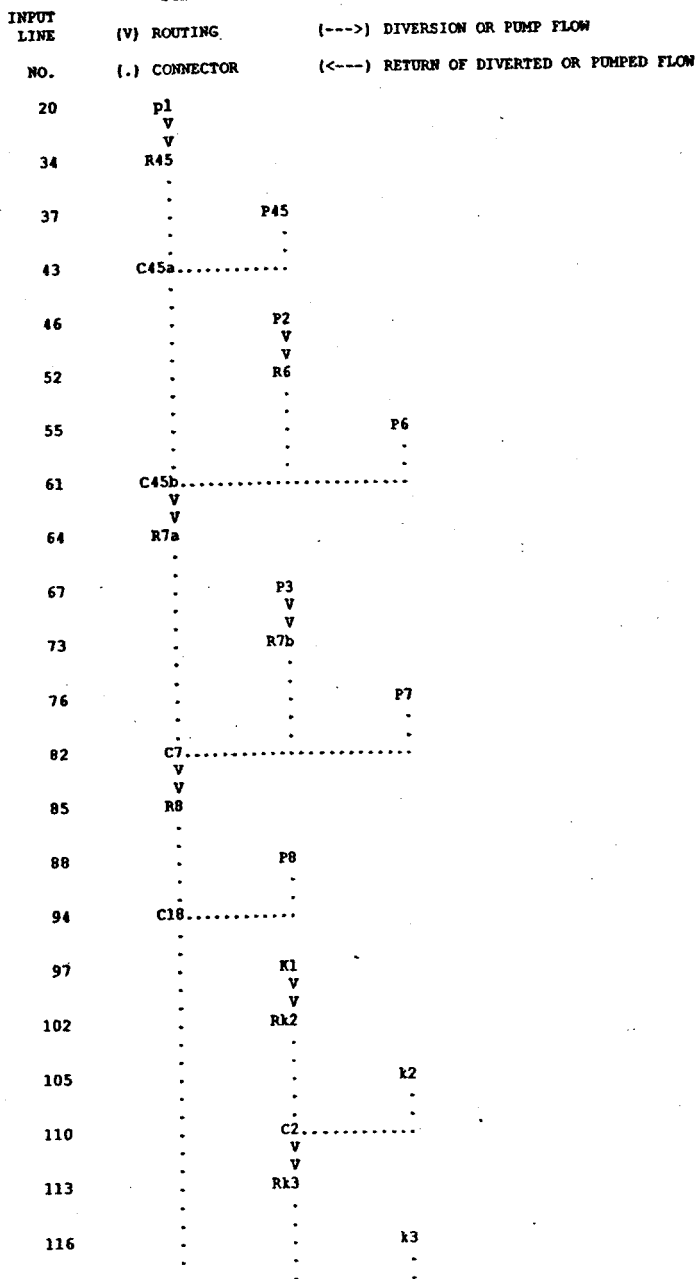
PAGE 6

LINE	ID	1	2	3	4	5	6	7	8	9	10
210	KK	Rk16									
211	KM	Route p17 through P16									
212	RK	37950 0.010 0.050	0	TRAP	800	10					
213	KK	p16									
214	KM	Subarea p16									
215	BA	27.0									
216	LS	0	85								
217	UD	1.935									
218	KK	C16									
219	KM	Combine Rk16, and P16									
220	HC	2									
221	KK	Rk15a									
222	KM	Route C16 through P15									
223	RK	40250 0.010 0.050	0	TRAP	800	10					
224	KK	p14									
225	KM	Subarea p14									
226	BA	61.0									
227	LS	0	85								
228	UD	2.271									
229	KK	Rk15b									
230	KM	Route p14 through P15									
231	RK	45540 0.010 0.050	0	TRAP	800	10					
232	KK	p15									
233	KM	Subarea p15									
234	BA	32.0									
235	LS	0	85								
236	UD	1.402									

237	KK	C15						
238	KM	Combine Rk15a, Rk15b, and P15 (at Point 5)						
239	HC	3						
240	KK	B						
241	KM	Combine C15 and C13						
242	HC	2						
243	KK	RDAM						
244	KM	Route c15 THROUGH ARROWHEAD VALLEY						
245	RK	42500 0.01 0.050 0 TRAP 800 10						
246	KK	Arrow						
247	KM	Arrow Canyon						
248	RS	1 STOR -1						
249	SV	0 14 460 915 2385 5005						
250	SE	2133 2140 2150 2160 2170 2180						
251	SQ	0 325 3186 10713 24587 46286						
252	ZZ							

1

SCHEMATIC DIAGRAM OF STREAM NETWORK



121	.	C3.....	
	.	V	
	.	V	
124	.	Rk4	
	.	.	
127	.	.	k4
	.	.	
132	.	.	k5
	.	.	
137	.	C45.....	
	.	V	
	.	V	
140	.	Rk6	
	.	.	
143	.	.	k6
	.	.	
148	.	C6.....	
	.	V	
	.	V	
151	.	Rk7	
	.	.	
154	.	.	k7
	.	.	
159	.	C7.....	
	.	.	
162	.	A.....	
	.	V	
	.	V	
165	.	Rk10	
	.	.	
168	.	P9	
	.	.	
173	.	.	p10
	.	.	
178	.	C10.....	
	.	V	
	.	V	
181	.	Rk12	
	.	.	
184	.	P11	
	.	.	
189	.	.	p12
	.	.	
194	.	C12.....	
	.	.	
197	.	P13	
	.	.	
202	.	C13.....	
	.	.	
205	.	p17	
	.	V	
	.	V	
210	.	Rk16	
	.	.	
213	.	.	p16
	.	.	
218	.	C16.....	
	.	V	
	.	V	
221	.	Rk15a	
	.	.	
224	.	.	p14
	.	.	V
	.	.	V
229	.	Rk15b	
	.	.	
232	.	.	p15
	.	.	
237	.	C15.....	

240 B.....
V
V
243 RDAM
V
V
246 Arrow

* ALL AREAS of 862 sq miles *
* PAHRANAGAT WATERSHED AND KANE SPRINGS *
* BASINS 1, 2, 3, and 5. Points A and B *

prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention
and depression area in Pahrnagat National Wild Life Refuge

PREC 0.531 0.477 0.439 0.407 0.389 0.370 0.351 0.332
AREA 200 300 400 500 600 700 800 900

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

IT HYDROGRAPH TIME DATA
NMIN 5 MINUTES IN COMPUTATION INTERVAL
IDATE 1 0 STARTING DATE
ITIME 0000 STARTING TIME
NQ 150 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 1 0 ENDING DATE
NDTIME 1225 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 12.42 HOURS

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

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.53 .48 .44 .41 .39 .37 .35 .33

1

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

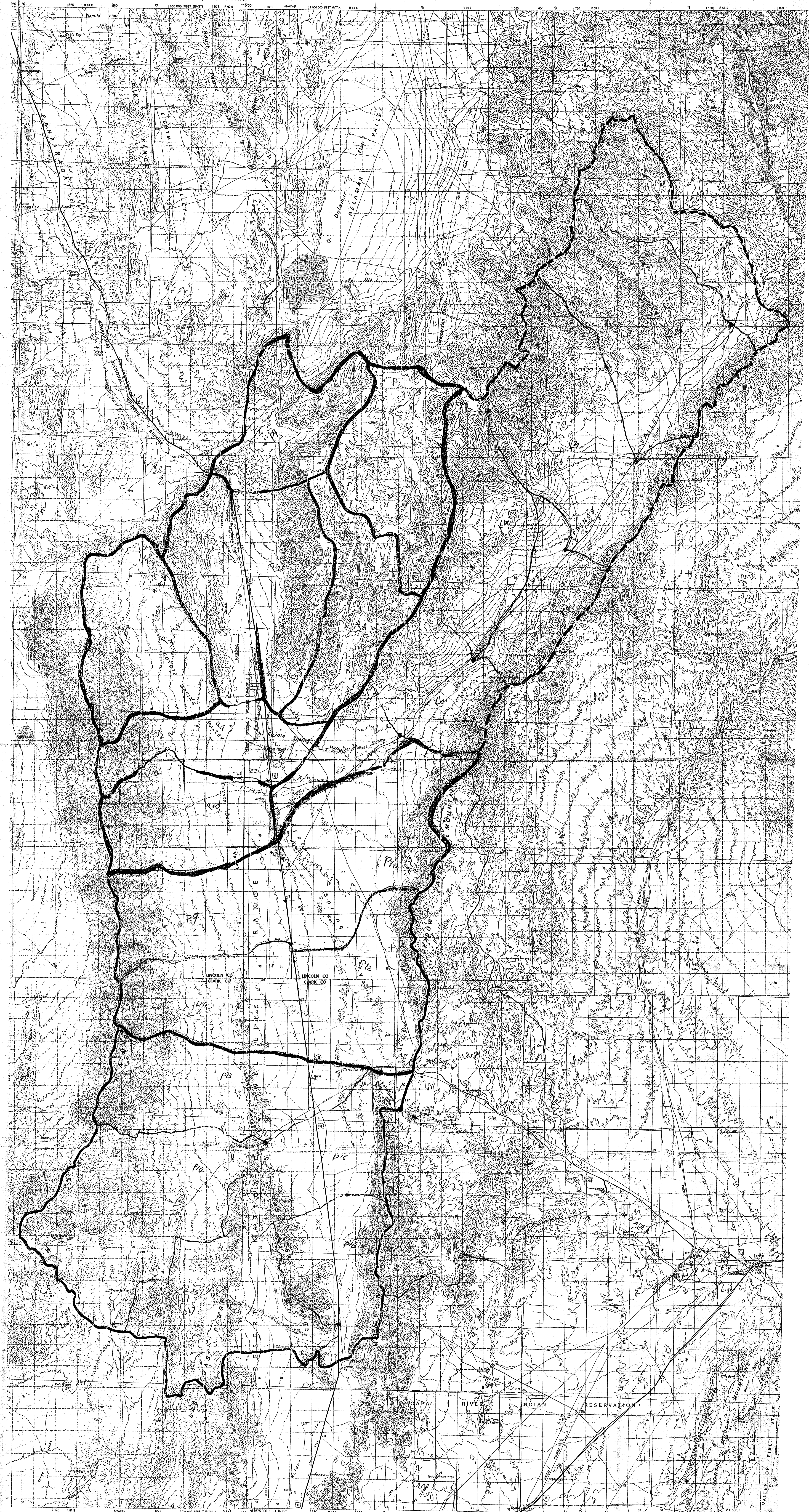
OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION								
					RATIO 1 .53	RATIO 2 .48	RATIO 3 .44	RATIO 4 .41	RATIO 5 .39	RATIO 6 .37	RATIO 7 .35	RATIO 8 .33	
HYDROGRAPH AT													
+	p1	28.00	1	FLOW TIME	2388. 6.42	1923. 6.42	1610. 6.50	1360. 6.50	1224. 6.50	1086. 6.50	952. 6.50	825. 6.50	
ROUTED TO													
+	R45	28.00	1	FLOW TIME	2386. 10.08	1919. 10.42	1610. 10.75	1356. 11.17	1222. 11.25	1084. 11.50	951. 11.83	823. 12.17	
HYDROGRAPH AT													
+	P45	59.00	1	FLOW TIME	4664. 6.67	3750. 6.67	3139. 6.75	2649. 6.75	2383. 6.75	2112. 6.83	1853. 6.83	1604. 6.83	
2 COMBINED AT													
+	C45a	87.00	1	FLOW TIME	4664. 6.67	3750. 6.67	3139. 6.75	2649. 6.75	2383. 6.75	2112. 6.83	1853. 6.83	1604. 6.83	
HYDROGRAPH AT													
+	P2	38.50	1	FLOW TIME	2791. 7.00	2243. 7.00	1876. 7.08	1582. 7.08	1423. 7.08	1261. 7.08	1105. 7.17	956. 7.17	
ROUTED TO													
+	R6	38.50	1	FLOW TIME	2787. 10.75	2239. 11.08	1874. 11.42	1579. 11.75	1420. 12.00	1258. 12.25	1099. 12.42	0. .00	

HYDROGRAPH AT	P6	30.00	1	FLOW	2588.	2085.	1747.	1475.	1327.	1178.	1033.	895.
+				TIME	6.33	6.42	6.42	6.42	6.50	6.50	6.50	6.58
3 COMBINED AT	C45b	155.50	1	FLOW	7213.	5805.	4860.	4102.	3693.	3274.	2870.	2485.
+				TIME	6.58	6.58	6.58	6.67	6.67	6.67	6.67	6.75
ROUTED TO	R7a	155.50	1	FLOW	7207.	5799.	4856.	4100.	3687.	3270.	2866.	2483.
•				TIME	7.42	7.58	7.67	7.83	7.83	7.92	8.08	8.17
HYDROGRAPH AT	P3	39.50	1	FLOW	3589.	2892.	2425.	2049.	1845.	1638.	1438.	1246.
+				TIME	6.17	6.25	6.25	6.25	6.33	6.33	6.33	6.33
ROUTED TO	R7b	39.50	1	FLOW	3583.	2890.	2422.	2047.	1845.	1634.	1434.	1244.
+				TIME	7.50	7.67	7.75	7.92	8.00	8.08	8.25	8.33
HYDROGRAPH AT	P7	25.50	1	FLOW	2705.	2185.	1835.	1555.	1403.	1247.	1097.	953.
+				TIME	5.67	5.67	5.75	5.75	5.75	5.75	5.83	5.83
3 COMBINED AT	C7	220.50	1	FLOW	11922.	9498.	7892.	6611.	5921.	5225.	4556.	3922.
+				TIME	7.25	7.42	7.58	7.75	7.83	7.92	8.00	8.17
ROUTED TO	R8	220.50	1	FLOW	11913.	9492.	7881.	6608.	5907.	5220.	4553.	3919.
•				TIME	7.67	7.83	8.08	8.25	8.42	8.50	8.58	8.75
HYDROGRAPH AT	P8	33.00	1	FLOW	3300.	2663.	2236.	1891.	1705.	1515.	1331.	1155.
+				TIME	5.83	5.92	5.92	5.92	6.00	6.00	6.00	6.00
2 COMBINED AT	C18	253.50	1	FLOW	13459.	10566.	8634.	7158.	6348.	5589.	4839.	4138.
+				TIME	7.42	7.67	7.92	8.17	8.33	8.42	8.58	8.75
HYDROGRAPH AT	K1	32.50	1	FLOW	2807.	2261.	1895.	1600.	1440.	1277.	1121.	971.
+				TIME	6.33	6.42	6.42	6.42	6.50	6.50	6.50	6.58
ROUTED TO	Rk2	32.50	1	FLOW	2806.	2259.	1892.	1599.	1438.	1276.	1120.	968.
+				TIME	9.00	9.25	9.50	9.75	9.92	10.08	10.33	10.58
HYDROGRAPH AT	k2	56.50	1	FLOW	4191.	3369.	2818.	2377.	2139.	1895.	1661.	1438.
+				TIME	6.92	6.92	7.00	7.00	7.00	7.00	7.08	7.08
2 COMBINED AT	C2	89.00	1	FLOW	5165.	3946.	3092.	2453.	2201.	1895.	1661.	1438.
+				TIME	8.83	9.08	9.42	9.75	9.75	7.00	7.08	7.08
ROUTED TO	Rk3	89.00	1	FLOW	5062.	3841.	3045.	2424.	2159.	1893.	1660.	1437.
•				TIME	10.50	10.92	11.42	11.92	12.08	9.33	9.50	9.67
HYDROGRAPH AT	k3	57.00	1	FLOW	4634.	3728.	3120.	2633.	2370.	2101.	1843.	1596.
+				TIME	6.58	6.58	6.58	6.67	6.67	6.67	6.75	6.75
2 COMBINED AT	C3	146.00	1	FLOW	6945.	5349.	4368.	3541.	3069.	2675.	2265.	1895.
+				TIME	8.08	8.33	8.50	8.75	9.00	9.08	9.33	9.58
ROUTED TO	Rk4	146.00	1	FLOW	6933.	5337.	4321.	3456.	3031.	2631.	2241.	1887.
+				TIME	9.42	9.92	10.25	10.75	11.00	11.25	11.58	11.92
HYDROGRAPH AT	k4	36.50	1	FLOW	1761.	1411.	1177.	990.	890.	787.	689.	596.
+				TIME	8.75	8.83	8.83	8.83	8.83	8.92	8.92	8.92
HYDROGRAPH AT	k5	21.50	1	FLOW	2123.	1712.	1437.	1216.	1096.	973.	855.	742.
•				TIME	5.92	5.92	6.00	6.00	6.00	6.00	6.08	6.08
3 COMBINED AT	C45	204.00	1	FLOW	8864.	6759.	5436.	4291.	3735.	3212.	2706.	2293.
+				TIME	9.42	9.92	10.25	10.75	11.00	11.25	11.50	9.08
ROUTED TO	Rk6	204.00	1	FLOW	8831.	6708.	5385.	4233.	3473.	3063.	2666.	2290.
+				TIME	10.58	11.17	11.67	12.33	10.33	10.50	10.75	11.00
HYDROGRAPH AT	k6	29.00	1	FLOW	2677.	2158.	1809.	1529.	1378.	1223.	1073.	930.
+				TIME	6.17	6.17	6.17	6.25	6.25	6.25	6.25	6.33
2 COMBINED AT												

+	C6	233.00	1	FLOW TIME	9009. 10.58	6802. 11.17	5440. 11.67	4262. 12.33	3597. 10.25	3158. 10.42	2736. 10.67	2340. 11.00
ROUTED TO												
+	Rk7	233.00	1	FLOW TIME	8982. 12.17	5871. 11.50	4840. 11.92	4013. 12.42	2175. 12.42	1143. 10.33	1207. 12.42	806. 11.08
HYDROGRAPH AT												
+	k7	15.50	1	FLOW TIME	1362. 6.33	1097. 6.33	919. 6.33	776. 6.42	699. 6.42	620. 6.42	544. 6.42	471. 6.50
2 COMBINED AT												
+	C7	248.50	1	FLOW TIME	9023. 12.17	5925. 11.50	4874. 11.92	4034. 12.42	2194. 12.42	1215. 10.33	1222. 12.42	840. 11.08
2 COMBINED AT												
+	A	502.00	1	FLOW TIME	15745. 12.17	11296. 7.67	9177. 7.92	7558. 8.17	6673. 8.33	5865. 8.33	5059. 8.50	4307. 8.75
ROUTED TO												
+	Rk10	502.00	1	FLOW TIME	14453. 8.33	11240. 8.75	9135. 9.08	7523. 9.33	6646. 9.58	5849. 9.75	5047. 10.00	4299. 10.25
HYDROGRAPH AT												
+	P9	32.50	1	FLOW TIME	3341. 5.75	2696. 5.83	2265. 5.83	1917. 5.83	1728. 5.83	1536. 5.92	1351. 5.92	1173. 5.92
HYDROGRAPH AT												
+	p10	50.00	1	FLOW TIME	4333. 6.33	3489. 6.42	2924. 6.42	2469. 6.42	2223. 6.42	1971. 6.50	1730. 6.50	1498. 6.50
3 COMBINED AT												
+	C10	584.50	1	FLOW TIME	17277. 8.25	12963. 8.67	10276. 9.00	8296. 9.33	7233. 9.58	6316. 9.75	5411. 9.92	4552. 10.25
ROUTED TO												
+	Rk12	584.50	1	FLOW TIME	17141. 9.17	12889. 9.67	10206. 10.08	8245. 10.50	7188. 10.83	6270. 11.08	5391. 11.33	4534. 11.75
HYDROGRAPH AT												
+	P11	36.00	1	FLOW TIME	3710. 5.75	2993. 5.75	2515. 5.83	2129. 5.83	1919. 5.83	1706. 5.92	1501. 5.92	1303. 5.92
HYDROGRAPH AT												
+	p12	36.50	1	FLOW TIME	3130. 6.42	2520. 6.42	2111. 6.42	1782. 6.50	1605. 6.50	1423. 6.50	1248. 6.50	1082. 6.58
3 COMBINED AT												
+	C12	657.00	1	FLOW TIME	18425. 9.08	13578. 9.67	10638. 10.08	8518. 10.50	7383. 10.83	6417. 11.08	5500. 11.33	4604. 11.75
HYDROGRAPH AT												
+	P13	42.50	1	FLOW TIME	3636. 6.42	2928. 6.42	2452. 6.42	2071. 6.50	1864. 6.50	1653. 6.50	1450. 6.58	1257. 6.58
2 COMBINED AT												
+	C13	699.50	1	FLOW TIME	19491. 9.08	14170. 9.67	11019. 10.08	8764. 10.50	7562. 10.83	6553. 11.08	5608. 7.58	4699. 7.75
HYDROGRAPH AT												
+	p17	42.00	1	FLOW TIME	3905. 6.08	3148. 6.17	2641. 6.17	2231. 6.17	2010. 6.25	1785. 6.25	1567. 6.25	1358. 6.25
ROUTED TO												
+	Rk16	42.00	1	FLOW TIME	3900. 7.83	3141. 8.00	2637. 8.17	2230. 8.42	2005. 8.50	1779. 8.67	1562. 8.75	1356. 8.92
HYDROGRAPH AT												
+	p16	27.00	1	FLOW TIME	2632. 5.92	2123. 6.00	1782. 6.00	1506. 6.00	1358. 6.08	1206. 6.08	1060. 6.08	919. 6.08
2 COMBINED AT												
+	C16	69.00	1	FLOW TIME	5151. 7.58	4025. 7.67	3253. 8.08	2642. 8.42	2393. 8.25	2089. 8.42	1805. 8.58	1538. 8.83
ROUTED TO												
+	Rk15a	69.00	1	FLOW TIME	5104. 9.33	4014. 9.58	3221. 10.17	2568. 10.75	2385. 10.58	2086. 10.83	1802. 11.08	1536. 11.50
HYDROGRAPH AT												
+	p14	61.00	1	FLOW TIME	5398. 6.25	4349. 6.33	3646. 6.33	3079. 6.33	2772. 6.42	2460. 6.42	2158. 6.42	1870. 6.42
ROUTED TO												
+	Rk15b	61.00	1	FLOW TIME	5393. 8.08	4341. 8.33	3636. 8.50	3074. 8.67	2770. 8.75	2458. 8.92	2157. 9.08	1868. 9.25
HYDROGRAPH AT												
+	p15	32.00	1	FLOW TIME	3582. 5.42	2895. 5.42	2436. 5.50	2066. 5.50	1865. 5.58	1661. 5.58	1464. 5.58	1274. 5.58
3 COMBINED AT												
+	C15	162.00	1	FLOW	9380.	7387.	5684.	4714.	4226.	3687.	3138.	2738.

				TIME	9.25	9.58	10.17	8.67	10.50	10.75	11.08	9.58
2 COMBINED AT	B	861.50	1	FLOW	28429.	21540.	16598.	12811.	11562.	10030.	8609.	7217.
				TIME	9.25	9.58	10.17	10.75	10.83	11.08	11.33	11.67
ROUTED TO	RDAM	861.50	1	FLOW	28135.	21480.	16523.	12677.	11535.	9911.	7038.	5640.
				TIME	10.17	10.58	11.25	12.00	12.08	12.42	11.50	12.08
ROUTED TO	ARROW	861.50	1	FLOW	23246.	17529.	13710.	10963.	9670.	7415.	6006.	4942.
				TIME	11.00	11.50	12.08	12.42	12.42	12.42	12.17	12.42
** PEAK STAGES IN FEET **												
1	STAGE	2169.03	2164.91	2162.16	2160.18	2158.61	2155.62	2153.75	2152.33			
	TIME	11.00	11.50	12.08	12.42	12.42	12.42	12.17	12.42			

1



2

**ADDENDUM #1 TO THE
STORM CENTERING STUDY**

FOR

**PAHRANAGAT VALLEY
UPSTREAM OF MOAPA, NEVADA**

CLARK COUNTY, NEVADA

W.O. #5685

Prepared for:

COYOTE SPRINGS INVESTMENT, LLC.

Submitted to:

**PUBLIC WORKS DEPT.
CLARK COUNTY, NEVADA**



Gale Wm. Fraser, II, P.E.
Manager/Chief Engineer

BOARD OF DIRECTORS

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August 7, 2000

Robert Thompson, P.E.
Community Development
Clark County Department of Public Works
500 South Grand Central Parkway
Las Vegas, NV 89155

DISTRICT CONCURRENCE:

COYOTE SPRINGS CONCEPTUAL
(HTE# 00-7110)

Dear Mr. Thompson:

The District has reviewed the Conceptual Drainage Study dated March 9, 2000, and Addendum No. 1 dated May 30, 2000, for the above captioned project as submitted by VTN Nevada and James C.Y. Guo, Ph.D., P.E. In addition, the District is in receipt of the Conditional Letter of Acceptance from Clark County Public Works dated June 9, 2000.

The District concurs with the acceptance of this Conceptual Drainage Study by Clark County Public Works.

The District's review of this project was limited to issues of Regional Flood Control Significance as defined in the Uniform Regulations for the Control of Drainage. As noted in the study the site resides in a Special Flood Hazard Area (SFHA) designated as "Zone A" per the effective Flood Insurance Rate Map (FIRM). Therefore the consultant should be advised that this acceptance does not serve to amend the FIRM or remove the SFHA designation.

Please be aware that as additional information becomes available and/or restudies of Flood Insurance Studies are performed, the information submitted by VTN Nevada and James C.Y. Guo, Ph.D., P.E. may be superseded. Compliance with the regulatory elements and design standards specified in the Uniform Regulations for the Control of Drainage does not imply a guarantee that properties will be free from flooding or flood damage. No liability is assumed by the District, its officials, or employees for the information, data or conclusions presented by the consulting engineers. We therefore make no warranties, either expressed or implied, in conducting this review.

GALE WM. FRASER II, P.E.
General Manager/Chief Engineer

BY:

Jon Hayslip
Jon Hayslip, P.E.
Senior Engineer

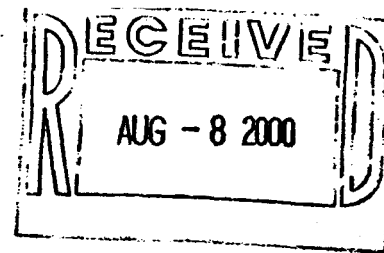
cc:

VTN Nevada ✓

File:

13-63-01.vtn

600 S. Grand Central Parkway, Suite 300 • Las Vegas, Nevada 89106-4511
(702) 455-3139 • FAX: (702) 455-3870
Website: <http://www.ccrfcd.org>



Don H.
Aaron
Jim F.
Marilyn
W.O. file

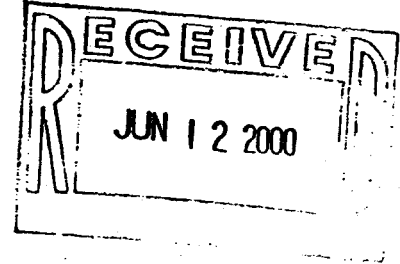


Department of Public Works

500 S Grand Central Pky • PO Box 554000 • Las Vegas NV 89155-4000
(702) 455-6000 • Fax (702) 455-6040

M.J. Manning, Director • E-Mail: mjm@co.clark.nv.us

June 9, 2000



VTN - Nevada

Attn: James L. Fitzpatrick, P.E.
2727 South Rainbow Boulevard
Las Vegas, NV 89102

Re: CONCEPTUAL DRAINAGE STUDY FOR COYOTE SPRINGS

Study Dated: March 5, 2000

Addendum #1 Dated: May 30, 2000

Location: Northeast and southeast of the NV Highway 168 and US HWY 93 intersection

Section 01, T. 13 S., R. 63 E.

NPM-0049-13

HTE# 00-7110

*Don Hood
Aaloe
Wa File
Jim F.
Mprdy*

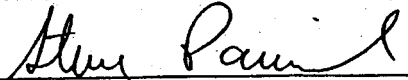
The referenced Conceptual Drainage Study has been reviewed and is accepted as complying with minimum improvement standards. As set forth in the subject drainage study, the following measures will be taken to mitigate flood hazards:

1. This approval does not allow any construction activity including grading, placement of fill or excavation of any kind. An approved technical drainage study shall be required prior to any construction activity or subdivision of the site.
2. The subject site is located within Zone X and Zone A as shown on FIRM Community Panel Numbers 32003C 225 D and 32003C 250 D, effective date: August 16, 1995. Zone X is an area determined by FEMA to be outside the 500-year flood plain. Zone A is a special flood hazard area determined to be within the 100-year flood plain. No base flood elevations have been determined by FEMA.
3. Clark County Regional Flood Control District (CCRFCD) concurrence is required because the project is located partially in Zone A and impacts a regional flood control facility. As a condition of final approval, the applicant must submit a copy of the drainage study and any addenda to the CCRFCD.

James L. Fitzpatrick, P.E.
Coyote Springs
June 9, 2000
Page 2 of 2

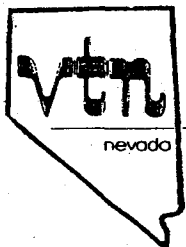
No liability is assumed by the County for information, data, and conclusions of the consulting engineer.

M. J. MANNING
DIRECTOR OF PUBLIC WORKS

By 
Steven C. Parrish, P.E.
Senior Engineer
Community Development Division

SCP:alg

cc: Coyote Springs, Inc.
Development File



CONSULTING ENGINEERS • PLANNERS • SURVEYORS

PROVIDING QUALITY PROFESSIONAL
SERVICES SINCE 1960

May 30, 2000

W.O. #5685

Clark County
Department of Public Works
500 S. Grand Central Parkway
Las Vegas, Nevada 89155-4000

Attention: Mr. Steve Parrish, P.E.
Community Development

**SUBJECT: ADDENDUM #1 TO THE STORM CENTERING STUDY FOR
PAHRANAGAT VALLEY UPSTREAM OF MOAPA, NEVADA**

Mr. Parrish:

This Addendum #1 is being submitted to Clark County Department of Public Works to address the review comments to the above mentioned study that were issued on March 31, 2000.

Dr. Guo has prepared a summary of his responses to the CCPW comments listed in Exhibit A. That exhibit is a summary of his responses which have been incorporated into the revised text of this report. The revised text has been attached to this letter and is part of the first addendum.

In addition, VTN Nevada has prepared responses to CCPW comments 1b-d, 3, 9, 13, 14, 15, and 17. Those responses are Exhibit B and have been attached to this letter.

If there are any questions or additional information is required, please contact this office.

Respectfully Submitted,

VTN Nevada



Aaron M. Yamachika, E.I.

/mjg

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

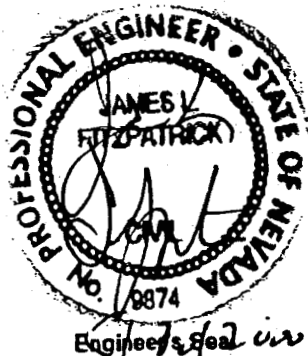
Name of Development: STORM CENTERING STUDY FOR PAHRANAGAT Date: MAY 30, 2000VALLEY UPSTREAM OF MOAPA, NEVADALocation of Development: a) Descriptive (Cross Streets) North/South US 93 East/West STATE ROUTE168b) Sect. REFER TO ATTACHED SHEET
Twn. Rng. Name of Owner: COYOTE SPRINGS INVESTMENT, LLC Assessors Parcel No: REFER TO ATTACHED SHEETTelephone No: (775) 626-6500Facsimile No: (775) 626-6526Address: 7755 SPANISH SPRINGS ROADSPARKS, NEVADA 89436Contact Person-Name: AARON M. YAMACHIKA, E.I. Telephone No: (702) 873-7550Firm: VTN NEVADAAddress: 2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146

Type of Land Development/Land Disturbance Process:

☐	Rezoning	☒	Subdivision Map	☐	Clearing and Grading Only
☐	Parcel Map	☐	Planned Unit Development	☐	Other (Please specify below)
☐	Large Parcel Map	☐	Building Permit	☐	

1. Total Owned Land Area: At Site: 42,800± ACRES Being Developed/Disturbed: NONE2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? XXXYES NO3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES NO XXX4. Proposed type of development (Residential, Commercial, Etc.)? MIXED USE5. Approximate upstream land area which drains to the subject site? 862± SQUARE MILES6. Has the site drainage been evaluated in the past? YES XXX NO If yes, please identify documentation:

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:

ARCH CULVERT UNDER STATE ROUTE 1688. Briefly describe your proposed schedule for the subject project: ASAP

Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

* Review and concurrence of the Clark County Regional Flood Control District is Required.

Local Entity File No.

Revision	Date

REFERENCE:

Assessors Parcel Numbers for Coyote Springs

APN' south of Clark/Lincoln County Line

009-00-001-003
009-00-001-004
009-00-001-005
009-00-001-002 (Portion)
009-00-001-006 (Portion)
009-00-001-009 (Portion)

009-00-002-003
009-00-002-004
009-00-002-002 (Portion)

008-00-001-001
008-00-001-005 (Portion)

008-00-002-001

Location of Development

Township 13 South
Range 63 East
Sections 1-5, 8-12, 13-17, and 20-24

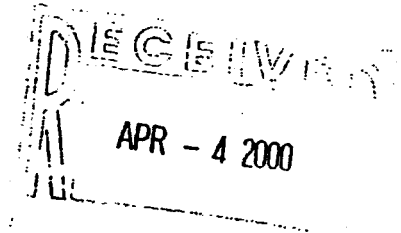
COMMENTS FROM CCPW



THE Louis Berger Group, INC.

500 Amigo Court, Suite 100, Las Vegas, Nevada 89119
Tel 702 736 6632 Fax 702 736 0704 www.louisberger.com

5685-STORM



March 28, 2000

James L. Fitzpatrick, P.E.
VTN - Nevada
2727 South Rainbow Boulevard
Las Vegas, NV 89102

Re: **STORM CENTERING STUDY FOR COYOTE SPRINGS**
Study Dated: March 5, 2000
Location: Northeast and southeast of the NV Highway 168 and US HWY 93
intersection
Section 01, T. 13 S., R. 63 E.
NPM-0049-13
HTE# 00-7110

Dear Mr. Fitzpatrick:

The staff at The Louis Berger Group, Inc. have conducted an initial review of the above-referenced Storm Centering Drainage Study and have the following comments:

1. The County requires the following figures with a report:
 - a. Vicinity map with north arrow and indication of scale, or not-to-scale;
 - b. A Flood Insurance Rate Map (FIRM) with: panel number, north arrow and bar scale, and site delineation;
 - c. The CCRFCD Master Plan Figure with north arrow, bar scale, and site delineation;
 - d. Design Manual Standard Form 1 signed and sealed by a professional engineer;
2. The study must use equation 613, in accordance with Section 606.3 of the (CCRFCD) *Hydrologic Criteria and Drainage Design Manual*, to determine the TLAG for the larger basins.



James L. Fitzpatrick, P.E.

Coyote Springs

March 28, 2000

Page 2 of 4

3. The study states "approximately 2750 square miles of this area are upstream of the Pahrnagat National Wild Life Refugee Area (PNWLRA) which has sufficient capacity to contain flood flows without overflow." Please provide information and calculations in support of the storage capacity of the depression/detention area.
4. The study use kinematic wave routing for the HEC-1 models. Muskingham routing should be used in accordance with section 608 of the CCRFCD Design Manual. Please revise accordingly.
5. Provide precipitation isohyets maps with site delineation and point precipitation depth calculation in accordance with Section 500 in the CCRFCD Design Manual.
6. The DARF's used in the HEC-1 model do not correspond to the values recommended in the CCRFCD Design Manual. Please revise the HEC-1 model accordingly.
7. Most of the 100-year flow rates listed and discussed in the conclusion section of the report do not appear in the HEC-1 model output. If these values were interpolated please provide calculations.
8. Provide supporting data and exhibits for the stage/storage relationships and HEC-RAS information presented in Table 2 of the report.
9. The study's cover letter by VTN (stamped by James Fitzpatrick) states that "the purpose of this study is to establish the peak flow rates for the Pahrnagat Wash as it crosses through this project." Dr. James Guo states in the study that "results of this study are derived from limited information and may only serve for preliminary investigations." Please clarify the purpose of this study.
10. The study concludes that the critical storm size is 250 square miles, although the final flow value for Arrow Canyon was based on a 360 square mile storm. Please explain.
11. Provide topographic data and/or available information in support of the channel routing geometry used in the HEC-1 analysis.
12. It is unclear how the Storm Centering Test HEC-1 analysis (in Appendix A) was utilized. Please provide discussion.
13. A Technical Drainage Study will be required for future development of the site.
14. The title on the cover of the drainage study differs from the title given on the Standard Form 1. Please revise and resubmit accordingly.



James L. Fitzpatrick, P.E.
Coyote Springs
March 28, 2000
Page 3 of 4

15. Site delineation must be accurately shown on the drainage maps. Please revise and resubmit accordingly.
16. Resubmit drainage map showing concentration points, cumulative flows, velocity and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows. The following needs to be added on the topographic map insert:
 - Provide a Figure number
 - Provide a north arrow
 - Basin K7 needs to be labeled
 - Provide contour intervals
17. The conceptual drainage study must correspond to the 1999 Updated Clark County Hydrologic Criteria and Design Manual, rather than the 1996 manual as stated on Page 4, paragraph 3 of the report.

~~The drainage plan has been red-lined and returned to the engineer. The red-lined drainage plan must be re-submitted with the revised drawings.~~

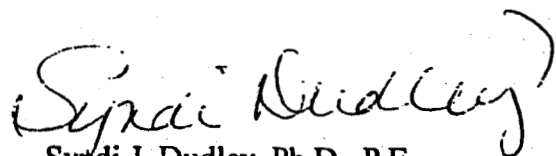
The items listed herein must be addressed. Addenda and revised plans must be submitted directly to Clark County for the necessary log-in procedures.

If you have any questions concerning the comments, please contact The Louis Berger Group, Inc. to schedule a study review meeting.

Sincerely,

THE LOUIS BERGER GROUP, INC.


Amanda L. Gonzales
Hydrologist


Syndi J. Dudley, Ph.D., P.E.
Director of Water Resources



James L. Fitzpatrick, P.E.

Coyote Springs

March 28, 2000

Page 4 of 4

CONCURRENCE BY CLARK COUNTY PUBLIC WORKS:

Steve Baum

Signature

03/31/00

Date

COMMENTS:

cc: Coyote Springs, Inc.

EXHIBIT A

**SUMMARY OF DR. GUO'S RESPONSE
TO CCPW COMMENTS**

Responses to March-28-2000 Comments

1. a. A north arrow and scale are added to Figure 1
b. The FIRM will be added to the Floodplain Delineation Study Report.
c.
d.
2. Eq 613 is used to calculate the lag times used in the HEC_1 model. (Page 6)
3. The storage capacity of PNWLRA is reported by the 1988 Master Plan Study as quoted on Page 5.
4. Muskingum method is used in the revised study, and compared with results from the kinematic wave model for the storm centering tests.
5. Precipitation isohytral maps are provided in Figures 3 and 4.
6. Point values of precipitation are calculated and summarized on Page 8.
7. All HEC-1 output printouts are included in Appendices A through E.
8. The topography upstream of Arrow Canyon is provided in Figure 2.
9. Inconsistency between statements has been reconciled with more information.
10. The are coverage of a critical storm is one of major factors in the selection of storm centers, but it does not exclude other orographic effects. The Basis for chosing these four storm centers are discussed on Page 12.
11. The HECRAS data file provides cross sections for the valleys in the study are. The channel width of 800 feet is suggested by the 1988 Master Plan, and also shown in Figure 2 as an example. In this study, the channel width of 800 ft and flow depth of 3-ft on alluvial fans were tested independently by both kinematic wave and Muskingum methods. Both produce closely agreeable results.
12. Figures 6 through 11 are added into the revised report for clarification on storm centering tests and the computer models developed for four storm centers. The predicted Q-10 and Q-100 are marked on the figure for each case. Tables 7 and 8 are provided to explain how the max and min value are selected.

14

15

16a A Figure number is assign to be FIGURE A

16b A North Arrow is added

16c Basin K7 is marked

16d Contour interval is added.

17

EXHIBIT B

VTN's RESPONSE TO CCPW COMMENTS

- 1b) Flood Insurance Rate Map (FIRM) Panel Numbers 32003C0225 and 32003C0250 effective date August 16, 1995, have been included. It should be noted that only the Clark County portion of this development has been included.
- 1c) This development is not located within or adjacent to any CCRFCD Master Plan facility. The *Master Plan Update* (MPU) does not extend to the north to include this development. Therefore, no figure has been included.
- 1d) The Standard Form 1 was stamped and signed by a professional engineer. However an additional stamped copy of the Standard Form 1 has been included.
- 3) The referenced information from the approved *Flood Control Master Plan for Moapa Valley, Nevada*, by The Mark Group, 1988, has been included with this submittal. That CCRFCD study references an Army Corps of Engineers (COE) study that determined the Pahrnagat Wash upstream of the Pahrnagat Lakes is not tributary to the Pahrnagat Wash downstream of those lakes. It should be noted that the study for Moapa Valley has been approved by CCRFCD and therefore, no calculations to support the storage capacity of the depression/detention area should be required.

In addition, this report as well as the CCRFCD Master Plan for Moapa Valley, Nevada determines that the design storm is not determined by the flow from the entire effective (without flow upstream of the Pahrnagat Lakes) basin. Therefore it is logical to assume that the peak flow rate would not be impacted by further increasing the basin area since the design storm does not include runoff from the entire tributary basin as determined by this study. Also, the reference material from the Mark Group has been included in the Appendix.

- 9) The purpose of this study is to determine the amount of flow that will be routed through the Pahrnagat Wash during certain storm events.
- 13) This comment has been noted.
- 14) The title of the Standard Form 1 has been revised to reflect the title of the drainage study "Storm Centering Study for Pahrnagat Valley Upstream of Moapa, Nevada.
- 15) The site delineation has been shown on the Drainage Map and included in the Appendix.
- 17) The text has been revised to state that the Conceptual Drainage Study corresponds to the 1999 *Updated Clark County Hydrologic Criteria and Design Manual*.

DR. GUO's STORM CENTERING ANALYSIS

**STORM CENTERING STUDY
FOR
PAHRANAGAT VALLEY
UPSTREAM OF MOAPA, NEVADA**

Prepared by

James C.Y. Guo, Ph.D., P.E.

3906 S. Pinehurst Circle, Denver, CO 80235

Phone: 303-947-3413

Fax : 303-984-8882

Prepared for

VTN-nevada

2727 South Rainbow Blvd.,

Las Vegas, NV 89102

February 2000

April 2000 – revised

**STORM CENTERING STUDY
FOR
PAHRANAGAT VALLEY
UPSTREAM OF MOAPA, NEVADA**

List of Figures

Figure A. Watershed Map in Back Pocket

- Figure 1. Watershed Map
- Figure 2. Topography near Arrow Canyon
- Figure 3. Rainfall Isohyetal Map of 10-year 6-hour Rainfall Depths for South Nevada
- Figure 4. Rainfall Isohyetal Map of 100-year 6-hour Rainfall Depths for South Nevada
- Figure 5. Derivation of Depth Reduction Area Factors for South Nevada
- Figure 6. Waterway and Tributary Area used in Storm Centering Test
- Figure 7. Critical Storm Cover Area with and without Valley Storage Effects
- Figure 8. Case 1 Storm Center in Basin 1
- Figure 9. Case 2 Storm Center in Basin 2
- Figure 10. Case 3 Storm Center in Basins 3 and 5
- Figure 11. Case 4 Storm Center Covering All Basins.

List of Tables

- Table 1. Hydrologic Parameters for Subareas
- Table 2. Frequency Analysis at USGS Gage Station near Moapa, Nevada.
- Table 3. Stage-Storage-Outflow Characteristics at Arrow Canyon
- Table 4. Depth Area Reduction Factors for South Nevada
- Table 5. Parameters Derived for Muskingum Method
- Table 6. Summary of Storm Center Tests
- Table 7. Determination of 100-year Design Peak Discharges
- Table 8. Determination of 10-year Design Peak Discharges

**STORM CENTERING STUDY
FOR
PAHRANAGAT VALLEY
UPSTREAM OF MOAPA, NEVADA**

List of Appendices

Appendix A -- Storm Centering Tests

1. Without Valley Storage by K.W. Model (file:SKW30.dat)
2. With Valley Storage Effects by KW Model (file: SKW800.dat)
3. With Valley Storage Effects by Muskingum Method (file:SMSKG.dat)

**Appendix B -- CASE 1 100-yr Storm Center in Basin 1 (file: B1-100.dat)
10-yr Storm Center in Basin 1 Ifile B1-10.dat)**

**Appendix C-- CASE 2 100-yr Storm Center in Basin 2 (file: B2-100.dat)
10-yr Storm Center in Basin 2 (file: B2-10.dat)**

**Appendix D-- CASE 3 100-yr Storm Center in Basins 3 and 5 (file: B35-100.dat)
10-yr Storm Center in Basins a and 5 (file: B35-10.dat)**

**Appendix E-- CASE 4 100-yr Storm Center in All Basins (file: Ball-100.dat)
10-yr Storm Center in All Basins (file: Ball-10.dat)**

STORM CENTERING STUDY FOR PAHRANAGAT VALLEY, UPSTREAM OF MOAPA, NEVADA

Introduction

This report presents a hydrologic study for the tributary area to Pahranagat Wash upstream of the city of Moapa, Nevada. The study area is approximately 862 square miles as shown in Figure 1 and Figure A. It covers the Kane Springs valley, and the Pahranagat Wash tributary area between the *Pahranagat Wild Life Refugee Area* and the City of Moapa, Nevada. The main purpose of this study is to determine the maximal flooding conditions at the confluence (Point A) of Kane Springs Wash and Pahranagat Wash, and the entrance (Point B) to Arrow Canyon upstream of the city of Moapa, Nevada. In this study, the HEC-1 computer model developed by the Hydrologic Engineering Center, Corps of Engineers was adopted for watershed rainfall/runoff modeling. Watershed parameters were prepared under the guidance of *1999 Design Criteria Manual, set forth by the Clark County Regional Flood Control District (CDRFCD)*. The SCS six-hour design rainfall distribution was employed to generate storm hydrographs.

Storm centering tests are conducted in this study to identify the critical storm cover area using the local rainfall depth area reduction factors (DARF). Both kinematic wave and Muskingum routing methods were tested with and without flood plain storage effects. And then the Muskingum routing method was adopted to model the movement of flood flows through natural washes. In this study, the critical storm cover area was identified to be between 250 and 300 square miles. Considering the regional topographic

conditions in the watershed and critical storm size, there are four storm centers separately developed for the upper and lower valley areas. The design discharges were determined by the maximal value among these four cases. The predicted peak discharges are comparable to the observed determined by records collected at the nearby USGS gage station.

Watershed Hydrology

Pahranagat Wash is originated from the Pahranagat valley, and has a total watershed area of 3,860 square miles. Approximately 2750 square miles of this area is located upstream of the Pahranagat National Wild Life Refugee Area (PNWLRA). In 1988, the Mark Group prepared a technical report: "*Flood Control Master Plan for Moappa Valley, Nevada*" (1988 Mater Plan) for CCRCD. The 1988 Master Plan Study divided the Pahranagat valley into the upper and lower areas based on the location of the PNWLRA. The surface area of the PNWLRA is more than 10 square miles. According to the 1988 Master Plan, the PNWLRA has a sufficient storage capacity to contain flood flows from the upper tributary area without overflow. This fact is confirmed by the flood records observed at the USGS Gage Station near the city of Moappa. The area between the PNWLRA and the city of Moapa is estimated to be 1110 square miles. As illustrated in Figure 1, the study area is from the PNWLRA to the north entrance of Arrow Canyon, and divided into four basins as:

- (1) Basin 1 of 249 square miles for the Kane Springs valley,
- (2) Basin 2 of 253.5 square miles for the Pahranagat Wash valley upstream of Pt A,
- (3) Basin 3 of 155.0 square miles for the area between Points A and B, and

(4) Basin 5 of 204.50 square miles for the area south of Point B.

The location, Point B, is the outfall point for the study area. The total watershed area upstream of Point B is 862 square miles for the above four basins. To model flood flows, each basin is further divided into subareas based on the natural drainage network. The hydrologic parameters for subareas are listed in Table 1. The previous studies recommended that the curve number was 85 for the type of soil in this area (1988 Master Plan, Corps of Engineers in 1988). In this study, the lag time was calculated by the USBR method with a roughness coefficient of 0.042, i.e. Eq 613 in Section 606.3 of the Manual, and then coded into the HEC-1 model for hydrograph predictions by the SCS synthetic unit hydrograph method.

Pahrnagat Wash is a major tributary to the Muddy River. Downstream of the confluence, the Muddy River has been monitored by the USGS Gage Station 09416000 at Arrow Canyon near the City of Moapa since 1945. The historic record indicates that the highest flood flow was 5100 cfs produced by the storm event on September 7, 1967. The 1988 Master Plan also found that the peak flow data of the Muddy River does not have any outlier, and the 100-year peak discharge at the USGA Gage Station 09416000 was estimated to be 6510 cfs by the Log-pearson Typy III analysis (see Table 2).

The low ratio of peak flow to watershed area implies that the flood plains in the watershed provide significant storage volumes. As stated in the 1988 Master Plan, the 100-year flood plains in this area are typically 800 feet wide. Such a wide flood plain acts as a detention system to attenuate flood flows. In addition to the storage effects

along the floodplains, the narrow passage at Arrow Canyon as shown in Figure 2 also creates a significant storm water storage volume upstream of the USGS Gage Station. Arrow Canyon acts as a detention basin due to the deep flow depth at the narrowest section. Such a detention process caused by backwater effects is different from the conventional outfall devices such as orifices or weirs. The narrowest section at Arrow Canyon is approximately located at Station 80+6 according to the HECRAS model developed for the 100-year flood plain delineation study. In this study, this section is approximated by a trapezoid with side slopes of 1v:3h and 1v:4h (see Table 3). The stage-storage curve at Arrow Canyon was derived by the elevation contours immediately upstream of Station 80+6 for flow depths ranging from zero to 47 feet. Figure 2 and Table 3 present the stage-outflow curve in which the outflow rates are determined by Manning's formula applied to the canyon section with a roughness coefficient of 0.042 and a slope of 0.001. This approach takes into consideration of the open channel hydraulics through the narrow section and the storage effects upstream of the narrow section.

Point Design Rainfall Statistics

The design rainfall statistics for the southern Nevada have been published on *NOAA Atlas 2, Volume VII for Nevada (1973)*, and *NOAA Technical Memorandum NWS Hydro-40* for the semi-area southwest United States (1984). Figures 3 and 4 are examples of 6-hour 10- and 100-year rainfall isohyets for the study area (NOAA Atlas 2, Volume VII 1973). The point design rainfall depths obtained from NOAA Atlas 2 are subject to the adjustment recommended by the CCRFCD. Design rainfall depths are summarized as:

<u>Return period</u>	<u>in years</u>	<u>10</u>	<u>25</u>	<u>50</u>	<u>100</u>
6-hr rainfall depth	in inches	1.30	1.55	1.90	2.10
1999 CCRFCD correction factor		1.24	1.33	1.39	1.43
6-hr design depth	in inches	1.60	2.05	2.64	3.00

These design rainfall values agree with those used in the 1988 Master Plan.

Depth Area Reduction Factors (DARF)

Records from a rain gage network provide the information of the spatial and temporal isohyetal distribution of a storm event. The rainfall depth in a storm event decays with respect to the distance from the storm center. The rainfall volume in a storm event is estimated by the integration of rainfall depth over cover area. Knowing the isohyetal distribution, the rainfall volumes can be cumulatively computed as the storm cover area expands from the center of the storm to its boundaries. Considering that the rainfall depth at the storm center as the point value, the DARF for a specified area is calculated by the ratio of the area-averaged rainfall depth to the point value.

According to the 1988 Master Plan, a special effort was made to the derivation of the local DARF for the study area because the Las Vegas experience might not be suitable for the Moapa valley area. A total of six severe storm events were evaluated, including 08/10/1983, 08/10/1981, 07/03/1975, 10/21/1957, 06/13/1955, and 10/17/1946 storm events. As shown in Figure 5, the derived DARF's were then compared with the recommendation by *NOAA Hydro 40*, and *Standard Project Storm* recommended by Corps of Engineers. Table 4 presents the local DARF developed for the Moapa valley, covering storm sizes from 10 to 900 square miles.

Although these DARF's are slightly different from the 1999 CCRFCD Criteria Manual, these values have been implemented for flood predictions since 1988 after *the Flood Control Master Plan for Moapa valley area* has published by CCRFCD. To be consistent, the DARF's in Table 4 are adopted in this study.

Storm Centering Tests

Although the total watershed area for this study is 862 square miles, the effective tributary area used in the 1988 Master Plan was assumed to be 200 square miles. Such a critical storm cover area was chosen based on the experience with the local hydrology. However, the analysis of the August 10, 1981 storm event indicated that the one-inch isohyetal line encompassed an area of 280 square miles. This discrepancy leads to the necessity of storm centering tests by which the critical storm cover area can be defined.

Along a major waterway, the amount of storm runoff is proportional to the product of tributary area and area-averaged rainfall depth. The tradeoff in the runoff accumulation is prescribed by the hyperbolic relationship between tributary area and DARF. The storm centering technique is to identify the maximal peak discharge as the tributary area increases, but the area-averaged rainfall depth decreases. The goal of a storm centering test is:

$$\text{Maximization of Peak Discharge} = \text{Max (Area} * \text{DARF} * \text{Point Rainfall Depth)}$$

Of course, the above objective function can not be solved by a direct algebraic summation, but by the rainfall/runoff routing processes through the waterway. In this

study, the test waterway is chosen to be the reach of Pahrnagat Wash between the PNWLRA and Point B. Figure 6 shows that the reach collects the storm water between Points A and B from a tributary area of 613.0 square miles, including Basins 2, 3, and 5. There are two scenarios performed in this study:

(A) Scenario A: without consideration of valley storage effects

This study was conducted using the kinematic wave routing method with channel widths of 100 feet through the valley. This approach obviously underestimates the flood plain storage volumes. The kinematic wave routing method essentially confines flood waves within the main channel of 100-ft wide. As a result, the flood waves are only translated through the waterway without sufficient attenuation. As shown in Figure 7, the plot of peak discharges versus tributary area indicates that the critical storm cover area is approximately 450 square miles. Details of calculations are summarized in Study 1 in Appendix A.

(B) Scenario B: with consideration of valley storage effects

As suggested in the 1998 Flood Control Master Plan, the valley in this area is 800 feet wide. Such a wide flood plain provides an immense storage volume and attenuates flood waves significantly. Flood routing is an algorithm to balance the inflow and outflow by the change of the storage volume in the reach. In this study, both kinematic wave approach and Muskingum method are tested for 800-ft flood plains.

The kinematic wave approach begins with an approximate width of flood plain. Flood waves are attenuated according to the flow depth determined by the continuity

principle. In this study, with a channel width of 800 feet, the kinematic wave method has demonstrated that the continuity principle can sufficiently reduce the peak flows. Figure 7 indicates that the critical storm cover area is reduced to 250 to 300 square miles (see Study 2 in Appendix A). This conclusion concurs with the assumption of 200 square miles as the critical storm size recommended by the 1988 Master Plan Study, and the observed storm size of 280 square miles in the August 10, 1981 event.

Although the predictions by the kinematic wave method closely agree with the previous assumption, the 1999 CCRFCD Manual suggests that the Muskingum routing method be considered when the peak flows are significantly attenuated by the storage effects on alluvial fans. The Muskingum method begins with an approximate flow depth on alluvial fans for flow velocity calculations. In this study, the flow velocity on alluvial fans is estimated by a 3-ft water depth. The Muskingum weighting factor, X , is set to be 0.10 to reflect the flood plain storage capacities in this area. The storage constant, K , representing the travel time of flood waves through the reach, is calculated by reach length and flow velocity. The number of computational step is determined for each reach according to the numerical stability criteria. Table 5 is the summary of Muskingum routing parameters developed for all reaches used in the study. Using the parameters in Table 5, the Muskingum method was then coded into the HEC-1 model. As presented in Table 6 and Figure 7, both Muskingum and kinematic wave methods produce closely agreeable predictions. The critical storm cover area is also identified between 250 to 300 square miles.

The 1988 Master Plan has recognized the significant storage capacities in the valley, and suggested that the critical storm area be approximately 200 square miles. The flood flow frequency analysis on the long-term data collected at the USGS Gage Station further confirms that the 100-year peak discharge is only 6510 cfs. Therefore, in this study, the critical storm cover area of 250 to 300 square miles is adopted for flood flow predictions.

Flood Predictions by Various Storm Centers

Precipitation processes in a storm event involve cyclonic, convective, and orographic effects. Although the critical storm cover area is identified to be 250 to 300 square miles for the study area, it does not exclude considerations of orographic effects and the natural wash network. The topographic conditions in the study area can be divided into three distinctive zones as:

(a) the Kane Springs Wash area (Basin 1) of 249 square miles east of Delamar Mountains.

(b) the Pahranaagat Wash area (Basin 2) of 253.5 square miles west of Delamar Mountains.

(c) the lower valley area of 359.5 (Basins 3 and 5) square miles on the plains.

Since no apparent topographic barriers exist in the lower valley area, it is suggested that the lower valley be treated as a hydro-meteorological region. According to the size of critical storm cover area and the aforementioned topographic condition, four locations are developed for storm centers as:

Case One :

The design storm only covers Basin 1 of 249.0 square miles (see Figure 9). The storm water released from Subarea K7 is routed through Basin 3 to Point B, and then from Point B through Arrow Canyon to the Gage Station. Due to the storage capacity in the downstream valley, the flood flows generated from Basin 1 are expected to have significant attenuation.

Case Two :

The design storm only covers Basin 2 of 253.50 square miles (see Figure 10). The storm water released from Subarea P8 is routed through Basin 3 to Point B, and then from Point B through Arrow Canyon to the Gage Station. Flood flows produced by Case Two is also subject to similar storage effects to Case One. However, the shape of Basin 2 tends to produce more concentrated flows with higher peaks than Basin 1.

Case Three:

The design storm only covers Basins 3 and 5 of 359.50 square miles (see Figure 10). The storm water released to Point B will directly flow to Arrow Canyon. Without adequate valley storage effects, Case Three may produce high peak flows at Point B.

Case Four :

The design storm covers the entire watershed area of 861.50 square miles, including Basins 1, 2, 3, and 5 (see Figure 11). In this case, the storm water is

accumulated through a large area with a low depth area reduction factor. Flood flows are subject to valley storage effects through the entire waterway.

At a design point, the range of the peak discharge can be predicted by the above four storm centers, and the highest one is recommended for designs. For instance, the design discharge at Point A, Q_a , can be determined as:

$Q_a = \text{Max}$ (Case 1: Basin 1 as the direct tributary to Pt. A,

Case 2: Basin 2 as the direct tributary area to Pt. A,

Case 4: All Basins under the storm, but only Basins 1 and 2 as the direct tributary area to Pt. A)

The design discharge at Point B, Q_b , can be determined as:

$Q_b = \text{Max}$ (Case 1: Basin 1 as the direct tributary area to Pt. A, and then routed to Pt. B,

Case 2: Basin 2 as the direct tributary area to Pt. A, and then routed to Pt. B,

Case 3: Basins 3 and 5 as the direct tributary area to Pt. B,

Case 4: All basins as the tributary area to Pt. B.)

Table 7 presents the minimal and maximal values of the 100-yr peak discharges predicted for the design points, and Table 8 presents the predicted 10-year peak discharges by various storm centers. The recommended design discharges are summarized as:

Location	10-year Peak Flow Q10 Cfs	100-year Peak Flow Q-100 Cfs	Remarks
Outlet of Basin 1	1858	9188	
Outlet of Basin 2	2456	12101	
Point A	2456	12101	
Outlet of Basin 5/Pt B	2739	15871	
Gage Station	2016	13484	

The range of the predicted 100-year peak discharge at the Gage Station is between 1445 to 13484 cfs versus 6510 cfs suggested by the Log-pearson analysis.

Conclusions

The watershed area upstream of Point B is identified to be 862.0 square miles. The 6-hour 10- and 100-yr rainfall depths at the study area are 1.60 and 3.0 inches. The Log-pearson analysis applied to the flood records at the USGS Gage Station near the city of Moapa indicates that the 10- and 100-year peak discharges are approximately 1410 and 6510 cfs. The analysis of the most severe historic event on August 10, 1981 shows that the storm cover area was approximately 280 square miles.

From the previous studies, the local depth area reduction factors have been developed for the Moapa valley. It is noticed that this set of DARF is slightly different from the published values on the 1999 CCRFCD Criteria Manual. Since 1988, the Master Plan has been implemented as a regional flood control guidance, the DARF used in the 1988 Master Plan are accepted and used in this study.

The wide flood plains in this area have significant impacts on peak flow attenuations. This study presents storm centering tests using the kinematic wave and

Muskingum methods with and without considering the valley storage effects. The critical storm cover area is identified to be approximately 250 to 300 square miles.

There are four storm centers developed for this area, based on the critical storm cover area and topographic conditions in the watershed. The maximal peak discharges at a point can be determined by the highest value among these four storm centers. For instance, the 10- and 100-year peak discharges are 2456 to 12010 cfs at Point A, and 2739 to 15871 cfs at Point B.

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- "Hydrology",* SCS national Engineering Handbook, Section 4, Soil Conservation Service, Washington, D.C., 1985

LIST OF FIGURES

- Figure 1. Watershed Map
- Figure 2. Topography near Arrow Canyon
- Figure 3. Rainfall Isohyetal Map of 10-year 6-hour Rainfall Depths for South Nevada
- Figure 4. Rainfall Isohyetal Map of 100-year 6-hour Rainfall Depths for South Nevada
- Figure 5. Derivation of Depth Reduction Area Factors for South Nevada
- Figure 6. Waterway and Tributary Area used in Storm Centering Test
- Figure 7. Critical Storm Cover Area with and without Valley Storage Effects
- Figure 8. Case 1 Storm Center in Basin 1
- Figure 9. Case 2 Storm Center in Basin 2
- Figure 10. Case 3 Storm Center in Basins 3 and 5
- Figure 11. Case 4 Storm Center Covering All Basins.

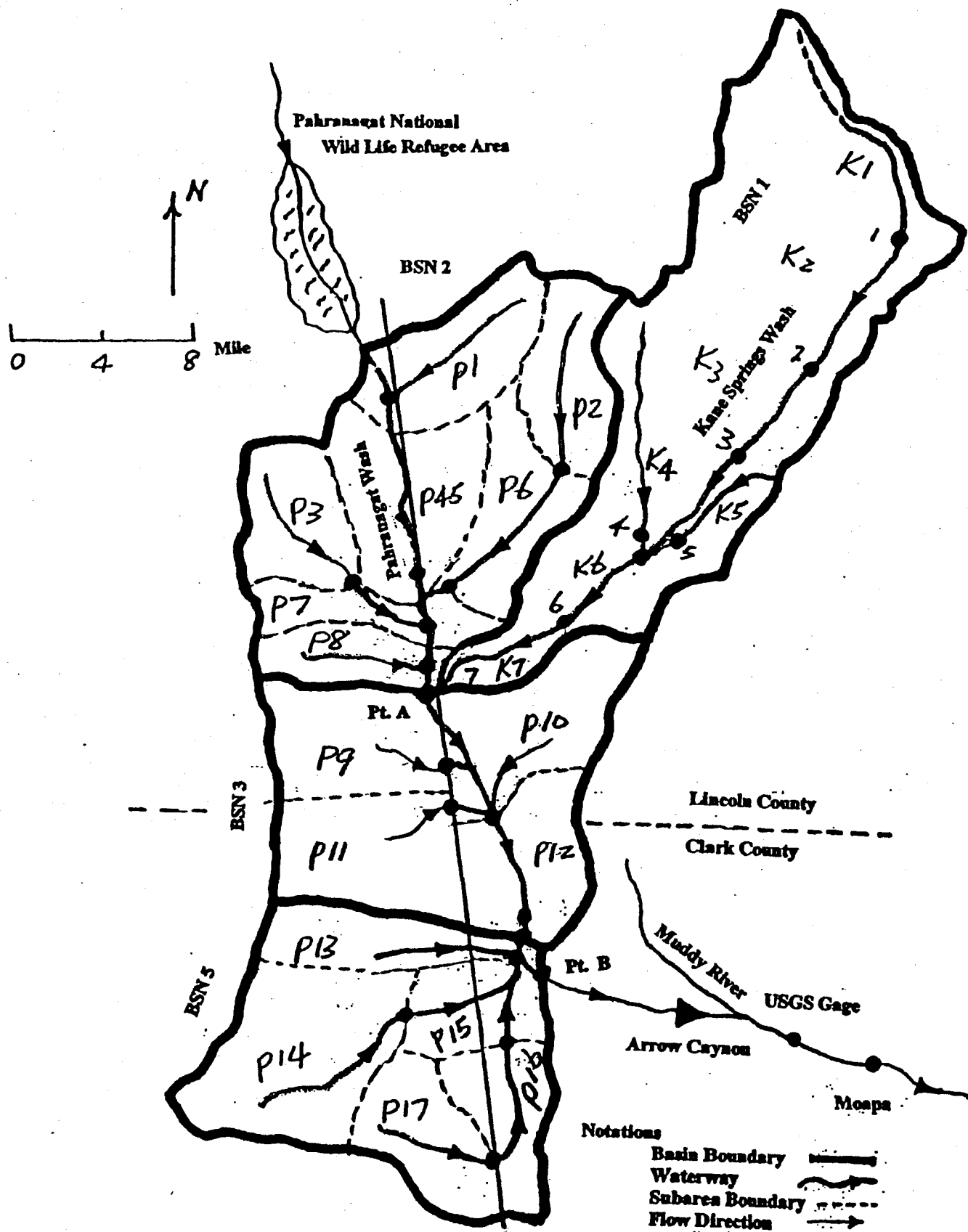


Figure 1. Watershed Map

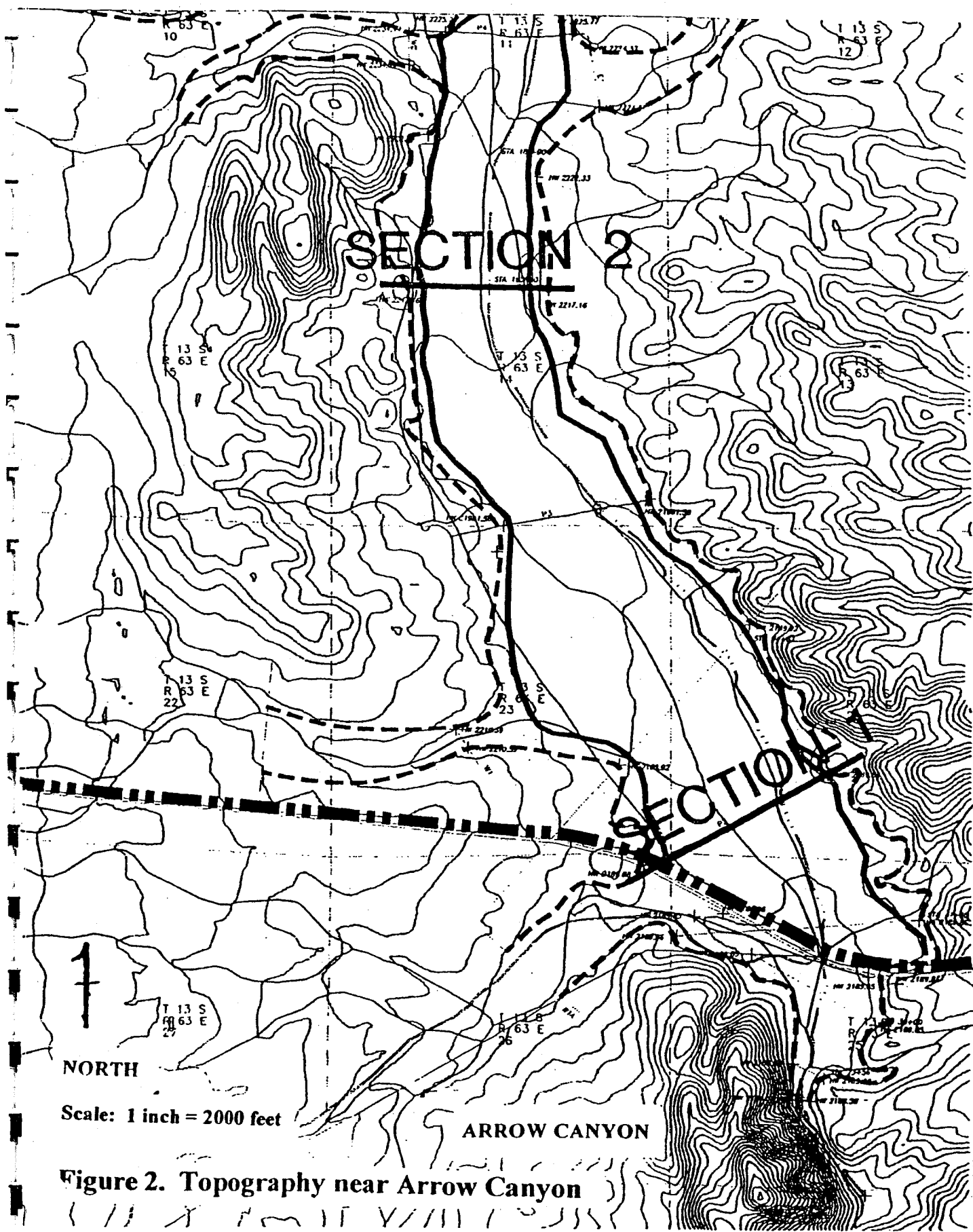


Figure 2. Topography near Arrow Canyon

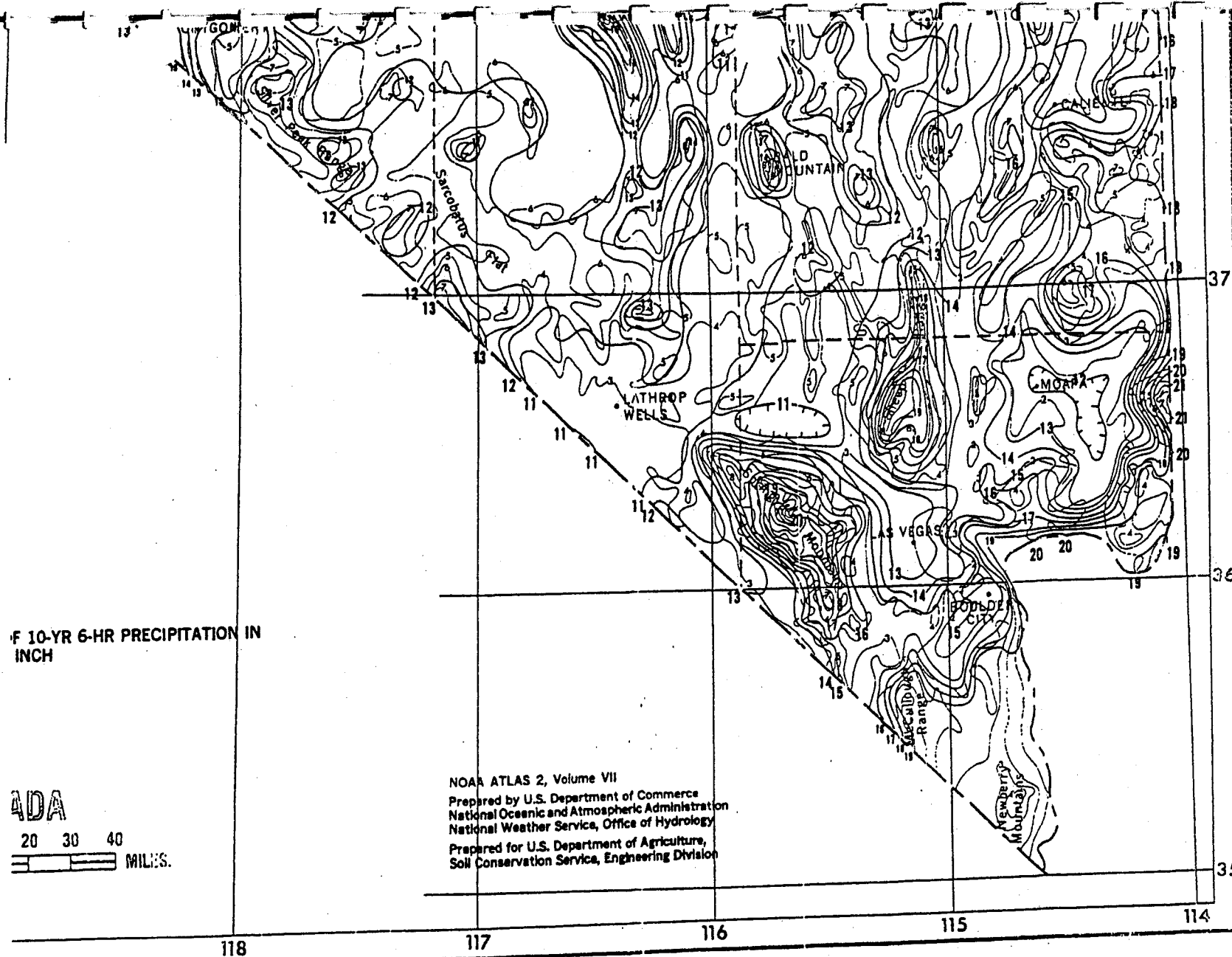


Figure 3. Rainfall Isohyetal Map of 10-year 6-hour Rainfall Depths for South Nevada

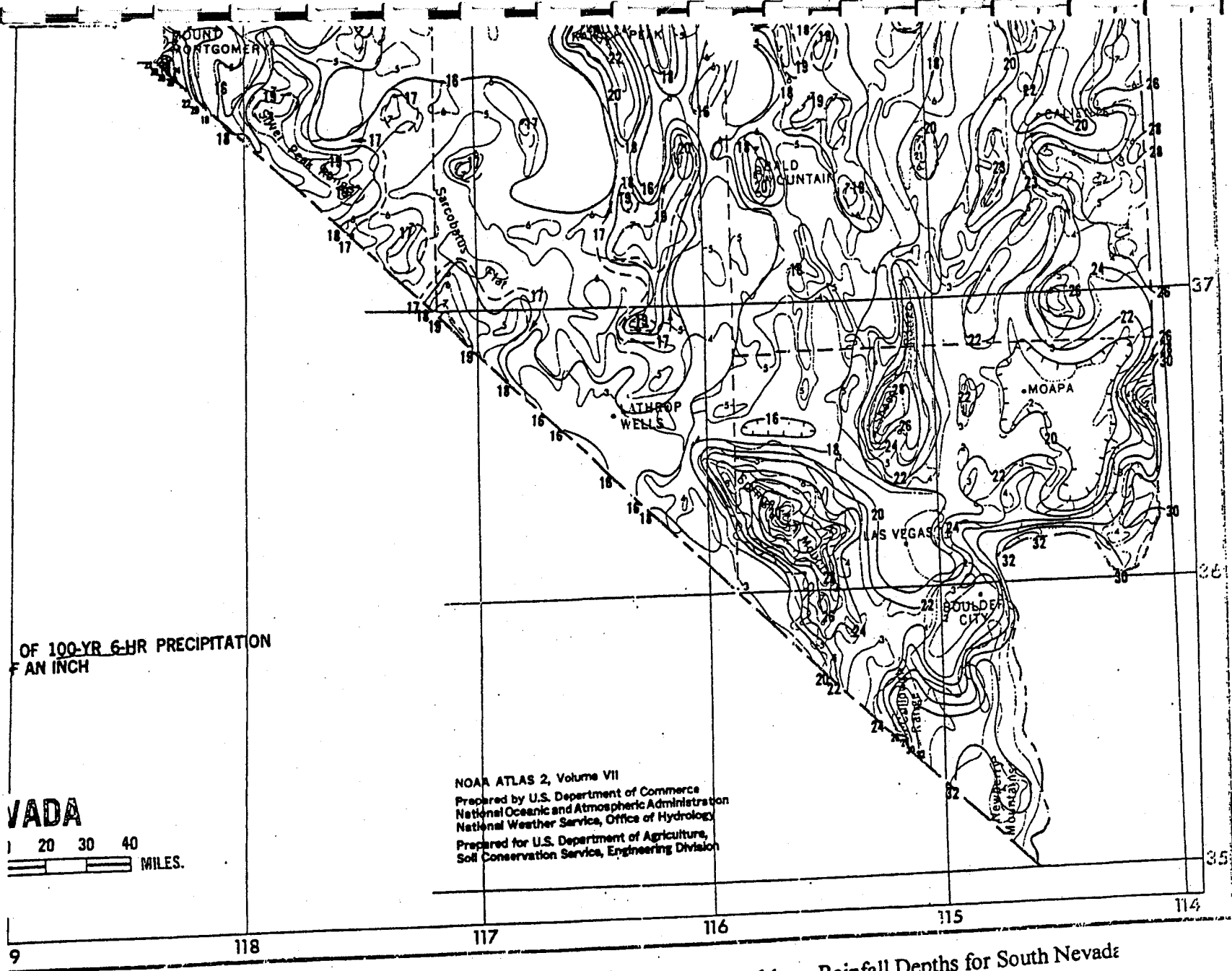


Figure 4. Rainfall Isohyetal Map of 100-year 6-hour Rainfall Depths for South Nevada

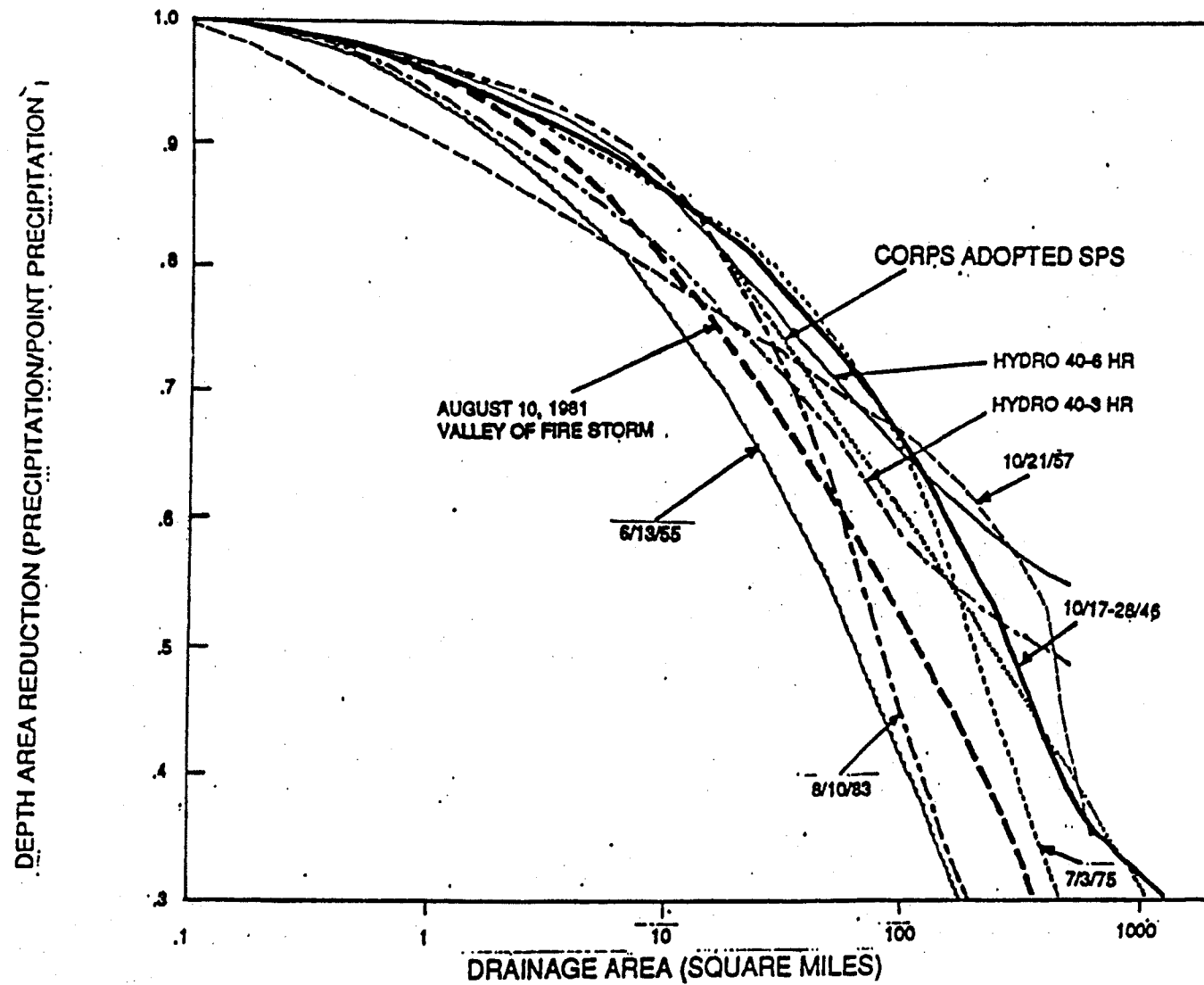


Figure 5. Derivation of Depth Reduction Area Factors for South Nevada

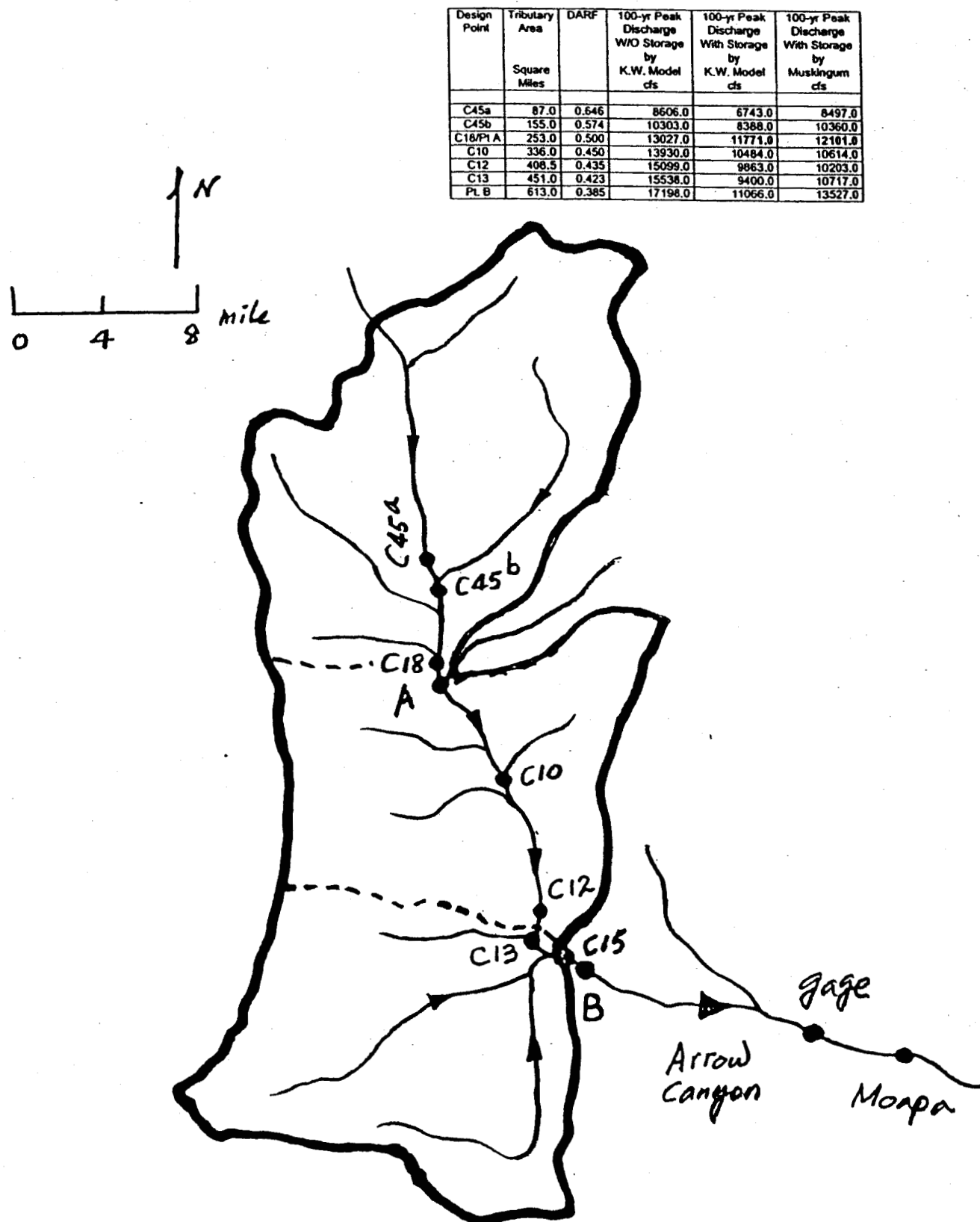


Figure 6. Waterway and Tributary Area used in Storm Centering Test

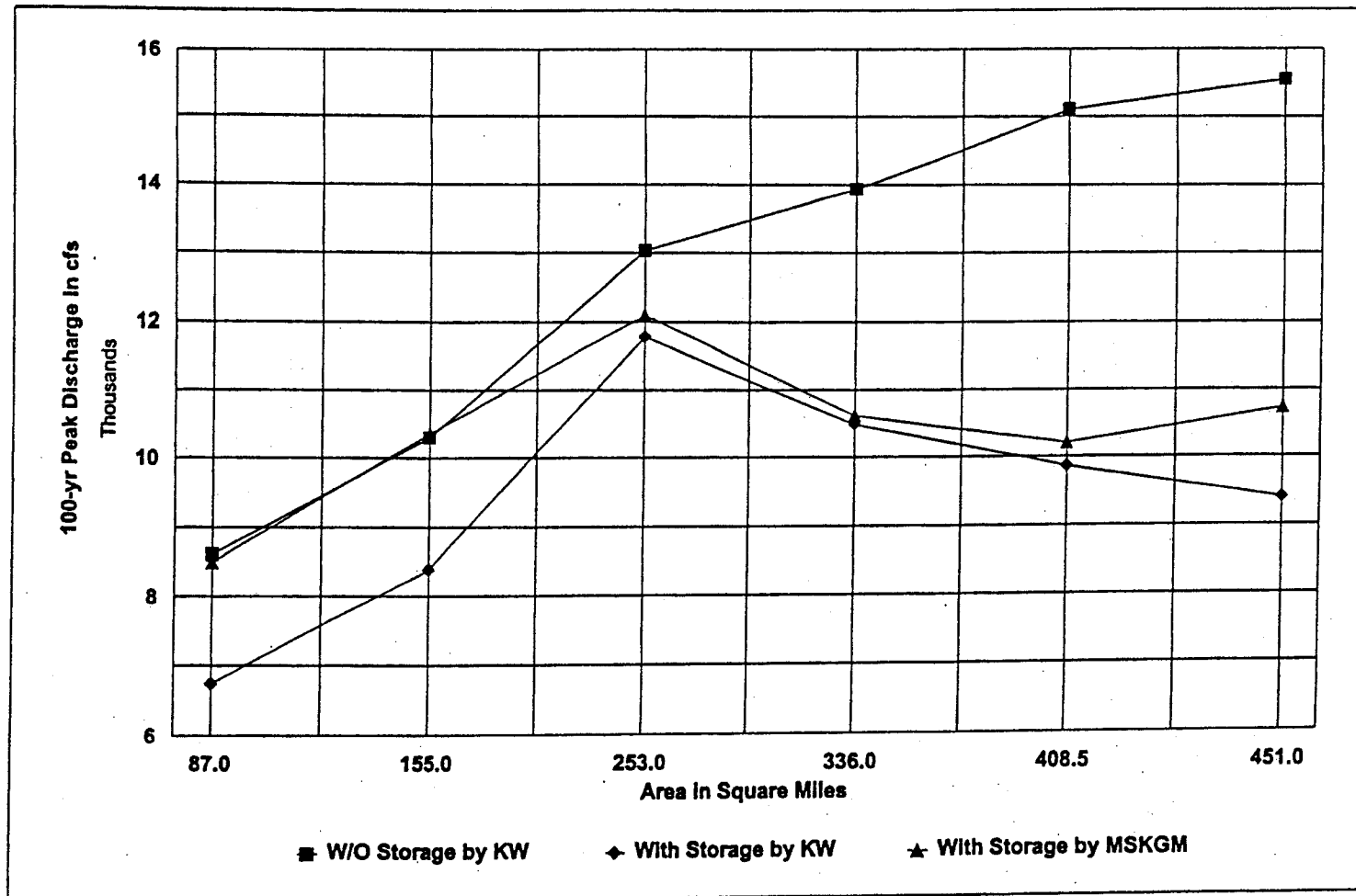


Figure 7 Analysis of Storm Centering Tests with and without Storage Effects

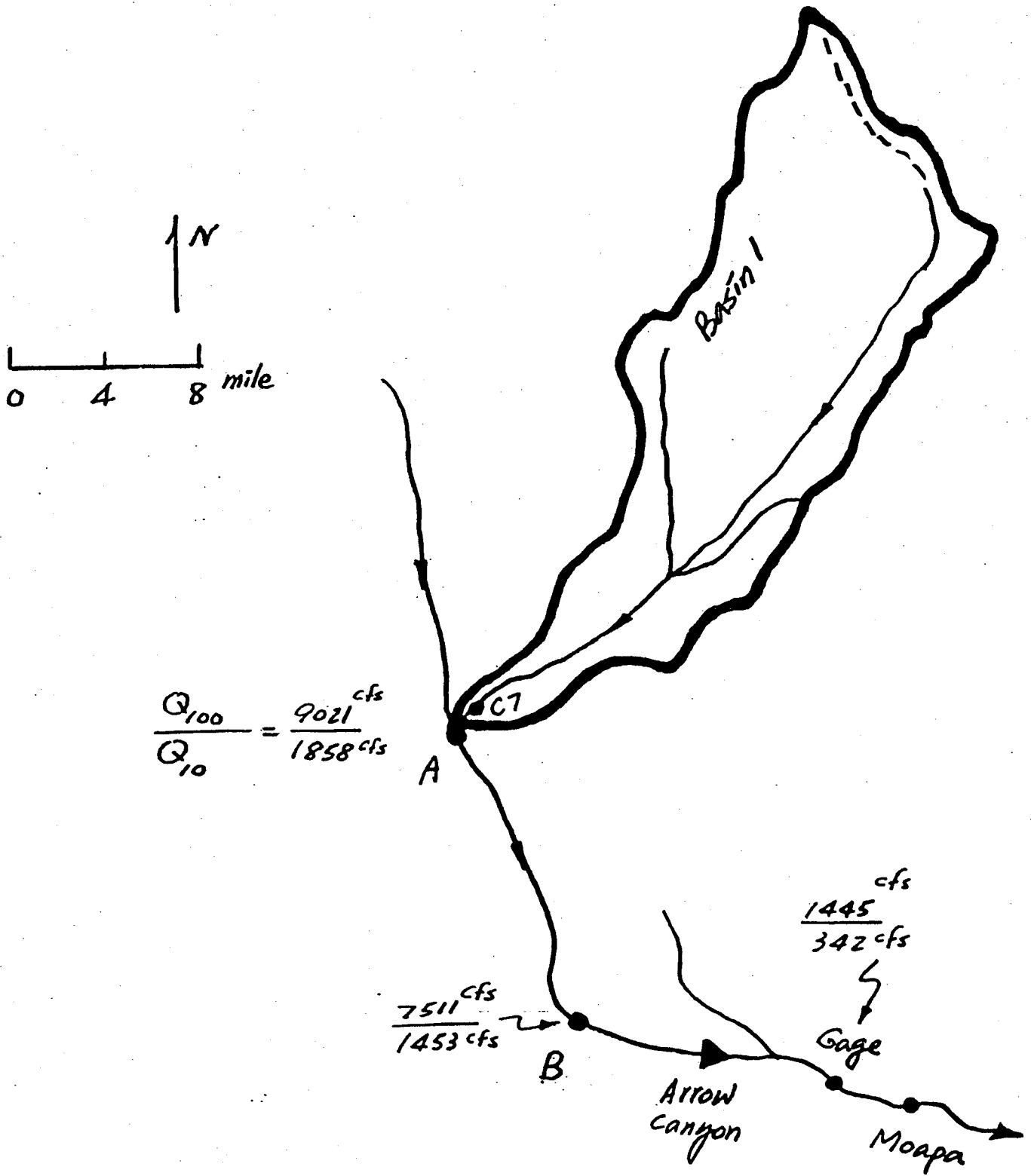


Figure 8. Case 1 Storm Center in Basin 1

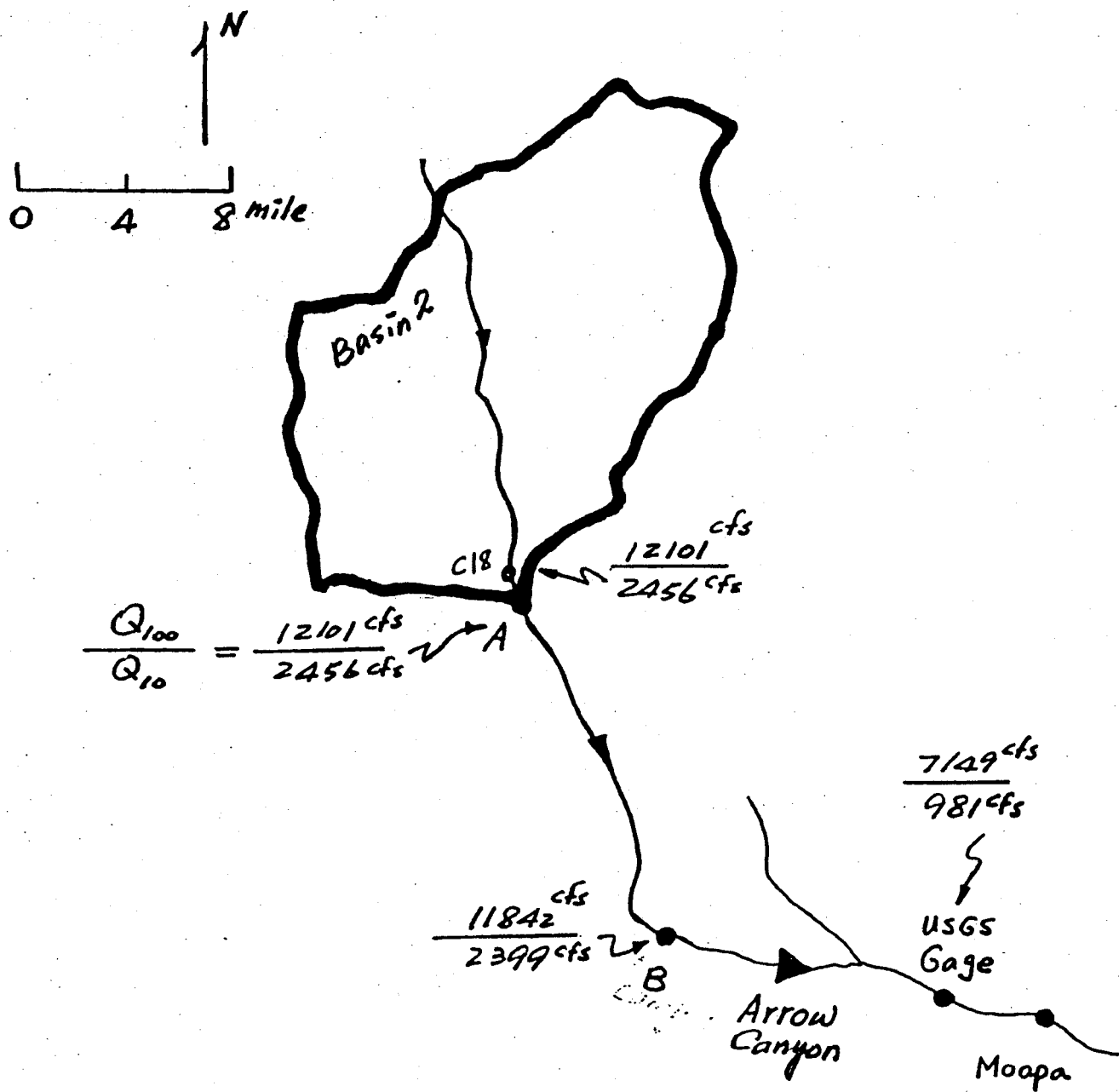


Figure 9. Case 2 Storm Center in Basin 2

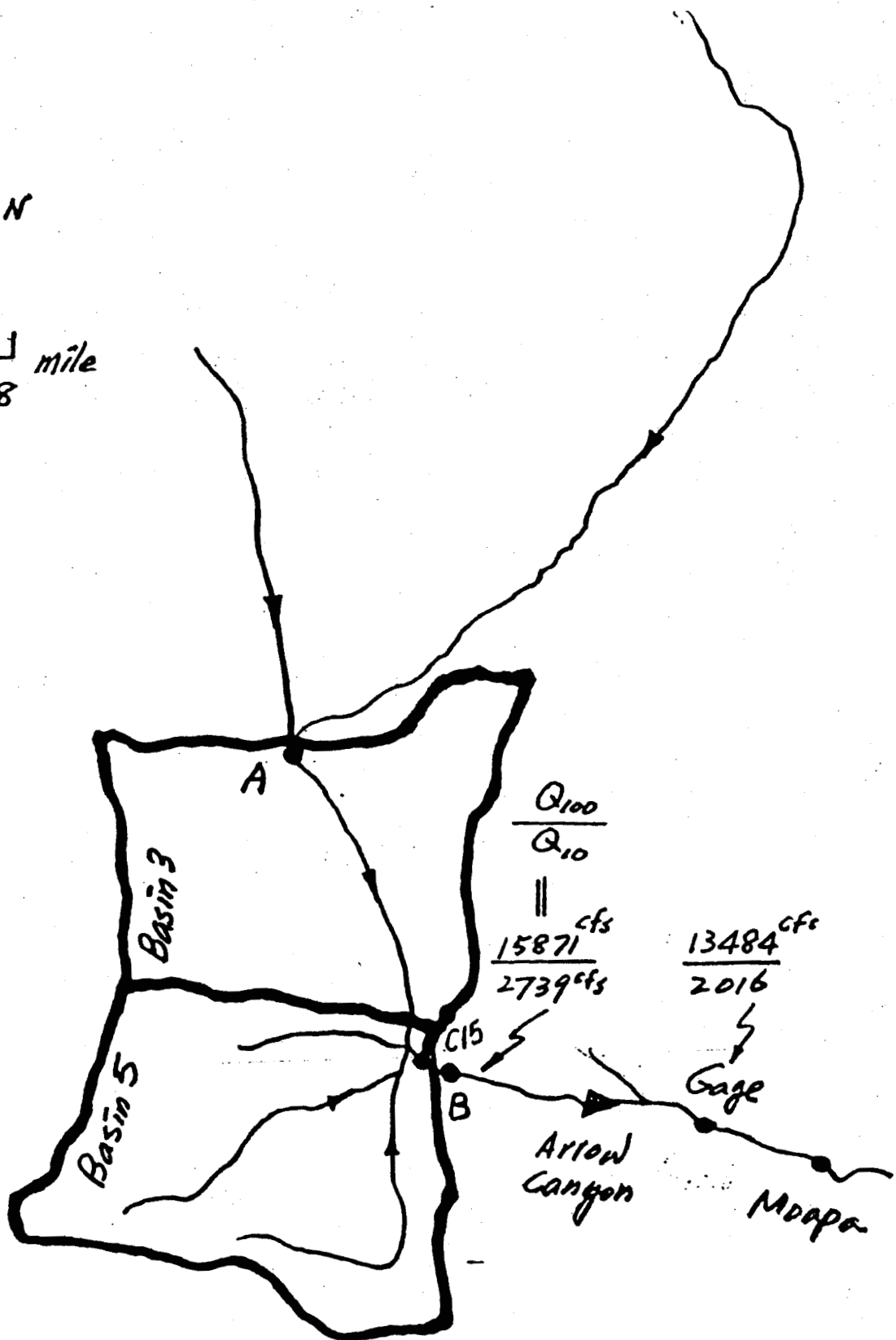
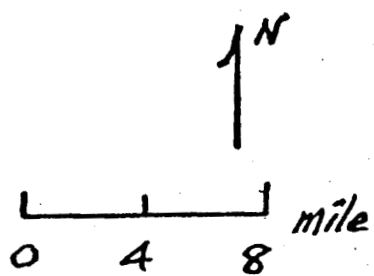


Figure 10. Case 3 Storm Center in Basins 3 and 5

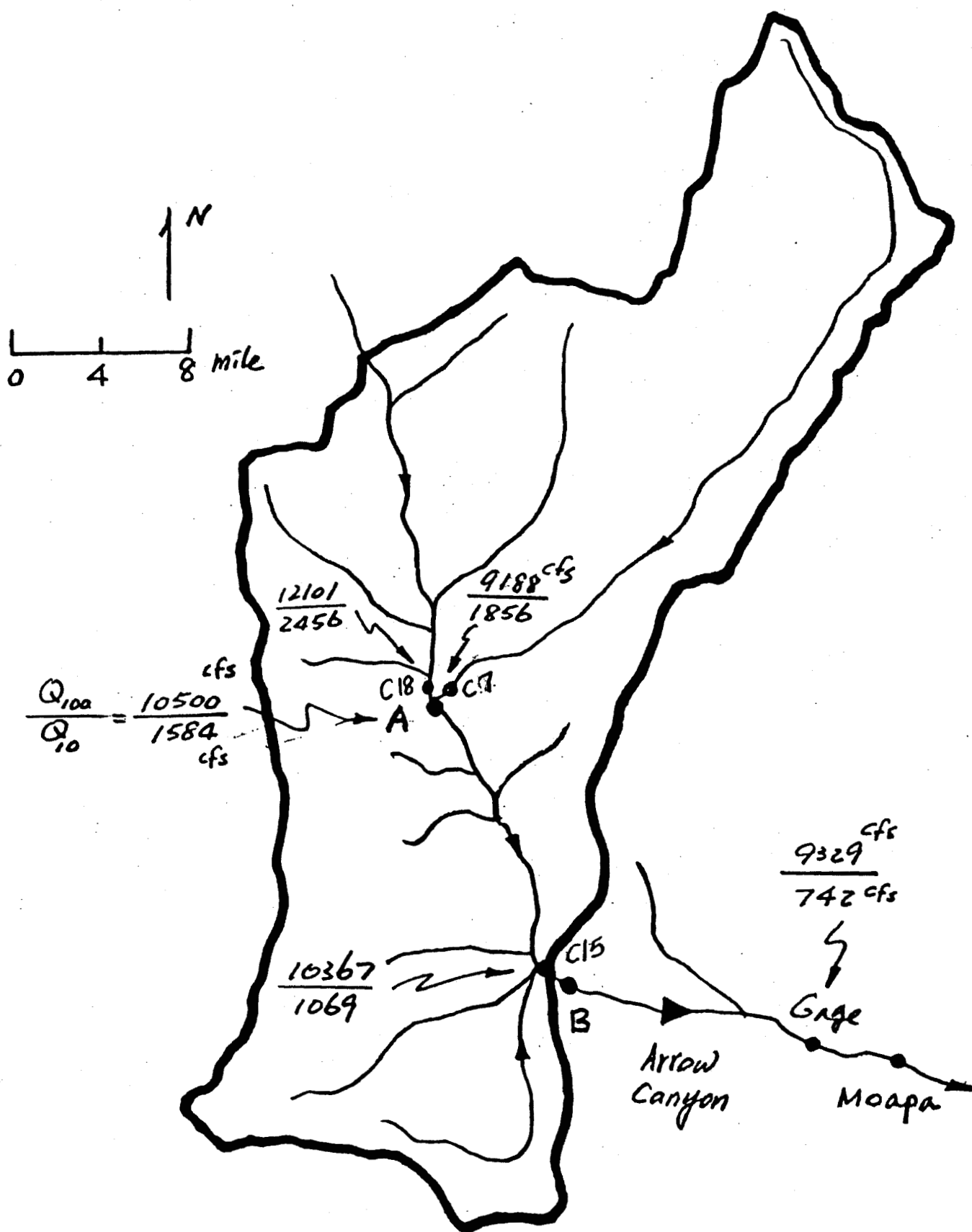


Figure 11. Case 4 Storm Center Covering All Basins.

LIST OF TABLES

- Table 1. Hydrologic Parameters for Subareas
- Table 2. Frequency Analysis at USGS Gage Station near Moapa, Nevada.
- Table 3 Stage-Storage-Outflow Characteristics at Arrow Canyon
- Table 4 Depth Area Reduction Factors for South Nevada
- Table 5 Parameters Derived for Muskingum Method
- Table 6 Summary of Storm Center Tests
- Table 7 Determination of 100-year Design Peak Discharges
- Table 8 Determination of 10-year Design Peak Discharges

Table 1 Watershed Hydrologic Parameters for the Area Upstream of Moapa, Nevada

Watershed Area	Subarea ID	Area sq mile	Upst Elev meter	Dnst Elev meter	Lenght of Waterway Kilometer	Waterway Slope percent	Waterway Slope ft/mile	Curve Number	Length to Centroid Mile	Roughness Kn	USBR Lag Time hours
Basin 1 Kane Springs Wash	K1 K2 K3 K4 K5 K6 K7 Sum	33.00 56.50 57.00 36.50 21.50 29.00 15.50 249.00	2222.00 2250.00 2050.00 1750.00 1500.00 1250.00 1000.00	1250.00 1050.00 1000.00 900.00 900.00 850.00 750.00	23.00 31.00 26.00 54.00 16.00 17.00 17.00	4.23 3.87 4.04 1.57 3.75 2.35 1.47	20.62 18.88 19.70 7.68 18.29 11.48 7.17	85.00 85.00 85.00 85.00 85.00 85.00 85.00	7.19 9.69 8.13 16.88 5.00 5.31 5.31	0.042 0.042 0.042 0.042 0.042 0.042 0.042	2.36 2.91 2.57 4.87 1.89 2.13 2.30
Basin 2 Pahrnagat Wash North of Pt A	P1 P2 P3 P45 P6 P7 P8 Sum	28.00 38.50 39.50 59.00 30.00 25.50 33.00 253.50	1550.00 1750.00 1500.00 1250.00 1750.00 2245.00 2000.00	1000.00 1250.00 900.00 800.00 800.00 775.00 750.00	21.00 27.00 19.00 23.00 23.00 16.00 18.00	2.62 1.85 3.16 1.96 4.13 9.19 6.94	12.78 9.03 15.40 9.54 20.15 44.82 33.88	85.00 85.00 85.00 85.00 85.00 85.00 85.00	6.56 8.44 5.94 7.19 7.19 5.00 5.63	0.042 0.042 0.042 0.042 0.042 0.042 0.042	2.40 3.00 2.18 2.67 2.36 1.63 1.85
Basin 3 Pahrnagat Wash Between A and B	P9 P10 P11 P12 Sum	32.50 50.00 36.00 36.50 155.00	1900.00 1500.00 2150.00 1000.00	775.00 700.00 800.00 650.00	16.50 22.00 17.00 19.00	6.82 3.64 7.94 1.84	33.26 17.74 38.74 8.99	85.00 85.00 85.00 85.00	5.16 6.88 5.31 5.94	0.042 0.042 0.042 0.042	1.75 2.35 1.74 2.38
Basin 5 Area South of Pt B	P17 P16 P15 P14 P13 Sum	42.00 27.00 61.00 32.00 42.50 204.50	2222.00 825.00 2500.00 1000.00 2000.00	825.00 725.00 1000.00 650.00 650.00	21.50 11.50 24.00 10.00 25.00	6.50 0.87 6.25 3.50 5.40	31.70 4.24 30.49 17.07 26.34	85.00 85.00 85.00 85.00 85.00	6.72 3.59 7.50 3.13 7.81	0.042 0.042 0.042 0.042 0.042	2.10 1.94 2.27 1.40 2.39

Return Period	Peak Flow (cfs)			Volume (AF)		
	Predicted	5%	95%	Predicted	5%	95%
2	270	370	200	180	300	110
5	780	1170	560	600	1140	360
10	1410	2330	960	1080	2320	620
25	2740	5110	1730	1970	4910	1050
50	4290	8760	2560	2880	7890	1450
100	6510*	14480	3680	4010*	12000	1920
500	15700	42200	7840	7650	27300	3300

* Recommended design values

Table 2. Frequency Analysis at USGS Gage Station near Moapa, Nevada.

TABLE 3 STAGE-STORAGE-OUTFLOW CURVE at ARROW CANYON

HECRAS Section Sta 80+6

X	Y (Elev)
ft	ft
0	2200
80	2180
120	2130
160	2160
220	2133
240	2160
300	2180
400	2260

Cross Section Triangular Section
 Z1=3.0 Z2=4.0
 n = 0.045

Elevation	Contour Area	Storage Volume	Flow Depth	Flowrate S=0.005 n=0.045	Flowrate S=0.001 n=0.045	Flowrate HECRAS Predictions
ft	acres	acre-ft	ft	cfs	cfs	cfs
2133.00	0.00	0.00	0.00	0.00	0	
2140.00	1.10	3.85	7.00	725.00	324	
2150.00	45.55	459.35	17.00	7126.00	3186	9300
2160.00	90.00	914.85	27.00	23957.00	10713	
2170.00	204.00	2384.85	37.00	54978.00	24587	55260
2180.00	320.00	5004.85	47.00	103499.00	46286	

Note: S = 0.005 was predicted by HECRAS under the condition of steady flow
 S = 0.001 is the ground slope upstream of this section, and used in this study.

TABLE 4 DARF Developed for Pahrnagat Valley, Nevada

Area	DARF 100-yr	DARF 50-yr	DARF 25-yr	DARF 10-year	DARF 5-year	DARF Average Value
1.000	1.000	1.000	1.000	1.000	1.000	1.000
5.000	0.950	0.960	0.960	0.937	0.932	0.948
10.000	0.900	0.900	0.900	0.873	0.890	0.893
20.000	0.830	0.840	0.840	0.804	0.805	0.824
30.000	0.800	0.780	0.780	0.778	0.771	0.782
40.000	0.750	0.740	0.740	0.759	0.737	0.745
50.000	0.720	0.720	0.720	0.728	0.678	0.713
60.000	0.702	0.700	0.700	0.696	0.669	0.694
70.000	0.684	0.680	0.680	0.665	0.661	0.674
80.000	0.666	0.668	0.668	0.652	0.653	0.661
90.000	0.648	0.652	0.652	0.633	0.644	0.646
100.000	0.630	0.640	0.640	0.614	0.636	0.632
150.000	0.580	0.600	0.600	0.506	0.583	0.574
200.000	0.530	0.560	0.560	0.475	0.530	0.531
300.000	0.500	0.480	0.480	0.449	0.477	0.477
400.000	0.460	0.440	0.440	0.430	0.424	0.439
500.000	0.436	0.400	0.400	0.392	0.407	0.407
600.000	0.412	0.382	0.382	0.380	0.390	0.389
700.000	0.388	0.365	0.365	0.361	0.373	0.370
800.000	0.364	0.347	0.347	0.342	0.356	0.351
900.000	0.340	0.330	0.330	0.323	0.339	0.332
1000.000	0.317	0.312	0.312	0.304	0.322	0.313

Parameters Developed for Muskingum Method

5 minutes

[illegible]

Table 6 Summary of Storm Centering Tests

Design Point	Location	Tributary Area Square Miles	DARF	100-yr Peak Discharge W/O Storage by K.W. Model cfs	100-yr Peak Discharge With Storage by K.W. Model cfs	100-yr Peak Discharge With Storage by Muskingum cfs
C45a		87.0	0.646	8606.0	6743.0	8497.0
C45b		155.0	0.574	10303.0	8388.0	10360.0
C18/Pt A	Outlet of BSN 2	253.0	0.500	13027.0	11771.0	12101.0
C10		336.0	0.450	13930.0	10484.0	10614.0
C12	Outlet of BSN 3	408.5	0.435	15099.0	9863.0	10203.0
C13		451.0	0.423	15538.0	9400.0	10717.0
Pt. B	Outlet of BSN 2, 3, & 5	613.0	0.385	17198.0	11066.0	13527.0

TABLE 7 Predictions of 100-year peak Discharges

Design Point	Location	100-yr Storm Center Case 1	100-yr Storm Center Case 2	100-yr Storm Center Case 3	100-yr Storm Center Case 4	Max 100-yr Peak Discharge	Min 100-yr Peak Discharge
		Q100/Area cfs/sq mile	Q100/Area cfs/sq mile	Q100/Area cfs/sq mile	Q100/Area cfs/sq mile	Q100 cfs	Q100 cfs
						(design)	
C7	Outlet of BSN 1	9021/249	N/P	N/P	9188/249.0	9188.0	9021.0
C18	Outlet of BSN 2	N/P	12101/253.5	N/P	12101/253.5	12101.0	12101.0
Pt A	Confluence	9021/249	12101/253.5	N/P	10500/502.5	12101.0	9021.0
C15/Pt B	Outlet of BSN 5	7511/249	11842/253.5	15871/359.0	10367/657.0	15871.0	7511.0
Gage		1445/249	7149/253.5	13484/359.0	9329/861.5	13484.0	1445.0
Source	HEC 1 Output	Appendix A	Appendix B	Appendix C	Appendix D		

Note: N/P = Not Application because of No Precipitation

TABLE 8 **Predictions of 10-year peak Discharges**

Design Point	Location	10-yr Storm Center Case 1	10-yr Storm Center Case 2	10-yr Storm Center Case 3	10-yr Storm Center Case 4	Max 10-yr Peak Discharge	Min 10-yr Peak Discharge
		Q10/Area cfs/sq mile	Q10/Area cfs/sq mile	Q10/Area cfs/sq mile	Q10/Area cfs/sq mile	Q10 cfs (design)	Q10 cfs
C7	Outlet of BSN 1	1858 /249	N/P	N/P	1856/249	1858.0	1856.0
C18	Outlet of BSN 2	N/P	2456/253.5	N/P	2456/253.5	2456.0	2456.0
Pt A	Confluence	1858 /249	2456/253.5	N/P	1584/502.5	2456.0	1584.0
C15/Pt B	Outlet of BSN 5	1453 /249	2399/253.5	2739/359	1069/657.0	2739.0	1069.0
Gage		342 /249	981/253.5	2016/359	742/861.5	2016.0	342.0
Source	HEC 1 Output	Appendix A	Appendix B	Appendix C	Appendix D		

Note: N/P = Not Application because of No Precipitation

LIST OF APPENDICES

Appendix A -- Storm Centering Tests

1. Without Valley Storage by K.W. Model (file:SKW30.dat)
2. With Valley Storage Effects by KW Model (file: SKW800.dat)
3. With Valley Storage Effects by Muskingum Method (file:SMSKG.dat)

Appendix B -- CASE 1 100-yr Storm Center in Basin 1 (file: B1-100.dat)
10-yr Storm Center in Basin 1 Ifile B1-10.dat)

Appendix C--CASE 2 100-yr Storm Center in Basin 2 (file: B2-100.dat)
10-yr Storm Center in Basin 2 (file: B2-10.dat)

Appendix D--CASE 3 100-yr Storm Center in Basins 3 and 5 (file: B35-100.dat)
10-yr Storm Center in Basins a and 5 (file: B35-10.dat)

Appendix E--CASE 4 100-yr Storm Center in All Basins (file: Ball-100.dat)
10-yr Storm Center in All Basins (file: Ball-10.dat)

APPENDIX A

STUDY 1: STORM CENTERING TEST BY KINEMATIC WAVE METHOD
WITHOUT VALLEY STORAGE EFFECTS

STUDY 2: STORM CENTERING TEST BY KINEMATIC WAVE METHOD
WITH VALLEY STORAGE EFFECTS

STUDY 3: STORM CENTERING TEST BY MUSKINGUM METHOD
WITH VALLEY STORAGE EFFECTS

STUDY 1: STORM CENTERING TEST BY KINEMATIC WAVE METHOD WITHOUT VALLEY STORAGE EFFECTS

Watershed Area: Pahranaagat Valley

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1 .....
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JAN    1997
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VERSION 4.1
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RUN DATE  10MAY00 TIME  02:00:49
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- U.S. ARMY CORPS OF ENGINEERS
- HYDROLOGIC ENGINEERING CENTER
- 609 SECOND STREET
- DAVIS, CALIFORNIA 95616
- (916) 756-1104

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

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

1

HEC-1 INPUT

PAGE 1

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

*DIAGRAM

1 ID

2 ID

3 ID * STORM CENTERING TEST *

4 ID * for Pahrnagat Watershed *

5 ID

6 ID

7 ID prepared by VTN-nevada in January 2000

8 ID

9 ID All tributary area north of Maynard Lake drains into the detention

10 ID and depression area in Pahrnagat National Wild Life Refuge

11 ID

12 ID JR PREC 0.646 0.574 0.500 0.450 0.435 0.423 0.385 DARF

13 ID AREA 87.0 155.5 253.5 336.0 408.0 451.0 613.0 sq miles

14 ID subare C45a C45b C18/A C10 C12 C13 Ptb

*** FREE ***

15 IT 5 0 0 150

16 IO 5 0 0

17 IN 5 0 0

18 JR PREC 0.646 0.574 0.500 0.450 0.435 0.423 0.385

19 KK pl

20 KM Subarea pl

21 BA 28.0

22 PB 3.0

23 PC .000 .020 .059 .080 .110 .144 .150 .160 .171

24 PC .180 .182 .187 .190 .197 .202 .210 .220 .241

25 PC .250 .259 .265 .280 .290 .300 .305 .309 .310

26 PC .321 .327 .333 .346 .361 .381 .408 .430 .477

27	PC	.561	.630	.710	.720	.731	.752	.779	.790	.795	.804
28	PC	.810	.820	.826	.840	.859	.889	.910	.938	.966	.970
29	PC	.974	.979	.981	.983	.985	.989	.990	.992	.993	.996
30	PC	.997	.999	1.00							
31	LS	0	85								
32	UD	2.401									
33	KK	R45									
34	KM	Route p1 through p45									
35	RK	64515	0.010	0.050	0	TRAP	100	10			
36	KK	P45									
37	KM	Subarea P45									
38	BA	59.0									
39	LS	0	85								
40	UD	2.675									
41	KK	C45a									
42	KM	Combine R45 and P45									
43	HC	2									

HEC-1 INPUT

PAGE 2

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

44	KK	P2									
45	KM	Subarea P2									
46	BA	38.5									
47	LS	0	85								
48	UD	3.00									
49	KK	R6									
50	KM	Route p2 through p6									
51	RK	70380	0.010	0.050	0	TRAP	100	10			
52	KK	P6									
53	KM	Subarea P6									
54	BA	30.0									
55	LS	0	85								
56	UD	2.36									
57	KK	C45b									
58	KM	Combine R45a, R6 and P6									
59	HC	3									
60	KK	R7a									
61	KM	Route C45b through P7									
62	RK	26565	0.010	0.050	0	TRAP	100	10			
63	KK	P3									
64	KM	Subarea P3									
65	BA	39.5									
66	LS	0	85								
67	UD	2.179									
68	KK	R7b									
69	KM	Route p3 through p7									
70	RK	27600	0.010	0.050	0	TRAP	100	10			
71	KK	P7									
72	KM	Subarea P7									
73	BA	25.5									
74	LS	0	85								
75	UD	1.631									
76	KK	C7									
77	KM	Combine R7b, R7a, and P7									
78	HC	3									
79	KK	R8									
80	KM	Route C7 through p8									
81	RK	15180	0.010	0.050	0	TRAP	100	10			
82	KK	P8									
83	KM	Subarea P8									
84	BA	33									
85	LS	0	85								
86	UD	1.846									

HEC-1 INPUT

PAGE 3

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

87	KK	C18/A									
88	KM	Combine R8 and P8									
89	HC	2									
90	KK	Rk10									
91	KM	Route A through P9/p10									
92	RK	34155	0.010	0.050	0	TRAP	100	10			
93	KK	P9									
94	KM	Subarea P9									
95	BA	32.5									
96	LS	0	85								

97 UD 1.748
 98 KK p10
 99 KM Subarea p10
 100 BA 50.0
 101 LS 0 85
 102 UD 2.345
 103 KK C10
 104 KM Combine A, P9 and p10
 105 HC 3
 106 KK Rk12
 107 KM Route C10 through P11/p12
 108 RK 34155 0.010 0.050 0 TRAP 100 10
 109 KK P11
 110 KM Subarea P11
 111 BA 36.0
 112 LS 0 85
 113 UD 1.739
 114 KK p12
 115 KM Subarea p12
 116 BA 36.5
 117 LS 0 85
 118 UD 2.382
 119 KK C12
 120 KM Combine Rk12, p11, and p12
 121 HC 3
 122 KK P13
 123 KM Subarea P13
 124 BA 42.5
 125 LS 0 85
 126 UD 2.390

1

HEC-1 INPUT

PAGE 4

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

127 KK C13
 128 KM Combine c12 and p13 (Watershed 3)
 129 HC 2
 130 KK p17
 131 KM Subarea p17
 132 BA 42.0
 133 LS 0 85
 134 UD 2.099
 135 KK Rk16
 136 KM Route p17 through P16
 137 RK 37950 0.010 0.050 0 TRAP 100 10
 138 KK p16
 139 KM Subarea p16
 140 BA 27.0
 141 LS 0 85
 142 UD 1.935
 143 KK C16
 144 KM Combine Rk16, and P16
 145 HC 2
 146 KK Rk15a
 147 KM Route C16 through P15
 148 RK 40250 0.010 0.050 0 TRAP 100 10
 149 KK p14
 150 KM Subarea p14
 151 BA 61.0
 152 LS 0 85
 153 UD 2.271
 154 KK Rk15b
 155 KM Route p14 through P15
 156 RK 45540 0.010 0.050 0 TRAP 100 10
 157 KK p15
 158 KM Subarea p15
 159 BA 32.0
 160 LS 0 85
 161 UD 1.402
 162 KK C15
 163 KM Combine Rk15a, Rk15b, and P15 (at Point 5)
 164 HC 3
 165 KK B
 166 KM Combine C15 and C13
 167 HC 2

1

HEC-1 INPUT

PAGE 5

LINE	ID	1	2	3	4	5	6	7	8	9	10
168	KK	RDAM									
169	KM	Route c15 THROUGH ARROWHEAD VALLEY									
170	RK	42500	0.01	0.050	0	TRAP	100	10			
171	KK	Arrow									
172	KM	Arrow Canyon									
173	RS	1	STOR	-1							
174	SV	0	14	460	915	2385	5005				
175	SE	2133	2140	2150	2160	2170	2180				
176	SQ	0	325	3186	10713	24587	46286				
177	KK	Gage									
178	KM	Route to USGS Gage									
179	RK	22500	0.01	0.050	0	TRAP	100	10			
180	ZZ										

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
19	p1	
	V	
	V	
33	R45	
	.	
36	.	P45
	.	
41	C45a	
	.	
44	.	P2
	.	V
	.	V
49	.	R6
	.	
52	.	P6
	.	
57	C45b	
	V	
	V	
60	R7a	
	.	
63	.	P3
	.	V
	.	V
68	.	R7b
	.	
71	.	P7
	.	
76	C7	
	V	
	V	
79	R8	
	.	
82	.	P8
	.	
87	C18/A	
	V	
	V	
90	Rk10	
	.	
93	.	P9
	.	
98	.	p10
	.	
103	C10	
	V	
	V	
106	Rk12	
	.	
109	.	P11
	.	
114	.	p12


```

119      C12.....
122      .          P13
127      C13.....
130      .          p17
131      .          V
132      .          V
135      .          Rk16
138      .          .          p16
143      .          C16.....
144      .          V
145      .          V
146      .          Rk15a
149      .          .          p14
150      .          .          V
151      .          .          V
154      .          .          Rk15b
157      .          .          .          p15
162      .          C15.....
165      .          B.....
166      .          V
167      .          V
168      .          RDAM
169      .          V
170      .          V
171      .          Arrow
172      .          V
173      .          V
177      .          Gage

```

```

.....
*   STORM CENTERING TEST
*   for Pahrnagat Watershed
*   .....

```

prepared by VIN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention and depression area in Pahrnagat National Wild Life Refuge

```

JR PREC  0.646 0.574 0.500 0.450 0.435 0.423 0.385 DARP
AREA     87.0 155.5 253.5 336.0 408.0 451.0 613.0 sq miles
subare   C45a C45b C18/A C10  C12  C13  P1B

```

```

16 IO      OUTPUT CONTROL VARIABLES
          IPRT      5  PRINT CONTROL
          IPLOT     0  PLOT CONTROL
          QSCAL     0.  HYDROGRAPH PLOT SCALE

IT         HYDROGRAPH TIME DATA
          NMIN      5  MINUTES IN COMPUTATION INTERVAL
          IDATE     1  0  STARTING DATE
          ITIME     0000 STARTING TIME
          NQ        150 NUMBER OF HYDROGRAPH ORDINATES
          NDDATE    1  0  ENDING DATE
          NDTIME    1225 ENDING TIME
          ICENT     19  CENTURY MARK

```

```

COMPUTATION INTERVAL .00 HOURS
TOTAL TIME BASE     12.42 HOURS

```

```

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

```

```

JP      MULTI-PLAN OPTION
          NPLAN      1  NUMBER OF PLANS

```

```

JR      MULTI-RATIO OPTION

```

RATIOS OF PRECIPITATION
 .65 .57 .50 .45 .44 .42 .38

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION						
				RATIO 1 .65	RATIO 2 .57	RATIO 3 .50	RATIO 4 .45	RATIO 5 .44	RATIO 6 .42	RATIO 7 .38
HYDROGRAPH AT	P1	28.00	1 FLOW TIME	3448. 6.33	2774. 6.42	2118. 6.42	1699. 6.42	1578. 6.50	1484. 6.50	1195. 6.50
ROUTED TO	R45	28.00	1 FLOW TIME	3444. 8.17	2771. 8.33	2115. 8.58	1698. 8.83	1577. 8.92	1482. 8.92	1192. 9.17
HYDROGRAPH AT	P45	59.00	1 FLOW TIME	6743. 6.58	5422. 6.67	4134. 6.67	3312. 6.75	3076. 6.75	2891. 6.75	2325. 6.75
2 COMBINED AT	C45a	87.00	1 FLOW TIME	8606. 7.58	6568. 7.92	4698. 8.25	3564. 8.50	3189. 8.67	2990. 8.67	2325. 6.75
HYDROGRAPH AT	P2	38.50	1 FLOW TIME	4044. 6.92	3247. 6.92	2473. 7.00	1980. 7.08	1839. 7.08	1727. 7.08	1388. 7.08
ROUTED TO	R6	38.50	1 FLOW TIME	4039. 8.83	3245. 9.00	2469. 9.25	1979. 9.50	1837. 9.58	1726. 9.67	1386. 9.83
HYDROGRAPH AT	P6	30.00	1 FLOW TIME	3737. 6.33	3008. 6.33	2296. 6.42	1843. 6.42	1712. 6.42	1609. 6.42	1295. 6.50
3 COMBINED AT	C45b	155.50	1 FLOW TIME	13514. 8.08	10303. 8.33	7310. 8.75	5464. 9.08	4942. 9.17	4596. 9.25	3659. 9.33
ROUTED TO	R7a	155.50	1 FLOW TIME	13500. 8.50	10276. 8.83	7271. 9.25	5401. 9.75	4929. 9.83	4541. 10.00	3611. 10.08
HYDROGRAPH AT	P3	39.50	1 FLOW TIME	5174. 6.17	4168. 6.17	3184. 6.25	2558. 6.25	2377. 6.25	2235. 6.25	1801. 6.33
ROUTED TO	R7b	39.50	1 FLOW TIME	5171. 6.75	4164. 6.83	3181. 7.00	2555. 7.08	2375. 7.08	2232. 7.17	1799. 7.25
HYDROGRAPH AT	P7	25.50	1 FLOW TIME	3884. 5.58	3134. 5.67	2404. 5.67	1935. 5.67	1800. 5.75	1694. 5.75	1370. 5.75
3 COMBINED AT	C7	220.50	1 FLOW TIME	18088. 6.67	14487. 6.75	11000. 6.83	8773. 6.92	8137. 7.00	7632. 7.00	6103. 7.08
ROUTED TO	R8	220.50	1 FLOW TIME	18084. 6.83	14476. 6.92	10997. 7.08	8767. 7.17	8129. 7.25	7625. 7.25	6097. 7.42
HYDROGRAPH AT	P8	33.00	1 FLOW TIME	4747. 5.83	3829. 5.83	2929. 5.92	2357. 5.92	2192. 5.92	2061. 5.92	1664. 6.00
2 COMBINED AT	C18/A	253.50	1 FLOW TIME	21714. 6.58	17312. 6.75	13027. 6.83	10327. 7.00	9555. 7.00	8951. 7.08	7110. 7.17
ROUTED TO	Rk10	253.50	1 FLOW TIME	21706. 7.08	17302. 7.25	13021. 7.42	10320. 7.58	9550. 7.67	8945. 7.75	7102. 7.92
HYDROGRAPH AT	P9	32.50	1 FLOW TIME	4800. 5.75	3875. 5.75	2966. 5.75	2388. 5.83	2221. 5.83	2089. 5.83	1687. 5.92
HYDROGRAPH AT	p10	50.00	1 FLOW TIME	6252. 6.33	5034. 6.33	3842. 6.33	3085. 6.42	2866. 6.42	2694. 6.42	2169. 6.42
3 COMBINED AT	C10	336.00	1 FLOW TIME	30631. 6.75	24188. 6.83	17871. 7.00	13930. 7.17	12802. 7.25	11905. 7.33	9247. 7.50
ROUTED TO	Rk12	336.00	1 FLOW	30622. 6.75	24178. 6.83	17855. 7.00	13924. 7.17	12788. 7.25	11899. 7.33	9244. 7.50

			TIME	7.00	7.25	7.50	7.75	7.83	7.92	8.17
HYDROGRAPH AT										
+	P11	36.00	1 FLOW TIME	5328. 5.75	4302. 5.75	3295. 5.75	2651. 5.83	2466. 5.83	2320. 5.83	1874. 5.83
HYDROGRAPH AT										
+	p12	36.50	1 FLOW TIME	4519. 6.33	3636. 6.33	2776. 6.42	2220. 6.42	2069. 6.42	1945. 6.42	1566. 6.50
3 COMBINED AT										
+	C12	408.50	1 FLOW TIME	37878. 6.92	29699. 7.08	21561. 7.33	16539. 7.58	15099. 7.67	13973. 7.75	10656. 8.08
HYDROGRAPH AT										
+	P13	42.50	1 FLOW TIME	5250. 6.33	4224. 6.33	3225. 6.42	2580. 6.42	2403. 6.42	2259. 6.50	1819. 6.50
2 COMBINED AT										
+	C13	451.00	1 FLOW TIME	42717. 6.92	33465. 7.00	24188. 7.33	18456. 7.58	16823. 7.67	15538. 7.75	11737. 8.08
HYDROGRAPH AT										
+	p17	42.00	1 FLOW TIME	5628. 6.08	4535. 6.08	3465. 6.17	2786. 6.17	2589. 6.17	2434. 6.17	1962. 6.25
ROUTED TO										
+	Rk16	42.00	1 FLOW TIME	5625. 6.92	4531. 7.00	3463. 7.17	2782. 7.33	2585. 7.33	2430. 7.33	1961. 7.50
HYDROGRAPH AT										
+	p16	27.00	1 FLOW TIME	3789. 5.92	3055. 5.92	2336. 6.00	1879. 6.00	1747. 6.00	1643. 6.00	1326. 6.08
2 COMBINED AT										
+	C16	69.00	1 FLOW TIME	8688. 6.50	6909. 6.67	5193. 6.75	4098. 6.92	3792. 6.92	3543. 7.00	2803. 7.17
ROUTED TO										
+	Rk15a	69.00	1 FLOW TIME	8680. 7.33	6905. 7.50	5190. 7.75	4094. 8.00	3786. 8.08	3539. 8.08	2801. 8.33
HYDROGRAPH AT										
+	p14	61.00	1 FLOW TIME	7788. 6.25	6271. 6.25	4789. 6.33	3846. 6.33	3573. 6.33	3359. 6.33	2705. 6.42
ROUTED TO										
+	Rk15b	61.00	1 FLOW TIME	7783. 7.17	6267. 7.25	4785. 7.42	3839. 7.58	3570. 7.58	3356. 7.67	2701. 7.75
HYDROGRAPH AT										
+	p15	32.00	1 FLOW TIME	5143. 5.33	4150. 5.33	3184. 5.42	2567. 5.50	2389. 5.50	2250. 5.50	1822. 5.58
3 COMBINED AT										
+	C15	162.00	1 FLOW TIME	18334. 7.00	14450. 7.17	10715. 7.42	8378. 7.67	7721. 7.75	7197. 7.83	5567. 8.17
2 COMBINED AT										
+	B	613.00	1 FLOW TIME	61024. 6.92	47842. 7.08	34768. 7.42	26717. 7.67	24449. 7.75	22704. 7.75	17198. 8.17
ROUTED TO										
+	RDAM	613.00	1 FLOW TIME	60932. 7.33	47770. 7.50	34686. 7.92	26656. 8.17	24335. 8.33	22638. 8.42	17141. 8.83
ROUTED TO										
+	Arrow	613.00	1 FLOW TIME	46054. 8.58	36291. 8.83	26958. 9.08	21097. 9.33	19378. 9.42	18056. 9.42	14095. 9.75
** PEAK STAGES IN FEET **										
1	STAGE			2179.89 8.58	2175.39 8.83	2171.09 9.08	2167.48 9.33	2166.25 9.42	2165.29 9.42	2162.44 9.75
ROUTED TO										
+	Gage	613.00	1 FLOW TIME	46043. 8.83	36285. 9.00	26950. 9.33	21093. 9.58	19375. 9.67	18053. 9.75	14091. 10.08
1										

Appendix A

STUDY 2: STORM CENTERING TEST BY KINEMATIC WAVE METHOD WITH VALLEY STORAGE EFFECTS

Watershed Area: Pahrnagat Valley

<pre> FLOOD HYDROGRAPH PACKAGE (HEC-1) JAN 1997 VERSION 4.1 RUN DATE 10MAY00 TIME 02:01:34 </pre>	<pre> U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEERING CENTER 609 SECOND STREET DAVIS, CALIFORNIA 95616 (916) 756-1104 </pre>
--	--

```

X   X XXXXXX XXXX   X
X   X X   X   X   X
X   X X   X   X   X
XXXXXX XXXX X   XXXX X
X   X X   X   X   X
X   X X   X   X   X
X   X XXXXXX XXXX   XXX
        
```

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1	HEC-1 INPUT	PAGE 1
LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10	
	*DIAGRAM	
1	ID	
2	ID	.....
3	ID	• STORM CENTERING TEST •
4	ID	• for Pahrnagat •
5	ID	.....
6	ID	
7	ID	prepared by VTN-nevada in January 2000
8	ID	
9	ID	All tributary area north of Maynard Lake drains into the detention
10	ID	and depression area in Pahrnagat National Wild Life Refuge
11	ID	
12	ID	JR PREC 0.646 0.574 0.500 0.450 0.435 0.423 0.385 DARF
13	ID	AREA 87.0 155.5 253.5 336.0 408.0 451.0 613.0 sq miles
14	ID	subare C45a C45b C18/A C10 C12 C13 Ptb
15	IT	5 0 0 150
16	IO	5 0 0
17	IN	5 0 0
18	JR	PREC 0.646 0.574 0.500 0.45 0.435 0.423 0.385
19	KK	p1
20	KM	Subarea p1
21	BA	28.0
22	PB	3.0
23	PC	.000 .020 .059 .080 .110 .144 .150 .160 .168 .171
24	PC	.180 .182 .187 .190 .197 .202 .210 .220 .230 .241
25	PC	.250 .259 .265 .280 .290 .300 .305 .309 .310 .317
26	PC	.321 .327 .333 .346 .361 .381 .408 .430 .477 .514
27	PC	.561 .630 .710 .720 .731 .752 .779 .790 .795 .804

28	PC	.810	.820	.826	.840	.859	.889	.910	.938	.966	.970
29	PC	.974	.979	.981	.983	.985	.989	.990	.992	.993	.996
30	PC	.997	.999	1.00							
31	LS	0	85								
32	UD	2.401									
33	KK	R45									
34	KM	Route p1 through p45									
35	RK	64515	0.010	0.050	0	TRAP	800	10			
36	KK	P45									
37	KM	Subarea P45									
38	BA	59.0									
39	LS	0	85								
40	UD	2.675									
41	KK	C45a									
42	KM	Combine R45 and P45									
43	NC	2									

1

HEC-1 INPUT

PAGE 2

LINE	ID	1	2	3	4	5	6	7	8	9	10
44	KK	P2									
45	KM	Subarea P2									
46	BA	38.5									
47	LS	0	85								
48	UD	3.00									
49	KK	R6									
50	KM	Route p2 through p6									
51	RK	70380	0.010	0.050	0	TRAP	800	10			
52	KK	P6									
53	KM	Subarea P6									
54	BA	30.0									
55	LS	0	85								
56	UD	2.36									
57	KK	C45b									
58	KM	Combine R45a, R6 and P6									
59	NC	3									
60	KK	R7a									
61	KM	Route C45b through P7									
62	RK	26565	0.010	0.050	0	TRAP	800	10			
63	KK	P3									
64	KM	Subarea P3									
65	BA	39.5									
66	LS	0	85								
67	UD	2.179									
68	KK	R7b									
69	KM	Route p3 through p7									
70	RK	27600	0.010	0.050	0	TRAP	800	10			
71	KK	P7									
72	KM	Subarea P7									
73	BA	25.5									
74	LS	0	85								
75	UD	1.631									
76	KK	C7									
77	KM	Combine R7b, R7a, and P7									
78	NC	3									
79	KK	R8									
80	KM	Route C7 through p8									
81	RK	15180	0.010	0.050	0	TRAP	800	10			
82	KK	P8									
83	KM	Subarea P8									
84	BA	33									
85	LS	0	85								
86	UD	1.846									

1

HEC-1 INPUT

PAGE 3

LINE	ID	1	2	3	4	5	6	7	8	9	10
87	KK	C18									
88	KM	Combine R8 and P8									
89	NC	2									
90	KK	Rk10									
91	KM	Route A through P9/p10									
92	RK	34155	0.010	0.050	0	TRAP	800	10			
93	KK	P9									
94	KM	Subarea P9									
95	BA	32.5									
96	LS	0	85								
97	UD	1.748									

98 KK p10
 99 KM Subarea p10
 100 BA 50.0
 101 LS 0 85
 102 UD 2.345

 103 KK C10
 104 KM Combine A, P9 and p10
 105 HC 3

 106 KK Rk12
 107 KM Route C10 through P11/p12
 108 RK 34155 0.010 0.050 0 TRAP 800 10

 109 KK P11
 110 KM Subarea P11
 111 BA 36.0
 112 LS 0 85
 113 UD 1.739

 114 KK p12
 115 KM Subarea p12
 116 BA 36.5
 117 LS 0 85
 118 UD 2.382

 119 KK C12
 120 KM Combine Rk12, p11, and p12
 121 HC 3

 122 KK P13
 123 KM Subarea P13
 124 BA 42.5
 125 LS 0 85
 126 UD 2.390

HEC-1 INPUT

PAGE 4

1

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

127 KK C13
 128 KM Combine c12 and p13 (Watershed 3)
 129 HC 2

 130 KK p17
 131 KM Subarea p17
 132 BA 42.0
 133 LS 0 85
 134 UD 2.099

 135 KK Rk16
 136 KM Route p17 through P16
 137 RK 37950 0.010 0.050 0 TRAP 800 10

 138 KK p16
 139 KM Subarea p16
 140 BA 27.0
 141 LS 0 85
 142 UD 1.935

 143 KK C16
 144 KM Combine Rk16, and P16
 145 HC 2

 146 KK Rk15a
 147 KM Route C16 through P15
 148 RK 40250 0.010 0.050 0 TRAP 800 10

 149 KK p14
 150 KM Subarea p14
 151 BA 61.0
 152 LS 0 85
 153 UD 2.271

 154 KK Rk15b
 155 KM Route p14 through P15
 156 RK 45540 0.010 0.050 0 TRAP 800 10

 157 KK p15
 158 KM Subarea p15
 159 BA 32.0
 160 LS 0 85
 161 UD 1.402

 162 KK C15
 163 KM Combine Rk15a, Rk15b, and P15 (at Point 5)
 164 HC 3

 165 KK B
 166 KM Combine C15 and C13
 167 HC 2

HEC-1 INPUT

PAGE 5

1

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

168	KK	RDAM							
169	KM	Route c15 THROUGH ARROWHEAD VALLEY							
170	RK	42500	0.01	0.050	0	TRAP	800	10	
171	KK	Arrow							
172	KM	Arrow Canyon							
173	RS	1	STOR	-1					
174	SV	0	14	460	915	2385	5005		
175	SE	2133	2140	2150	2160	2170	2180		
176	SQ	0	325	3186	10713	24587	46286		
177	KK	Gage							
178	KM	Route to USGS Gage							
179	RK	22500	0.01	0.050	0	TRAP	800	10	
180	ZZ								

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW

19	p1	
	V	
33	R45	
	.	
36	.	P45
	.	.
41	C45a	.....
	.	
44	.	P2
	.	V
49	.	V
	.	R6
	.	.
52	.	P6
	.	.
57	C45b	.....
	V	
	V	
60	R7a	
	.	
63	.	P3
	.	V
	.	V
68	.	R7b
	.	.
71	.	P7
	.	.
76	C7	.....
	V	
	V	
79	R8	
	.	
82	.	P8
	.	.
87	C18	.....
	V	
	V	
90	Rk10	
	.	
93	.	P9
	.	.
98	.	p10
	.	.
103	C10	.....
	V	
	V	
106	Rk12	
	.	
109	.	P11
	.	.
114	.	p12
	.	.
119	C12	.....

```

122      .      P13
127      C13.....
130      .      p17
131      .      v
132      .      v
135      .      Rk16
138      .      .      p16
143      .      C16.....
144      .      v
145      .      v
146      .      Rk15a
149      .      .      p14
150      .      .      v
151      .      .      v
154      .      .      Rk15b
157      .      .      .      p15
162      .      C15.....
165      .      B.....
166      .      v
167      .      v
168      .      RDAM
169      .      v
170      .      v
171      .      Arrow
172      .      v
177      .      Gage

```

```

.....
*   STORM CENTERING TEST   *
*   for Pahrnagat and lower Kane Spring Watersheds   *
.....

```

prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention and depression area in Pahrnagat National Wild Life Refuge

```

JR PREC  0.646 0.574 0.500 0.450 0.435 0.423 0.385 DARF
AREA    87.0 155.5 253.5 336.0 408.0 451.0 613.0 sq miles
subare  C45a C45b C16/A C10  C12  C13  PtB

```

```

16 IO      OUTPUT CONTROL VARIABLES
          IPRMT      5  PRINT CONTROL
          IPLOT      0  PLOT CONTROL
          QSCAL      0.  HYDROGRAPH PLOT SCALE

```

```

IT          HYDROGRAPH TIME DATA
          NMIN      5  MINUTES IN COMPUTATION INTERVAL
          IDATE     1  0  STARTING DATE
          ITIME     0000 STARTING TIME
          NQ        150 NUMBER OF HYDROGRAPH ORDINATES
          NDOATE    1  0  ENDING DATE
          NDTIME    1225 ENDING TIME
          ICENT     19  CENTURY MARK

```

```

          COMPUTATION INTERVAL  .08 HOURS
          TOTAL TIME BASE      12.42 HOURS

```

```

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

```

```

JP          MULTI-PLAN OPTION
          MPLAN      1  NUMBER OF PLANS

```

```

JR          MULTI-RATIO OPTION
          RATIOS OF PRECIPITATION
          .65      .57      .50      .45      .44      .42      .38

```


1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION						
				RATIO 1 .65	RATIO 2 .57	RATIO 3 .50	RATIO 4 .45	RATIO 5 .44	RATIO 6 .42	RATIO 7 .38
HYDROGRAPH AT	p1	28.00	1 FLOW TIME	3448. 6.33	2774. 6.42	2118. 6.42	1699. 6.42	1578. 6.50	1484. 6.50	1195. 6.50
ROUTED TO	R45	28.00	1 FLOW TIME	3443. 9.50	2772. 9.83	2117. 10.25	1698. 10.67	1577. 10.75	1483. 10.92	1192. 11.33
HYDROGRAPH AT	P45	59.00	1 FLOW TIME	6743. 6.58	5422. 6.67	4134. 6.67	3312. 6.75	3076. 6.75	2891. 6.75	2325. 6.75
2 COMBINED AT	C45a	87.00	1 FLOW TIME	6743. 6.58	5422. 6.67	4134. 6.67	3312. 6.75	3076. 6.75	2891. 6.75	2325. 6.75
HYDROGRAPH AT	P2	38.50	1 FLOW TIME	4044. 6.92	3247. 6.92	2473. 7.00	1980. 7.08	1839. 7.08	1727. 7.08	1388. 7.08
ROUTED TO	R6	38.50	1 FLOW TIME	4040. 10.17	3246. 10.50	2469. 10.92	1978. 11.33	1838. 11.50	1725. 11.67	1386. 12.08
HYDROGRAPH AT	P6	30.00	1 FLOW TIME	3737. 6.33	3008. 6.33	2296. 6.42	1843. 6.42	1712. 6.42	1609. 6.42	1295. 6.50
3 COMBINED AT	C45b	155.50	1 FLOW TIME	10431. 6.50	8388. 6.50	6396. 6.58	5129. 6.58	4763. 6.58	4476. 6.67	3603. 6.67
ROUTED TO	R7a	155.50	1 FLOW TIME	10426. 7.25	8381. 7.33	6390. 7.50	5125. 7.67	4759. 7.67	4475. 7.75	3601. 7.92
HYDROGRAPH AT	P3	39.50	1 FLOW TIME	5174. 6.17	4168. 6.17	3184. 6.25	2558. 6.25	2377. 6.25	2235. 6.25	1801. 6.33
ROUTED TO	R7b	39.50	1 FLOW TIME	5171. 7.25	4164. 7.33	3182. 7.58	2553. 7.75	2375. 7.75	2233. 7.83	1797. 8.00
HYDROGRAPH AT	P7	25.50	1 FLOW TIME	3884. 5.58	3134. 5.67	2404. 5.67	1935. 5.67	1800. 5.75	1694. 5.75	1370. 5.75
3 COMBINED AT	C7	220.50	1 FLOW TIME	17500. 7.08	13958. 7.17	10513. 7.33	8344. 7.50	7731. 7.58	7242. 7.67	5775. 7.83
ROUTED TO	R8	220.50	1 FLOW TIME	17482. 7.33	13946. 7.50	10507. 7.75	8339. 8.00	7722. 8.08	7240. 8.08	5771. 8.33
HYDROGRAPH AT	P8	33.00	1 FLOW TIME	4747. 5.83	3829. 5.83	2929. 5.92	2357. 5.92	2192. 5.92	2061. 5.92	1664. 6.00
2 COMBINED AT	C18	253.50	1 FLOW TIME	20157. 7.17	15907. 7.33	11771. 7.58	9206. 7.75	8447. 8.00	7890. 8.00	6223. 8.25
ROUTED TO	Rk10	253.50	1 FLOW TIME	20138. 7.92	15887. 8.17	11764. 8.58	9198. 8.92	8440. 9.08	7875. 9.25	6217. 9.50
HYDROGRAPH AT	P9	32.50	1 FLOW TIME	4800. 5.75	3875. 5.75	2966. 5.75	2388. 5.83	2221. 5.83	2089. 5.83	1687. 5.92
HYDROGRAPH AT	p10	50.00	1 FLOW TIME	6252. 6.33	5034. 6.33	3842. 6.33	3085. 6.42	2866. 6.42	2694. 6.42	2169. 6.42
3 COMBINED AT	C10	336.00	1 FLOW TIME	25624. 7.67	19561. 8.00	13870. 8.50	10484. 8.92	9503. 9.08	8796. 9.17	6827. 9.50
ROUTED TO	Rk12	336.00	1 FLOW TIME	25532. 8.42	19490. 8.83	13831. 9.42	10418. 10.00	9464. 10.17	8759. 10.33	6772. 10.83

HYDROGRAPH AT	P11	36.00	1	FLOW TIME	5328. 5.75	4302. 5.75	3295. 5.75	2651. 5.83	2466. 5.83	2320. 5.83	1874. 5.83
HYDROGRAPH AT	p12	36.50	1	FLOW TIME	4519. 6.33	3636. 6.33	2776. 6.42	2228. 6.42	2069. 6.42	1945. 6.42	1566. 6.50
3 COMBINED AT	C12	408.50	1	FLOW TIME	28514. 8.42	21275. 8.83	14735. 9.42	10919. 9.92	9863. 10.17	9093. 10.33	6961. 10.83
HYDROGRAPH AT	P13	42.50	1	FLOW TIME	5250. 6.33	4224. 6.33	3225. 6.42	2588. 6.42	2403. 6.42	2259. 6.50	1819. 6.50
2 COMBINED AT	C13	451.00	1	FLOW TIME	30911. 8.33	22725. 8.83	15499. 9.42	11367. 9.92	10217. 10.17	9400. 7.25	7304. 7.42
HYDROGRAPH AT	p17	42.00	1	FLOW TIME	5628. 6.08	4535. 6.08	3465. 6.17	2786. 6.17	2589. 6.17	2434. 6.17	1962. 6.25
ROUTED TO	Rk16	42.00	1	FLOW TIME	5624. 7.58	4531. 7.75	3458. 7.92	2782. 8.17	2585. 8.25	2430. 8.25	1958. 8.50
HYDROGRAPH AT	p16	27.00	1	FLOW TIME	3789. 5.92	3055. 5.92	2336. 6.00	1879. 6.00	1747. 6.00	1643. 6.00	1326. 6.08
2 COMBINED AT	C16	69.00	1	FLOW TIME	7803. 7.17	6105. 7.42	4504. 7.58	3465. 8.00	3184. 8.08	2965. 8.17	2328. 8.33
ROUTED TO	Rk15a	69.00	1	FLOW TIME	7780. 8.58	6083. 9.00	4462. 9.50	3443. 10.00	3129. 10.25	2902. 10.42	2326. 10.58
HYDROGRAPH AT	p14	61.00	1	FLOW TIME	7788. 6.25	6271. 6.25	4789. 6.33	3846. 6.33	3573. 6.33	3359. 6.33	2705. 6.42
ROUTED TO	Rk15b	61.00	1	FLOW TIME	7780. 7.83	6262. 8.00	4784. 8.25	3838. 8.42	3569. 8.50	3356. 8.58	2703. 8.83
HYDROGRAPH AT	p15	32.00	1	FLOW TIME	5143. 5.33	4150. 5.33	3184. 5.42	2567. 5.50	2389. 5.50	2250. 5.50	1822. 5.58
3 COMBINED AT	C15	162.00	1	FLOW TIME	15024. 8.50	11404. 9.00	8166. 9.50	6140. 10.00	5493. 10.25	5143. 8.58	4162. 10.50
2 COMBINED AT	B	613.00	1	FLOW TIME	45494. 8.50	33722. 8.92	23505. 9.50	17464. 10.00	15618. 10.25	14348. 10.42	11066. 10.83
ROUTED TO	RDAM	613.00	1	FLOW TIME	45152. 9.25	33300. 9.83	23193. 10.50	17300. 11.08	15447. 11.42	14190. 11.58	10999. 12.08
ROUTED TO	Arrow	613.00	1	FLOW TIME	35545. 10.25	26919. 10.67	18795. 11.42	14081. 12.00	12702. 12.25	11777. 12.42	8885. 12.42
** PEAK STAGES IN FEET **											
	1	STAGE			2175.05 10.25	2171.07 10.67	2165.83 11.42	2162.43 12.00	2161.43 12.25	2160.77 12.42	2157.57 12.42
ROUTED TO	Gage	613.00	1	FLOW TIME	35534. 10.58	26914. 11.08	18786. 11.92	14022. 12.42	12389. 12.42	11157. 12.42	7399. 12.42

Appendix A

STUDY 3: STORM CENTERING TEST BY MUSKINGUM METHOD WITH VALLEY STORAGE EFFECTS

Watershed Area: Pahrnagat Valley

```

.....
.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 02:03:20
.....

```

```

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

```

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X X XXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DS, AND HEC1KW.

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

1

HEC-1 INPUT

PAGE 1

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1          ID
2          ID
3          ID * STORM CENTERING TEST
4          ID * for Pahrnagat Watershed
5          ID
6          ID
7          ID prepared by VTN-nevada in January 2000
8          ID
9          ID All tributary area north of Maynard Lake drains into the detention
10         ID and depression area in Pahrnagat National Wild Life Refuge
11         ID
12         ID JR PREC 0.646 0.574 0.500 0.45 0.435 0.423 0.385 DARP
13         ID AREA 87.0 155.5 253.5 336.0 408.0 451.0 613.0 sq miles
14         ID Dagn Pt C45a C45b C18 C10 C12 C13 PtB
... FREE ...
15         IT 5 0 0 150
16         IO 5 0 0
17         IN 5 0 0
18         JR PREC 0.646 0.574 0.500 0.450 0.435 0.423 0.385
19         KK pl
20         RM Subarea pl
21         BA 28.0
22         PB 3.0
23         PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
24         PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241

```

25	PC	.250	.259	.265	.280	.290	.300	.305	.309	.310	.317
26	PC	.321	.327	.333	.346	.361	.381	.408	.430	.477	.514
27	PC	.561	.630	.710	.720	.731	.752	.779	.790	.795	.804
28	PC	.810	.820	.826	.840	.859	.889	.910	.938	.966	.970
29	PC	.974	.979	.981	.983	.985	.989	.990	.992	.993	.996
30	PC	.997	.999	1.00							
31	LS	0	85								
32	UD	2.401									
33	KK	R45									
34	KM	Route p1 through p45									
35	RM	10.	2.16	0.10							
36	KK	P45									
37	KM	Subarea P45									
38	BA	59.0									
39	LS	0	85								
40	UD	2.675									
41	KK	C45a									
42	KM	Combine R45 and P45									
43	HC	2									

HEC-1 INPUT

PAGE 2

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
44	KK P2
45	KM Subarea P2
46	BA 38.5
47	LS 0 85
48	UD 3.00
49	KK R6
50	KM Route p2 through p6
51	RM 10 2.64 0.10
52	KK P6
53	KM Subarea P6
54	BA 30.0
55	LS 0 85
56	UD 2.36
57	KK C45b
58	KM Combine R45a, R6 and P6
59	HC 3
60	KK R7a
61	KM Route C45b through P7
62	RM 10 1.00 0.10
63	KK P3
64	KM Subarea P3
65	BA 39.5
66	LS 0 85
67	UD 2.179
68	KK R7b
69	KM Route p3 through p7
70	RM 10 1.13 0.10
71	KK P7
72	KM Subarea P7
73	BA 25.5
74	LS 0 85
75	UD 1.631
76	KK C7
77	KM Combine R7b, R7a, and P7
78	HC 3
79	KK R8
80	KM Route C7 through p8
81	RM 10. 0.62 0.10
82	KK P8
83	KM Subarea P8
84	BA 33
85	LS 0 85
86	UD 1.846

HEC-1 INPUT

PAGE 3

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
87	KK C18(A)
88	KM Combine R8 and P8
89	HC 2
90	KK Rk10
91	KM Route A through P9/p10
92	RM 10. 1.40 0.10
93	KK P9
94	KM Subarea P9

95	BA	32.5		
96	LS	0	85	
97	UD	1.748		
98	KK	p10		
99	KM	Subarea p10		
100	BA	50.0		
101	LS	0	85	
102	UD	2.345		
103	KK	C10		
104	KM	Combine A, P9 and p10		
105	HC	3		
106	KK	Rk12		
107	KM	Route C10 through P11/p12		
108	RM	10. 1.40 0.10		
109	KK	P11		
110	KM	Subarea P11		
111	BA	36.0		
112	LS	0	85	
113	UD	1.739		
114	KK	p12		
115	KM	Subarea p12		
116	BA	36.5		
117	LS	0	85	
118	UD	2.382		
119	KK	C12		
120	KM	Combine Rk12, p11, and p12		
121	HC	3		
122	KK	P13		
123	KM	Subarea P15		
124	BA	42.5		
125	LS	0	85	
126	UD	2.390		

1

HBC-1 INPUT

PAGE 4

LINE	ID	1	2	3	4	5	6	7	8	9	10
127	KK	C13									
128	KM	Combine c12 and p13 (Watershed 3)									
129	HC	2									
130	KK	p17									
131	KM	Subarea p17									
132	BA	42.0									
133	LS	0	85								
134	UD	2.099									
135	KK	Rk16									
136	KM	Route p17 through P16									
137	RM	10. 1.56 0.10									
138	KK	p16									
139	KM	Subarea p16									
140	BA	27.0									
141	LS	0	85								
142	UD	1.935									
143	KK	C16									
144	KM	Combine Rk16, and P16									
145	HC	2									
146	KK	Rk15a									
147	KM	Route C16 through P15									
148	RM	10. 1.65 0.10									
149	KK	p14									
150	KM	Subarea p14									
151	BA	61.0									
152	LS	0	85								
153	UD	2.271									
154	KK	Rk15b									
155	KM	Route p14 through P15									
156	RM	10. 1.87 0.10									
157	KK	p15									
158	KM	Subarea p15									
159	BA	32.0									
160	LS	0	85								
161	UD	1.402									
162	KK	C15									
163	KM	Combine Rk15a, Rk15b, and P15 (at Point 5)									
164	HC	3									
165	KK	B									
166	KM	Combine C15 and C13									
167	HC	2									

LINE	ID	1	2	3	4	5	6	7	8	9	10
168	KK	RDAM									
169	KM	Route c15 THROUGH ARROWHEAD VALLEY									
170	RM	10.	1.12	0.10							
171	KK	Arrow									
172	KM	Arrow Canyon									
173	RS	1	STOR	-1							
174	SV	0	14	460	915	2385	5005				
175	SE	2133	2140	2150	2160	2170	2180				
176	SQ	0	325	3186	10713	24587	46286				
177	KK	Gage									
178	KM	Route to USGS Gage									
179	RM	10.	1.10	0.15							
180	ZZ										

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(----) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<----) RETURN OF DIVERTED OR PUMPED FLOW
19	p1	
	V	
	V	
33	R45	
	.	
36	.	P45
	.	
41	C45a	
	.	
44	.	P2
	.	V
	.	V
49	.	R6
	.	
52	.	P6
	.	
57	C45b	
	V	
	V	
60	R7a	
	.	
63	.	P3
	.	V
	.	V
66	.	R7b
	.	
71	.	P7
	.	
76	C7	
	V	
	V	
79	R8	
	.	
82	.	P8
	.	
87	C18(A)	
	V	
	V	
90	Rk10	
	.	
93	.	P9
	.	
98	.	p10
	.	
103	C10	
	V	
	V	
106	Rk12	
	.	
109	.	P11
	.	
114	.	p12
	.	

```

119 C12.....
122 . P13
127 C13.....
130 . p17
135 . V
138 . V
143 . Rk16
146 . p16
149 . C16.....
154 . V
157 . V
162 . Rk15a
165 . p14
168 . V
171 . V
177 . Rk15b
179 . p15
182 . C15.....
185 . B.....
188 . V
191 . V
194 . RDAM
197 . V
200 . V
203 . Arrow
206 . V
209 . V
212 . Gage

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

*****
* STORM CENTERING TEST
* for Pahrnagat Watershed
*****

```

prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention and depression area in Pahrnagat National Wild Life Refuge

```

JR PREC 0.646 0.574 0.500 0.45 0.435 0.423 0.385 DARP
AREA 87.0 155.5 253.5 336.0 408.0 451.0 613.0 sq miles
Dgn Pt C45a C45b C18 C10 C12 C13 PCB

```

```

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

```

```

IT HYDROGRAPH TIME DATA
   NMIN 5 MINUTES IN COMPUTATION INTERVAL
   IDATE 1 0 STARTING DATE
   ITIME 0000 STARTING TIME
   NQ 150 NUMBER OF HYDROGRAPH ORDINATES
   MDATE 1 0 ENDING DATE
   MTIME 1225 ENDING TIME
   ICENT 19 CENTURY MARK

```

```

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 12.42 HOURS

```

```

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

```

```

JP MULTI-PLAN OPTION
   NPLAN 1 NUMBER OF PLANS

```

JR

MULTI-RATIO OPTION

RATIOS OF PRECIPITATION

.65 .57 .50 .45 .44 .42 .38

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION						
				RATIO 1 .65	RATIO 2 .57	RATIO 3 .50	RATIO 4 .45	RATIO 5 .44	RATIO 6 .42	RATIO 7 .38
HYDROGRAPH AT	P1	28.00	1 FLOW TIME	3448. 6.33	2774. 6.42	2118. 6.42	1699. 6.42	1578. 6.50	1484. 6.50	1195. 6.50
ROUTED TO	R45	28.00	1 FLOW TIME	3179. 8.50	2554. 8.50	1946. 8.58	1559. 8.58	1447. 8.67	1360. 8.67	1093. 8.67
HYDROGRAPH AT	P45	59.00	1 FLOW TIME	6743. 6.58	5422. 6.67	4134. 6.67	3312. 6.75	3076. 6.75	2891. 6.75	2325. 6.75
2 COMBINED AT	C45a	87.00	1 FLOW TIME	8197. 7.17	6812. 7.17	5174. 7.25	4137. 7.25	3839. 7.25	3605. 7.25	2893. 7.33
HYDROGRAPH AT	P2	38.50	1 FLOW TIME	4044. 6.92	3247. 6.92	2473. 7.00	1980. 7.00	1839. 7.08	1727. 7.08	1388. 7.08
ROUTED TO	R6	38.50	1 FLOW TIME	3702. 9.58	2969. 9.58	2258. 9.67	1806. 9.67	1676. 9.75	1575. 9.75	1265. 9.75
HYDROGRAPH AT	P6	30.00	1 FLOW TIME	3737. 6.33	3008. 6.33	2296. 6.42	1843. 6.42	1712. 6.42	1609. 6.42	1295. 6.50
3 COMBINED AT	C45b	155.50	1 FLOW TIME	12949. 7.17	10360. 7.17	7854. 7.25	6272. 7.25	5817. 7.25	5461. 7.33	4380. 7.33
ROUTED TO	R7a	155.50	1 FLOW TIME	12845. 8.17	10278. 8.25	7793. 8.25	6223. 8.33	5773. 8.33	5419. 8.33	4346. 8.33
HYDROGRAPH AT	P3	39.50	1 FLOW TIME	5174. 6.17	4168. 6.17	3184. 6.25	2558. 6.25	2377. 6.25	2235. 6.25	1801. 6.33
ROUTED TO	R7b	39.50	1 FLOW TIME	5039. 7.25	4054. 7.25	3096. 7.33	2484. 7.33	2307. 7.42	2169. 7.42	1747. 7.42
HYDROGRAPH AT	P7	25.50	1 FLOW TIME	3884. 5.58	3134. 5.67	2404. 5.67	1935. 5.67	1800. 5.75	1694. 5.75	1370. 5.75
3 COMBINED AT	C7	220.50	1 FLOW TIME	18512. 7.50	14828. 7.58	11258. 7.58	9000. 7.67	8351. 7.67	7842. 7.67	6295. 7.67
ROUTED TO	R8	220.50	1 FLOW TIME	18446. 8.17	14773. 8.17	11216. 8.25	8965. 8.25	8318. 8.25	7810. 8.25	6271. 8.33
HYDROGRAPH AT	P8	31.00	1 FLOW TIME	4747. 5.83	3829. 5.83	2929. 5.92	2357. 5.92	2192. 5.92	2061. 5.92	1664. 6.00
2 COMBINED AT	C18(A)	253.50	1 FLOW TIME	19928. 7.83	15949. 7.83	12101. 7.92	9668. 8.00	8969. 8.00	8421. 8.00	6756. 8.08
ROUTED TO	Rk10	253.50	1 FLOW TIME	19643. 9.25	15719. 9.33	11925. 9.33	9525. 9.42	8836. 9.42	8296. 9.42	6654. 9.42
HYDROGRAPH AT	P9	32.50	1 FLOW TIME	4800. 5.75	3875. 5.75	2966. 5.75	2388. 5.83	2221. 5.83	2089. 5.83	1667. 5.92
HYDROGRAPH AT	p10	50.00	1 FLOW TIME	6252. 6.33	5034. 6.33	3842. 6.33	3085. 6.42	2866. 6.42	2694. 6.42	2169. 6.42
3 COMBINED AT	C10	336.00	1 FLOW TIME	21964. 8.67	17560. 8.75	13302. 8.75	10614. 8.83	9842. 8.83	9237. 8.92	7403. 8.92

ROUTED TO	Rk12	336.00	1	FLOW TIME	21793. 10.00	17425. 10.08	13199. 10.17	10531. 10.17	9766. 10.25	9166. 10.25	7344. 10.25
HYDROGRAPH AT	P11	36.00	1	FLOW TIME	5328. 5.75	4302. 5.75	3295. 5.75	2651. 5.83	2466. 5.83	2320. 5.83	1874. 5.83
HYDROGRAPH AT	p12	36.50	1	FLOW TIME	4519. 6.33	3636. 6.33	2776. 6.42	2228. 6.42	2069. 6.42	1945. 6.42	1566. 6.50
3 COMBINED AT	C12	408.50	1	FLOW TIME	22822. 9.58	18234. 9.67	13801. 9.75	11005. 9.83	10203. 9.83	9575. 9.83	7668. 9.92
HYDROGRAPH AT	P13	42.50	1	FLOW TIME	5250. 6.33	4224. 6.33	3225. 6.42	2588. 6.42	2403. 6.42	2259. 6.50	1819. 6.50
2 COMBINED AT	C13	451.00	1	FLOW TIME	25556. 7.33	20404. 7.33	15439. 7.42	12314. 7.42	11419. 7.42	10717. 7.42	8589. 7.42
HYDROGRAPH AT	p17	42.00	1	FLOW TIME	5628. 6.08	4535. 6.08	3465. 6.17	2786. 6.17	2589. 6.17	2434. 6.17	1962. 6.25
ROUTED TO	Rk16	42.00	1	FLOW TIME	5347. 7.58	4300. 7.67	3283. 7.67	2632. 7.75	2446. 7.75	2299. 7.75	1851. 7.75
HYDROGRAPH AT	p16	27.00	1	FLOW TIME	3789. 5.92	3055. 5.92	2336. 6.00	1879. 6.00	1747. 6.00	1643. 6.00	1326. 6.08
2 COMBINED AT	C16	69.00	1	FLOW TIME	7566. 7.00	6079. 7.08	4628. 7.17	3707. 7.17	3441. 7.17	3233. 7.25	2599. 7.25
ROUTED TO	Rk15a	69.00	1	FLOW TIME	7325. 8.67	5879. 8.75	4474. 8.75	3580. 8.83	3324. 8.83	3122. 8.83	2507. 8.83
HYDROGRAPH AT	p14	61.00	1	FLOW TIME	7788. 6.25	6271. 6.25	4789. 6.33	3846. 6.33	3573. 6.33	3359. 6.33	2705. 6.42
ROUTED TO	Rk15b	61.00	1	FLOW TIME	7289. 8.08	5859. 8.08	4467. 8.17	3580. 8.17	3324. 8.17	3124. 8.25	2514. 8.25
HYDROGRAPH AT	p15	32.00	1	FLOW TIME	5143. 5.33	4150. 5.33	3184. 5.42	2567. 5.50	2389. 5.50	2250. 5.50	1822. 5.58
3 COMBINED AT	C15	162.00	1	FLOW TIME	14921. 8.17	11975. 8.25	9108. 8.25	7291. 8.33	6766. 8.33	6355. 8.33	5104. 8.42
2 COMBINED AT	B	613.00	1	FLOW TIME	40086. 8.00	32048. 8.08	24285. 8.08	19381. 8.08	17974. 8.17	16972. 8.17	13527. 8.17
ROUTED TO	RDAM	613.00	1	FLOW TIME	39821. 9.08	31838. 9.17	24117. 9.17	19249. 9.25	17851. 9.25	16755. 9.25	13431. 9.33
ROUTED TO	Arrow	613.00	1	FLOW TIME	36154. 10.50	29050. 10.50	22244. 10.42	17807. 10.50	16541. 10.50	15553. 10.42	12599. 10.42
** PEAK STAGES IN FEET **											
1	STAGE TIME				2175.33 10.50	2172.06 10.50	2168.31 10.42	2165.11 10.50	2164.20 10.50	2163.49 10.42	2161.36 10.42
ROUTED TO	Gage	613.00	1	FLOW TIME	36020. 11.58	28945. 11.58	22158. 11.58	17740. 11.58	16479. 11.58	15495. 11.58	12555. 11.58

*** NORMAL END OF HEC-1 ***

APPENDIX B

100-year STORM CENTER IN BASIN 1

```

1.....
.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 01:32:05
.....

```

```

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

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X X XXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC10S, HEC1DS, AND HEC1KW.

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

1 HEC-1 INPUT PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*DIAGRAM
1 ID
2 ID
3 ID
4 ID • BASIN 1 of 249 sq miles •
5 ID • KANE SPRINGS Watershed only •
6 ID • BASINS 1 to Points A •
7 ID .....
8 ID 100-year event with PB=3.0 inches
9 ID
10 ID prepared by VTN-nevada in January 2000
11 ID
12 ID All tributary area north of Maynard Lake drains into the detention
13 ID and depression area in Pahrnagat National Wild Life Refuge
14 ID
15 ID PREC 0.51
16 ID AREA 248.5 sq mile
17 ID Point C7 (Outlet of Basin 1)
18 ID
*** FREE ***
19 IT 5 0 0 150
20 IO 5 0 0
21 IM 5 0 0
22 JR PREC 0.51
23 KK K1
24 KM Subarea k1
25 BA 33
26 PB 3.0
27 PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
28 PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
29 PC .250 .259 .265 .280 .290 .300 .305 .309 .310 .317

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30	PC	.321	.327	.333	.346	.361	.381	.408	.430	.477	.514
31	PC	.561	.630	.710	.720	.731	.752	.779	.790	.795	.804
32	PC	.810	.820	.826	.840	.859	.889	.910	.938	.966	.970
33	PC	.974	.979	.981	.983	.985	.989	.990	.992	.993	.996
34	PC	.997	.999	1.00							
35	LS	0	85								
36	UD	2.356									
37	KK	Rk2									
38	KM	Route k1 through k2									
39	RM	10	1.68	0.10							
40	KK	k2									
41	KM	Subarea k2									
42	BA	56.5									
43	LS	0	85								
44	UD	2.911									

HEC-1 INPUT

PAGE 2

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
45	KK C2
46	KM Combine Rk2, and k2
47	HC 2
48	KK Rk3
49	KM Route c2 through k3
50	RM 10 1.56 0.10
51	KK k3
52	KM Subarea k3
53	BA 57.0
54	LS 0 85
55	UD 2.573
56	KK C3
57	KM Combine Rk3, and k3
58	HC 2
59	KK Rk4
60	KM Route c2 through k3
61	RM 10 1.56 0.10
62	KK k4
63	KM Subarea k4
64	BA 36.5
65	LS 0 85
66	UD 4.87
67	KK k5
68	KM Subarea k5
69	BA 21.5
70	LS 0 85
71	UD 1.891
72	KK C45
73	KM Combine Rk4, k4, and k5
74	HC 3
75	KK Rk6
76	KM Route c45 through k6
77	RM 10.0 1.40 0.10
78	KK k6
79	KM Subarea k6
80	BA 29.0
81	LS 0 85
82	UD 2.125
83	KK C6
84	KM Combine Rk6 and k6
85	HC 2

HEC-1 INPUT

PAGE 3

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
86	KK Rk7
87	KM Route c6 through k7
88	RM 10.0 2.03 0.10
89	KK k7
90	KM Subarea k7
91	BA 15.5
92	LS 0 85
93	UD 2.297
94	KK C7(pt A)
95	KM Combine Rk7 and k7 (BASIN 1-Kane Springs)
96	HC 2
97	KK B
98	KM Route C7 from A to B
99	RM 10.0 1.70 0.10

100	KK	RDAM					
101	KM	Route B to ARROWHEAD Dam					
102	RM	10.0	1.75	0.10			
103	KK	Arrow					
104	KM	Arrow Canyon					
105	RS	1	STOR	-1			
106	SV	0	14	460	915	2385	5005
107	SR	2133	2140	2150	2160	2170	2180
108	SQ	0	325	3186	10713	24587	46286
109	KK	Gage					
110	RM	10.0	2.16	0.10			
111	ZZ						

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
23	K1	
	V	
	V	
37	Rk2	
	.	
40	.	k2
	.	
45	C2.....	
	V	
	V	
48	Rk3	
	.	
51	.	k3
	.	
56	C3.....	
	V	
	V	
59	Rk4	
	.	
62	.	k4
	.	
67	.	k5
	.	
72	C45.....	
	V	
	V	
75	Rk6	
	.	
78	.	k6
	.	
83	C6.....	
	V	
	V	
86	Rk7	
	.	
89	.	k7
	.	
94	C7.....	
	V	
	V	
97	B	
	V	
	V	
100	RDAM	
	V	
	V	
103	Arrow	
	V	
	V	
109	Gage	

```

.....
* BASIN 1 of 249 sq miles
* KANE SPRINGS Watershed only
* BASINS 1 to Points A
.....
100-year event with PB=3.0 inches

```

prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention and depression area in Pahrangat National Wild Life Refuge

```

PREC 0.51
AREA 248.5 sq mile
Point C7 (Outlet of Basin 1)

```

```

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

IT          HYDROGRAPH TIME DATA
           NMIN      5  MINUTES IN COMPUTATION INTERVAL
           IDATE      1  0  STARTING DATE
           ITIME      0000  STARTING TIME
           NQ         150  NUMBER OF HYDROGRAPH ORDINATES
           NDDATE      1  0  ENDING DATE
           NDTIME      1225  ENDING TIME
           ICENT       19  CENTURY MARK

```

```

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 12.42 HOURS

```

```

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

```

```

JP          MULTI-PLAN OPTION
           NPLAN      1  NUMBER OF PLANS

```

```

JR          MULTI-RATIO OPTION
           RATIOS OF PRECIPITATION
           .51

```

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	.51
HYDROGRAPH AT	K1	33.00	1	FLOW	2631.
				TIME	6.42
ROUTED TO	Rk2	33.00	1	FLOW	2491.
				TIME	8.08
HYDROGRAPH AT	k2	56.50	1	FLOW	3867.
				TIME	6.92
2 COMBINED AT	C2	89.50	1	FLOW	5967.
				TIME	7.42
ROUTED TO	Rk3	89.50	1	FLOW	5774.
				TIME	9.00
HYDROGRAPH AT	k3	57.00	1	FLOW	4276.
				TIME	6.58
2 COMBINED AT	C3	146.50	1	FLOW	7812.
				TIME	8.25
ROUTED TO	Rk4	146.50	1	FLOW	7685.
				TIME	9.75

HYDROGRAPH AT	k4	36.50	1	FLOW TIME	1622. 8.75
HYDROGRAPH AT	k5	21.50	1	FLOW TIME	1961. 5.92
3 COMBINED AT	C45	204.50	1	FLOW TIME	9392. 9.50
ROUTED TO	Rk6	204.50	1	FLOW TIME	9300. 10.92
HYDROGRAPH AT	k6	29.00	1	FLOW TIME	2472. 6.17
2 COMBINED AT	C6	233.50	1	FLOW TIME	9433. 10.83
ROUTED TO	Rk7	233.50	1	FLOW TIME	9169. 12.42
HYDROGRAPH AT	k7	15.50	1	FLOW TIME	1257. 6.33
2 COMBINED AT	<u>C7</u>	<u>249.00</u>	1	FLOW TIME	<u>9201.</u> <u>12.42</u>
ROUTED TO	<u>B</u>	<u>249.00</u>	1	FLOW TIME	<u>7511.</u> <u>12.42</u>
ROUTED TO	RDAM	249.00	1	FLOW TIME	5453. 12.42
ROUTED TO	Arrow	249.00	1	FLOW TIME	3860. 12.42
** PEAK STAGES IN FEET **					
	1	STAGE	2150.90	TIME	12.42
ROUTED TO	Gage	249.00	1	FLOW TIME	1445. 12.42

*** NORMAL END OF HEC-1 ***

APPENDIX B

10-year STORM CENTER IN BASIN 1

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.....
.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 13:36:30
.....

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U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104
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X X XXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1G, HEC1DB, AND HEC1KM.

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

1

HEC-1 INPUT

PAGE 1

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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1          ID
2          ID
3          ID
4          ID      BASIN 1 of 249 sq miles
5          ID      KANE SPRINGS Watershed only
6          ID      BASINS 1 to Points A
7          ID
8          ID      10-year event with PB=3.0 inches
9          ID
10         ID      prepared by VIN-nevada in January 2000
11         ID
12         ID      All tributary area north of Maynard Lake drains into the detention
13         ID      and depression area in Pahrangat National Wild Life Refuge
14         ID
15         ID      PREC 0.51
16         ID      AREA 248.5 sq mile
17         ID      Point C7 (Outlet of Basin 1)
18         ID
... FREE ...
19         IT      5      0      0      150
20         IO      5      0      0
21         IM      5      0      0
22         JR      PREC 0.51
23         KK      K1
24         KM      Subarea k1
25         BA      33
26         PB      1.60
27         PC      .000      .020      .059      .080      .110      .144      .150      .160      .168      .171
28         PC      .180      .182      .187      .190      .197      .202      .210      .220      .230      .241
29         PC      .250      .259      .265      .280      .290      .300      .305      .309      .310      .317
30         PC      .321      .327      .333      .346      .361      .381      .408      .430      .477      .514
31         PC      .561      .630      .710      .720      .731      .752      .779      .790      .795      .804
32         PC      .810      .820      .826      .840      .859      .889      .910      .938      .966      .970
33         PC      .974      .979      .981      .983      .985      .989      .990      .992      .993      .996
34         PC      .997      .999      1.00
35         LS      0      85

```

36 UD 2.356
 37 KK Rk2
 38 KM Route k1 through k2
 39 RM 10 1.60 0.10
 40 KK k2
 41 KM Subarea k2
 42 BA 56.5
 43 LS 0 85
 44 UD 2.911

HEC-1 INPUT

PAGE 2

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

45 KK C2
 46 KM Combine Rk2, and k2
 47 HC 2
 48 KK Rk3
 49 KM Route c2 through k3
 50 RM 10 1.56 0.10
 51 KK k3
 52 KM Subarea k3
 53 BA 57.0
 54 LS 0 85
 55 UD 2.573

56 KK C3
 57 KM Combine Rk3, and k3
 58 HC 2

59 KK Rk4
 60 KM Route c2 through k3
 61 RM 10 1.56 0.10

62 KK k4
 63 KM Subarea k4
 64 BA 36.5
 65 LS 0 85
 66 UD 4.87

67 KK k5
 68 KM Subarea k5
 69 BA 21.5
 70 LS 0 85
 71 UD 1.891

72 KK C45
 73 KM Combine Rk4, K4, and k5
 74 HC 3

75 KK Rk6
 76 KM Route c45 through k6
 77 RM 10.0 1.40 0.10

78 KK k6
 79 KM Subarea k6
 80 BA 29.0
 81 LS 0 85
 82 UD 2.125

83 KK C6
 84 KM Combine Rk6 and k6
 85 HC 2

HEC-1 INPUT

PAGE 3

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

86 KK Rk7
 87 KM Route c6 through k7
 88 RM 10.0 2.03 0.10

89 KK k7
 90 KM Subarea k7
 91 BA 15.5
 92 LS 0 85
 93 UD 2.297

94 KK C7(pt A)
 95 KM Combine Rk7 and k7 (BASIN 1-Kane Springs)
 96 HC 2

97 KK B
 98 KM Route C7 from A to B
 99 RM 10.0 1.70 0.10

100 KK RDM
 101 KM Route B to ARROWHEAD Dam
 102 RM 10.0 1.75 0.10

103 KK Arrow

104	KM	Arrow Canyon					
105	RS	1	STOR	-1			
106	SV	0	14	460	915	2385	5005
107	SE	2133	2140	2150	2160	2170	2180
108	SQ	0	325	3186	10713	24587	46286
109	KK	Gage					
110	RM	10.0	2.16	0.10			
111	ZZ						

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(----) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
23	K1	
	V	
	V	
37	Rk2	
	.	
40	.	k2
	.	
45	C2	
	V	
	V	
48	Rk3	
	.	
51	.	k3
	.	
56	C3	
	V	
	V	
59	Rk4	
	.	
62	.	k4
	.	
67	.	k5
	.	
72	C45	
	V	
	V	
75	Rk6	
	.	
78	.	k6
	.	
83	C6	
	V	
	V	
86	Rk7	
	.	
89	.	k7
	.	
94	C7	
	V	
	V	
97	B	
	V	
	V	
100	RDAM	
	V	
	V	
103	Arrow	
	V	
	V	
109	Gage	

.....
 • BASIN 1 of 249 sq miles
 • KANE SPRINGS Watershed only
 • BASINS 1 to Points A

10-year event with PB=3.0 inches

prepared by VTM-neveda in January 2000

All tributary area north of Maynard Lake drains into the detention
 and depression area in Pahrangat National Wild Life Refuge

PREC 0.51
 AREA 248.5 sq mile
 Point C7 (Outlet of Basin 1)

20 10

OUTPUT CONTROL VARIABLES

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

IT

HYDROGRAPH TIME DATA

NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 150 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 1 0 ENDING DATE
 NDTIME 1225 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 12.42 HOURS

ENGLISH UNITS

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

JP

MULTI-PLAN OPTION

NPLAN 1 NUMBER OF PLANS

JR

MULTI-RATIO OPTION

RATIOS OF PRECIPITATION
 .51

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	.51
HYDROGRAPH AT	K1	33.00	1	FLOW	560.
				TIME	6.67
ROUTED TO	Rk2	33.00	1	FLOW	526.
				TIME	8.33
HYDROGRAPH AT	k2	56.50	1	FLOW	812.
				TIME	7.17
2 COMBINED AT	C2	89.50	1	FLOW	1249.
				TIME	7.75
ROUTED TO	Rk3	89.50	1	FLOW	1205.
				TIME	9.33
HYDROGRAPH AT	k3	57.00	1	FLOW	904.
				TIME	6.83
2 COMBINED AT	C3	146.50	1	FLOW	1614.
				TIME	8.50
ROUTED TO	Rk4	146.50	1	FLOW	1587.
				TIME	10.08
HYDROGRAPH AT	k4	36.50	1	FLOW	335.
				TIME	9.08
HYDROGRAPH AT	k5	21.50	1	FLOW	424.
				TIME	6.17
3 COMBINED AT	C45	204.50	1	FLOW	1938.
				TIME	9.83
ROUTED TO	Rk6	204.50	1	FLOW	1918.
				TIME	11.25

HYDROGRAPH AT	K6	29.00	1	FLOW TIME	530. 6.42
2 COMBINED AT	C6	233.50	1	FLOW TIME	1944. 11.17
ROUTED TO	Rk7	233.50	1	FLOW TIME	1850. 12.42
HYDROGRAPH AT	K7	15.50	1	FLOW TIME	268. 6.58
2 COMBINED AT	C7	249.00	1	FLOW TIME	1858. 12.42
ROUTED TO	B	249.00	1	FLOW TIME	1453. 12.42
ROUTED TO	RDAN	249.00	1	FLOW TIME	1047. 12.42
ROUTED TO	ARROW	249.00	1	FLOW TIME	680. 12.42
				** PEAK STAGES IN FEET **	
	1	STAGE		2141.24	
		TIME		12.42	
ROUTED TO	Gage	249.00	1	FLOW TIME	342. 12.42

*** NORMAL END OF MEC-1 ***

APPENDIX C

100-year STORM CENTER IN BASIN 2

```

1.....
.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 01:39:24
.....

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

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

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1EW.

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

1

HEC-1 INPUT

PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*DIAGRAM
1 ID
2 ID
3 ID * Pahransagat WATERSHED North of Pt A --- BASIN 2 *
4 ID
5 ID 100-year event with PB=3.0 inches
6 ID
7 ID THE CRITICAL STORM COVER AREA IS 250 sq miles
8 ID
9 ID prepared by VTN-neveda in January 2000
10 ID
11 ID PREC 0.50
12 ID AREA 253.6 sq mile (Outlet of Basin 2)
13 ID Point C18
14 ID
*** FREE ***
15 IT 5 0 0 150
16 IO 5 0 0
17 IN 5 0 0
18 JR PREC 0.50
19 KK p1
20 RM Subarea p1
21 BA 28.0
22 PB 3.0
23 PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
24 PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
25 PC .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
26 PC .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
27 PC .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
28 PC .810 .820 .826 .840 .859 .889 .910 .938 .966 .970
29 PC .974 .979 .981 .983 .985 .989 .990 .992 .993 .996
30 PC .997 .999 1.00
31 LS 0 85
32 UD 2.401

```

33 KK R45
34 KM Route p11 through p45
35 RM 10.0 2.16 0.10

36 KK P45
37 KM Subarea P45
38 BA 59.0
39 LS 0 85
40 UD 2.675

41 KK C45a
42 KM Combine R45 and P45
43 HC 2

HEC-1 INPUT

PAGE 2

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

44 KK P2
45 KM Subarea P2
46 BA 38.5
47 LS 0 85
48 UD 1.00

49 KK R6
50 KM Route p2 through p6
51 RM 10.0 2.64 0.10

52 KK P6
53 KM Subarea P6
54 BA 30.0
55 LS 0 85
56 UD 2.36

57 KK C45b
58 KM Combine R45a, R6 and P6
59 HC 3

60 KK R7a
61 KM Route C45b through P7
62 RM 10.0 1.00 0.10

63 KK P3
64 KM Subarea P3
65 BA 39.5
66 LS 0 85
67 UD 2.179

68 KK R7b
69 KM Route p3 through p7
70 RM 10.0 1.13 0.10

71 KK P7
72 KM Subarea P7
73 BA 25.5
74 LS 0 85
75 UD 1.631

76 KK C7
77 KM Combine R7b, R7a, and P7
78 HC 3

79 KK R8
80 KM Route C7 through p8
81 RM 10.0 0.62 0.10

82 KK P8
83 KM Subarea P8
84 BA 33
85 LS 0 85
86 UD 1.846

HEC-1 INPUT

PAGE 3

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

87 KK C18(Pt A)
88 KM Combine R8 and P8(Basin 2 --Prahrangat Watershed north of Point A)
89 HC 2

90 KK B
91 KM Route B to ARROWHEAD VALLEY
92 RM 10.0 1.70 0.10

93 KK RDAM
94 KM Route c15 THROUGH the Valley to ARROWHEAD VALLEY
95 RM 10.0 1.75 0.10

96 KK Arrow
97 KM Arrow Canyon
98 RS 1 STOR -1
99 SV 0 14 460 915 2385 5005
100 SE 2133 2140 2150 2160 2170 2180
101 SQ 0 325 3186 10713 24587 46286

102	KK	Gage		
103	RM	10.0	2.16	0.10
104	ZZ			

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
19	p1	
	V	
	V	
33	R45	
	.	
36	.	P45
	.	
41	C45a.....	
	.	
44	.	P2
	.	V
	.	V
49	.	R6
	.	
52	.	P6
	.	
57	C45b.....	
	V	
	V	
60	R7a	
	.	
63	.	P3
	.	V
	.	V
68	.	R7b
	.	
71	.	P7
	.	
76	C7.....	
	V	
	V	
79	R8	
	.	
82	.	P8
	.	
87	C18.....	
	V	
	V	
90	B	
	V	
	V	
93	RDAM	
	V	
	V	
96	ARROW	
	V	
	V	
102	Gage	

.....
 • Pahranagat WATERSHED North of Pt A --- BASIN 2 •

 100-year event with PB=3.0 inches

 THE CRITICAL STORM COVER AREA IS 250 sq miles
 prepared by VTW-nevada in January 2000

 PREC 0.50
 AREA 253.6 sq mile (Outlet of Basin 2)
 Point C18

16 10	OUTPUT CONTROL VARIABLES	
	IPRMT	5 PRINT CONTROL
	IPLOT	0 PLOT CONTROL
	QSCAL	0. HYDROGRAPH PLOT SCALE
IT	HYDROGRAPH TIME DATA	
	NMIN	5 MINUTES IN COMPUTATION INTERVAL

IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 150 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 1 0 ENDING DATE
 NDTIME 1225 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 12.42 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .50

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	.50
HYDROGRAPH AT					
+	p1	28.00	1 FLOW	2118.	6.42
			TIME		
ROUTED TO					
+	R45	28.00	1 FLOW	1946.	8.58
			TIME		
HYDROGRAPH AT					
+	P45	59.00	1 FLOW	4134.	6.67
			TIME		
2 COMBINED AT					
+	C45a	87.00	1 FLOW	5174.	7.25
			TIME		
HYDROGRAPH AT					
+	P2	38.50	1 FLOW	2473.	7.00
			TIME		
ROUTED TO					
+	R6	38.50	1 FLOW	2258.	9.67
			TIME		
HYDROGRAPH AT					
+	P6	30.00	1 FLOW	2296.	6.42
			TIME		
3 COMBINED AT					
+	C45b	155.50	1 FLOW	7854.	7.25
			TIME		
ROUTED TO					
+	R7a	155.50	1 FLOW	7793.	8.25
			TIME		
HYDROGRAPH AT					
+	P3	39.50	1 FLOW	3184.	6.25
			TIME		
ROUTED TO					
+	R7b	39.50	1 FLOW	3096.	7.33
			TIME		
HYDROGRAPH AT					
+	P7	25.50	1 FLOW	2404.	5.67
			TIME		
3 COMBINED AT					
+	C7	220.50	1 FLOW	11258.	7.58
			TIME		
ROUTED TO					
+	R8	220.50	1 FLOW	11216.	8.25
			TIME		
HYDROGRAPH AT					
+	P8	33.00	1 FLOW	2929.	5.92
			TIME		

2 COMBINED AT					
+	C18	253.50	1	FLOW TIME	12101. 7.92
ROUTED TO					
+	B	253.50	1	FLOW TIME	11042. 9.67
ROUTED TO					
•	RDAM	253.50	1	FLOW TIME	11502. 11.42
ROUTED TO					
+	Arrow	253.50	1	FLOW TIME	10949. 12.25
** PEAK STAGES IN FEET **					
	1	STAGE	2160.17	TIME	12.25
ROUTED TO					
•	Gage	253.50	1	FLOW TIME	7149. 12.42

*** NORMAL END OF HEC-1 ***

APPENDIX C

10-year STORM CENTER IN BASIN 2

```

.....
.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 13:36:42
.....

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

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X X XXXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXXX XXXX XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1M.

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

1

HEC-1 INPUT

PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID *DIAGRAM
2 ID .....
3 ID * Pahranagat WATERSHED North of Pt A --- BASIN 2 *
4 ID .....
5 ID 10-year event with PB=3.0 inches
6 ID
7 ID THE CRITICAL STORM COVER AREA IS 250 sq miles
8 ID
9 ID prepared by VIN-nevada in January 2000
10 ID
11 ID PREC 0.50
12 ID AREA 253.6 sq mile (Outlet of Basin 2)
13 ID Point C18
14 ID
... PREC ...
15 IT 5 0 0 150
16 IO 5 0 0
17 IN 5 0 0
18 JR PREC 0.50
19 KK p1
20 KM Subarea p1
21 BA 28.0
22 PB 1.6
23 PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
24 PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
25 PC .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
26 PC .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
27 PC .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
28 PC .810 .820 .826 .840 .859 .889 .910 .938 .966 .970
29 PC .974 .979 .981 .983 .985 .989 .990 .992 .993 .996
30 PC .997 .999 1.00
31 LR 0 85
32 UD 2.401

```

33 KK R45
 34 KM Route p11 through p45
 35 RM 10.0 2.16 0.10

 36 KK P45
 37 KM Subarea P45
 38 BA 59.0
 39 LS 0 85
 40 UD 2.675

 41 KK C45a
 42 KM Combine R45 and P45
 43 HC 2

HBC-1 INPUT

PAGE 2

1

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

44 KK P2
 45 KM Subarea P2
 46 BA 38.5
 47 LS 0 85
 48 UD 1.00

 49 KK R6
 50 KM Route p2 through p6
 51 RM 10.0 2.64 0.10

 52 KK P6
 53 KM Subarea P6
 54 BA 30.0
 55 LS 0 85
 56 UD 2.36

 57 KK C45b
 58 KM Combine R45a, R6 and P6
 59 HC 3

 60 KK R7a
 61 KM Route C45b through P7
 62 RM 10.0 1.00 0.10

 63 KK P3
 64 KM Subarea P3
 65 BA 39.5
 66 LS 0 85
 67 UD 2.179

 68 KK R7b
 69 KM Route p3 through p7
 70 RM 10.0 1.13 0.10

 71 KK P7
 72 KM Subarea P7
 73 BA 25.5
 74 LS 0 85
 75 UD 1.631

 76 KK C7
 77 KM Combine R7b, R7a, and P7
 78 HC 3

 79 KK R8
 80 KM Route C7 through p8
 81 RM 10.0 0.62 0.10

 82 KK P8
 83 KM Subarea P8
 84 BA 33
 85 LS 0 85
 86 UD 1.846

HBC-1 INPUT

PAGE 3

1

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

87 KK C18(Pt A)
 88 KM Combine R8 and P8(Basin 2 --Prahangat Watershed north of Point A)
 89 HC 2

 90 KK B
 91 KM Route B to ARROWHEAD VALLEY
 92 RM 10.0 1.70 0.10

 93 KK RDMH
 94 KM Route c15 THROUGH the Valley to ARROWHEAD VALLEY
 95 RM 10.0 1.75 0.10

 96 KK Arrow
 97 KM Arrow Canyon
 98 RS 1 STOR -1
 99 SV 0 14 460 915 2385 5005
 100 SE 2133 2140 2150 2160 2170 2180
 101 SQ 0 325 3186 10713 24587 46286

102	KK	Gage		
103	RM	10.0	2.16	0.10
104	ZZ			

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
19	p1	
	V	
	V	
33	R45	
	.	
36	.	P45
	.	
41	C45a.....	
	.	
44	.	P2
	.	V
	.	V
49	.	R6
	.	
52	.	P6
	.	
57	C45b.....	
	V	
	V	
60	R7a	
	.	
63	.	P3
	.	V
	.	V
68	.	R7b
	.	
71	.	P7
	.	
76	C7.....	
	V	
	V	
79	R8	
	.	
82	.	P8
	.	
87	C18.....	
	V	
	V	
90	B	
	V	
	V	
93	RDAM	
	V	
	V	
96	Arrow	
	V	
	V	
102	Gage	

 * Pahrnagat WATERSHED North of Pt A --- BASIN 2 *

 10-year event with PB=3.0 inches

THE CRITICAL STORM COVER AREA IS 250 sq miles

prepared by VIN-nevada in January 2000

PREC 0.50
 AREA 253.6 sq mile (Outlet of Basin 2)
 Point C18

16 10

OUTPUT CONTROL VARIABLES

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

IT

HYDROGRAPH TIME DATA

NMIN	5	MINUTES IN COMPUTATION INTERVAL
------	---	---------------------------------

Appen C

IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 150 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 1 0 ENDING DATE
 NDTIME 1225 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 12.42 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .50

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	.50
HYDROGRAPH AT	p1	28.00	1	FLOW	440.
				TIME	6.67
ROUTED TO	R45	28.00	1	FLOW	401.
				TIME	6.92
HYDROGRAPH AT	P45	59.00	1	FLOW	853.
				TIME	6.92
2 COMBINED AT	C45a	87.00	1	FLOW	1052.
				TIME	7.50
HYDROGRAPH AT	P2	38.50	1	FLOW	507.
				TIME	7.25
ROUTED TO	R6	38.50	1	FLOW	461.
				TIME	10.00
HYDROGRAPH AT	P6	30.00	1	FLOW	478.
				TIME	6.67
3 COMBINED AT	C45b	155.50	1	FLOW	1590.
				TIME	7.50
ROUTED TO	R7a	155.50	1	FLOW	1577.
				TIME	8.50
HYDROGRAPH AT	P3	39.50	1	FLOW	666.
				TIME	6.50
ROUTED TO	R7b	39.50	1	FLOW	644.
				TIME	7.58
HYDROGRAPH AT	P7	25.50	1	FLOW	516.
				TIME	5.92
3 COMBINED AT	C7	220.50	1	FLOW	2295.
				TIME	7.92
ROUTED TO	R8	220.50	1	FLOW	2286.
				TIME	8.50
HYDROGRAPH AT	P8	33.00	1	FLOW	621.
				TIME	6.17

2 COMBINED AT

CLB	253.50	1	FLOW	2456.
			TIME	8.25

ROUTED TO

B	253.50	1	FLOW	2399.
			TIME	10.00

ROUTED TO

RDAM	253.50	1	FLOW	2344.
			TIME	11.75

ROUTED TO

Arrow	253.50	1	FLOW	1848.
			TIME	12.42

** PEAK STAGES IN FEET **

1	STAGE	2145.32
	TIME	12.42

ROUTED TO

Gage	253.50	1	FLOW	981.
			TIME	12.42

*** NORMAL END OF HEC-1 ***

APPENDIX D

100-year STORM CENTER IN BASINS 3 and 5

```

.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 17:31:30
.....

```

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

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X X XXXXXX XXXX X
X X X X X XX
X X X X X
XXXXXX XXXX X XXXX X
X X X X X
X X X X X
X X XXXXXX XXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DS, AND HEC1KW.

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

1

HEC-1 INPUT

PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID
2 ID
3 ID
4 ID • Basin 3 between Points A and B •
5 ID • Basin 5 South of Point B •
6 ID • Basins 3 and 5 are critical tributary area to Point B •
7 ID
8 ID
9 ID 100-year event with PB=3.0 inch
10 ID prepared by VTN-nevada in January 2000
11 ID
12 ID All tributary area north of Maynard Lake drains into the detention
13 ID and depression area in Pahrnagat National Wild Life Refuge
14 ID
15 ID PREC 0.574 0.44
16 ID AREA 150 359.0 sq mile (Outlet of Basin 5)
17 ID Point C12/C15 B
18 ID
*** FREE ***
19 IT 5 0 0 150
20 IO 5 0 0
21 IN 5 0 0
22 JR PREC 0.574 0.44
23 KK P9
24 KM Subarea P9
25 BA 32.5
26 PB 3.0
27 PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
28 PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
29 PC .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
30 PC .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
31 PC .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
32 PC .810 .820 .826 .840 .859 .889 .910 .938 .966 .970
33 PC .974 .979 .981 .983 .985 .989 .990 .992 .993 .996
34 PC .997 .999 1.00
35 LS 0 85
36 UD 1.748

```

37 KK p10
 38 KM Subarea p10
 39 BA 50.0
 40 LS 0 85
 41 UD 2.345
 42 KK C10
 43 KM Combine P9 and p10
 44 HC 2

HEC-1 INPUT

PAGE 2

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

45 KK Rk12
 46 KM Route C10 through P11/p12
 47 RM 10.0 1.40 0.10
 48 KK P11
 49 KM Subarea p11
 50 BA 36.0
 51 LS 0 85
 52 UD 1.739
 53 KK p12
 54 KM Subarea p12
 55 BA 36.5
 56 LS 0 85
 57 UD 2.382
 58 KK C12
 59 KM Combine Rk12, p11, and p12
 60 HC 3
 61 KK P13
 62 KM Subarea P13
 63 BA 42.5
 64 LS 0 85
 65 UD 2.390
 66 KK C13
 67 KM Combine c12 and p13 (Watershed 3)
 68 HC 2
 69 KK p17
 70 KM Subarea p17
 71 BA 42.0
 72 LS 0 85
 73 UD 2.099
 74 KK Rk16
 75 KM Route p17 through P16
 76 RM 10.0 1.56 0.10
 77 KK p16
 78 KM Subarea p16
 79 BA 27.0
 80 LS 0 85
 81 UD 1.935
 82 KK C16
 83 KM Combine Rk16, and P16
 84 HC 2

HEC-1 INPUT

PAGE 3

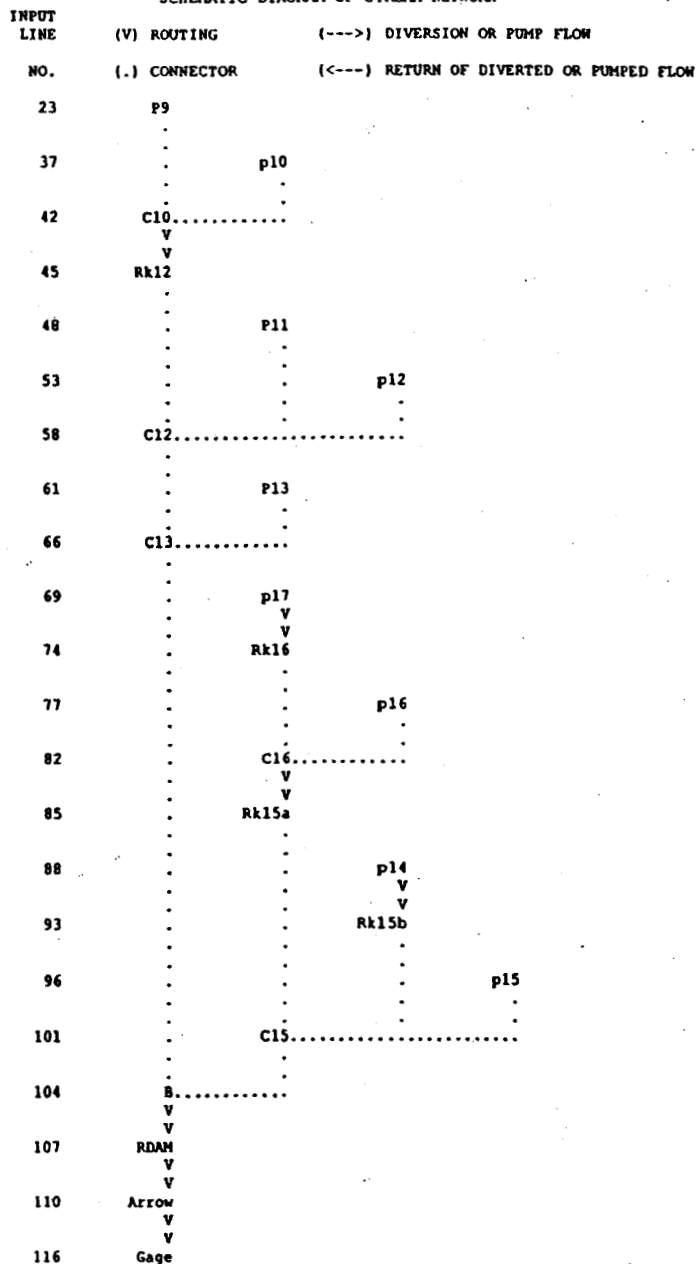
LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

85 KK Rk15a
 86 KM Route C16 through P15
 87 RM 10.0 1.65 0.10
 88 KK p14
 89 KM Subarea p14
 90 BA 61.0
 91 LS 0 85
 92 UD 2.271
 93 KK Rk15b
 94 KM Route p14 through P15
 95 RM 10.0 1.87 0.10
 96 KK p15
 97 KM Subarea p15
 98 BA 32.0
 99 LS 0 85
 100 UD 1.402
 101 KK C15
 102 KM Combine Rk15a, Rk15b, and P15 (at Point 5)
 103 HC 3
 104 KK B

105	KM	Combine C15 and C13					
106	HC	2					
107	KK	RDAM(Pt B)					
108	KM	Route c15 THROUGH ARROWHEAD VALLEY					
109	RM	10.0 1.75 0.10					
110	KK	Arrow					
111	KM	Arrow Canyon					
112	RS	1 STOR -1					
113	SV	0 14 460 915 2385 5005					
114	SE	2133 2140 2150 2160 2170 2180					
115	SQ	0 325 3186 10713 24587 46286					
116	KK	Gage					
117	RM	10.0 2.16 0.10					
118	ZZ						

1

SCHEMATIC DIAGRAM OF STREAM NETWORK



- Basin 3 between Points A and B
- Basin 5 South of Point B
- Basins 3 and 5 are critical tributary area to Point B

100-year event with PB-3.0 inch
prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention
and depression area in Pahranaagat National Wild Life Refuge

PREC 0.574 0.44
AREA 150 359.0 sq mile (Outlet of Basin 5)
Point C12/C15 B

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

IT HYDROGRAPH TIME DATA
NMIN 5 MINUTES IN COMPUTATION INTERVAL
IDATE 1 0 STARTING DATE
ITIME 0000 STARTING TIME
NQ 150 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 1 0 ENDING DATE
NUTIME 1225 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 12.42 HOURS

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

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 .44

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .57	RATIO 2 .44
HYDROGRAPH AT					
+	P9	32.50	1 FLOW TIME	3875. 5.75	2276. 5.83
HYDROGRAPH AT					
+	p10	50.00	1 FLOW TIME	5034. 6.33	2939. 6.42
2 COMBINED AT					
+	C10	82.50	1 FLOW TIME	8677. 6.00	5068. 6.08
ROUTED TO					
+	Rk12	82.50	1 FLOW TIME	8330. 7.42	4857. 7.50
HYDROGRAPH AT					
+	P11	36.00	1 FLOW TIME	4302. 5.75	2527. 5.83
HYDROGRAPH AT					
+	p12	36.50	1 FLOW TIME	3636. 6.33	2122. 6.42
3 COMBINED AT					
+	C12	155.00	1 FLOW TIME	14024. 6.83	8142. 6.92
HYDROGRAPH AT					
+	P13	42.50	1 FLOW TIME	4224. 6.33	2464. 6.42

2 COMBINED AT						
+	C13	197.50	1	FLOW TIME	18115. 6.67	10517. 6.75
HYDROGRAPH AT						
+	p17	42.00	1	FLOW TIME	4535. 6.08	2654. 6.17
ROUTED TO						
+	Rk16	42.00	1	FLOW TIME	4300. 7.67	2508. 7.75
HYDROGRAPH AT						
+	p16	27.00	1	FLOW TIME	3055. 5.92	1791. 6.00
2 COMBINED AT						
+	C16	69.00	1	FLOW TIME	6079. 7.08	3529. 7.17
ROUTED TO						
+	Rk15a	69.00	1	FLOW TIME	5879. 8.75	3409. 8.83
HYDROGRAPH AT						
+	p14	61.00	1	FLOW TIME	6271. 6.25	3664. 6.33
ROUTED TO						
+	Rk15b	61.00	1	FLOW TIME	5859. 8.08	3409. 8.17
HYDROGRAPH AT						
+	p15	32.00	1	FLOW TIME	4150. 5.33	2448. 5.50
3 COMBINED AT						
+	C15	162.00	1	FLOW TIME	11975. 8.25	6940. 8.33
2 COMBINED AT						
+	B	359.50	1	FLOW TIME	27495. 7.08	15871. 7.25
ROUTED TO						
+	RDAM	359.50	1	FLOW TIME	26743. 8.92	15448. 9.00
ROUTED TO						
+	Arrow	359.50	1	FLOW TIME	23605. 10.00	13888. 10.00
				** PEAK STAGES IN FEET **		
			1	STAGE	2169.29	2162.29
				TIME	10.00	10.00
ROUTED TO						
+	Gage	359.50	1	FLOW TIME	22862. 12.17	13484. 12.17

*** NORMAL END OF HEC-1 ***

APPENDIX D

10-year STORM CENTER IN BASINS 3 and 5

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.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
  JAN 1997
  VERSION 4.1
.....
RUN DATE 10MAY00 TIME 17:37:05
.....

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

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X X XXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXX XXX

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

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

1

HEC-1 INPUT

PAGE 1

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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*DIAGRAM
1 ID
2 ID
3 ID
4 ID
5 ID
6 ID
7 ID
8 ID
9 ID
10 ID
11 ID
12 ID
13 ID
14 ID
15 ID
16 ID
17 ID
18 ID
... FREE ...
19 IT      5      0      0      150
20 IO      5      0      0
21 IN      5      0      0
22 JR      PREC  0.574  0.44
23 KK      P9
24 KM      Subarea P9
25 BA      32.5
26 PB      1.6
27 PC      .000      .020      .059      .080      .110      .144      .150      .160      .168      .171
28 PC      .180      .182      .187      .190      .197      .202      .210      .220      .230      .241
29 PC      .250      .259      .265      .280      .290      .300      .305      .309      .310      .317
30 PC      .321      .327      .333      .346      .361      .381      .408      .430      .477      .514
31 PC      .561      .630      .710      .720      .731      .752      .779      .790      .795      .804
32 PC      .810      .820      .826      .840      .859      .889      .910      .938      .966      .970
33 PC      .974      .979      .981      .983      .985      .989      .990      .992      .993      .996
34 PC      .997      .999      1.00
35 LS      0      85
36 UD      1.748
37 KK      p10
38 KM      Subarea p10

```

39 BA 50.0
40 LS 0 85
41 UD 2.345

42 KK C10
43 KM Combine P9 and p10
44 HC 2

REC-1 INPUT

PAGE 2

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

45 KK Rk12
46 KM Route C10 through P11/p12
47 RM 10.0 1.40 0.10

48 KK P11
49 KM Subarea p11
50 BA 36.0
51 LS 0 85
52 UD 1.739

53 KK p12
54 KM Subarea p12
55 BA 36.5
56 LS 0 85
57 UD 2.382

58 KK C12
59 KM Combine Rk12, p11, and p12
60 HC 3

61 KK P13
62 KM Subarea P13
63 BA 42.5
64 LS 0 85
65 UD 2.390

66 KK C13
67 KM Combine c12 and p13 (Watershed 3)
68 HC 2

69 KK p17
70 KM Subarea p17
71 BA 42.0
72 LS 0 85
73 UD 2.099

74 KK Rk16
75 KM Route p17 through P16
76 RM 10.0 1.56 0.10

77 KK p16
78 KM Subarea p16
79 BA 27.0
80 LS 0 85
81 UD 1.935

82 KK C16
83 KM Combine Rk16, and P16
84 HC 2

REC-1 INPUT

PAGE 3

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

85 KK Rk15a
86 KM Route C16 through P15
87 RM 10.0 1.65 0.10

88 KK p14
89 KM Subarea p14
90 BA 61.0
91 LS 0 85
92 UD 2.271

93 KK Rk15b
94 KM Route p14 through P15
95 RM 10.0 1.87 0.10

96 KK p15
97 KM Subarea p15
98 BA 32.0
99 LS 0 85
100 UD 1.402

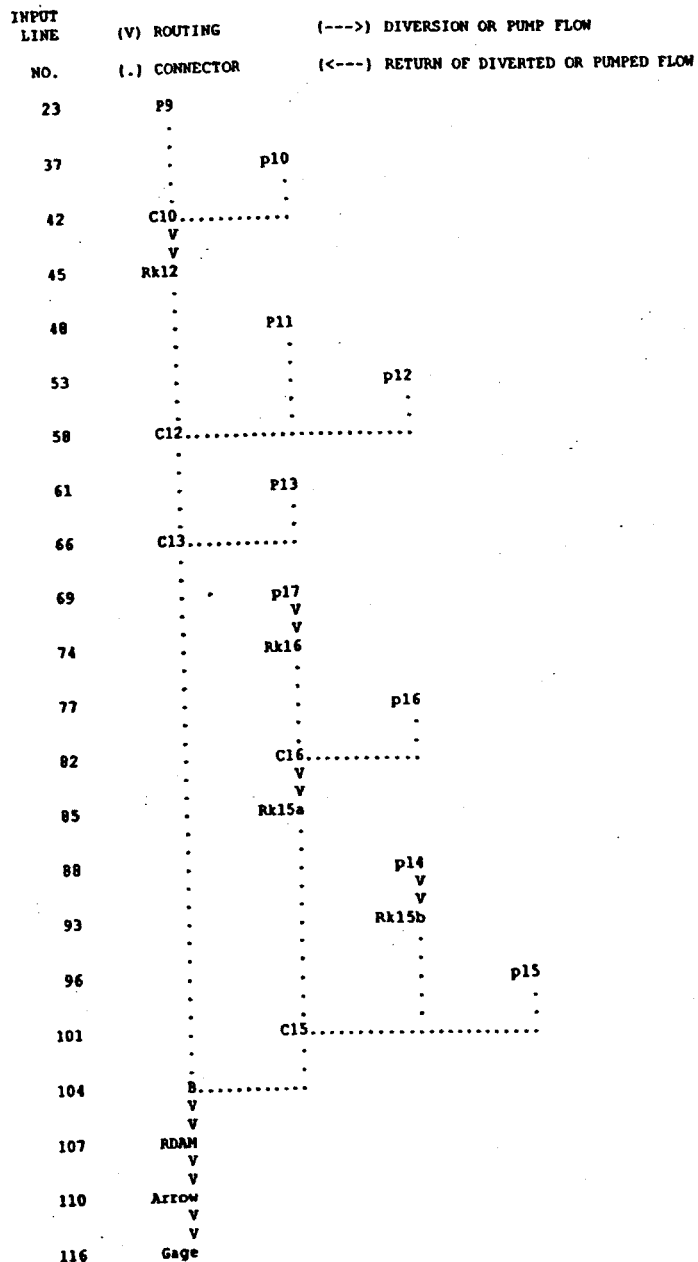
101 KK C15
102 KM Combine Rk15a, Rk15b, and P15 (at Point 5)
103 HC 3

104 KK h
105 KM Combine C15 and C13
106 HC 2

107	KK	RDAM(Pt B)					
108	KM	Route c15 THROUGH ARROWHEAD VALLEY					
109	RM	10.0 1.75 0.10					
110	KK	Arrow					
111	KM	Arrow Canyon					
112	RS	1 STOR -1					
113	SV	0 14 460 915 2385 5005					
114	SE	2133 2140 2150 2160 2170 2180					
115	SQ	0 325 3186 10713 24587 46286					
116	KK	Gage					
117	RM	10.0 2.16 0.10					
118	ZZ						

1

SCHEMATIC DIAGRAM OF STREAM NETWORK



- Basin 3 between Points A and B
- Basin 5 South of Point B
- Basins 3 and 5 are critical tributary area to Point B

10-year event
prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention
and depression area in Pahranaagat National Wild Life Refuge

PREC 0.574 0.44
AREA 150 359.0 sq mile (Outlet of Basin 5)
Point C12/C15 B

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

17 HYDROGRAPH TIME DATA
NMIN 5 MINUTES IN COMPUTATION INTERVAL
IDATE 1 0 STARTING DATE
ITIME 0000 STARTING TIME
NQ 150 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 1 0 ENDING DATE
NDTIME 1225 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 12.42 HOURS

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

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 .44

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .57	RATIO 2 .44
HYDROGRAPH AT	P9	32.50	1 FLOW TIME	945. 6.00	415. 6.08
HYDROGRAPH AT	p10	50.00	1 FLOW TIME	1203. 6.58	521. 6.75
2 COMBINED AT	C10	82.50	1 FLOW TIME	2080. 6.25	907. 6.42
ROUTED TO	Rk12	82.50	1 FLOW TIME	1990. 7.67	864. 7.83
HYDROGRAPH AT	P11	36.00	1 FLOW TIME	1049. 6.00	461. 6.08
HYDROGRAPH AT	p12	36.50	1 FLOW TIME	868. 6.58	376. 6.75
3 COMBINED AT	C12	155.00	1 FLOW TIME	3307. 7.08	1421. 7.25
HYDROGRAPH AT	P13	42.50	1 FLOW	1008.	436.

APPENDIX E

100-year STORM CENTER IN ALL BASINS

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1.....
.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 01:20:10
.....

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

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X X XXXXXX XXXX X
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X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC108, HEC1DB, AND HEC10W.

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

1

HEC-1 INPUT

PAGE 1

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LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID
2 ID
3 ID
4 ID * ALL AREAS of 862 sq miles
5 ID * BASINS 1, 2, 3, and 5. Points A and B
6 ID
7 ID
8 ID prepared by VTN-nevada in January 2000
9 ID
10 ID All tributary area north of Maynard Lake drains into the detention
11 ID and depression area in Pahrnagat National Wild Life Refuge
12 ID
13 ID PREC 0.510 0.500 0.407 0.380 0.340
14 ID AREA 248.5 253.5 502.0 657.0 861.5 Sq Mile
15 ID Point C18 C7 A C12 B
16 ID Outfall Ben2 Ben1 Ben3 Ben5
*** FREE ***
17 IT 5 0 0 150
18 IO 5 0 0
19 IN 5 0 0
20 JR PREC 0.510 0.500 0.407 0.380 0.340
21 KK p1
22 KM Subarea p1
23 BA 28.0
24 PB 3.0
25 PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
26 PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
27 PC .250 .259 .265 .280 .290 .300 .305 .309 .316 .317
28 PC .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
29 PC .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
30 PC .810 .820 .826 .840 .859 .889 .910 .938 .966 .970
31 PC .974 .979 .981 .983 .985 .989 .990 .992 .993 .996

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32 PC .997 .999 1.00
 33 LS 0 85
 34 UD 2.401

 35 KK R45
 36 KM Route p11 through p45
 37 RM 10.0 2.16 0.10

 38 KK P45
 39 KM Subarea P45
 40 BA 59.0
 41 PB 3.0
 42 LS 0 85
 43 UD 2.675

 44 KK C45a
 45 KM Combine R45 and P45
 46 HC 2

1

HEC-1 INPUT

PAGE 2

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

47 KK P2
 48 KM Subarea P2
 49 BA 38.5
 50 PB 3.0
 51 LS 0 85
 52 UD 3.00

 53 KK R6
 54 KM Route p2 through p6
 55 RM 10.0 2.64 0.10

 56 KK P6
 57 KM Subarea P6
 58 BA 30.0
 59 PB 3.0
 60 LS 0 85
 61 UD 2.36

 62 KK C45b
 63 KM Combine R45a, R6 and P6
 64 HC 3

 65 KK R7a
 66 KM Route C45b through P7
 67 RM 10.0 1.0 0.10

 68 KK P3
 69 KM Subarea P3
 70 BA 33.5
 71 PB 3.0
 72 LS 0 85
 73 UD 2.179

 74 KK R7b
 75 KM Route p3 through p7
 76 RM 10.0 1.13 0.10

 77 KK P7
 78 KM Subarea P7
 79 BA 25.5
 80 PB 3.0
 81 LS 0 85
 82 UD 1.631

 83 KK C7
 84 KM Combine R7b, R7a, and P7
 85 HC 3

 86 KK R8
 87 KM Route C7 through p8
 88 RM 10.0 0.62 0.10

1

HEC-1 INPUT

PAGE 3

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

89 KK P8
 90 KM Subarea P8
 91 BA 33
 92 PB 3.0
 93 LS 0 85
 94 UD 1.846

 95 KK C18
 96 KM Combine R8 and P8 (Basin 2 --Prahrangat Watershed north of Point A)
 97 HC 2

 98 KK K1
 99 KM Subarea k1
 100 BA 32.5
 101 LS 0 85
 102 UD 2.356

171	BA	32.5		
172	LS	0	85	
173	UD	1.748		
174	KK	p10		
175	KM	Subarea p10		
176	BA	50.0		
177	LS	0	85	
178	UD	2.345		
179	KK	C10		
180	KM	Combine A, P9 and p10		
181	HC	3		
182	KK	Rk12		
183	KM	Route C10 through P11/p12		
184	RM	10.0	1.40	0.10
185	KK	P11		
186	KM	Subarea p11		
187	BA	36.0		
188	LS	0	85	
189	UD	1.739		
190	KK	p12		
191	KM	Subarea p12		
192	BA	36.5		
193	LS	0	85	
194	UD	2.382		
195	KK	C12		
196	KM	Combine Rk12, p11, and p12		
197	HC	3		
198	KK	P13		
199	KM	Subarea P13		
200	BA	42.5		
201	LS	0	85	
202	UD	2.390		
203	KK	C13		
204	KM	Combine c12 and p13 (Watershed 3)		
205	HC	2		
206	KK	p17		
207	KM	Subarea p17		
208	BA	42.0		
209	LS	0	85	
210	UD	2.099		

HRC-1 INPUT

PAGE 6

LINE	ID	1	2	3	4	5	6	7	8	9	10
211	KK	Rk16									
212	KM	Route p17 through P16									
213	RM	10.0	1.56	0.10							
214	KK	p16									
215	KM	Subarea p16									
216	BA	27.0									
217	LS	0	85								
218	UD	1.935									
219	KK	C16									
220	KM	Combine Rk16, and P16									
221	HC	2									
222	KK	Rk15a									
223	KM	Route C16 through P15									
224	RM	10.0	1.65	0.10							
225	KK	p14									
226	KM	Subarea p14									
227	BA	61.0									
228	LS	0	85								
229	UD	2.271									
230	KK	Rk15b									
231	KM	Route p14 through P15									
232	RM	10.0	1.87	0.10							
233	KK	p15									
234	KM	Subarea p15									
235	BA	32.0									
236	LS	0	85								
237	UD	1.402									
238	KK	C15									
239	KM	Combine Rk15a, Rk15b, and P15 (at Point 5)									
240	HC	3									
241	KK	B									
242	KM	Combine C15 and C13									
243	HC	2									

244	KK	RDAM					
245	KM	Route c15 THROUGH ARROWHEAD VALLEY					
246	RM	10.0	1.75	0.10			
247	KK	Arrow					
248	KM	Arrow Canyon					
249	RS	1	STOR	-1			
250	SV	0	14	460	915	2385	5005
251	SE	2133	2140	2150	2160	2170	2180
252	SQ	0	325	3186	10713	24587	46286

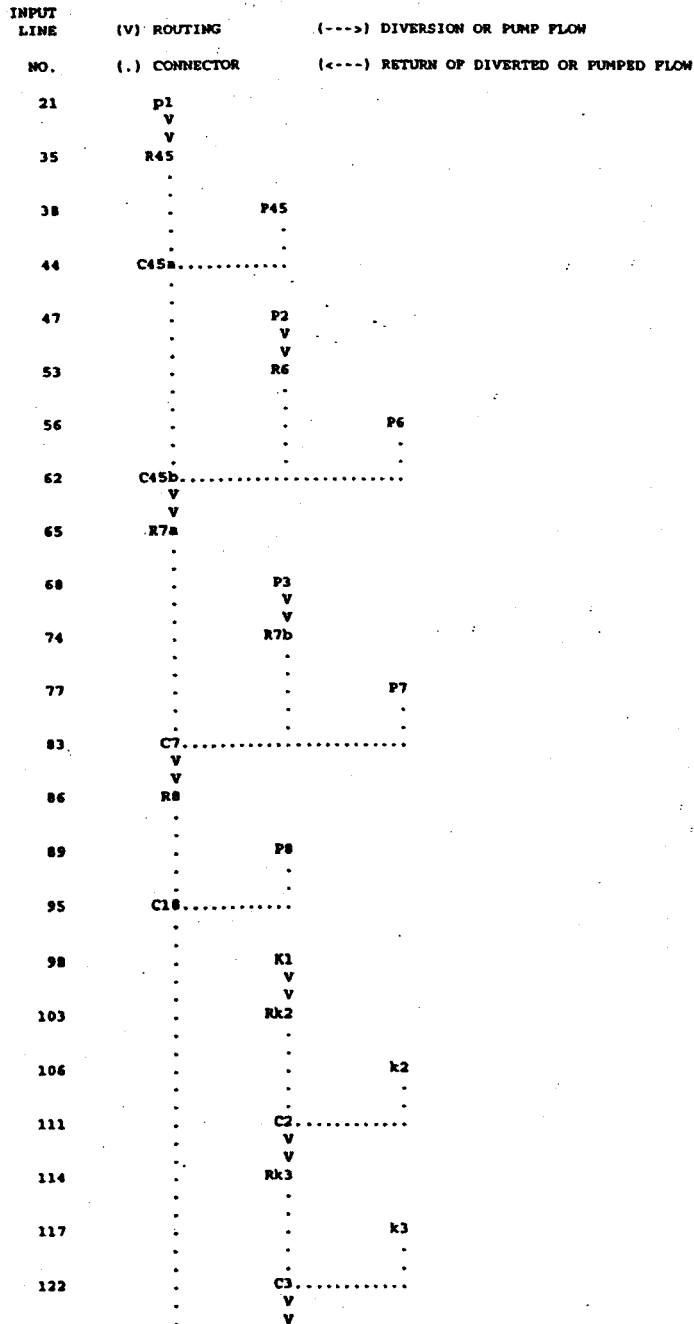
NEC-1 INPUT

PAGE 7

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

253	KK	GAGE		
254	RM	10.0	2.16	0.10
255	ZZ			

SCHEMATIC DIAGRAM OF STREAM NETWORK



103	KK	Rk2
104	KM	Route k1 through k2
105	RM	10.0 1.68 0.10
106	KK	k2
107	KM	Subarea k2
108	BA	56.5
109	LS	0 85
110	UD	2.911
111	KK	C2
112	KM	Combine Rk2, and k2
113	HC	2
114	KK	Rk3
115	KM	Route c2 through k3
116	RM	10.0 1.56 0.10
117	KK	k3
118	KM	Subarea k3
119	BA	57.0
120	LS	0 85
121	UD	2.573
122	KK	C3
123	KM	Combine Rk3, and k3
124	HC	2
125	KK	Rk4
126	KM	Route c2 through k3
127	RM	10.0 1.56 0.10

HEC-1 INPUT

PAGE 4

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

128	KK	k4
129	KM	Subarea k4
130	BA	36.5
131	LS	0 85
132	UD	4.87
133	KK	k5
134	KM	Subarea k5
135	BA	21.5
136	LS	0 85
137	UD	1.891
138	KK	C45
139	KM	Combine Rk4, k4, and k5
140	HC	3
141	KK	Rk6
142	KM	Route c45 through k6
143	RM	10.0 1.40 0.10
144	KK	k6
145	KM	Subarea k6
146	BA	29.0
147	LS	0 85
148	UD	2.125
149	KK	C6
150	KM	Combine Rk6 and k6
151	HC	2
152	KK	Rk7
153	KM	Route c6 through k7
154	RM	10.0 2.03 0.10
155	KK	k7
156	KM	Subarea k7
157	BA	15.5
158	LS	0 85
159	UD	2.297
160	KK	C7
161	KM	Combine Rk7 and k7 (Watershed 1-Kane Springs)
162	HC	2
163	KK	A
164	KM	Combine C7 and C18 (Point A)
165	HC	2
166	KK	Rk10
167	KM	Route A through P9/p10
168	RM	10.0 1.40 0.10

HEC-1 INPUT

PAGE 5

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

169	KK	P9
170	KM	Subarea p9

125	.	Rk4	.	.
128	.	.	k4	.
133	.	.	.	k5
138	.	C45	.....	.
	.	V	.	.
	.	V	.	.
141	.	Rk6	.	.
144	.	.	k6	.
149	.	C6	.....	.
	.	V	.	.
	.	V	.	.
152	.	Rk7	.	.
155	.	.	k7	.
160	.	C7	.....	.
163	A	.....	.	.
	V	.	.	.
	V	.	.	.
166	Rk10	.	.	.
169	.	P9	.	.
174	.	.	p10	.
179	C10	.....	.	.
	V	.	.	.
	V	.	.	.
182	Rk12	.	.	.
185	.	P11	.	.
190	.	.	p12	.
195	C12	.....	.	.
198	.	P13	.	.
203	C13	.....	.	.
206	.	p17	.	.
	.	V	.	.
	.	V	.	.
211	.	Rk16	.	.
214	.	.	p16	.
219	.	C16	.....	.
	.	V	.	.
	.	V	.	.
222	.	Rk15a	.	.
225	.	.	p14	.
	.	.	V	.
	.	.	V	.
230	.	Rk15b	.	.
233	.	.	.	p15
238	.	C15	.....	.
241	B	.....	.	.
	V	.	.	.
	V	.	.	.
244	RDAM	.	.	.
	V	.	.	.

QAGE

• (916) 756-1104

Appendix B

•	R45	28.00	1	FLOW TIME	2025. 8.58	1946. 8.58	1246. 8.67	1060. 8.67	802. 8.75
•	HYDROGRAPH AT								
•	P45	59.00	1	FLOW TIME	4303. 6.67	4134. 6.67	2649. 6.75	2253. 6.75	1707. 6.83
•	2 COMBINED AT								
•	C45a	87.00	1	FLOW TIME	5388. 7.25	5174. 7.25	3299. 7.33	2803. 7.33	2118. 7.42
•	HYDROGRAPH AT								
•	P2	38.50	1	FLOW TIME	2574. 7.00	2473. 7.00	1582. 7.08	1345. 7.08	1018. 7.17
•	ROUTED TO								
•	R6	38.50	1	FLOW TIME	2351. 9.67	2258. 9.67	1442. 9.75	1225. 9.75	926. 9.83
•	HYDROGRAPH AT								
•	P6	30.00	1	FLOW TIME	2389. 6.42	2296. 6.42	1475. 6.42	1256. 6.50	952. 6.50
•	3 COMBINED AT								
•	C45b	155.50	1	FLOW TIME	8182. 7.25	7854. 7.25	4997. 7.33	4244. 7.33	3205. 7.42
•	ROUTED TO								
•	R7a	155.50	1	FLOW TIME	8119. 8.25	7793. 8.25	4959. 8.33	4211. 8.33	3180. 8.42
•	HYDROGRAPH AT								
•	P3	39.50	1	FLOW TIME	3313. 6.17	3184. 6.25	2049. 6.25	1746. 6.33	1326. 6.33
•	ROUTED TO								
•	R7b	39.50	1	FLOW TIME	3222. 7.33	3096. 7.33	1988. 7.42	1693. 7.42	1285. 7.50
•	HYDROGRAPH AT								
•	P7	25.50	1	FLOW TIME	2500. 5.67	2404. 5.67	1555. 5.75	1329. 5.75	1013. 5.83
•	3 COMBINED AT								
•	C7	220.50	1	FLOW TIME	11726. 7.58	11258. 7.58	7179. 7.67	6099. 7.67	4612. 7.75
•	ROUTED TO								
•	R8	220.50	1	FLOW TIME	11681. 8.25	11216. 8.25	7150. 8.33	6077. 8.33	4593. 8.42
•	HYDROGRAPH AT								
•	P8	33.00	1	FLOW TIME	3047. 5.83	2929. 5.92	1891. 5.92	1614. 6.00	1228. 6.00
•	2 COMBINED AT								
•	C18	253.50	1	FLOW TIME	12605. 7.92	12101. 7.92	7706. 8.00	6546. 8.08	4945. 8.08
•	HYDROGRAPH AT								
•	K1	32.50	1	FLOW TIME	2591. 6.42	2490. 6.42	1600. 6.42	1362. 6.50	1033. 6.50
•	ROUTED TO								
•	Rk2	32.50	1	FLOW TIME	2453. 8.08	2357. 8.08	1511. 8.17	1286. 8.17	974. 8.25
•	HYDROGRAPH AT								
•	k2	56.50	1	FLOW TIME	3867. 6.92	3714. 6.92	2377. 7.00	2022. 7.00	1530. 7.08
•	2 COMBINED AT								
•	C2	89.00	1	FLOW TIME	5932. 7.42	5697. 7.42	3641. 7.50	3096. 7.58	2342. 7.58
•	ROUTED TO								
•	Rk3	89.00	1	FLOW TIME	5741. 9.00	5513. 9.00	3522. 9.08	2993. 9.08	2263. 9.17
•	HYDROGRAPH AT								
•	k3	57.00	1	FLOW TIME	4276. 6.58	4108. 6.58	2633. 6.67	2241. 6.67	1699. 6.75
•	2 COMBINED AT								
•	C3	146.00	1	FLOW TIME	7789. 8.25	7478. 8.25	4763. 8.33	4044. 8.42	3053. 8.42
•	ROUTED TO								
•	Rk4	146.00	1	FLOW TIME	7662. 9.75	7356. 9.75	4682. 9.83	3976. 9.92	3001. 9.92
•	HYDROGRAPH AT								
•	k4	36.50	1	FLOW TIME	1622. 8.75	1557. 8.83	990. 8.83	841. 8.92	635. 8.92

HYDROGRAPH AT	k5	21.50	1	FLOW TIME	1961. 5.92	1885. 5.92	1216. 6.00	1037. 6.00	789. 6.08
3 COMBINED AT	C45	204.00	1	FLOW TIME	9373. 9.50	8997. 9.50	5724. 9.67	4860. 9.67	3668. 9.75
ROUTED TO	Rk6	204.00	1	FLOW TIME	9280. 10.92	8909. 10.92	5666. 11.00	4810. 11.00	3630. 11.08
HYDROGRAPH AT	k6	29.00	1	FLOW TIME	2472. 6.17	2376. 6.17	1529. 6.25	1304. 6.25	989. 6.33
2 COMBINED AT	C6	233.00	1	FLOW TIME	9415. 10.83	9037. 10.83	5746. 10.92	4878. 10.92	3681. 11.00
ROUTED TO	Rk7	233.00	1	FLOW TIME	9156. 12.42	8785. 12.42	5557. 12.42	4708. 12.42	3540. 12.42
HYDROGRAPH AT	k7	15.50	1	FLOW TIME	1257. 6.33	1208. 6.33	776. 6.42	661. 6.42	501. 6.50
2 COMBINED AT	C7	248.50	1	FLOW TIME	<u>9188.</u> 12.42	8816. 12.42	5578. 12.42	4726. 12.42	3554. 12.42
2 COMBINED AT	A	502.00	1	FLOW TIME	17217. 8.42	16524. 8.42	<u>10500.</u> 8.50	8916. 8.50	6732. 8.50
ROUTED TO	Rk10	502.00	1	FLOW TIME	17040. 9.83	16354. 9.83	10389. 9.92	8819. 9.92	6659. 10.00
HYDROGRAPH AT	P9	32.50	1	FLOW TIME	3086. 5.75	2966. 5.75	1917. 5.83	1636. 5.92	1247. 5.92
HYDROGRAPH AT	p10	50.00	1	FLOW TIME	3999. 6.33	3842. 6.33	2469. 6.42	2102. 6.42	1594. 6.50
3 COMBINED AT	C10	584.50	1	FLOW TIME	17972. 9.50	17248. 9.50	10955. 9.58	9298. 9.67	7017. 9.67
ROUTED TO	Rk12	584.50	1	FLOW TIME	17832. 10.92	17114. 10.92	10866. 11.00	9222. 11.00	6959. 11.08
HYDROGRAPH AT	P11	36.00	1	FLOW TIME	3427. 5.75	3295. 5.75	2129. 5.83	1817. 5.92	1385. 5.92
HYDROGRAPH AT	p12	36.50	1	FLOW TIME	2889. 6.42	2776. 6.42	1782. 6.50	1518. 6.50	1151. 6.58
3 COMBINED AT	C12	657.00	1	FLOW TIME	18162. 10.75	17430. 10.75	11064. 10.83	<u>9321.</u> 10.92	7084. 11.00
HYDROGRAPH AT	P13	42.50	1	FLOW TIME	3357. 6.42	3225. 6.42	2071. 6.50	1763. 6.50	1337. 6.58
2 COMBINED AT	C13	699.50	1	FLOW TIME	18497. 10.58	17751. 10.67	11266. 10.75	9561. 10.75	7211. 10.83
HYDROGRAPH AT	p17	42.00	1	FLOW TIME	3605. 6.08	3465. 6.17	2231. 6.17	1903. 6.25	1445. 6.25
ROUTED TO	Rk16	42.00	1	FLOW TIME	3417. 7.67	3283. 7.67	2107. 7.75	1794. 7.75	1361. 7.83
HYDROGRAPH AT	p16	27.00	1	FLOW TIME	2430. 6.00	2336. 6.00	1506. 6.00	1286. 6.08	978. 6.08
2 COMBINED AT	C16	69.00	1	FLOW TIME	4818. 7.17	4628. 7.17	2961. 7.25	2518. 7.25	1905. 7.33
ROUTED TO	Rk15a	69.00	1	FLOW TIME	4659. 8.75	4474. 8.75	2858. 8.83	2429. 8.92	1836. 8.92

HYDROGRAPH AT	p14	61.00	1	FLOW TIME	4983. 6.33	4789. 6.33	3879. 6.33	2623. 6.42	1990. 6.42
ROUTED TO	Rk15b	61.00	1	FLOW TIME	4650. 8.17	4467. 8.17	2863. 8.25	2437. 8.25	1846. 8.33
HYDROGRAPH AT	p15	32.00	1	FLOW TIME	3311. 5.42	3184. 5.42	2066. 5.50	1768. 5.58	1353. 5.58
3 COMBINED AT	C15	162.00	1	FLOW TIME	9484. 8.25	9108. 8.25	5817. 8.33	4946. 8.42	3739. 8.50
2 COMBINED AT	B	861.50	1	FLOW TIME	26580. 8.33	25508. 8.42	16192. 8.42	13741. 8.50	10367. 8.50
ROUTED TO	RDAM	861.50	1	FLOW TIME	26272. 10.25	25214. 10.25	16006. 10.33	13585. 10.33	10249. 10.42
ROUTED TO	ARTOW	861.50	1	FLOW TIME	24651. 11.58	23670. 11.58	15116. 11.58	12906. 11.58	9985. 11.25
** PEAK STAGES IN FEET **									
1	STAGE	2170.03	2169.34	2163.17	2161.58	2159.03			
	TIME	11.58	11.58	11.58	11.58	11.25			
ROUTED TO	GAGE	861.50	1	FLOW TIME	22640. 12.42	21729. 12.42	13969. 12.42	12045. 12.42	9329. 12.42

*** NORMAL END OF HEC-1 ***

APPENDIX E

10-year STORM CENTER IN ALL BASINS

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.....
.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 17:50:55
.....

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

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X X XXXXXX XXXX X
X X X X X
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XXXXXX XXXX X XXXX X
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X X XXXXXX XXXX XXX

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

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

1

HEC-1 INPUT

PAGE 1

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LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*DIAGRAM
1 ID
2 ID
3 ID
4 ID * ALL AREAS of 862 sq miles
5 ID * BASINS 1, 2, 3, and 5. Points A and B
6 ID
7 ID
8 ID 10-year event
9 ID prepared by VTH-nevada in January 2000
10 ID
11 ID All tributary area north of Maynard Lake drains into the detention
12 ID and depression area in Pahrangat National Wild Life Refuge
13 ID
14 ID PREC 0.510 0.500 0.407 0.380 0.340
15 ID AREA 248.5 253.5 502.0 657.0 861.5
16 ID Point C10 C7 A C12 B
17 ID Outfall Ben2 Ben1 Ben3 Ben5
... FREE ...
18 IT 5 0 0 150
19 IO 5 0 0
20 IM 5 0 0
21 JR PREC 0.510 0.500 0.407 0.380 0.340
22 KK pl
23 KM Subarea pl
24 BA 28.0
25 PB 1.6
26 PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
27 PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
28 PC .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
29 PC .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
30 PC .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
31 PC .810 .820 .826 .840 .859 .889 .910 .938 .966 .970
32 PC .974 .979 .981 .983 .985 .989 .990 .992 .993 .996

```

33 PC .997 .999 1.00
 34 LS 0 85
 35 UD 2.401
 36 KK R45
 37 KM Route p11 through p45
 38 RM 10.0 2.16 0.10
 39 KK P45
 40 KM Subarea P45
 41 BA 59.0
 42 LS 0 85
 43 UD 2.675
 44 KK C45a
 45 KM Combine R45 and P45
 46 HC 2

HEC-1 INPUT

PAGE 2

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

47 KK P2
 48 KM Subarea P2
 49 BA 38.5
 50 LS 0 85
 51 UD 3.00
 52 KK R6
 53 KM Route p2 through p6
 54 RM 10.0 2.64 0.10
 55 KK P6
 56 KM Subarea P6
 57 BA 30.0
 58 LS 0 85
 59 UD 2.36
 60 KK C45b
 61 KM Combine R45a, R6 and P6
 62 HC 3
 63 KK R7a
 64 KM Route C45b through P7
 65 RM 10.0 1.0 0.10
 66 KK P3
 67 KM Subarea P3
 68 BA 39.5
 69 LS 0 85
 70 UD 2.179
 71 KK R7b
 72 KM Route p3 through p7
 73 RM 10.0 1.13 0.10
 74 KK P7
 75 KM Subarea P7
 76 BA 25.5
 77 LS 0 85
 78 UD 1.631
 79 KK C7
 80 KM Combine R7b, R7a, and P7
 81 HC 3
 82 KK R8
 83 KM Route C7 through p8
 84 RM 10.0 0.62 0.10
 85 KK P8
 86 KM Subarea P8
 87 BA 33
 88 LS 0 85
 89 UD 1.846

HEC-1 INPUT

PAGE 3

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

90 KK C18
 91 KM Combine R8 and P8(Basin 2 --Prahrangat Watershed north of Point A)
 92 HC 2
 93 KK K1
 94 KM Subarea k1
 95 BA 32.5
 96 LS 0 85
 97 UD 2.356
 98 KK K2
 99 KM Route k1 through k2
 100 RM 10.0 1.68 0.10

101	KK	k2			
102	KM	Subarea k2			
103	BA	56.5			
104	LS	0	85		
105	UD	2.911			
106	KK	C2			
107	KM	Combine Rk2, and k2			
108	HC	2			
109	KK	Rk3			
110	KM	Route c2 throug k3			
111	RM	10.0	1.56	0.10	
112	KK	k3			
113	KM	Subarea k3			
114	BA	57.0			
115	LS	0	85		
116	UD	2.573			
117	KK	C3			
118	KM	Combine Rk3, and k3			
119	HC	2			
120	KK	Rk4			
121	KM	Route c2 throug k3			
122	RM	10.0	1.56	0.10	
123	KK	k4			
124	KM	Subarea k4			
125	BA	36.5			
126	LS	0	85		
127	UD	4.87			
128	KK	k5			
129	KM	Subarea k5			
130	BA	21.5			
131	LS	0	85		
132	UD	1.891			

HEC-1 INPUT

PAGE 4

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

133	KK	C45			
134	KM	Combine Rk4, K4, and k5			
135	HC	3			
136	KK	Rk6			
137	KM	Route c45 throug k6			
138	RM	10.0	1.40	0.10	
139	KK	k6			
140	KM	Subarea k6			
141	BA	29.0			
142	LS	0	85		
143	UD	2.125			
144	KK	C6			
145	KM	Combine Rk6 and k6			
146	HC	2			
147	KK	Rk7			
148	KM	Route c6 throug k7			
149	RM	10.0	2.03	0.10	
150	KK	k7			
151	KM	Subarea k7			
152	BA	15.5			
153	LS	0	85		
154	UD	2.297			
155	KK	C7			
156	KM	Combine Rk7 and k7 (Watershed 1-Kane Springs)			
157	HC	2			
158	KK	A			
159	KM	Combine C7 and C18 (Point A)			
160	HC	2			
161	KK	Rk10			
162	KM	Route A throug P9/p10			
163	RM	10.0	1.40	0.10	
164	KK	P9			
165	KM	Subarea p9			
166	BA	32.5			
167	LS	0	85		
168	UD	1.748			
169	KK	p10			
170	KM	Subarea p10			

171 BA 50.0
172 LS 0 85
173 UD 2.345

HEC-1 INPUT

PAGE 5

1

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

174 KK C10
175 KM Combine A, P9 and p10
176 RC 3

177 KK Rk12
178 KM Route C10 through P11/p12
179 RM 10.0 1.40 0.10

180 KK P11
181 KM Subarea p11
182 BA 36.0
183 LS 0 85
184 UD 1.739

185 KK p12
186 KM Subarea p12
187 BA 36.5
188 LS 0 85
189 UD 2.382

190 KK C12
191 KM Combine Rk12, p11, and p12
192 RC 3

193 KK P13
194 KM Subarea P13
195 BA 42.5
196 LS 0 85
197 UD 2.390

198 KK C13
199 KM Combine c12 and p13 (Watershed 3)
200 RC 2

201 KK p17
202 KM Subarea p17
203 BA 42.0
204 LS 0 85
205 UD 2.099

206 KK Rk16
207 KM Route p17 through P16
208 RM 10.0 1.56 0.10

209 KK p16
210 KM Subarea p16
211 BA 27.0
212 LS 0 85
213 UD 1.935

HEC-1 INPUT

PAGE 6

1

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

214 KK C16
215 KM Combine Rk16, and P16
216 RC 2

217 KK Rk15a
218 KM Route C16 through P15
219 RM 10.0 1.65 0.10

220 KK p14
221 KM Subarea p14
222 BA 61.0
223 LS 0 85
224 UD 2.271

225 KK Rk15b
226 KM Route p14 through P15
227 RM 10.0 1.87 0.10

228 KK p15
229 KM Subarea p15
230 BA 32.0
231 LS 0 85
232 UD 1.402

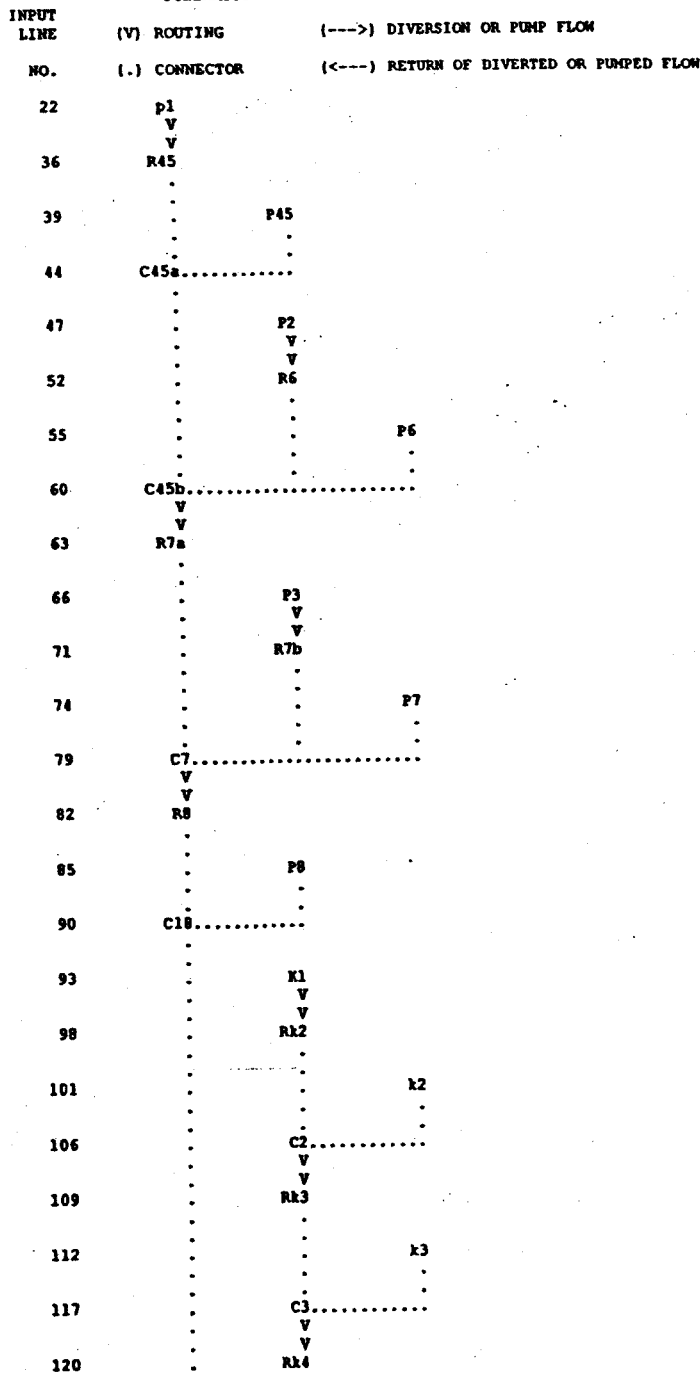
233 KK C15
234 KM Combine Rk15a, Rk15b, and P15 (at Point 5)
235 RC 3

236 KK B
237 KM Combine C15 and C13
238 RC 2

239	KK	RDAM					
240	KH	Route	c15 THROUGH ARROWHEAD VALLEY				
241	RM		10.0	1.75	0.10		
242	KK	Arrow					
243	KH	Arrow Canyon					
244	RS	1	STOR	-1			
245	SV	0	14	460	915	2385	5005
246	SE	2133	2140	2150	2160	2170	2180
247	SQ	0	325	3186	10713	24587	46286
248	KK	GAGE					
249	KH		10.0	2.16	0.10		
250	ZZ						

1

SCHEMATIC DIAGRAM OF STREAM NETWORK



123	.	.	k4
128	.	.	k5
133	.	C45.....	
	.	V	
136	.	Rk6	
139	.	.	k6
144	.	C6.....	
	.	V	
147	.	Rk7	
150	.	.	k7
155	.	C7.....	
158	A.....	.	
	V	.	
161	Rk10	.	
164	.	P9	
169	.	.	p10
174	C10.....	.	
	V	.	
177	Rk12	.	
180	.	P11	
185	.	.	p12
190	C12.....	.	
193	.	P13	
198	C13.....	.	
201	.	p17	
	.	V	
206	.	Rk16	
209	.	.	p16
214	.	C16.....	
	.	V	
217	.	Rk15a	
220	.	.	p14
	.	V	
225	.	Rk15b	
228	.	.	p15
233	.	C15.....	
236	B.....	.	
	V	.	
239	RDAM	.	
	V	.	

(***). RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1 .....
.....
FLOOD HYDROGRAPH PACKAGE (NEC-1)
JAN 1997
VERSION 4.1
RUN DATE 10MAY00 TIME 17:50:55
.....

```

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

- ALL AREAS of 862 sq miles
- BASINS 1, 2, 3, and 5. Points A and B

10-year event
prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention and depression area in Pahranaagat National Wild Life Refuge

PREC	0.510	0.500	0.407	0.380	0.340
AREA	248.5	253.5	502.0	657.0	861.5
Point	C18	C7	A	C12	B
Outfall	Bsn2	Bsn1		Bsn3	Bsn5

```

19 10      OUTPUT CONTROL VARIABLES
           IPRINT      5  PRINT CONTROL
           IPLOT       0  PLOT CONTROL
           QSCAL       0.  HYDROGRAPH PLOT SCALE

```

HYDROGRAPH TIME DATA			
IT		MMIN	5 MINUTES IN COMPUTATION INTERVAL
	1	IDATE	0 STARTING DATE
		ITIME	0000 STARTING TIME
		NO	150 NUMBER OF HYDROGRAPH ORDINATES
	1	NDDATE	0 ENDING DATE
		NDDTIME	1225 ENDING TIME
		ICENT	19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 12.42 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR	MULTI-RATIO OPTION				
	RATIOS OF PRECIPITATION				
	.51	.50	.41	.38	.34

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION				
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5
				.51	.50	.41	.38	.34
HYDROGRAPH AT								
+	p1	28.00	1 FLOW	468.	440.	214.	161.	95.

Appendix E

				TIME	6.67	6.67	6.83	6.92	7.00
ROUTED TO									
+	R45	28.00	1	FLOW TIME	426. 8.83	401. 8.92	194. 9.00	146. 9.08	86. 9.25
HYDROGRAPH AT									
+	P45	59.00	1	FLOW TIME	907. 6.92	853. 6.92	413. 7.08	311. 7.17	183. 7.25
2 COMBINED AT									
+	C45a	87.00	1	FLOW TIME	1120. 7.50	1052. 7.50	505. 7.67	379. 7.75	221. 7.83
HYDROGRAPH AT									
+	P2	38.50	1	FLOW TIME	540. 7.25	507. 7.25	245. 7.42	184. 7.50	108. 7.58
ROUTED TO									
+	R6	38.50	1	FLOW TIME	490. 9.92	461. 10.00	222. 10.08	167. 10.17	98. 10.33
HYDROGRAPH AT									
+	P6	30.00	1	FLOW TIME	508. 6.67	478. 6.67	232. 6.83	175. 6.83	103. 7.00
3 COMBINED AT									
+	C45b	155.50	1	FLOW TIME	1693. 7.50	1590. 7.50	763. 7.67	571. 7.67	333. 7.75
ROUTED TO									
+	R7a	155.50	1	FLOW TIME	1680. 8.50	1577. 8.50	757. 8.67	567. 8.75	331. 8.83
HYDROGRAPH AT									
+	P3	39.50	1	FLOW TIME	709. 6.50	666. 6.50	325. 6.58	245. 6.67	145. 6.75
ROUTED TO									
+	R7b	39.50	1	FLOW TIME	685. 7.58	644. 7.58	314. 7.75	237. 7.83	140. 7.92
HYDROGRAPH AT									
+	P7	25.50	1	FLOW TIME	548. 5.92	516. 5.92	256. 6.08	194. 6.17	117. 6.25
3 COMBINED AT									
+	C7	220.50	1	FLOW TIME	2443. 7.83	2295. 7.92	1106. 8.00	830. 8.08	486. 8.17
ROUTED TO									
+	R8	220.50	1	FLOW TIME	2433. 8.50	2286. 8.50	1101. 8.67	826. 8.67	483. 8.83
HYDROGRAPH AT									
+	P8	33.00	1	FLOW TIME	660. 6.17	621. 6.17	306. 6.25	231. 6.33	138. 6.42
2 COMBINED AT									
+	C18	253.50	1	FLOW TIME	2615. 8.25	2456. 8.25	1182. 8.42	886. 8.50	518. 8.58
HYDROGRAPH AT									
+	K1	32.50	1	FLOW TIME	551. 6.67	518. 6.67	252. 6.83	190. 6.83	112. 7.00
ROUTED TO									
+	Rk2	32.50	1	FLOW TIME	518. 8.33	487. 8.33	237. 8.50	178. 8.58	105. 8.67
HYDROGRAPH AT									
+	k2	56.50	1	FLOW TIME	812. 7.17	763. 7.17	369. 7.33	277. 7.42	163. 7.50
2 COMBINED AT									
+	C2	89.00	1	FLOW TIME	1241. 7.75	1166. 7.75	563. 7.92	423. 8.00	248. 8.08
ROUTED TO									
+	Rk3	89.00	1	FLOW TIME	1198. 9.33	1126. 9.33	543. 9.50	408. 9.50	239. 9.67
HYDROGRAPH AT									
+	k3	57.00	1	FLOW TIME	904. 6.83	850. 6.83	412. 7.00	310. 7.08	183. 7.17
2 COMBINED AT									
+	C3	146.00	1	FLOW TIME	1610. 8.50	1511. 8.50	723. 8.67	541. 8.67	314. 8.83
ROUTED TO									
+	Rk4	146.00	1	FLOW TIME	1582. 10.08	1486. 10.08	712. 10.25	533. 10.33	310. 10.42

HYDROGRAPH AT	k4	36.50	1	FLOW TIME	335. 9.08	314. 9.08	151. 9.17	113. 9.25	66. 9.42
HYDROGRAPH AT	k5	21.50	1	FLOW TIME	424. 6.17	399. 6.17	196. 6.33	148. 6.42	88. 6.50
3 COMBINED AT	C45	204.00	1	FLOW TIME	1934. 9.83	1816. 9.83	870. 10.00	651. 10.08	378. 10.17
ROUTED TO	Rk6	204.00	1	FLOW TIME	1914. 11.25	1797. 11.25	860. 11.42	644. 11.42	375. 11.58
HYDROGRAPH AT	k6	29.00	1	FLOW TIME	530. 6.42	498. 6.42	243. 6.58	183. 6.67	109. 6.75
2 COMBINED AT	C6	233.00	1	FLOW TIME	1940. 11.17	1822. 11.17	872. 11.33	652. 11.33	379. 11.50
ROUTED TO	Rk7	233.00	1	FLOW TIME	1848. 12.42	1734. 12.42	818. 12.42	607. 12.42	348. 12.42
HYDROGRAPH AT	k7	15.50	1	FLOW TIME	268. 6.58	252. 6.58	123. 6.75	92. 6.83	55. 6.92
2 COMBINED AT	C7	<u>248.50</u>	1	FLOW TIME	1856. 12.42	1741. 12.42	822. 12.42	610. 12.42	350. 12.42
2 COMBINED AT	A	502.00	1	FLOW TIME	3556. 8.67	3340. 8.67	1604. 8.83	1201. 8.83	700. 9.00
ROUTED TO	Rk10	502.00	1	FLOW TIME	3515. 10.08	3301. 10.17	1584. 10.25	1186. 10.33	691. 10.42
HYDROGRAPH AT	P9	32.50	1	FLOW TIME	672. 6.00	632. 6.08	312. 6.17	237. 6.25	142. 6.33
HYDROGRAPH AT	p10	50.00	1	FLOW TIME	851. 6.67	800. 6.67	389. 6.75	293. 6.83	173. 6.92
3 COMBINED AT	C10	584.50	1	FLOW TIME	3702. 9.83	3476. 9.83	1666. 10.00	1247. 10.08	726. 10.17
ROUTED TO	Rk12	584.50	1	FLOW TIME	3669. 11.25	3446. 11.25	1651. 11.42	1235. 11.50	719. 11.58
HYDROGRAPH AT	P11	36.00	1	FLOW TIME	746. 6.00	702. 6.00	347. 6.17	263. 6.25	157. 6.33
HYDROGRAPH AT	p12	36.50	1	FLOW TIME	614. 6.67	577. 6.67	281. 6.83	211. 6.92	125. 7.00
3 COMBINED AT	C12	657.00	1	FLOW TIME	3734. 11.08	3506. 11.08	1679. 11.25	1256. 11.33	731. 11.50
HYDROGRAPH AT	P13	42.50	1	FLOW TIME	713. 6.67	670. 6.67	326. 6.83	245. 6.92	145. 7.00
2 COMBINED AT	C13	699.50	1	FLOW TIME	3799. 11.00	3567. 11.00	1707. 11.17	1277. 11.25	743. 11.42
HYDROGRAPH AT	p17	42.00	1	FLOW TIME	773. 6.42	727. 6.42	355. 6.50	268. 6.58	159. 6.67
ROUTED TO	Rk16	42.00	1	FLOW TIME	726. 8.00	682. 8.00	333. 8.17	251. 8.17	149. 8.33
HYDROGRAPH AT	p16	27.00	1	FLOW TIME	525. 6.25	494. 6.25	242. 6.33	183. 6.42	109. 6.50

2 COMBINED AT	C16	69.00	1	FLOW TIME	1009. 7.42	948. 7.42	457. 7.58	343. 7.67	201. 7.75
ROUTED TO	Rk15a	69.00	1	FLOW TIME	972. 9.08	913. 9.08	440. 9.25	330. 9.33	194. 9.42
HYDROGRAPH AT	p14	61.00	1	FLOW TIME	1063. 6.58	999. 6.58	486. 6.75	367. 6.75	217. 6.83
ROUTED TO	Rk15b	61.00	1	FLOW TIME	982. 8.42	923. 8.50	448. 8.58	338. 8.67	199. 8.75
HYDROGRAPH AT	p15	32.00	1	FLOW TIME	739. 5.75	697. 5.75	351. 5.92	269. 5.92	163. 6.00
3 COMBINED AT	C15	162.00	1	FLOW TIME	1981. 8.58	1861. 8.58	898. 8.75	674. 8.83	396. 9.00
2 COMBINED AT	B	861.50	1	FLOW TIME	5463. 8.67	5130. 8.67	2456. 8.83	1838. 8.92	1069. 9.00
ROUTED TO	RDAM	861.50	1	FLOW TIME	5403. 10.50	5073. 10.50	2428. 10.67	1816. 10.75	1056. 10.83
ROUTED TO	Arrow	861.50	1	FLOW TIME	5199. 11.58	4864. 11.58	2144. 12.42	1605. 12.42	936. 12.42
** PEAK STAGES IN FEET **									
	1	STAGE		TIME	2152.67 11.50	2152.23 11.58	2146.36 12.42	2144.47 12.42	2142.14 12.42
ROUTED TO	GAGE	861.50	1	FLOW TIME	4468. 12.42	4090. 12.42	1710. 12.42	1272. 12.42	742. 12.42

*** NORMAL END OF REC-1 ***

.....
 * BASIN 1 of 249 sq miles
 * KANE SPRINGS Watershed only
 * BASINS 1 to Points A

 100-year event with PB=3.0 inches

prepared by VTN-nevada in January 2000

All tributary area north of Maynard Lake drains into the detention
 and depression area in Pahrnagat National Wild Life Refuge

PREC 0.51
 AREA 248.5 sq mile
 Point C7 (Outlet of Basin 1)

20 10 OUTPUT CONTROL VARIABLES
 IPRNT 5 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 150 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 1 0 ENDING DATE
 NDTIME 1225 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 12.42 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .51

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	
					.51
HYDROGRAPH AT	K1	33.00	1	FLOW	2631.
				TIME	6.42
ROUTED TO	Rk2	33.00	1	FLOW	2491.
				TIME	8.08
HYDROGRAPH AT	K2	56.50	1	FLOW	3867.
				TIME	6.92
2 COMBINED AT	C2	89.50	1	FLOW	5967.
				TIME	7.42
ROUTED TO	Rk3	89.50	1	FLOW	5774.
				TIME	9.00
HYDROGRAPH AT	K3	57.00	1	FLOW	4276.
				TIME	6.58
2 COMBINED AT	C3	146.50	1	FLOW	7812.
				TIME	8.25
ROUTED TO	Rk4	146.50	1	FLOW	7685.
				TIME	9.75

HYDROGRAPH AT	K4	36.50	1	FLOW	1622.
+				TIME	8.75
HYDROGRAPH AT	K5	21.50	1	FLOW	1961.
+				TIME	5.92
3 COMBINED AT	C45	204.50	1	FLOW	9392.
+				TIME	9.50
ROUTED TO	RK6	204.50	1	FLOW	9300.
+				TIME	10.92
HYDROGRAPH AT	K6	29.00	1	FLOW	2472.
+				TIME	6.17
2 COMBINED AT	C6	233.50	1	FLOW	9433.
+				TIME	10.83
ROUTED TO	RK7	233.50	1	FLOW	9169.
+				TIME	12.42
HYDROGRAPH AT	K7	15.50	1	FLOW	1257.
+				TIME	6.33
2 COMBINED AT	C7	249.00	1	FLOW	9201.
+				TIME	12.42
ROUTED TO	B	249.00	1	FLOW	7511.
+				TIME	12.42
ROUTED TO	RDAM	249.00	1	FLOW	5453.
+				TIME	12.42
ROUTED TO	Arrow	249.00	1	FLOW	3860.
+				TIME	12.42
** PEAK STAGES IN FEET **					
	1	STAGE	2150.90		
		TIME	12.42		
ROUTED TO	Gage	249.00	1	FLOW	1445.
+				TIME	12.42

*** NORMAL END OF HEC-1 ***

**REFERENCE MATERIAL
FROM THE MARK GROUP**

#518

ONLY COPY

REGIONAL FLOOD CONTROL DISTRICT
301 E. Clark, Suite 300
Las Vegas, Nevada 89101

Flood Control Master Plan
Moapa Valley, Nevada
Technical Report
December 1, 1988
87-02137.18

Section 4: Hydrologic and Hydraulic Modeling

4.1 General

The hydrologic modeling approach taken in this study was similar in concept to that followed in the CFCMP. A hydrograph from the upper Moapa Valley drainage (above the Glendale gauge and Wells Siding Diversion dam) was developed from analysis of the historic record and used as input for the Corps of Engineers' HEC-1 flood hydrograph computer model. Peak flow values generated by the HEC-1 modeling were in turn used as input for the Corps of Engineers' HEC-2 water surface profile computer program.

The scope of this analysis, however, required prediction of both peak flood flows and volumes for the upper Moapa Valley in order to evaluate the effectiveness of detention storage in the upper basins to reduce peak flows in the lower Moapa Valley.

The methods, assumptions, and results of the hydrologic and hydraulic modeling efforts used in this study to estimate peak flow and volume are described in this section.

4.2 Upper Moapa Valley Hydrologic Analysis

The major watersheds that can cause flooding in the lower Moapa Valley are the upper Muddy River (above the mouth of California Wash), California Wash, and Meadow Valley Wash. The major watersheds are shown in Figure 4.1. All of these watersheds combine near Glendale, where flow has been monitored by the U.S. Geologic Survey since 1950 (USGS Gauge 09419000). Flows have also been monitored on the upper Muddy River near Moapa (USGS Gauge 09416000) since 1945. No continuous flow monitoring has occurred on California Wash or Meadow Valley Wash.

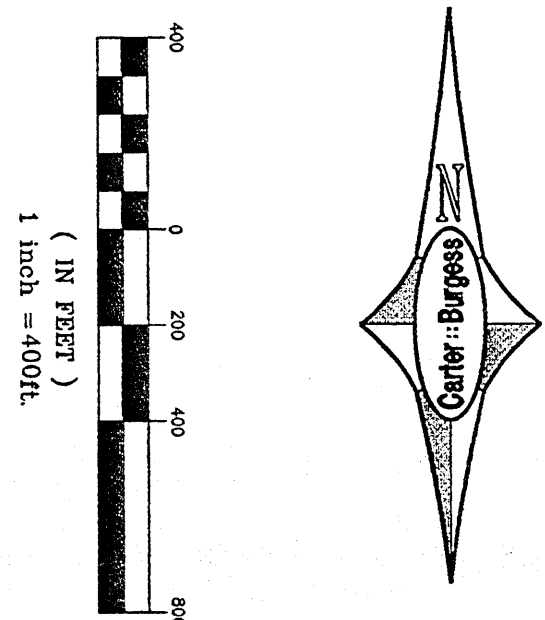
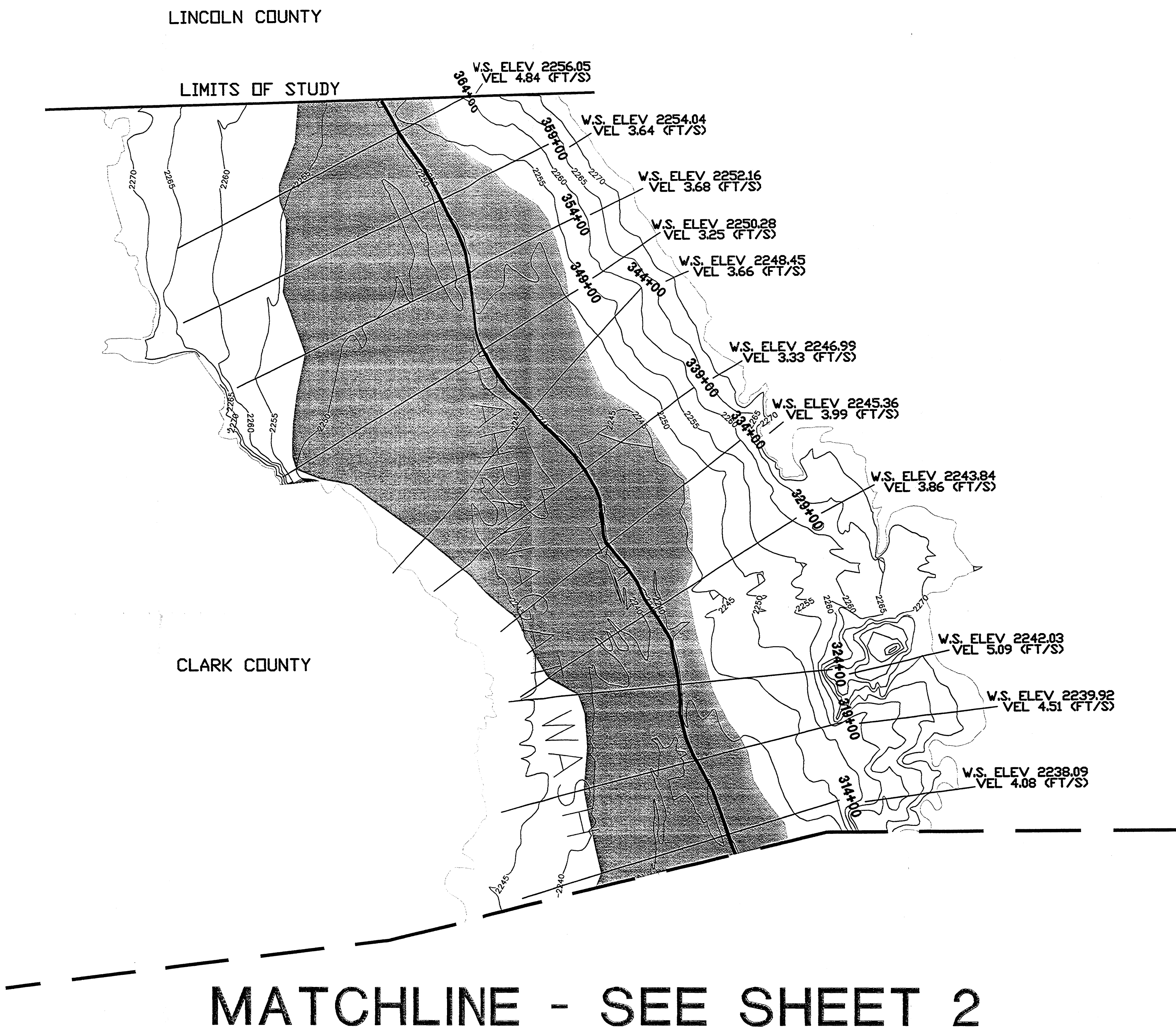
4.2.1 Muddy River Above Mouth of California Wash

The Muddy River upstream of California Wash has a drainage area greater than 3,860 square miles. Approximately 2,750 square miles of this area are upstream of the Pahrnatagat lakes which have sufficient volume to contain flood flows (Corps, 1948) without overflow. The drainage area downstream of the Pahrnatagat lakes is approximately 1,110 square miles (USBR, 1951), with all but about 40 square miles (USGS, 1987) of the area being upstream of Arrowhead Canyon dam which dampens flood flows at both stream flow gauges.

Three methods were used to estimate flood peak flows and volumes for this watershed:

- (1) An S-graph analysis of precipitation-runoff;

PAHRANAGAT WASH EXISTING CONDITIONS



WATER SURFACE

2+00 STATION NUMBER

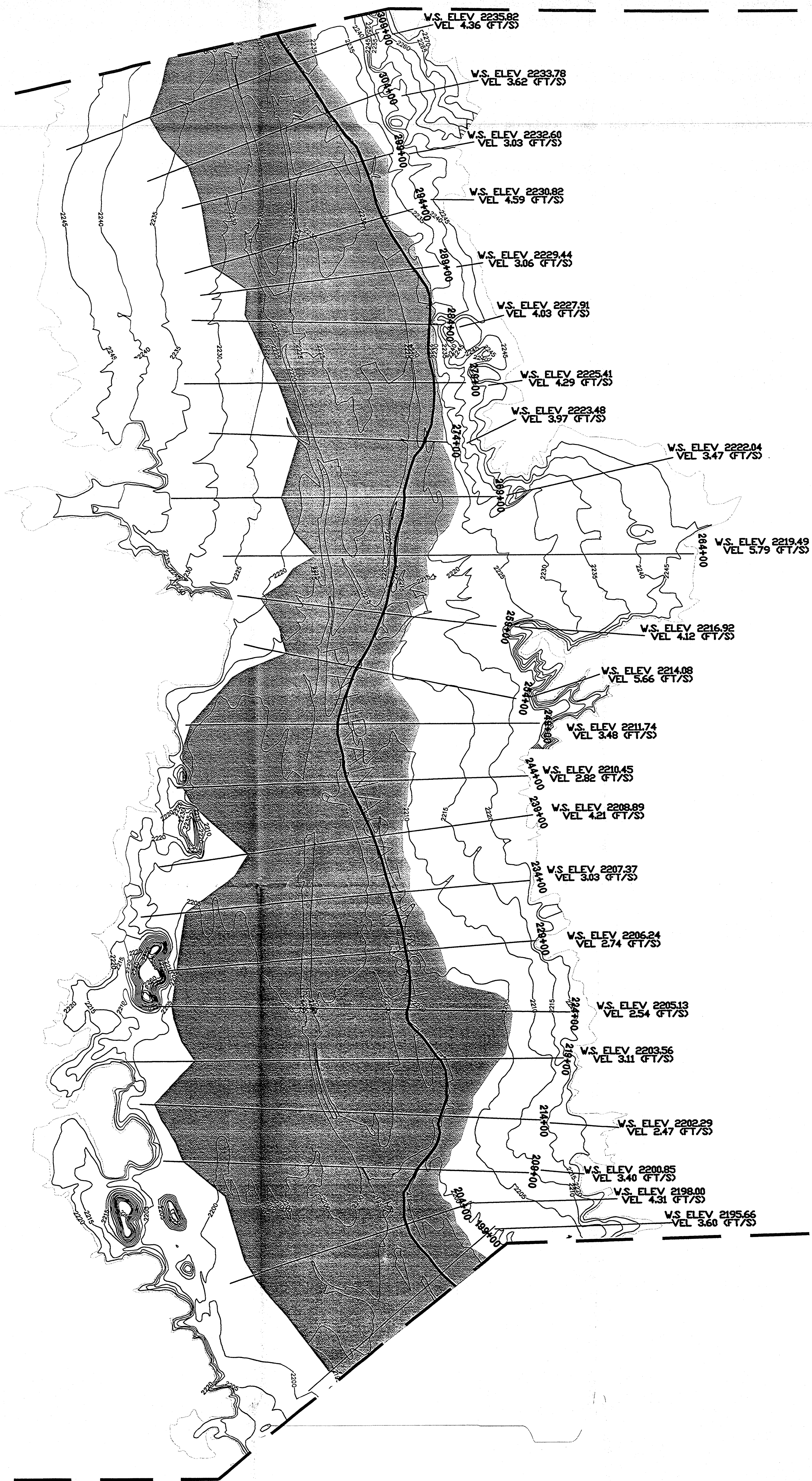
STATION LINE

COUNTUR LINE 5' INTERVAL

SHEET 1 OF 5

Carter Burgess
Consultants in Planning, Engineering,
Construction Management, and Related Services
6655 Bermuda Road, Suite 800
Las Vegas, Nevada 89119
(702) 898-6400 Fax (702) 898-6464

MATCHLINE - SEE SHEET 1

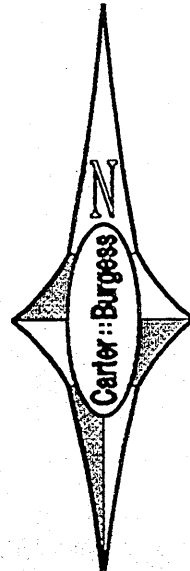
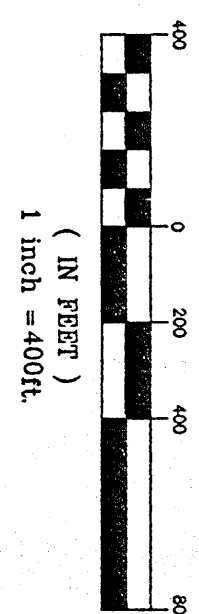
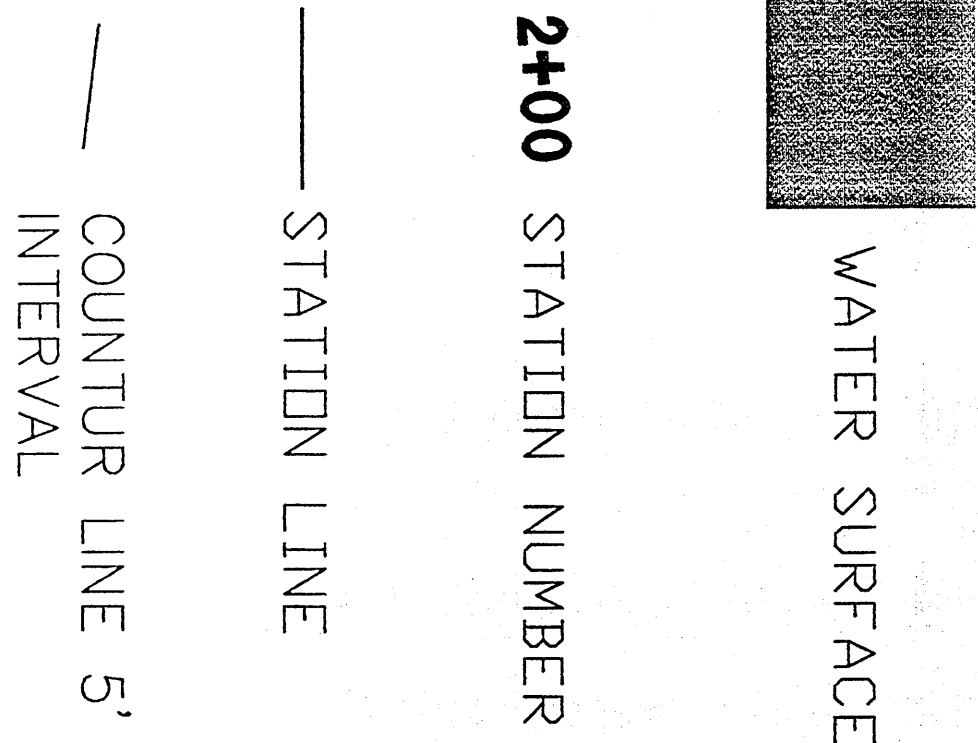


MATCHLINE - SEE SHEET 3

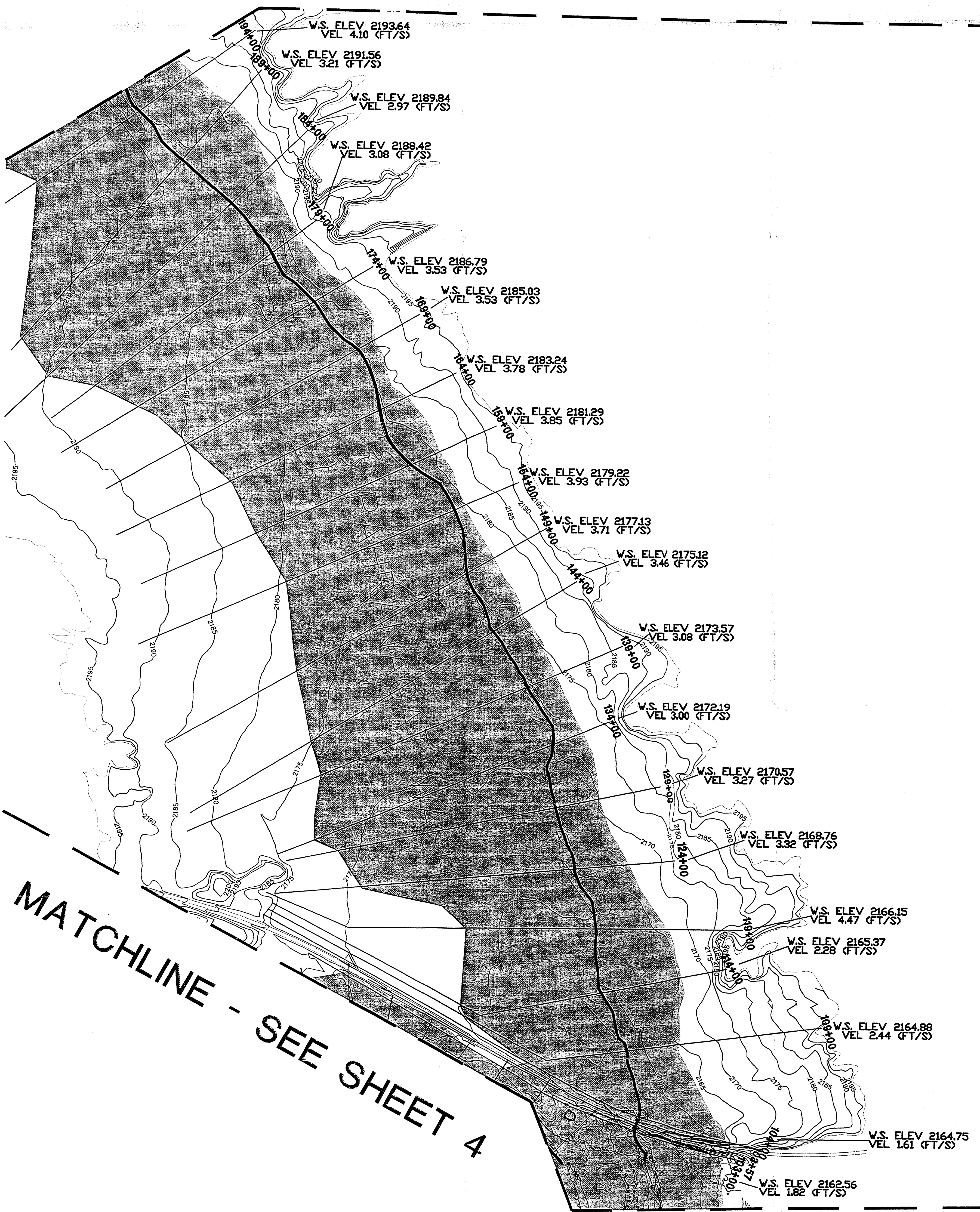
PAHRANAGAT WASH
EXISTING CONDITIONS

Carter Burgess
Consultants in Planning, Engineering,
Construction Management, and Related Services
6666 Bermuda Road
Las Vegas, Nevada 89119
(702) 898-5400 Fax (702) 898-5454

SHEET 2 OF 5



MATCHLINE - SEE SHEET 2



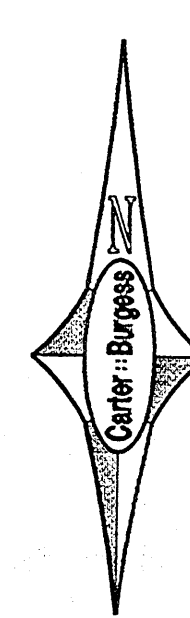
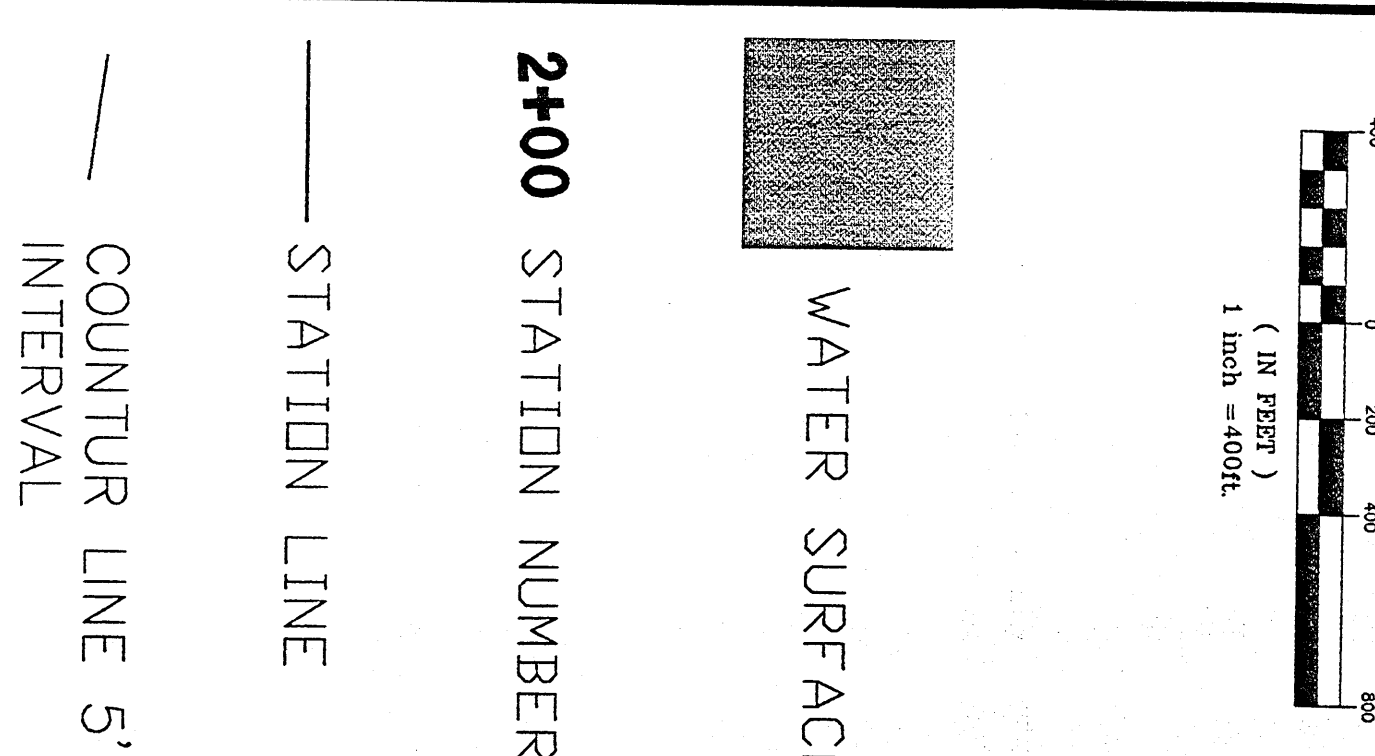
PAHRANAGAT WASH
EXISTING CONDITIONS

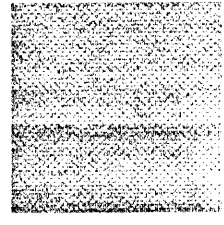
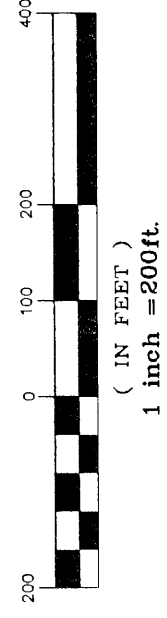
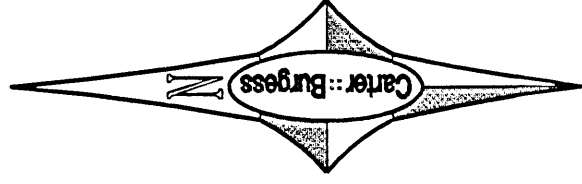
MATCHLINE - SEE SHEET 4

MATCHLINE - SEE SHEET 5

Carter-Burgess
Consultants in Planning, Engineering,
Construction Management, and Related Services
6665 Bermuda Road, Suite 200
Las Vegas, Nevada 89119
(702) 885-6400 Fax (702) 885-6454

SHEET 3 OF 5





WATER SURFACE

2+00 STATION NUMBER

— STATION LINE

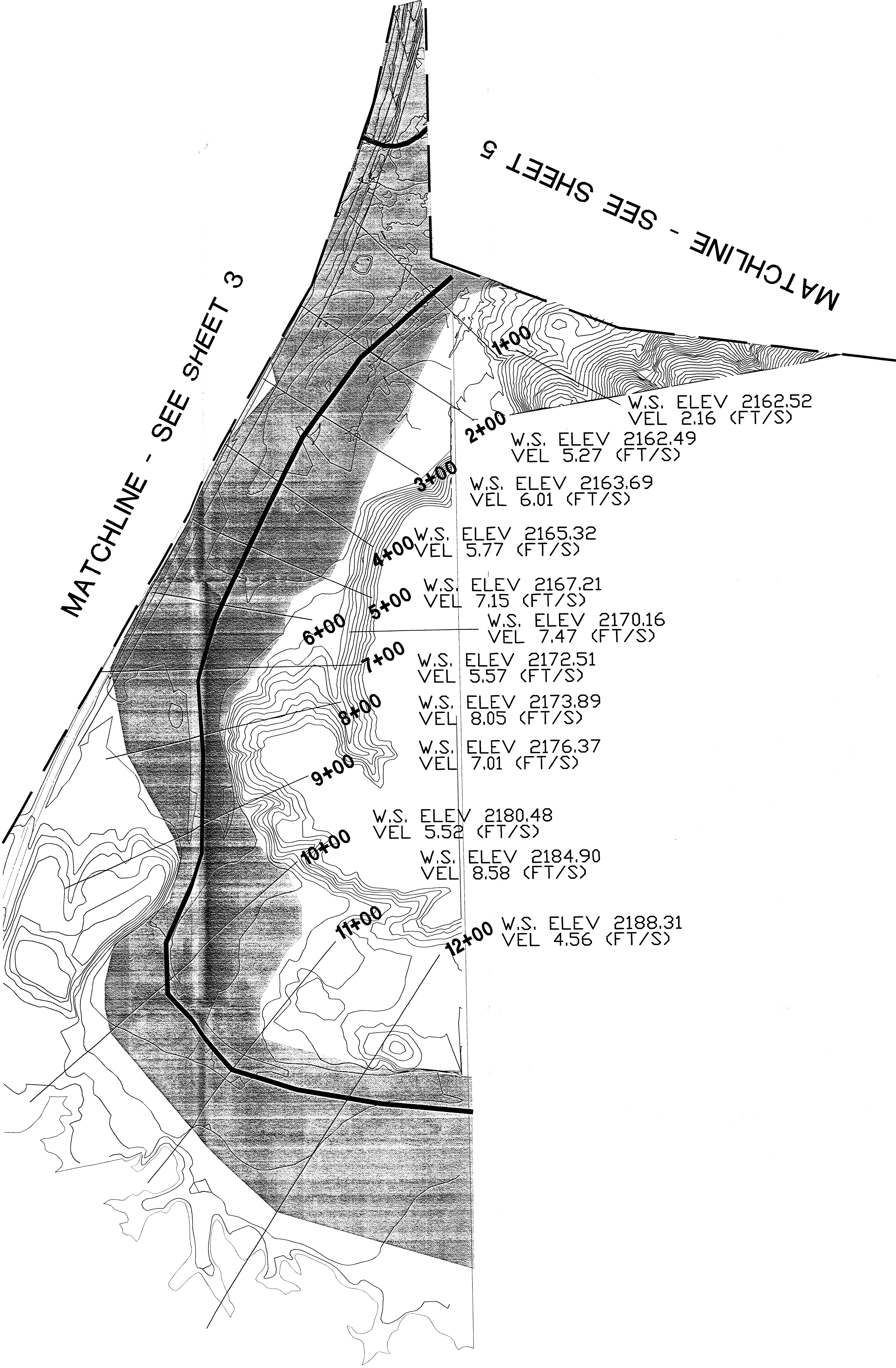
— COUNTER LINE 5' INTERVAL

SHEET 4 OF 5

Carter Burgess
Consultants in Planning, Engineering,
Construction Management, and Related Services
8885 Bermuda Road 89119
Las Vegas, Nevada
(702) 898-6400 Fax (702) 898-6464

MATCHLINE - SEE SHEET 3

MATCHLINE - SEE SHEET 5



PAHRANAGAT WASH
EXISTING CONDITIONS

MATCHLINE - SEE SHEET 3

PAHRANAGAT WASH
EXISTING CONDITIONS

W.S. ELEV 2162.53
VEL 1.25 (FT/S)

W.S. ELEV 2162.51
VEL 1.26 (FT/S)

W.S. ELEV 2162.49
VEL 1.51 (FT/S)

W.S. ELEV 2162.46
VEL 1.75 (FT/S)

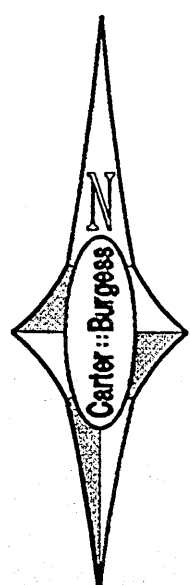
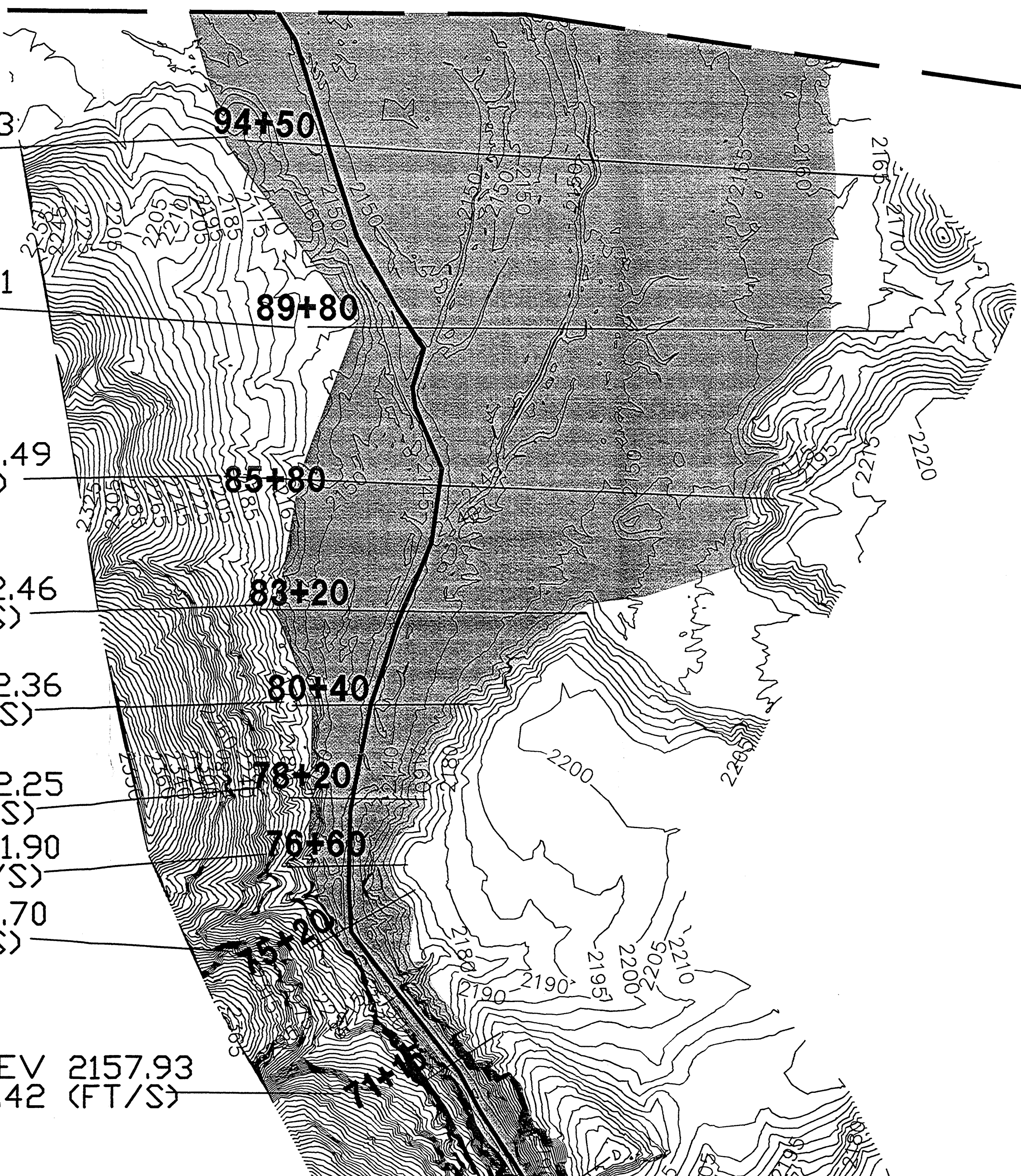
W.S. ELEV 2162.36
VEL 2.82 (FT/S)

W.S. ELEV 2162.25
VEL 3.54 (FT/S)

W.S. ELEV 2161.90
VEL 5.49 (FT/S)

W.S. ELEV 2161.70
VEL 6.16 (FT/S)

W.S. ELEV 2157.93
VEL 14.42 (FT/S)



WATER SURFACE

2+00 STATION NUMBER

STATION LINE

COUNTUR LINE 5' INTERVAL

SHEET 5 OF 5

Carter-Burgess
Consultants in Planning, Engineering,
Construction Management, and Related Services
6865 Bermuda Road
Las Vegas, Nevada 89119
(702) 898-5400 Fax (702) 898-5464