REMEDIAL ACTION PLAN
BENTON BURN SITE
ESCONDIDO, CALIFORNIA

PREPARED FOR:

CALIFORNIA INTEGRATED WASTE MANAGEMENT BOARD

URS PROJECT NO. 17326074.10003

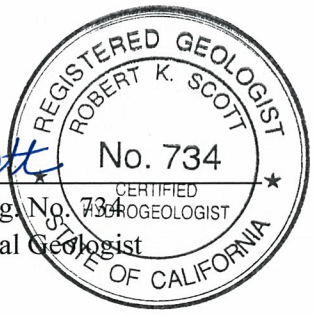
OCTOBER 5, 2009

FINAL

FINAL REMEDIAL ACTION PLAN
BENTON BURN SITE
SWIS NO. 37-CR-0008
ESCONDIDO, CALIFORNIA

Prepared for
California Integrated Waste Management Board
101 I Street
Sacramento, CA 95814

URS Project No. 17326074.10003



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October 5, 2009

Mr. Wes Mindermann
California Integrated Waste Management Board
1001 I Street, MS #10A-1
Sacramento, CA 95812-4025

Subject: Final Remedial Action Plan
Benton Burn Site
SWIS No. 37-CR-0008
Escondido, California
URS Project No. 17326074.10003

Dear Mr. Mindermann:

URS Corporation Americas (URS) is pleased to provide the California Integrated Waste Management Board (CIWMB) this final Remedial Action Plan for the Benton Burn Site, located in Escondido, California. The RAP includes the results of additional sampling conducted by Ninyo & Moore, summarized in a report dated May 29, 2009 and the results of laboratory analyses conducted by EXCELCHEM Environmental Labs, dated June 10, 2009. The RAP also addresses comments provided by the Department of Toxic Substances Control (DTSC) that appear in a letter dated April 3, 2009. The RAP has been prepared in general accordance with DTSC's RAP Policy, document EO-95-007-PP dated November 16, 1995. Our professional judgments and opinions appearing in the RAP are based on the findings of an investigation conducted at the site that is described in a report by the CIWMB that is titled, "Final Report, Site Investigation, Benton Dump, Escondido, California", dated May 31, 2007, the information noted above, and our review of other documentation provided by the San Diego County Department of Environmental Health, Solid Waste Local Enforcement Agency (LEA). Our services were performed in accordance with Standard Agreement IWM07035 with the CIWMB for Engineering Services for Landfill, Disposal Site, and Waste Tire Site Remediation, executed on June 24, 2008, Work Order No. F2 and F2a dated November 26, 2008 and September 3, 2009, respectively. If you have any questions, please give us a call.

Sincerely,

URS CORPORATION

Robert K. Scott

Robert K. Scott, P.G., C.Hg.
Registration No. 734
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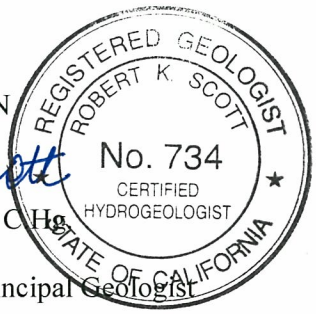

cc: Ms. Melissa Porter, County of San Diego Solid Waste Local Enforcement Agency

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COMMENTS ON DRAFT REMEDIAL ACTION PLAN, MARCH 12, 2009 BENTON BURN DUMP SITE, ESCONDIDO, CALIFORNIA
DTSC LETTER OF APRIL 3, 2009

DEPARTMENT OF TOXIC SUBSTANCES CONTROL	
COMMENTS	**RESPONSE**
1. We were not provided with the report prepared by the California Integrated Waste Management Board (CIWMB) titled, "Final Report, Site Investigation, Benton Dump, Escondido, California," dated May 31, 2007. However, this report concludes that the site fails to meet the following requirements: • The site is not secured. • Burn ash-containing waste is present on the ground surface in many locations; therefore, the site fails to comply with requirements for grading of fill surfaces. • The presence of glass and debris on the ground surface is a threat to human health both as a physical and chemical hazard, as the site is not maintained. • The exposed burn ash-containing wastes fail to meet the requirements for drainage and erosion control. The investigation indicates that the site does not meet the state minimum standards (SMS). We concur with these conclusions.	None.
The Draft RAP indicates it was prepared in general accordance with the process described in DTSC's "Remedial Action Plan (RAP) Policy," (EO-95-007-PP), dated November 16, 1995 and to comply with state minimum standards appearing in the applicable Articles and Sections of California Code of Regulations Division 2, Title 27, Chapter 3 and Subpart 4 related to: site security, grading of fill surfaces (cover), site maintenance, drainage and erosion control and gas monitoring during closure and post closure. We understand that the CIWMB, along with the County of San Diego Solid Waste Local Enforcement Agency (LEA) are the lead regulatory agencies for this site.	None.
2. We were not provided with project documents that would be necessary to comply with the California Environmental Quality Act (CEQA). We note that Section 4 indicates that it may be possible to complete the remedial activity under a Notice of Exemption. In accordance with the DTSC RAP Policy, a draft RAP is circulated for review concurrently with the applicable CEQA document(s).	The CIWMB is not implementing the RAP. The RAP may be implemented by the property owners. Therefore CEQA documentation is not provided at this time.

COMMENTS ON DRAFT REMEDIAL ACTION PLAN, MARCH 12, 2009 BENTON BURN DUMP SITE, ESCONDIDO, CALIFORNIA
DTSC LETTER OF APRIL 3, 2009

DEPARTMENT OF TOXIC SUBSTANCES CONTROL	
COMMENTS	**RESPONSE**
3. We note that additional sampling is proposed to further delineate the extent of the burn ash-containing wastes and determine whether the wastes are hazardous. We recommend that the results be included and addressed in the final RAP since the area of proposed excavation and capping may change based on the sampling results.	The additional sampling was conducted in May 2009 and the results are included in the Final RAP in Section 2.4. The additional sampling was conducted to identify whether lead is present in soil within 2 feet of the ground surface at concentrations above the cleanup objective in the western portion of the burn site footprint. The objective was not specifically to identify if the soil is hazardous. A copy of the laboratory analytical report has been included as Appendix A.
4. We note that the parcel number (APN 224-190-42) identified in Section 1.1.1 is not the same as that listed in the Executive Summary. Also, please identify parcel number 224-190-47 on the figures. We note that parcel number 224-190-52 is shown, but this is not one of the three mentioned in the text.	The APN has been corrected and is included on the figures.
5. The summary of site risks, described in Section 3, should include a more detailed discussion of complete and potential exposure routes, quantify the human health risk, and describe any ecological risk associated with this site.	It is recognized that there is a level of health risk based on the current conditions at the site. Both human health and ecological risk will be mitigated through implementing the alternative to consolidate and cap burn ash at the site. There are no aquatic habitats on site as the drainage is dry except during occasional rain events. Lead and other metals in burn ash are of low solubility and are not likely to be bioavailable. Therefore, the potential ecological risk at the site is relatively low.
6. The text, Section 4.2, indicates that a "flag" is currently on one of the properties and that another should be initiated for another. It is not clear whether these "flags" are equivalent to formal deed restrictions attached to the property deed and recorded by the County of San Diego. Deed restrictions are necessary since burn ash-containing wastes may remain on the site following remedial activities.	The “flag” is filed with the County Building Department and limits subsurface construction activities on each property.
7. Please clarify whether all of the activities described in Section 4.2.2 (such as the additional sampling activities and the placement of a geotextile cap) would be performed by the property owners or the CIWMB and/or LEA.	The sampling activities have been completed by the CIWMB and the results are provided in Section 2.4. For clarification, the geotextile serves as a delimiter marking the depth of burn ash-containing materials and is not a cap. The clean soil placed above the geotextile will serve as the cap. Implementation of the corrective action is likely to be done by others and not the CIWMB or LEA.

COMMENTS ON DRAFT REMEDIAL ACTION PLAN, MARCH 12, 2009 BENTON BURN DUMP SITE, ESCONDIDO, CALIFORNIA
DTSC LETTER OF APRIL 3, 2009

DEPARTMENT OF TOXIC SUBSTANCES CONTROL	
COMMENTS	**RESPONSE**
8. We recommend that the burn ash-containing wastes not be placed and capped within the 100-year flood plain.	Burn ash containing materials are already present in this very limited area that drains a very small watershed (approximately 60 acres). Placement of a geotextile and gravel in this area will limit the potential for burn ash to be mobilized during infrequent storm events. The condition of the site will be monitored by the County LEA following implementation of the remedial alternative in accordance with Title 27. If erosion of the cap or a breach is identified, it will be repaired.
9. The imported fill soil should be tested to verify it is "clean". Also, confirmation samples should be collected following soil excavation.	Imported fill will be analyzed to confirm that it does not contain constituents above applicable California Human Health-based Screening Levels (CHHSLs) and Preliminary Remediation Goals (PRGs) in accordance with DTSC guidance. This is noted in the text for Alternatives 2 and 3. Because burn ash will not be removed from any portion of the footprint in entirety for Alternative 2, no confirmation sampling is anticipated. However, confirmation sampling will be conducted as noted for Alternative 3, since it would be necessary to confirm that all burn ash-containing soil above the cleanup objectives had been removed.
10. It is not clear why Alternative 3 would require a construction storm water pollution prevention plan (SWPPP), but Alternative 2 would not.	Alternative 2 disturbs an area that will be less than 1 acre. A construction SWPPP is required for sites greater than 1 acre. If Alternative 3 were implemented, the area disturbed would be greater than 1 acre and a construction SWPPP would be needed.
11. Please describe in Section 4.3.3 the controls and how they will mitigate potential health risks associated with breaching the cap.	The text in Section 4.3.3 has been revised to address this comment.
12. Please describe how the burrowing of animals around and beneath the proposed cap will be prevented and/or controlled.	The degree of burrowing will be monitored by the LEA during its monitoring of the site. If there is a high degree of burrowing, additional action will be implemented to control this activity. The action could include rodent control.
13. The title for Table 5 should be checked for accuracy.	The heading for Table 5 has been revised accordingly.

COMMENTS ON DRAFT REMEDIAL ACTION PLAN, MARCH 12, 2009 BENTON BURN DUMP SITE, ESCONDIDO, CALIFORNIA
DTSC LETTER OF APRIL 3, 2009

DEPARTMENT OF TOXIC SUBSTANCES CONTROL	
COMMENTS	**RESPONSE**
14. Please provide the basis and rationale for relaxing the universal treatment standard by a factor of ten (10) as identified in Table A-1 of Appendix A.	Statement has been revised.
15. The existence of critical habitat in the immediate vicinity of the site should be verified and evaluated (Table A-3 of Appendix A).	An evaluation of critical habitat will be done prior to any remedial action.
16. The cost estimate (Table B-3 of Appendix B) should include: security, fencing, and signage. Also, we note that Section 5 of Appendix C recommends the use of a minimum gravel diameter of 1 to 2-inches rather than the listed 3/4-inch, and the recommended use of larger rock (> 12-inches) is not included.	The inconsistencies between the cost estimate and Appendix C have been corrected.
17. The hydrological analysis should consider the more conservative 24-hour event scenario.	Per San Diego County Hydrology Manual recommendations, we used the Modified Rational Method with a 6-hour storm because the size of the watershed is only approximately 60 acres. The Rational Method (which uses the 6-hour storm) is recommended to be used for drainage areas covering up to 1 square mile (640 acres). The Unit Hydrograph Method that might utilize a 24-hour storm is for watersheds of 640 acres and greater. Therefore, the 24-hour storm was not utilized.

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Appendix C	Estimated Costs for Alternatives
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µg/m^3	micrograms per cubic meter
ARARs	Applicable Relevant and Appropriate Requirements
ASTM	American Society of Testing and Materials
bgs	Below the ground surface
BMPs	Best Management Practices
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CHHSL	California Human Health Screening Level
City	City of Escondido
CIWMB	California Integrated Waste Management Board
COPCs	Chemicals of potential concern
DEH	San Diego Coutny Department of Environmental Health
DI	Deionized
dioxin	Tetrachlordibenzo-p-dioxin
DTSC	Department of Toxic Substances Control
EPA	California Environmental Protection Agency
H:V	horizontal:vertical
HASP	Site-specific Health and Safety Plan
HOA	Homeowner's Association
LEA	Local Enforcement Agency
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
mg/m^3	milligrams per cubic meter
mpg	miles per hour
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOE	Notice of Exemption
NPL	National Priorities List
O&M	Operation and Maintenance
OCPs	Organochlorine pesticides
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated biphenyls
PEL	Permissible Exposure Limit
PM_{10}	Particulate matter less than 10 µm in diameter
PNAs	Polynuclear aromatic hydrocarbons
ppt	parts per trillion
PRG	Preliminary Remediation Goal
RAOs	Remedial Action Objectives
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
SBBM	San Bernardino Base Meridian
SMS	state minimum standards

STLC	Soluble Threshold Limit Concentration
SWPPP	Storm Water Pollution Prevention Plan
TCLP	Toxicity Characterisztic Leaching Procedure
TEQs	Toxicity Equivalent Quotients
the site	Benton Burn Site
TTLC	Total Threshold Limit Concentration
U.S. EPA	United States Environmental Protection Agency
URS	URS Corporation Americas
USA	Underground Service Alert
WET	Waste Extraction Test

EXECUTIVE SUMMARY

This Remedial Action Plan (RAP) has been prepared by URS Corporation Americas (URS) for the California Integrated Waste Management Board (CIWMB) for the former Benton Burn Site (the site) located near the intersection of Still Water Glen and David Glen in Escondido, California (see Figure 1). This RAP has been prepared to comply with state minimum standards (SMS) appearing in the applicable Articles and Sections of California Code of Regulations (CCR) Division 2, Title 27, Chapter 3 and Subchapter 4 related to: site security, grading of fill surfaces (cover), site maintenance, drainage and erosion control and gas monitoring during closure and post closure. It has also been prepared in general accordance with the process described in, "Remedial Action Plan (RAP) Policy", document EO-95-007-PP issued by the California EPA/Department of Toxic Substances Control (DTSC), dated November 16, 1995.

This RAP identifies alternatives that will be implemented to remediate areas where waste containing burn ash was identified in soil at the site. The findings of a previous investigation conducted by the CIWMB in 2007, recent additional sampling and analyses conducted in May 2009, and other sampling information provided by the San Diego County Solid Waste Local Enforcement Agency (LEA) serve as a basis for this RAP.

The site is located approximately 2 miles northwest of downtown Escondido, west of Interstate Highway 15 (I-15) near the intersection of Still Water Glen and David Glen in the unincorporated portion of the County of San Diego and the City of Escondido. The site lies primarily in a ravine where the surrounding areas have been developed with residences. Based on information appearing in the CIWMB report, the former burn site is located on three parcels. One parcel is undeveloped, and part of a subdivision belonging to the Country Club Homeowners Association (HOA; APN 224-163-42). The two other parcels are residential properties owned by Jesse and Charlene Longacre (APN 224-190-36) and Joel and Kathie Phillips (APN 224-190-47). The Longacre and Phillips properties are located at 2346 and 2374 Sleepy Hill Lane, respectively.

Samples of fill, native soil and burn ash-containing materials were analyzed for the chemicals of potential concern (COPCs) associated with burn ash. These included lead and other metals and organic compounds such as polynuclear aromatic compounds (PNAs), organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs) and dioxins and furans. The majority of the samples were analyzed for metals and a smaller subset was analyzed for the organic compounds. In general, lead was found to be present at concentrations that would characterize the materials as California hazardous. In addition, lead concentrations were present in some samples above its residential California Human Health Screening Level (CHHSL). Select samples were also subjected to the Waste Extraction Test (WET), the Toxicity Characteristic Leaching Procedure (TCLP) and the Deionized Water (DI) WET for lead and other metals. Copper was found to exceed regulatory limits in one sample to characterize the materials as California Hazardous. None of the TCLP results indicated that the burn ash-containing waste is a Resource Conservation and Recovery Act (RCRA) hazardous waste. The DI WET results indicate the lead present in the soil does not exceed the Soluble Threshold Limit Concentration (STLC) of 5 mg/l. As such, this indicates that the lead present in the soil/waste is of low solubility and does not pose a significant threat to groundwater quality. This is supported by similar results at other burn sites investigated throughout California.

Additional sampling and analyses were conducted in May 2009 by Ninyo & Moore in the western portion of the burn site footprint to refine the extent of the area where burn ash is present at depths shallower than 2 feet bgs. Five samples collected from four of the 11 borings contained lead above the CHHSL of 150 mg/kg. None of the samples analyzed contained lead above the TTLC regulatory limit, but eight samples contained lead at concentrations above 10 times its STLC regulatory limit (50 mg/kg). Of the eight samples subjected to the DI WET, none contained lead above the STLC regulatory limit of 5 mg/l.

This RAP has been prepared to address burn ash-containing waste present within the burn site footprint that is located on the three parcels previously indicated. Based on the investigation conducted by the CIWMB, the burn site occupies approximately 1 acre. Remedial action alternatives were individually evaluated based on the nine criteria established under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (U.S. EPA 1990) as modified by the State of California as described below. The three remedial action alternatives evaluated included:

- Alternative 1 – No Action.
- Alternative 2 – Consolidation, Capping and Institutional Controls (Consolidation and Capping).
- Alternative 3 – Excavation and Off-site Land Disposal and Fill Replacement (Excavation).

The No Action alternative must be considered for baseline comparison to the other alternatives. The Excavation alternative involves the excavation of burn ash-containing waste soil within the site footprint and backfilling with clean soil to an acceptable grade. The Consolidation and Capping alternative considers consolidating burn ash-containing waste within the burn site footprint and capping it with clean soil, asphalt or concrete. The thickness of the soil surface cap will be a minimum of 2 feet to meet the SMS. Since the burn ash-containing waste will remain on the site, there will be a requirement that activities that could disturb and expose receptors to the underlying burn ash-containing waste be restricted. There is currently a flag on the Longacre and Phillips properties at the County Building Department (Department of Planning and Land Use), and one should be initiated for the HOA property with the City of Escondido Building Department. Based on the results of investigation conducted by the CIWMB and the evaluation of remedial alternatives, the preferred remedy is Consolidation and Capping. The area that will require this action covers less than 1 acre.

SECTION ONE

SECTION 1 INTRODUCTION

This Remedial Action Plan (RAP) has been prepared by URS Corporation Americas (URS) for the California Integrated Waste Management Board (CIWMB) for the former Benton Burn Site (the site) located near the intersection of Still Water Glen and David Glen in Escondido, California (see Figure 1). This RAP has been prepared in general accordance with the process described in "Remedial Action Plan (RAP) Policy", document EO-95-007-PP issued by the California EPA/Department of Toxic Substances Control (DTSC), dated November 16, 1995 and to comply with state minimum standards (SMS) appearing in the applicable Articles and Sections of California Code of Regulations (CCR) Division 2, Title 27, Chapter 3 and Subchapter 4 related to: site security, grading of fill surfaces (cover), site maintenance, drainage and erosion control and gas monitoring during closure and post closure.

This RAP identifies alternatives that will be implemented to remediate areas where waste containing burn ash was identified in soil at the site. Remedial action alternatives were individually evaluated based on the nine criteria established under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (U.S. EPA 1990) as modified by the State of California. The findings of a previous investigation conducted by the CIWMB in 2007, additional sampling and analyses conducted in May 2009, and other sampling information provided by the San Diego County Solid Waste Local Enforcement Agency (LEA) serve as a basis for this RAP.

1.1 SITE DESCRIPTION AND BACKGROUND

The CIWMB and LEA have conducted previous investigations to evaluate the condition of the site and identify whether further action is needed to comply with the SMS for former landfill sites. The site is located approximately 2 miles northwest of downtown Escondido, California at 33.16532° North latitude, 117.11882 West longitude. The former burn dump operated in the eastern 300 feet of Lot 1, Section 6 and part of Lot 4 Section 5 of Township 12 South, Range 2, San Bernardino Base Meridian (SBBM). The site occupies approximately 1 acre near the intersection of Still Water Glen and David Glen. Ground surface elevations at the site generally range from approximately 820 to 870 feet above Mean Sea Level datum (MSL) and topography is shown on the map provided as Figure 2. The site lies within a ravine that serves as a drainage for a very small watershed of approximately 60 acres. There is no perennial stream in the ravine; however, some surface flow was observed during a site visit during a major rainfall event in December 2008.

1.1.1 Current Land Use/Property Ownership

The land uses for areas considered in this RAP are primarily open space and residential. One parcel is owned by the Country Club Woods Homeowner Association (APN 224-163-42) and is maintained as open space. The two other parcels are privately owned by Jesse and Charlene Longacre (APN 224-190-36) and Joel and Kathie Phillips (APN 224-190-47). The Longacre and Phillips properties are located at 2346 and 2374 Sleepy Hill Lane, respectively. The perimeter of the ravine have been used for dumping of residential green waste (brush and other debris). Access to the site by trespassers is unrestricted.

1.1.2 Future Land Use

The current land uses of the site will remain in the future.

1.1.3 Surrounding Land Use

Adjacent property uses are primarily single-family residential. The area immediately west of the site is undeveloped and part of open space that is part of the Escondido Master Plan.

1.2 SITE HISTORY

URS reviewed the site investigation report prepared by the CIWMB in May 2007 and other documents provided by the LEA. The summary below has been prepared based on this information that has been provided to URS.

The Benton Dump was owned and operated by Mr. Jesse Benton from 1948 to 1953. Eugene W. and Beulah E. McFeeters owned and adjacent property and assisted Mr. Benton in operating the dump. The site reportedly accepted residential and commercial waste. The volume of waste accepted at the dump is not known. Information appearing in a Garbage and Trash Disposal Survey for the City of Escondido (City) indicated that approximately 84 tons of trash and rubbish was collected on a weekly basis. The waste was disposed in a ravine where it was burned.

Mr. Benton leased the dump to the County of San Diego for a short period between January and July 1950, when the lease was terminated. The dump remained open until May 1953, when it was ordered closed by a judgment through an injunction of the State Superior Court (*County of San Diego*, Case 165725). The site was ordered closed as the smoke and odors from burning refuse were considered a public nuisance.

The area to the south of the former burn dump was developed with a residential development sometime in the 1980s. The site has remained relatively undeveloped as part of two residential properties and a portion of open space associated with the residential development.

1.3 PURPOSE

The primary objective of this RAP is to provide basis for an evaluation and selection of remedial alternative(s) that will be implemented at the site to meet the SMS for former landfill sites, and also reduce the potential for human exposure and health risk related to burn ash-containing waste. The primary constituent of concern in burn ash-containing waste is lead along with other metals (arsenic, antimony, cadmium and copper) and organic constituents [polynuclear aromatic hydrocarbons (PNAs) and dioxins and furans]. Each of these other constituents is collocated with the lead in the burn ash-containing waste and therefore, will be addressed similarly to mitigate possible human health risk. In addition, lead concentrations were present in the waste at levels that would indicate that it could be considered a California hazardous waste.

SECTION TWO

SECTION 2 PREVIOUS INVESTIGATIONS

URS reviewed the site investigation report prepared by the CIWMB in May 2007 and other documents provided by the LEA. The summary below has been prepared based on this information that has been provided to URS.

2.1 SOIL INVESTIGATION: SEPTEMBER 1982

In September 1982, a preliminary soil investigation was conducted by Soil and Material Testing Laboratory for the construction of a proposed subdivision on Escondido Tract 533, which includes the Homeowner's Association (HOA) and Lot 42 on the south and west of the burn dump. Ten test pits were excavated to a depth of approximately 11 feet. Based on the logs, no fill materials were encountered and the logs did not indicate any characteristics that were suggestive of the presence of burn ash-containing soil.

2.2 DEH STUDY/SITE RECONNAISSANCE: 1995

In 1995, the San Diego County Department of Environmental Health (DEH) prepared a report of a desktop study, similar to a Phase I Environmental Site Assessment (Phase I ESA). It summarized the results of a site visit, research of available data and documents including topographic maps and a San Diego Superior Court Case (#165725). The extent of the former burn site was estimated based on ground surface observations of burn ash indicators (dark soil, melted glass). It also cited the presence of a stream bed in the bottom of the ravine.

In March 1999, the LEA conducted soil sampling of the burn dump as there were food crops observed growing in burn ash-containing soil during a site visit. A children's play area was also present in this area. Seven surface samples were collected and analyzed by the LEA for Title 22 metals by various U.S. Environmental Protection Agency (U.S. EPA) methods to identify whether the levels of constituents in the soil were present at levels that could be a threat to public health and safety. Of the 7 samples analyzed, two contained lead at concentrations that are above the current California Human Health Screening Level (CHHSL) of 150 milligram per kilogram (mg/kg) for lead. Sample A3 was one of these samples that was collected in the garden area. The concentrations of lead detected in samples A3 and A4 were 1,240 and 490 mg/kg. Sample A3 contained lead at a concentration above the Total Threshold Limit Concentration (TTLC) of 1,000 mg/kg indicating that the materials could be considered a California hazardous waste. Because the samples were present on the ground surface and the site was unsecured, the LEA recommended that some corrective action, such as consolidation and capping be conducted to obtain compliance for the site and reduce potential for exposure to the burn ash-containing material.

In March 2003, The DTSC conducted a preliminary assessment for the U.S EPA under Section 104 (CERCLA; also known as Superfund). The assessment was to identify whether the site qualified for placement on the National Priorities List (NPL).

Nine surface soil samples were collected and analyzed for Title 22 metals, four of which were collected outside of the footprint of the former burn site that were used to evaluate background metals concentrations. Lead was detected in three samples collected within the burn site footprint (SS-1-0, SS5-0

and SS-6-0) at concentrations of 350, 440 and 100 mg/kg. The concentrations of lead detected in samples SS-1-0 and SS-5-0 were above the current residential California Human Health Screening level (CHHSL) of 150 mg/kg established for lead. Samples were also analyzed for dioxins and furans. Reported 2, 3, 7, 8-Tetrachlordibenzo-p-dioxin (dioxin) Toxicity Equivalent Quotients (TEQs) ranged from 7.47 to 19 parts per trillion (ppt). The current CHHSL for dioxin TEQ is 4.6 ppt. Based on the sample results, it was found that the site did not qualify for further assessment under CERCLA.

2.3 CIWMB INVESTIGATION: 2007

At the request of the LEA, the CIWMB conducted a site investigation in 2007. There were 26 borings advanced and three surface soil samples collected during the investigation. In addition, a geophysical investigation was conducted to assist in identifying the extent of the former burn site. In addition to soil sampling and analyses, methane gas and radiation surveys were conducted at the site during the investigation. No methane was detected where monitored at a limited number of boring locations. Radiation monitoring results indicated that levels were within background. Organic vapors were also monitored during the field program and were not present at levels of concern.

Of the 26 borings advanced, 20 were accomplished using a direct-push rig and nine were completed with a hand auger. Samples were collected and analyzed from the waste and underlying native materials. The analyses were conducted by Creek Environmental Laboratories for Title 22 metals, PNAs, petroleum hydrocarbons organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs) and metals by various leaching procedures. Tables 1 through 5 summarize the results of the analyses.

As a result of the investigation, it was found that site fails to meet the following requirements:

- The site is not secured.
- Burn ash-containing waste is present on the ground surface in many locations; therefore, the site fails to comply with requirements for grading of fill surfaces.
- The presence of glass and debris on the ground surface is a threat to human health both as a physical and chemical hazard, as the site is not maintained.
- The exposed burn ash-containing wastes fail to meet requirements for drainage and erosion control.

The investigation indicates that less than one acre of the site does not meet the SMS. In addition, sample analytical results indicated the following with respect to hazardous waste and human health screening criteria:

Waste Characterization

Of the samples and constituents analyzed, only some specific metals were present at concentrations that indicated that the burn ash-containing waste could be considered hazardous waste. Four contained lead at levels above the TTLC of 1,000 mg/kg indicating that the waste containing material could be considered a non-Resource Conservation and Recovery Act (RCRA) hazardous waste. Samples were additionally subjected to the Waste Extraction Test (WET) and compared to the Soluble Threshold Limit Concentration (STLC) regulatory limits in instances where a TTLC metal concentration exceeded 10

times the respective STLC regulatory limit. There was one sample that contained TTLC barium, two that contained TTLC chromium, five that contained TTLC copper, 31 samples that contained TTLC lead and two samples that contained TTLC zinc at concentrations above 10 times their respective STLC regulatory limits. These samples (with the exception of those containing lead) were subjected to the WET and analyzed. The results for STLC barium, chromium and zinc were all below their respective regulatory limits. One sample contained copper at a concentration above its STLC of 25 mg/l. The two samples containing the highest detected lead concentrations were also subjected to the Toxicity Characteristic Leaching Procedure (TCLP) and analyzed for lead. None of the eight RCRA metals were present at concentrations above their regulatory limits. Based on these results, the burn ash-containing waste does not appear to be RCRA hazardous. Similar to investigation results at other sites, burn ash-containing waste at the site is primarily a non-RCRA (California) hazardous waste.

Human Health Screening

The data from the investigation were compared to residential CHHSLs. Of the metals present, lead concentrations in the samples were most frequently detected above its CHHSL of 150 mg/kg (20 samples). Arsenic was also detected above its residential CHHSL of 0.37 mg/kg; however, the background concentration of arsenic in native soil from the site appears to range from approximately 1 to 2 mg/kg which is above the CHHSL. Antimony was present in one sample above its residential CHHSL of 30 mg/kg. None of the other metals were present in soil at the site at concentrations above their respective residential CHHSLs.

Of the other constituents analyzed, low levels of petroleum hydrocarbons were detected in some samples. There are no human health screening levels for petroleum hydrocarbons. None of the PNAs or PCBs was present at detectable levels; therefore, none contained these constituents at concentrations that was above its respective residential CHHSL. Low levels of some OCPs were detected in some of the samples analyzed, but the concentrations were not above their respective residential CHHSLs.

Leachability

The samples containing lead at concentrations above 10 times the STLC were also subjected to the WET using a deionized water extractant. This is typically conducted to evaluate the potential leachability of the burn ash-containing waste and its ability to affect groundwater quality. The concentrations in the extract resulting from the extraction are compared the STLC regulatory limit. The deionized (DI) WET lead concentrations ranged from not detected (<0.04 mg/l) to 1.4 mg/l, well below the STLC regulatory limit of 5 milligrams per liter (mg/l). Based on the results, it appears that there is a low likelihood that the lead in the burn ash-containing waste has the potential to affect groundwater quality.

2.4 ADDITIONAL SOIL SAMPLING: 2009

Ninyo & Moore conducted additional soil sampling on behalf of the CIWMB. Based on URS' review of the existing data, additional sampling and analyses were recommended in the western portion of the burn site footprint to refine the extent of the area where burn ash is present at depths shallower than 2 feet bgs. The additional sampling was conducted in 11 shallow borings on May 19, 2009. The findings of Ninyo & Moore's additional sampling were summarized in a report dated May 29, 2009 that was submitted to

the CIWMB. Analyses were conducted by EXCELCHEM Environmental Labs, a state-certified laboratory located in Rocklin, California. Since the laboratory report was not included in the Ninyo & Moore report, it is provided in Appendix A.

The borings were advanced using a hand auger to a depth of 2 feet bgs or refusal as directed by the CIWMB. Samples were analyzed for lead by EPA Method 6010B/6020. A subset of the samples was subjected to the DI WET and analyzed for lead by the method previously indicated. Analytical results are included in Tables 1 and 5. Five samples collected from four of the 11 borings contained lead above the CHHSL of 150 mg/kg. None of the samples analyzed contained lead above the TTLC regulatory limit, but eight samples contained lead at concentrations above 10 times its STLC regulatory limit (50 mg/kg). Of the eight samples subjected to the DI WET, none contained lead above the STLC regulatory limit of 5 mg/l. The extent of the burn site footprint where burn ash-containing materials are present at depths less than 2 feet, based on the results of the additional sampling and analyses, is shown on Figure 2.

SECTION THREE

SECTION 3 SUMMARY OF SITE RISKS

Lead is typically the primary chemical of potential concern (COPC) in burn ash-containing waste that has the greatest potential to pose an adverse human health risk. The primary exposure pathways are through direct exposure by ingestion or inhalation. Other COPCs are collocated with lead such that receptors can be exposed to these through the same exposure pathways as lead. Eliminating complete exposure pathways between lead-containing burn ash and site occupants, users and workers and the surrounding community can mitigate the level of risk. Response actions that accomplish this include constructing a barrier, such as physical controls or removal.

There are no aquatic habitats on site as the drainage is dry except during short periods following occasional rain events. Lead and burn ash are of low solubility and are not likely to be bioavailable. Therefore, the potential ecological risk at the site is relatively low.

SECTION FOUR

SECTION 4 SUMMARY AND EVALUATION OF ALTERNATIVES

4.1 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are established to protect human health and the environment. RAOs focus on site-specific characteristics and may include site-specific media of concern, COPCs, exposure routes and receptors, acceptable contaminant level for each exposure route, and/or range of contaminant levels for each exposure route. For the Benton Burn Dump, the media of concern is limited to soil and the COPCs associated with burn ash-containing waste. Based on the results of the investigation conducted by the CIWMB, groundwater is not included in the RAOs as it is an incomplete exposure pathway. Surface water is a potential exposure pathway resulting in possible off site migration of burn ash-containing waste through sediment transport during storm events when it intermittently flows in the bottom of the ravine.

The cleanup objective for lead at residential sites is 150 mg/kg, based on the default input parameters to the LeadSpread 7.0 model. Figures 2 and 3 show the footprint of the burn site and the depth and thickness of materials that contain burn ash-containing waste. Cleanup levels for other collocated COPCs will be the residential CHHSLs, Preliminary Remediation Goals (PRGs), or background levels (in the case of arsenic), as appropriate. The cleanup levels apply to the upper 2 feet of soil below the ground surface, with lead serving as the surrogate.

The overall RAOs described in this RAP include the following:

- Perform a remedial action that results in a condition of the site that meets SMS appearing in the applicable Articles and Sections of CCR Division 2, Title 27, Chapter 3 and Subchapter 4 related to: site security, grading of fill surfaces (cover), site maintenance and drainage and erosion control.
- Limit the potential for exposure to burn ash-containing waste and the associated COPCs to property owners, users, maintenance workers, construction workers and community residents.
- Limit the potential for exposure to burn ash-containing waste through off-site migration via surface water sediment transport.

4.2 EVALUATION OF REMEDIAL ACTION ALTERNATIVES

There are several proven technologies that have been used to meet the SMSs and reduce potential human health risk associated with burn ash-containing waste materials throughout California by eliminating exposure pathways to receptors. As indicated in the CIWMB's LEA Advisory No. 56, risk can be mitigated through physical controls such as fencing, eliminating the burn ash exposure pathway through removal and or capping. Institutional controls are also needed in instances where burn ash-containing waste remains on a site. This typically includes maintaining the site in a condition that reduces the potential for human exposure and a restriction to use of the affected area, attached to the property deed so that future owners are aware of the site conditions. There is currently a flag on t the Longacre and Phillips properties at the County Building Department (Department of Planning and Land Use), and one should be initiated for the HOA property with the City of Escondido Building Department.

The three remedial action alternatives considered for this site include:

- Alternative 1 – No Action.
- Alternative 2 – Containment through Consolidation and Surface Cap and Institutional Controls (Consolidation and Capping).
- Alternative 3 – Excavation with Off-site Disposal, Fill Replacement (Excavation).

Each of these alternatives was individually evaluated based on the nine criteria established under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations, 300.400 *et seq.*) and modifications by the State of California. The NCP and CERCLA require consideration of the No Action alternative.

This section provides a description of each remedial alternative selected for evaluation for the site as a whole. Each alternative is considered individually and not comparatively. Rationale for the selection of each alternative for evaluation and a description of the technology as it applies to this site is also provided. This section also provides an evaluation of each remedial alternative compared to nine criteria defined in Section 300.430(e)(9)(iii) of the U.S.EPA or NCP (USEPA 1990) and modifications by the State of California. These criteria are identified and described as follows:

- Overall Protection of Human Health and the Environment – This criterion evaluates whether the remedial alternative provides adequate short- and long-term protection to human health and the environment.
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) – This criterion addresses whether or not a remedial alternative will meet Federal, State, and local environmental laws and regulations and guidelines. The ARARs are provided in Appendix B.
- Long-term Effectiveness and Permanence – This criterion addresses issues related to the management of residual risk remaining onsite after a remedial action has been performed and has met its objectives. The primary focus is on the controls that may be required to manage risk posed by treatment residuals and/or untreated wastes.
- Reduction of Toxicity, Mobility, or Volume – This criterion evaluates whether the remedial technology employed results in significant permanent reduction in toxicity, mobility, or volume of the hazardous substances.
- Short-term Effectiveness – This criterion evaluates the effects of the remedial alternative during the construction and implementation phase until remedial objectives are met. It accounts for the protection of workers and the community during remedial activities and environmental impacts from implementing the action.
- Implementability – This criterion evaluates the technical and administrative feasibility of the alternatives, as well as the availability of the necessary goods and services. This includes the ability to construct and operate an alternative; ability to obtain services and equipment, ability to monitor the performance and effectiveness of technologies; and ability to obtain necessary approvals and regulatory case closure from agencies, if applicable.
- Cost (30-year present worth) – This criterion involves estimation of capital, operation and maintenance cost (O&M) (30-year) and is based on a variety of information. The actual costs will depend on true labor and material cost, competitive market conditions, the final project scope, and the

implementation schedule. Cost does not include permitting and agency approvals that may be required to implement the alternative. A comparative summary and detailed breakdown of preliminary estimated costs for each alternative are provided in Appendix C.

- Regulatory Agency Acceptance – This criterion indicates whether, based on its review of the information, the applicable regulatory agencies would agree with the preferred remedial alternative.
- Community Acceptance – This criterion evaluates the degree to which it is perceived that a remedial alternative will address community concerns. Community acceptance will be evaluated through receipt of public comments.

4.2.1 Alternative 1 – No Action

As required by the NCP and CERCLA, the No Action alternative must be included to provide a baseline for comparisons among other remedial actions. This action includes no physical or institutional controls, no treatment of soil, and no monitoring. Consideration of this alternative with respect to the evaluation criteria is provided below.

Overall Protection of Human Health and the Environment

This alternative does not meet the RAOs or the overall protection of human health as there is no reduction in the potential human health risks in areas where burn ash-containing waste is present.

Compliance with ARARs

The No Action alternative does not comply with State and Federal requirements where burn ash-containing waste is present on the site.

Long-term Effectiveness and Permanence

The potential for exposure to surface soil would continue, and the long-term risks to park users, site workers and the community would be unchanged.

Reduction of Toxicity, Mobility, or Volume

The No Action alternative does not result in a reduction of toxicity, mobility, or volume of the COPCs present at the site.

Cost

There is no construction cost associated with the No Action alternative.

Short-term Effectiveness

The potential for exposure to surface soil would continue, and the short-term risks to residents, site workers and the community would be unchanged.

Implementability

The No Action alternative is implementable, but it does not meet the RAOs for areas where burn ash-containing waste are present on the site.

Regulatory Agency Acceptance

Since the No Action alternative does not address the evaluation criteria satisfactorily, it would not be acceptable to the regulatory agencies for areas where burn ash-containing waste are present on the site.

Community Acceptance

Community acceptance will be assessed during a public meeting.

4.2.2 Alternative 2 – Containment through Consolidation and Surface Cap and Institutional Controls

This alternative would consist of consolidating waste and capping the surface with an engineered soil cover. The cap could include clean soil to meet the SMS and minimize the potential for human exposure to burn ash-containing waste present on the ground surface and in shallow soil (less than 2 feet). In the areas where burn ash-containing waste is present, a suitable cap consisting of at least 2 feet of clean soil will be constructed. This alternative would be implemented by the property owners. The area of the site that does not meet the SMS and would be included in Alternative 2 covers less than 1 acre. A consolidation and capping plan and profile of this alternative is provided in Appendix E.

Burn ash-containing waste present near or at the ground surface on the steep side slopes of the ravine will be excavated (shown with red hatching on Figure E-1) so that the grade will be similar, once a 2-foot soil cap is placed in these areas. The excavated material will be spread thinly across the floor of the ravine (blue hatching, Figure D-1), where it will be capped with clean soil. Prior to excavation and placement of burn ash-containing materials, vegetation present in the areas where the remedial action will be conducted will be removed. Other areas along the eastern portion of the burn site on the Longacre Property may be spot excavated or covered with two feet of clean soil to meet the SMS (shown in yellow, Figure E-1). Excavated materials will be spread thinly on the floor of the ravine. Once the areas of burn ash have been excavated where it is shallower than 2 feet and placed in the ravine, the sides of the ravine will be backfilled with clean soil at no more than a 2:1 slope and compacted. The burn ash-containing waste on the floor of the ravine will be covered with a geotextile within the approximate area of the 100-year flood plain (blue hatched and yellow areas between the purple lines, Figure E-1). Two feet of clean soil will be placed above the waste placed on the floor of the ravine, with the exception of the width of the former stream channel and its floodplain. This area will be backfilled with 2 feet of rock and gravel, so that future storm flows will not result in the mobilization of sediment that could be carried downstream of the former burn site.

As a result of these earthmoving activities, the site would be regraded using track hoes and other relatively small construction equipment. Excavation will occur up to the brow ditch, but the structure will not be removed. Excavation would be conducted only that distance from the brow ditch where there is

little or no vegetation in the footprint. No confirmation sampling is anticipated following excavation for this alternative since the existing site footprint will be capped with a minimum of 2 feet of clean soil. There are no areas that will remain uncapped following excavation. The cap will consist of clean soil that would contain lead at concentrations below 150 mg/kg and other regulated chemicals at concentrations below their respective residential CHHSLs or PRGs. This will be confirmed by analytical testing that will be conducted in accordance with DTSC's guidance on analyzing imported fill soil. It is estimated that approximately 500 cubic yards of burn ash-containing soil will be removed and placed elsewhere within the former burn site footprint. Approximately 2,000 cubic yards (2,600 tons assuming 1.3 tons/cubic yard) of imported clean fill (soil and gravel) will be needed for the cap.

Fugitive dust can be generated during the handling of soil and burn ash-containing materials after it has been excavated or disturbed. Fugitive dust control measures will be implemented at the site to mitigate dust migration outside of the work area (exclusion zone) and off site; so that there is limited potential for exposure to site workers, visitors and residents in the neighborhood. Light spraying of soil with water during excavation and grading activities is an effective control measure that has been implemented during removal actions at other burn sites. Site activities are not likely to generate excessive fugitive dust and the potential for exposure to COPCs in burn ash is minimal provided that controls are implemented; however, laborers/construction personnel will be required to keep dust generation to a minimum. Potable water will be lightly sprayed at the time of excavation and grading to control dust. Dust control may be accomplished through use of a water truck or a spray nozzle, depending on the activity. The volume of water sprayed will not be such that it results in surface water runoff or standing water.

Airborne dust monitoring will be conducted by a contractor to verify and document dust suppression efforts described above. Air monitoring for total particulate concentrations will be conducted in the work zone to monitor worker exposure and downwind of daily excavation and grading activities along the site perimeter, to monitor potential fugitive particulate concentrations and dust suppression effectiveness. Periodic meteorological monitoring will be performed on-site away from trees, buildings, or other structures that could influence the measurements. Wind speed and wind direction will also be measured during excavation and grading activities using an anemometer.

The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for dust, or Particulates Not Otherwise Classified, is 15 milligrams per cubic meter (mg/m^3) for total particulates and 5 mg/m^3 for respirable dust. The OSHA PEL for lead in air of 0.05 mg/m^3. The action level for dust monitoring will be 50 micrograms per cubic meter ($\mu g/m^3$) (measured as the difference between the upwind and downwind monitoring stations).

Institutional controls are currently in place for the Longacre and Phillips properties. The existing institutional controls include provisions to limit the potential for future breaching of the cap and potential exposure of receptors to COPCs in burn ash-containing materials/waste. Use of the areas within the HOA affected by burn ash-containing waste would be limited to open space. Some type of institutional control is needed by the City of Escondido for the HOA property. In accordance with California Code of Regulations Title 27, future activities that could involve breaching of the cap and exposure to burn ash-containing waste would require LEA notification and oversight. A summary of the assessment of this alternative for each of the screening criteria is provided below.

Overall Protection of Human Health and the Environment

The overall protection of human health and the environment for containment treatments is good, provided that long-term monitoring and maintenance is conducted. Such monitoring and maintenance oversight would continue to be provided by the LEA.

Compliance with ARARs

There are several state and Federal regulatory requirements that could affect the implementation of this alternative (see Appendix B). Because the site is a former solid waste facility, it must comply with CCR Title 27. This will require regular monitoring, maintenance and reporting by the LEA or Regional Water Quality Control Board (RWQCB). The placement of the cap and grading activities would not require a Construction Storm Water Pollution Prevention Plan (SWPPP) because the affected area covers less than 1 acre. It is possible that the intermittent drainage could be considered Waters of the U.S. It may be possible to complete this remedial activity under a California Environmental Quality Act (CEQA) Notice of Exemption (NOE).

Long-term Effectiveness and Permanence

The installation of a cap would require long-term inspection and maintenance to meet ARARs and to provide long-term effectiveness. Periodic inspections for settlement, ponding of liquids, and erosion would be required. Additionally, precautions would have to be taken to ensure that the integrity of the cap is not compromised by land use activities. Based on these factors, the effort required ensuring long-term effectiveness is considered relatively low.

Reduction of Toxicity, Mobility, or Volume

Containment through capping would not lessen toxicity or volume of the COPCs, but would limit mobility through erosion and surface accessibility to receptors.

Cost

Containment/capping technologies are typically a low to moderate cost treatment group. For cover material located onsite, cost estimates for cut, fill and compaction range from $10 to $15 per ton depending on distance material is moved. Landfill caps are generally the least expensive way to manage human health and ecological risks effectively; however, burn ash-containing waste remaining onsite will require some type of institutional controls and long-term maintenance and monitoring that may result in significant long-term costs. A summary of the estimated costs to implement this alternative is presented in Appendix C, Table C-1.

Short-term Effectiveness

Potential short-term risks to onsite workers, public health, and the environment could result from dust or particulates that may be generated during these activities. The Consolidation and Capping alternative would involve only minor disturbance of the waste that could include the generation of fugitive dust

during placement of materials consolidated from other areas onsite and placement of the first lift of soil for the surface cap. Short-term risks can be effectively mitigated through the use of personal protective equipment for onsite workers and engineering controls, such as dust suppression and additional traffic and equipment operating safety procedures for protection of the surrounding community. The short-term risks associated with this alternative would be low to moderate.

Implementability

Capping is a relatively simple technology that is easily implemented and offers quick installation times. Due to the permanence of leaving the COPCs onsite, obtaining permits and regulatory approval can be difficult in some situations. There are no structures within the footprint that would need to be removed or that could complicate grading. A hydrology evaluation was conducted to evaluate whether changes to the geometry of the ravine resulting form consolidation, capping and grading could affect surface water flow downstream of the site during storm events.

The results of the study are provided in a report that is included in Appendix D. Based on our evaluation, the proposed Consolidation and Capping alternative should not affect surface water flow on up and downstream properties, provided that it is implemented as described in this RAP.

Regulatory Agency Acceptance

This alternative would be acceptable to the regulatory agencies, since it will meet the SMSs for landfill sites and it is a common practice to mitigate health risks associated with burn sites by creating an incomplete pathway for the potential exposure to COPCs. This remedial alternative will result in leaving the burn ash-containing waste onsite, and it also eliminates the potential for exposure to the community that could result from hauling the materials off site.

Community Acceptance

Community acceptance will be assessed during a public meeting.

4.2.3 Alternative 3 – Excavation with Off-site Land Disposal and Fill Replacement

This alternative would include excavating the burn ash-containing waste within the footprint of the former burn site until concentrations of lead are below unrestricted levels, transporting these materials to a permitted off-site disposal facility, and replacing the excavated soil with clean fill material of equal thickness. It is assumed based on the level of complexity and invasive nature of this alternative, its implementation would not be performed by the residents, but by subcontractors.

Based on the results of the investigation conducted by the CIWMB and other limited data, the burn ash is mixed with fill soil and occurs as thin discrete lenses in fill. However, it would be impractical to remove only those materials containing burn ash for disposal. As such, it is estimated that the total volume of burn ash-containing fill (including overburden) to be removed is approximately 7,500 cubic yards. It is possible that more or less soil could be placed on the site following excavation. It is possible that less soil may be needed to restore the ravine, as the final configuration will represent the pre-dumping natural topography. However, some grading and sloping of placed fill would be needed particularly along the

southern side slope of the ravine where there are residences in close proximity to this area. If fill is imported to the site to restore the site grade, it will be analyzed in accordance with DTSC's guidance for analyzing imported fill. Once placed, the backfill would be compacted and graded. Prior to excavation, brush within the affected areas would be removed.

Measures would be performed to control and monitor fugitive dust generated during excavation activities as previously described in Section 4.2.2. Also, excavated soil loaded into end dump trucks would be lightly sprayed with water to minimize dust and each truck would be tarped before leaving the site. Each truck would be observed for the presence of loose soil/debris and these materials would be removed prior to leaving the site.

During and following excavation, confirmation sampling would be conducted to document that the soil remaining in-place does not contain lead at concentrations above the residential CHHSL of 150 mg/kg. It is estimated that approximately 30 samples would be collected and analyzed for this purpose. It is possible that during excavation, the presence of burn ash-containing waste may extend beyond the footprint that is currently noted on Figures 2 and 3. If for any reason the remaining materials cannot be excavated (for example, along the top of the eastern side slope of the ravine), flags will remain or be placed (if not previously flagged) on that specific property with the County and/or City Building Departments.

The burn ash-containing materials removed from the site would require waste characterization and profiling for disposal and each truck would be properly manifested to document its transport of materials to the appropriate off-site disposal facility. A summary of the assessment of this alternative for each of the screening criteria is provided in this section.

Overall Protection of Human Health and the Environment

This alternative reduces the potential risks from the COPCs at the site by placing them in a permitted landfill, thereby meeting the RAOs. Consequently, it is considered protective of human health and the environment.

Compliance with ARARs

This alternative may require that excavated materials be transported and disposed of as hazardous waste. This would require manifests for the transportation and disposal of the materials. Any waste identified as RCRA waste would be transported off-site to a Class I disposal facility. State requirements prohibit the discharge of air emissions, including dust, in quantities that may cause injury, detriment, nuisance, or annoyance to the public. The excavation and grading activities would require a Construction SWPPP and implementation of BMPs to control storm water runoff and erosion.

Long-term Effectiveness and Permanence

Excavation and disposal would remove the COPCs from the site, and therefore eliminate the long-term risk associated with burn ash-containing waste at the site. This results in meeting the RAOs.

Reduction of Toxicity, Mobility, or Volume

The toxicity and volume of COPCs at the site will be reduced through the proposed remedial action. By placing the impacted soil in an engineered landfill suitable for receiving the concentrations of COPCs in the soil, the mobility of the COPCs will be reduced. However, from a larger perspective, excavation and off-site land disposal does not result in the reduction, but rather relocation of toxicity and volume of the COPCs.

Cost

Cost estimates for excavation and disposal range from $75 to $150 per ton depending on the nature of hazardous materials and methods of excavation. These estimates include excavation/removal, transportation, and disposal at an approved facility. Additional cost of treatment at the disposal facility may also be required, but is not likely based on the existing analytical data. A summary of the estimated costs to implement this alternative is presented in Table C-1 in Appendix C.

Short-term Effectiveness

Potential short-term risks to onsite workers, public health, and the environment could result from dust or particulates that may be generated during excavation and soil handling activities. These risks could be mitigated using personal protective equipment for onsite workers and engineering controls, such as dust suppression and additional traffic and equipment operating safety procedures, for protection of the surrounding community and to meet all ARARs. Implementation of site-specific and community health and safety plans will mitigate the potential short-term risks during the remedial action.

Implementability

Excavation, off-site disposal, and clean fill replacement are a well-proven, readily implementable technology that is a common method for cleaning up hazardous waste sites. It is a relatively simple process, with proven procedures. Equipment and labor required to implement this alternative are uncomplicated and readily available. The implementability of removing burn ash-containing waste at increasing depths adjacent to existing structures is feasible, but may require engineering controls.

Regulatory Agency Acceptance

Regulatory acceptance for this alternative would be low, since full removal is not needed to meet the SMSs and mitigate the potential human health risk associated with the burn ash-containing waste. The excavation, loading and hauling of the affected soil has an increased potential for the production of fugitive dust and short-term exposure. For these reasons, the acceptance of this alternative would also be considered to be low.

Community Acceptance

Community acceptance will be assessed during a public meeting.

4.3 COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

A comparative analysis was conducted to identify the advantages and disadvantages of each remedial action alternative. The comparative analysis was conducted to address the nine criteria listed in Section 4.2.

4.3.1 Overall Protection of Human Health and the Environment

The No Action alternative would not result in meeting the SMS or any reduction in the potential risk associated with the COPCs at the site, and therefore, the RAOs would not be met. The Consolidation and Capping and Excavation alternatives both satisfy RAOs and are overall protective of human health and the environment. The Consolidation and Capping alternative meets the SMS and reduces the potential for exposure by constructing a barrier between the burn ash-containing waste and the receptor. Institutional controls reduce the potential for exposure through breaching of the cap. However, the Excavation alternative eliminates the potential for exposure to a receptor by removing the burn ash-containing waste in its entirety; however, this is not necessary to protect potential receptors and meet the SMS. The duration of the excavation could result in short-term risks to the surrounding community that could be unacceptable. Therefore, the less invasive Consolidation and Capping alternative adequately meets the SMS and provides better protection to human health and the environment.

4.3.2 Compliance with ARARs

The No Action alternative does not comply with State and Federal requirements. Both the Consolidation and Capping and Excavation alternatives can comply with regulatory requirements. Only the Excavation alternative can eliminate the need to comply with Title 27 requirements for long–term monitoring and maintenance and institutional controls; however, this is not necessary to meet the SMS. Land use restrictions are often difficult to enforce. However, future activities that could breach the cap can be effectively controlled to mitigate potential health risks.

4.3.3 Long-Term Effectiveness and Permanence

Under the No Action alternative, there would be no effectiveness and permanence in mitigating human health risk and the RAOs would not be satisfied. The Consolidation and Capping and Excavation alternatives reduce or eliminate potential exposure to the COPCs, and therefore, satisfy the RAOs. However, excavation is not needed to meet the SMS. Once implemented, the Consolidation and Capping alternative would require long-term monitoring to ensure its effectiveness. For example, in the event of animal burrowing, the degree of activity will be evaluated by the LEA during its long-term monitoring of the site. If burrowing is an extensive issue, some further action may be needed by the responsible parties in order to maintain the integrity of the soil cap. In addition, future changes in land use could result in disturbance and penetration of the cap, resulting in the potential for exposure. However, institutional controls implemented on the affected properties would reduce the potential for future exposure through breaching the cap. The Excavation alternative would remove the COPCs from the site, and would require less management and/or site controls. For this reason, the Excavation alternative is most effective in the long-term as it is a permanent option.

4.3.4 Reduction of Toxicity, Mobility, or Volume

The No Action alternative does not result in reducing the toxicity, mobility, or volume of the COPCs present at the site. Implementing the Consolidation and Capping alternative would not reduce volume, but could reduce mobility and toxicity (the cap would prevent surface water infiltration and prevent exposure to fugitive dust). The Excavation alternative would reduce volume, mobility and toxicity at the site, but transfer the materials to an engineered landfill suitable for the placement of hazardous waste. Accordingly, the Excavation alternative is slightly favored in this category.

4.3.5 Cost

A comparative summary of preliminary estimated costs to implement each of the alternatives is presented in Table C-1 in Appendix C.

4.3.6 Short-Term Effectiveness

The No Action alternative is not effective in the short-term as future activities could disturb the burn ash-containing waste soil and result in exposure. The Consolidation and Capping alternative could result in some disturbance of burn ash-containing waste that could be mitigated through proper site control measures. The Excavation alternative will require removing, handling, and transporting the burn ash-containing waste soil, resulting in higher short-term exposure risks to the COPCs. It is expected that these risks can be sufficiently mitigated through site control measures. However, the short-term risks are considerably less for the Consolidation and Capping alternative, since the soil will not be disturbed through excavation. The short-term effectiveness of the Capping Alternative is favored over the other alternatives.

4.3.7 Implementability

No measures would be implemented for the No Action alternative. Each of the other alternatives is technologically feasible and easily implemented. The Consolidation and Capping alternative is easily implementable, because the cover soil can be placed over the burn site footprint in its currently graded condition since there are few structures on the site. The Excavation alternative is considerably less feasible in that it involves considerable earthmoving that will affect and disturb the local community. Additional engineering controls such as shoring will be needed to remove burn ash-containing waste in areas where it is present at depths greater than 5 feet, where benching is not feasible. For these reasons, the Consolidation and Capping alternative is favored in this category.

4.3.8 Regulatory Acceptance

The No Action and the Excavation alternatives are not anticipated to be acceptable to regulatory agencies. However, this will be evaluated as part of the public comment period.

4.3.9 Community Acceptance

Community acceptance will be assessed during the public meeting.

4.4 RECOMMENDED REMEDIAL ACTION ALTERNATIVES

Based on the results of previous investigations presented and remedial action selection process conducted herein, the Consolidation and Capping alternative is recommended for the site. Because burn ash-containing waste will remain on portions of the site, those parcels affected will also require institutional controls to limit the potential for future exposure of receptors to these materials through controlling and limiting future excavation, routine maintenance and any other disturbances to the cap, such that the site continues to meet the SMS and protect human health and the environment.

SECTION FIVE

SECTION 5 REMOVAL ACTION IMPLEMENTATION

This section describes the field procedures and methods that will be used to implement the recommended remedial alternative, which is Consolidation and Capping. Based on discussions with CIWMB, it is our understanding that the property owners will be implementing this alternative to minimize cost in meeting the SMS and reducing potential health risks. Field activities that involve disturbance of the affected soil will require a contractor that is meets OSHA requirements.

5.1 PERMITTING

It is possible that a City and/or County grading permit will be required to implement the remedial alternative of consolidation and capping. As part of the permit, it is possible that a Drainage and Grading Plan and an Erosion Control Plan may be needed for the proposed activities. A Construction SWPPP will not be needed since the affected area of the site is less than 1 acre. However, it is likely that a set of forms may be required that provide descriptions of BMPs that would be implemented during and post-construction. No air or other permitting requirements have been identified for the proposed removal action activities.

It is possible that this remedial action could be completed under a CEQA NOE based on the following:

- Estimated construction costs are less than $1 Million (Class 30 exemption; CCR Title 14 Section 15330).
- There is little or no effect on the environment due to the relatively small volume, short duration and controlled manner of execution (activities to occur within the site).
- It is applicable to minor cleanup actions to mitigate areas affected by hazardous substances.

5.2 HEALTH AND SAFETY PLANS

The work will be conducted under a Health and Safety Plan (HASP) that complies with OSHA guidelines appearing in 29 CFR 1910.126. The HASP will also meet the lead guidelines set forth in CCR Title 8 Section 5192. In addition, a Community Health and Safety Plan to protect the health and safety of the community will be incorporated in the HASP. It is possible that the CIWMB/LEA may provide a plan that they have used for similar projects.

5.3 UTILITY CLEARANCE

Prior to commencing with excavation activities, Underground Service Alert (USA) will be contacted at least 48 hours in advance to identify the location of utilities that enter each property. Proposed excavation areas will be clearly marked with white paint or surveyors flagging as required by USA. USA will contact utility owners of record within the site vicinity and notify them of the intent to excavate. All utility owners of record will be expected to clearly mark the position of their utilities on the ground surface throughout the public right-of-ways adjacent to each property if present, subsurface utilities will be disconnected as needed so that the removal action can proceed.

5.4 TEMPORARY FENCING AND SIGNAGE

A temporary 6-foot high chain-link fence will be placed along the western site perimeter during RAP implementation in the area that may be readily accessible to trespassers. Other areas that are not accessible will not require fencing. Appropriate signage will be placed on the fencing to discourage entry and inform the public of the hazard associated with the site and remedial activities.

5.5 STORM WATER BEST MANAGEMENT PRACTICES

Removal activities will disturb the ground surface and could result in the potential to increase erosion and storm water runoff at the site. Therefore, prior to initiating the removal action, BMPs will be implemented. It should be noted that the placement of these and other possible BMPs will be conducted as site conditions warrant, so that erosion and storm water runoff do not pose a problem at the site. The action will be conducted during the dry weather season (between May and October). The following BMPs will be implemented:

- Covering of temporary soil stockpiles (if generated) during non-work hours to abate dispersion by both wind and rain.
- Placement of silt fences in down slope areas to trap any sediment that might become mobilized.
- Placement of temporary berms in and around work areas to divert storm water flow, prevent soil erosion and catch sediment before it exits the site.
- Periodic street sweeping as needed to prevent the tracking of soil onto the nearby public streets.

A construction entrance will be installed at each point where construction vehicles will enter and leave the site to ensure that soil is not tracked off site. There should be minimal tracking, since there will be no transport of wastes off site. The stabilized construction entrance shall be maintained to prevent runoff from the site flowing across the entrance onto the public street.

Following completion of consolidation, backfilling and regrading of the site, BMPs should be implemented to ensure that there is no increased sedimentation resulting from the remedial action. This may include placement of fiber rolls, straw bales, silt fencing, and stabilizing the soil slopes with a tackifier. The bare soil can be hydroseeded with a native seed mix and groundcover and other plantings could be performed to revegetate the area. Any revegetation of the area should not involve penetration of the 2-foot cover soil cap.

5.6 EXCAVATION AND CAPPING METHODS

Burn ash remediation can consist of providing 2 feet of soil cover over most of the areas where burn ash is present with less than 2 feet of cover soil. The approximate area affected by excavation and capping is shown on the conceptual consolidation and capping plan provided as Figure E-1 in Appendix E. It should only be necessary to remove burn ash in localized areas (red hatched areas, Figure E-1), so that capping will result in similar grade. Prior to implementing the alternative, a licensed surveyor will be retained to stake the areas that will be cut and filled. Earthwork to cover burn ash is proposed to consist of:

- Forming a fill slope at a 2:1 horizontal:vertical (H:V) inclination over the existing north to northwest facing slopes to provide at least two feet of vertical cover over the slope.
- Providing at least 2 feet of vertical soil cover over the existing ground surface within the drainage that is oriented northeast-southwest at the site (yellow shaded areas, Figure E-1).

It may be necessary to locally remove burn ash near the crest of the existing slopes to transition the proposed fill slope into the existing ground surface. It may also be necessary to locally remove burn ash from portions of the more uneven surfaces of the existing slopes to provide two feet of vertical soil cover. Locally removed burn ash will be thinly spread over the ground surface of the existing drainage before it is covered with a clean soil cap (blue hatched area in ravine, Figure E-1). A schematic showing the proposed excavation and fill recommendations in profile (side view) is also provided in Appendix E.

Fill slopes should be formed by placing import soils in loose horizontal lifts that do not exceed 6 to 8 inches (loose thickness). Each lift should be compacted to at least 90% relative compaction using the latest version of the American Society for Testing and Materials (ASTM) D1577 as the compaction standard before the next lift in placed. Fill slopes should be benched into the existing slopes; the material removed to from the bench should be thin spread over ground surface of the existing drainage before it is covered with soil. Before placing fill, existing vegetation, deleterious soil and other debris should be removed and properly disposed off site.

Import soil placed within the existing drainage should be placed and compacted as recommended for fill slopes in the preceding paragraph. Alternatively, a geotextile fabric that provides erosion control and separation may be placed on the existing ground surface on the floor of the ravine (after removing vegetation and other debris) and the two feet of soil cover consisting of gravel of various sizes depending on estimated flow velocities.

It is estimated that about 2,000 cubic yards of import soil will be required to provide sufficient soil cover. From a geotechnical perspective, import soils should be coarse-grained with a maximum particle size of three inches. There should be some cohesive fines to mitigate slope erosion.

5.7 EXCAVATION AND SOIL HANDLING METHODS

Prior to any excavation, the approximate horizontal extent of the burn site footprint will be marked using stakes and/or marking paint to facilitate the excavation process. Brush and existing vegetation within the area included in the remedial action will be cleared and grubbed. This includes removal of green waste that is present at the northern and eastern margins of the ravine. No removal of vegetation will be conducted on the western side of the ravine that is covered with sagebrush scrub. The removed materials can be disposed at a municipal landfill as green waste, provided that no burn ash-containing materials are commingled with the green waste.

Conventional construction equipment, such as a front-end loader equipped with a backhoe, will be used to excavate the burn ash-containing waste on the margins of the burn site footprint. These materials will be placed on the floor of the ravine, where it will be thinly spread.

The soil will be excavated, to the extent possible, in a manner that reduces the potential to generate dust. Dust suppression procedures are discussed in Section 5.7.

5.8 SOIL STOCKPILING AND PROFILING

No soil stockpiling will be conducted unless it is deemed necessary. If required, the excavated soil will be placed in temporary stockpiles on the floor of the ravine within the footprint of the burn site. The soil will be placed on heavy gauge (20-mil thick or greater) plastic sheeting. During non-working hours or adverse weather conditions, the stockpiles will be covered with plastic 10-mil (or greater) sheeting. The temporary stockpiles will be designed, constructed, and operated, so that potential ponding, infiltration, inundation, erosion, slope failure, and washout are limited as much as possible. The total estimated volume of a temporary stockpile onsite will not exceed 200 cubic yards at any one time. The stockpiles will not be managed in such a manner as to create a condition of pollution or nuisance. Wastes will be managed in compliance with applicable State requirements in 23 CCR, Chapter 15.

5.9 CONTROL MEASURES

Dust suppression will be performed by lightly spraying or misting the work areas with water. Water mist may also be used on soil placed in temporary stockpiles. Upon initiation of field activities for the removal action, the burn site and work area will be secured to reduce the potential for unauthorized personnel to enter the site.

During the import and placement of clean backfill, dust generation will be controlled through lightly spraying the soil with water and efforts will be made to minimize the soil drop height from excavator's bucket.

5.10 AIR MONITORING DURING EXCAVATION

Fugitive dust control measures will be implemented by a contractor at the site to mitigate dust migration outside of the work area (exclusion zone) and offsite; so that there is limited potential for exposure to adjacent residents. To mitigate dust migration outside of the exclusion zone and offsite, light spraying of the active excavation areas with potable water will be conducted throughout the remedial action. In addition, airborne dust monitoring will be conducted to verify and document dust suppression efforts. Air monitoring for dust will be performed during the excavation activities; in the worker's breathing zone, at the perimeter of the exclusion zone, and at the perimeter of the site utilizing an upwind/downwind monitoring approach. Dust monitoring procedures will be outlined in a community health and safety plan, and will be conducted approximately once per hour during excavating, or more often if visible dust is observed, using a hand-held dust meter. The National Ambient Air Quality Standard (NAAQS) for dust is 50 ug/m^3, based on dust particles greater than 10 microns in diameter (PM_{10}). The NAAQS dust standard (50 ug/m^3), steady for 5 minutes, has been selected as the action level for dust monitoring activities at the perimeter of the property. The action level for dust for the equipment operators and workers, will initially be conservatively set at 5 mg/m^3 steady for 5 minutes. Respiratory protection will be worn by the equipment operators if dust levels exceed 2 mg/m^3, but are less than 5 mg/m^3, for greater than 5 minutes.

In addition, periodic meteorological readings will be taken on-site away from trees, buildings, or other structures that may unduly influence the measurements. Wind speed and wind direction will also be measured approximately once per hour, during excavating, using a monitoring device. If sustained wind speeds exceed 25 miles per hour (mph), (which seldom is the case in San Diego) excavation activities will cease and resume when the wind speed is below 25 mph.

5.11 CLEAN FILL IMPORT

Prior to completion of consolidation, a source of import soil will be identified. Up to five samples will be collected from the proposed fill materials to confirm that there are no possible contaminants present above residential CHHSLs or PRGs. The sampling and analyses will be conducted in accordance with the DTSC Information Advisory titled, "Clean Imported Fill Material" dated October 2001. The analyses performed will be consistent with past property use for the fill source.

5.12 TRANSPORTATION PLAN FOR IMPORTED FILL

Approximately 2,000 cubic yards (approximately 2,600 tons) of clean fill material will need to be imported to the site to complete the cap. The soil will be delivered by end-dump trucks. Assuming a weight of approximately 20 tons per load, it is estimated that approximately 130 truckloads of material will be delivered to the site.

Delivery of the material will require transportation through a residential neighborhood. Therefore, trucks will be restricted from entering the site between the hours of 8am to 5 pm. The surfaces of the streets will be periodically observed for wear and tear, and the school district will be notified of schedule so that bus stops can be identified and avoided where possible to allow for safe pick up and drop off of school children.

Soil arriving on site will be appropriately tarped and dust control will be conducted upon dumping soil from the trucks as needed. Upon dumping the soil on site, the truck will be observed for loose soil. These materials will be removed before the trucks leave the site. Streets will be observed for fugitive soil and will be swept as needed.

The tentative truck route to the site will be as follows:

- Exist I-15 and travel we approximately ½-mile on El Norte Parkway;
- Right (north) on Nutmeg Street;
- Left (west) on Country Club Lane;
- Right (north) on Gary Lane;
- Left on David Drive to David Glen, and
- Right on Still Water Glen and proceed to cul-de-sac.

The total distance from I-15 is approximately 2.5 miles.

5.13 SCHEDULE

Once implementation of Alternative 2 begins, if conducted on a continuous schedule with the equipment described herein, the field work could be completed in approximately 3 to 4 weeks.

SECTION SIX

SECTION 6 LIMITATIONS

This RAP for the Benton Burn Dump, located in Escondido, California was prepared by URS on behalf of the CIWMB in a manner consistent with the level of care and skill ordinarily exercised by professional engineers, geologists, and environmental scientists.

Geology and geochemistry are inexact sciences, and investigative data related to subsurface investigations commonly contain large uncertainties. This is particularly true when investigating materials such as burn ash that may have been historically used as fill near this Site. Burn ash-containing waste is typically a very heterogeneous material based on the nature of dump operations and its placement.

Our judgments and conclusions are based upon previous investigations conducted by others and our experiences on other similar projects. The volume estimates are based on field observations appearing on boring logs included in the CIWMB site investigation report completed in 2007 and additional sampling conducted by others in May 2009. Costs provided herein are only order-of-magnitude for comparison of the possible remedial alternatives. The actual costs will depend on true labor and material costs, market conditions at the time of implementation, and the final project scope. Samples were analyzed using California state-certified laboratory procedures with limited review to obtain data suitable for decision-making. However, sample analysis is subject to uncertainties associated with precision, accuracy, and detection of chemicals at low concentrations. Our conclusions described herein are based on data collected from a limited number of sample locations. Some unsampled areas could have higher (or lower) concentrations than the available sampling data indicate. There are technical and financial limitations to the amount of sampling that can be conducted on a site.

We performed our services for this project in accordance with professional standards for these types of investigations and plans; no guarantees are either expressed or implied.

SECTION SEVEN

SECTION 7 REFERENCES

California Code of Regulations (CCR), Title 27, Division 2, Chapter 3, Subchapter 4, Articles 1 and 6, apply: Sections 20530, 20650, 20750, 20820, 20919, 21100(d), and 21190.

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TABLES

Table 1
Soil Sample Analytical Results - Title 22 Metals
(concentrations reported in mg/kg)

Boring/ Sample ID	Sample Date	Approx. Sample Depth (feet)	Lab ID	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Hg	Pb	Mo	Ni	Se	Ag	Tl	V	Zn
B1	01/24/07	0	07-C12-51	<0.4	0.6	27	<0.4	<0.4	4.0	2.1	3.7	<0.04	5.0	1.0	1.5	<0.4	<0.4	<0.4	15	24
		2'-3'	07-C12-53	<0.4	<0.4	24	<0.4	<0.4	2.8	2.1	1.3	0.04	2.3	0.4	0.8	<0.4	<0.4	<0.4	9.4	9
		5'-6'	07-C12-85	<0.4	0.5	36	<0.4	<0.4	4.1	2.2	2.7	<0.04	5.8	0.6	1.8	<0.4	<0.4	<0.4	16	13
B2	01/24/07	0	07-C12-55	<0.4	0.9	48	<0.4	<0.4	5.6	2.9	15	<0.04	46	1.2	3.0	<0.4	<0.4	<0.4	20	70
		3.2'-5'	07-C12-56	1.3	1.5	110	<0.4	1.3	13	4.7	38	0.06	220	1.6	14	<0.4	0.6	<0.4	16	360
		11'-11.8'	07-C12-86	0.5	0.9	66	<0.4	0.5	13	3.2	55	<0.04	100	2.6	5.2	<0.4	<0.4	<0.4	16	180
B3	01/24/07	0	07-C12-61	<0.4	0.7	39	<0.4	<0.4	3.7	2.4	9.5	0.05	20	1.1	1.9	<0.4	<0.4	<0.4	15	31
		2.8'-5'	07-C12-62	0.8	1.5	130	<0.4	0.6	18	3.4	66	0.04	190	1.6	9.2	<0.4	<0.4	<0.4	16	320
B4	01/24/07	0	07-C12-64	<0.4	0.8	51	<0.4	<0.4	5.1	3.2	11	<0.04	38	0.6	3.3	<0.4	<0.4	<0.4	16	59
		3'-5'	07-C12-65	<0.4	3.4	45	<0.4	0.5	6.4	2.8	16	<0.04	66	1.0	3.9	<0.4	<0.4	<0.4	18	140
		5'-6'	07-C12-66	1.4	11	210	<0.4	1.0	10	4.9	90	0.04	320	2.0	12	<0.4	<0.4	<0.4	17	350
B5	01/24/07	0	07-C12-68	1.3	4.4	140	<0.4	3.6	14	5.4	110	0.04	270	1.6	16	<0.4	<0.4	<0.4	23	410
		2.5'-2.8' & 3.5'-3.8'	07-C12-69	3.5	8.0	280	<0.4	2.0	18	6.6	260	0.04	410	2.8	35	<0.4	0.5	<0.4	21	620
	01/24/07	4'-6.5'-8'	07-C12-70	<0.4	1.3	39	<0.4	<0.4	4.9	3.0	9.8	0.04	36	1.0	3.3	<0.4	<0.4	<0.4	20	69
B6	01/24/07	0	07-C12-71	<0.4	1.6	57	<0.4	<0.4	11	6.0	14	<0.04	7.2	<0.4	3.2	<0.4	<0.4	<0.4	36	30
		2.5'-3.5'	07-C12-72	<0.4	<0.4	34	<0.4	<0.4	3.3	2.2	2.7	<0.04	2.5	0.6	1.5	<0.4	<0.4	<0.4	14	12
		8'-10'	07-C12-73	<0.4	0.5	16	<0.4	<0.4	2.3	1.8	1.4	<0.04	2.3	0.9	0.7	<0.4	<0.4	<0.4	14	12
B7	01/24/07	0	07-C12-01	1.5	1.4	60	<0.04	0.5	7.2	2.7	52	<0.04	140	0.8	6.4	<0.04	<0.04	<0.04	20	120
		1.5'-4'	07-C12-02	<0.4	0.6	54	<0.4	<0.4	5.1	3.8	6.5	<0.04	9.4	0.9	3.6	<0.4	<0.4	<0.4	14	24
		4.5'-5'	07-C12-03	<0.4	<0.4	45	<0.4	<0.4	4.4	3.0	4.6	<0.04	23	1.6	1.6	<0.4	<0.4	<0.4	30	33
		6'-8'	07-C12-04	<0.4	0.8	19	<0.4	<0.4	3.3	2.9	1.8	<0.04	3.7	1.3	1.0	<0.4	<0.4	<0.4	18	11
B8	01/24/07	0	07-C12-82	15	12	2000	<0.4	5.1	56	10	250	0.21	900	10	53	<0.4	2.1	<0.4	24	2300
		3	07-C12-83	<0.4	1.0	13	<0.4	<0.4	2.8	0.9	8.6	<0.04	16	1.1	1.1	<0.4	<0.4	<0.4	14	21
		1.5	07-C12-84	62	41	490	<0.4	5.1	67	23	780	0.11	19000	16	180	<0.4	12	<0.4	15	3200
B9	01/24/07	0	07-C12-79	1.8	2.0	190	<0.4	4.0	12	3.5	78	0.16	520	1.4	7.3	<0.4	<0.4	<0.4	16	310
		2.5'-3.5'	07-C12-80	0.7	3.6	69	<0.4	0.8	5.7	3.0	120	<0.04	48	0.9	4.3	<0.4	<0.4	<0.4	16	84
		3.5'-5'	07-C12-81	<0.4	0.6	68	<0.4	<0.4	4.2	2.4	2.0	<0.04	3.2	1.8	1.6	<0.4	<0.4	<0.4	18	14
B10	01/24/07	0	07-C12-05	<0.4	0.6	31	<0.4	0.5	4.6	2.1	11	<0.04	10	0.6	2.1	<0.4	<0.4	<0.4	14	61
B11	01/24/07	0	07-C12-06	4.0	7.0	150	<0.4	3.3	15	13	130	0.10	450	2.1	35	<0.4	0.7	<0.4	17	820
		3.25	07-C12-07	1.7	15	240	<0.4	4.6	20	11	150	<0.04	530	1.4	32	<0.4	0.7	<0.4	28	430
B12	01/24/07	0	07-C12-08	<0.4	0.6	44	<0.4	<0.4	4.7	2.4	4.1	<0.04	4.7	0.8	2.0	<0.4	<0.4	<0.4	16	18
B13	01/24/07	0	07-C12-10	<0.4	0.8	37	<0.4	<0.4	5.5	2.4	24	<0.04	3.0	0.7	4.1	<0.4	<0.4	<0.4	19	48
		7.5'-8'	07-C12-12	7.0	18	200	<0.4	2.9	20	6.9	110	<0.04	1100	3.2	17	<0.4	0.4	<0.4	16	1200

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(concentrations reported in mg/kg)

Boring/ Sample ID	Sample Date	Approx. Sample Depth (feet)	Lab ID	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Hg	Pb	Mo	Ni	Se	Ag	Tl	V	Zn
		8'-10'	07-C12-13	<0.4	0.9	26	<0.4	<0.4	5.0	2.7	2.9	<0.04	4.9	2.9	1.8	<0.4	<0.4	<0.4	29	13
B14	01/24/07	0	07-C12-14	<0.4	0.6	35	<0.4	<0.4	4.4	3.2	7.2	0.07	8.2	1.4	2.0	<0.4	<0.4	<0.4	16	32
B15	01/24/07	0	07-C12-16	<0.4	0.7	48	<0.4	<0.4	6.3	2.7	12	<0.04	75	0.7	2.7	<0.4	<0.4	<0.4	17	49
B16	01/24/07	0'-1.5'-S	07-C12-19	<0.4	0.7	33	<0.4	<0.4	4.4	10	2.6	<0.04	5.8	1.2	1.7	<0.4	<0.4	<0.4	20	16
B17	01/24/07	0'-4'-S	07-C12-21	<0.4	0.7	37	<0.4	<0.4	5.5	3.1	6.0	0.08	8.2	0.7	2.6	<0.4	<0.4	<0.4	24	18
B18	01/24/07	0'-2'	07-C12-23	0.5	1.1	71	<0.4	<0.4	13	4.6	21	0.09	92	0.6	5.0	<0.4	<0.4	<0.4	30	120
		2'-4'	07-C12-24	<0.4	1.2	72	<0.4	<0.4	9.3	5.2	17	0.04	69	0.7	4.7	<0.4	<0.4	<0.4	32	68
		4'-8'	07-C12-25	<0.4	1.2	77	<0.4	<0.4	10	5.2	16	0.04	77	0.7	4.5	<0.4	<0.4	<0.4	33	120
		8'-12'	07-C12-26	<0.4	0.6	40	<0.4	<0.4	5.1	2.8	5.2	<0.04	8.4	0.6	2.8	<0.4	<0.4	<0.4	17	57
B19	01/24/07	0	07-C12-27	0.8	2.0	94	<0.4	0.5	10	4.6	22	0.06	120	0.6	5.0	<0.4	<0.4	<0.4	31	110
		1'-1.5'	07-C12-28	1.6	2.6	260	<0.4	2.0	18	6.2	160	0.08	180	1.0	7.4	<0.4	<0.4	<0.4	42	520
		2.75'-3'	07-C12-29	8.2	6.1	230	<0.4	2.1	15	12	310	0.14	1500	1.4	23	<0.4	0.5	<0.4	35	1200
B20	01/24/07	0	07-C12-30	<0.4	<0.4	61	<0.4	<0.4	4.9	2.7	5.0	<0.04	3.6	0.4	2.6	<0.4	<0.4	<0.4	14	17
B21	01/24/07	0	07-C12-74	<0.4	0.6	24	<0.4	<0.4	6.1	1.9	16	<0.04	25	0.7	3.2	<0.4	<0.4	<0.4	30	52
		1'-3'	07-C12-75	<0.4	0.8	100	<0.4	<0.4	14	6.6	12	<0.04	37	0.7	7.6	<0.4	<0.4	<0.4	45	42
		7'-8'	07-C12-76	<0.4	2.9	52	<0.4	0.4	6.8	3.1	22	<0.04	74	0.8	4.2	<0.4	<0.4	<0.4	17	82
B22	01/24/07	0	07-C12-32	<0.4	0.8	42	<0.4	<0.4	7.1	3.0	22	0.05	12	0.6	5.0	<0.4	<0.4	<0.4	28	64
		3.5'-4'	07-C12-33	3.0	21	240	<0.4	3.2	15	7.3	220	0.04	500	3.2	20	<0.4	0.7	<0.4	12	2200
		4'-4.5'	07-C12-34	9.8	10	64	<0.4	<0.4	8.5	4.9	120	0.04	43	2.0	15	<0.4	<0.4	<0.4	16	210
		5'-5.5'	07-C12-35	<0.4	1.3	62	<0.4	<0.4	4.7	2.9	16	<0.04	86	0.9	3.4	<0.4	<0.4	<0.4	16	120
		6'-6.5'	07-C12-36	<0.4	10	33	<0.4	0.8	4.6	2.8	11	<0.04	120	0.9	2.8	<0.4	<0.4	<0.4	12	190
B23	01/24/07	0	07-C12-37	0.7	0.9	50	<0.4	<0.4	9.2	3.3	12	0.07	200	0.6	4.6	<0.4	<0.4	<0.4	22	58
		1.5'-2'	07-C12-38	1.8	1.7	130	<0.4	1.2	13	5.4	37	0.07	180	0.8	6.2	<0.4	<0.4	<0.4	33	260
		3'-4'	07-C12-39	<0.4	0.5	49	<0.4	<0.4	4.5	3.0	4.3	<0.04	5.0	0.6	2.2	<0.4	<0.4	0.4	17	17
		4'-5'	07-C12-40	<0.4	0.5	44	<0.4	<0.4	4.4	3.0	4.1	<0.04	7.6	0.6	2.9	<0.4	<0.4	<0.4	18	18
		5'-6'	07-C12-41	<0.4	0.6	35	<0.4	<0.4	4.0	3.1	3.1	<0.04	8.0	0.7	1.8	<0.4	<0.4	<0.4	18	19
B24	01/24/07	0	07-C12-42	<0.4	1.9	54	<0.4	<0.4	8.5	3.5	13	<0.04	140	0.5	3.5	<0.4	<0.4	<0.4	26	63
B25	01/24/07	0	07-C12-43	0.8	1.7	110	<0.4	1.1	21	3.4	88	0.24	340	1.8	15	<0.4	<0.4	<0.4	7.6	780
		2'-3'	07-C12-46	<0.4	<0.4	32	<0.4	<0.4	3.9	2.3	4.8	<0.04	9.3	0.5	1.8	<0.4	<0.4	<0.4	15	23
B26	01/24/07	0	07-C12-48	<0.4	0.6	50	<0.4	<0.4	5.3	2.5	16	0.06	6.2	0.7	3.0	<0.4	<0.4	<0.4	19	50
SS-1	01/24/07	0	07-C12-77	4.5	18	260	<0.4	3.0	27	12	260	0.06	1800	2.5	43	<0.4	1.5	<0.4	24	850
SS-2	01/24/07	0	07-C12-78	5.8	29	100	<0.4	6.3	13	5.1	60	0.09	150	3	11	<0.4	<0.4	<0.4	9.5	2700
SS-3	01/24/07	S'-3'	07-C12-50	0.9	2.5	130	<0.4	1.0	11	3.4	40	0.08	810	1.4	19	<0.4	0.5	<0.4	11	140
B27	05/28/09	0.5'	0905130-01	--	--	--	--	--	--	--	--	--	3.6	--	--	--	--	--	--	--

Table 1
Soil Sample Analytical Results - Title 22 Metals
(concentrations reported in mg/kg)

Boring/ Sample ID	Sample Date	Approx. Sample Depth (feet)	Lab ID	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Hg	Pb	Mo	Ni	Se	Ag	Tl	V	Zn
B27	05/28/09	1.5'	0905130-02	--	--	--	--	--	--	--	--	--	3.4	--	--	--	--	--	--	--
B28	05/28/09	0.5'	0915130-03	--	--	--	--	--	--	--	--	--	12.3	--	--	--	--	--	--	--
B28	05/28/09	1.5'	0905130-04	--	--	--	--	--	--	--	--	--	3.0	--	--	--	--	--	--	--
B29	05/28/09	0.5'	0905130-05	--	--	--	--	--	--	--	--	--	28.4	--	--	--	--	--	--	--
B29	05/28/09	1.5'	0905130-06	--	--	--	--	--	--	--	--	--	41.3	--	--	--	--	--	--	--
B30	05/28/09	0.5'	0905130-07	--	--	--	--	--	--	--	--	--	18.7	--	--	--	--	--	--	--
B30	05/28/09	1.0'	0905130-08	--	--	--	--	--	--	--	--	--	922	--	--	--	--	--	--	--
B31	05/28/09	0.5'	0905130-09	--	--	--	--	--	--	--	--	--	60.7	--	--	--	--	--	--	--
B31	05/28/09	1.5'	0905130-10	--	--	--	--	--	--	--	--	--	49.8	--	--	--	--	--	--	--
B32	05/28/09	0.5	0905130-11	--	--	--	--	--	--	--	--	--	4.6	--	--	--	--	--	--	--
B32	05/28/09	1.5'	0905130-12	--	--	--	--	--	--	--	--	--	5.0	--	--	--	--	--	--	--
B33	05/28/09	0.5'	0905130-13	--	--	--	--	--	--	--	--	--	5.7	--	--	--	--	--	--	--
B33	05/29/09	1.5'	0905130-14	--	--	--	--	--	--	--	--	--	14.2	--	--	--	--	--	--	--
B34	05/29/09	0.5'	0905130-15	--	--	--	--	--	--	--	--	--	331	--	--	--	--	--	--	--
B34	05/29/09	1.5'	0905130-16	--	--	--	--	--	--	--	--	--	588	--	--	--	--	--	--	--
B35	05/29/09	0.5	0905130-17	--	--	--	--	--	--	--	--	--	607	--	--	--	--	--	--	--
B35	05/29/09	1.5'	0905130-18	--	--	--	--	--	--	--	--	--	110	--	--	--	--	--	--	--
B36	05/29/09	0.5'	0905130-19	--	--	--	--	--	--	--	--	--	115	--	--	--	--	--	--	--
B36	05/29/09	1.0'	0905130-20	--	--	--	--	--	--	--	--	--	22.1	--	--	--	--	--	--	--
B37	05/29/09	0.5'	0905130-21	--	--	--	--	--	--	--	--	--	181	--	--	--	--	--	--	--
B37	05/29/09	1.5'	0905130-22	--	--	--	--	--	--	--	--	--	23.6	--	--	--	--	--	--	--
TTLC				500	500	10000	75	100	2500	8000	2500	20	1000	3500	2000	100	500	700	2400	5000
STLC (mg/l)				15	5.0	100	0.75	1.0	5 (560)	80	25	5.0	0.2	350	20	1.0	5	7.0	24	250
Residential CHHSL				30	0.07	5,200	150	1.7	10,000	660	3,000	150	150	1,600	1,600	380	380	5.0	530	23,000

Notes:

The "less than" symbol (<) indicates that the constituent was not detected above the detection limit specified.

CHHSLs: California Human Health Screening Levels for Soil, Residential Land Use, as developed by the California Department of Toxic Substances Control, dated January 2005.

Sb: Antimony
As: Arsenic
Ba: Barium
Be: Beryllium
Cd: Cadmium
Cr: Chromium
Co: Cobalt
Cu: Copper
Pb: Lead
Hg: Mercury
Mo: Molybdenum
Ni: Nickel
Se: Selenium
Ag: Silver
Tl: Thallium
V: Vanadium
Zn: Zinc

Table 2
Soil Sample Analytical Results - Petroleum Hydrocarbons
(concentrations reported mg/kg)

Sample ID	Sample Date	Approx. Sample Depth (feet)	Lab ID	C28-C30	C30-C32	C32-C34	C34-C36	C36-C38	C38-C40	C40-C44	C28-C44 TOTAL
B1	01/25/07	2'-3'	07-C1253	<1	<1	<1	<1	<1	<1	<1	<10
B2	01/24/07	3.2'-5'	07-C1256	**2.5**	**3.3**	**5.4**	**5.9**	**7.2**	**6.4**	**13**	**44**
B3	01/24/07	2.8'-5'	07-C1262	**1.5**	**5.0**	**2.8**	**6.0**	**539**	**5.6**	**12**	**36**
B4	01/24/07	5'-6'	07-C1266	<1	1	<1	<1	<1	<1	<1	<10
B5	01/24/07	2.5'-2.8' & 3.5'-3.8'	07-C1269	**1.5**	**2.8**	**2.4**	**3.5**	**4.7**	**4.8**	**12**	**31**
	01/24/07	4'-6.5'-8'	07-C1270	<1	<1	<1	<1	<1	<1	<1	<10
B19	01/25/07	1'-1.5'	07-C1228	**4.8**	**7.0**	**8.0**	**7.3**	**10**	**12**	**34**	**84**
B19	01/25/07	2.75'-3'	07-C1229	**9.2**	**13**	**13**	**16**	**16**	**20**	**43**	**130**
B22	01/25/07	4'-4.5'	07-C1234	<1	<1	<1	<1	<1	<1	<1	<10
B23	01/25/07	1.5'-2'	07-C1238	**15**	**38**	**42**	**31**	**32**	**40**	**55**	**250**

Notes:

The "less than" symbol (<) indicates that the constituent was not detected above the detection limit specified.

Table 3
Soil Sample Analytical Results - PNAs, OCPs and PCBs
(concentrations reported in ug/kg)

Sample ID	Sample Date	Approx. Sample Depth (feet)	Lab ID	PNAs	OCPs					PCBs
					gamma-Chlordane	alpha-Chlordane	4,4-DDE	4,4'-DDT	Dieldrin	
B19	01/25/07	1'-1.5'	07-C1228	ND	7.87	4.62	ND	ND	ND	ND
	01/25/07	2.75'-3'	07-C1229	ND	12.2	9.26	5.03	4.97	ND	ND
B22	01/25/07	4'-4.5'	07-C1234	ND	<2.00	<2.00	<4.00	<4.00	<4.00	ND
B23	01/25/07	1.5'-2'	07-C1238	ND	32.0	17.7	<4.00	<4.00	8.41	ND
B1	01/25/07	2'-3'	07-C1253	ND	<2.00	<2.00	<4.00	<4.00	<4.00	ND
B2	01/24/07	3.2'-5'	07-C1256	ND	<2.00	<2.00	<4.00	<4.00	<4.00	ND
B3	01/24/07	2.8'-5'	07-C1262	ND	<2.00	<2.00	<4.00	<4.00	<4.00	ND
B4	01/24/07	5'-6'	07-C1266	ND	<2.00	<2.00	<4.00	<4.00	<4.00	ND
B5	01/24/07	2.5'-2.8'-3.8'	07-C1269	ND	<2.00	<2.00	13.4	5.30	<4.00	ND
	01/24/07	4'-8'	07-C1270	ND	<2.00	<2.00	<4.00	<4.00	<4.00	ND
TTLC				--	2500		1000		8000	--
STLC (mg/l)				--	250		100		800	--
Residential CHHSL				--	430		1600	1600	35	85

Notes:

PNAs: Polynuclear Aromatic Hydrocarbons
OCPs: Organochlorine Pesticides
PCBs: Polychlorinated Biphenyls

The "less than" symbol (<) indicates that the constituent was not detected above the detection limit specified.

Table 4
Soil Sample Analytical Results - Dioxins and Furans
(concentrations reported in ppt)

Sample ID	TEFs (unitless)	B1			B8		
Sample Depth (feet)		2-3			0-1.5		
Date		1/30/2007			1/30/2007		
Laboratory ID		Results	1/2 MDLs	only detects	Results	1/2 MDLs	only detects
2,3,7,8-TCDD	1	0.782	0.782	0.782	0.848	0.848	0.848
1,2,3,7,8-PeCDD	1	1.09	1.09	1.09	3.10	3.1	3.1
1,2,3,4,7,8-HxCDD	0.1	1.65	0.165	0.165	2.58	0.258	0.258
1,2,3,6,7,8-HxCDD	0.1	2.15	0.215	0.215	6.48	0.648	0.648
1,2,3,7,8,9-HxCDD	0.1	1.93	0.193	0.193	4.27	0.427	0.427
1,2,3,4,6,7,8-HpCDD	0.01	2.07	0.0207	0.0207	57.1	0.571	0.571
OCDD	0.0001	3.81	0.000381	0.000381	203	0.0203	0.0203
2,3,7,8-TCDF	0.1	0.740	0.074	0.074	12.1	1.21	1.21
1,2,3,7,8-PeCDF	0.05	1.11	0.0555	0.0555	8.76	0.438	0.438
2,3,4,7,8-PeCDF	0.5	1.20	0.6	0.6	6.69	3.345	3.345
1,2,3,4,7,8-HxCDF	0.1	0.676	0.0676	0.0676	9.82	0.982	0.982
1,2,3,6,7,8-HxCDF	0.1	0.585	0.0585	0.0585	8.07	0.807	0.807
2,3,4,6,7,8-HxCDF	0.1	0.714	0.0714	0.0714	10.9	1.09	1.09
1,2,3,7,8,9-HxCDF	0.1	0.871	0.0871	0.0871	2.39	0.239	0.239
1,2,3,4,6,7,8-HpCDF	0.01	1.53	0.0153	0.0153	42.6	0.426	0.426
1,2,3,4,7,8,9-HpCDF	0.01	1.74	0.0174	0.0174	2.71	0.0271	0.0271
OCDF	0.0001	4.11	0.000411	0.000411	20.9	0.00209	0.00209
2,3,7,8-TCDD TEQ in ppt =			**3.5**	**3.5**		**14.4**	**14.4**

Table 5
Soil Sample Analytical Results - DI WET, STLC and TCLP Metals
(concentrations reported in mg/l, unless noted otherwise)

Boring/ Sample ID	Sample Date	Approx. Sample Depth (feet)	Lab ID	TTLC Pb (mg/kg)	DI WET Pb	STLC				TCLP							
						Ba	Cu	Cr	Zn	Hg	As	Ba	Cd	Cr	Pb	Se	Ag
B2	01/24/07	3.2'-5'	07-C2668		0.10	--	--	--	--	--	--	--	--	--	--	--	--
	01/24/07	11'-11.8'	07-C2680	100	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
B3	01/24/07	2.8'-5'	07-C2669	190	0.08	--	--	--	--	--	--	--	--	--	--	--	--
B4	01/24/07	3'-5'	07-C2670	66	0.14	--	--	--	--	--	--	--	--	--	--	--	--
	01/24/07	5'-6'	07-C2671	320	0.23	--	--	--	--	--	--	--	--	--	--	--	--
B5	01/24/07	0	07-C2672	270	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
	01/24/07	2.5'-2.8' & 3.5'-3.8'	07-C2673	410	0.05	--	3.0	--	--	--	--	--	--	--	--	--	--
B7	01/24/07	0	07-C2650	140	0.08	--	--	--	--	--	--	--	--	--	--	--	--
B8	01/24/07	0	07-C2678	900	0.19	14	8.5	0.79	--	--	--	--	--	--	--	--	--
	01/24/07	1.5	07-C2679	19000	--	--	62	0.76	160	<0.005	<0.04	0.98	<0.04	0.04	0.78	<0.04	<0.04
B9	01/24/07	0	07-C2677	520	0.30	--	--	--	--	--	--	--	--	--	--	--	--
B11	01/24/07	0	07-C2651	450	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
	01/24/07	3.25	07-C2652	530	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
B15	01/24/07	0	07-C2653	75	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
B18	01/24/07	0'-2'	07-C2654	92	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
	01/25/07	2-'4'	07-C2655	69	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
	01/25/07	4'-8'	07-C2656	77	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
B19	01/25/07	0	07-C2657	120	0.07	--	--	--	--	--	--	--	--	--	--	--	--
	01/25/07	1'-1.5'	07-C2658	180	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
B21	01/24/07	7'-8'	07-C2674	1500	0.09	--	--	--	--	--	--	--	--	--	--	--	--
B22	01/25/07	3.5'-4'	07-C2660	500	0.21	--	--	--	--	--	--	--	--	--	--	--	--
	01/25/07	5'-5.5'	07-C2661	86	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
	01/25/07	6'-6.5	07-C2662	120	<0.04	--	--	--	--	--	--	--	--	--	--	--	--
B23	01/25/07	S	07-C2663	200	0.37	--	--	--	--	--	--	--	--	--	--	--	--
	01/25/07	1.5'-2'	07-C2664	180	0.07	--	--	--	--	--	--	--	--	--	--	--	--
B24	01/25/07	0	07-C2665	140	0.08	--	--	--	--	--	--	--	--	--	--	--	--
B25	01/25/07	0	07-C2666	340	0.10	--	--	--	--	--	--	--	--	--	--	--	--
SS-1	01/24/07	0	07-C2675	1800	--	--	10	--	--	<0.005	<0.04	1.1	<0.04	0.05	0.43	<0.04	<0.04
SS-2	01/24/07	0	07-C2676	150	0.10	--	--	--	26	--	--	--	--	--	--	--	--
SS-3	01/25/07	S'-3'	07-C2667	810	1.4	--	--	--	--	--	--	--	--	--	--	--	--
B27	05/28/09	0.5'	0905130-01	3.6	--	--	--	--	--	--	--	--	--	--	--	--	--
B27	05/28/09	1.5'	0905130-02	3.4	--	--	--	--	--	--	--	--	--	--	--	--	--
B28	05/28/09	0.5'	0915130-03	12.3	--	--	--	--	--	--	--	--	--	--	--	--	--
B28	05/28/09	1.5'	0905130-04	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--
B29	05/28/09	0.5'	0905130-05	28.4	--	--	--	--	--	--	--	--	--	--	--	--	--
B29	05/28/09	1.5'	0905130-06	41.3	--	--	--	--	--	--	--	--	--	--	--	--	--
B30	05/28/09	0.5'	0905130-07	18.7	--	--	--	--	--	--	--	--	--	--	--	--	--
B30	05/28/09	1.0'	0905130-08	922	<0.01	--	--	--	--	--	--	--	--	--	--	--	--
B31	05/28/09	0.5'	0905130-09	60.7	<0.01	--	--	--	--	--	--	--	--	--	--	--	--

Table 5
Soil Sample Analytical Results - DI WET, STLC and TCLP Metals
(concentrations reported in mg/l, unless noted otherwise)

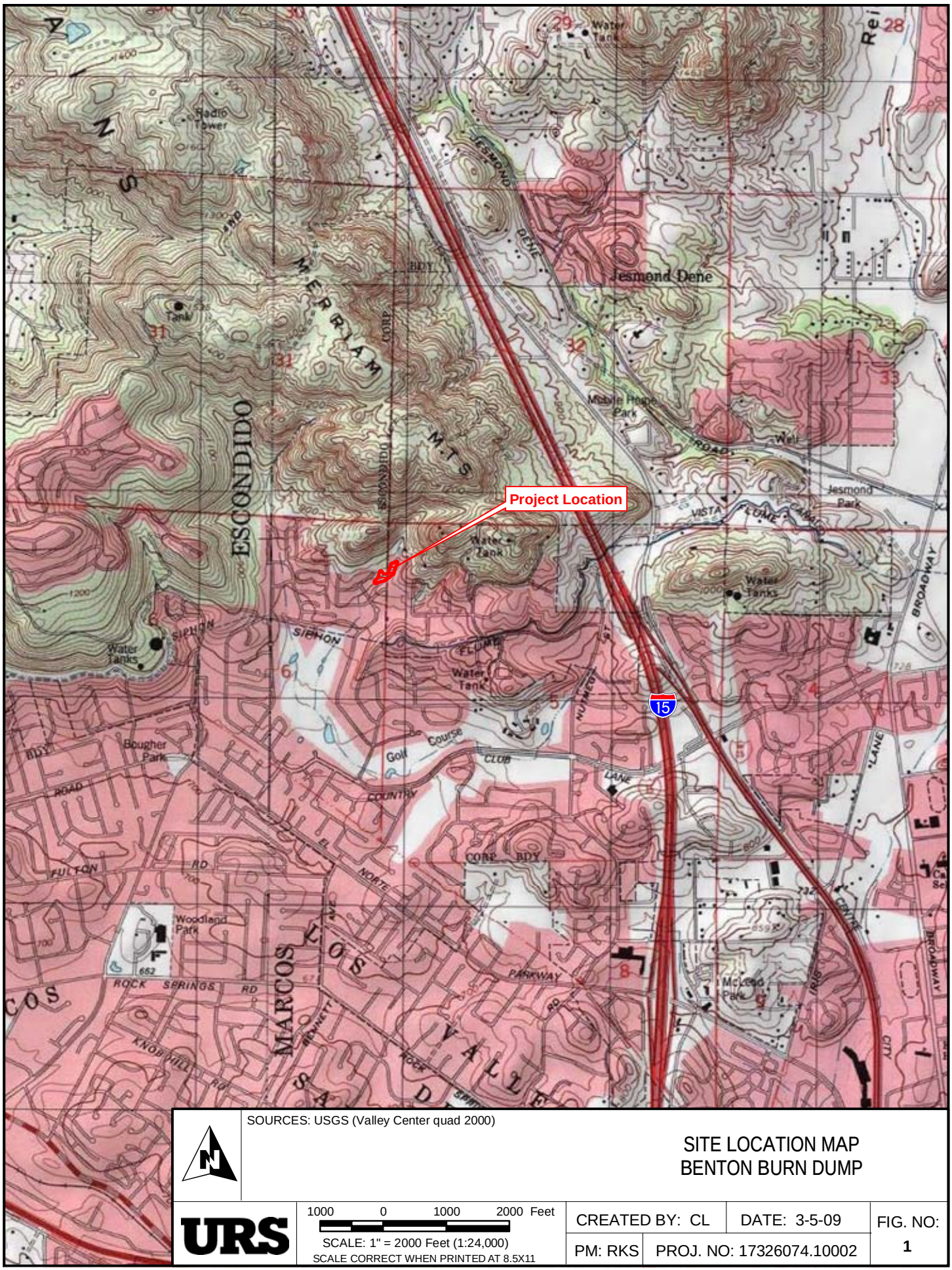
Boring/ Sample ID	Sample Date	Approx. Sample Depth (feet)	Lab ID	TTLC Pb (mg/kg)	DI WET Pb	STLC				TCLP							
						Ba	Cu	Cr	Zn	Hg	As	Ba	Cd	Cr	Pb	Se	Ag
B31	05/28/09	1.5'	0905130-10	49.8	--	--	--	--	--	--	--	--	--	--	--	--	--
B32	05/28/09	0.5	0905130-11	4.6	--	--	--	--	--	--	--	--	--	--	--	--	--
B32	05/28/09	1.5'	0905130-12	5.0	--	--	--	--	--	--	--	--	--	--	--	--	--
B33	05/28/09	0.5'	0905130-13	5.7	--	--	--	--	--	--	--	--	--	--	--	--	--
B33	05/29/09	1.5'	0905130-14	14.2	--	--	--	--	--	--	--	--	--	--	--	--	--
B34	05/29/09	0.5'	0905130-15	331	23.5	--	--	--	--	--	--	--	--	--	--	--	--
B34	05/29/09	1.5'	0905130-16	588	<0.01	--	--	--	--	--	--	--	--	--	--	--	--
B35	05/29/09	0.5	0905130-17	607	<0.01	--	--	--	--	--	--	--	--	--	--	--	--
B35	05/29/09	1.5'	0905130-18	110	16.2	--	--	--	--	--	--	--	--	--	--	--	--
B36	05/29/09	0.5'	0905130-19	115	<0.01	--	--	--	--	--	--	--	--	--	--	--	--
B36	05/29/09	1.0'	0905130-20	22.1	--	--	--	--	--	--	--	--	--	--	--	--	--
B37	05/29/09	0.5'	0905130-21	181	<0.01	--	--	--	--	--	--	--	--	--	--	--	--
B37	05/29/09	1.5'	0905130-22	23.6	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

The "less than" symbol (<) indicates that the constituent was not detected above the detection limit specified.

Pb: Lead
As: Arsenic
Ba: Barium
Cd: Cadmium
Cr: Chromium
Se: Selenium
Hg: Mercury
Ag: Silver
Zn: Zinc
--: Not analyzed

FIGURES



SOURCES: USGS (Valley Center quad 2000)

SITE LOCATION MAP
BENTON BURN DUMP

URS

1000 0 1000 2000 Feet

SCALE: 1" = 2000 Feet (1:24,000)

SCALE CORRECT WHEN PRINTED AT 8.5X11

CREATED BY: CL	DATE: 3-5-09	FIG. NO: 1
PM: RKS	PROJ. NO: 17326074.10002	

Path: G:\gis\projects\1577\17326074\map_docs\mxd\Location_Map.mxd, 03/05/09, camille_lill

Portions of this DERIVED PRODUCT contains geographic information copyrighted by SanGIS. All Rights Reserved.

LEGEND

- Boring location where burn ash-containing waste observed in fill
- Boring location where no burn ash-containing waste was observed in fill
- Boring location where no fill was observed
- **(3.5)** Indicates thickness of cover soil (in feet)
- **NP** No burn ash containing waste present
- **GREEN** Indicates no burn ash-containing waste present
- **ORANGE** Indicates burn ash-containing waste present
- **BLACK** Depth to burn ash-containing materials is not known, but greater than 2 feet.
- Approximate location indicating 2 feet cover soil thickness
- Approximate Burn Site Footprint
- Parcel Boundary

2241634200
2241631800
2241631900
2241634100
2241631600
2241631500
2241631000
2241630900
2241630800
2241903600
2241904700
2241904100
2241901700

B1 (NP)
B2 (3.2)
B3 (2)
B4 (4.5)
B5 (2.5)
B6 (1)
B7 (0)
B8 (0)
B9 (2.5)
B10 (NP)
B11 (0)
B12 (NP)
B13 (7.5)
B14 (NP)
B15 (NP)
B16 (NP)
B17 (NP)
B18 (0)
B19 (0.5)
B20 (NP)
B21 (7)
B22 (0)
B23 (1.5)
B24 (NP)
B25 (0)
B26 (0)
B27 (>2)
B28 (>2)
B29 (>2)
B30 (1.0)
B31 (>2)
B32 (>2)
B33 (>2)
B34 (0.5)
B35 (0.5)
B36 (>1.5)
B37 (0.5)
SS1 (0)
SS2 (0)
SS3 (0)

>2 feet <2 feet
<2 feet >2 feet
<2 feet >2 feet

SOURCES:
Ninyo & Moore, 2007

EXISTING COVER SOIL THICKNESS MAP
BENTON BURN DUMP

URS

20 0 20 40 Feet
SCALE: 1" = 40' (1:480)
SCALE CORRECT WHEN PRINTED AT 11X17

CREATED BY: CL	DATE: 10-06-09	FIG. NO:
PM: RKS	PROJ. NO: 17326074.10003	2

Path: G:\gis\projects\17\7\17326074\map_docs\mxd\Cover_Soil_Thickness_oct09.mxd, 10/06/09, Camille_Lill

LEGEND

- Boring location where burn ash-containing waste observed in fill
- Boring location where no burn ash-containing waste was observed in fill
- Boring location where no fill was observed
- (3.5) Indicates fill thickness (in feet); some or all of which contains burn ash/dump debris
- NP No burn ash-containing waste present
- GREEN Indicates no burn ash-containing waste present
- ORANGE Indicates burn ash-containing waste present
- Approximate contour of equal waste/fill thickness (in feet)
- Approximate Burn Site Footprint
- Parcel Boundary

2241634200
B1 (0)
2241631800
2241631900
2241634100
2241631600
2241631500
2241631000
2241630900
2241630800
2241903600
2241904700
2241904100
2241901700
B2 (11.8)
B3 (5)
B4 (5.3)
B5 (2.5)
B6 (6.2)
B7 (6)
B8 (1.5)
B9 (3.5)
B10 (>2)
B11 (2)
B12 (0)
B13 (8)
B14 (1.5)
B15 (6)
B16 (2)
B17 (0)
B18 (8.5)
B19 (>3.3)
B20 (5.5)
B21 (8)
B22 (6.5)
B23 (>6)
B24 (0)
B25 (1.5)
B26 (0.5)

SOURCES:
Ninyo & Moore, 2007

WASTE/FILL ISOPACH MAP
BENTON BURN DUMP

URS

20 0 20 40 Feet
SCALE: 1" = 40' (1:480)
SCALE CORRECT WHEN PRINTED AT 11X17

CREATED BY: CL	DATE: 10-06-09	FIG. NO: 3
PM: RKS	PROJ. NO: 17326074.10003	

Path: G:\gis\projects\17\17326074\map_docs\mxd\Waste_Area_Volume.mxd, 10/06/09, Camille_Lill

APPENDIX A

EXCELCHEM
Environmental Labs

1135 W Sunset Boulevard
Suite A
Rocklin, CA 95765
Phone# 916-543-4445
Fax# 916-543-4449

ELAP Certificate No. : 2119

10 June 2009

John 'Mac' Macanas

CIWMB

P.O. Box 4025 / 1001 I Street

Sacramento, CA 95812

RE: Benton Dump Site

Workorder number:0905130

Enclosed are the results of analyses for samples received by the laboratory on 05/20/09 09:00. All Quality Control results are within acceptable limits except where noted as a case narrative. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

_____

John Somers, Lab Director

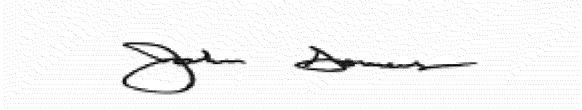
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
B-27-0.5	0905130-01	Soil	05/19/09 08:35	05/20/09 09:00
B-27-1.5	0905130-02	Soil	05/19/09 08:45	05/20/09 09:00
B-28-0.5	0905130-03	Soil	05/19/09 09:00	05/20/09 09:00
B-28-1.5	0905130-04	Soil	05/19/09 09:05	05/20/09 09:00
B-29-0.5	0905130-05	Soil	05/19/09 09:15	05/20/09 09:00
B-29-1.5	0905130-06	Soil	05/19/09 09:20	05/20/09 09:00
B-30-0.5	0905130-07	Soil	05/19/09 09:35	05/20/09 09:00
B-30-1.0	0905130-08	Soil	05/19/09 09:40	05/20/09 09:00
B-31-0.5	0905130-09	Soil	05/19/09 09:55	05/20/09 09:00
B-31-1.5	0905130-10	Soil	05/19/09 10:00	05/20/09 09:00
B-32-0.5	0905130-11	Soil	05/19/09 10:15	05/20/09 09:00
B-32-1.5	0905130-12	Soil	05/19/09 10:25	05/20/09 09:00
B-33-0.5	0905130-13	Soil	05/19/09 10:39	05/20/09 09:00
B-33-1.5	0905130-14	Soil	05/19/09 10:44	05/20/09 09:00
B-34-0.5	0905130-15	Soil	05/19/09 10:56	05/20/09 09:00
B-34-1.5	0905130-16	Soil	05/19/09 11:05	05/20/09 09:00
B-35-0.5	0905130-17	Soil	05/19/09 11:14	05/20/09 09:00
B-35-1.5	0905130-18	Soil	05/19/09 11:19	05/20/09 09:00
B-36-0.5	0905130-19	Soil	05/19/09 11:35	05/20/09 09:00
B-36-1.0	0905130-20	Soil	05/19/09 11:40	05/20/09 09:00
B-37-0.5	0905130-21	Soil	05/19/09 12:10	05/20/09 09:00
B-37-1.5	0905130-22	Soil	05/19/09 12:14	05/20/09 09:00

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

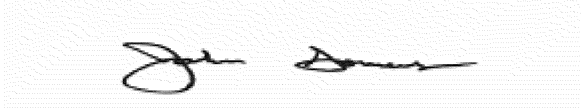
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-27-0.5

0905130-01 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**3.6**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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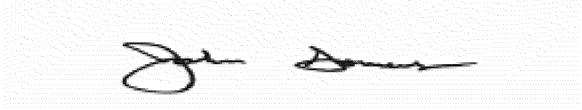
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-27-1.5
0905130-02 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**3.4**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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Excelchem Environmental Labs

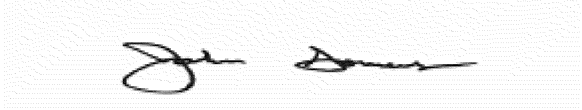
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-28-0.5

0905130-03 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**12.3**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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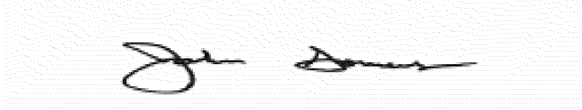
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-28-1.5
0905130-04 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**3.0**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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Excelchem Environmental Labs

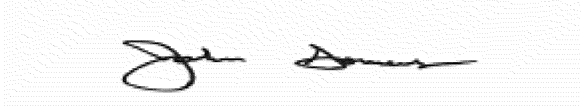
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-29-0.5

0905130-05 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**28.4**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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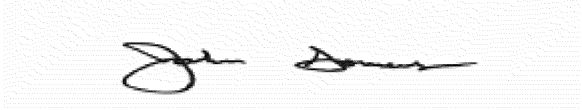
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-29-1.5
0905130-06 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**41.3**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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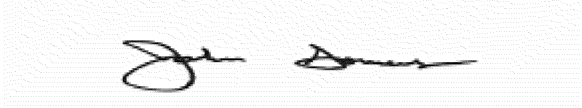
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-30-0.5
0905130-07 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**18.7**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

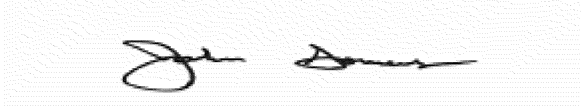
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-30-1.0
0905130-08 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**922**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	
WET-DI analysis								
Lead	ND	10.0	ug/l	ASF0051	06/03/09	06/08/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

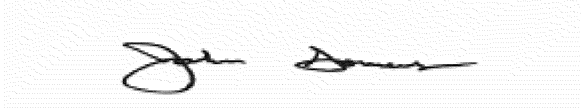
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-31-0.5
0905130-09 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**60.7**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	
WET-DI analysis								
Lead	ND	10.0	ug/l	ASF0051	06/03/09	06/08/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

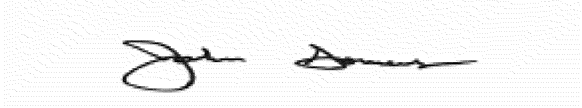
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-31-1.5
0905130-10 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**49.8**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

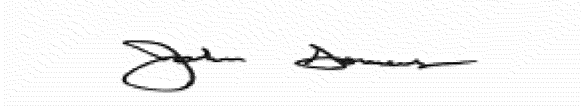
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-32-0.5
0905130-11 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**4.6**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-32-1.5
0905130-12 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**5.0**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

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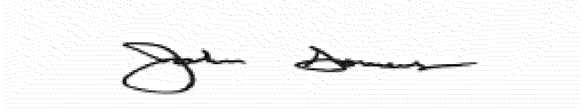
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-33-0.5
0905130-13 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**5.7**	1.0	mg/kg	ASE0235	05/28/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



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CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-33-1.5
0905130-14 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**14.2**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	

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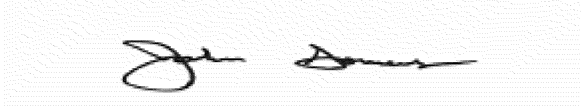
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-34-0.5
0905130-15 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**331**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	
WET-DI analysis								
Lead	**23.5**	10.0	ug/l	ASF0051	06/03/09	06/08/09	EPA 6010B	

Excelchem Environmental Lab.



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Excelchem Environmental Labs

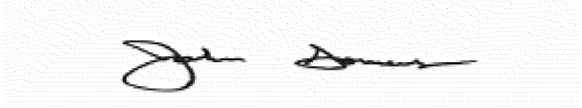
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-34-1.5

0905130-16 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**588**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	
WET-DI analysis								
Lead	ND	10.0	ug/l	ASF0051	06/03/09	06/08/09	EPA 6010B	

Excelchem Environmental Lab.



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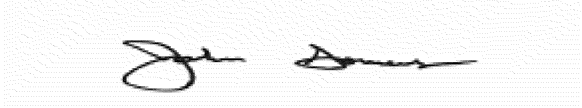
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-35-0.5
0905130-17 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**607**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	
WET-DI analysis								
Lead	ND	10.0	ug/l	ASF0051	06/03/09	06/08/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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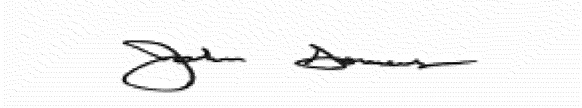
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-35-1.5
0905130-18 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**110**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	
WET-DI analysis								
Lead	**16.2**	10.0	ug/l	ASF0051	06/03/09	06/08/09	EPA 6010B	

Excelchem Environmental Lab.



Laboratory Representative

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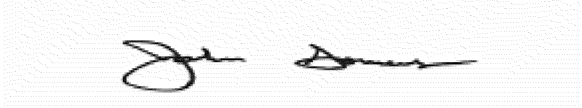
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-36-0.5
0905130-19 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**115**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	
WET-DI analysis								
Lead	ND	10.0	ug/l	ASF0051	06/03/09	06/08/09	EPA 6010B	

Excelchem Environmental Lab.



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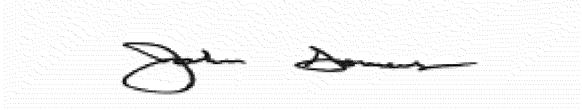
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-36-1.0
0905130-20 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**22.1**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



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Excelchem Environmental Labs

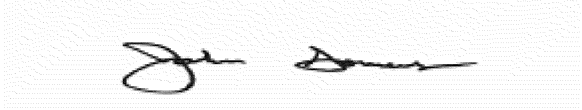
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-37-0.5

0905130-21 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**181**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	
WET-DI analysis								
Lead	ND	10.0	ug/l	ASF0051	06/03/09	06/08/09	EPA 6010B	

Excelchem Environmental Lab.



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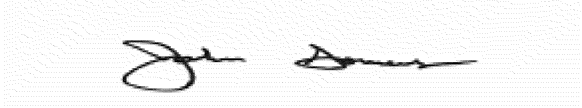
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

B-37-1.5
0905130-22 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Lead	**23.6**	1.0	mg/kg	ASE0236	05/29/09	05/29/09	EPA 6010B	

Excelchem Environmental Lab.



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Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

METALS BY 6000/7000 SERIES - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch ASE0235 - EPA 6010B										
Blank (ASE0235-BLK1)				Prepared & Analyzed: 05/28/09						
Lead	ND	1.0	mg/kg							
LCS (ASE0235-BS1)				Prepared & Analyzed: 05/28/09						
Lead	102	1.0	mg/kg	100		102	75-125			
LCS Dup (ASE0235-BSD1)				Prepared & Analyzed: 05/28/09						
Lead	102	1.0	mg/kg	100		102	75-125	0.461	25	
Matrix Spike (ASE0235-MS1)		**Source: 0905115-31**		Prepared & Analyzed: 05/28/09						
Lead	132	1.0	mg/kg	100	47.2	84.6	75-125			
Matrix Spike Dup (ASE0235-MSD1)		**Source: 0905115-31**		Prepared & Analyzed: 05/28/09						
Lead	146	1.0	mg/kg	100	47.2	99.0	75-125	10.3	25	
Batch ASE0236 - EPA 6010B										
Blank (ASE0236-BLK1)				Prepared & Analyzed: 05/29/09						
Lead	ND	1.0	mg/kg							
LCS (ASE0236-BS1)				Prepared & Analyzed: 05/29/09						
Lead	103	1.0	mg/kg	100		103	75-125			
LCS Dup (ASE0236-BSD1)				Prepared & Analyzed: 05/29/09						
Lead	102	1.0	mg/kg	100		102	75-125	1.05	25	
Matrix Spike (ASE0236-MS1)		**Source: 0905130-19**		Prepared & Analyzed: 05/29/09						
Lead	172	1.0	mg/kg	100	115	57.4	75-125			QL-01

Excelchem Environmental Lab.

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Laboratory Representative

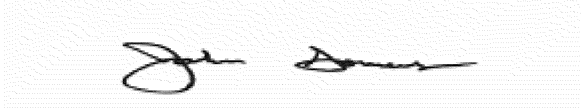
Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

METALS BY 6000/7000 SERIES - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch ASE0236 - EPA 6010B										
Matrix Spike Dup (ASE0236-MSD1)		**Source: 0905130-19**		Prepared & Analyzed: 05/29/09						
Lead	149	1.0	mg/kg	100	115	34.0	75-125	14.5	25	QL-01

Excelchem Environmental Lab.



Laboratory Representative

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Excelchem Environmental Labs

CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

WET-DI analysis - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch ASF0051 - EPA 6010B										
Blank (ASF0051-BLK1)				Prepared: 06/03/09 Analyzed: 06/08/09						
Lead	ND	10.0	ug/l							
LCS (ASF0051-BS1)				Prepared: 06/03/09 Analyzed: 06/08/09						
Lead	1020	10.0	ug/l	1000		102	75-125			
LCS Dup (ASF0051-BSD1)				Prepared: 06/03/09 Analyzed: 06/08/09						
Lead	1040	10.0	ug/l	1000		104	75-125	1.18	25	
Matrix Spike (ASF0051-MS1)		**Source: 0905130-08**		Prepared: 06/03/09 Analyzed: 06/08/09						
Lead	1040	10.0	ug/l	1000	8.48	103	75-125			
Matrix Spike Dup (ASF0051-MSD1)		**Source: 0905130-08**		Prepared: 06/03/09 Analyzed: 06/08/09						
Lead	1030	10.0	ug/l	1000	8.48	102	75-125	0.776	25	

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CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32

Notes and Definitions

QL-01 Sample results for the QC batch were accepted based on LCS/LCSD percent recoveries and RPD values.

ND Analyte not detected at reporting limit.

NR Not reported

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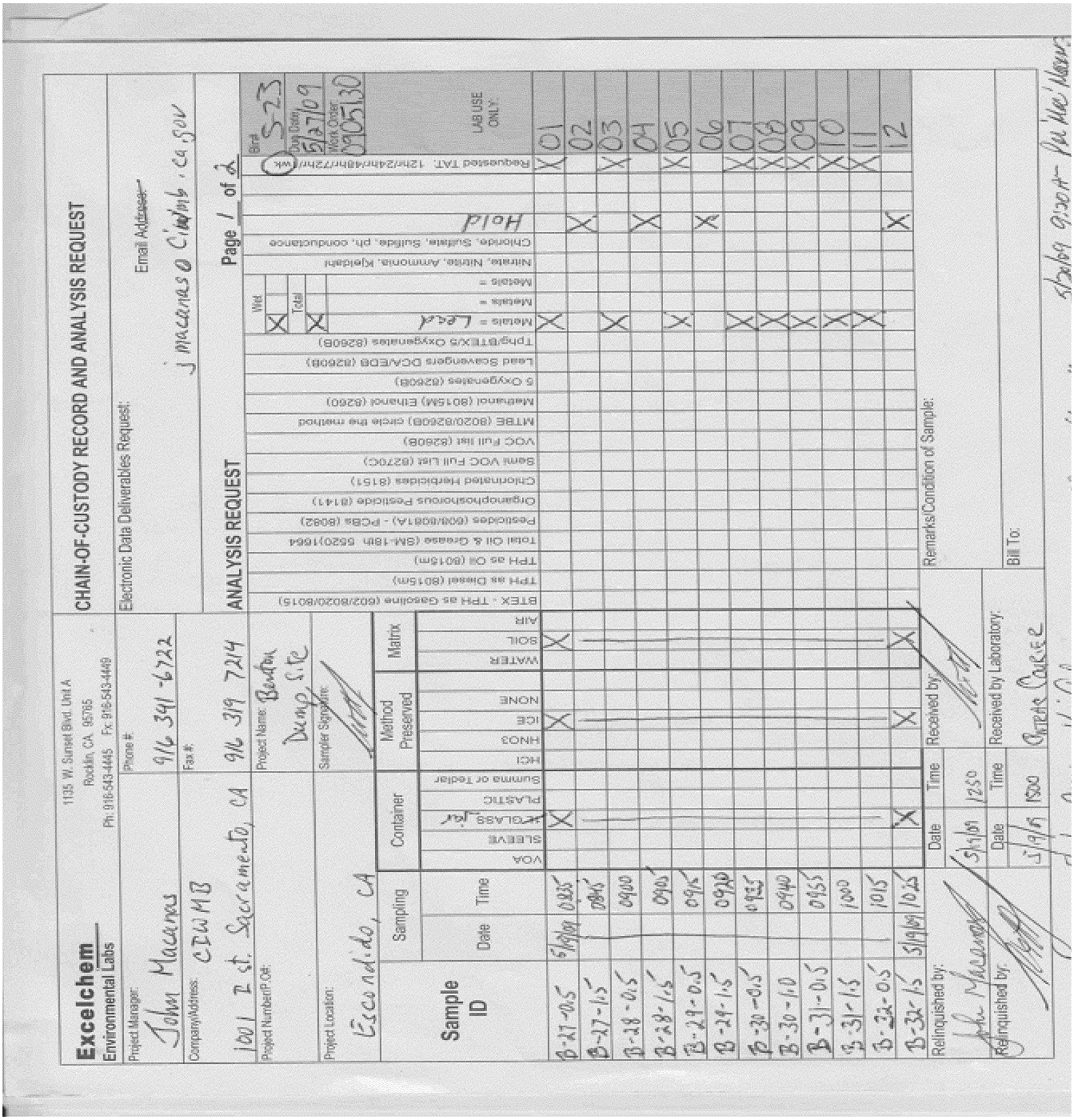
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32



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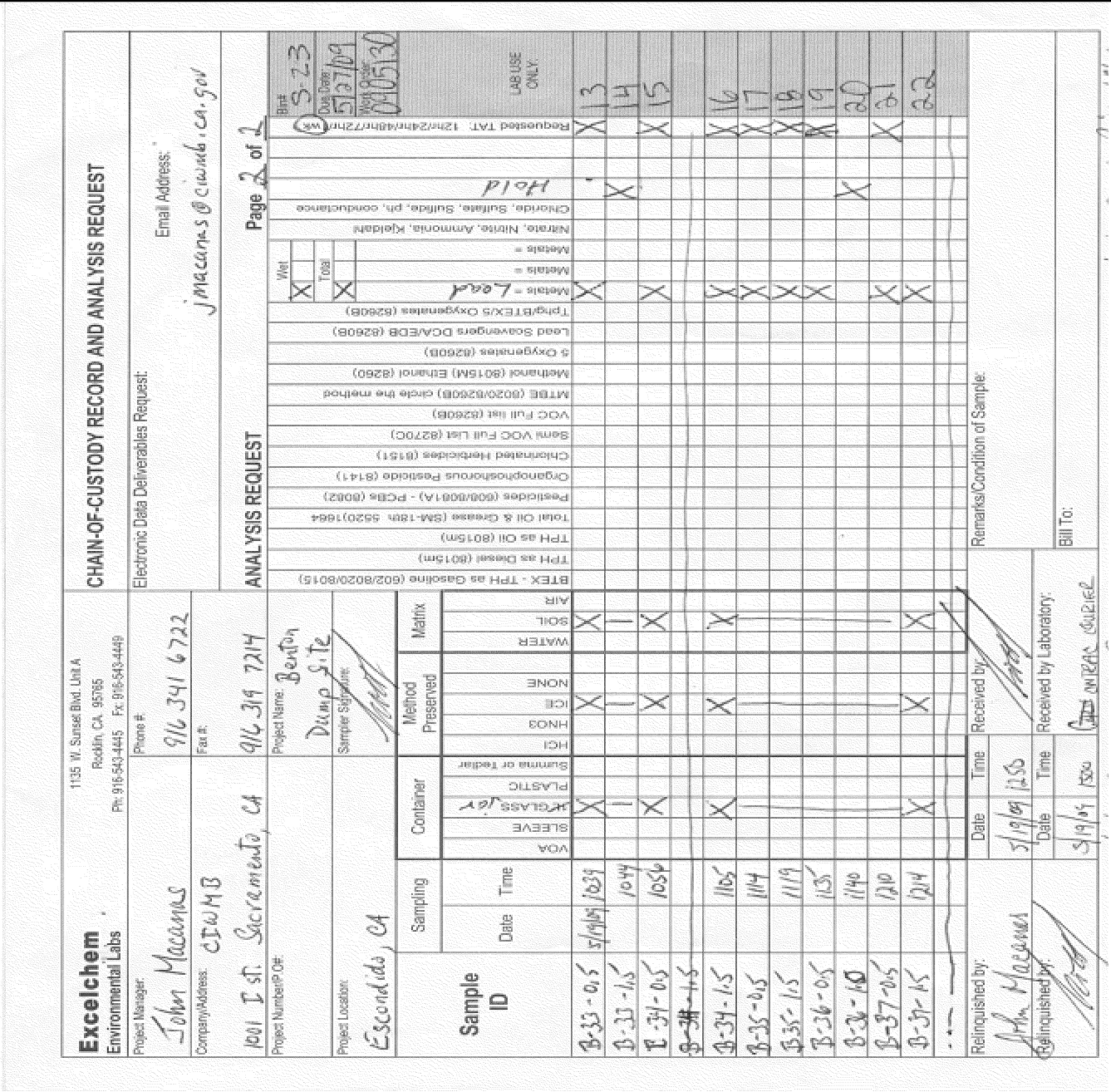
CIWMB	Project:	Benton Dump Site	
P.O. Box 4025 / 1001 I Street	Project Number:	[none]	Date Reported:
Sacramento, CA 95812	Project Manager:	John 'Mac' Macanas	06/10/09 15:32



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APPENDIX B

Table B-1
Federal Chemical-Specific ARARs

Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL				
Resource Conservation and Recovery Act (RCRA)/HWCA*				
Definition of RCRA hazardous waste.	Waste soil or wastewater	Title 22 CCR Sections 66261.21, 66261,.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Potentially applicable for response actions.	Based on results of the site investigation, a small volume of the soil would be considered a RCRA hazardous waste if it were transported off-site to a permitted disposal facility.
Land Disposal Restrictions	Waste soil	Title 22 CCR Section 66268 40 CFR Part 268	Potentially applicable for response actions.	The applicable standard for land disposal is based on the Universal Treatment Standard (UTS). The UTS for the COPCs will vary based on the chemical constituents present. The land disposal standards for hazardous waste soils were relaxed to 10-times the UTS.
WATER				
Clean Water Act (CWA) 33 USC 1251-1376				
Regulates discharges of water from a facility or site including site runoff	Wastewater discharge to a water body	40 CFR 100-149	Not an ARAR	No ex-situ groundwater treatment is proposed at the site. Hence no treated groundwater is proposed to be discharged. Stormwater runoff during remedial action may require control.
Safe Drinking Water Act (SDWA) 42 USC 300f - 300j				
Regulates the quality of drinking water supply and lists maximum contaminant levels	Drinking water	40 CFR 141-143	Potentially applicable for response actions.	Maximum Contaminant Limits are considered relevant and appropriate for this remedial action.

Table B-1
Federal Chemical-Specific ARARs
(Continued)

Requirement	Prerequisite	Citation	ARAR Determination	Comments
AIR				
Clean Air Act (CAA), 40 USC 7401 et seq.*				
National Ambient Air Quality Standards (NAAQS): Primary and secondary standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead).	Contamination of air affecting public health and welfare.	40 CFR 50.4 - 50.12	Potentially applicable for response actions.	These requirements will be evaluated further in the action-specific ARARs.
Provisions of State Implementation Plan (SIP) approved by EPA under Section 110 of CAA.	Major sources of air pollutants.	40 USC 7410; portions of 40 CFR 52.220 applicable to South Coast Air Quality Management District	Potentially applicable for response actions.	Emission of air pollutants regulated by SIP are possible at the site. These requirements will be evaluated further in the action-specific ARARs.

*Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the preparer accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

ARARs - Applicable or relevant and appropriate requirements
CCR - California Code of Regulations
CFR - Code of Federal Regulations
EPA - U.S. Environmental Protection Agency
RCRA - Resource Conservation and Recovery Act
SIP - State Implementation Plan
USC - United States Code

Chemical-specific concentrations used for the RAP may not be ARARs indicated in this table, but may be concentrations based upon other factors. Such factors may include the following:

- Human health risk-based concentrations (risk-based; PRGs 40 CFR 300.430[e][A][1] and [2]).
- Ecological risk-based concentrations (40 CFR 300.430[e][G]).
- Practical quantitation limits of contaminants (40 CFR 300.430[e][A][3]).

Table B-2
State Chemical-Specific ARARs

Requirement	Prerequisites	Citation	ARAR Determination	Comments
SOIL				
Cal-EPA Department of Toxic Substances Control (DTSC)*				
Definition of "Non-RCRA hazardous waste"	Waste	22 CCR 66261.22(a)(3) and (4), 66261.24(a)(2) to (a)(8), 66261.101, 66261.3(a)(2)(C), or 66261.3(a)(2)(F)	Applicable	Results from the site investigation indicate that the soil would be considered non-RCRA (California) hazardous if it were removed from the site and disposed at a permitted facility.
State and Regional Water Quality Control Board (RWQCB)*				
Authorizes the State and Regional Water Boards to establish in Water Quality Control Plans beneficial uses and numerical and narrative standards to protect both surface and groundwater quality. Authorizes regional water boards to issue permits for discharges to land or surface or groundwater that could affect water quality, including NPDES permits, and to take enforcement action to protect water quality.	Waste discharge	California Water Code, Division 7, Section 13241, 13243, 13263(a), and 13360 (Porter-Cologne Water Quality Control Act)	Applicable	Substantive provisions are ARARs.
		Other provisions of Porter-Cologne Water Quality Control Act	Not ARARs	

Table B-2
State Chemical-Specific ARARs
(Continued)

Requirement	Prerequisites	Citation	ARAR Determination	Comments
SOIL				
Describes the water basins in San Diego, establishes beneficial uses of ground and surface waters, establishes water quality objectives, including narrative and numerical standards, establishes implementation plans to meet water quality objectives and protect beneficial uses, and incorporates statewide water quality control plans and policies.	Waste discharge	San Diego Region Basin Plan	Potentially applicable	Substantive provisions are ARARs, including beneficial use designations, water quality objectives, and water discharge limits.

*Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the preparer accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs.

ARAR - Applicable or relevant and appropriate requirements.

RCRA - Resource Conservation and Recovery Act.

Chemical-specific concentrations used for removal action alternative evaluation may not be ARARs indicated in this table, but may be concentrations based upon other factors. Such factors may include the following:

- Human health risk-based concentrations (Risk-based PRGs) [40 CFR 300.430(e)(A)(1) and (2)].
- Ecological risk-based concentrations [40 CFR 300.430(e)(G)].
- Practical quantitation limits of contaminants [40 CFR 300.430(e)(A)(3)].

Table B-3
Federal Location-Specific ARARs

Location	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Endangered Species Act of 1973[a]					
Critical habitat upon which endangered species or threatened species depend	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior.	Determination of effect upon endangered or threatened species or their habitat	16 USC 1536(a)	Applicable	There may be critical habitats in the immediate vicinity of the site.
Executive Order 11990, Protection of Wetlands					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland as defined by Executive Order 11990, Section 7	40 CFR 6, Appendix A (excluding Sections 6[a][2], [4], and [6]); 40 CFR 6.302	Not an ARAR	There is no wetland at the site.
Clean Water Act, Section 404a					
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit. Mitigation may be required to avoid net loss of wetlands.	Wetland as defined by Executive Order 11990, Section 7	40 CFR 230.10; 40 CFR 231 (excluding 231.1, 231.2, 231.7, and 231.8)	No an ARAR	There is no wetland at the site.

Table B-3
Federal Location-Specific ARARs
(Continued)

Location	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Fish and Wildlife Coordination Act, Section 662a					
Area affecting stream or other water body	Action taken should protect fish or wildlife.	Diversion, channeling, or other activity that modifies a stream or other water body and affects fish or wildlife	16 USC 662	Not an ARAR	
Migratory Bird Treaty Act of 1972a					
Migratory bird area	Protects almost all species of native birds in the United States from unregulated "take," which can include poisoning at hazardous waste sites.	Presence of migratory birds	16 USC 703	Not an ARAR	

[a]Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs. Specific potential ARARs follow each general heading.

ARAR - Applicable or relevant and appropriate requirement.

CFR - Code of Federal Regulations.

USC - United States Code.

Table B-4
State Location-Specific ARARs

Location	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Fish and Game Code*					
Endangered Species Habitat	Ensures that action taken will not jeopardize the survival and reproduction of any threatened or endangered species		Fish and Game Code Sections 2090-2096	Not an ARAR	Not effective after 1 January 1994.

* Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the preparer accepts the entire statutes or policies as potential ARARs. Specific potential ARARs follow each general heading; only substantive requirements of the specific citations are considered potential ARARs.

ARAR - Applicable or relevant and appropriate requirement.

CCR - California Code of Regulations

Table B-5
Federal Action-Specific ARARs

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Resource Conservation and Recovery Act (RCRA) 42 USC 6901 et seq.*					
Onsite waste generation	Person who generates waste shall determine if that waste is a hazardous waste.	Generator of hazardous waste in California.	22 CCR 66262.10(a), 66262.11,	Applicable	Applicable for operation where waste is generated.
Hazardous waste accumulation	Generator may accumulate waste onsite for 90 days or less or must comply with requirements for operating a storage facility.	Accumulate hazardous waste.	22 CCR Section 66262.34	Applicable	Accumulation of hazardous wastes onsite for longer than 90 days would be subject to RCRA requirements for storage facilities.
Recordkeeping	Generator must keep records.	Generate hazardous waste.	22 CCR Section 66262.40	Applicable	Applicable if hazardous wastes are accumulated for longer than 90 days.
Container storage	Containers of RCRA hazardous waste must be: - Maintained in good condition. - Compatible with hazardous waste to be stored. - Closed during storage except to add or remove waste.	Storage of RCRA hazardous waste not meeting small quantity generator criteria held for a temporary period greater than 90 days before treatment, disposal or storage elsewhere, in a container.	22 CCR 66264.171, 172, 173	Applicable	See comment above.
	Inspect container storage areas weekly for deterioration.		22 CCR 66264.174		See comment above.
Container Storage (Cont'd)	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.		22 CCR 66264.175(a) and (b)		See comment above.

Table B-5
Federal Action-Specific ARARs
(Continued)

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
	Keep containers of ignitable or reactive waste at least 50 feet from the facility property line.		22 CCR 66264.176		See comment above.
	Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier.		22 CCR 66264.177		See comment above.
	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers, liners.		22 CCR 66264.178		Potentially applicable for all alternatives generating hazardous waste.
Excavation	Movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions for the excavated waste or closure requirements for the unit in which the waste is being placed.	Materials containing hazardous wastes subject to land disposal restrictions are placed in another unit.	22 CCR 66268.40	Applicable	Applicable for Alternative 3, which involves off-site disposal.
	Area from which materials are excavated may require cleanup to levels established by closure requirements.	Hazardous waste placed at site after the effective date of the requirements.	22 CCR 66264.228(a), (b), (e) through (k), (m), (o) through (q); 22 CCR 66264.258(a) and (b), except as it cross-references procedural requirements.		Not an ARAR. Requirements in 23 CCR 2582 are more stringent.
Treatment when waste will be land disposed	Treatment of waste subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste, if residual is to be land disposed.	Placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, or underground mine or cave.	22 CCR 66268.40 and 42	Potentially Applicable	Potentially applicable to alternatives involving disposal of hazardous waste offsite.

Table B-5
Federal Action-Specific ARARs
(Continued)

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Placement of waste in land disposal unit	Attain land disposal treatment standards before putting waste into landfill in order to comply with land ban restrictions.		22 CCR 66268.40	Applicable	Applicable for soil, which is a listed hazardous waste, that is regulated under land disposal restrictions.
Groundwater monitoring	Owners/operators of RCRA surface impoundment, waste pile, land treatment unit, or landfill shall conduct a monitoring and response program for each regulated unit.	Surface impoundment, waste pile, land treatment unit, or landfill for which constituents in or derived from waste in the unit may pose a threat to human health or the environment.	22 CCR 66264.90(a) and (c), 66264.91(a) and (c), 66264.92-.95, 66264.97-.98 except as it cross-references permit requirements	Potentially Applicable	

Table B-5
Federal Action-Specific ARARs
(Continued)

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Clean Air Act (CAA) 40 USC 7401 et seq.					
Discharge to air	Provisions of State Implementation Plan (SIP) approved by EPA under Section 110 of CAA.	Major sources of air pollutants	40 USC Section 7410; portions of 40 CFR Section 52.220 applicable to South Coast Air Quality Management District	Potentially Applicable	
	National Primary and Secondary Ambient Air Quality Standards (NAAQS) - standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead).	Contamination of air affecting public health and welfare	40 CFR Sections 50.4 - 50.12	Applicable	
U.S Department of Transportation, 49 USC 1802, et seq.*					
Hazardous Materials Transportation	No person shall represent that a container or package is safe unless it meets the requirements of 49 USC 1802, et seq. or represent that a hazardous material is present in a package or motor vehicle if it is not.	Interstate carriers transporting hazardous waste and substances by motor vehicle. Transportation of hazardous material under contract with any department of the executive branch of the Federal government.	49 CFR 171.2(f)	Applicable if soil is classified as a hazardous waste	Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Offsite transport must comply with both substantive and administrative requirements.
	No person shall unlawfully alter or deface labels, placards or descriptions, packages, containers, or motor vehicles used for transportation of hazardous materials.		49 CFR 171.2(g)		See comment above.

Table B-5
Federal Action-Specific ARARs
(Continued)

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Hazardous Materials Marking, Labeling, and Placarding	Each person who offers hazardous material for transportation or each carrier that transports it shall mark each package, container, and vehicle in the manner required.	Person who offers hazardous material for transportation; carries hazardous material; or packages, labels, or placards hazardous material.	49 CFR 172.300	Applicable if soil is classified as a hazardous waste	See comment above.
	Each person offering nonbulk hazardous materials for transportation shall mark the proper shipping name and identification number (technical name) and consignee's name and address.		49 CFR 172.301		See comment above.
	Hazardous materials for transportation in bulk packages must be labeled with proper identification (ID) number, specified in 49 CFR 172.101 table, with required size of print. Packages must remain marked until cleaned or refilled with material requiring other marking.		49 CFR 172.302	Applicable if soil is classified as a hazardous waste	See comment above.
	No package marked with a proper shipping name or ID number may be offered for transport or transported unless the package contains the identified hazardous material or its residue.		49 CFR 172.303		See comment above.
	The markings must be durable, in English, in contrasting colors, unobscured, and away from other markings.		49 CFR 172.304		See comment above.
	Labeling of hazardous material packages shall be as specified in the list.		49 CFR 172.400		See comment above.

Table B-5
Federal Action-Specific ARARs
(Continued)

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Hazardous Materials Marking, Labeling, and Placarding (Cont'd)	Nonbulk combination packages containing liquid hazardous materials must be packed with closures upward, and marked with arrows pointing upward.		49 CFR 172.312		See comment above.
	Each bulk packaging or transport vehicle containing any quantity of hazardous material must be placarded on each side and each end with the type of placards listed in Tables 1 and 2 of 49 CFR 172.504.	Each person who offers for transport or transports any hazardous materials shall comply with these placarding requirements.	49 CFR 172.504		See comment above.

*Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs. Specific potential ARARs are addressed in the table below each general heading.

A - Applicable.

ARAR - Applicable or relevant and appropriate requirement.

CAA - Clean Air Act.

CCR - California Code of Regulations.

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act.

CFR - Code of Federal Regulations.

CWA - Clean Water Act.

DOT - U.S. Department of Transportation.

EPA - U.S. Environmental Protection Agency.

NAAQS - National Ambient Air Quality Standards (primary and secondary).

NESHAPs - National emission standards for hazardous air pollutants.

NPDES - National Pollutant discharge elimination system.

RA - Relevant and appropriate.

RCRA - Resource Conservation and Recovery Act.

RWQCB - California Regional Water Quality Control Board, San Diego Region.

SWRCB - California State Water Resources Control Board.

SDWA - Safe Drinking Water Act.

SIP - State Implementation Plan.

TBC - To be considered.

USC - United States Code.

Table B-6
State Action-Specific ARARs

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB)*					
Discharge Affecting Water Quality	Authorizes the State and Regional Water Boards to establish in Water Quality Control Plans beneficial uses and numerical and narrative standards to protect both surface and ground water quality. Authorizes regional water boards to issue permits for discharges to land or surface or ground water that could affect water quality, including NPDES permits, and to take enforcement action to protect water quality.	Waters of the state.	California Water Code, Division 7, Section 13241, 13243, 13263(a), and 13360 (Porter-Cologne Water Quality Control Act)	Potentially applicable	It should be noted that the site is in a beneficial groundwater-use area. However, DI WET results are well below STLC regulatory limit. Waste has low potential to affect water quality.
Management of Waste Piles	Control of waste piles during cleanup project such that their management does not lead to the creation of a condition of pollution or nuisance.		23 CCR, Chapter 15, Sections 2540-2543, and 2546	Applicable	Stockpiles will be managed in accordance with these regulations.
San Diego Pollution Control District					
Discharge to Air	Prohibits the discharge of any air emissions in quantities that may cause injury, detriment, nuisance, or annoyance to any considerable number of persons, or the public, or which cause or have the tendency to cause injury or damage to business or property.			Applicable	Dust generated during removal action will be controlled.

Table B-6
State Action-Specific ARARs
(Continued)

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Integrated Waste Management Board (LEA)					
Post-Closure Activity	Authorizes LEAs to require owners to address site-specific conditions to ensure that public health and safety and or the environment are protected for new post-closure activities that may jeopardize the integrity of previously closed disposal sites or pose a potential threat to public health and safety or the environment.	Protection of human health and safety.	27CCR21100(b)(2)	Applicable.	
Post-Closure Land Use	All proposed post-closure land uses other than non-irrigated open space, shall be submitted to the LEA, RWQCB, local air district and local land use agency. The LEA shall review and approve post-closure land uses if the project involves structures within 1,000-feet of the disposal area, structures on top of wastes, modifications of the low permeability layer, or irrigation over waste.	Protection of human health and safety.	27CCR21190©	Applicable.	
Emergency Response Plan	Addresses manner in which operator of facility will address emergency response that could endanger human health or the environment.	Water quality protection	27CCR21130	Applicable.	
Site Security	Security and signage for site.	Protection of human health and safety.	27CCR21135	Applicable.	

Table B-6
State Action-Specific ARARs
(Continued)

Action	Requirement	Prerequisites	Citation	ARAR Determination	Comments
Final Grading	Final grades must be designed and maintained to reduce impacts to health and safety.	Maintenance/ensure cover integrity.	27CCR21142	Applicable.	
Drainage and Erosion Control	Drainage and erosion control to ensure protection of human health and safety and integrity of cap.	Maintenance/ensure cover integrity.	27CCR21150	Applicable.	
Post-Closure Maintenance	Post closure maintenance requirements and procedures.	Maintenance/ensure cover integrity.	27CCR21180	Applicable.	

* Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the preparer accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific actions are considered potential ARARs.

A - Applicable.

ARAR - Applicable or relevant and appropriate requirement.

CCR - California Code of Regulations.

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act.

CFR - Code of Federal Regulations.

EPA - U.S. Environmental Protection Agency.

NPDES - National Polluant discharge elimination system.

RA - Relevant and appropriate.

RCRA - Resource Conservation and Recovery Act.

SDWA - Safe Drinking Water Act.

TBC - To be considered.

USC - United States Code.

APPENDIX C

Table C-1
Comparative Summary of Costs for Remedial Alternatives
Benton Burn Dump
Escondido, California

ALTERNATIVE		1	2	3
ALTERNATIVE DESCRIPTION	YEAR COST INCURRED	No Action	Consolidation, Capping and Institutional Controls	Complete Excavation and Off-Site Disposal
CAPITAL COSTS	0	0	$191,871	$2,551,116
ANNUAL O&M COSTS	0 to 30	0	$0	$0
PERIODIC COSTS	5	0	$3,000	$0
PERIODIC COSTS	15	0	$3,000	$0
PERIODIC COSTS	25	0	$3,000	$0
NET PRESENT VALUE		$0	$195,871	$2,551,116

Assumptions:
Annual Interest Rate: 6.000%
Annual Inflation Rate: 3.000%
Periodic Costs Estimations not subject to inflation

Table C-2
Preliminary Cost Estimate
Alternative 1 - No Action

ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
CAPITAL COSTS:						
1	Clearing and Grubbing	0	sf	$0.15	$0	
2	Temporary Fencing and Signage	0	lf	$0.15	$0	
3	Cut, Fill and Compaction	0	ton	$11.00	$0	
4	Import cover soils to site	0	ton	$8.00	$0	
5	Placement of cover soils	0	ton	$9.00	$0	
6	Excavate and load cover soils	0	ton	$15.00	$0	
7	Truck cover soils to disposal site	0	ton	$33.00	$0	
8	Tipping fees for cover soils	0	ton	$18.00	$0	
9	Excavate and load burn ash	0	ton	$15.00	$0	
10	Truck burn ash to disposal site	0	ton	$65.00	$0	
11	Tipping fees for burn ash	0	ton	$25.00	$0	
12	Import backfill soils to site	0	ton	$25.00	$0	
13	Placement of cover soils	0	ton	$9.00	$0	
14	Erosion Control	0	ls	$100,000	$0	
	Subtotal				$0	
15	Mob/Demob for contractor			5%	$0	
	Subtotal				$0	
16	Contingency			25%	$0	
	Subtotal				$0	
17	Project Management			5%	$0	
18	Remedial Design			8%	$0	
19	Construction Management			10%	$0	
20	Institutional Controls	0	ls	$100,000	$0	
	TOTAL CAPITAL COSTS				$0	
O&M COSTS:						
21	Quarterly Monitoring & Reporting	0	ls	$10,000.00	$0	
	Subtotal				$0	
22	Contingency			30%	$0	
	Subtotal				$0	
23	Project Management			5%	$0	
24	Technical Support			8%	$0	
25	Institutional Controls	0	ls	$3,500.00	$0	
	TOTAL O&M COSTS				$0	
PERIODIC COSTS:						
26	Surface Maintenance (0-5 years)	0	ls	$10,000.00	$0	
27	Surface Maintenance (5 years)	0	ls	$10,000.00	$0	
28	Surface Maintenance (15 years)	0	ls	$15,000.00	$0	
	TOTAL PERIODIC COSTS				$0	

Table C-3
Preliminary Cost Estimate
Alternative 2 - Consolidation, Capping and Institutional Controls

ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
CAPITAL COSTS:						
1	Clearing and Grubbing	26,000	sf	$0.15	$3,900	
2	Temporary Fencing and Signage	300	lf	$8.00	$2,400	2-month rental.
3	Cut, Fill and Compaction	2,500	ton	$11.00	$27,500	
4	Import cover soils to site	0	ton	$8.00	$0	
5	Placement of cover soils	0	ton	$9.00	$0	
6	Excavate margins to 2 feet	450	ton	$11.00	$4,950	
7	Truck cover soils to disposal site	0	ton	$33.00	$0	None; spread margin soil on floor
8	Tipping fees for cover soils	0	ton	$18.00	$0	Not applicable.
9	Excavate and load burn ash	0	ton	$11.00	$0	Excavate margin, see #5
10	Truck burn ash to disposal site	0	ton	$65.00	$0	Burn ash remains on site
11	Tipping fees for burn ash	0	ton	$25.00	$0	Burn ash remains on site
12	Import backfill soils to site	2,100	ton	$25.00	$52,500	Assume 1.3 factor
13	Placement of backfill soils	2,100	ton	$9.00	$18,900	Assume 1.3 factor
14	Import gravel for channel	350	cy	$15.00	$5,250	Use gravel, 1- to 2-inch diam, and 12-inch diam.
15	Filter fabric	26,000	sf	$0.20	$5,200	
16	Erosion control BMPs	2,000	lf	$3.33	$6,660	Fiber rolls and hydroseed
17	Grading Permit	1	ls	$7,500	$7,500	Assumes effort is minimal.
18	Sampling	1	ls	$0	$0	
	Subtotal				$134,760	
19	Mob/Demob for contractor			5%	$6,738	
	Subtotal				$141,498	
20	Contingency			20%	$28,300	
	Subtotal				$169,798	
21	Project Management			5%	$8,490	To be provided by owners or their contractor.
22	Remedial Design			0%	$0	No additional remedial design needed
23	Construction Management			8%	$13,584	Provided by owners or their contractor.
24	Institutional Controls	1	ls	$0	$0	Flag at County for Longacre, Phillips. No flag for HOA at City.
	TOTAL CAPITAL COSTS				$191,871	
O&M COSTS:						
25	Quarterly Monitoring & Reporting	1	ls	$0.00	$0	Currently conducted by LEA. No cost included.
	Subtotal				$0	
26	Contingency			30%	$0	
	Subtotal				$0	
27	Project Management			5%	$0	
28	Technical Support			8%	$0	
29	Institutional Controls	1	ls	$0.00	$0	Deed flagging by County is already in place.
	TOTAL O&M COSTS				$0	
PERIODIC COSTS:						
30	Surface Maintenance (0-5 years)	1	ls	$3,000.00	$3,000	Placement of additional fill to maintain 2-foot cap.
31	Surface Maintenance (5 years)	1	ls	$3,000.00	$3,000	Placement of additional fill to maintain 2-foot cap.
32	Surface Maintenance (15 years)	1	ls	$3,000.00	$3,000	Placement of additional fill to maintain 2-foot cap.
	TOTAL PERIODIC COSTS				$9,000	

Table C-4
Preliminary Cost Estimate
Alternative 3 - Complete Excavation and Off-site Disposal

ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	NOTES
CAPITAL COSTS:						
1	Clearing and Grubbing	43,560	sf	$0.15	$6,534	Includes entire footprint (approx.1 acre).
2	Temporary Fencing and Signage	300	lf	$8.00	$2,400	2-month rental.
3	Cut, Fill and Compaction	9,050	ton	$11.00	$99,550	Return site to preexisting grade.
4	Import cover soils to site	0	ton	$8.00	$0	
5	Placement of cover soils	0	ton	$9.00	$0	
6	Excavate and load cover soils	0	ton	$15.00	$0	
7	Truck cover soils to disposal site	0	ton	$33.00	$0	
8	Tipping fees for cover soils	0	ton	$18.00	$0	
9	Excavate and load burn ash	10,500	ton	$15.00	$157,500	Assume 1.4 factor
10	Truck burn ash to disposal site	10,500	ton	$65.00	$682,500	To Copper Mountain Landfill, Wellton, AZ
11	Tipping fees for burn ash	10,500	ton	$30.00	$315,000	To Copper Mountain Landfill, Wellton, AZ
12	Import backfill soils to site	9,050	ton	$25.00	$226,250	Incl. material and transport; 1.3 factor
13	Placement of backfill soils	9,050	ton	$9.00	$81,450	Incl. placement and compaction
14	Place rock for channel	550	cy	$15.00	$8,250	Assumes return site to pre-existing grade.
15	Filter fabric	0	sf	$0.20	$0	None needed.
16	Erosion control BMPs	2,000	lf	$3	$6,660	Fiber rolls and hydro seed
17	Grading Permit/Other Plans	1	ls	$50,000	$50,000	Incl. Grading Plan, Const SWPPP and implementation
18	Confirmation Sampling	1	ls	$10,000	$10,000	
	Subtotal				$1,646,094	
19	Mob/Demob for contractor			5%	$82,305	Assumes all work done by OSHA contractor.
	Subtotal				$1,728,399	
20	Contingency			20%	$345,680	
	Subtotal				$2,074,078	
21	Project Management			5%	$103,704	Assumes done by contractor.
22	Remedial Design			8%	$165,926	Assumes done by contractor.
23	Construction Management			10%	$207,408	
24	Institutional Controls	0	ls	$30,000	$0	
	TOTAL CAPITAL COSTS				$2,551,116	
O&M COSTS:						
25	Quarterly Monitoring & Reporting	0	ls	$5,000.00	$0	Not required; clean closure.
	Subtotal				$0	
26	Contingency			30%	$0	Not required
	Subtotal				$0	
27	Project Management			5%	$0	Not required
28	Technical Support			8%	$0	Not required
29	Institutional Controls	0	ls	$0	$0	Not required
	TOTAL O&M COSTS				$0	
PERIODIC COSTS:						
30	Surface Maintenance (0-5 years)	0	ls	$3,000.00	$0	Not required; clean closure.
31	Surface Maintenance (5 years)	0	ls	$3,000.00	$0	Not required
32	Surface Maintenance (15 years)	0	ls	$3,000.00	$0	Not required
	TOTAL PERIODIC COSTS				$0	

APPENDIX D

HYDROLOGY
AND HYDRAULIC REPORT
BENTON BURN SITE
ESCONDIDO, CALIFORNIA

Prepared for

California Integrated Waste Management Board
101 I Street
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Appendix B Hydraulic Calculations

CCR	California Code of Regulations
CIWMB	California Integrated Waste Management Board
cfs	cubic feet per second
DU	dwelling unit
fps	feet per second
ft	feet
LEA	Local Enforcement Agency
RAP	Remedial Action Plan
RCP	Reinforced Concrete Pipe
SMS	State Minimum Standards

SECTION 1 INTRODUCTION

This drainage report presents the results of the hydrologic and hydraulic analyses associated with the Remedial Action Plan (RAP) for the Benton Burn Site, SWIS No. 37-CR-0008 (project). The project site is partly located within the limits of the City of Escondido (city) and unincorporated areas or the County of San Diego (County), California. The project site, at its southwesterly terminus, is surrounded by single-family dwellings along Still Water Glen, David Glen, and Larkhaven Glen roads; while at its northeasterly terminus the project site is bound by Sleepy Hill Lane. See Figure 1, Site Vicinity Map.

Based on reports provided by the California Integrated Waste Management Board (CIWMB) the project site was operated as a burn site from about 1948 through 1953. Municipal and commercial refuse was accepted at the facility where it was burned and placed in a canyon. The San Diego County Local Enforcement Agency (LEA) has been inspecting the site for compliance with applicable regulatory state minimum standards (SMS) in accordance with California Code of Regulations (CCR), Title 27, Division 2, Chapter 3, Subchapter 4, Articles 1 and 6, et. seq. Inspections of the burn dump revealed the presence of conditions that were cited as violations of the SMS. These violations included site security, ***drainage and erosion control***, grading of fill surfaces, and site maintenance. In 2006, the LEA requested the CIWMB to conduct an investigation of the site to assess its conditions with respect to SMS.

At the request of CIWMB, URS has prepared a Remedial Action Plan (RAP) to meet the SMS and address the violations cited per the LEA investigations. As part of the RAP for the project, the hydrologic and hydraulic evaluations included herein have enabled URS to develop the RAP.

In general, the analyses presented herein provide the following:

- Existing and proposed conditions hydrologic analyses for the 2-, 10-, 50-, and 100-year storm events;
- Existing and proposed conditions hydraulic HEC-RAS analyses for the 2-, 10-, 50-, and 100-year storm events;
- A comparative analysis of existing versus proposed flow velocities and water surface profiles.

1.1 HYDROLOGIC SETTING

The project site encompasses portions of an ephemeral stream near the base of granitic hills. The topography of the project site footprint generally slopes from northeast to southwest with elevations of approximately 860 at its northeasterly end, and 820 at its southwesterly end. The average stream slope along the lower end of the project site varies from approximately 2 to 7%, while the slopes along the upper end of the project site vary from approximately 5% to 30%.

From a regional perspective, the watershed tributary to the project site encompasses approximately 60 acres. It stretches from David Glen at its southwesterly end to the Merriam Mountains at its northerly end. The watershed land uses within the County side consist of low density and multiple rural uses, while the watershed areas within the city are designated as biological open space and are part of the city's draft

Multiple Habitat Conservation Subarea Plan Reserve. The hydrologic soil group types consist of B, C and D, with the C hydrologic soil type being the most prevalent.

The storm runoff conveyed by the ephemeral stream enters into a 42-inch reinforced concrete pipe (RCP) that is located under David Glen. The entrance to the 42-inch RCP culvert is located on the easterly side of David Glen. Storm runoff is then conveyed to the west.

SECTION 2 HYDROLOGIC CRITERIA AND METHODOLOGY

This section of the report summarizes the hydrology criteria and methodology that were used in the hydrologic analyses.

2.1 HYDROLOGIC CRITERIA

The Rational Method outlined in the San Diego County Hydrology Manual (June 2003) was used in the 2-, 10-, 50-, and 100-year/6-hour storm event hydrologic analyses. Table 1 summarizes the San Diego County hydrologic parameters used for the project.

Appendix A includes the Land Use Map, Runoff Coefficients for Urban Areas (Table 3-1), Hydrologic Soil Group map, and the 2-, 10-, 50- and 100-yr Isopluvials. The Land Use Map was obtained from the County of San Diego GIS database; and the Runoff Coefficients for Urban Areas, Hydrologic Soil Group map, and the isopluvials were extracted from the San Diego County Hydrology Manual.

2.2 HYDROLOGIC METHODOLOGY

The project watershed and drainage subareas were delineated using a two-foot contour topographic map that was specifically developed for the project by Ninyo & Moore, which was then augmented with 2-foot aerial topography obtained from the City of Escondido.

It is important to note that only one set of hydrology calculations was prepared for both the existing and proposed conditions. The underlying premise is that the proposed project remedial alternatives included in the RAP maintain the existing conditions such as land use/impermeability and grading.

CIVILCADD/CIVILDESIGN Engineering Software was used to model and compute the 2-, 10-, 50-, and 100-year storm runoff quantities. CIVILCADD/CIVILDESIGN is a computer-aided design program where the user develops a node link model of the watershed. The program allows for the modeling of processes such as initial areas, street flow, pipe flow, channel flow, confluences, user specified hydrology data, etc. The program has the capability of estimating conduit sizes to convey design storm runoffs, or the user may input specific conduit sizes and open channels. The watershed hydrologic parameters such as hydrologic soil group types, land use, and rainfall intensity distribution can be based on the County of San Diego Hydrology Manual, 1984 or 2003 editions. The program uses node numbers to identify the location of each process. Developing independent node link models for each interior watershed and linking these sub-models together at confluence points creates the node link model. Stream entries must be made sequentially until all are entered. The node numbers used for the hydrology analysis are shown on Figure 2, Hydrology Map. Appendix A also includes the existing/developed project hydrology Rational Method computer output.

SECTION 3 HYDRAULIC METHODOLOGY

This section describes the methodology used in the hydraulic analyses associated with the existing conditions and remedial alternatives proposed in the RAP for the project.

In general, mathematical models such as HEC-2 or HEC-RAS provide an approximation of a river's rigid-boundary response to parameters such as discharge, geometry, and roughness. For this project the HEC-RAS model was used. The hydrology analyses results (peak 2-, 10-, 50-, and 100-year flows) for the various storm events were used in the HEC-RAS model to determine existing floodplain widths, water surface profiles, and velocities associated with the project.

From a hydraulic perspective, the purpose of the HEC-RAS analyses was to verify that existing condition hydraulic parameters such as topwidths, water surface profiles and channel velocities for remedial alternatives presented in the RAP are reasonably maintained and do not adversely impact neighboring properties along the project footprint, as well as upstream and downstream from the project.

3.1 EXISTING CONDITION HYDRAULIC MODEL DEVELOPMENT

Cross Section Development: The cross section elevation data used to develop the first five HEC-RAS cross sections, from cross section 30 through cross section 125 was determined using the City's 2-foot contour map. Data for the development of cross sections 150 through 215 was extracted from the 2-foot contour map by Ninyo & Moore. The cross sections extend upstream and downstream of the site so that potential impacts due to the RAP can be evaluated. The cross section locations are shown on Figures 3 and 4.

Loss Coefficients: The loss coefficients along the creek are based on a visual inspection of the site. The vegetation density along the creek varies widely from clean, straight bare soil to very weedy reaches with heavy stands of brush. Therefore, the Manning's roughness coefficients (n-values) along the main channel and overbanks vary from 0.025 to 0.070. Contraction and expansion coefficients of 0.1 and 0.3 were used, respectively, in areas away from the entrance to the existing 42-inch RCP culvert, while of 0.3 and 0.5 were used near the culvert.

Starting Water Surface Elevations: The HEC-RAS analyses were initialized at the entrance of the existing 42-inch RCP culvert located immediately on the easterly side of David Glen. The invert elevation at the entrance of the culvert, and cross sections 30 through 125 were approximated using the city's 2-foot contour map. To verify these approximations, a sensitivity analysis was performed. The purpose of the sensitivity analysis was to verify that the 42-inch RCP invert elevation and cross section approximations do not create a backwater condition that could potentially affect the calculated water surface profiles along the project footprint, as well as downstream and upstream from the project. The sensitivity analysis consisted of calculating two water surface profiles for each storm event (2-, 10-, 50, and 100-year). The headwater calculations for the starting water surface elevations at the entrance of the 42-inch RCP were done assuming an inlet control condition for each profile, and for each storm event, one headwater calculation was done assuming a "Square Edge with Headwall" entrance, while the second one was done assuming a "Groove End with Headwall".

It is important to note that only the most conservative HEC-RAS computer output results of the sensitivity analyses were included herein.

Explanation of HEC-RAS Model: The HEC-RAS program calculates water surface profiles for steady or unsteady gradually varied flow in natural or man made channels, and can be used to calculate both subcritical and supercritical flow profiles. The computational procedure solves the energy equation by using the standard step method, with energy loss due to friction (Manning's equation). The program can model the effects of channel improvements and physical obstructions such as bridges, culverts, weirs and levees. Input data such as channel geometry, discharge, roughness coefficient and stage/discharge relationship for the river is entered manually, and can be in either English or metric units.

3.2 PROPOSED RAP HYDRAULIC ANALYSIS

The proposed grading alternative included in the RAP consists of 2 feet of clean fill over the existing burn area, with filter fabric covered by rock within the 100-year floodplain limits. The revised grading was modeled in HEC-RAS by adding 2 feet of fill to the existing cross section. The rock fill within the floodplain was modeled by adjusting the Manning's roughness coefficient ('n' value) to 0.04 to reflect the increased hydraulic roughness associated with the rock.

SECTION 4 RESULTS

4.1 HYDROLOGY RESULTS

Table 2 summarizes the results for the 2-, 10-, 50- and 100-year hydrologic analyses for the project. Figure 2, Hydrology Map shows the surface watershed boundaries, and Appendix A contains the hydrology model output files.

Note that the results shown in Table 2 above represent the results for the existing and proposed conditions at the downstream end of the site. Because the existing runoff coefficients/land use and grades will be maintained, it is anticipated that storm runoff for both conditions will be maintained. As a result, only one set of calculations was prepared for both conditions.

4.2 HYDRAULIC ANALYSIS RESULTS

Hydraulic analysis results for the existing condition indicate that there will be no backwater effect from the 42-inch culvert at David Glen downstream of the site for a range of culvert entrance condition assumptions. The HEC-RAS model output is included in Appendix B. Figures 3 and 4, Hydraulic Maps show the cross section locations, along with the 100-year floodplain limits. A summary of existing condition 100-year hydraulic parameters is provided below.

- 100-year floodplain topwidths of 8 to 44 feet.
- 100-year flow depths of 1 to 2 feet.
- 100-year flow velocities of 4 to 19 feet per second (fps).

The 100-year floodplain topwidths and flow depths are relatively small in comparison to the canyon topwidth and depth as shown in Figures 3 and 4. Flow velocities are relatively high in the narrow, steep portions of the site which is the cause of existing localized channel erosion in these areas. Design sizing of the proposed rock fill within channel bottom will utilize shear stress, in lieu of velocity, as the criterion for erosion through the site.

Hydraulic modeling of the proposed fill within the burn area indicates that there will be areas of increased 100-year flood elevations that mirror the 2 feet of proposed fill; however, as shown in Table 3 and by the HEC-RAS cross section plots in Appendix B, the water surface elevations will be well below the canyon top of bank (and house pad elevations) through the proposed fill areas.

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SECTION 5 CONCLUSION AND RECOMMENDATIONS

Implementation of the proposed RAP will result in the placement of approximately 2 feet of fill over those areas where burn ash containing waste is within 2 feet of the ground surface at the site. Within the areas of the 100-year floodplain included in the area to be capped, filter fabric will be placed and covered with 2 feet of rock designed to withstand 100-year flood hydraulic shear stresses to prevent mobilization of the rock during flood events. The recommended minimum rock diameter is 1 to 2 inches. Larger rock (a minimum of 12-inch diameter) is recommended for the steeper area of the drainage near the center of the burn site footprint.

While implementation of the RAP will result in local increases in water surface elevations due to rock fill placement within the 100-year floodplain, the water surface elevations will be well below the existing top of bank and house pad elevations and will not result in increased flooding, erosion, or sedimentation upstream of downstream of the site.

Table 1 Hydrology Criteria

Design Storm Event	2-, 10-, 50-, and 100-year/6-hour
Land Use (Existing and Proposed)	County: Multiple Rural Use: 1DU/4,8,20 Ac (undisturbed natural terrain), Residential Use: 1DU/1,2,4 Ac (low density residential) City: Biological Open Space (undisturbed natural terrain)
Hydrologic Group Soil Type	B, C, and D
Runoff Coefficients	Varies from C = 0.25 to C = 0.36 (weighted C values)
Precipitation	2-year: 1.6in 10-year: 2.4in 50-year: 3.0in 100-year: 3.5in

Table 2 Hydrology Analysis Results

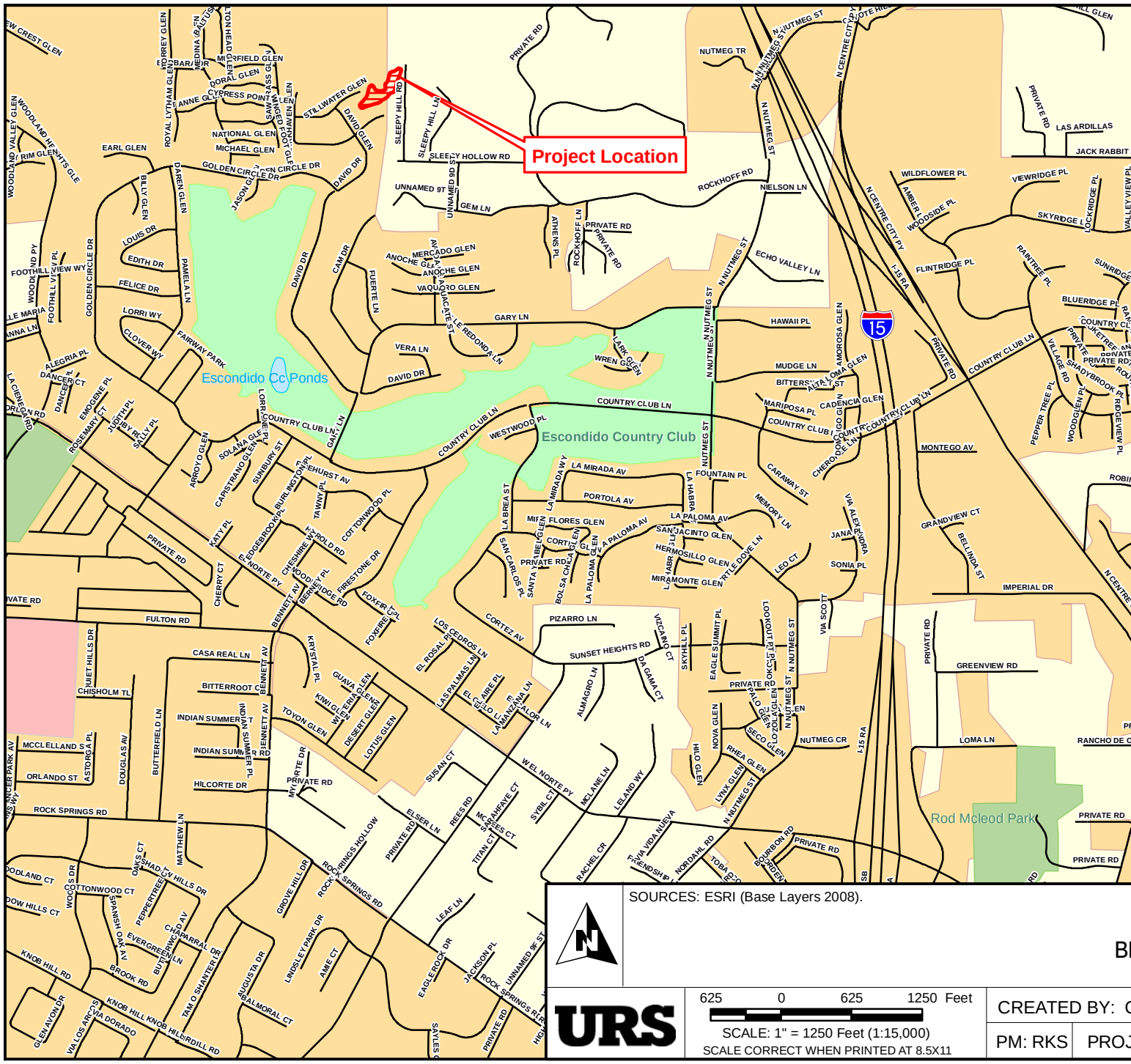
Storm Event	Peak Flow (cfs)
2-year/6-hour	44
10-year/6-hour	69
50-year/6-hour	88
100-year/6-hour	104

Table 3 Hydraulic Analysis Results

Cross Section	Existing Channel Invert Elevation (ft)	Proposed Channel Invert Elevation (ft)	Existing 100-year WSEL (ft)	Proposed 100-year WSEL (ft)	Elevation of Top of Left Bank (ft)	Elevation of Top of Right Bank (ft)	Existing 100 year Velocit (fps)
30	817	817	823.90	823.90	822-824[1]	830[1]	1.88
40	817.5	817.5	823.96	823.96	822-824[1]	832[1]	1.00
50	819.5	819.5	823.96	823.96	824[1]	832[1]	1.28
100	819.7	819.7	823.96	823.96	828[1]	832	1.54
125	819.8	819.8	823.96	823.96	830[1]	834	1.57
150	822	822.0	823.61	823.92	835[1]	832	11.11
155	826	827.5	827.94	828.53	842	834	4.56
160	828	829.2	829.07	830.26	840	842	7.64
165	830.1	832.1	831.48	833.63	843	844	7.32
170	834	836.0	835.07	837.11	856	855	10.11
175	836.6	838.6	838.52	840.70	860	860	7.88
180	838.1	840.1	839.63	841.63	862	862	12.06
185	840	842.0	841.43	843.45	864	866	18.69
190	850	852.0	851.19	853.59	864	870	17.47
195	860	862.0	861.13	863.04	873	875	9.44
200	866	868	867.82	870.27	889	874.5	9.60

Notes:

[1] Top of bank elevations for these sections are estimated based upon City of Escondido 2 foot contour mapping (no spot elevations for estimating pad elevations as with the more detailed topography).



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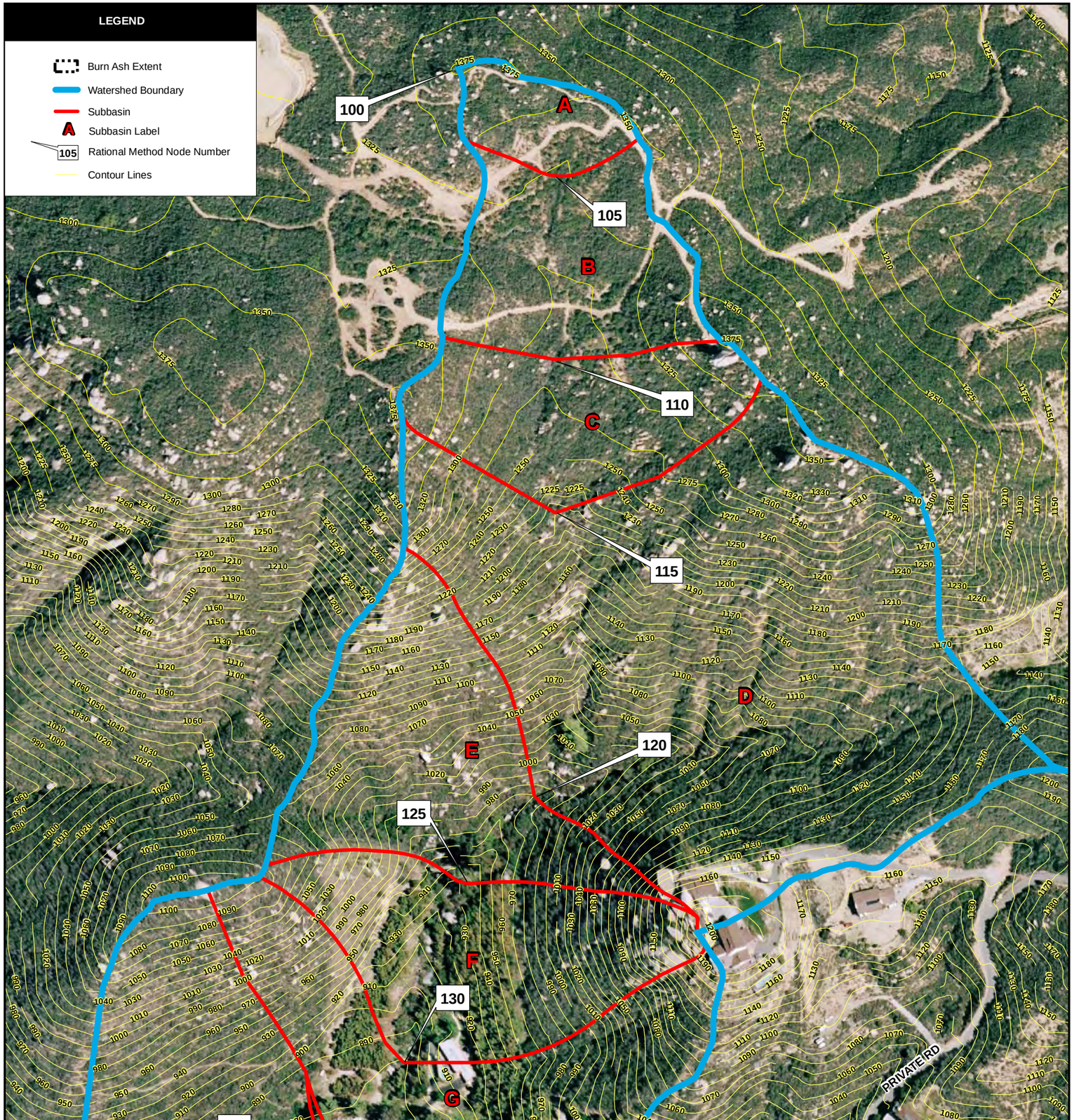
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Burn Ash Extent
Watershed Boundary
Subbasin
A
Subbasin Label
105
Rational Method Node Number
Contour Lines
100
105
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115
120
125
130
A
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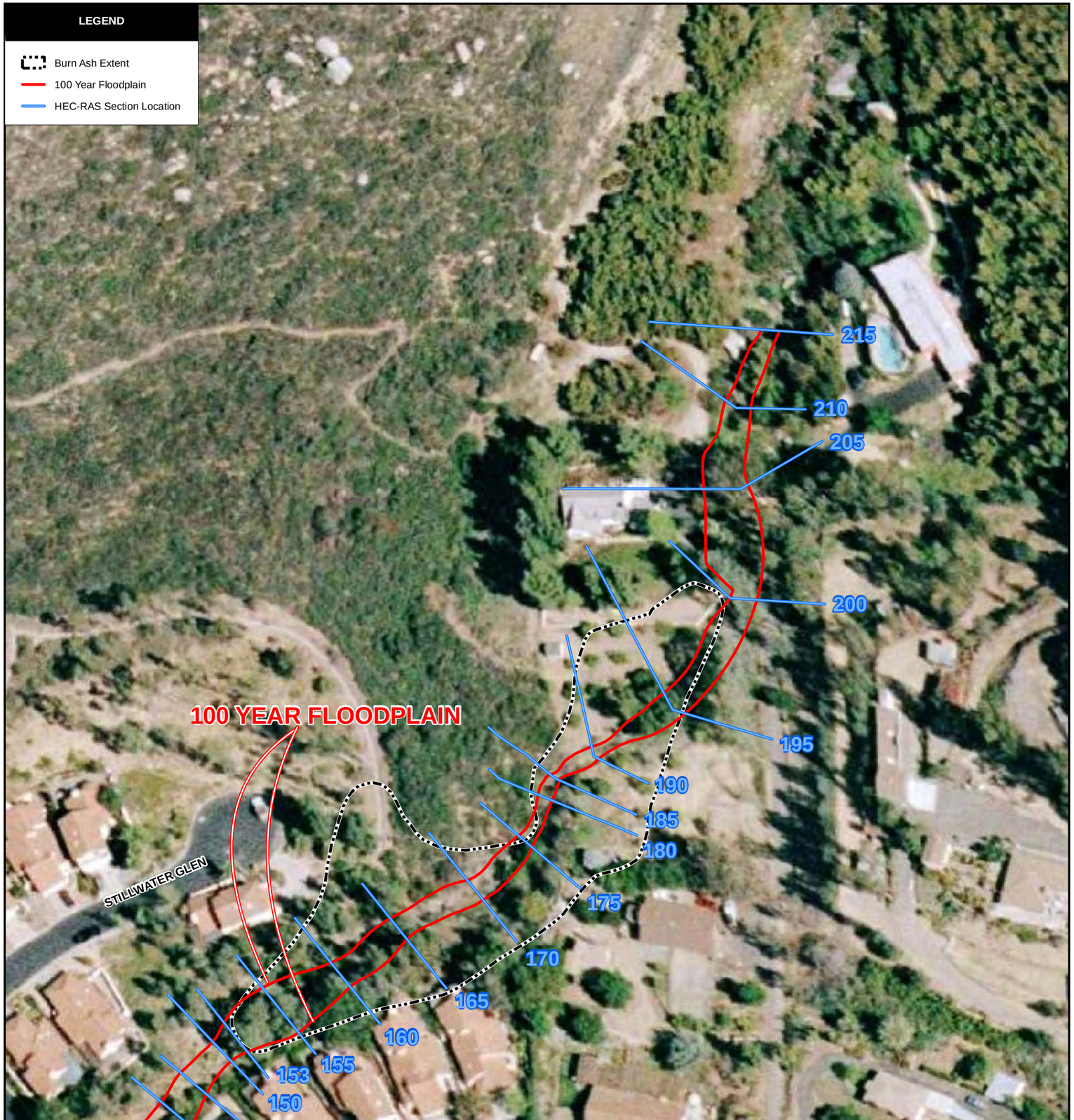
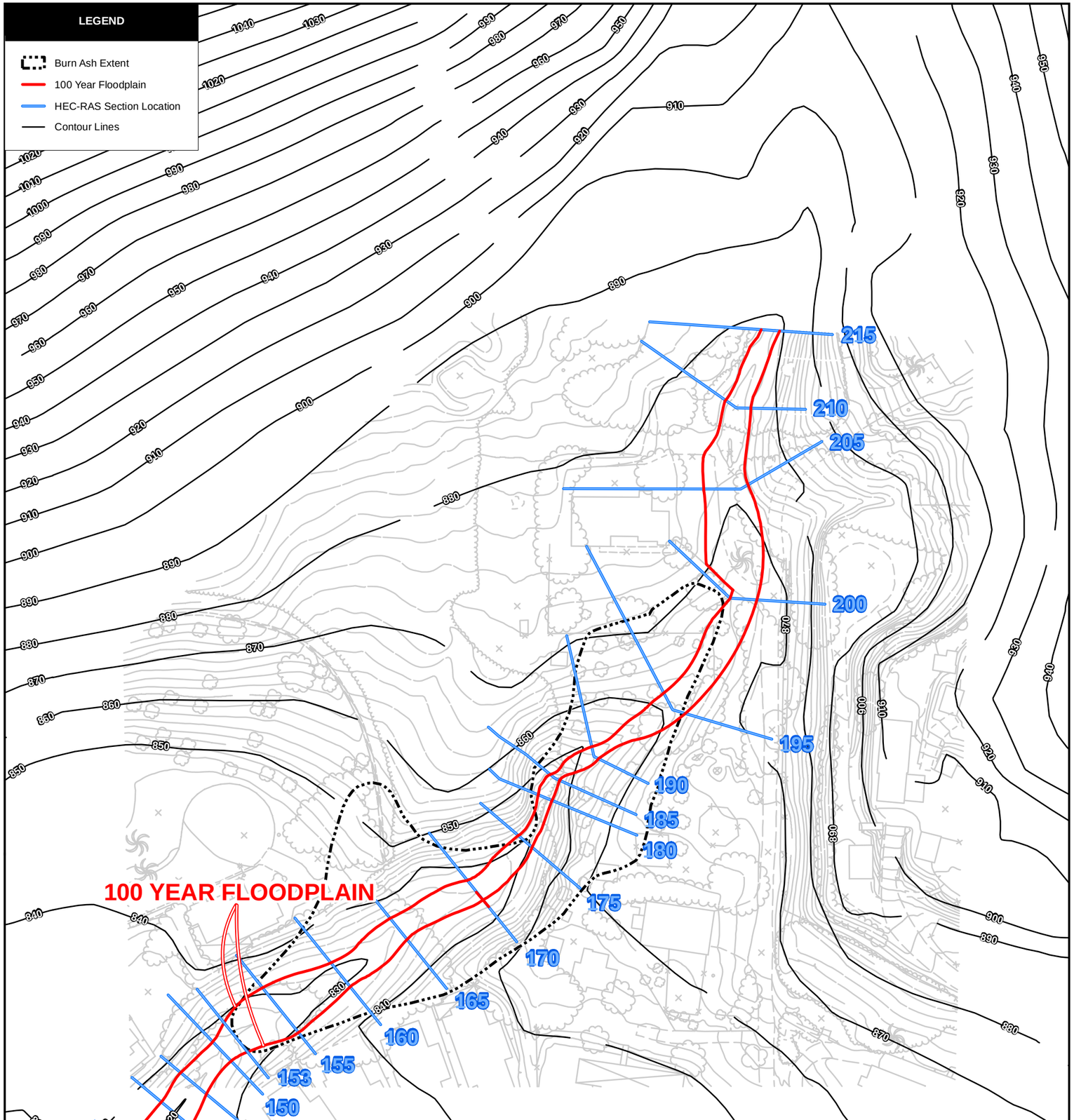
PRIVATE RD


LEGEND
Burn Ash Extent
100 Year Floodplain
HEC-RAS Section Location
215
210
205
200
195
190
185
180
175
170
165
160
155
153
150
100 YEAR FLOODPLAIN
STILLWATER GLEN


LEGEND
Burn Ash Extent
100 Year Floodplain
HEC-RAS Section Location
Contour Lines
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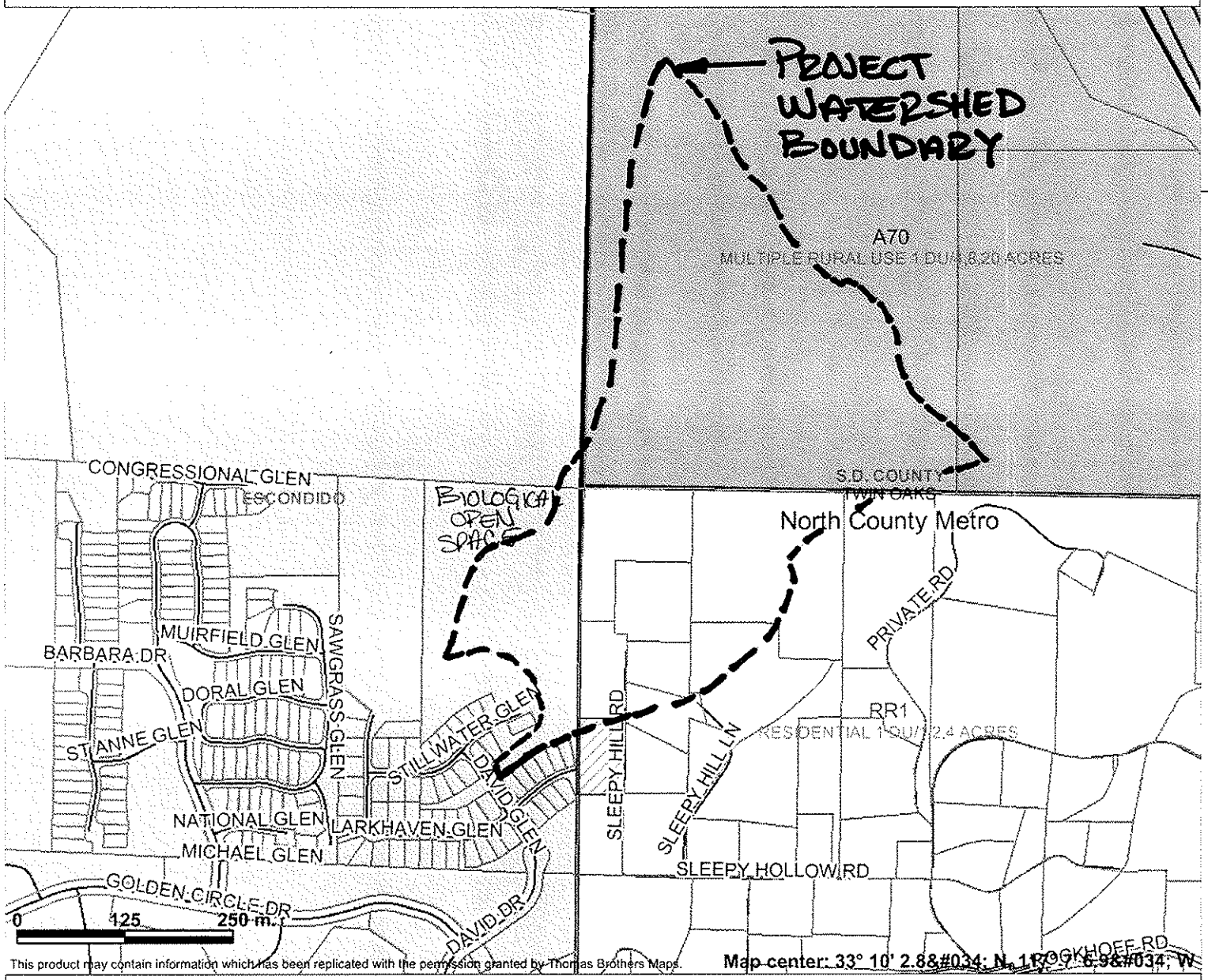
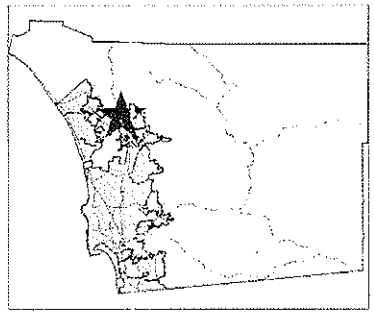
210
205
200
195
190
185
180
175
170
165
160
155
153
150
100 YEAR FLOODPLAIN

LAND USE/ZONING





Legend

- Parcels
- Highways
- Freeways
- Streets
- Water Bodies
- Water Bodies

General Plan (Existing)

- Residential 1 DU/1,2,4 Acres
- Residential 1 DU/ Acre
- Residential 2 DU/Acre
- Residential 2.9 DU/Acre
- Residential 4.3 DU/Acre
- Residential 7.3 DU/Acre
- Residential 10.9 DU/Acre
- Residential 14.5 DU/Acre
- Residential 24 DU/Acre
- Residential 43 DU/Acre
- Office Professional
- Neighborhood Professional
- General Commercial
- Service Commercial
- Visitor Serving Commercial
- Limited Impact Industrial
- Fallbrook Village Mixed Use
- General Impact Industrial
- Estate Residential 1 DU/2,4 Acres
- Multiple Rural Use 1 DU/4,8,20 Acres
- Intensive Ag. 1DU/ 4,8 Acres
- General Agriculture
- Specific Plan Area
- Public/Semi-Public Lands
- National Forest and State Parks
- Impact Sensitive 1DU/20 Acres
- Extractive
- Telecommunications
- Indian Reservation

Scale: 1:6,966

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Map center: 33° 10' 2.8" N, 117° 6.9" W

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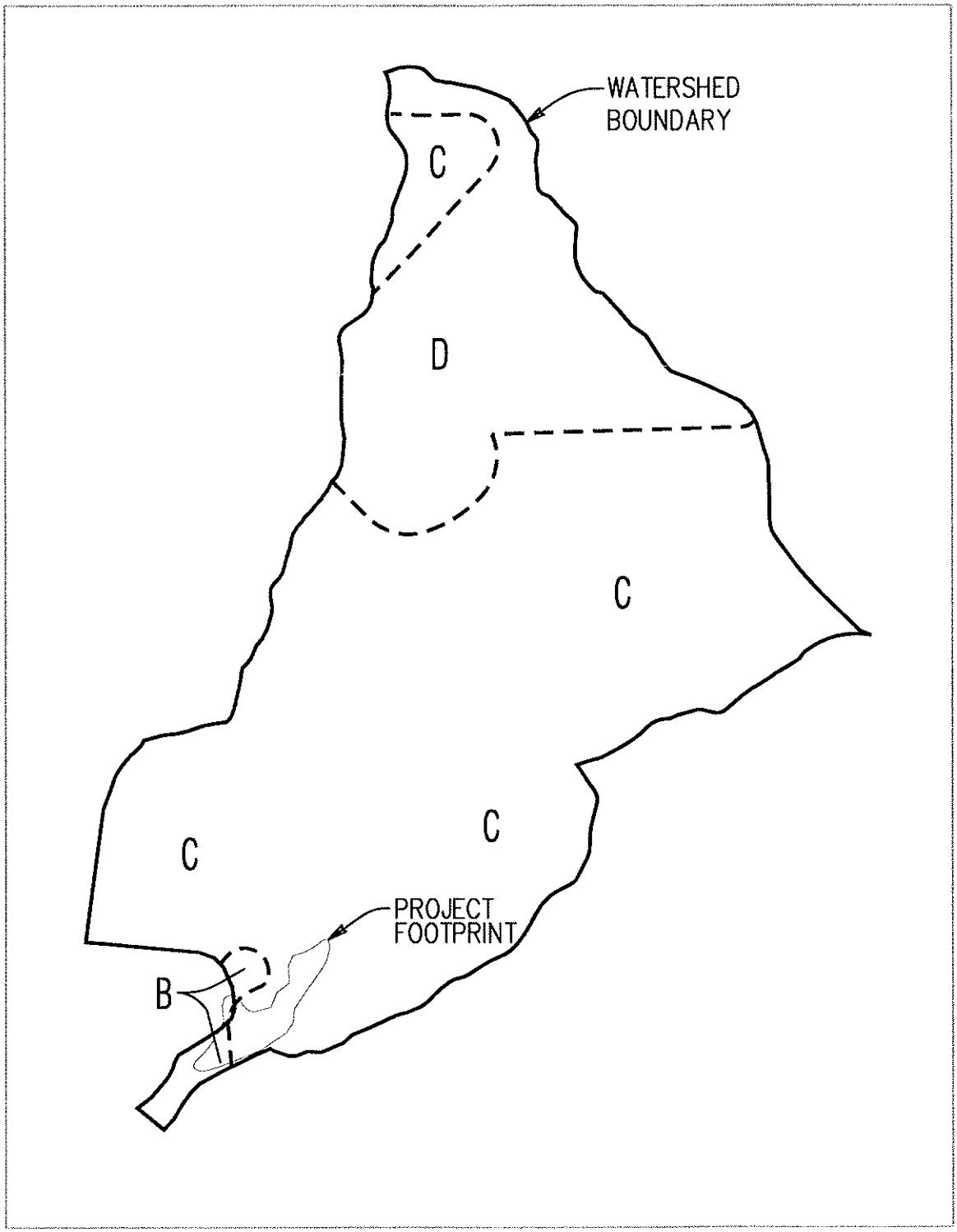
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



HYDROLOGIC SOILS GROUP MAP

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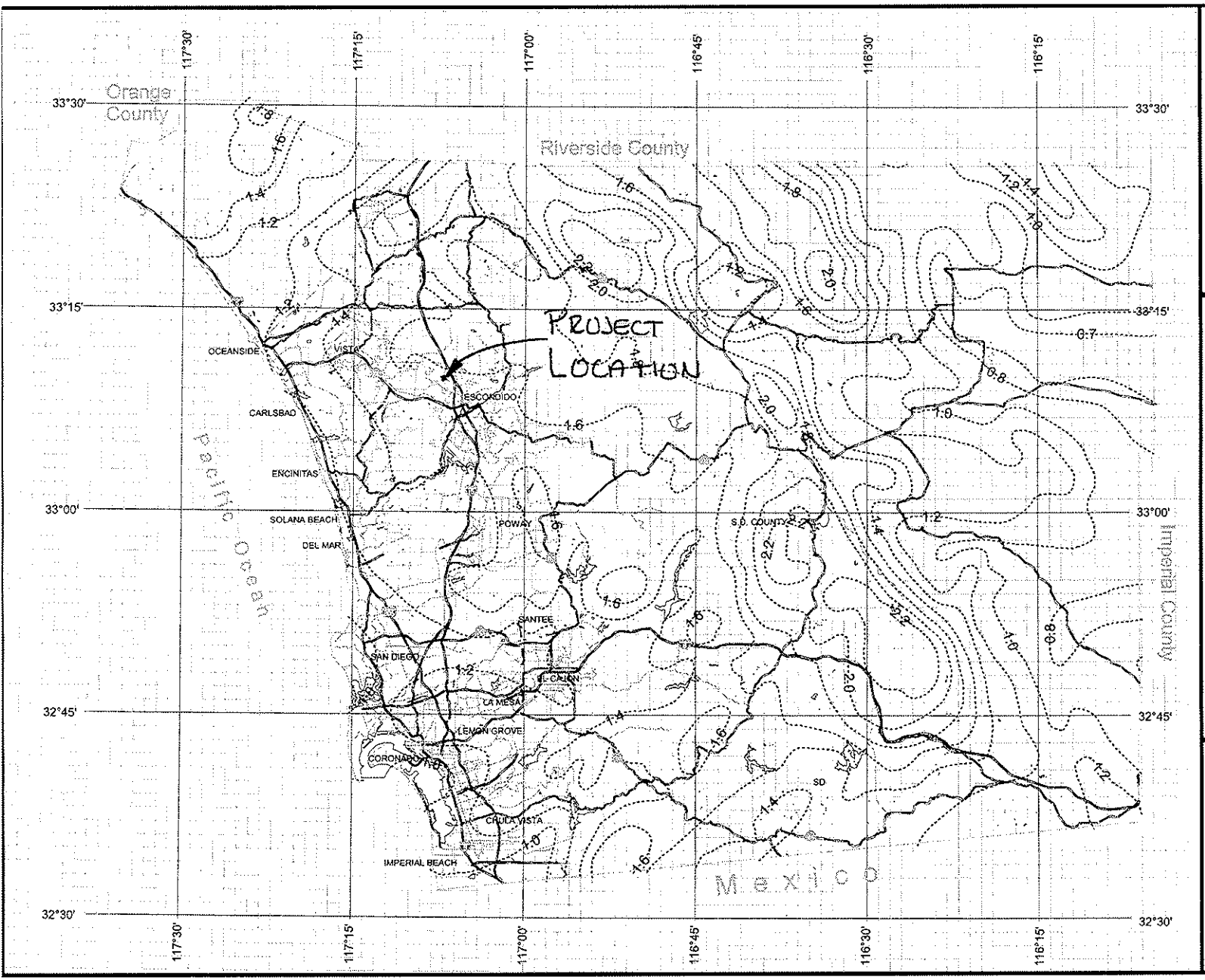
(EXCERPT FROM APPENDIX A, HYDROLOGIC SOIL GROUPS MAP, OF THE COUNTY OF SAN DIEGO HYDROLOGY MANUAL)



County of San Diego Hydrology Manual

Rainfall Isopluvials

2 Year Rainfall Event - 6 Hours

Isopluvial (inches)

$I_2 = 1.6$

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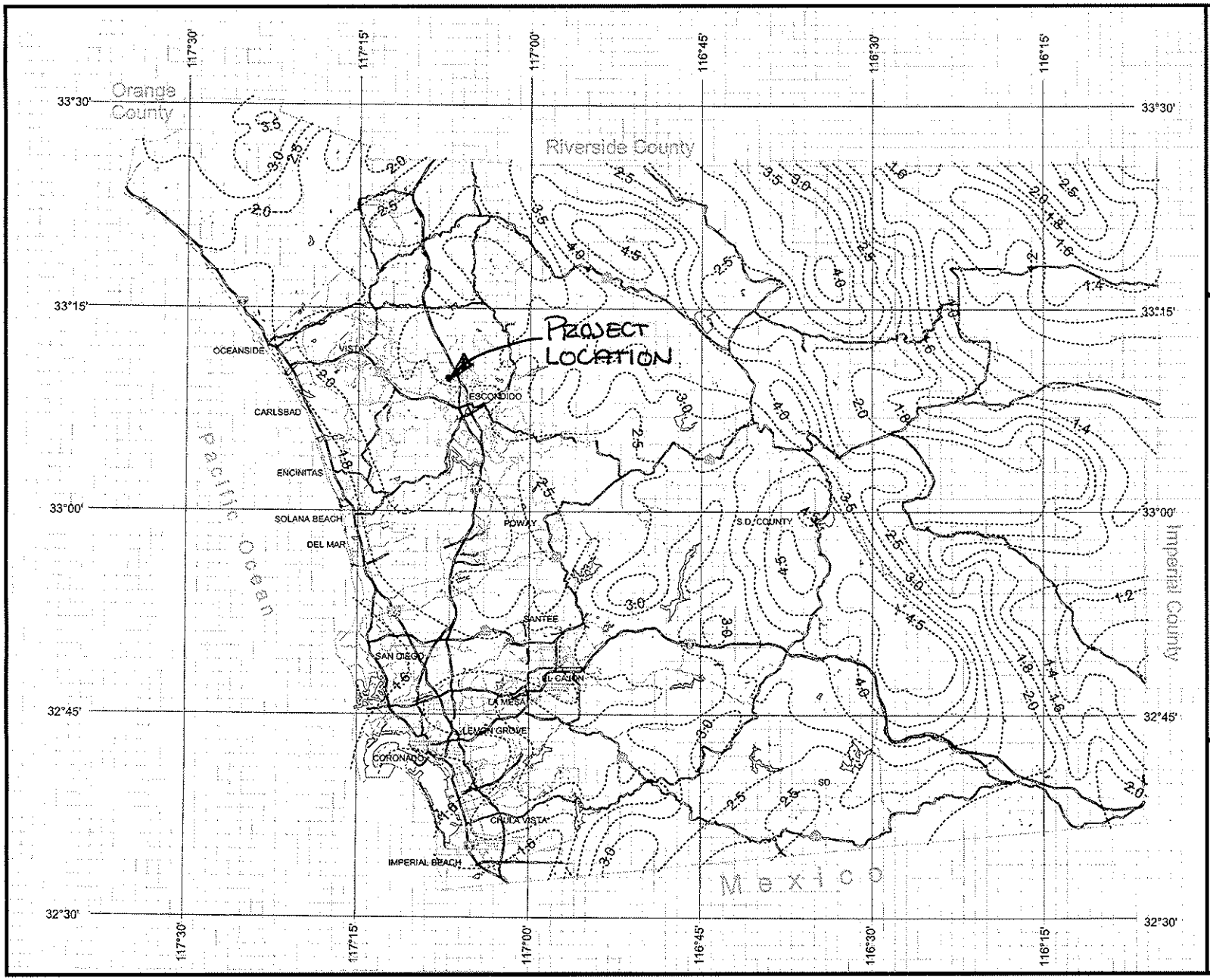

County of San Diego Hydrology Manual

Rainfall Isopluvials

2 Year Rainfall Event - 24 Hours

Isopluvial (inches)

$I_2 = 2.5$

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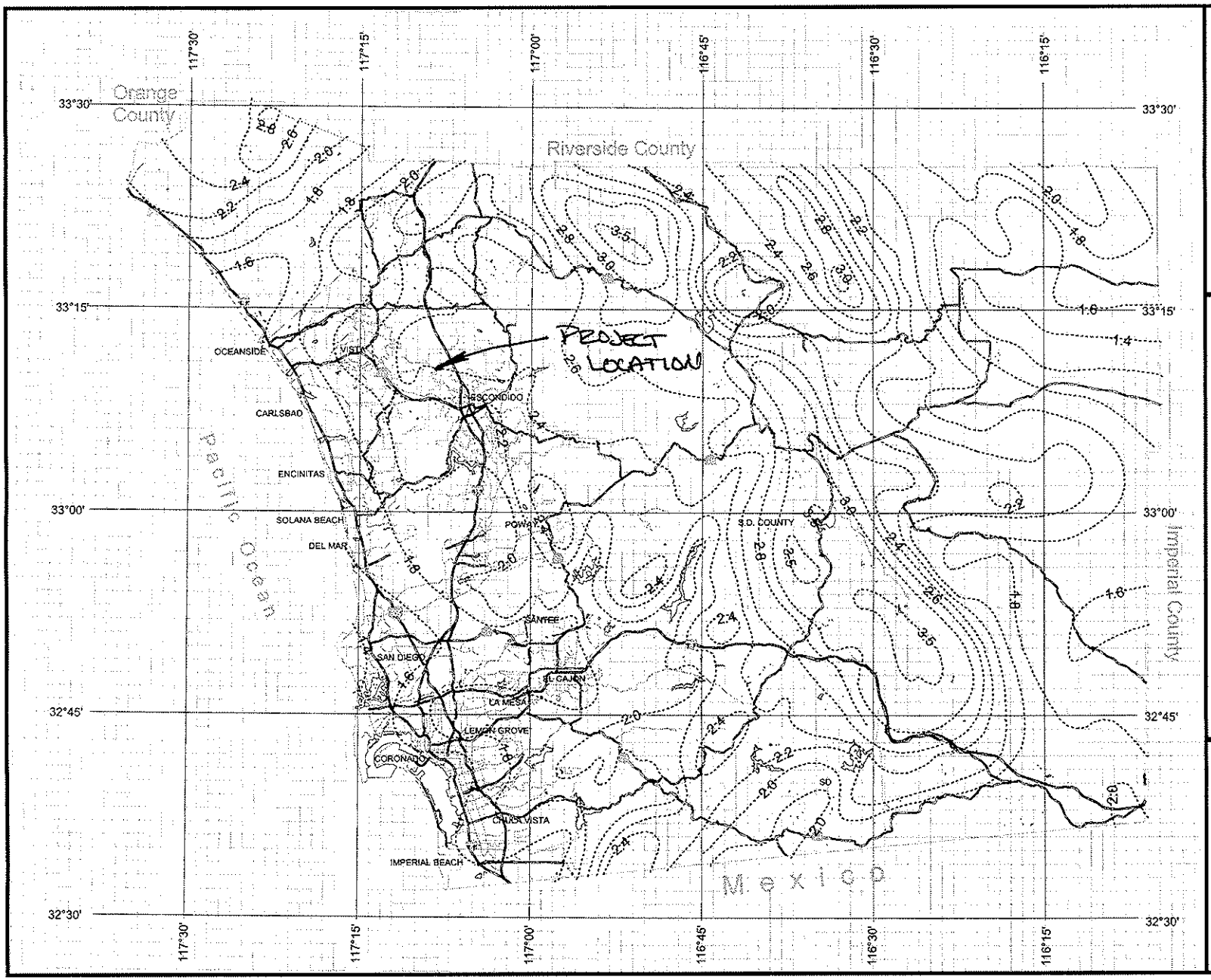

County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (inches)

$I_{10} = 2.4$

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3 0 3 Miles

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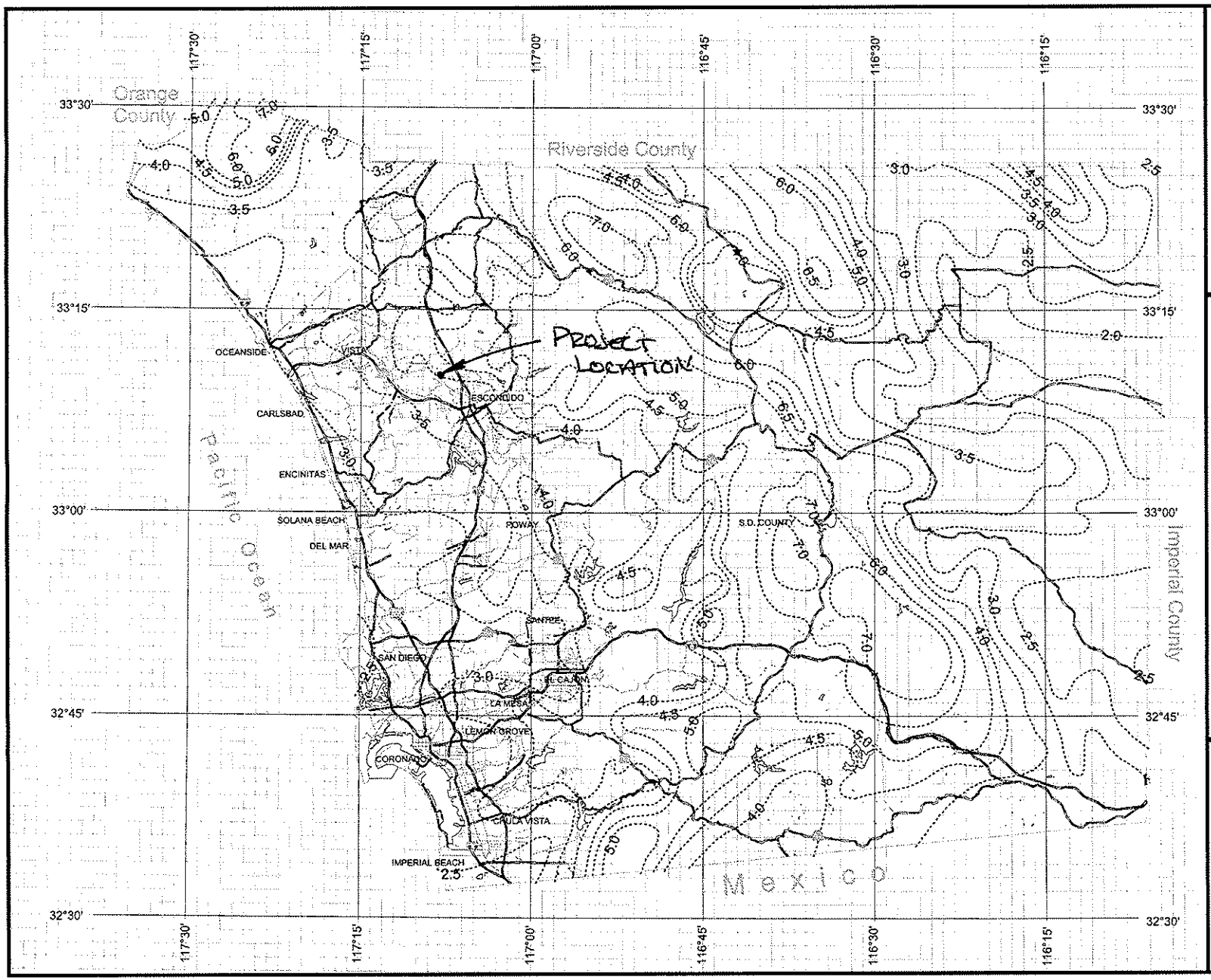
County of San Diego Hydrology Manual

Rainfall Isopluvials



10 Year Rainfall Event - 24 Hours

Isopluvial (inches)

$I_{10} = 4.0$

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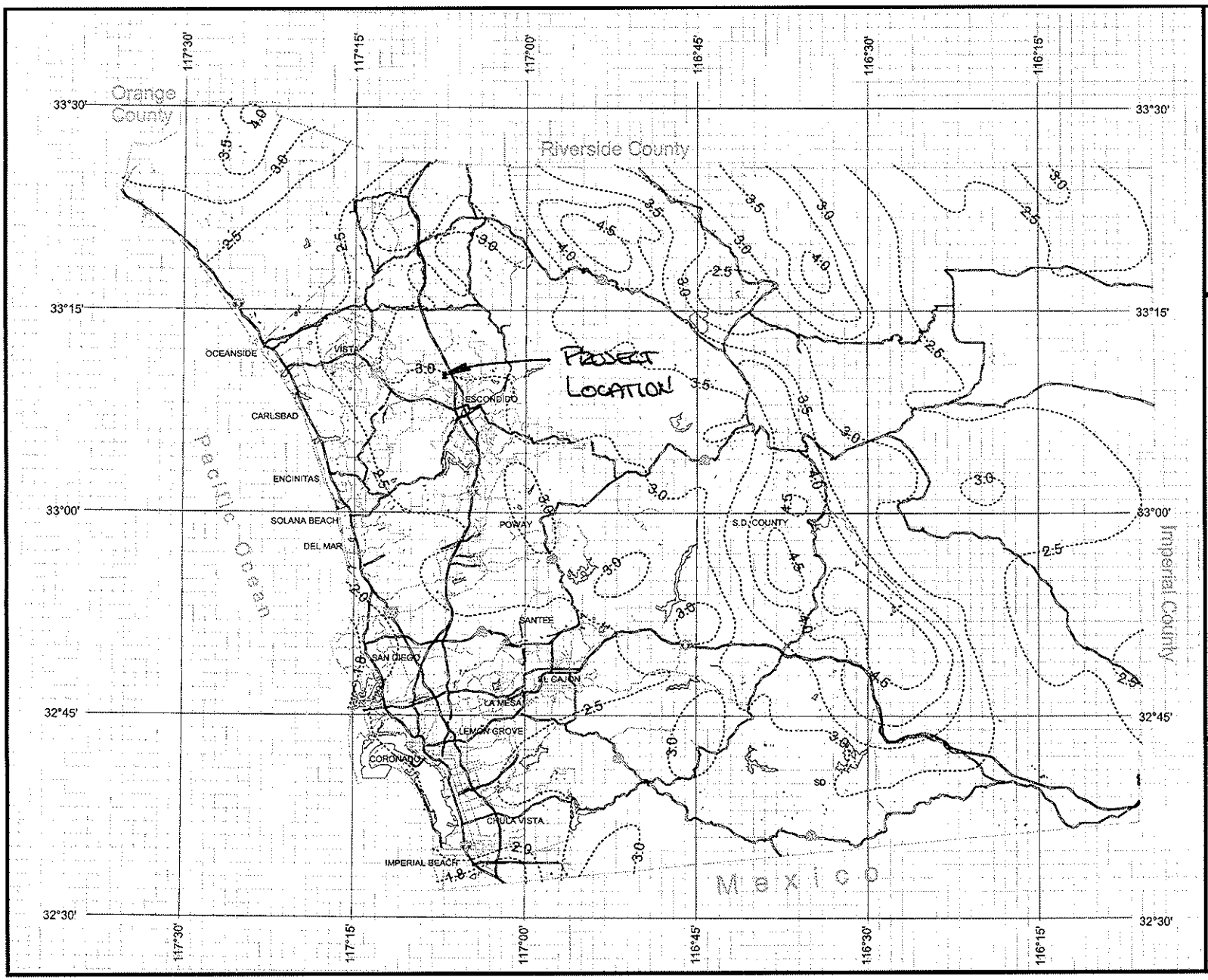

County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

Isopluvial (inches)

$I_{50} = 3.0$

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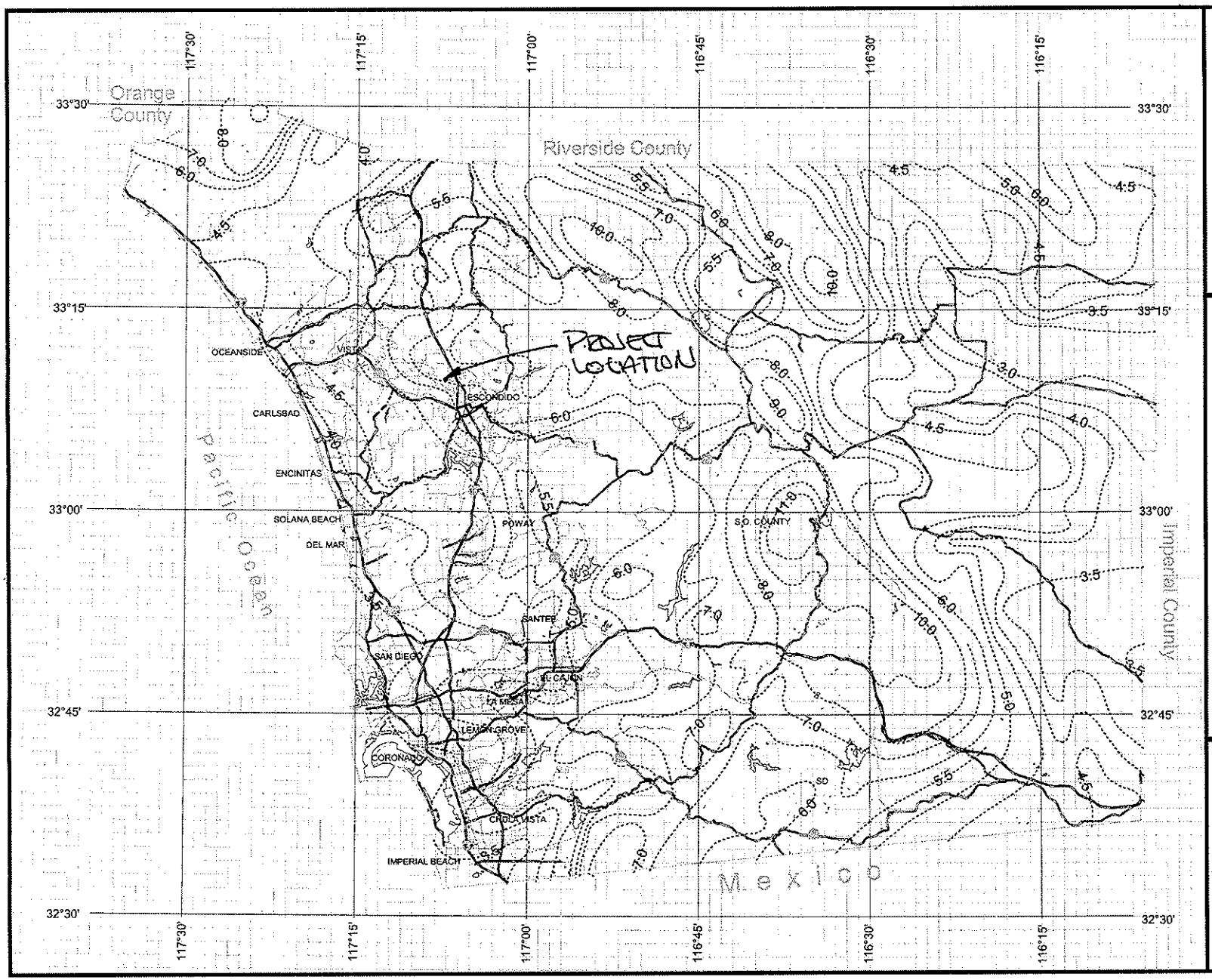
N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 24 Hours

Isopluvial (inches)

$I_{50} = 6.0$

DPW GIS

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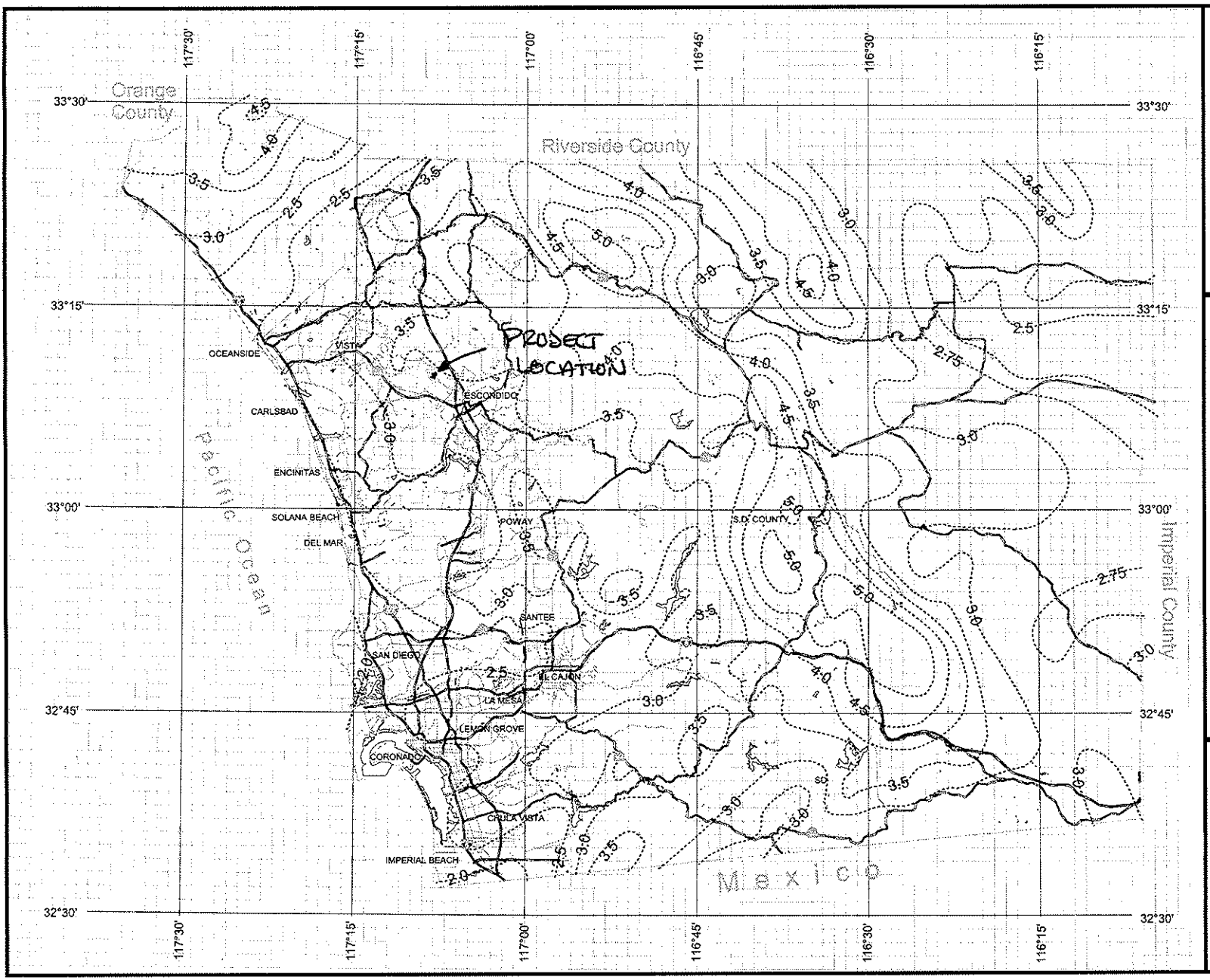
N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

$I_{100} = 3.5$

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N W E S

3 0 3 Miles

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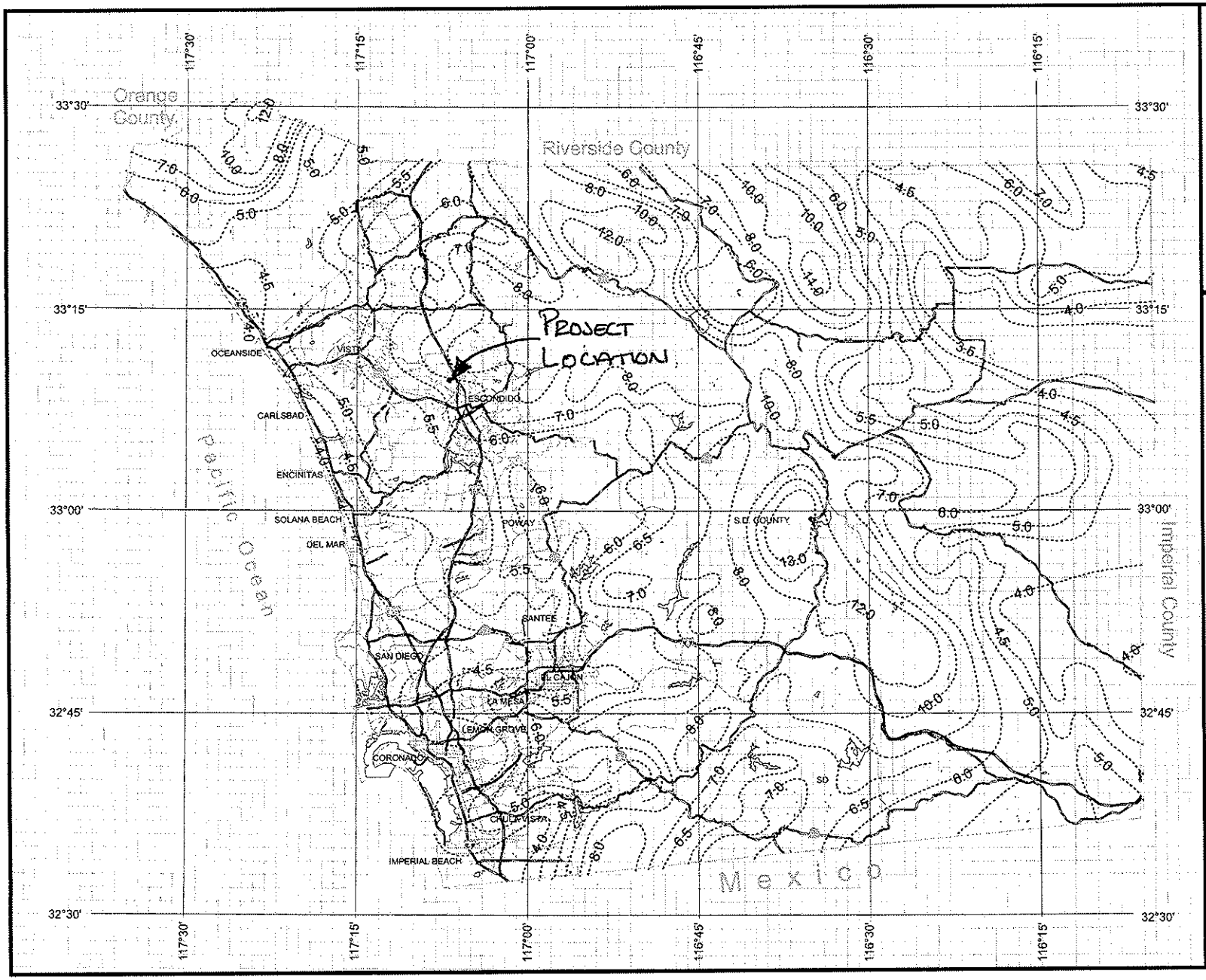
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

$I_{100} = 7.0$



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N W E S

3 0 3 Miles

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/21/09

BENTON DUMP - CITY OF ESCONDIDO - EXISTING CONDITIONS HYDROLOGIC
ANALYSIS-USE n = 0.025 THRU n = 0.035 FOR CHANNEL FLOW PROCESSES
2-YR, 6-HOUR STORM EVENT
CIVILD FILE: EX2.RD3

********* Hydrology Study Control Information **********

Program License Serial Number 6219

Rational hydrology study storm event year is 2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.600
24 hour precipitation(inches) = 2.500
P6/P24 = 64.0%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 100.000 to Point/Station 105.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.350
Decimal fraction soil group D = 0.650
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.332
Initial subarea total flow distance = 341.800(Ft.)
Highest elevation = 1377.500(Ft.)
Lowest elevation = 1320.000(Ft.)
Elevation difference = 57.500(Ft.) Slope = 16.823 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 16.82 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.39 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3325)*(100.000^.5)/(16.823^(1/3)]= 5.39
The initial area total distance of 341.80 (Ft.) entered leaves a
remaining distance of 241.80 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.06 minutes
for a distance of 241.80 (Ft.) and a slope of 16.82 %
with an elevation difference of 40.68(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
= 1.061 Minutes
Tt=[(11.9*0.0458^3)/(40.68)]^.385= 1.06
Total initial area Ti = 5.39 minutes from Figure 3-3 formula plus
1.06 minutes from the Figure 3-4 formula = 6.45 minutes
Rainfall intensity (I) = 3.576(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.332

```
Subarea runoff =      1.730(CFS)
Total initial stream area =        1.455(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      3.936(CFS)
Depth of flow =   0.369(Ft.), Average velocity =   3.899(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              12.90
      2             12.30              11.90
      3             16.90               9.90
      4             21.30               7.90
      5             34.20               3.90
      6             43.40               1.90
      7             60.50               0.00
      8             71.50               1.90
      9             77.30               3.90
      10             91.60               9.90
      11             97.00              11.90
Manning's 'N' friction factor =   0.035
----------------------------------------------------------------------
Sub-Channel flow  =      3.936(CFS)
   '      '    flow top width =      5.464(Ft.)
   '      '    velocity=    3.899(Ft/s)
   '      '    area =      1.009(Sq.Ft)
   '      '    Froude number =     1.599

Upstream point elevation =  1320.000(Ft.)
Downstream point elevation =  1285.000(Ft.)
Flow length =   431.000(Ft.)
Travel time  =    1.84 min.
Time of concentration =    8.30 min.
Depth of flow =   0.369(Ft.)
Average velocity =   3.899(Ft/s)
Total irregular channel flow =     3.936(CFS)
Irregular channel normal depth above invert elev. =   0.369(Ft.)
Average velocity of channel(s) =   3.899(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.041(In/Hr) for a     2.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.210
Decimal fraction soil group D = 0.790
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.339
Rainfall intensity =      3.041(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.338  CA =      1.998
Subarea runoff =      4.346(CFS) for      4.460(Ac.)
Total runoff =      6.076(CFS)      Total area =       5.915(Ac.)
Depth of flow =   0.435(Ft.), Average velocity =   4.347(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      115.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      8.109(CFS)
Depth of flow =   0.341(Ft.), Average velocity =   6.430(Ft/s)
      ******* Irregular Channel Data ***********
```

```
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              8.20
      2              5.60              6.00
      3             11.60              4.00
      4             20.30              2.00
      5             40.20              0.00
      6             63.80              2.00
      7             74.30              4.00
      8             80.40              6.00
      9             95.10             14.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =      8.109(CFS)
   '      '    flow top width =      7.407(Ft.)
   '      '    velocity=    6.430(Ft/s)
   '      '    area =      1.261(Sq.Ft)
   '      '    Froude number =     2.746

Upstream point elevation =  1285.000(Ft.)
Downstream point elevation =  1200.000(Ft.)
Flow length =   347.800(Ft.)
Travel time  =    0.90 min.
Time of concentration =    9.20 min.
Depth of flow =   0.341(Ft.)
Average velocity =   6.430(Ft/s)
Total irregular channel flow =     8.109(CFS)
Irregular channel normal depth above invert elev. =   0.341(Ft.)
Average velocity of channel(s) =   6.430(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.845(In/Hr) for a     2.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      2.845(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.343  CA =      3.541
Subarea runoff =      3.999(CFS) for      4.408(Ac.)
Total runoff =     10.075(CFS)      Total area =      10.323(Ac.)
Depth of flow =   0.369(Ft.), Average velocity =   6.788(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      120.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     19.252(CFS)
Depth of flow =   0.539(Ft.), Average velocity =  10.388(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             13.00
      2             12.30             12.00
      3             16.90             10.00
      4             21.30              8.00
      5             34.20              4.00
      6             43.40              2.00
      7             60.50              0.00
      8             77.30              4.00
      9             91.60             10.00
      10             97.00             12.00
```

```
      11            101.00             14.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     19.252(CFS)
   '      '    flow top width =      6.875(Ft.)
   '      '    velocity=   10.388(Ft/s)
   '      '    area =      1.853(Sq.Ft)
   '      '    Froude number =     3.526

Upstream point elevation =  1200.000(Ft.)
Downstream point elevation =   970.000(Ft.)
Flow length =   657.000(Ft.)
Travel time  =    1.05 min.
Time of concentration =   10.25 min.
Depth of flow =   0.539(Ft.)
Average velocity =  10.388(Ft/s)
Total irregular channel flow =    19.252(CFS)
Irregular channel normal depth above invert elev. =   0.539(Ft.)
Average velocity of channel(s) =  10.388(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.653(In/Hr) for a     2.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.220
Decimal fraction soil group D = 0.780
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.339
Rainfall intensity =      2.653(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.340  CA =     10.687
Subarea runoff =     18.279(CFS) for     21.081(Ac.)
Total runoff =     28.354(CFS)      Total area =      31.404(Ac.)
Depth of flow =   0.623(Ft.), Average velocity =  11.444(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      125.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
-----------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     31.002(CFS)
Depth of flow =   0.757(Ft.), Average velocity =   8.488(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2             12.30              12.00
      3             16.90              10.00
      4             21.30               8.00
      5             34.20               4.00
      6             43.40               2.00
      7             60.50               0.00
      8             77.30               4.00
      9             91.60              10.00
      10             97.00              12.00
      11            101.00              14.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     31.002(CFS)
   '      '    flow top width =      9.651(Ft.)
   '      '    velocity=    8.488(Ft/s)
   '      '    area =      3.652(Sq.Ft)
   '      '    Froude number =     2.432

Upstream point elevation =   970.000(Ft.)
Downstream point elevation =   930.000(Ft.)
```

```
Flow length =   269.000(Ft.)
Travel time  =    0.53 min.
Time of concentration =   10.78 min.
Depth of flow =   0.757(Ft.)
Average velocity =   8.488(Ft/s)
Total irregular channel flow =    31.002(CFS)
Irregular channel normal depth above invert elev. =   0.757(Ft.)
Average velocity of channel(s) =   8.488(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.569(In/Hr) for a     2.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.970
Decimal fraction soil group D = 0.030
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.361
Rainfall intensity =      2.569(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.344  CA =     13.065
Subarea runoff =      5.203(CFS) for      6.577(Ac.)
Total runoff =     33.557(CFS)      Total area =      37.981(Ac.)
Depth of flow =   0.780(Ft.), Average velocity =   8.658(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      130.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     35.409(CFS)
Depth of flow =   0.774(Ft.), Average velocity =   7.999(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              12.90
      2             12.30              11.90
      3             16.90               9.90
      4             21.30               7.90
      5             34.20               3.90
      6             43.40               1.90
      7             60.50               0.00
      8             71.50               1.90
      9             77.30               3.90
      10             91.60               9.90
      11             97.00              11.90
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =     35.409(CFS)
   '      '    flow top width =     11.443(Ft.)
   '      '    velocity=    7.999(Ft/s)
   '      '    area =      4.427(Sq.Ft)
   '      '    Froude number =     2.266

Upstream point elevation =   930.000(Ft.)
Downstream point elevation =   876.000(Ft.)
Flow length =   423.500(Ft.)
Travel time  =    0.88 min.
Time of concentration =   11.66 min.
Depth of flow =   0.774(Ft.)
Average velocity =   7.999(Ft/s)
Total irregular channel flow =    35.409(CFS)
Irregular channel normal depth above invert elev. =   0.774(Ft.)
Average velocity of channel(s) =   7.999(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.441(In/Hr) for a     2.0 year storm
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      2.441(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.346  CA =     15.240
Subarea runoff =      3.650(CFS) for      6.042(Ac.)
Total runoff =     37.207(CFS)      Total area =      44.023(Ac.)
Depth of flow =   0.788(Ft.), Average velocity =   8.098(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      135.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     39.551(CFS)
Depth of flow =   0.887(Ft.), Average velocity =   5.568(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              20.00
      2             18.60               8.00
      3             23.20               6.00
      4             27.70               4.00
      5             33.80               2.00
      6             48.30               0.00
      7             69.90               2.00
      8             75.90               4.00
      9             82.30               6.00
      10             98.70              14.00
      11            105.40              16.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =     39.552(CFS)
  '      '    flow top width =     16.013(Ft.)
  '      '    velocity=    5.568(Ft/s)
  '      '    area =      7.103(Sq.Ft)
  '      '    Froude number =     1.473

Upstream point elevation =   876.000(Ft.)
Downstream point elevation =   860.000(Ft.)
Flow length =   312.000(Ft.)
Travel time  =    0.93 min.
Time of concentration =   12.60 min.
Depth of flow =   0.887(Ft.)
Average velocity =   5.568(Ft/s)
Total irregular channel flow =    39.551(CFS)
Irregular channel normal depth above invert elev. =   0.887(Ft.)
Average velocity of channel(s) =   5.568(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.323(In/Hr) for a     2.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      2.323(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.348  CA =     18.009
Subarea runoff =      4.629(CFS) for      7.692(Ac.)
```

```
Total runoff =     41.836(CFS)      Total area =      51.715(Ac.)
Depth of flow =   0.906(Ft.), Average velocity =   5.647(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      135.000 to Point/Station      140.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     41.929(CFS)
Depth of flow =   0.590(Ft.), Average velocity =   9.020(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             13.00
      2              3.80             12.00
      3             14.00              6.00
      4             19.00              4.00
      5             26.70              2.00
      6             47.70              0.00
      7             49.70              0.00
      8             68.60              2.00
      9             75.00              4.00
      10             94.20             12.00
      11             99.40             14.00
Manning's 'N' friction factor =   0.035
----------------------------------------------------------------------------
Sub-Channel flow  =     41.930(CFS)
   '      '    flow top width =     13.765(Ft.)
   '      '    velocity=    9.020(Ft/s)
   '      '    area =      4.648(Sq.Ft)
   '      '    Froude number =     2.736

Upstream point elevation =   860.000(Ft.)
Downstream point elevation =   840.000(Ft.)
Flow length =   103.600(Ft.)
Travel time  =    0.19 min.
Time of concentration =   12.79 min.
Depth of flow =   0.590(Ft.)
Average velocity =   9.020(Ft/s)
Total irregular channel flow =    41.929(CFS)
Irregular channel normal depth above invert elev. =   0.590(Ft.)
Average velocity of channel(s) =   9.020(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.301(In/Hr) for a     2.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.070
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.297
Rainfall intensity =      2.301(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.347  CA =     18.239
Subarea runoff =      0.124(CFS) for      0.775(Ac.)
Total runoff =     41.960(CFS)      Total area =      52.490(Ac.)
Depth of flow =   0.590(Ft.), Average velocity =   9.022(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      140.000 to Point/Station      145.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     43.159(CFS)
Depth of flow =   0.714(Ft.), Average velocity =   6.626(Ft/s)
      ******* Irregular Channel Data ***********
```

```
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2              3.80              12.00
      3             14.00               6.00
      4             19.00               4.00
      5             26.70               2.00
      6             47.70               0.00
      7             49.70               0.00
      8             68.60               2.00
      9             75.00               4.00
      10             94.20              12.00
      11             99.40              14.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =     43.159(CFS)
  '      '    flow top width =     16.244(Ft.)
  '      '    velocity=    6.626(Ft/s)
  '      '    area =      6.513(Sq.Ft)
  '      '    Froude number =     1.844

Upstream point elevation =   840.000(Ft.)
Downstream point elevation =   820.000(Ft.)
Flow length =   473.000(Ft.)
Travel time  =    1.19 min.
Time of concentration =   13.98 min.
Depth of flow =   0.714(Ft.)
Average velocity =   6.626(Ft/s)
Total irregular channel flow =    43.159(CFS)
Irregular channel normal depth above invert elev. =   0.714(Ft.)
Average velocity of channel(s) =   6.626(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.172(In/Hr) for a     2.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.070
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.297
Rainfall intensity =      2.172(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.341  CA =     20.394
Subarea runoff =      2.342(CFS) for      7.269(Ac.)
Total runoff =     44.302(CFS)      Total area =      59.759(Ac.)
Depth of flow =   0.722(Ft.), Average velocity =   6.670(Ft/s)
End of computations, total study area =          59.759 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/21/09

BENTON DUMP - CITY OF ESCONDIDO - EXISTING CONDITIONS HYDROLOGIC
ANALYSIS-USE n = 0.025 THRU n = 0.035 FOR CHANNEL FLOW PROCESSES
10-YR, 6-HOUR STORM EVENT
CIVILD FILE: EX10.RD3

********* Hydrology Study Control Information **********

Program License Serial Number 6219

Rational hydrology study storm event year is 10.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.400
24 hour precipitation(inches) = 4.000
P6/P24 = 60.0%
San Diego hydrology manual 'C' values used

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Process from Point/Station 100.000 to Point/Station 105.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.350
Decimal fraction soil group D = 0.650
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.332
Initial subarea total flow distance = 341.800(Ft.)
Highest elevation = 1377.500(Ft.)
Lowest elevation = 1320.000(Ft.)
Elevation difference = 57.500(Ft.) Slope = 16.823 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 16.82 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.39 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3325)*(100.000^.5)/(16.823^(1/3)]= 5.39
The initial area total distance of 341.80 (Ft.) entered leaves a
remaining distance of 241.80 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.06 minutes
for a distance of 241.80 (Ft.) and a slope of 16.82 %
with an elevation difference of 40.68(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
= 1.061 Minutes
Tt=[(11.9*0.0458^3)/(40.68)]^.385= 1.06
Total initial area Ti = 5.39 minutes from Figure 3-3 formula plus
1.06 minutes from the Figure 3-4 formula = 6.45 minutes
Rainfall intensity (I) = 5.364(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.332

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Subarea runoff =      2.595(CFS)
Total initial stream area =        1.455(Ac.)


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Process from Point/Station      105.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      5.964(CFS)
Depth of flow =   0.432(Ft.), Average velocity =   4.327(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              12.90
      2             12.30              11.90
      3             16.90               9.90
      4             21.30               7.90
      5             34.20               3.90
      6             43.40               1.90
      7             60.50               0.00
      8             71.50               1.90
      9             77.30               3.90
      10             91.60               9.90
      11             97.00              11.90
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =      5.964(CFS)
   '      '    flow top width =      6.386(Ft.)
   '      '    velocity=    4.327(Ft/s)
   '      '    area =      1.379(Sq.Ft)
   '      '    Froude number =     1.641

Upstream point elevation =  1320.000(Ft.)
Downstream point elevation =  1285.000(Ft.)
Flow length =   431.000(Ft.)
Travel time  =    1.66 min.
Time of concentration =    8.11 min.
Depth of flow =   0.432(Ft.)
Average velocity =   4.327(Ft/s)
Total irregular channel flow =     5.964(CFS)
Irregular channel normal depth above invert elev. =   0.432(Ft.)
Average velocity of channel(s) =   4.327(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.628(In/Hr) for a    10.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.210
Decimal fraction soil group D = 0.790
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.339
Rainfall intensity =      4.628(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.338  CA =      1.998
Subarea runoff =      6.651(CFS) for      4.460(Ac.)
Total runoff =      9.246(CFS)      Total area =       5.915(Ac.)
Depth of flow =   0.509(Ft.), Average velocity =   4.828(Ft/s)


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Process from Point/Station      110.000 to Point/Station      115.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     12.373(CFS)
Depth of flow =   0.399(Ft.), Average velocity =   7.146(Ft/s)
      ******* Irregular Channel Data ***********
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------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00               8.20
      2              5.60               6.00
      3             11.60               4.00
      4             20.30               2.00
      5             40.20               0.00
      6             63.80               2.00
      7             74.30               4.00
      8             80.40               6.00
      9             95.10              14.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =     12.373(CFS)
   '      '    flow top width =      8.679(Ft.)
   '      '    velocity=    7.146(Ft/s)
   '      '    area =      1.731(Sq.Ft)
   '      '    Froude number =     2.819

Upstream point elevation =  1285.000(Ft.)
Downstream point elevation =  1200.000(Ft.)
Flow length =   347.800(Ft.)
Travel time  =    0.81 min.
Time of concentration =    8.92 min.
Depth of flow =   0.399(Ft.)
Average velocity =   7.146(Ft/s)
Total irregular channel flow =    12.373(CFS)
Irregular channel normal depth above invert elev. =   0.399(Ft.)
Average velocity of channel(s) =   7.146(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.352(In/Hr) for a    10.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.352(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.343  CA =      3.541
Subarea runoff =      6.163(CFS) for      4.408(Ac.)
Total runoff =     15.408(CFS)      Total area =      10.323(Ac.)
Depth of flow =   0.433(Ft.), Average velocity =   7.549(Ft/s)


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Process from Point/Station      115.000 to Point/Station      120.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     29.520(CFS)
Depth of flow =   0.633(Ft.), Average velocity =  11.560(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2             12.30              12.00
      3             16.90              10.00
      4             21.30               8.00
      5             34.20               4.00
      6             43.40               2.00
      7             60.50               0.00
      8             77.30               4.00
      9             91.60              10.00
      10             97.00              12.00
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      11            101.00             14.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     29.520(CFS)
   '      '    flow top width =      8.070(Ft.)
   '      '    velocity=   11.560(Ft/s)
   '      '    area =      2.554(Sq.Ft)
   '      '    Froude number =     3.621

Upstream point elevation =  1200.000(Ft.)
Downstream point elevation =   970.000(Ft.)
Flow length =   657.000(Ft.)
Travel time  =    0.95 min.
Time of concentration =    9.87 min.
Depth of flow =   0.633(Ft.)
Average velocity =  11.560(Ft/s)
Total irregular channel flow =    29.520(CFS)
Irregular channel normal depth above invert elev. =   0.633(Ft.)
Average velocity of channel(s) =  11.560(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.078(In/Hr) for a    10.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.220
Decimal fraction soil group D = 0.780
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.339
Rainfall intensity =      4.078(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.340  CA =     10.687
Subarea runoff =     28.170(CFS) for     21.081(Ac.)
Total runoff =     43.578(CFS)      Total area =      31.404(Ac.)
Depth of flow =   0.732(Ft.), Average velocity =  12.742(Ft/s)


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Process from Point/Station      120.000 to Point/Station      125.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________
Estimated mean flow rate at midpoint of channel =     47.663(CFS)
Depth of flow =   0.889(Ft.), Average velocity =   9.452(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2             12.30              12.00
      3             16.90              10.00
      4             21.30               8.00
      5             34.20               4.00
      6             43.40               2.00
      7             60.50               0.00
      8             77.30               4.00
      9             91.60              10.00
      10             97.00              12.00
      11            101.00              14.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     47.663(CFS)
   '      '    flow top width =     11.340(Ft.)
   '      '    velocity=    9.452(Ft/s)
   '      '    area =      5.043(Sq.Ft)
   '      '    Froude number =     2.498

Upstream point elevation =   970.000(Ft.)
Downstream point elevation =   930.000(Ft.)
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Flow length =   269.000(Ft.)
Travel time  =    0.47 min.
Time of concentration =   10.35 min.
Depth of flow =   0.889(Ft.)
Average velocity =   9.452(Ft/s)
Total irregular channel flow =    47.663(CFS)
Irregular channel normal depth above invert elev. =   0.889(Ft.)
Average velocity of channel(s) =   9.452(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.956(In/Hr) for a    10.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.970
Decimal fraction soil group D = 0.030
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.361
Rainfall intensity =      3.956(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.344  CA =     13.065
Subarea runoff =      8.106(CFS) for      6.577(Ac.)
Total runoff =     51.684(CFS)      Total area =     37.981(Ac.)
Depth of flow =   0.917(Ft.), Average velocity =   9.645(Ft/s)


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Process from Point/Station      125.000 to Point/Station      130.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     54.625(CFS)
Depth of flow =   0.910(Ft.), Average velocity =   8.914(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              12.90
      2             12.30              11.90
      3             16.90               9.90
      4             21.30               7.90
      5             34.20               3.90
      6             43.40               1.90
      7             60.50               0.00
      8             71.50               1.90
      9             77.30               3.90
      10             91.60               9.90
      11             97.00              11.90
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------
Sub-Channel flow  =     54.625(CFS)
   '      '    flow top width =     13.463(Ft.)
   '      '    velocity=    8.914(Ft/s)
   '      '    area =      6.128(Sq.Ft)
   '      '    Froude number =     2.328

Upstream point elevation =   930.000(Ft.)
Downstream point elevation =   876.000(Ft.)
Flow length =   423.500(Ft.)
Travel time  =    0.79 min.
Time of concentration =   11.14 min.
Depth of flow =   0.910(Ft.)
Average velocity =   8.914(Ft/s)
Total irregular channel flow =    54.625(CFS)
Irregular channel normal depth above invert elev. =   0.910(Ft.)
Average velocity of channel(s) =   8.914(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.772(In/Hr) for a    10.0 year storm
Decimal fraction soil group A = 0.000
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Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      3.772(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.346  CA =     15.240
Subarea runoff =      5.804(CFS) for      6.042(Ac.)
Total runoff =     57.488(CFS)      Total area =      44.023(Ac.)
Depth of flow =   0.928(Ft.), Average velocity =   9.029(Ft/s)


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Process from Point/Station      130.000 to Point/Station      135.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     61.203(CFS)
Depth of flow =   1.045(Ft.), Average velocity =   6.211(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              20.00
      2             18.60               8.00
      3             23.20               6.00
      4             27.70               4.00
      5             33.80               2.00
      6             48.30               0.00
      7             69.90               2.00
      8             75.90               4.00
      9             82.30               6.00
      10             98.70              14.00
      11            105.40              16.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =     61.203(CFS)
   '      '    flow top width =     18.861(Ft.)
   '      '    velocity=    6.211(Ft/s)
   '      '    area =      9.854(Sq.Ft)
   '      '    Froude number =     1.514

Upstream point elevation =   876.000(Ft.)
Downstream point elevation =   860.000(Ft.)
Flow length =   312.000(Ft.)
Travel time  =    0.84 min.
Time of concentration =   11.98 min.
Depth of flow =   1.045(Ft.)
Average velocity =   6.211(Ft/s)
Total irregular channel flow =    61.203(CFS)
Irregular channel normal depth above invert elev. =   1.045(Ft.)
Average velocity of channel(s) =   6.211(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.600(In/Hr) for a    10.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      3.600(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.348  CA =     18.009
Subarea runoff =      7.343(CFS) for      7.692(Ac.)
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Total runoff =     64.831(CFS)      Total area =      51.715(Ac.)
Depth of flow =   1.068(Ft.), Average velocity =   6.301(Ft/s)


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Process from Point/Station      135.000 to Point/Station      140.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     64.992(CFS)
Depth of flow =   0.710(Ft.), Average velocity =  10.079(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2              3.80              12.00
      3             14.00               6.00
      4             19.00               4.00
      5             26.70               2.00
      6             47.70               0.00
      7             49.70               0.00
      8             68.60               2.00
      9             75.00               4.00
      10             94.20              12.00
      11             99.40              14.00
Manning's 'N' friction factor =   0.035
----------------------------------------------------------------------------
Sub-Channel flow  =     64.992(CFS)
   '      '    flow top width =     16.164(Ft.)
   '      '    velocity=   10.079(Ft/s)
   '      '    area =      6.448(Sq.Ft)
   '      '    Froude number =     2.812

Upstream point elevation =   860.000(Ft.)
Downstream point elevation =   840.000(Ft.)
Flow length =   103.600(Ft.)
Travel time  =    0.17 min.
Time of concentration =   12.15 min.
Depth of flow =   0.710(Ft.)
Average velocity =  10.079(Ft/s)
Total irregular channel flow =    64.992(CFS)
Irregular channel normal depth above invert elev. =   0.710(Ft.)
Average velocity of channel(s) =  10.079(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.567(In/Hr) for a    10.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.070
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.297
Rainfall intensity =      3.567(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.347  CA =     18.239
Subarea runoff =      0.228(CFS) for      0.775(Ac.)
Total runoff =     65.060(CFS)      Total area =      52.490(Ac.)
Depth of flow =   0.710(Ft.), Average velocity =  10.082(Ft/s)


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Process from Point/Station      140.000 to Point/Station      145.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     67.027(CFS)
Depth of flow =   0.858(Ft.), Average velocity =   7.405(Ft/s)
      ******* Irregular Channel Data ***********
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```
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2              3.80              12.00
      3             14.00               6.00
      4             19.00               4.00
      5             26.70               2.00
      6             47.70               0.00
      7             49.70               0.00
      8             68.60               2.00
      9             75.00               4.00
      10             94.20              12.00
      11             99.40              14.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------------
Sub-Channel flow  =     67.027(CFS)
  '      '    flow top width =     19.109(Ft.)
  '      '    velocity=    7.405(Ft/s)
  '      '    area =      9.052(Sq.Ft)
  '      '    Froude number =     1.896

Upstream point elevation =   840.000(Ft.)
Downstream point elevation =   820.000(Ft.)
Flow length =   473.000(Ft.)
Travel time  =    1.06 min.
Time of concentration =   13.21 min.
Depth of flow =   0.858(Ft.)
Average velocity =   7.405(Ft/s)
Total irregular channel flow =    67.027(CFS)
Irregular channel normal depth above invert elev. =   0.858(Ft.)
Average velocity of channel(s) =   7.405(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.379(In/Hr) for a    10.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.070
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.297
Rainfall intensity =      3.379(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.341  CA =     20.394
Subarea runoff =      3.851(CFS) for      7.269(Ac.)
Total runoff =     68.910(CFS)      Total area =      59.759(Ac.)
Depth of flow =   0.867(Ft.), Average velocity =   7.457(Ft/s)
End of computations, total study area =          59.759 (Ac.)
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San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/21/09

BENTON DUMP - CITY OF ESCONDIDO - EXISTING CONDITIONS HYDROLOGIC
ANALYSIS-USE n = 0.025 THRU n = 0.035 FOR CHANNEL FLOW PROCESSES
50-YR, 6-HOUR STORM EVENT
CIVILD FILE: EX50.RD3

********* Hydrology Study Control Information **********

Program License Serial Number 6219

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 6.000
P6/P24 = 50.0%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 100.000 to Point/Station 105.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.350
Decimal fraction soil group D = 0.650
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.332
Initial subarea total flow distance = 341.800(Ft.)
Highest elevation = 1377.500(Ft.)
Lowest elevation = 1320.000(Ft.)
Elevation difference = 57.500(Ft.) Slope = 16.823 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 16.82 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.39 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3325)*(100.000^.5)/(16.823^(1/3)]= 5.39
The initial area total distance of 341.80 (Ft.) entered leaves a
remaining distance of 241.80 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.06 minutes
for a distance of 241.80 (Ft.) and a slope of 16.82 %
with an elevation difference of 40.68(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
= 1.061 Minutes
Tt=[(11.9*0.0458^3)/(40.68)]^.385= 1.06
Total initial area Ti = 5.39 minutes from Figure 3-3 formula plus
1.06 minutes from the Figure 3-4 formula = 6.45 minutes
Rainfall intensity (I) = 6.705(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.332

```
Subarea runoff =      3.244(CFS)
Total initial stream area =        1.455(Ac.)


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Process from Point/Station      105.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      7.469(CFS)
Depth of flow =   0.470(Ft.), Average velocity =   4.577(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              12.90
      2             12.30              11.90
      3             16.90               9.90
      4             21.30               7.90
      5             34.20               3.90
      6             43.40               1.90
      7             60.50               0.00
      8             71.50               1.90
      9             77.30               3.90
      10             91.60               9.90
      11             97.00              11.90
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =      7.469(CFS)
   '      '    flow top width =      6.948(Ft.)
   '      '    velocity=    4.577(Ft/s)
   '      '    area =      1.632(Sq.Ft)
   '      '    Froude number =     1.664

Upstream point elevation =  1320.000(Ft.)
Downstream point elevation =  1285.000(Ft.)
Flow length =   431.000(Ft.)
Travel time  =    1.57 min.
Time of concentration =    8.02 min.
Depth of flow =   0.470(Ft.)
Average velocity =   4.577(Ft/s)
Total irregular channel flow =     7.469(CFS)
Irregular channel normal depth above invert elev. =   0.470(Ft.)
Average velocity of channel(s) =   4.577(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.827(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.210
Decimal fraction soil group D = 0.790
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.339
Rainfall intensity =      5.827(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.338  CA =      1.998
Subarea runoff =      8.398(CFS) for      4.460(Ac.)
Total runoff =     11.641(CFS)      Total area =       5.915(Ac.)
Depth of flow =   0.555(Ft.), Average velocity =   5.114(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      115.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     15.575(CFS)
Depth of flow =   0.435(Ft.), Average velocity =   7.569(Ft/s)
      ******* Irregular Channel Data ***********
```

```
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              8.20
      2              5.60              6.00
      3             11.60              4.00
      4             20.30              2.00
      5             40.20              0.00
      6             63.80              2.00
      7             74.30              4.00
      8             80.40              6.00
      9             95.10             14.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =     15.575(CFS)
  '      '    flow top width =      9.461(Ft.)
  '      '    velocity=    7.569(Ft/s)
  '      '    area =      2.058(Sq.Ft)
  '      '    Froude number =     2.860

Upstream point elevation =  1285.000(Ft.)
Downstream point elevation =  1200.000(Ft.)
Flow length =   347.800(Ft.)
Travel time  =    0.77 min.
Time of concentration =    8.79 min.
Depth of flow =   0.435(Ft.)
Average velocity =   7.569(Ft/s)
Total irregular channel flow =    15.575(CFS)
Irregular channel normal depth above invert elev. =   0.435(Ft.)
Average velocity of channel(s) =   7.569(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.494(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.494(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.343  CA =      3.541
Subarea runoff =      7.811(CFS) for      4.408(Ac.)
Total runoff =     19.452(CFS)      Total area =      10.323(Ac.)
Depth of flow =   0.473(Ft.), Average velocity =   8.002(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      120.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     37.339(CFS)
Depth of flow =   0.691(Ft.), Average velocity =  12.259(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             13.00
      2             12.30             12.00
      3             16.90             10.00
      4             21.30              8.00
      5             34.20              4.00
      6             43.40              2.00
      7             60.50              0.00
      8             77.30              4.00
      9             91.60             10.00
      10             97.00             12.00
```

```
      11             101.00             14.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     37.340(CFS)
   '      '    flow top width =      8.813(Ft.)
   '      '    velocity=   12.259(Ft/s)
   '      '    area =      3.046(Sq.Ft)
   '      '    Froude number =     3.675

Upstream point elevation =  1200.000(Ft.)
Downstream point elevation =   970.000(Ft.)
Flow length =   657.000(Ft.)
Travel time  =    0.89 min.
Time of concentration =    9.68 min.
Depth of flow =   0.691(Ft.)
Average velocity =  12.259(Ft/s)
Total irregular channel flow =    37.339(CFS)
Irregular channel normal depth above invert elev. =   0.691(Ft.)
Average velocity of channel(s) =  12.259(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.161(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.220
Decimal fraction soil group D = 0.780
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.339
Rainfall intensity =      5.161(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.340  CA =     10.687
Subarea runoff =     35.708(CFS) for     21.081(Ac.)
Total runoff =     55.160(CFS)      Total area =      31.404(Ac.)
Depth of flow =   0.800(Ft.), Average velocity =  13.515(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      125.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________
Estimated mean flow rate at midpoint of channel =     60.367(CFS)
Depth of flow =   0.972(Ft.), Average velocity =  10.027(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2             12.30              12.00
      3             16.90              10.00
      4             21.30               8.00
      5             34.20               4.00
      6             43.40               2.00
      7             60.50               0.00
      8             77.30               4.00
      9             91.60              10.00
      10             97.00              12.00
      11            101.00              14.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     60.367(CFS)
   '      '    flow top width =     12.390(Ft.)
   '      '    velocity=   10.027(Ft/s)
   '      '    area =      6.020(Sq.Ft)
   '      '    Froude number =     2.535

Upstream point elevation =   970.000(Ft.)
Downstream point elevation =   930.000(Ft.)
```

```
Flow length =   269.000(Ft.)
Travel time  =    0.45 min.
Time of concentration =   10.13 min.
Depth of flow =   0.972(Ft.)
Average velocity =  10.027(Ft/s)
Total irregular channel flow =    60.367(CFS)
Irregular channel normal depth above invert elev. =   0.972(Ft.)
Average velocity of channel(s) =  10.027(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.013(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.970
Decimal fraction soil group D = 0.030
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.361
Rainfall intensity =      5.013(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.344  CA =     13.065
Subarea runoff =     10.336(CFS) for      6.577(Ac.)
Total runoff =     65.496(CFS)      Total area =      37.981(Ac.)
Depth of flow =   1.002(Ft.), Average velocity =  10.234(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      130.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     69.284(CFS)
Depth of flow =   0.995(Ft.), Average velocity =   9.460(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              12.90
      2             12.30              11.90
      3             16.90               9.90
      4             21.30               7.90
      5             34.20               3.90
      6             43.40               1.90
      7             60.50               0.00
      8             71.50               1.90
      9             77.30               3.90
      10             91.60               9.90
      11             97.00              11.90
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =     69.284(CFS)
  '      '    flow top width =     14.718(Ft.)
  '      '    velocity=    9.460(Ft/s)
  '      '    area =      7.324(Sq.Ft)
  '      '    Froude number =     2.363

Upstream point elevation =   930.000(Ft.)
Downstream point elevation =   876.000(Ft.)
Flow length =   423.500(Ft.)
Travel time  =    0.75 min.
Time of concentration =   10.87 min.
Depth of flow =   0.995(Ft.)
Average velocity =   9.460(Ft/s)
Total irregular channel flow =    69.284(CFS)
Irregular channel normal depth above invert elev. =   0.995(Ft.)
Average velocity of channel(s) =   9.460(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.789(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      4.789(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.346  CA =     15.240
Subarea runoff =      7.481(CFS) for      6.042(Ac.)
Total runoff =     72.977(CFS)      Total area =      44.023(Ac.)
Depth of flow =   1.015(Ft.), Average velocity =   9.584(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      135.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     77.730(CFS)
Depth of flow =   1.143(Ft.), Average velocity =   6.593(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              20.00
      2             18.60               8.00
      3             23.20               6.00
      4             27.70               4.00
      5             33.80               2.00
      6             48.30               0.00
      7             69.90               2.00
      8             75.90               4.00
      9             82.30               6.00
      10             98.70              14.00
      11            105.40              16.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =     77.730(CFS)
  '      '    flow top width =     20.630(Ft.)
  '      '    velocity=    6.593(Ft/s)
  '      '    area =     11.789(Sq.Ft)
  '      '    Froude number =     1.537

Upstream point elevation =   876.000(Ft.)
Downstream point elevation =   860.000(Ft.)
Flow length =   312.000(Ft.)
Travel time  =    0.79 min.
Time of concentration =   11.66 min.
Depth of flow =   1.143(Ft.)
Average velocity =   6.593(Ft/s)
Total irregular channel flow =    77.730(CFS)
Irregular channel normal depth above invert elev. =   1.143(Ft.)
Average velocity of channel(s) =   6.593(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.577(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      4.577(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.348  CA =     18.009
Subarea runoff =      9.452(CFS) for      7.692(Ac.)
```

```
Total runoff =     82.429(CFS)      Total area =      51.715(Ac.)
Depth of flow =   1.168(Ft.), Average velocity =   6.691(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      135.000 to Point/Station      140.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     82.616(CFS)
Depth of flow =   0.785(Ft.), Average velocity =  10.709(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2              3.80              12.00
      3             14.00               6.00
      4             19.00               4.00
      5             26.70               2.00
      6             47.70               0.00
      7             49.70               0.00
      8             68.60               2.00
      9             75.00               4.00
      10             94.20              12.00
      11             99.40              14.00
Manning's 'N' friction factor =   0.035
----------------------------------------------------------------------------
Sub-Channel flow  =     82.616(CFS)
   '      '    flow top width =     17.658(Ft.)
   '      '    velocity=   10.709(Ft/s)
   '      '    area =      7.715(Sq.Ft)
   '      '    Froude number =     2.855

Upstream point elevation =   860.000(Ft.)
Downstream point elevation =   840.000(Ft.)
Flow length =   103.600(Ft.)
Travel time  =    0.16 min.
Time of concentration =   11.82 min.
Depth of flow =   0.785(Ft.)
Average velocity =  10.709(Ft/s)
Total irregular channel flow =    82.616(CFS)
Irregular channel normal depth above invert elev. =   0.785(Ft.)
Average velocity of channel(s) =  10.709(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.537(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.070
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.297
Rainfall intensity =      4.537(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.347  CA =     18.239
Subarea runoff =      0.316(CFS) for      0.775(Ac.)
Total runoff =     82.745(CFS)      Total area =      52.490(Ac.)
Depth of flow =   0.785(Ft.), Average velocity =  10.713(Ft/s)


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Process from Point/Station      140.000 to Point/Station      145.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     85.296(CFS)
Depth of flow =   0.947(Ft.), Average velocity =   7.868(Ft/s)
      ******* Irregular Channel Data ***********
```

```
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2              3.80              12.00
      3             14.00               6.00
      4             19.00               4.00
      5             26.70               2.00
      6             47.70               0.00
      7             49.70               0.00
      8             68.60               2.00
      9             75.00               4.00
      10             94.20              12.00
      11             99.40              14.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------------
Sub-Channel flow  =     85.296(CFS)
   '      '    flow top width =     20.893(Ft.)
   '      '    velocity=    7.868(Ft/s)
   '      '    area =     10.841(Sq.Ft)
   '      '    Froude number =     1.925

Upstream point elevation =   840.000(Ft.)
Downstream point elevation =   820.000(Ft.)
Flow length =   473.000(Ft.)
Travel time  =    1.00 min.
Time of concentration =   12.83 min.
Depth of flow =   0.947(Ft.)
Average velocity =   7.868(Ft/s)
Total irregular channel flow =    85.296(CFS)
Irregular channel normal depth above invert elev. =   0.947(Ft.)
Average velocity of channel(s) =   7.868(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.305(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.070
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.297
Rainfall intensity =      4.305(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.341  CA =     20.394
Subarea runoff =      5.049(CFS) for      7.269(Ac.)
Total runoff =     87.794(CFS)      Total area =      59.759(Ac.)
Depth of flow =   0.958(Ft.), Average velocity =   7.926(Ft/s)
End of computations, total study area =          59.759 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/21/09

BENTON DUMP - CITY OF ESCONDIDO - EXISTING CONDITIONS HYDROLOGIC
ANALYSIS-USE n = 0.025 THRU n = 0.035 FOR CHANNEL FLOW PROCESSES
100-YR, 6-HOUR STORM EVENT
CIVILD FILE: EX100.RD3

********* Hydrology Study Control Information **********

Program License Serial Number 6219

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.000
P6/P24 = 50.0%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 100.000 to Point/Station 105.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.350
Decimal fraction soil group D = 0.650
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.332
Initial subarea total flow distance = 341.800(Ft.)
Highest elevation = 1377.500(Ft.)
Lowest elevation = 1320.000(Ft.)
Elevation difference = 57.500(Ft.) Slope = 16.823 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 16.82 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.39 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3325)*(100.000^.5)/(16.823^(1/3)]= 5.39
The initial area total distance of 341.80 (Ft.) entered leaves a
remaining distance of 241.80 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.06 minutes
for a distance of 241.80 (Ft.) and a slope of 16.82 %
with an elevation difference of 40.68(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
= 1.061 Minutes
Tt=[(11.9*0.0458^3)/(40.68)]^.385= 1.06
Total initial area Ti = 5.39 minutes from Figure 3-3 formula plus
1.06 minutes from the Figure 3-4 formula = 6.45 minutes
Rainfall intensity (I) = 7.822(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.332

```
Subarea runoff =      3.784(CFS)
Total initial stream area =        1.455(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      8.746(CFS)
Depth of flow =   0.498(Ft.), Average velocity =   4.761(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              12.90
      2             12.30              11.90
      3             16.90               9.90
      4             21.30               7.90
      5             34.20               3.90
      6             43.40               1.90
      7             60.50               0.00
      8             71.50               1.90
      9             77.30               3.90
      10             91.60               9.90
      11             97.00              11.90
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =      8.746(CFS)
   '      '    flow top width =      7.371(Ft.)
   '      '    velocity=    4.761(Ft/s)
   '      '    area =      1.837(Sq.Ft)
   '      '    Froude number =     1.681

Upstream point elevation =  1320.000(Ft.)
Downstream point elevation =  1285.000(Ft.)
Flow length =   431.000(Ft.)
Travel time  =    1.51 min.
Time of concentration =    7.96 min.
Depth of flow =   0.498(Ft.)
Average velocity =   4.761(Ft/s)
Total irregular channel flow =     8.746(CFS)
Irregular channel normal depth above invert elev. =   0.498(Ft.)
Average velocity of channel(s) =   4.761(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      6.831(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.210
Decimal fraction soil group D = 0.790
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.339
Rainfall intensity =      6.831(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.338  CA =      1.998
Subarea runoff =      9.864(CFS) for      4.460(Ac.)
Total runoff =     13.648(CFS)      Total area =       5.915(Ac.)
Depth of flow =   0.589(Ft.), Average velocity =   5.321(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      115.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     18.279(CFS)
Depth of flow =   0.462(Ft.), Average velocity =   7.878(Ft/s)
      ******* Irregular Channel Data ***********
```

```
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              8.20
      2              5.60              6.00
      3             11.60              4.00
      4             20.30              2.00
      5             40.20              0.00
      6             63.80              2.00
      7             74.30              4.00
      8             80.40              6.00
      9             95.10             14.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =     18.279(CFS)
  '      '    flow top width =     10.046(Ft.)
  '      '    velocity=    7.878(Ft/s)
  '      '    area =      2.320(Sq.Ft)
  '      '    Froude number =     2.889

Upstream point elevation =  1285.000(Ft.)
Downstream point elevation =  1200.000(Ft.)
Flow length =   347.800(Ft.)
Travel time  =    0.74 min.
Time of concentration =    8.70 min.
Depth of flow =   0.462(Ft.)
Average velocity =   7.878(Ft/s)
Total irregular channel flow =    18.279(CFS)
Irregular channel normal depth above invert elev. =   0.462(Ft.)
Average velocity of channel(s) =   7.878(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      6.453(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      6.453(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.343  CA =      3.541
Subarea runoff =      9.199(CFS) for      4.408(Ac.)
Total runoff =     22.847(CFS)      Total area =      10.323(Ac.)
Depth of flow =   0.502(Ft.), Average velocity =   8.330(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      120.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     43.912(CFS)
Depth of flow =   0.735(Ft.), Average velocity =  12.766(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             13.00
      2             12.30             12.00
      3             16.90             10.00
      4             21.30              8.00
      5             34.20              4.00
      6             43.40              2.00
      7             60.50              0.00
      8             77.30              4.00
      9             91.60             10.00
      10             97.00             12.00
```

```
      11             101.00             14.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     43.912(CFS)
   '      '    flow top width =      9.365(Ft.)
   '      '    velocity=   12.766(Ft/s)
   '      '    area =      3.440(Sq.Ft)
   '      '    Froude number =     3.712

Upstream point elevation =  1200.000(Ft.)
Downstream point elevation =   970.000(Ft.)
Flow length =   657.000(Ft.)
Travel time  =    0.86 min.
Time of concentration =    9.56 min.
Depth of flow =   0.735(Ft.)
Average velocity =  12.766(Ft/s)
Total irregular channel flow =    43.912(CFS)
Irregular channel normal depth above invert elev. =   0.735(Ft.)
Average velocity of channel(s) =  12.766(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      6.073(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.220
Decimal fraction soil group D = 0.780
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.339
Rainfall intensity =      6.073(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.340  CA =     10.687
Subarea runoff =     42.054(CFS) for     21.081(Ac.)
Total runoff =     64.901(CFS)      Total area =      31.404(Ac.)
Depth of flow =   0.850(Ft.), Average velocity =  14.076(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      125.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________
Estimated mean flow rate at midpoint of channel =     71.055(CFS)
Depth of flow =   1.033(Ft.), Average velocity =  10.444(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2             12.30              12.00
      3             16.90              10.00
      4             21.30               8.00
      5             34.20               4.00
      6             43.40               2.00
      7             60.50               0.00
      8             77.30               4.00
      9             91.60              10.00
      10             97.00              12.00
      11            101.00              14.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     71.055(CFS)
   '      '    flow top width =     13.171(Ft.)
   '      '    velocity=   10.444(Ft/s)
   '      '    area =      6.803(Sq.Ft)
   '      '    Froude number =     2.561

Upstream point elevation =   970.000(Ft.)
Downstream point elevation =   930.000(Ft.)
```

```
Flow length =   269.000(Ft.)
Travel time  =    0.43 min.
Time of concentration =    9.98 min.
Depth of flow =   1.033(Ft.)
Average velocity =  10.444(Ft/s)
Total irregular channel flow =    71.055(CFS)
Irregular channel normal depth above invert elev. =   1.033(Ft.)
Average velocity of channel(s) =  10.444(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.903(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.970
Decimal fraction soil group D = 0.030
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.361
Rainfall intensity =      5.903(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.344  CA =     13.065
Subarea runoff =     12.221(CFS) for      6.577(Ac.)
Total runoff =     77.122(CFS)      Total area =      37.981(Ac.)
Depth of flow =   1.065(Ft.), Average velocity =  10.660(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      130.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     81.603(CFS)
Depth of flow =   1.058(Ft.), Average velocity =   9.855(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              12.90
      2             12.30              11.90
      3             16.90               9.90
      4             21.30               7.90
      5             34.20               3.90
      6             43.40               1.90
      7             60.50               0.00
      8             71.50               1.90
      9             77.30               3.90
      10             91.60               9.90
      11             97.00              11.90
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------
Sub-Channel flow  =     81.603(CFS)
  '      '    flow top width =     15.650(Ft.)
  '      '    velocity=    9.855(Ft/s)
  '      '    area =      8.280(Sq.Ft)
  '      '    Froude number =     2.388

Upstream point elevation =   930.000(Ft.)
Downstream point elevation =   876.000(Ft.)
Flow length =   423.500(Ft.)
Travel time  =    0.72 min.
Time of concentration =   10.70 min.
Depth of flow =   1.058(Ft.)
Average velocity =   9.855(Ft/s)
Total irregular channel flow =    81.603(CFS)
Irregular channel normal depth above invert elev. =   1.058(Ft.)
Average velocity of channel(s) =   9.855(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.645(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      5.645(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.346  CA =     15.240
Subarea runoff =      8.908(CFS) for      6.042(Ac.)
Total runoff =     86.030(CFS)      Total area =      44.023(Ac.)
Depth of flow =   1.079(Ft.), Average velocity =   9.986(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      135.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     91.685(CFS)
Depth of flow =   1.216(Ft.), Average velocity =   6.871(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             20.00
      2             18.60              8.00
      3             23.20              6.00
      4             27.70              4.00
      5             33.80              2.00
      6             48.30              0.00
      7             69.90              2.00
      8             75.90              4.00
      9             82.30              6.00
      10             98.70             14.00
      11            105.40             16.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =     91.685(CFS)
   '      '    flow top width =     21.948(Ft.)
   '      '    velocity=    6.871(Ft/s)
   '      '    area =     13.344(Sq.Ft)
   '      '    Froude number =     1.553

Upstream point elevation =   876.000(Ft.)
Downstream point elevation =   860.000(Ft.)
Flow length =   312.000(Ft.)
Travel time  =    0.76 min.
Time of concentration =   11.46 min.
Depth of flow =   1.216(Ft.)
Average velocity =   6.871(Ft/s)
Total irregular channel flow =    91.685(CFS)
Irregular channel normal depth above invert elev. =   1.216(Ft.)
Average velocity of channel(s) =   6.871(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.402(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                        ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      5.402(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.348  CA =     18.009
Subarea runoff =     11.248(CFS) for      7.692(Ac.)
```

```
Total runoff =     97.279(CFS)      Total area =      51.715(Ac.)
Depth of flow =   1.243(Ft.), Average velocity =   6.973(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      135.000 to Point/Station      140.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     97.509(CFS)
Depth of flow =   0.841(Ft.), Average velocity =  11.166(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2              3.80              12.00
      3             14.00               6.00
      4             19.00               4.00
      5             26.70               2.00
      6             47.70               0.00
      7             49.70               0.00
      8             68.60               2.00
      9             75.00               4.00
      10             94.20              12.00
      11             99.40              14.00
Manning's 'N' friction factor =   0.035
----------------------------------------------------------------------------
Sub-Channel flow  =     97.509(CFS)
  '      '    flow top width =     18.773(Ft.)
  '      '    velocity=   11.166(Ft/s)
  '      '    area =      8.733(Sq.Ft)
  '      '    Froude number =     2.885

Upstream point elevation =   860.000(Ft.)
Downstream point elevation =   840.000(Ft.)
Flow length =   103.600(Ft.)
Travel time  =    0.15 min.
Time of concentration =   11.61 min.
Depth of flow =   0.841(Ft.)
Average velocity =  11.166(Ft/s)
Total irregular channel flow =    97.509(CFS)
Irregular channel normal depth above invert elev. =   0.841(Ft.)
Average velocity of channel(s) =  11.166(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.355(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.070
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.297
Rainfall intensity =      5.355(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.347  CA =     18.239
Subarea runoff =      0.393(CFS) for      0.775(Ac.)
Total runoff =     97.672(CFS)      Total area =      52.490(Ac.)
Depth of flow =   0.841(Ft.), Average velocity =  11.171(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      140.000 to Point/Station      145.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =    100.743(CFS)
Depth of flow =   1.014(Ft.), Average velocity =   8.205(Ft/s)
      ******* Irregular Channel Data ***********
```

```
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              13.00
      2              3.80              12.00
      3             14.00               6.00
      4             19.00               4.00
      5             26.70               2.00
      6             47.70               0.00
      7             49.70               0.00
      8             68.60               2.00
      9             75.00               4.00
      10             94.20              12.00
      11             99.40              14.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =    100.743(CFS)
   '      '    flow top width =     22.224(Ft.)
   '      '    velocity=    8.205(Ft/s)
   '      '    area =     12.279(Sq.Ft)
   '      '    Froude number =     1.945

Upstream point elevation =   840.000(Ft.)
Downstream point elevation =   820.000(Ft.)
Flow length =   473.000(Ft.)
Travel time  =    0.96 min.
Time of concentration =   12.57 min.
Depth of flow =   1.014(Ft.)
Average velocity =   8.205(Ft/s)
Total irregular channel flow =   100.743(CFS)
Irregular channel normal depth above invert elev. =   1.014(Ft.)
Average velocity of channel(s) =   8.205(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.087(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.070
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.297
Rainfall intensity =      5.087(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.341  CA =     20.394
Subarea runoff =      6.083(CFS) for      7.269(Ac.)
Total runoff =    103.754(CFS)      Total area =      59.759(Ac.)
Depth of flow =   1.026(Ft.), Average velocity =   8.266(Ft/s)
End of computations, total study area =          59.759 (Ac.)
```

HEC-RAS Plan: 2-yr Exist River: BENTON Reach: BENTON Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	215	PF 1	44.30	873.50	874.54	874.74	875.21	0.060031	6.55	6.76	10.84	1.46
BENTON	210	PF 1	44.30	870.80	872.75	872.10	872.83	0.003325	2.25	19.65	17.74	0.38
BENTON	205	PF 1	44.30	871.30	872.12	872.12	872.35	0.030134	3.85	11.56	26.41	1.00
BENTON	200	PF 1	44.30	866.00	867.35	867.62	868.23	0.085501	7.53	5.88	8.75	1.62
BENTON	195	PF 1	44.30	860.00	860.82	861.10	861.73	0.054557	7.63	5.80	14.13	2.10
BENTON	190	PF 1	44.30	850.00	850.82	851.47	854.60	0.234641	15.60	2.84	6.90	4.28
BENTON	185	PF 1	44.30	840.00	841.06	841.75	844.36	0.390683	14.57	3.04	5.73	3.53
BENTON	180	PF 1	44.30	838.10	839.27	839.64	840.47	0.120072	8.79	5.04	8.62	2.03
BENTON	175	PF 1	44.30	836.60	838.03	838.17	838.60	0.024245	6.03	7.35	10.24	1.25
BENTON	170	PF 1	44.30	834.00	834.75	835.08	835.91	0.152200	8.61	5.14	13.63	2.47
BENTON	165	PF 1	44.30	830.10	831.12	831.27	831.63	0.033300	5.74	7.72	15.11	1.42
BENTON	160	PF 1	44.30	828.00	828.75	828.94	829.36	0.051198	6.25	7.09	16.93	1.70
BENTON	155	PF 1	44.30	826.00	827.63	827.63	827.84	0.018149	3.64	12.18	28.43	0.98
BENTON	150	PF 1	44.30	822.00	823.27	823.69	825.06	0.268450	10.72	4.13	10.31	2.99
BENTON	125	PF 1	44.30	819.80	820.67	820.96	821.59	0.050297	8.01	5.85	10.00	1.60
BENTON	100	PF 1	44.30	819.70	820.99	820.68	821.16	0.002800	3.43	14.19	15.67	0.57
BENTON	50	PF 1	44.30	819.50	820.51	820.51	820.88	0.021065	4.99	9.39	13.18	0.93
BENTON	40	PF 1	44.30	817.50	820.10	818.71	820.16	0.001043	2.27	23.55	13.68	0.25
BENTON	30	PF 1	44.30	817.00	820.10	817.99	820.15	0.000366	1.79	24.80	17.20	0.18

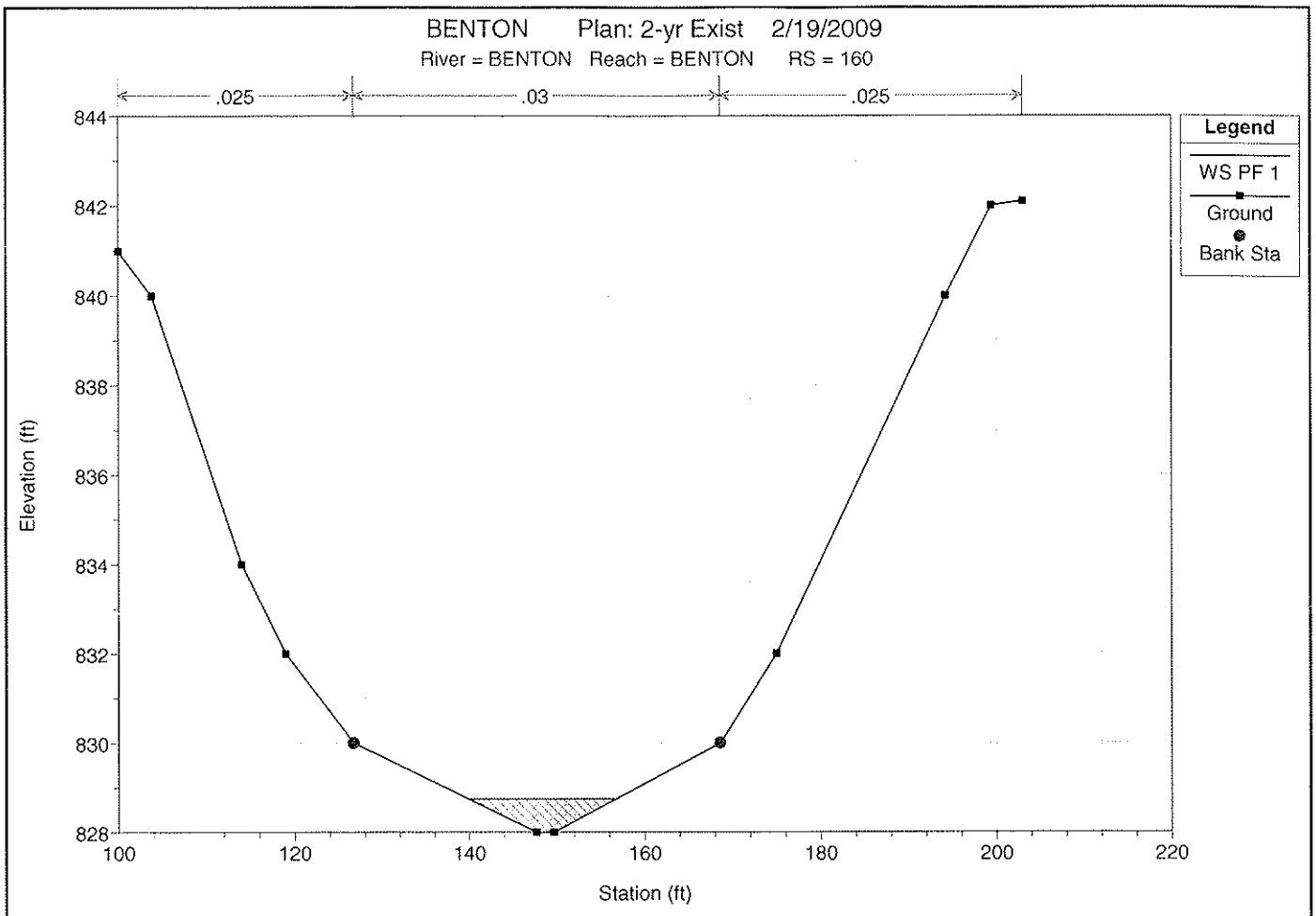
Headwater Depth for Concrete Pipe Culverts with Inlet Control

- (•) Square Edge with Headwall
- ( ) Groove End with Headwall
- ( ) Groove End Projecting

2.075	Calc	Critical Depth (ft)
7.458		Critical Velocity (ft/s)
44.3		Q = Discharge (cfs) ← 2-YR FLOW
.02		Culvert Barrel Slope (ft/ft)
3.5		Culvert diameter (ft)
3.111		Headwater (ft)

Calc

Units
(•) English ( ) Metric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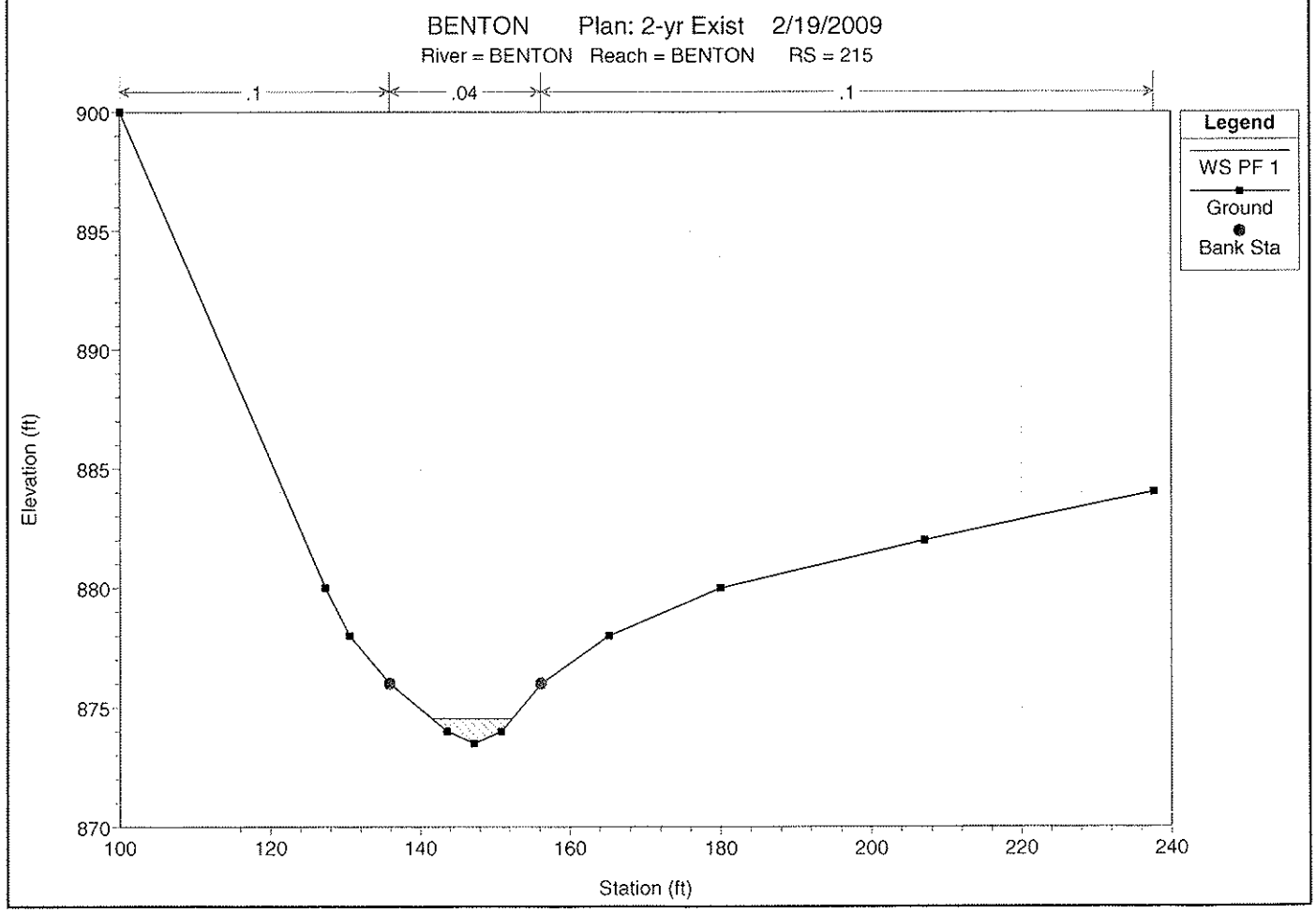
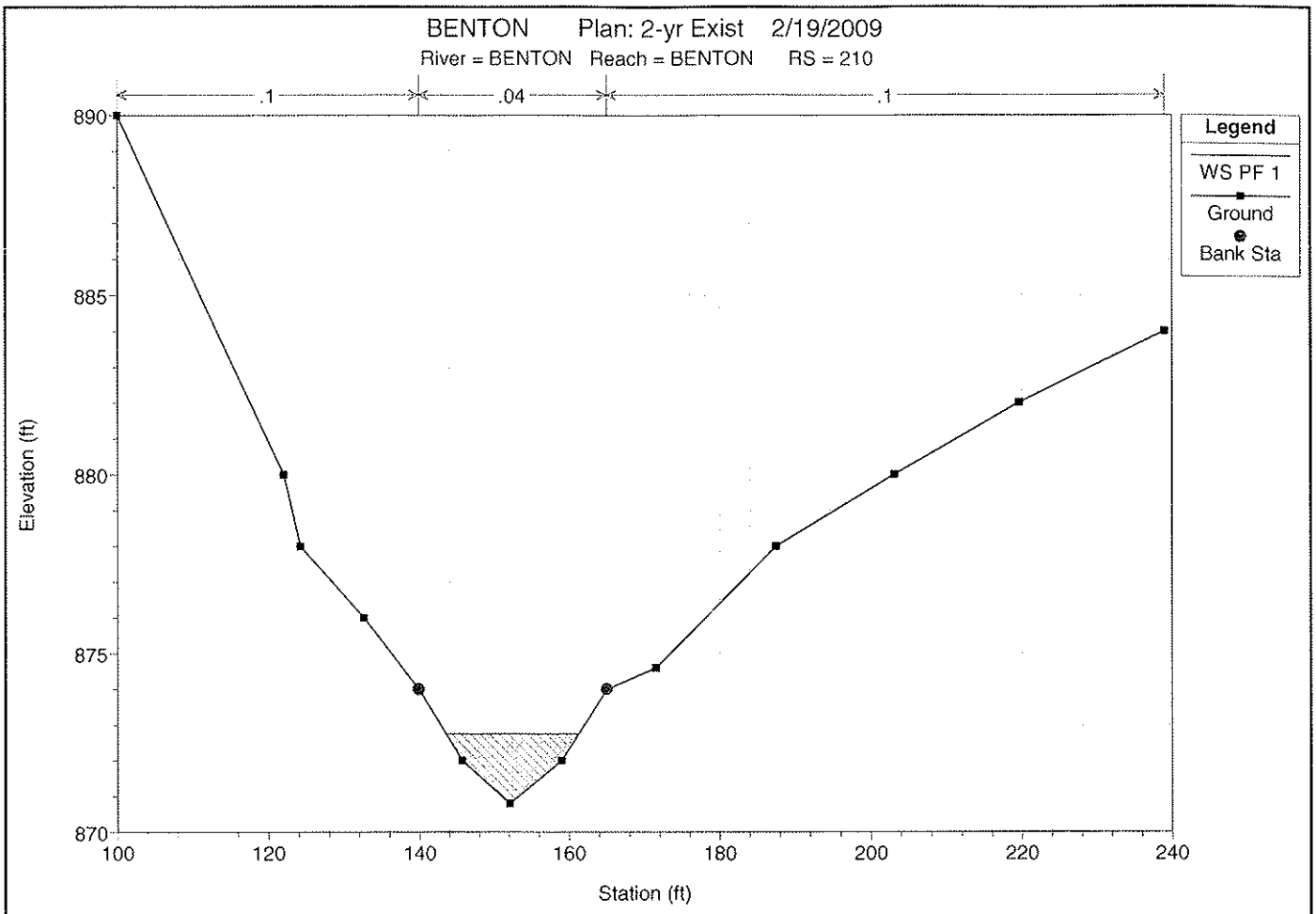
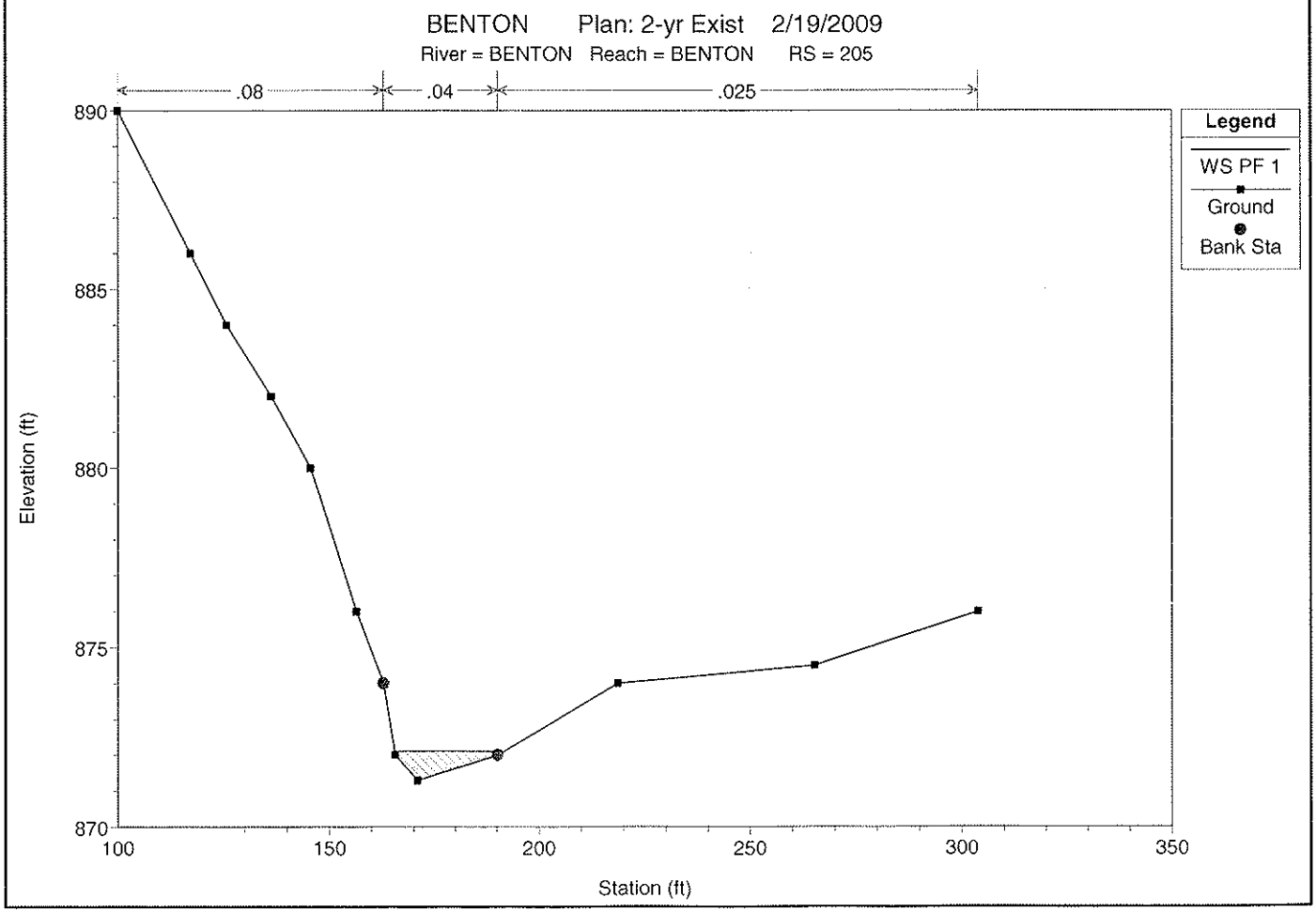
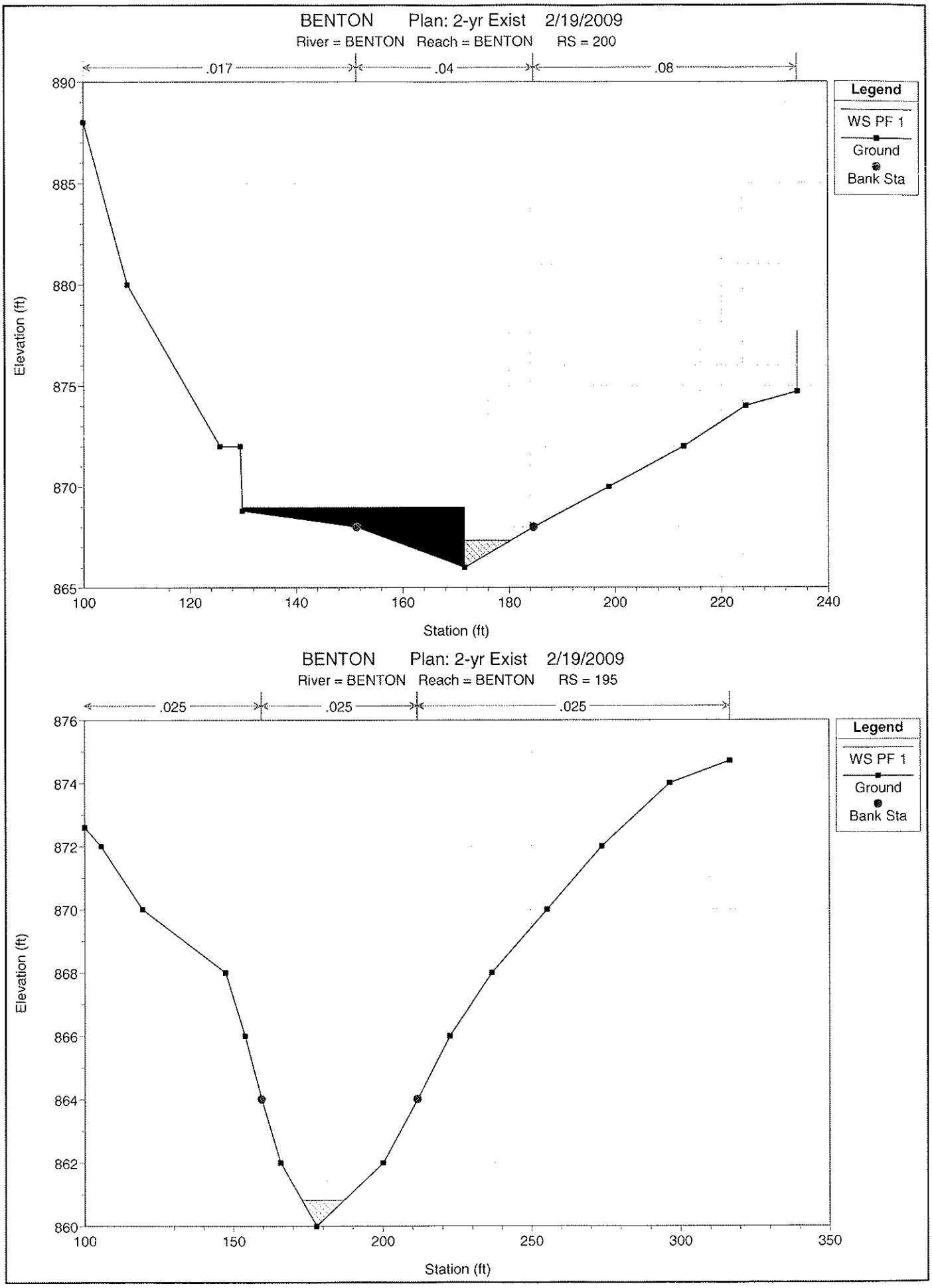
River = BENTON Reach = BENTON RS = 160
.025
.03
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
844
842
840
838
836
834
832
830
828
100
120
140
160
180
200
220
Station (ft)


BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 215
.1
.04
.1
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
900
895
890
885
880
875
870
100
120
140
160
180
200
220
240
Station (ft)


BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 210
.1
.04
.1
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
890
885
880
875
870
100
120
140
160
180
200
220
240
Station (ft)


BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 205
.08
.04
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
890
885
880
875
870
100
150
200
250
300
350
Station (ft)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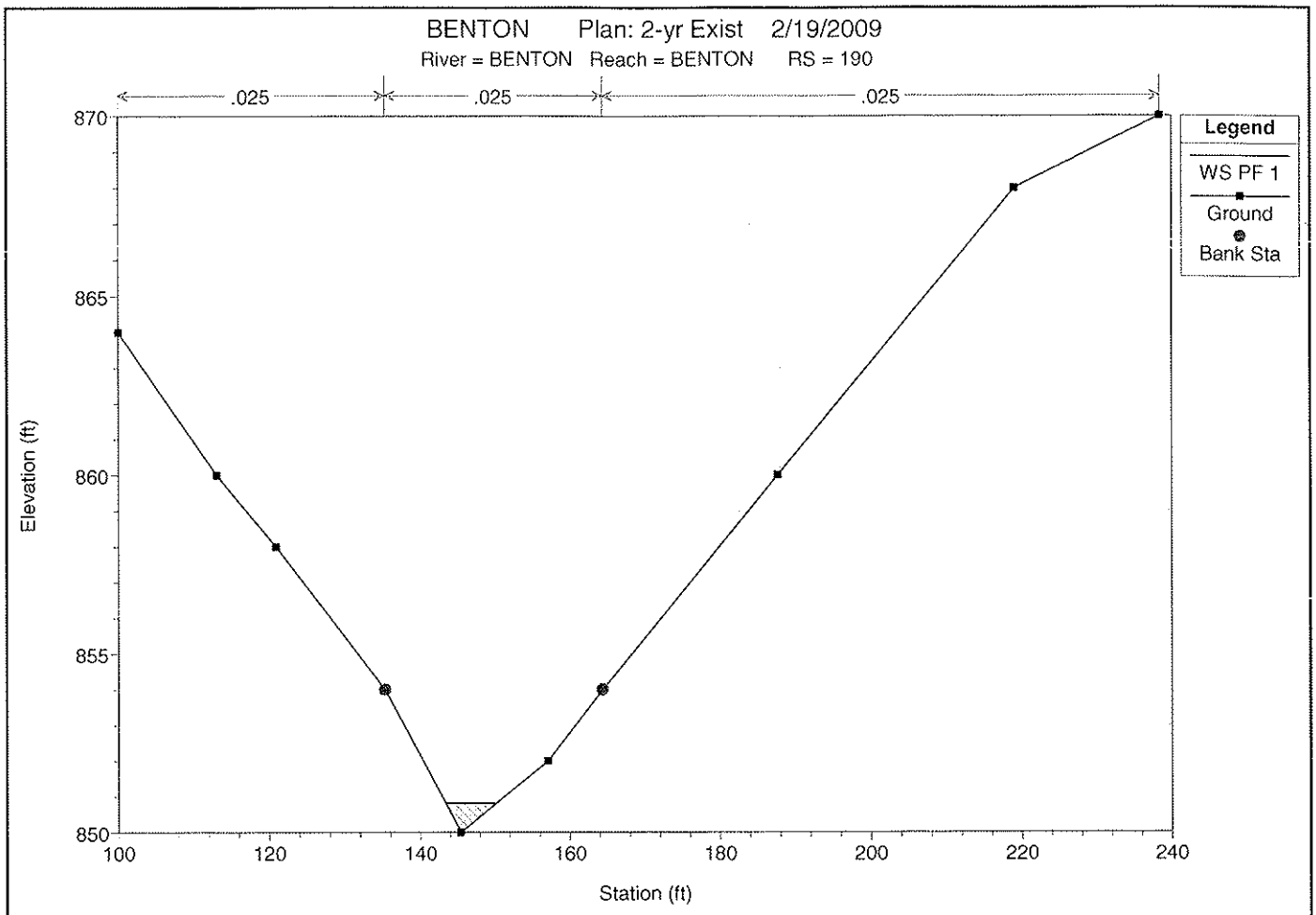
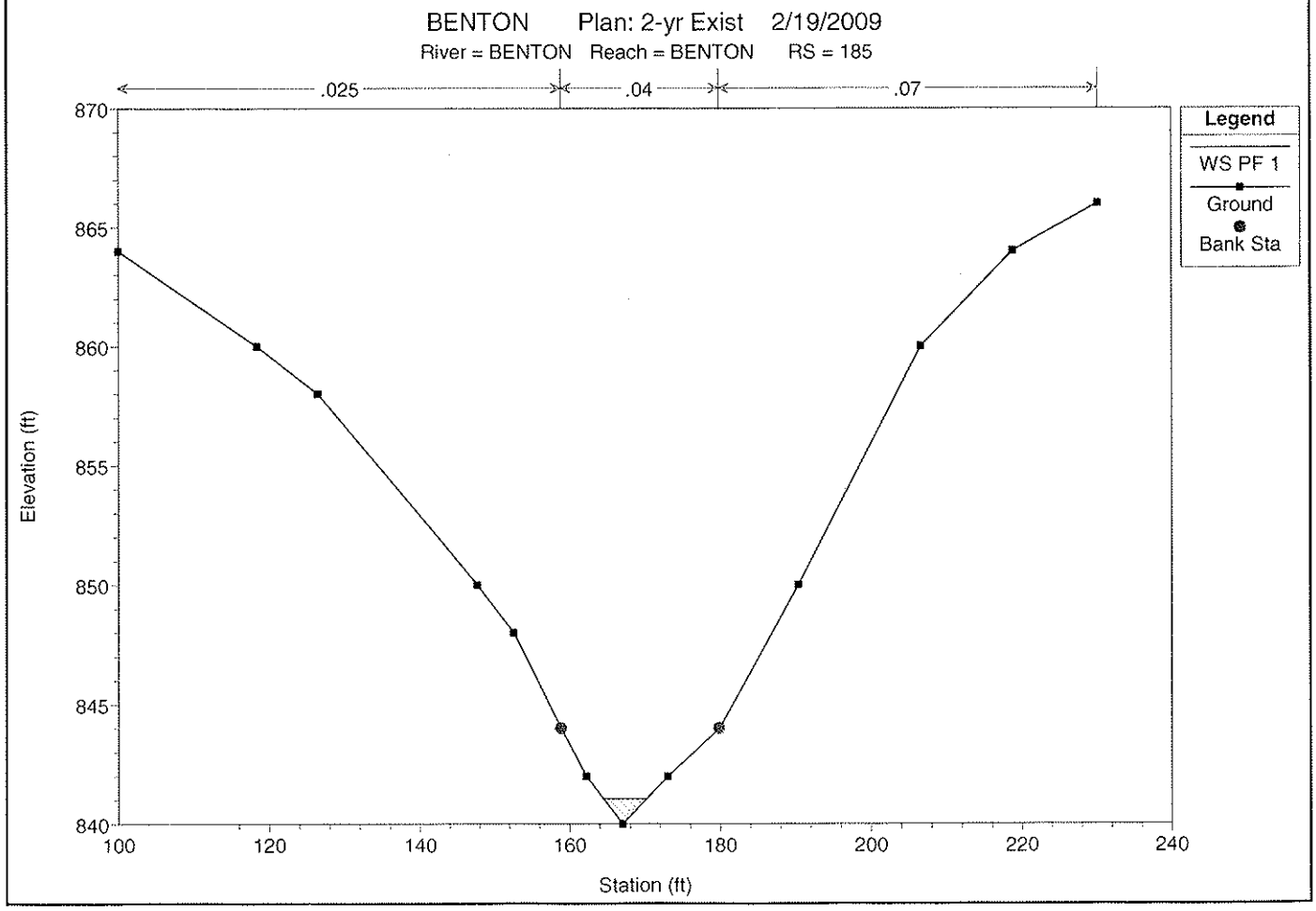
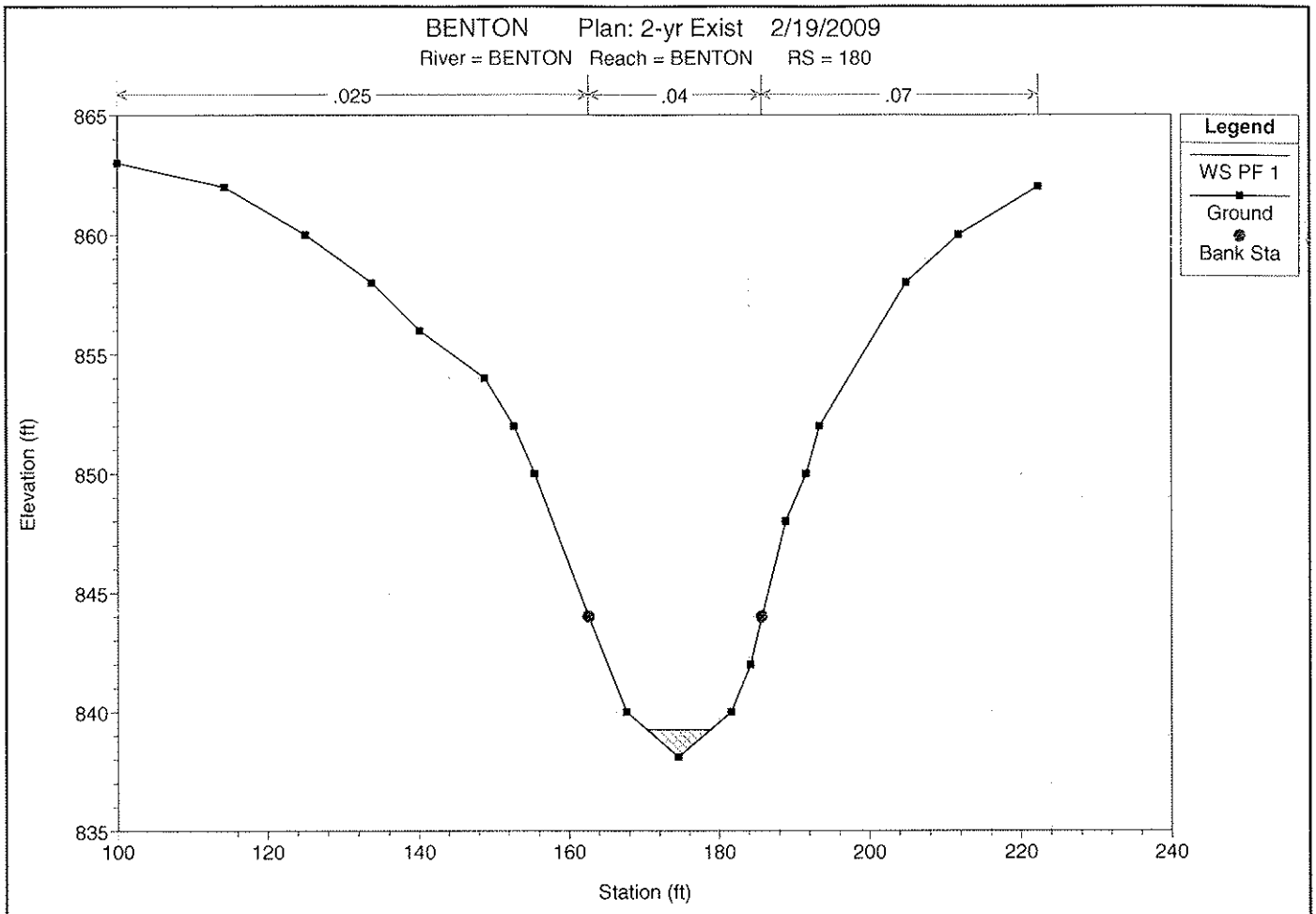
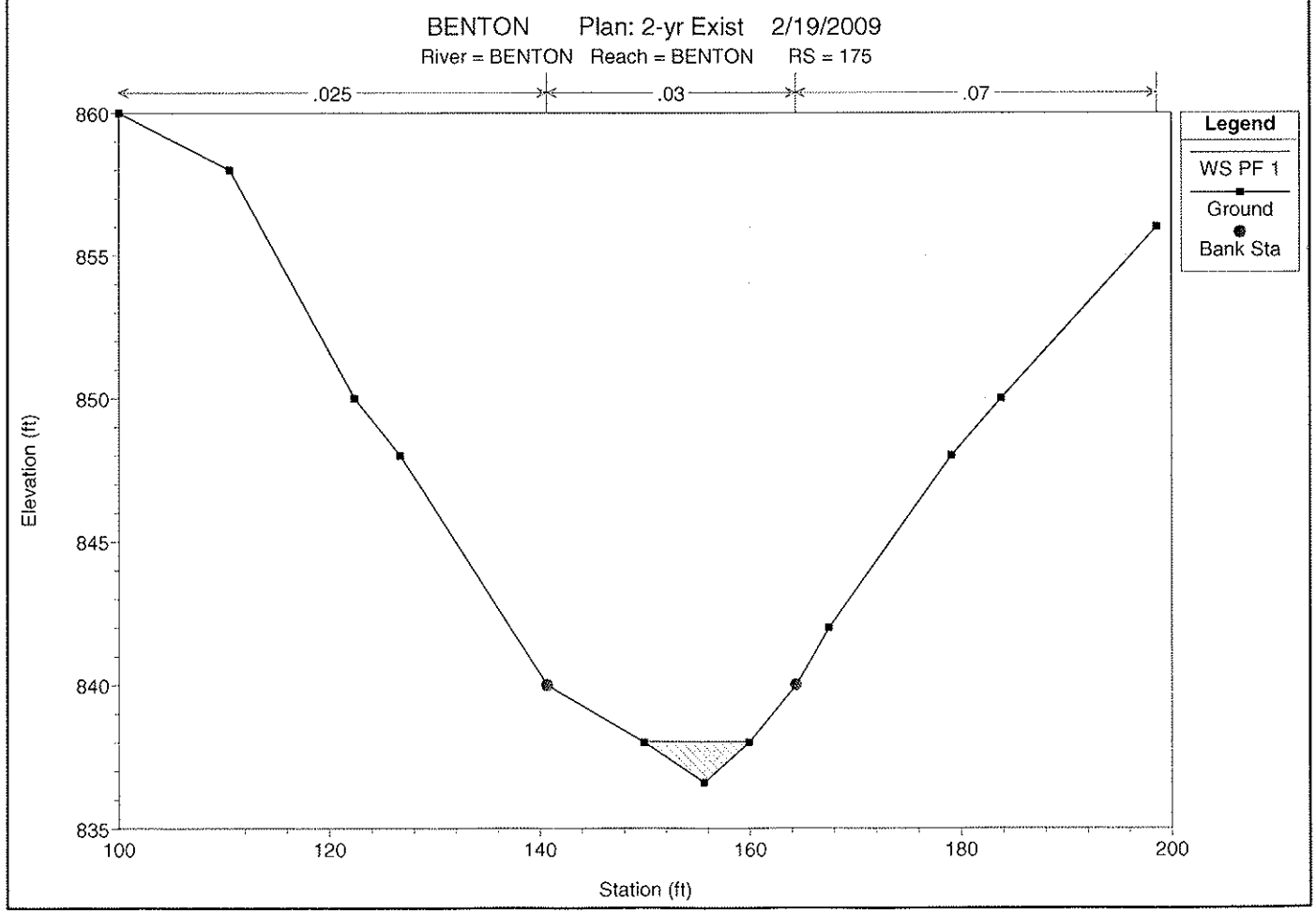
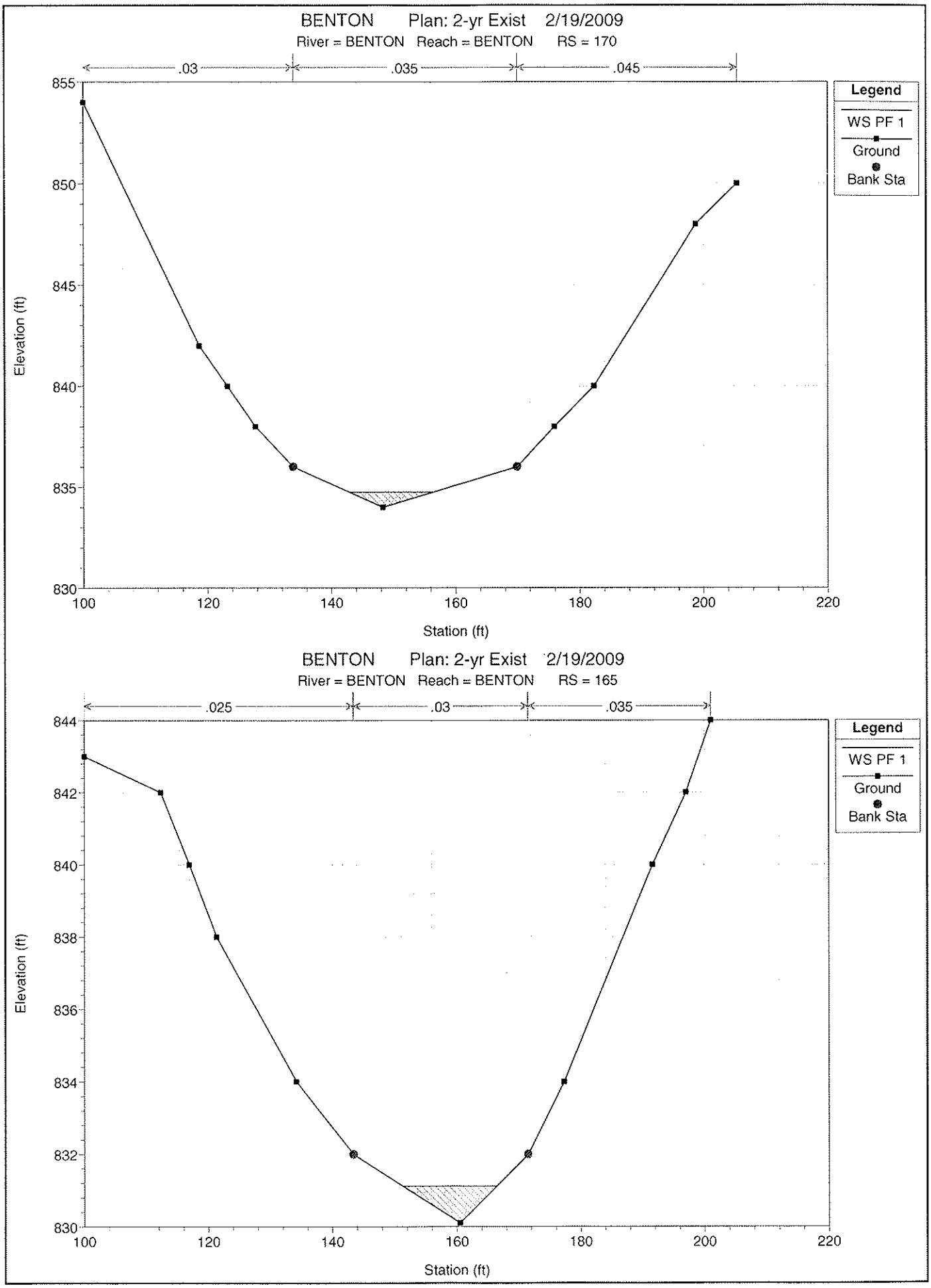
River = BENTON Reach = BENTON RS = 200
.017
.04
.08
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 195
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

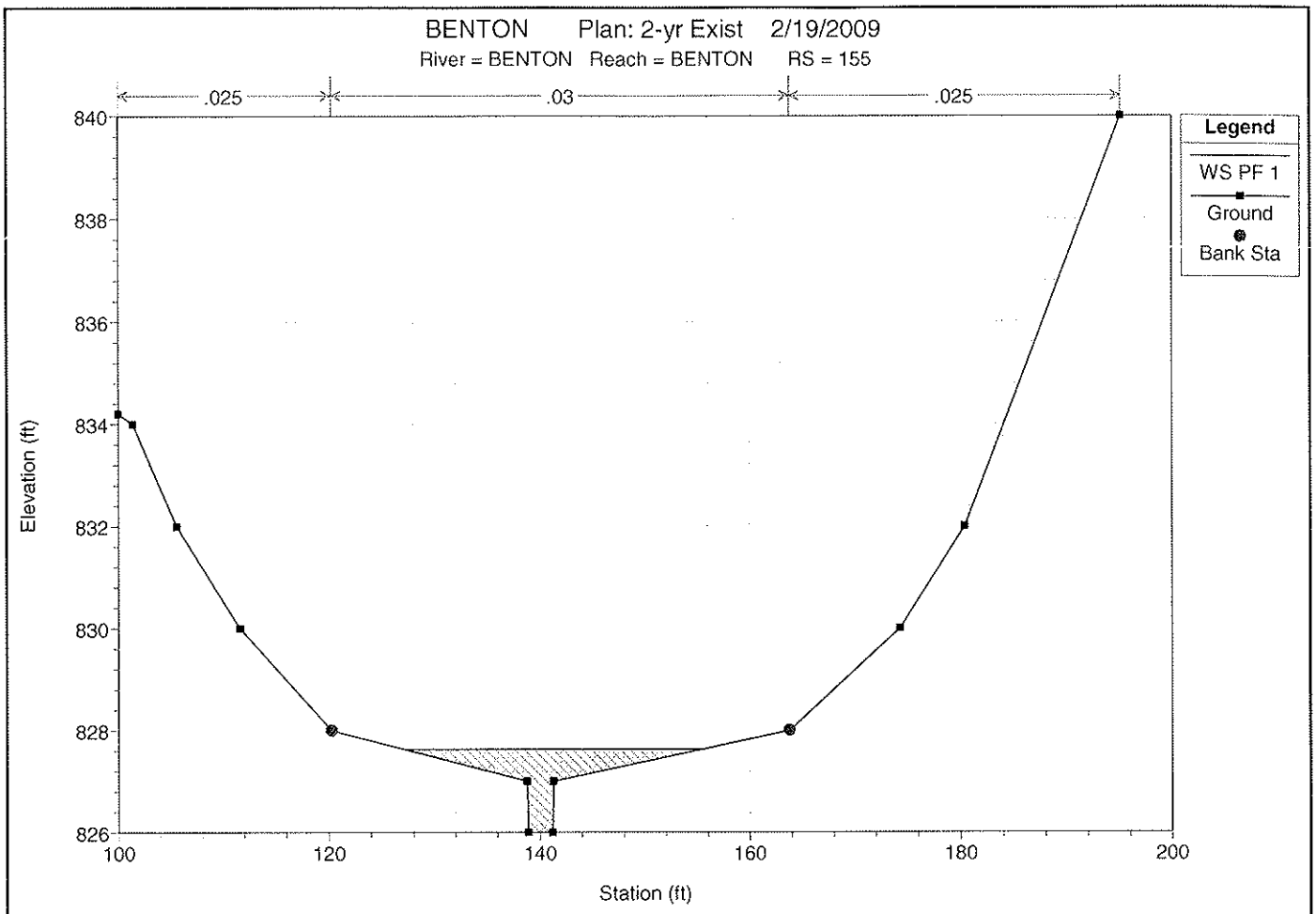

BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 190
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
870
865
860
855
850
Elevation (ft)
100
120
140
160
180
200
220
240
Station (ft)

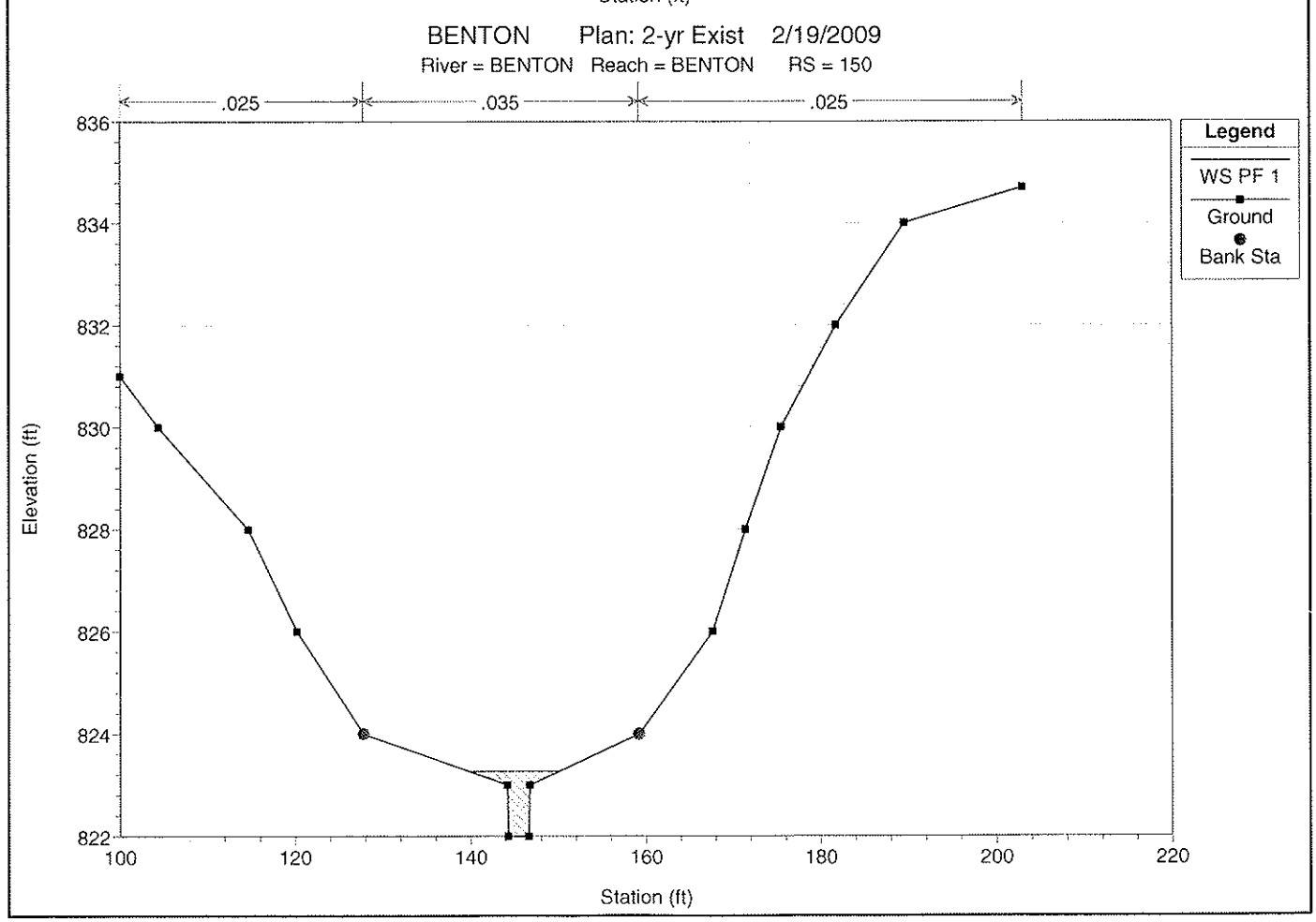

BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 185
.025
.04
.07
Legend
WS PF 1
Ground
Bank Sta
870
865
860
855
850
845
840
Elevation (ft)
100
120
140
160
180
200
220
240
Station (ft)

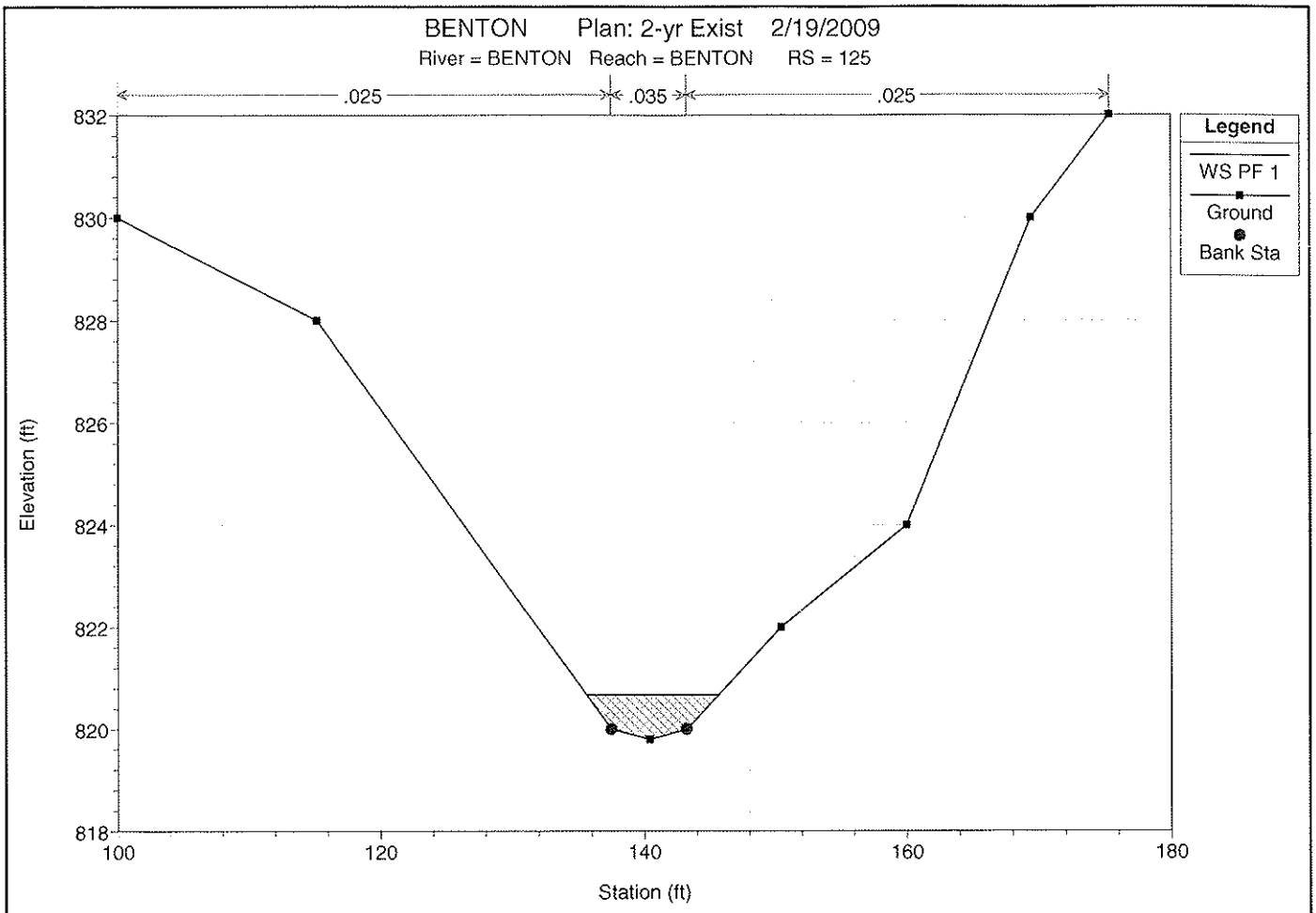

BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 180
.025
.04
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
865
860
855
850
845
840
835
100
120
140
160
180
200
220
240

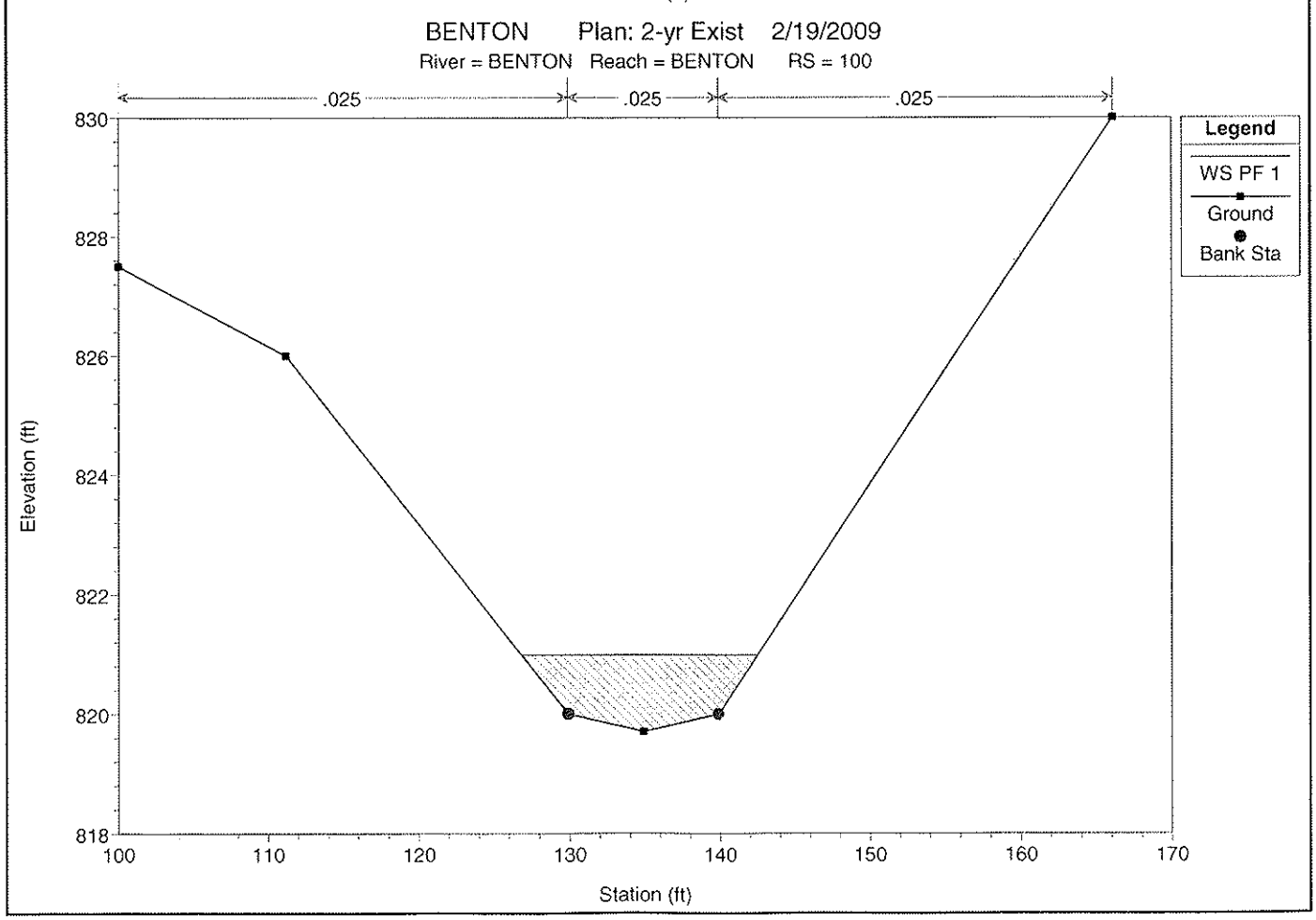

BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 175
.025
.03
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
860
855
850
845
840
835
100
120
140
160
180
200

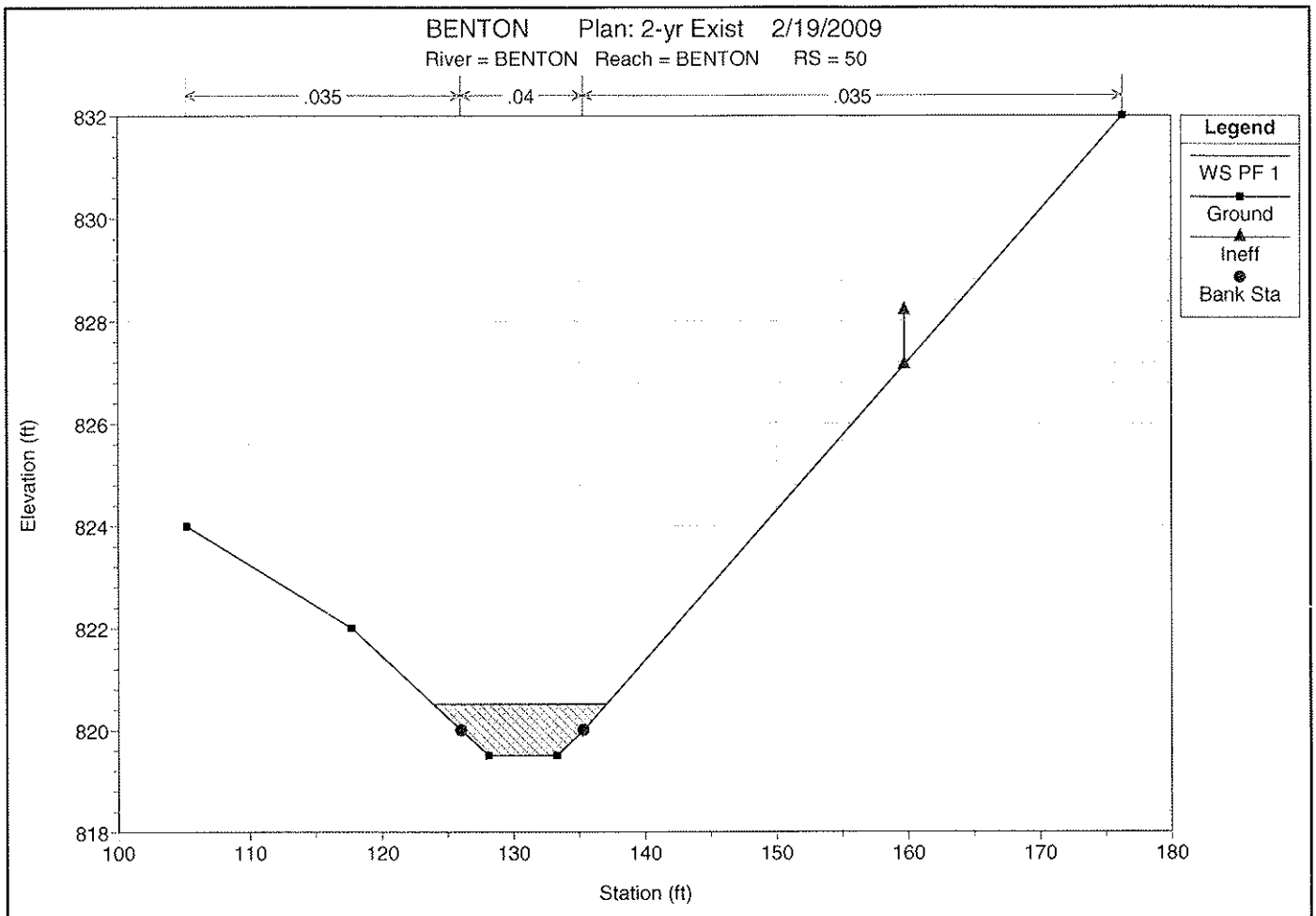

BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 170
.03
.035
.045
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 165
.025
.03
.035
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

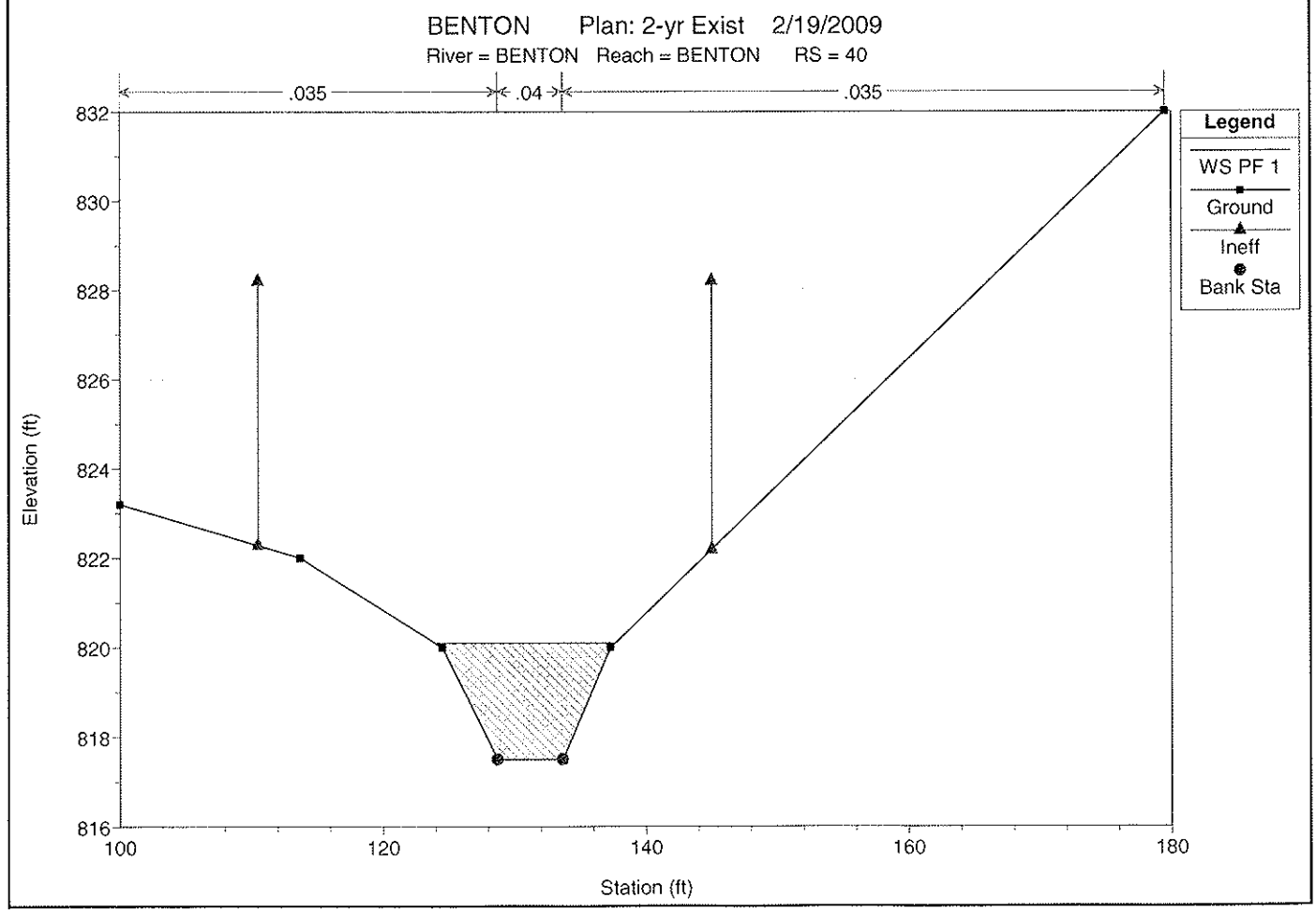

BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 155
.025
.03
.025
Legend
WS PF 1
Ground
Bank Sta
840
838
836
834
832
830
828
826
Elevation (ft)
100
120
140
160
180
200
Station (ft)

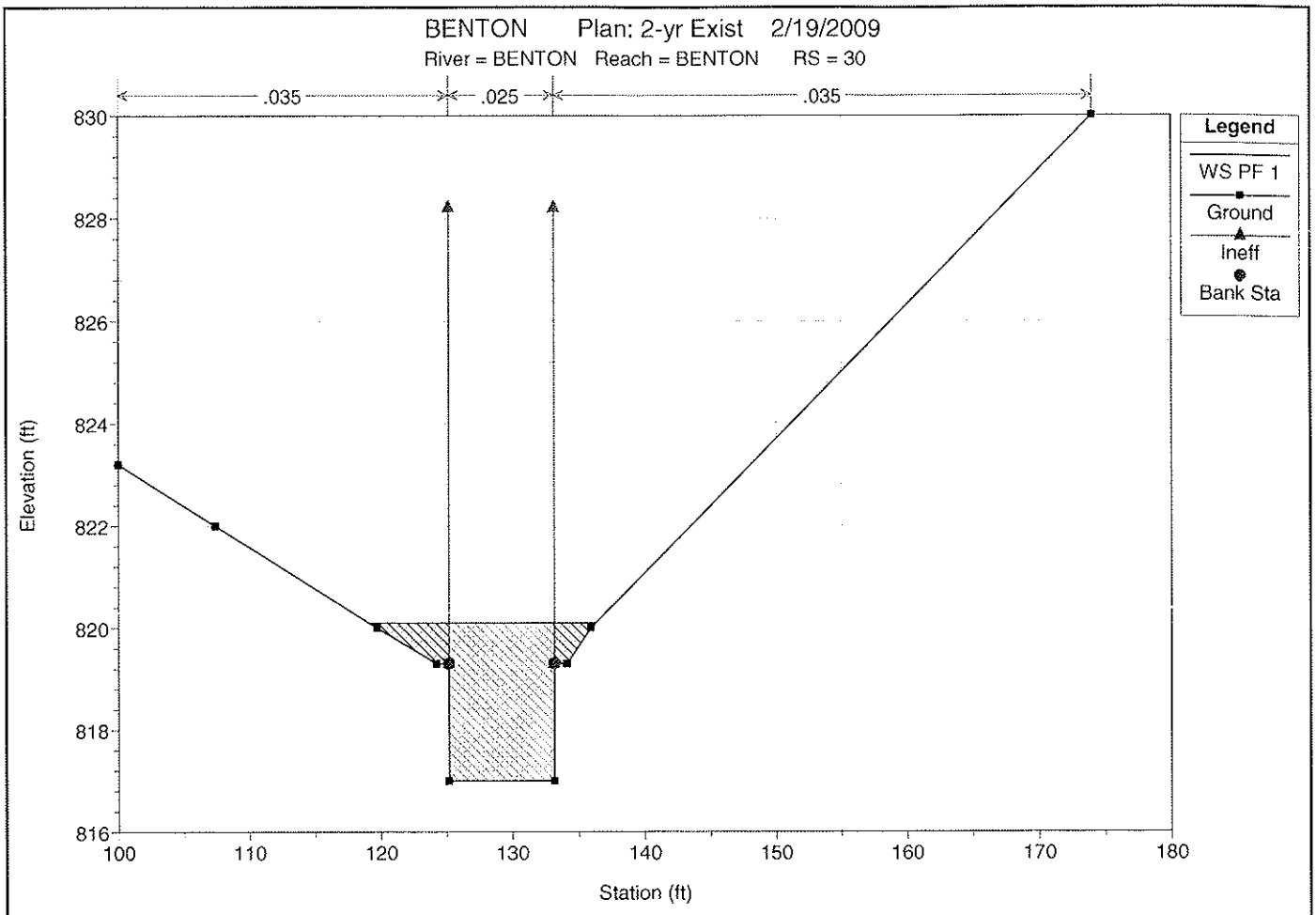

BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 150
.025
.035
.025
Legend
WS PF 1
Ground
Bank Sta
836
834
832
830
828
826
824
822
Elevation (ft)
100
120
140
160
180
200
220
Station (ft)


BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 125
.025
.035
.025
Legend
WS PF 1
Ground
Bank Sta
832
830
828
826
824
822
820
818
Elevation (ft)
100
120
140
160
180
Station (ft)


BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 100
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
830
828
826
824
822
820
818
Elevation (ft)
100
110
120
130
140
150
160
170
Station (ft)


BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 50
.035
.04
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
100
110
120
130
140
150
160
170
180
Station (ft)


BENTON Plan: 2-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 40
.035
.04
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
816
100
120
140
160
180
Station (ft)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River = BENTON Reach = BENTON RS = 30
.035
.025
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
830
828
826
824
822
820
818
816
100
110
120
130
140
150
160
170
180
Station (ft)

HEC-RAS Plan: 10-yr Exist River: BENTON Reach: BENTON Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	215	PF 1	68.90	873.50	874.76	875.02	875.62	0.060045	7.44	9.27	12.25	1.51
BENTON	210	PF 1	68.90	870.80	873.01	872.35	873.13	0.004367	2.82	24.41	19.26	0.44
BENTON	205	PF 1	68.90	871.30	872.28	872.28	872.57	0.025782	4.33	16.13	28.99	0.97
BENTON	200	PF 1	68.90	866.00	867.57	867.94	868.72	0.091295	8.62	7.99	10.19	1.72
BENTON	195	PF 1	68.90	860.00	860.97	861.31	862.09	0.053585	8.47	8.14	16.73	2.14
BENTON	190	PF 1	68.90	850.00	850.99	851.75	855.29	0.207297	16.63	4.14	8.33	4.15
BENTON	185	PF 1	68.90	840.00	841.24	842.08	845.58	0.420457	16.73	4.12	6.67	3.75
BENTON	180	PF 1	68.90	838.10	839.44	839.94	841.11	0.138477	10.36	6.65	9.90	2.23
BENTON	175	PF 1	68.90	836.60	838.28	838.47	839.01	0.025557	6.88	10.02	11.89	1.32
BENTON	170	PF 1	68.90	834.00	834.90	835.29	836.27	0.142769	9.39	7.34	16.27	2.46
BENTON	165	PF 1	68.90	830.10	831.30	831.49	831.95	0.034580	6.50	10.60	17.71	1.48
BENTON	160	PF 1	68.90	828.00	828.90	829.14	829.65	0.050297	6.94	9.93	20.00	1.74
BENTON	155	PF 1	68.90	826.00	827.76	827.79	828.04	0.021319	4.27	16.12	33.64	1.09
BENTON	150	PF 1	68.90	822.00	823.46	823.89	825.14	0.221984	10.40	6.62	15.82	2.83
BENTON	125	PF 1	68.90	819.80	820.88	821.25	822.06	0.048175	9.16	8.02	11.30	1.63
BENTON	100	PF 1	68.90	819.70	821.48	820.93	821.64	0.001773	3.46	22.60	18.50	0.48
BENTON	50	PF 1	68.90	819.50	821.39	820.79	821.54	0.003686	3.29	23.88	19.83	0.43
BENTON	40	PF 1	68.90	817.50	821.43	819.07	821.47	0.000417	1.89	49.70	25.56	0.17
BENTON	30	PF 1	68.90	817.00	821.40	818.32	821.46	0.000276	1.96	35.20	30.14	0.16

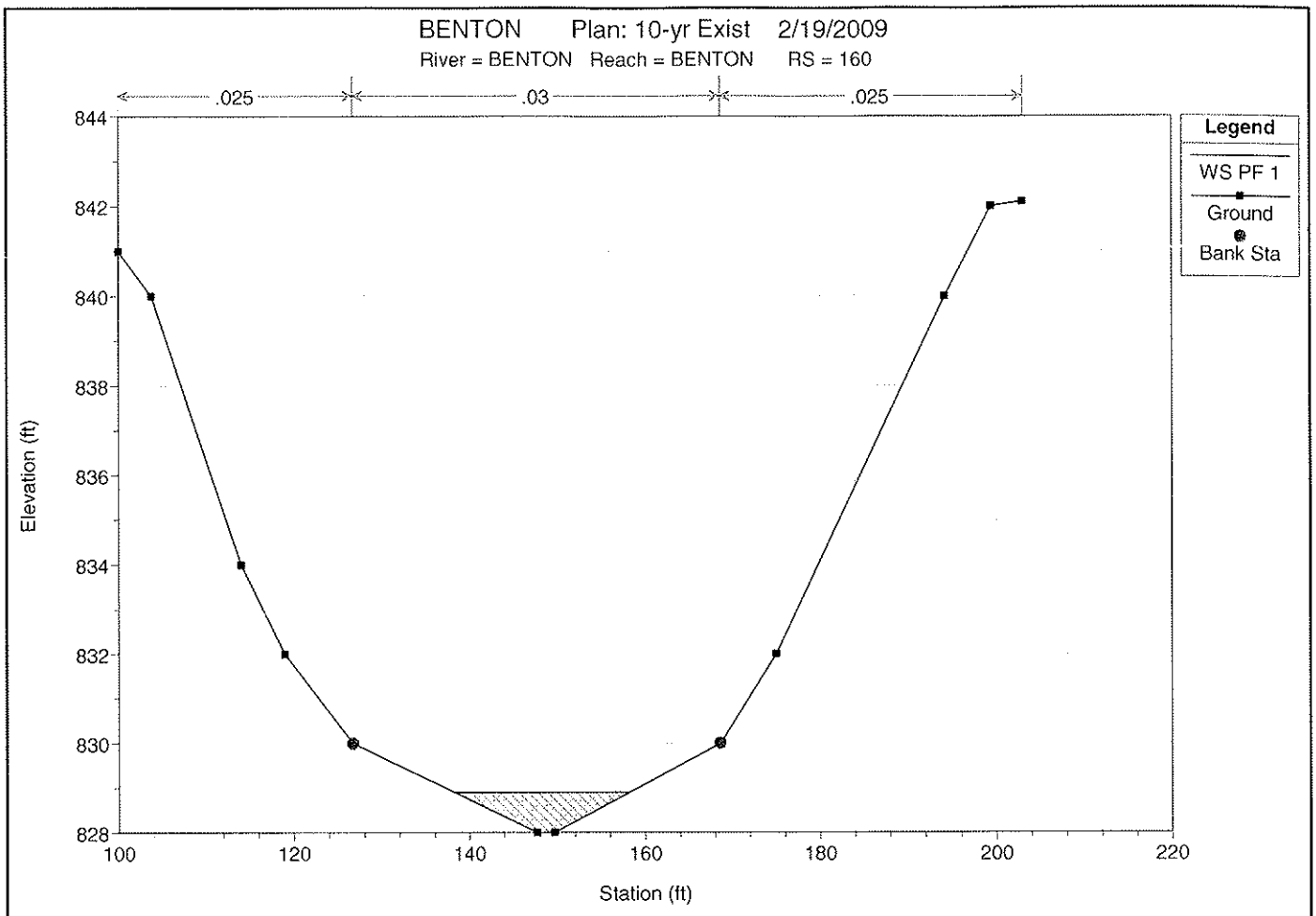
Headwater Depth for Concrete Pipe Culverts with Inlet Control

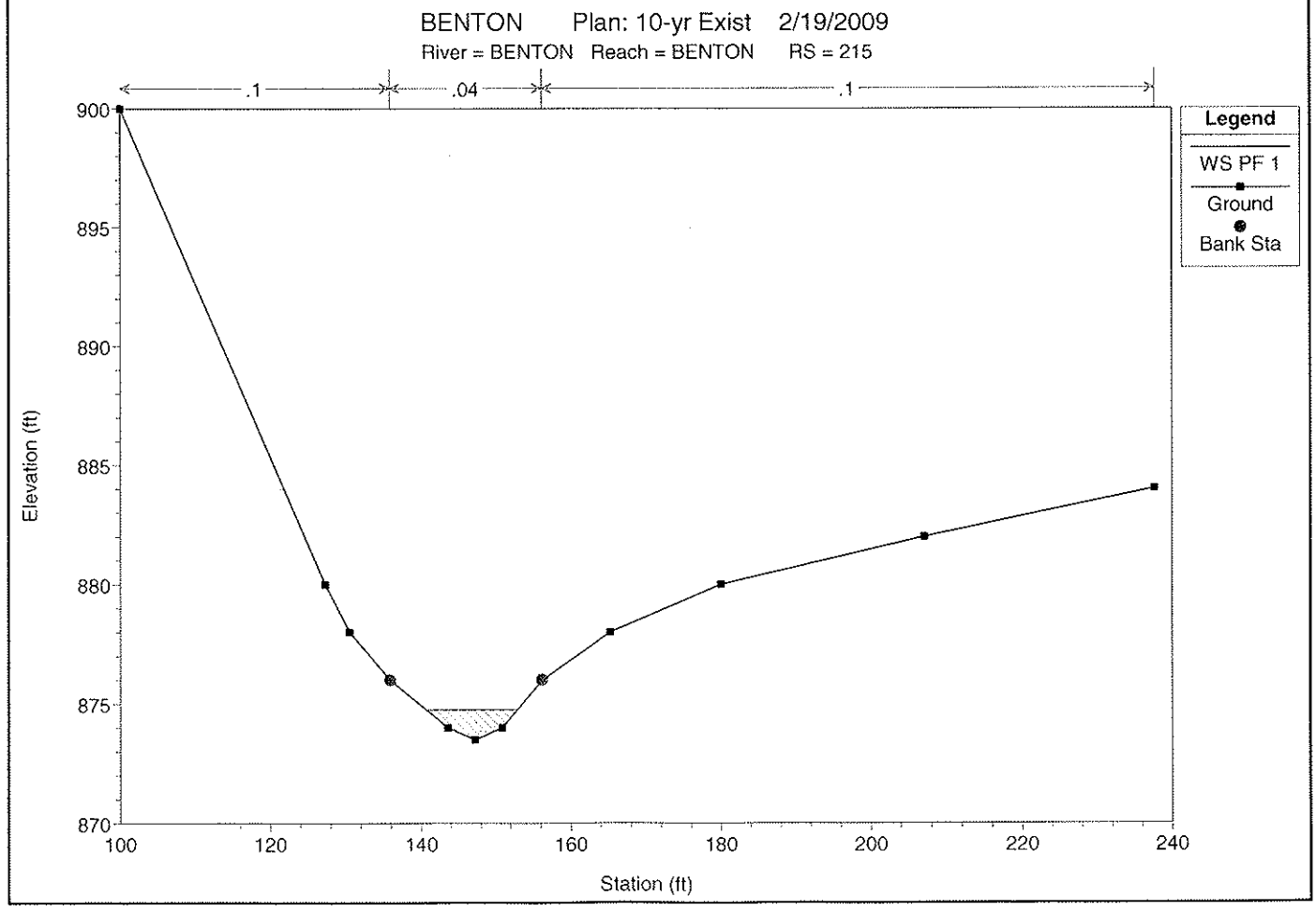
- (•) Square Edge with Headwall
- ( ) Groove End with Headwall
- ( ) Groove End Projecting

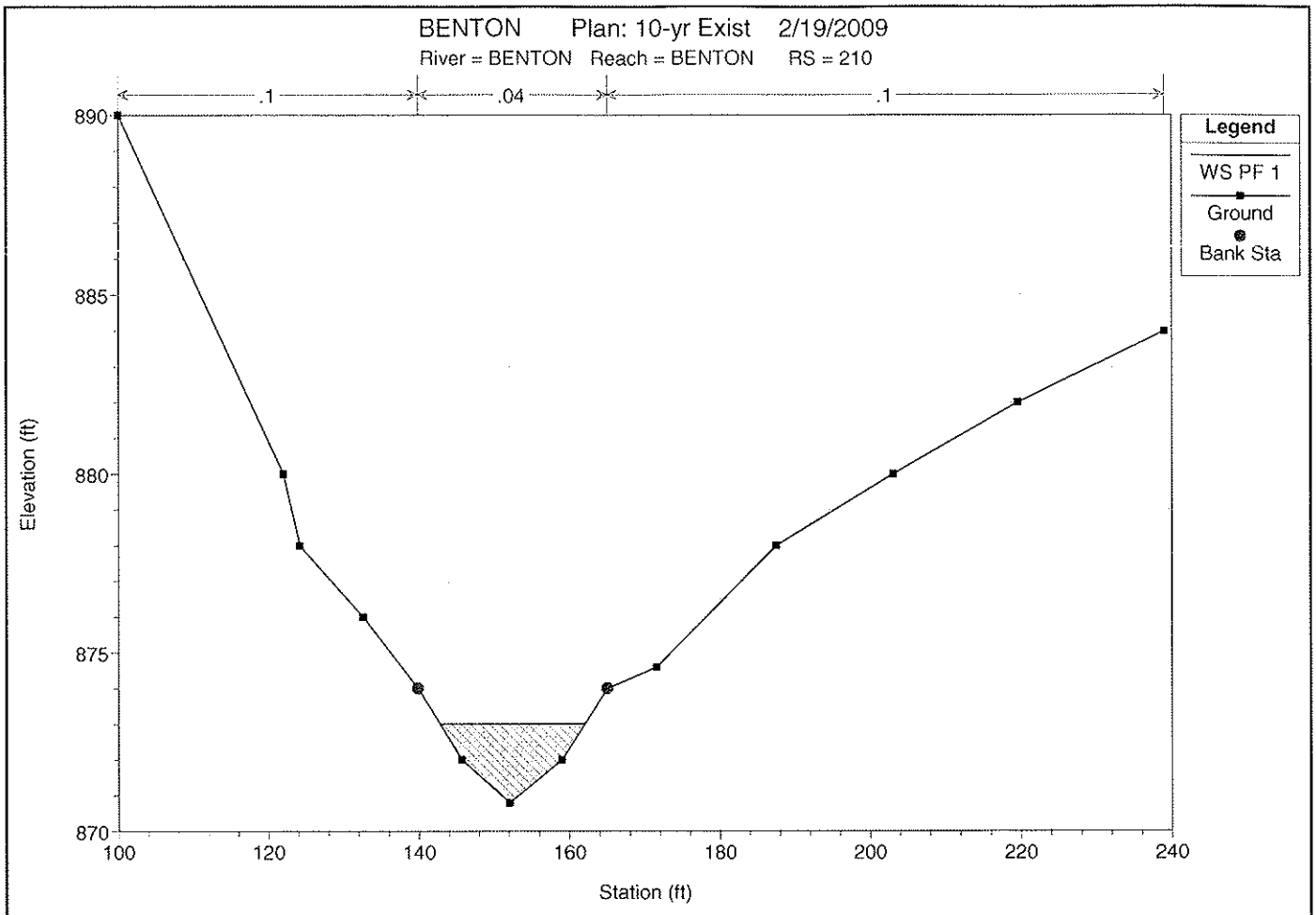
2.601	Calc	Critical Depth (ft)
8.985		Critical Velocity (ft/s)
68.9		Q = Discharge (cfs) ← 10-YR FLOW
0.02		Culvert Barrel Slope (ft/ft)
3.5		Culvert diameter (ft)
4.351		Headwater (ft)

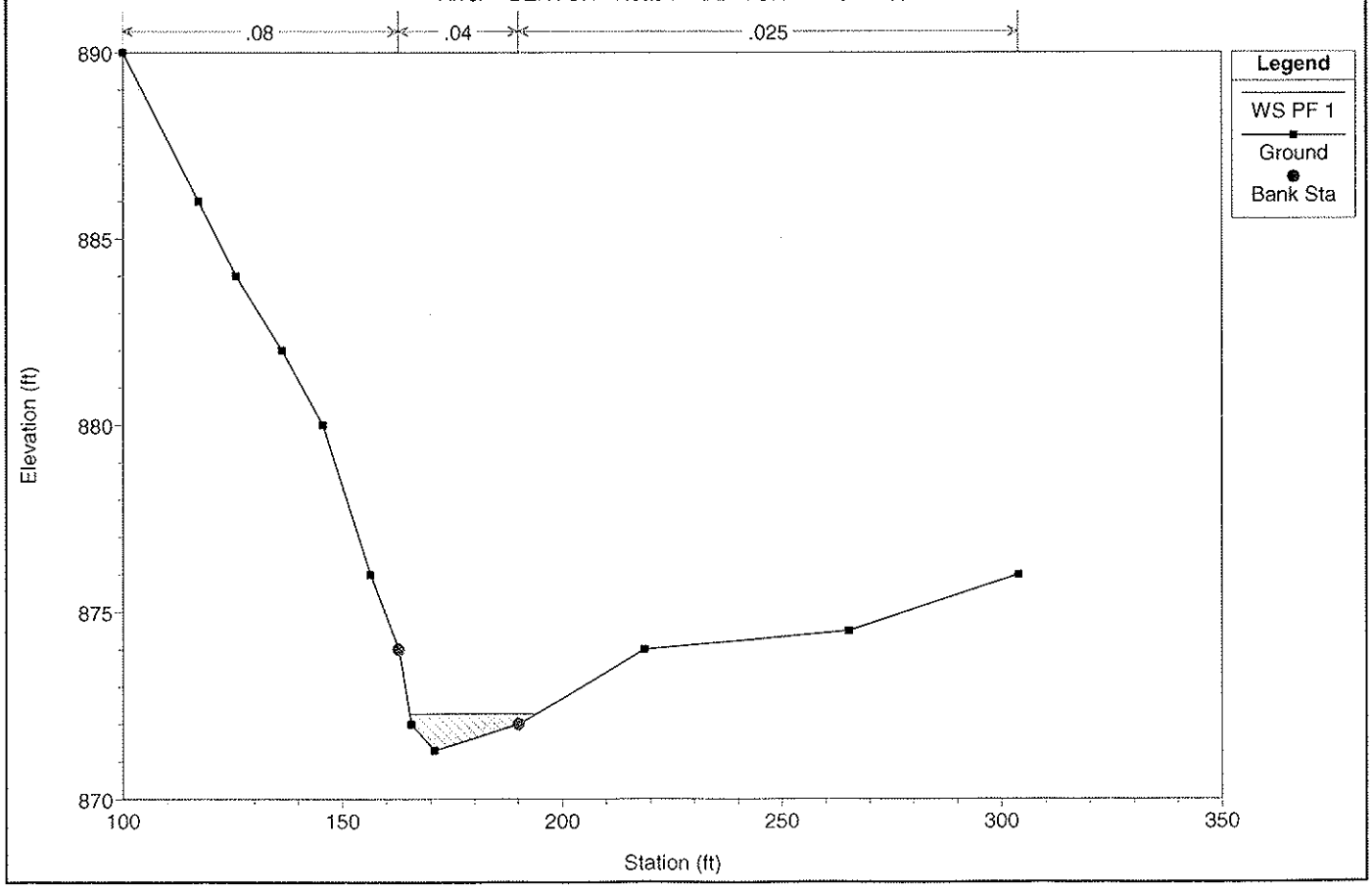
Calc

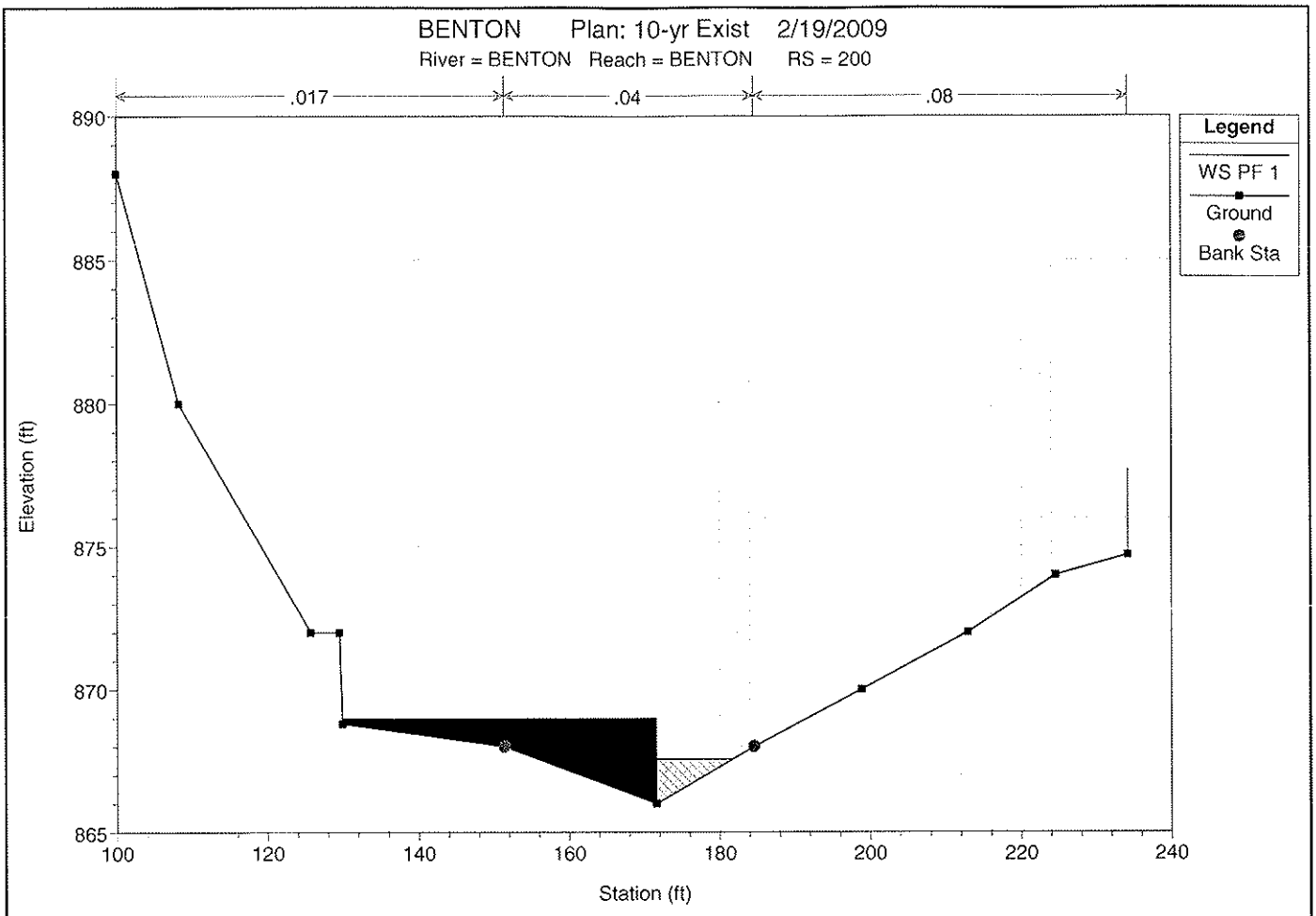
Units: (•) English ( ) Metric

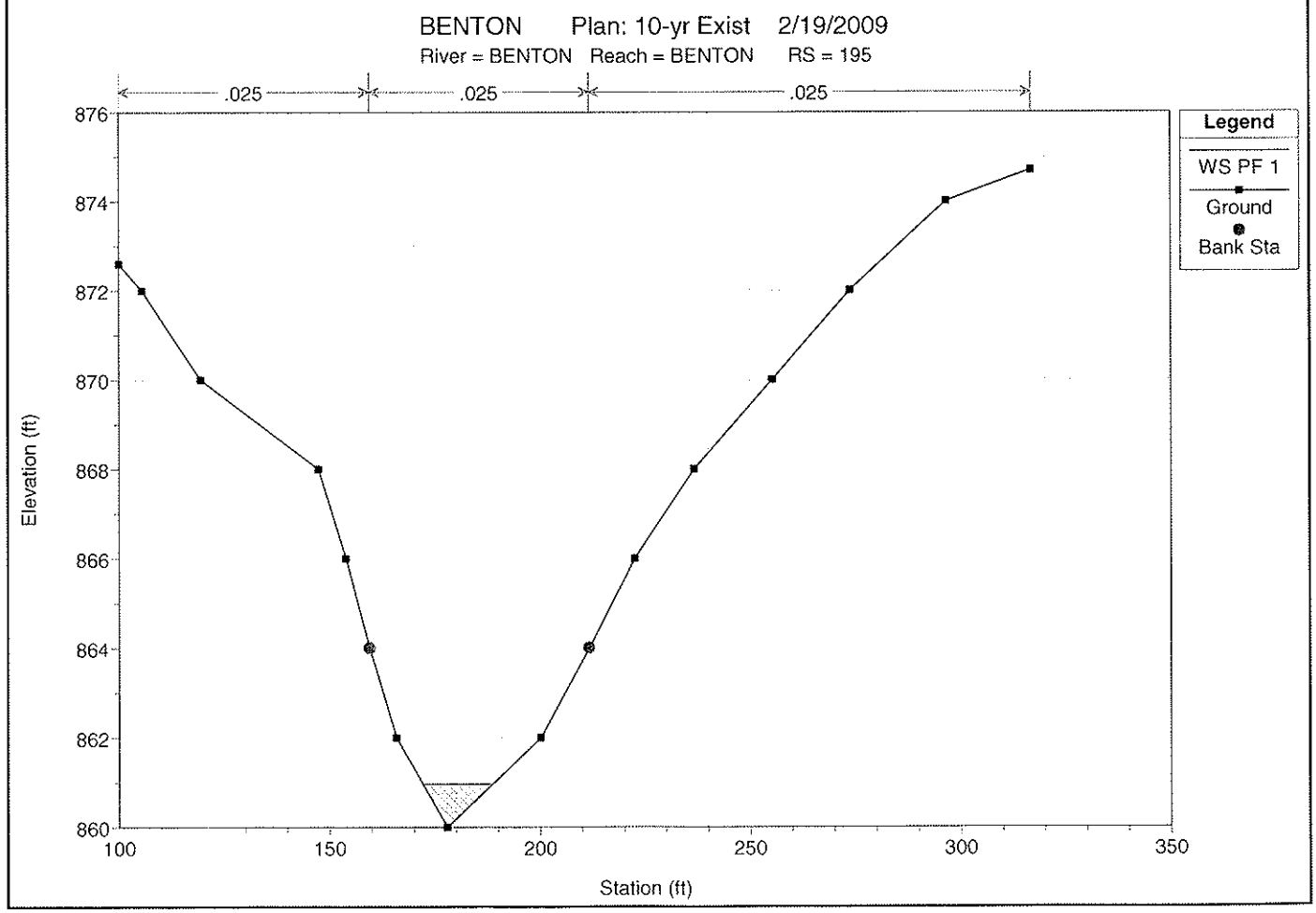

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 160
.025
.03
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
844
842
840
838
836
834
832
830
828
100
120
140
160
180
200
220
Station (ft)

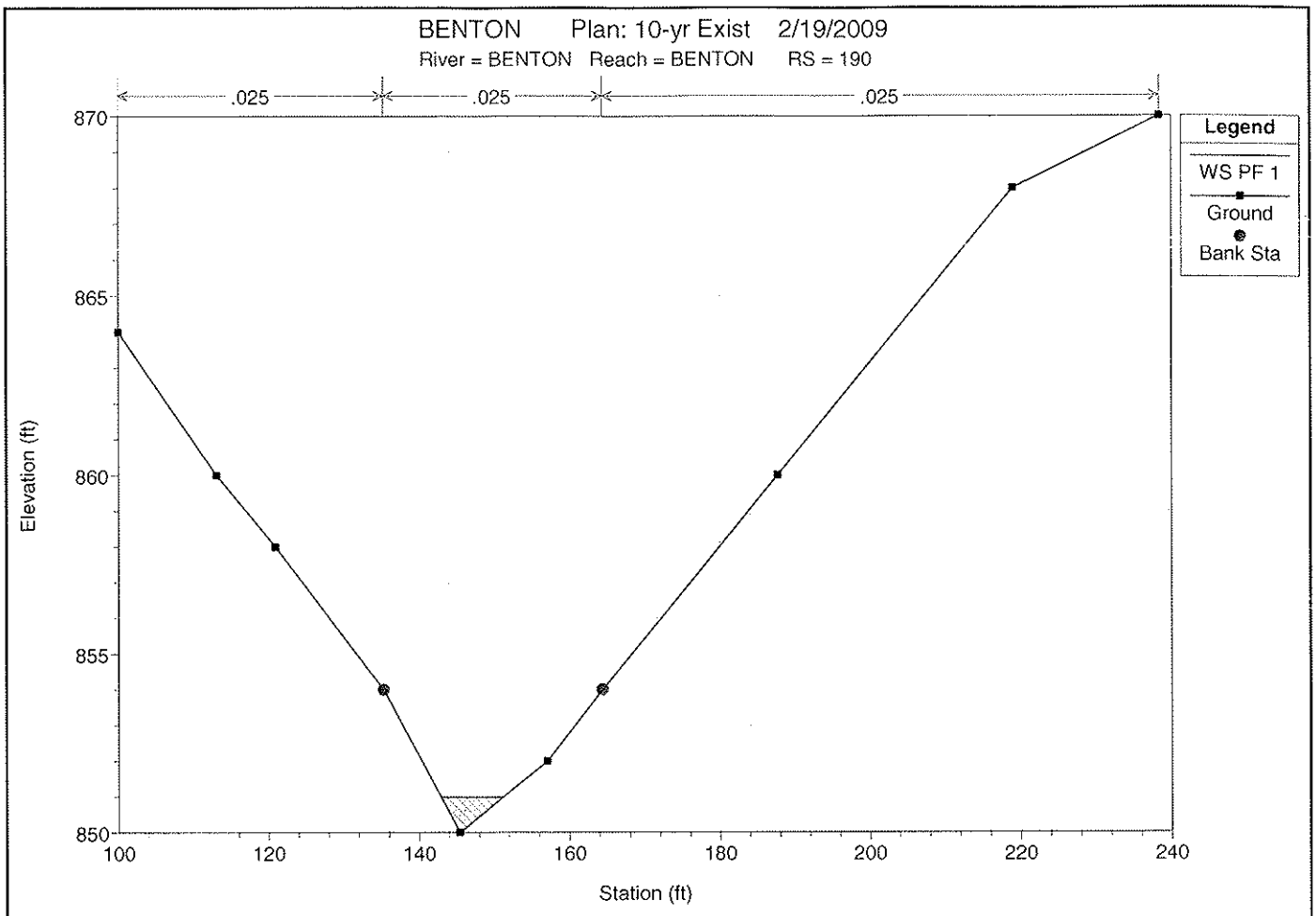

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 215
.1
.04
.1
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
900
895
890
885
880
875
870
100
120
140
160
180
200
220
240
Station (ft)

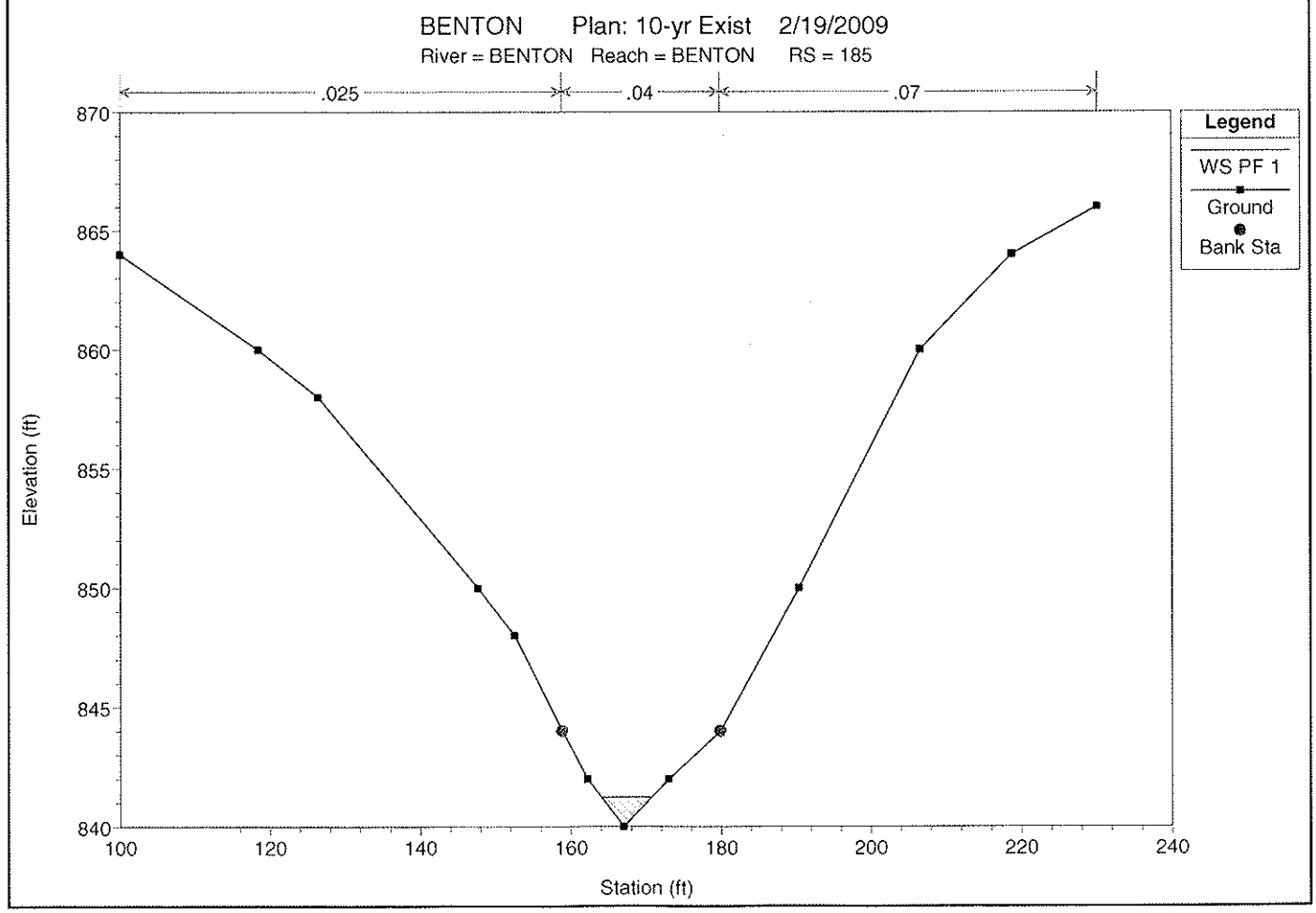

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 210
.1
.04
.1
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
890
885
880
875
870
100
120
140
160
180
200
220
240
Station (ft)

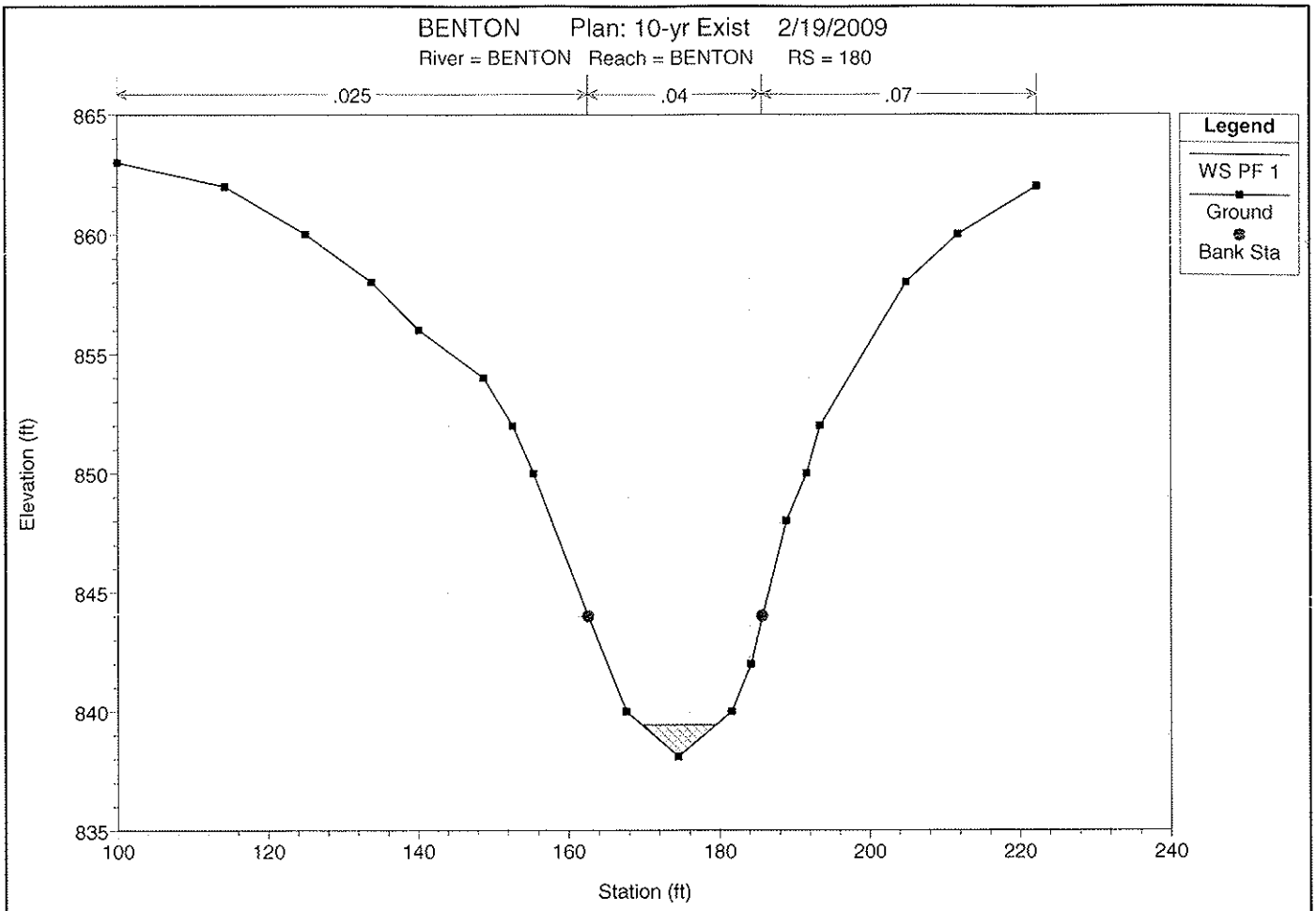

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 205
.08
.04
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
890
885
880
875
870
100
150
200
250
300
350
Station (ft)

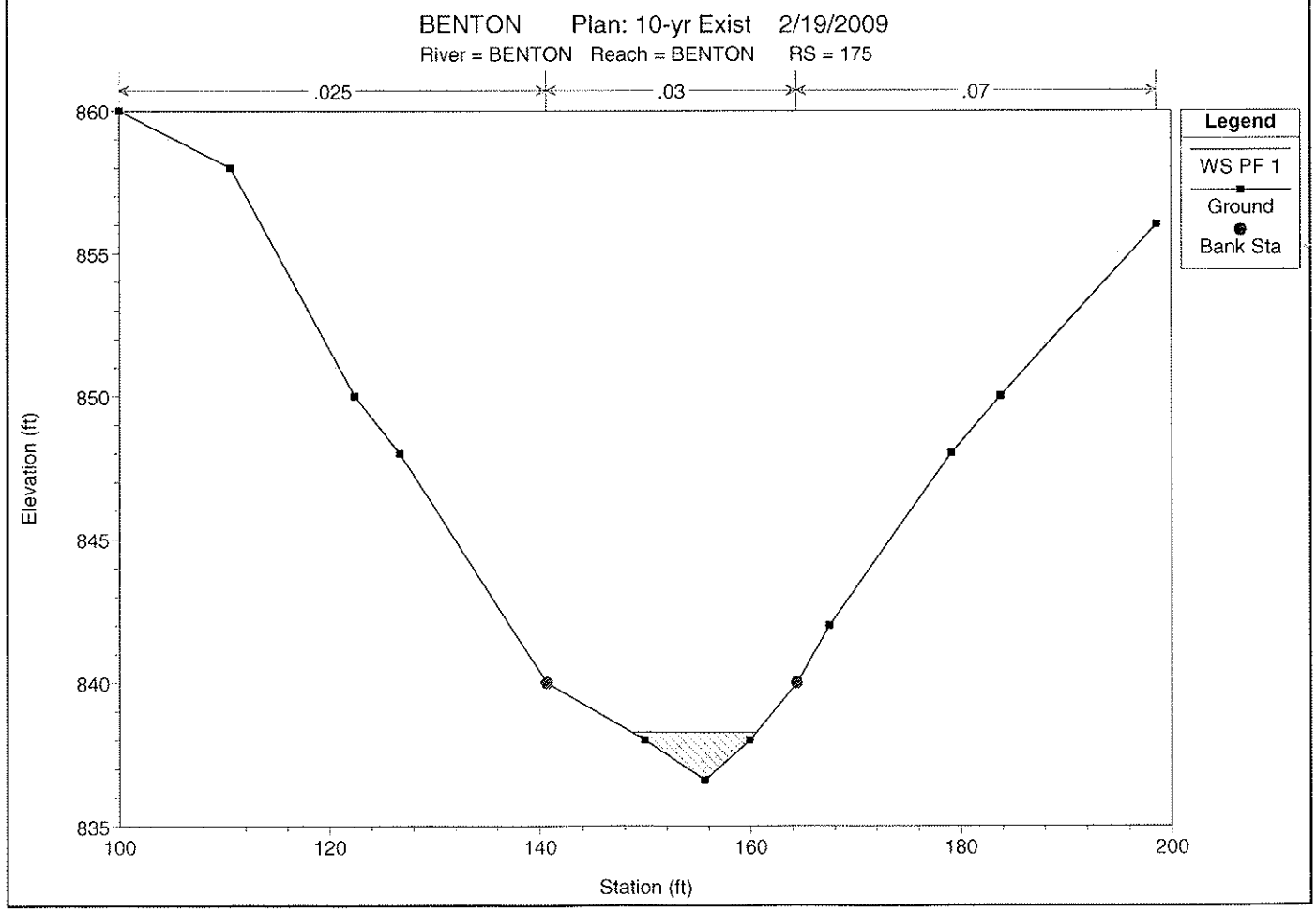

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 200
.017
.04
.08
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
890
885
880
875
870
865
100
120
140
160
180
200
220
240
Station (ft)

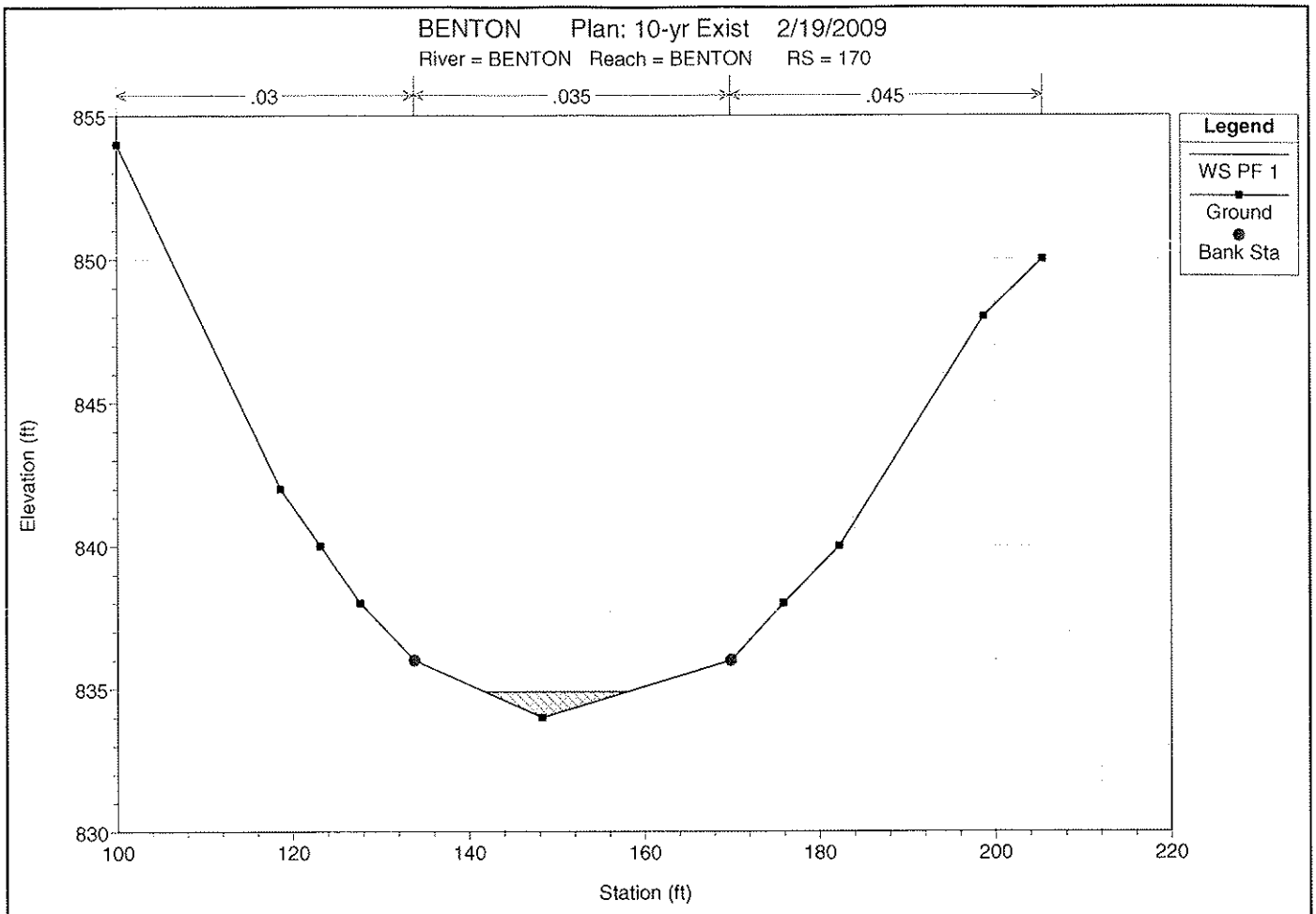

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 195
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
876
874
872
870
868
866
864
862
860
100
150
200
250
300
350
Station (ft)

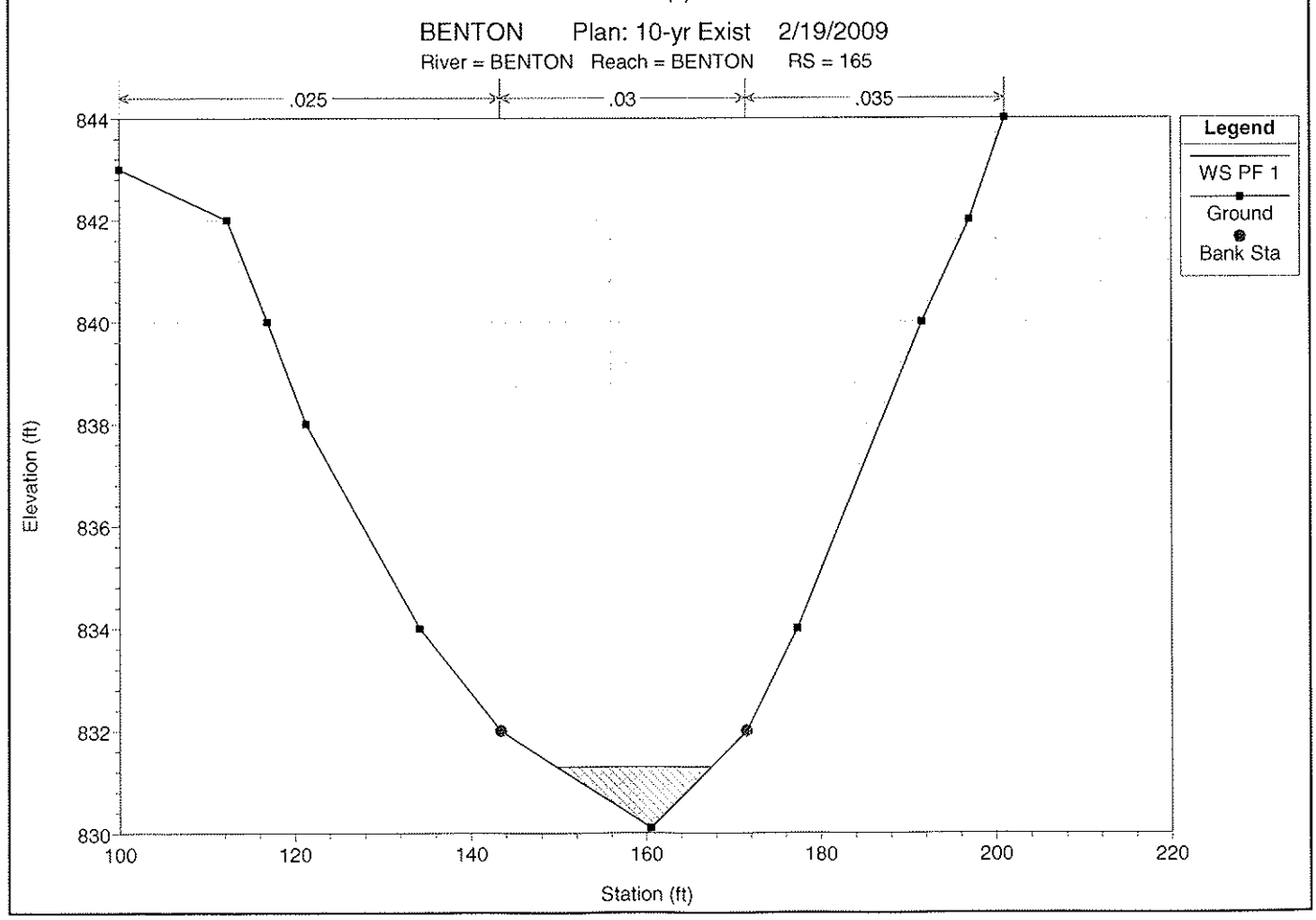

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 190
.025
.025
.025
870
865
860
855
850
Elevation (ft)
100
120
140
160
180
200
220
240
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

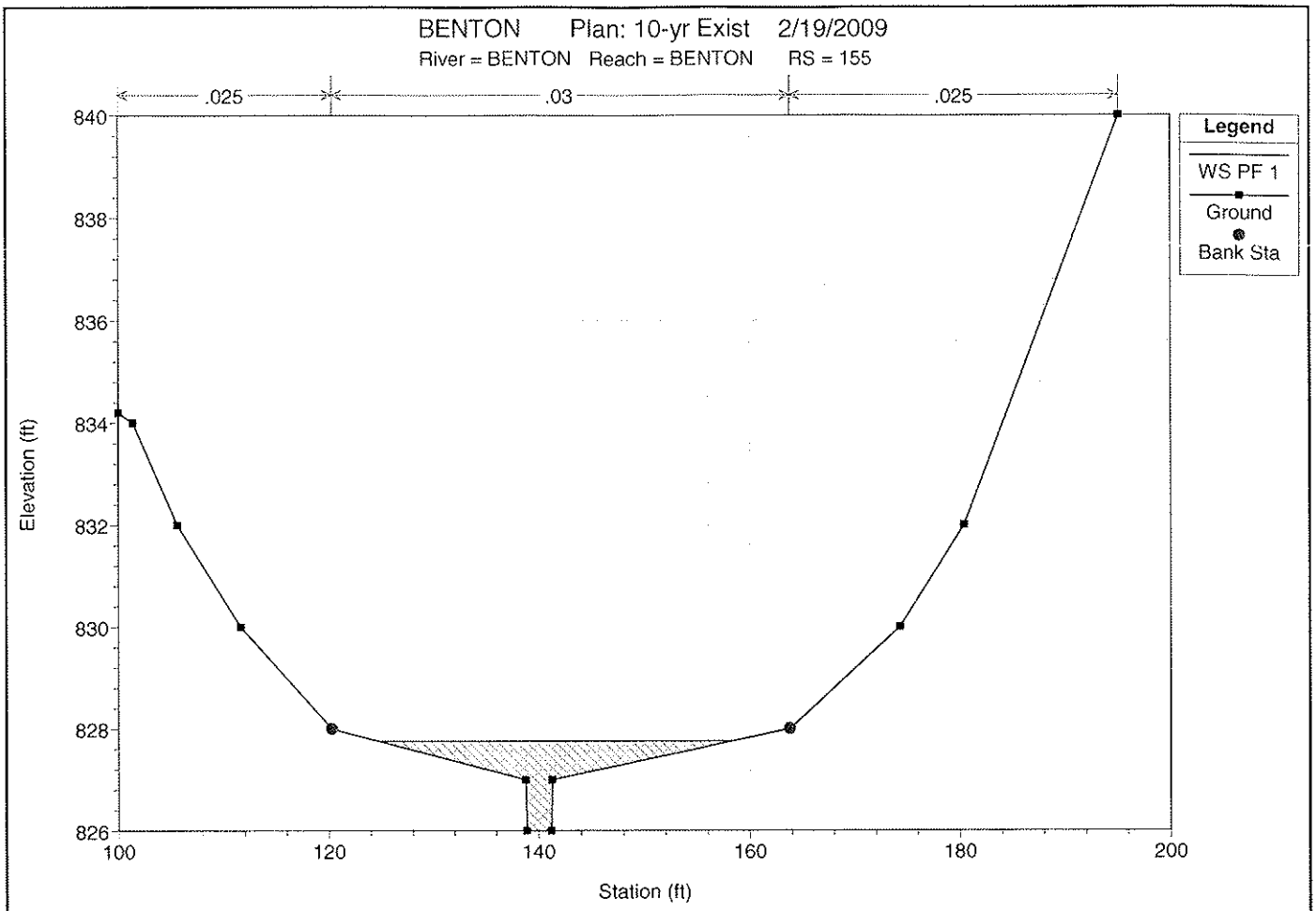

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 185
.025
.04
.07
870
865
860
855
850
845
840
Elevation (ft)
100
120
140
160
180
200
220
240
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

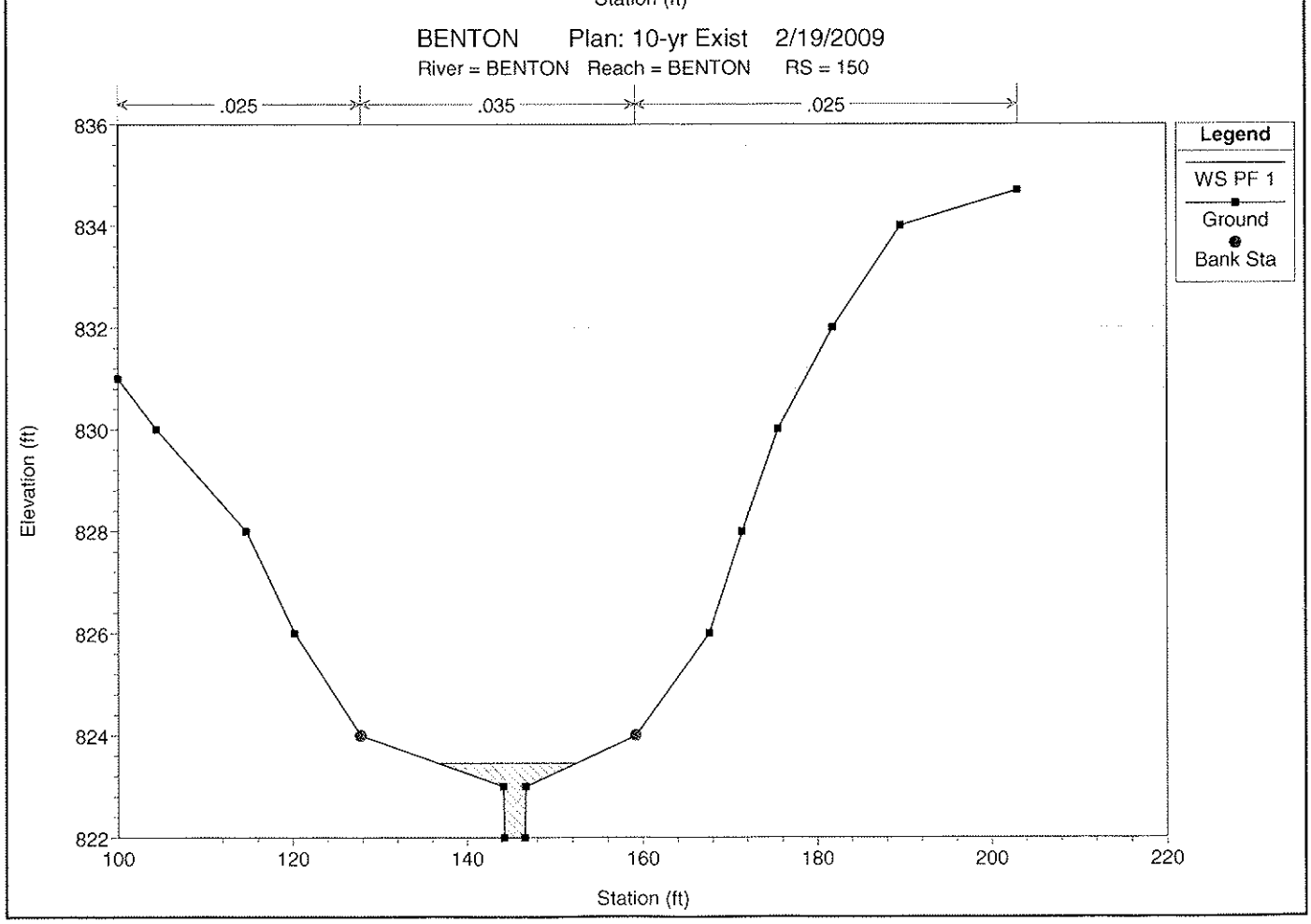

BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 180
.025
.04
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
865
860
855
850
845
840
835
100
120
140
160
180
200
220
240


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 175
.025
.03
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
860
855
850
845
840
835
100
120
140
160
180
200


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 170
.03
.035
.045
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
855
850
845
840
835
830
100
120
140
160
180
200
220
Station (ft)


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 165
.025
.03
.035
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
844
842
840
838
836
834
832
830
100
120
140
160
180
200
220
Station (ft)


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 155
.025
.03
.025
Legend
WS PF 1
Ground
Bank Sta
840
838
836
834
832
830
828
826
Elevation (ft)
100
120
140
160
180
200
Station (ft)


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 150
.025
.035
.025
Legend
WS PF 1
Ground
Bank Sta
836
834
832
830
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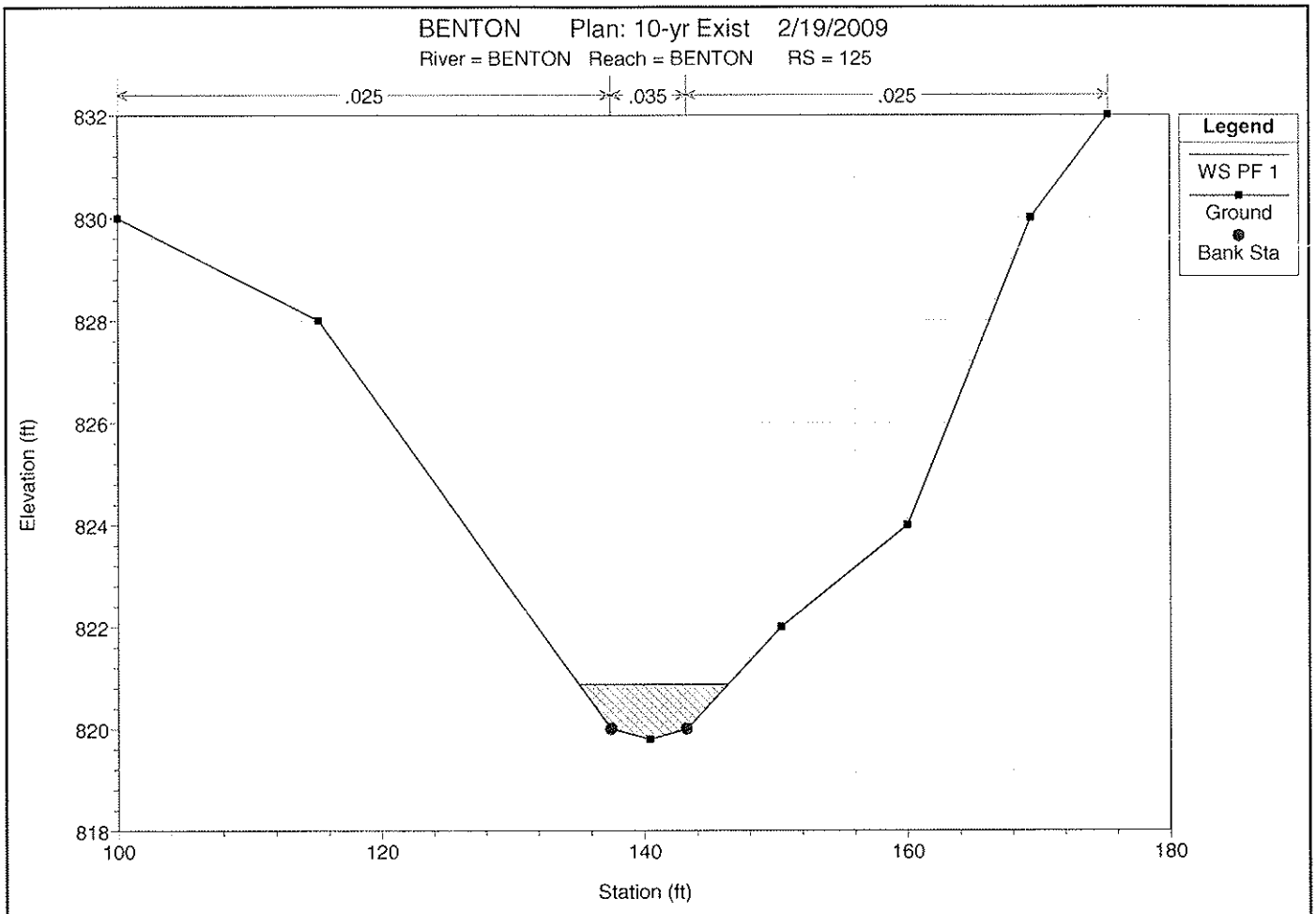
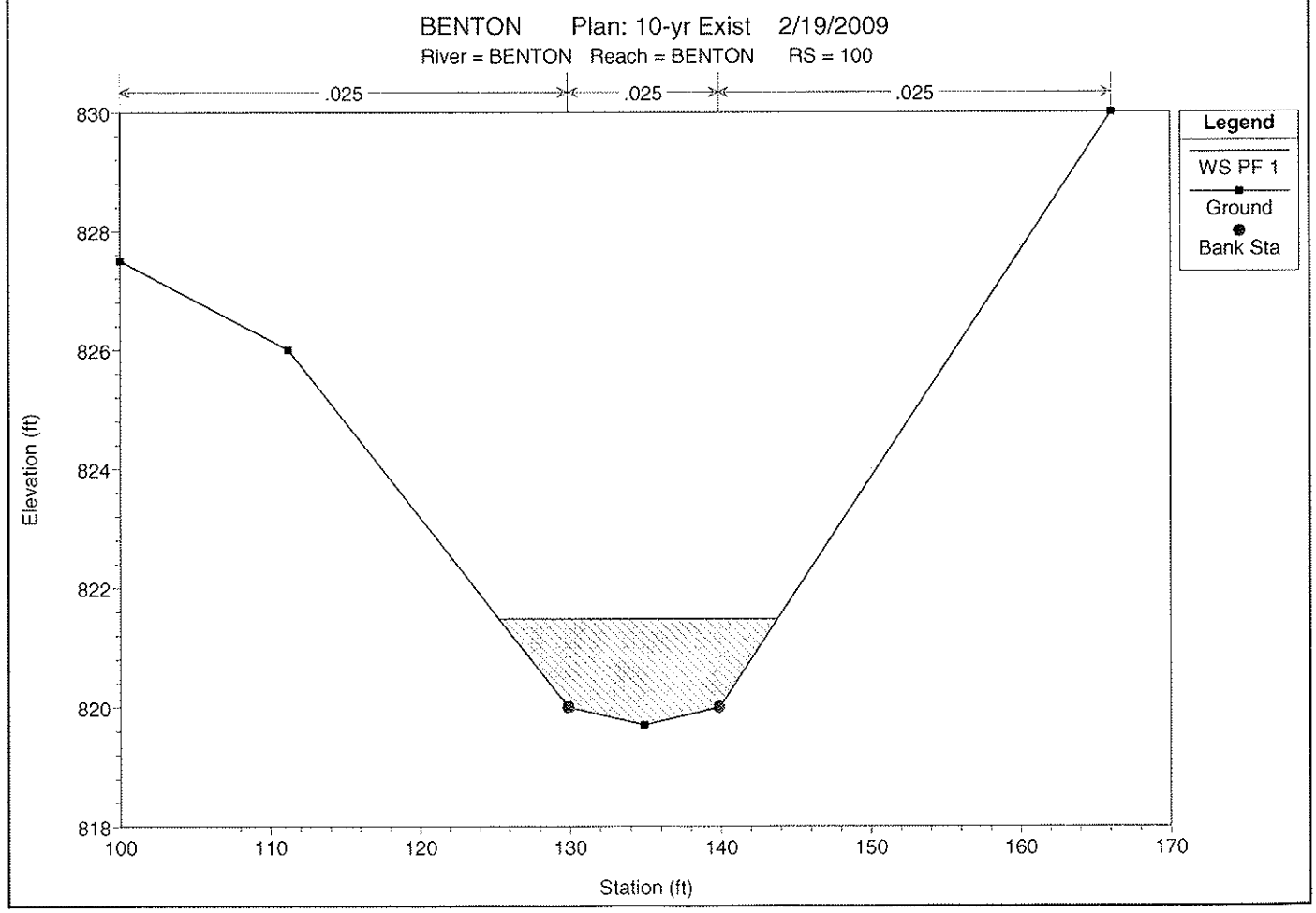
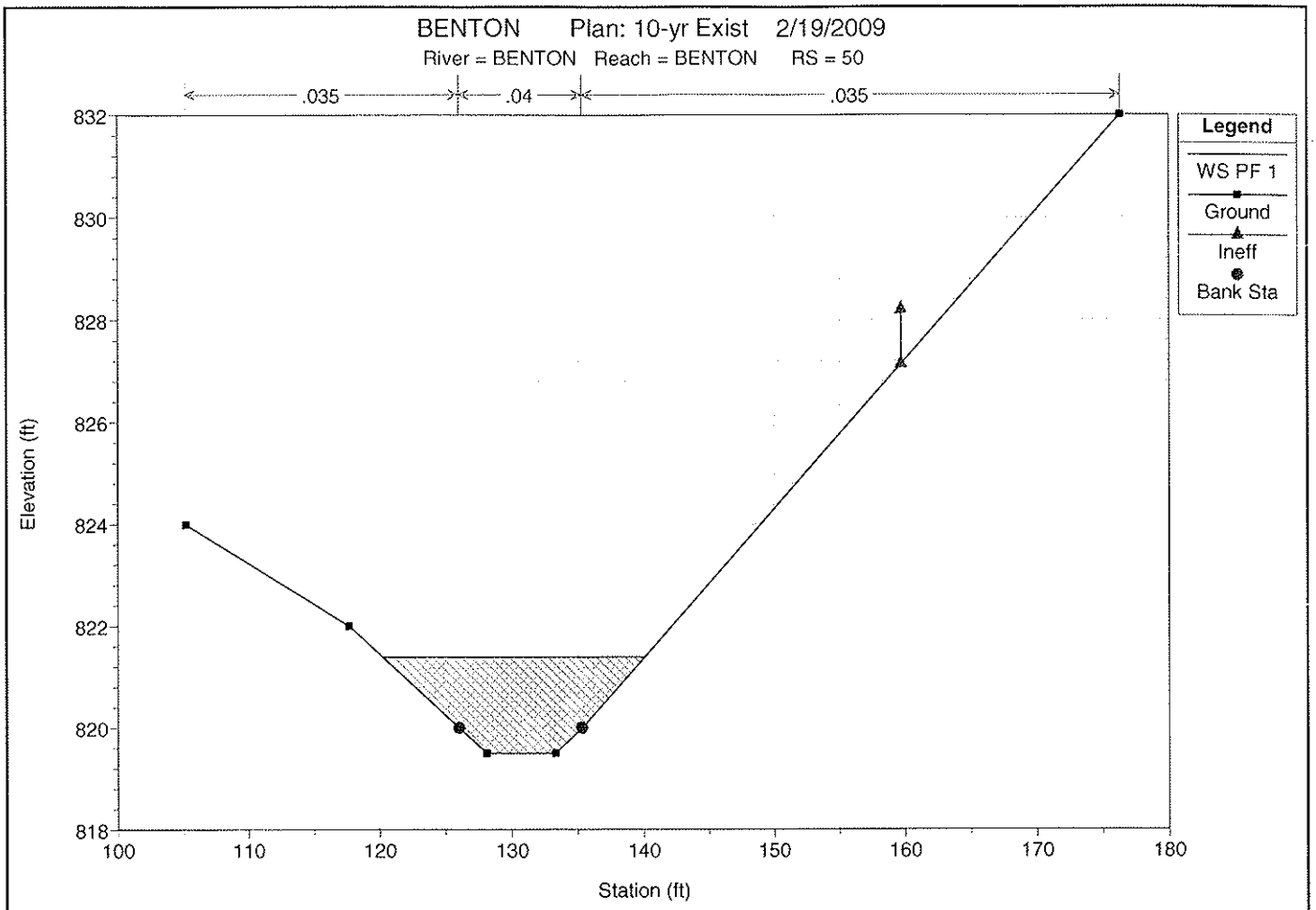
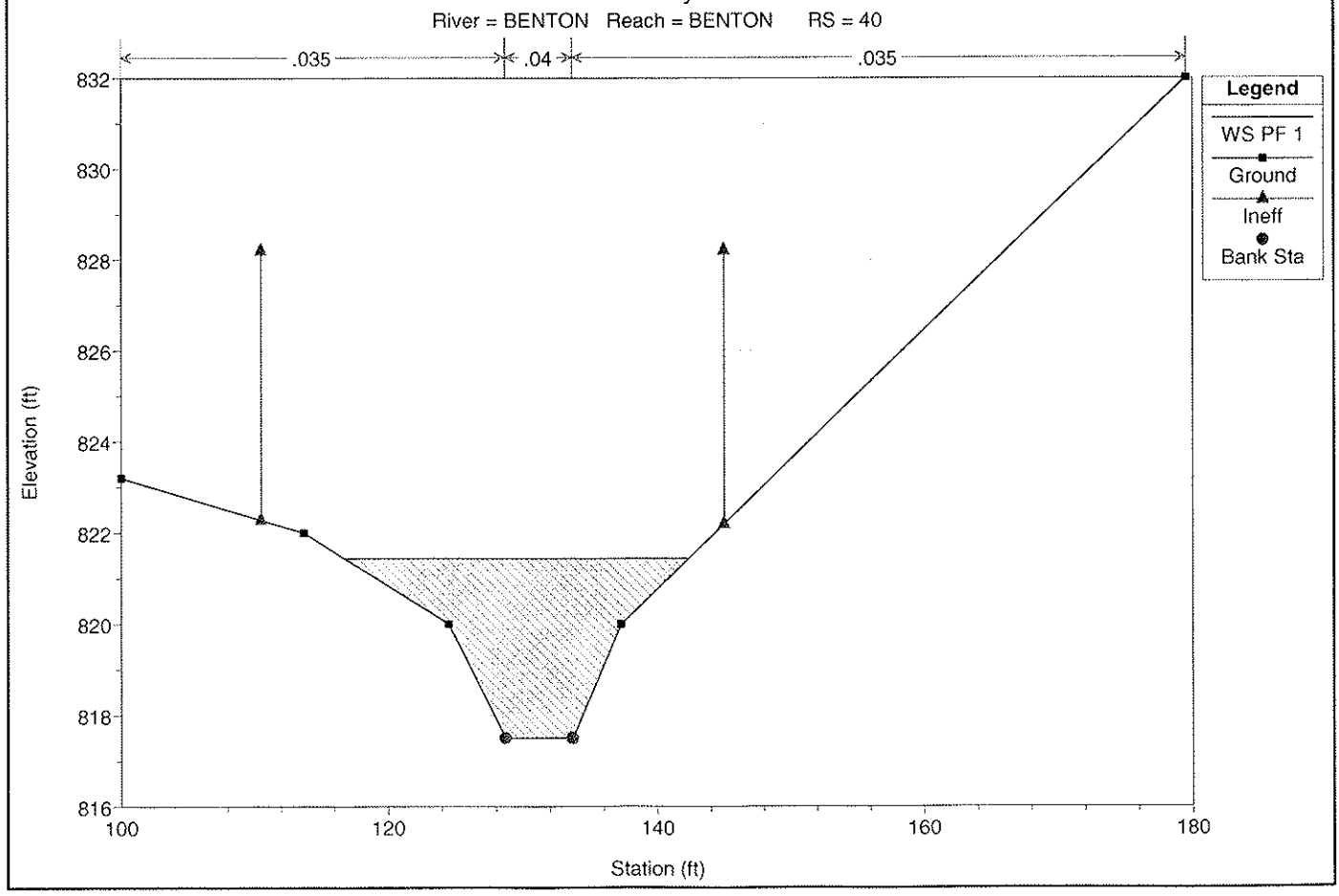
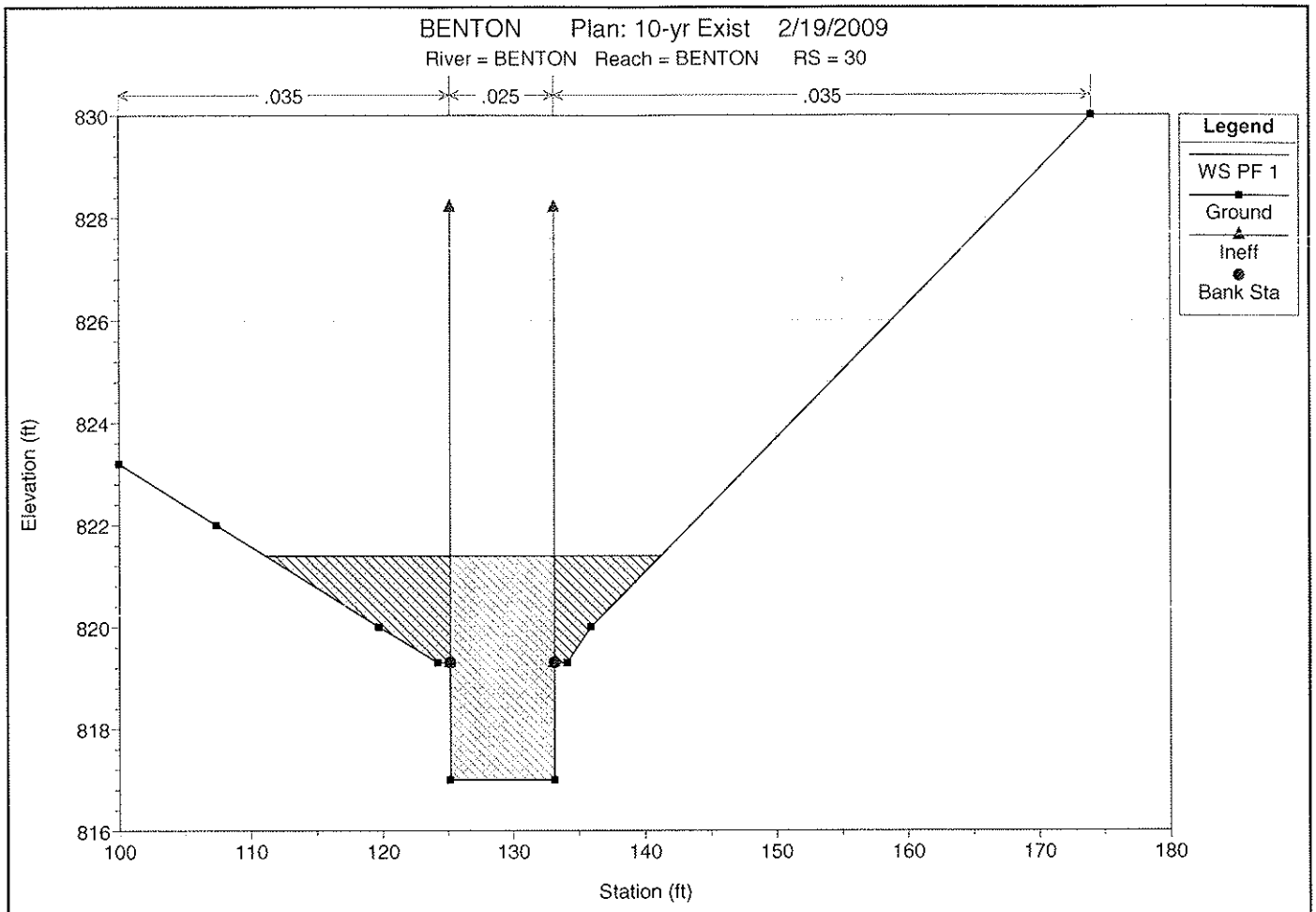
824
822
Elevation (ft)
100
120
140
160
180
200
220
Station (ft)


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 125
.025
.035
.025
Legend
WS PF 1
Ground
Bank Sta
832
830
828
826
824
822
820
818
Elevation (ft)
100
120
140
160
180
Station (ft)


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 100
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
830
828
826
824
822
820
818
Elevation (ft)
100
110
120
130
140
150
160
170
Station (ft)


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 50
.035
.04
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
100
110
120
130
140
150
160
170
180
Station (ft)


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 40
.035
.04
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
816
100
120
140
160
180
Station (ft)


BENTON Plan: 10-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 30
.035
.025
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
830
828
826
824
822
820
818
816
100
110
120
130
140
150
160
170
180
Station (ft)

HEC-RAS Plan: 50-yr Exist River: BENTON Reach: BENTON Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	215	PF 1	87.80	873.50	874.90	875.20	875.88	0.060042	7.96	11.03	13.15	1.53
BENTON	210	PF 1	87.80	870.80	873.17	872.52	873.33	0.005060	3.19	27.55	20.19	0.48
BENTON	205	PF 1	87.80	871.30	872.39	872.39	872.71	0.023879	4.62	19.36	30.69	0.95
BENTON	200	PF 1	87.80	866.00	867.71	868.11	869.03	0.092540	9.20	9.54	11.14	1.75
BENTON	195	PF 1	87.80	860.00	861.06	861.44	862.33	0.054106	9.03	9.72	18.29	2.18
BENTON	190	PF 1	87.80	850.00	851.11	851.93	855.65	0.190506	17.11	5.13	9.27	4.05
BENTON	185	PF 1	87.80	840.00	841.35	842.29	846.32	0.427993	17.89	4.91	7.28	3.84
BENTON	180	PF 1	87.80	838.10	839.55	840.11	841.55	0.149917	11.34	7.75	10.68	2.35
BENTON	175	PF 1	87.80	836.60	838.42	838.65	839.28	0.026776	7.44	11.79	12.87	1.37
BENTON	170	PF 1	87.80	834.00	835.00	835.42	836.49	0.136344	9.81	8.95	17.98	2.45
BENTON	165	PF 1	87.80	830.10	831.40	831.64	832.16	0.035466	6.97	12.59	19.30	1.52
BENTON	160	PF 1	87.80	828.00	829.00	829.27	829.84	0.049603	7.34	11.96	21.94	1.75
BENTON	155	PF 1	87.80	826.00	827.88	827.89	828.17	0.018891	4.32	20.34	38.44	1.05
BENTON	150	PF 1	87.80	822.00	823.54	824.00	825.46	0.235309	11.14	7.88	17.98	2.96
BENTON	125	PF 1	87.80	819.80	822.65	821.43	822.74	0.000947	2.56	38.41	23.42	0.27
BENTON	100	PF 1	87.80	819.70	822.65		822.71	0.000348	2.20	48.24	25.23	0.23
BENTON	50	PF 1	87.80	819.50	822.65	820.97	822.69	0.000634	1.94	55.14	30.67	0.20
BENTON	40	PF 1	87.80	817.50	822.65	819.30	822.67	0.000157	1.39	87.76	40.41	0.11
BENTON	30	PF 1	87.80	817.00	822.60	818.55	822.66	0.000200	1.96	44.80	42.11	0.15

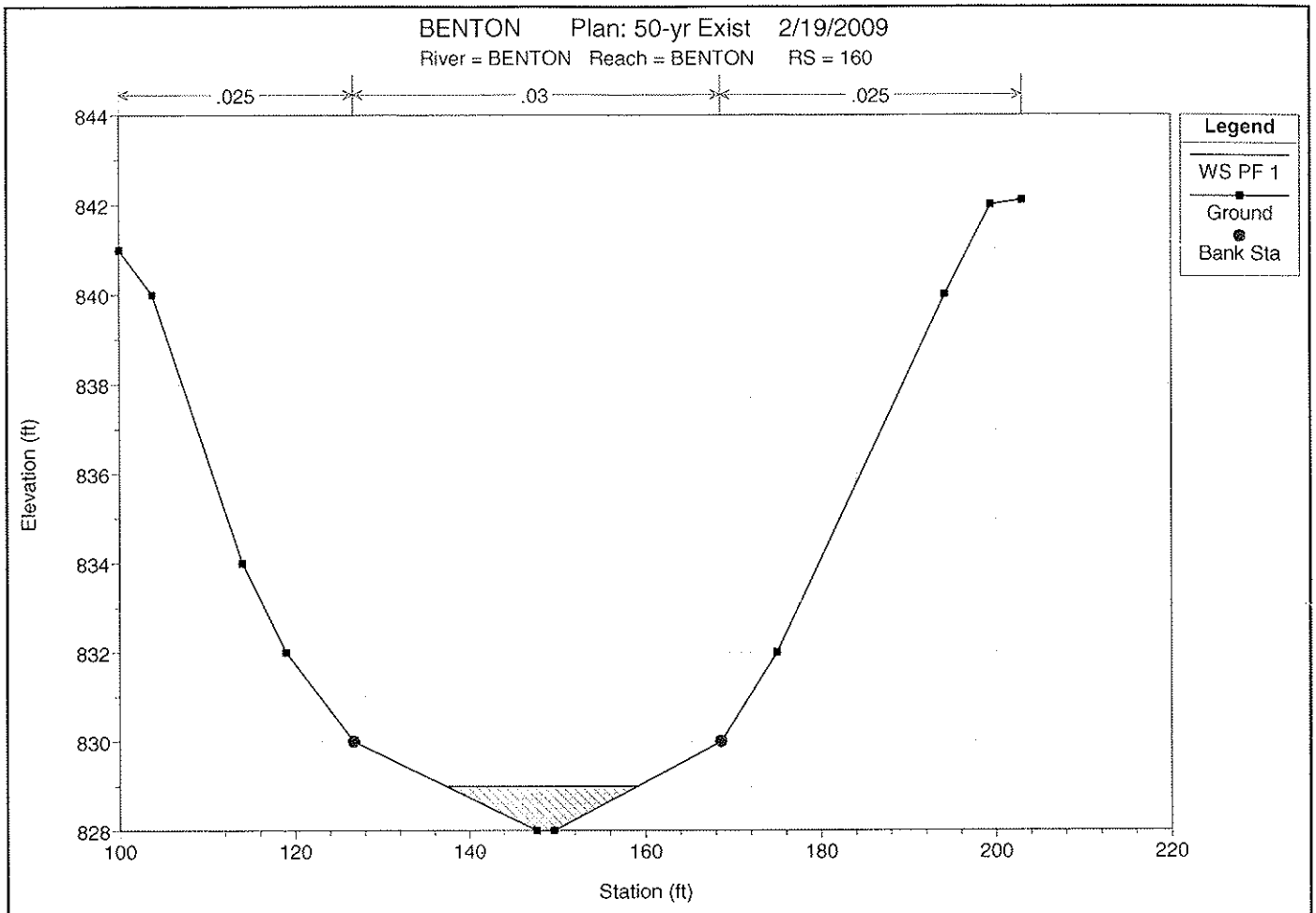
Headwater Depth for Concrete Pipe Culverts with Inlet Control

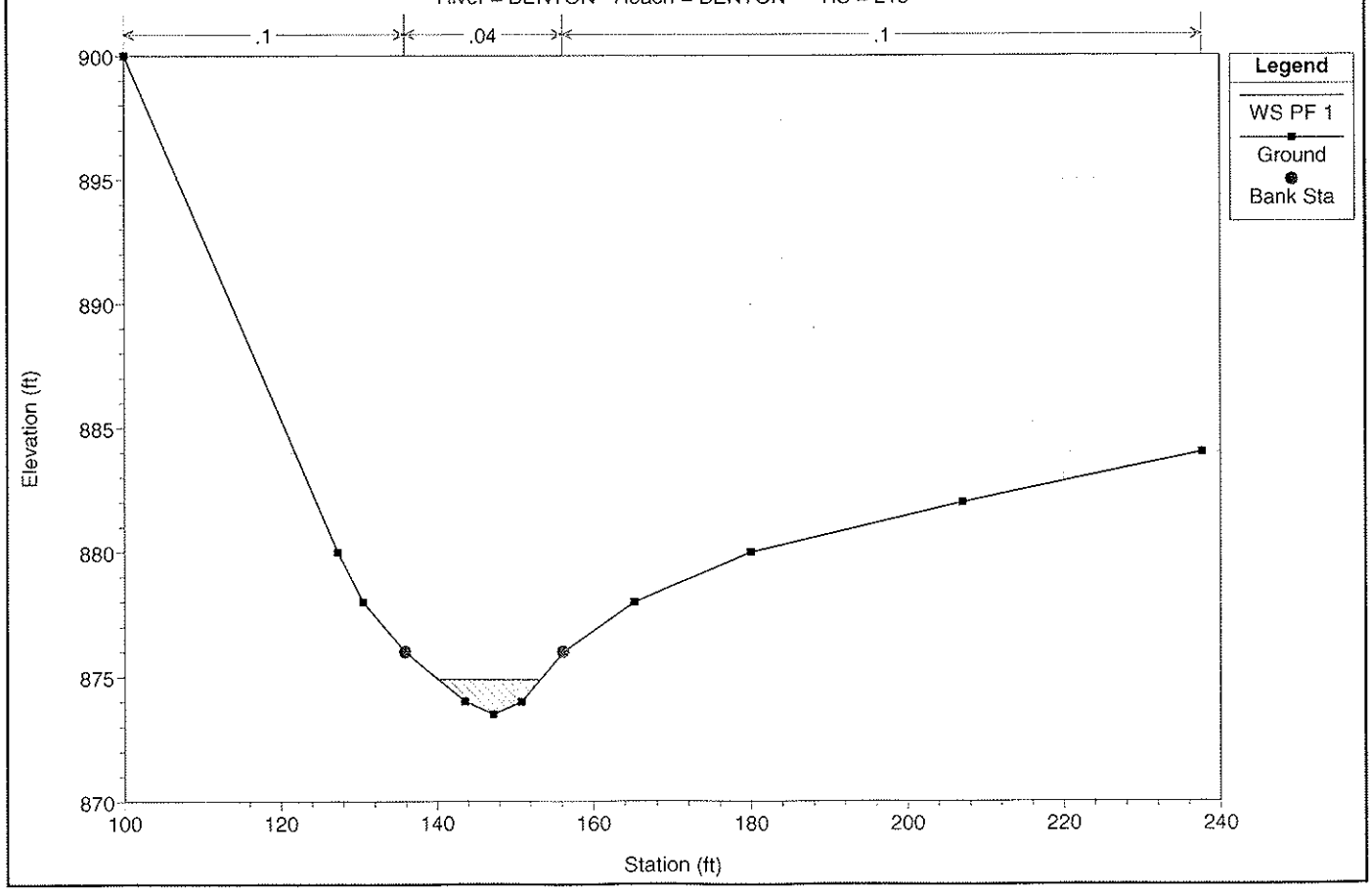
- (•) Square Edge with Headwall
- ( ) Groove End with Headwall
- ( ) Groove End Projecting

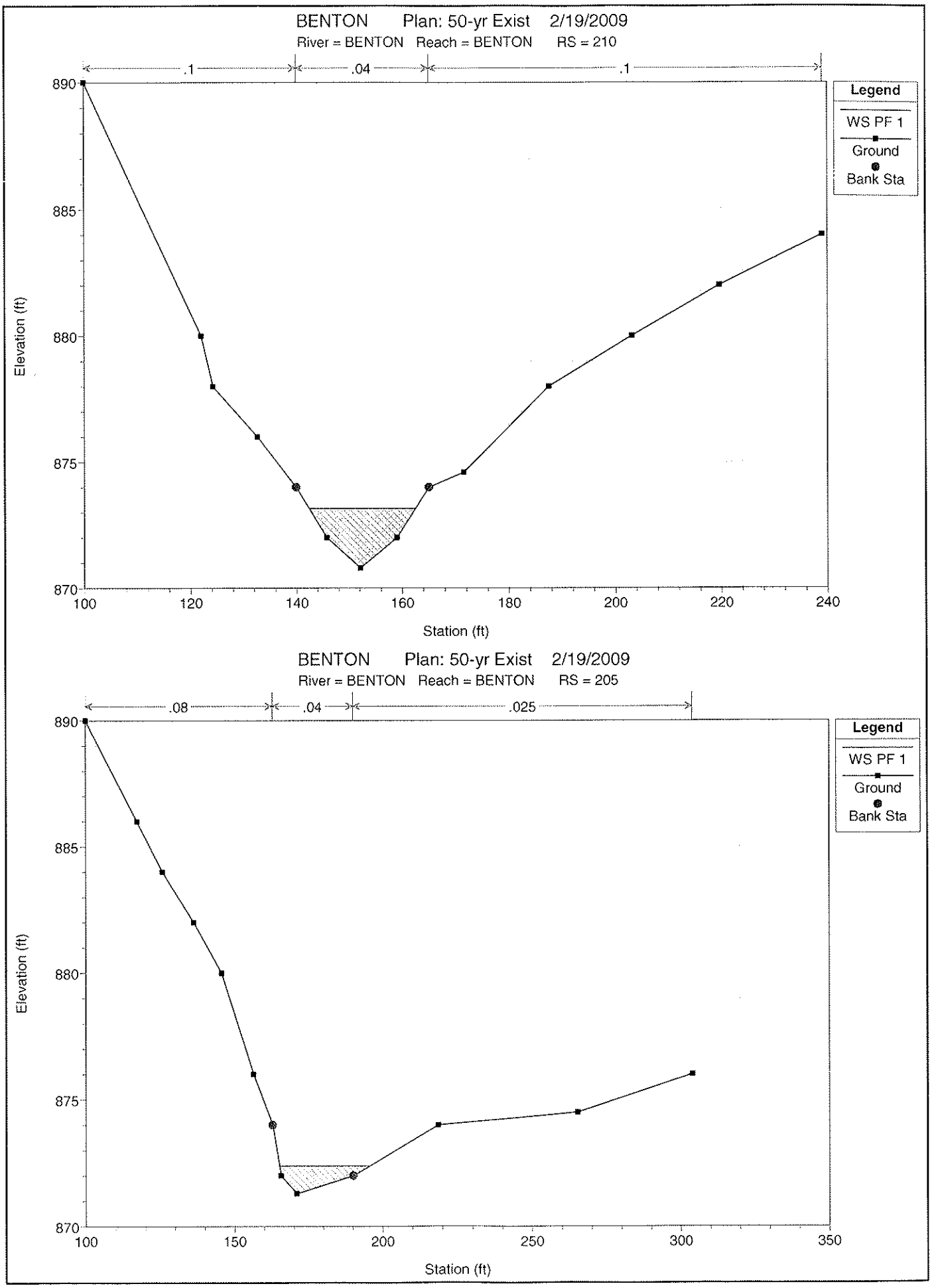
2.912	Calc	Critical Depth (ft)
10.262		Critical Velocity (ft/s)
87.8		Q = Discharge (cfs) ← 50-YR FLOW
0.02		Culvert Barrel Slope (ft/ft)
3.5		Culvert diameter (ft)
5.625		Headwater (ft)

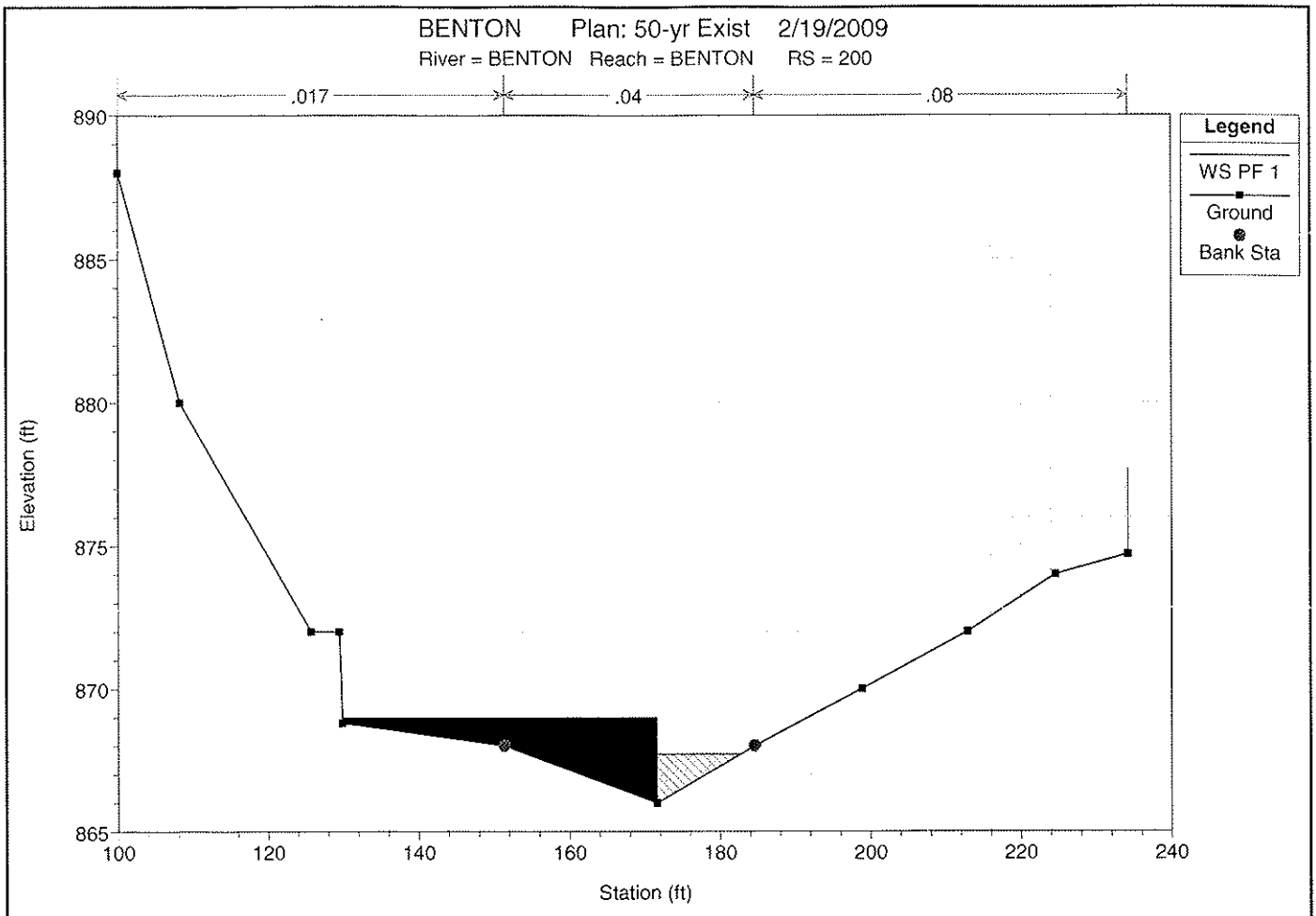
Calc

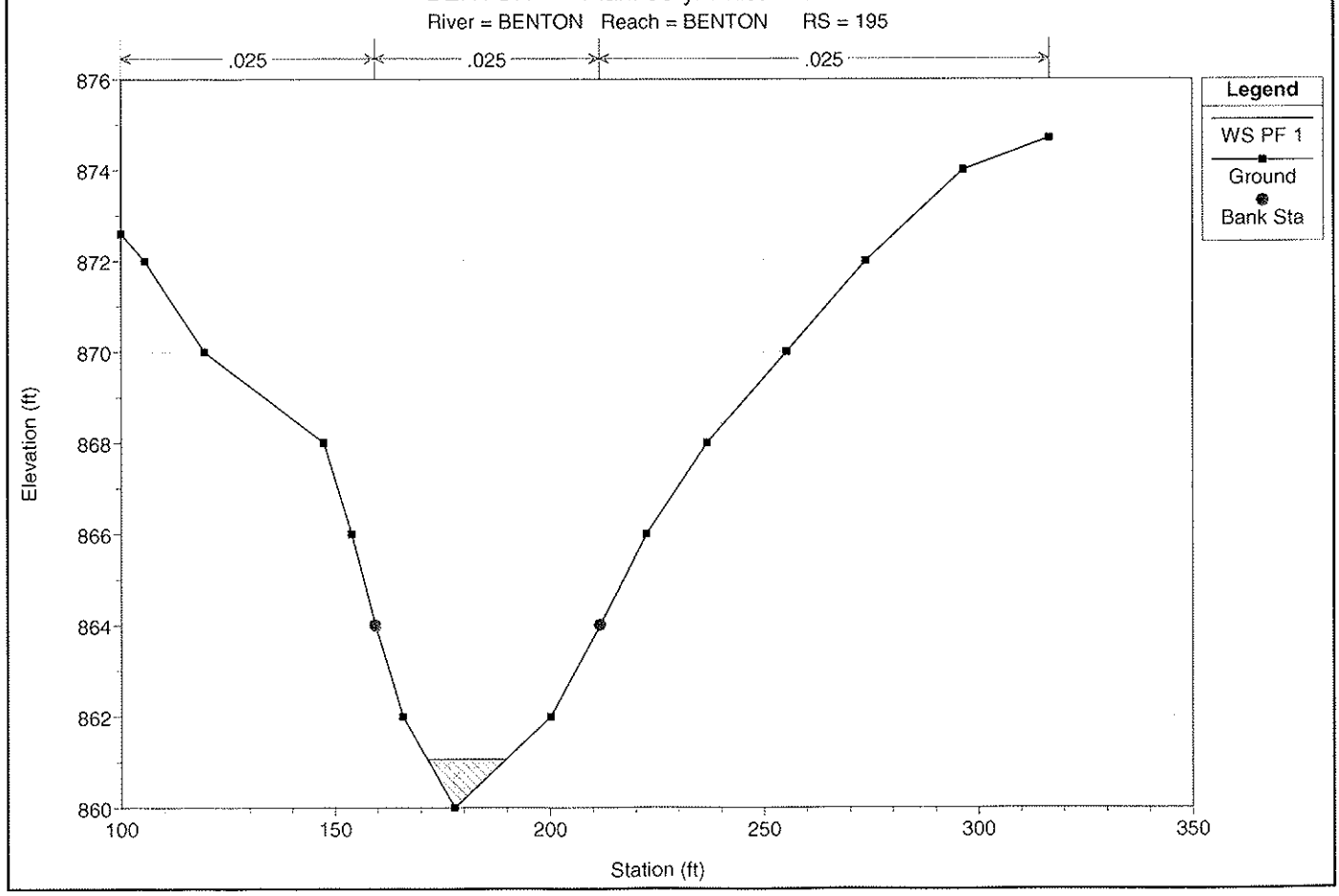
Units
(•) English ( ) Metric

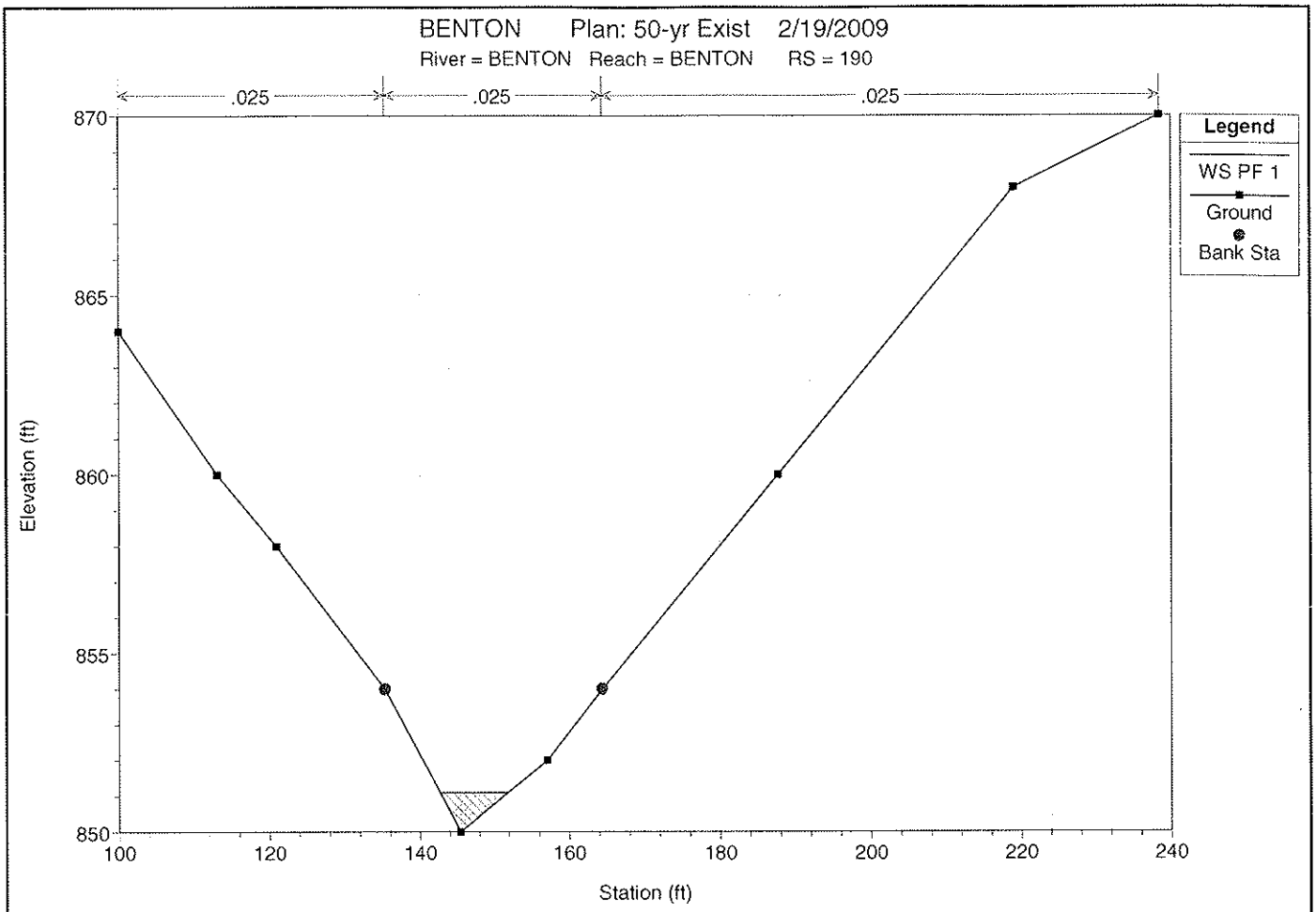

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 160
.025
.03
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
844
842
840
838
836
834
832
830
828
100
120
140
160
180
200
220
Station (ft)

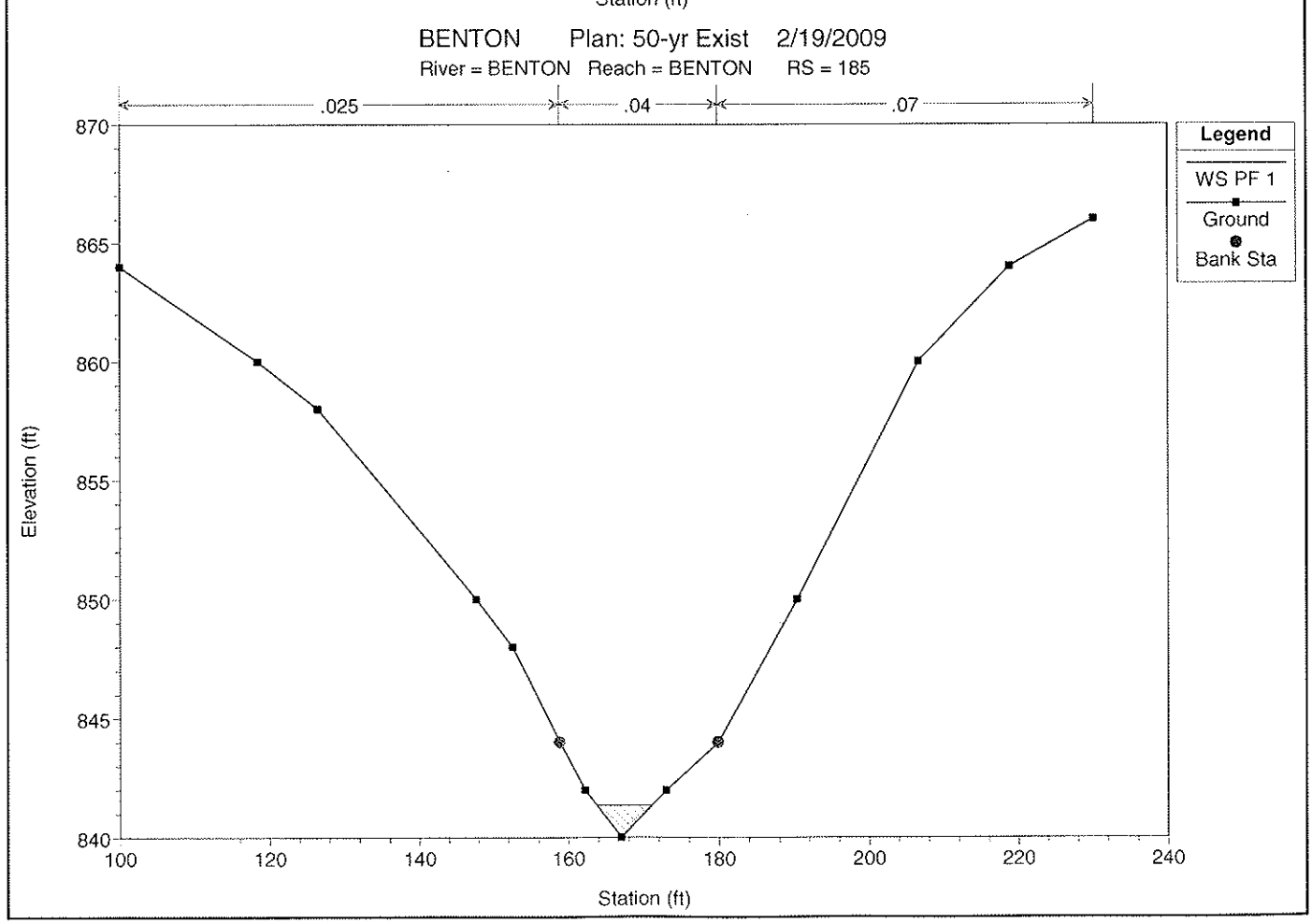

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 215
.1
.04
.1
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
900
895
890
885
880
875
870
100
120
140
160
180
200
220
240
Station (ft)

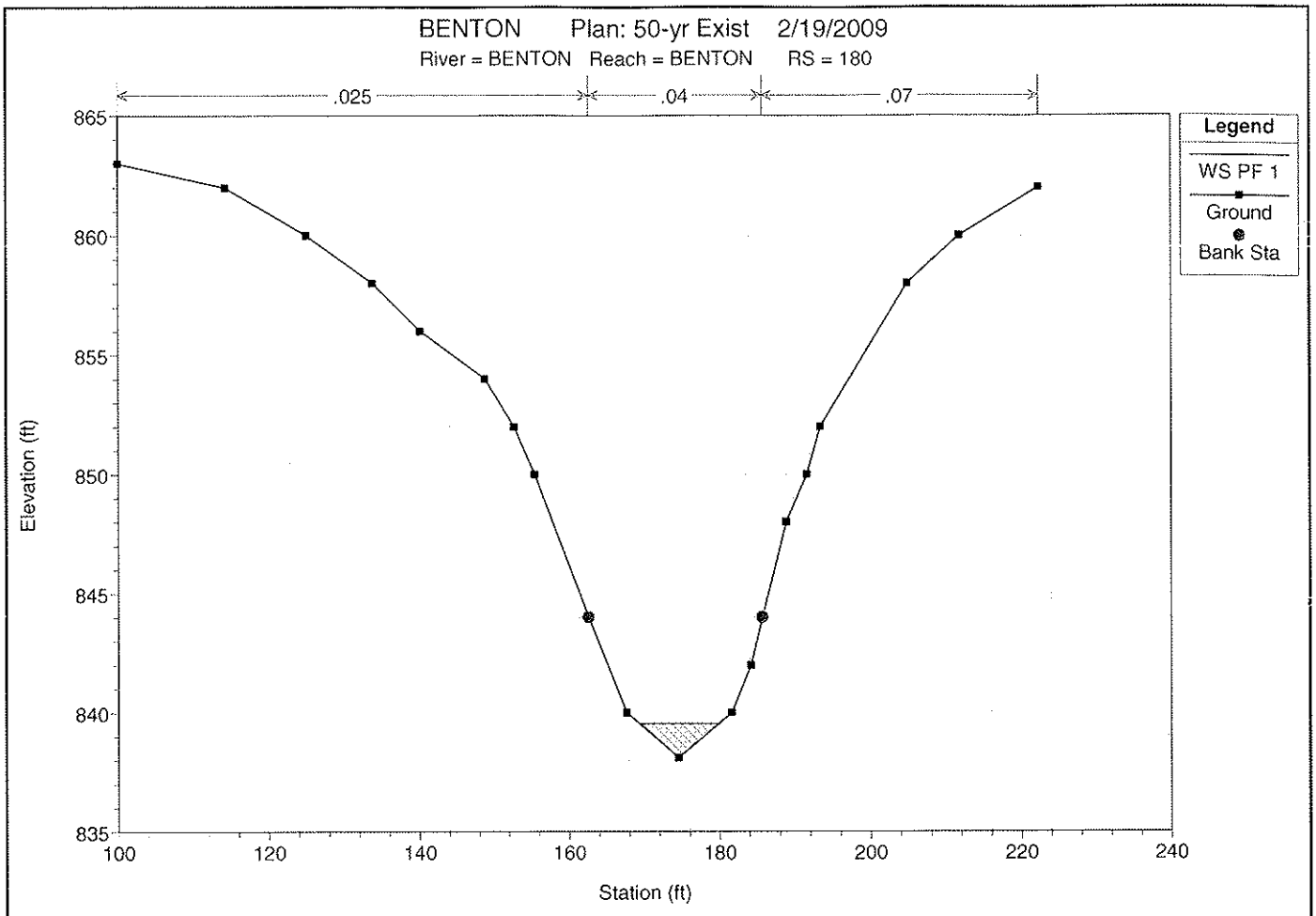

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 210
.1
.04
.1
Legend
WS PF 1
Ground
Bank Sta
890
885
880
875
870
Elevation (ft)
100
120
140
160
180
200
220
240
Station (ft)
BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 205
.08
.04
.025
Legend
WS PF 1
Ground
Bank Sta
890
885
880
875
870
Elevation (ft)
100
150
200
250
300
350
Station (ft)

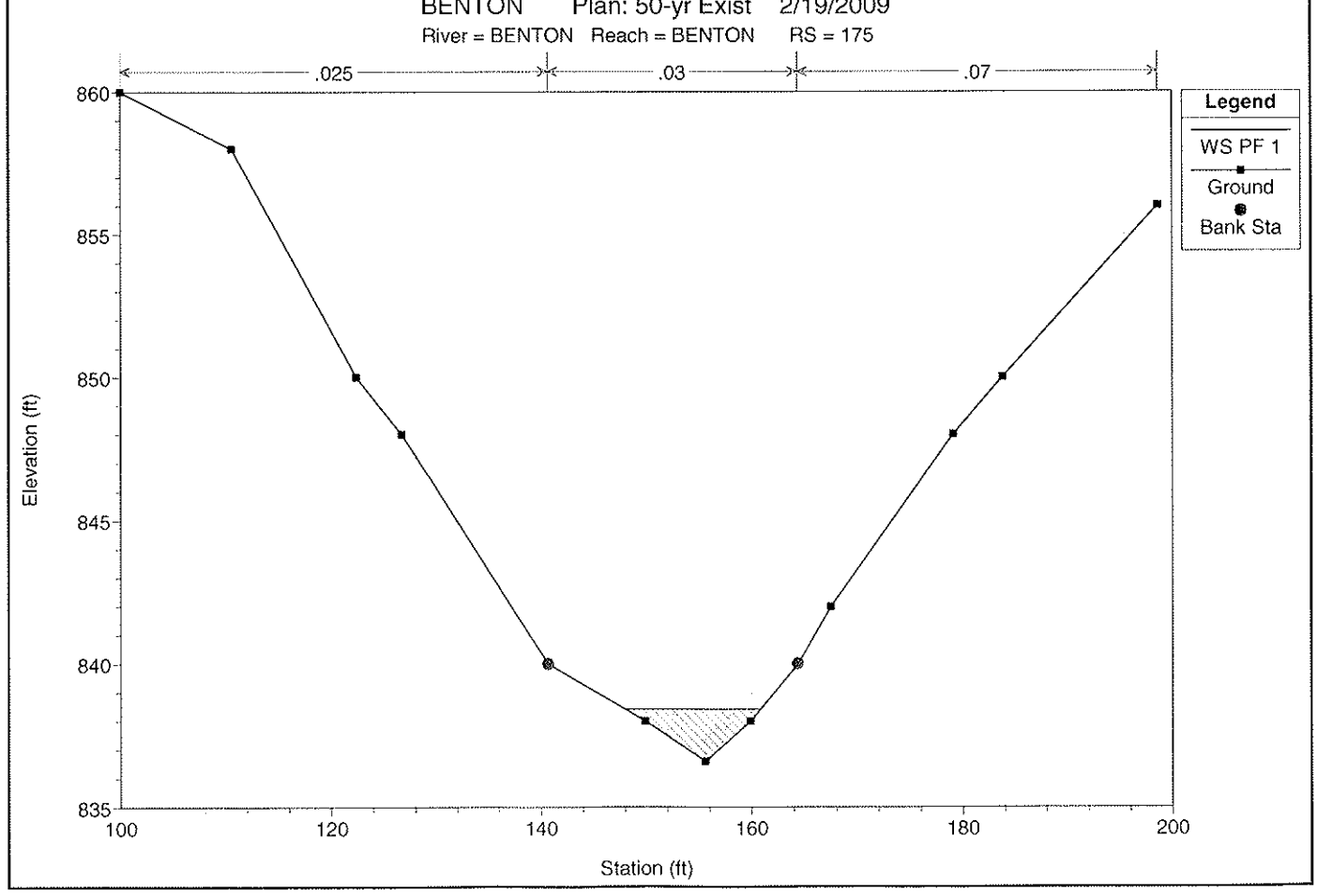

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 200
.017
.04
.08
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
890
885
880
875
870
865
100
120
140
160
180
200
220
240

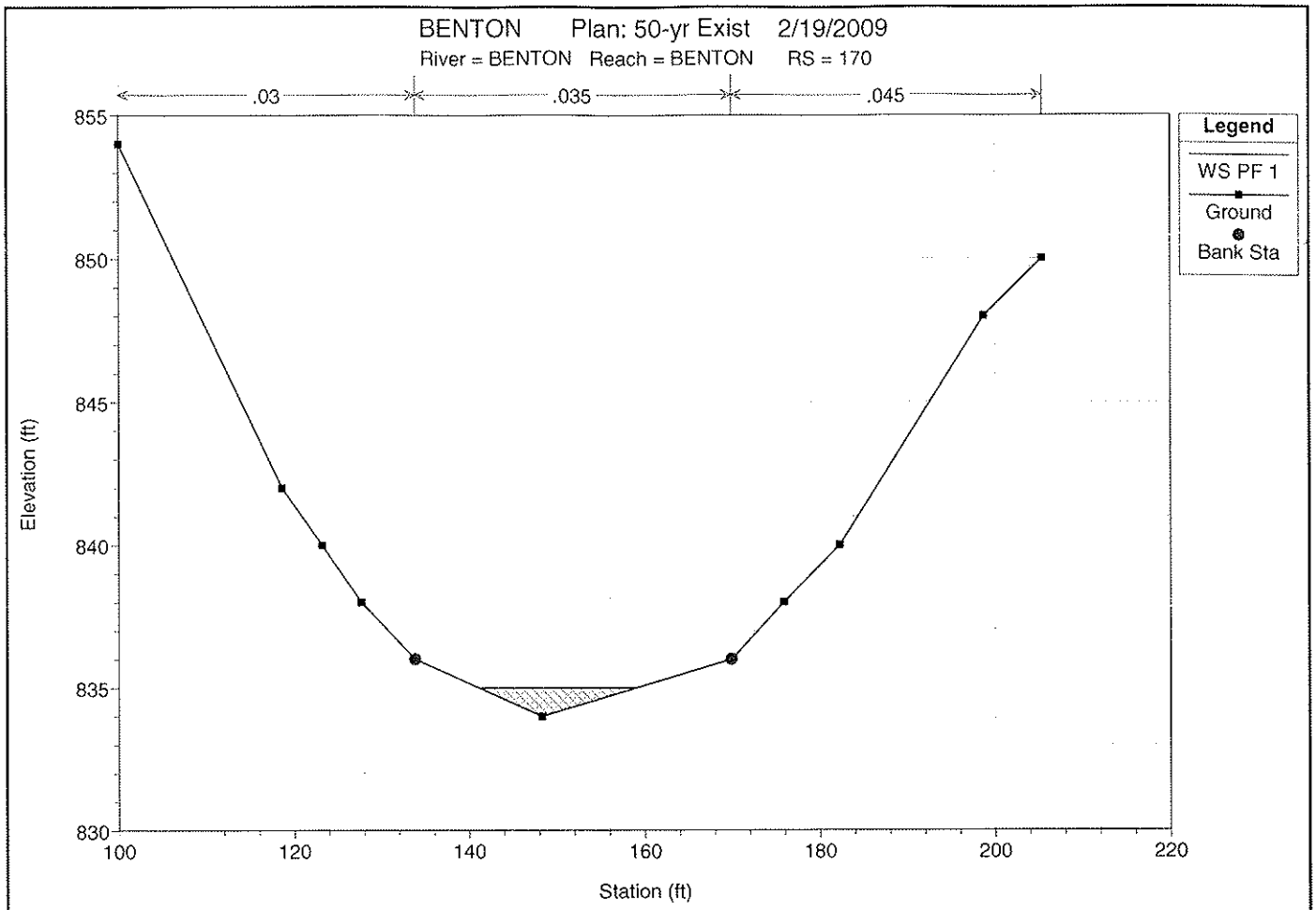

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 195
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
876
874
872
870
868
866
864
862
860
100
150
200
250
300
350

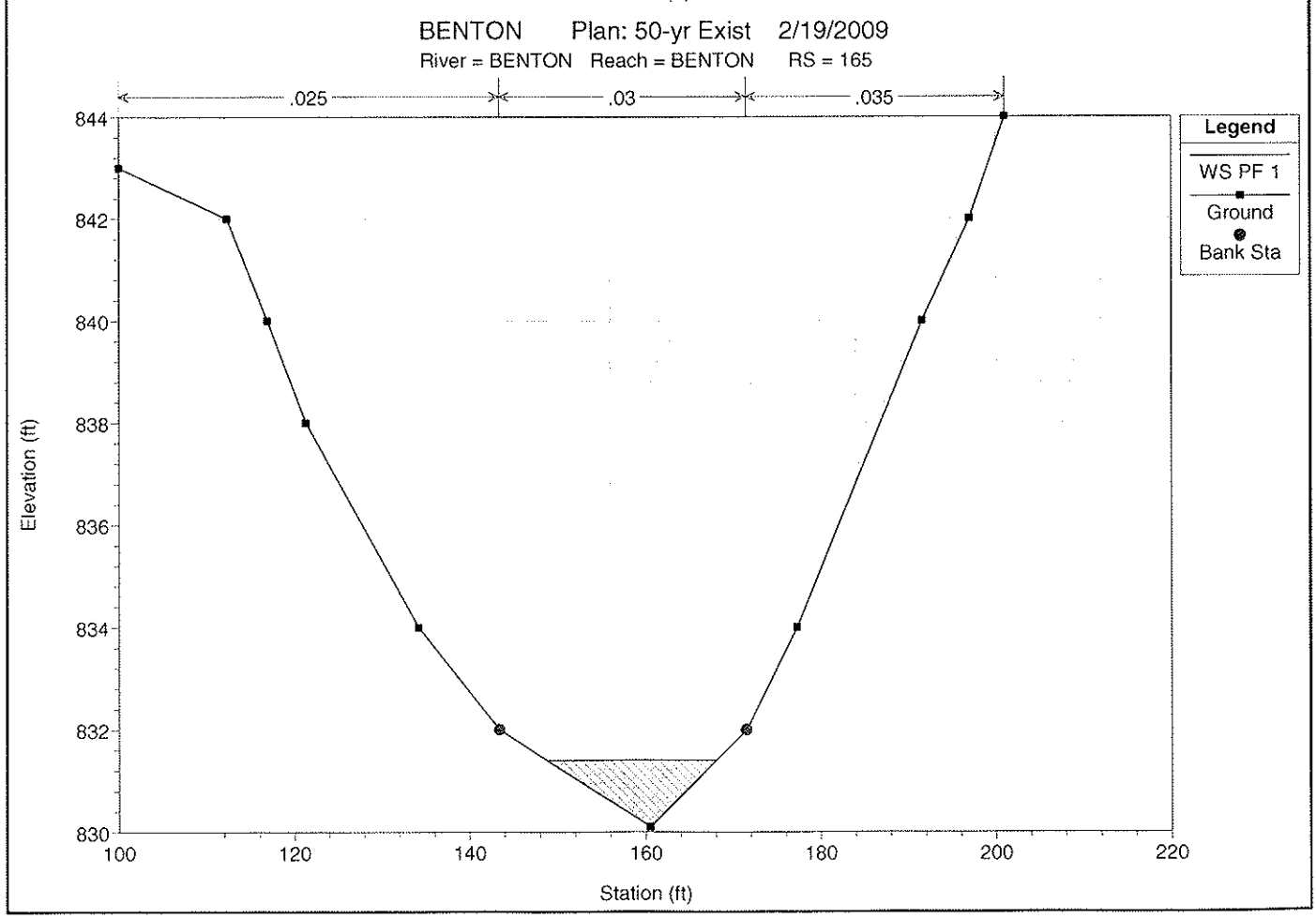

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 190
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
870
865
860
855
850
100
120
140
160
180
200
220
240
Station (ft)

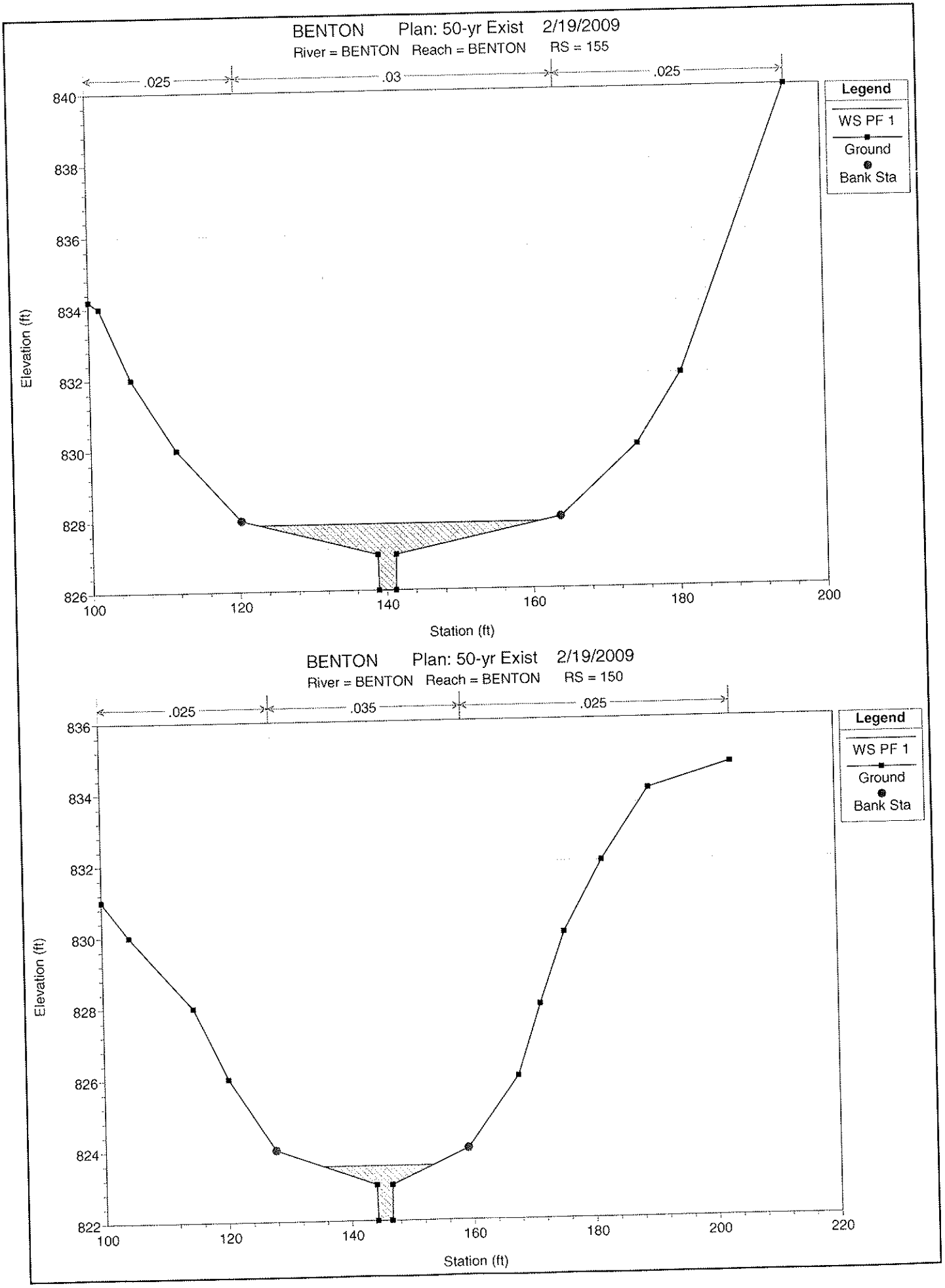

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 185
.025
.04
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
870
865
860
855
850
845
840
100
120
140
160
180
200
220
240
Station (ft)

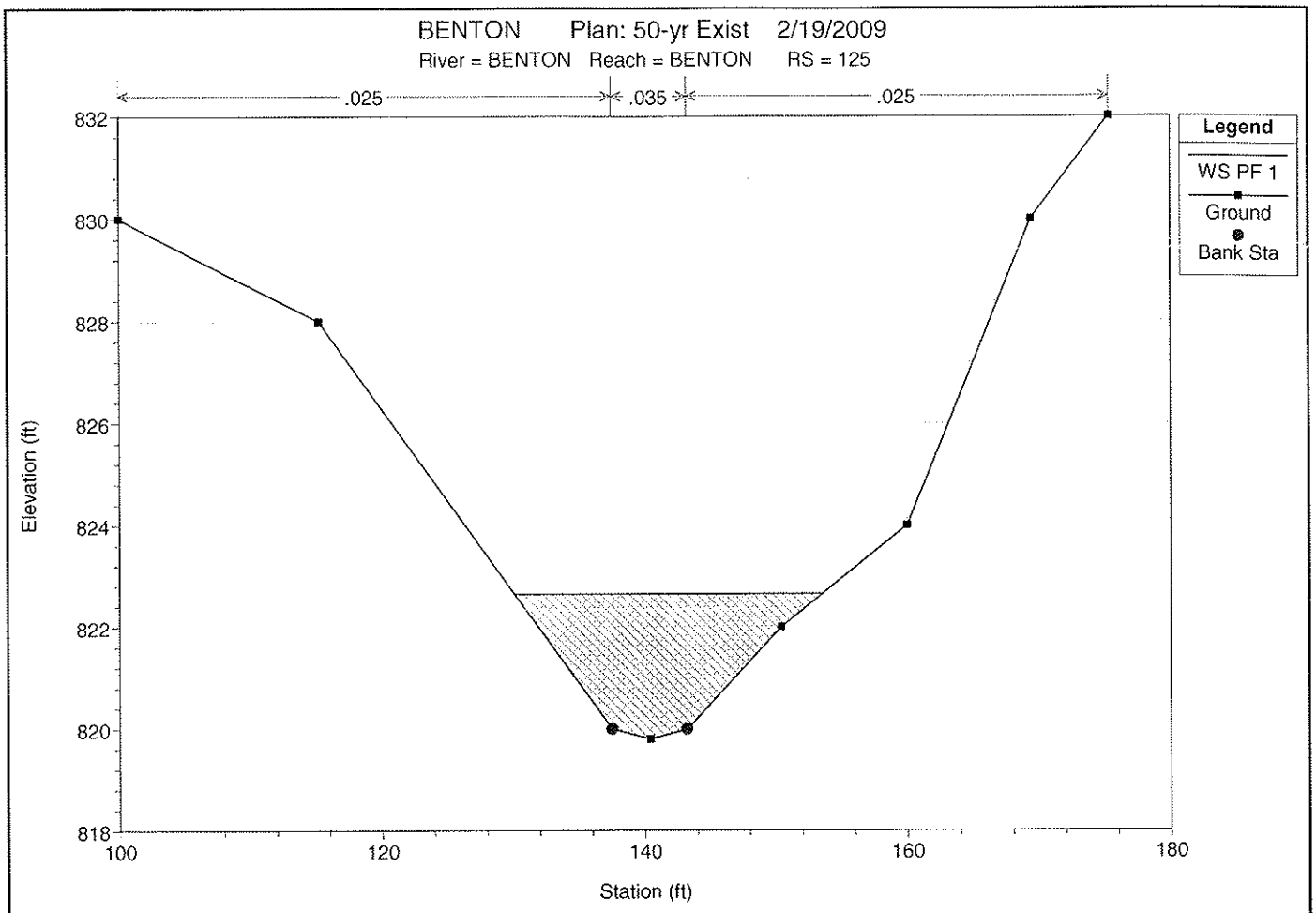

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 180
.025
.04
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
865
860
855
850
845
840
835
100
120
140
160
180
200
220
240

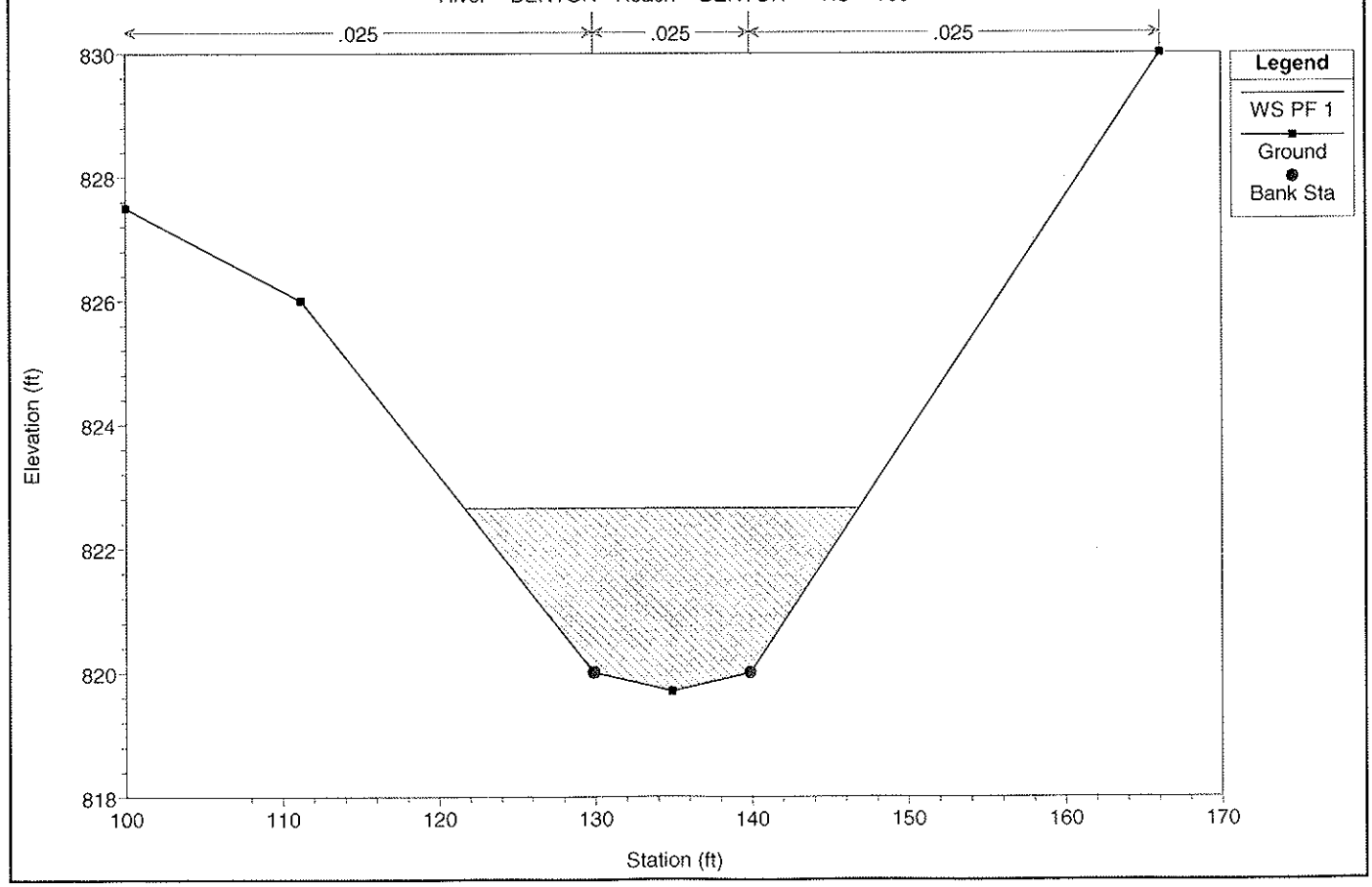

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 175
.025
.03
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
860
855
850
845
840
835
100
120
140
160
180
200

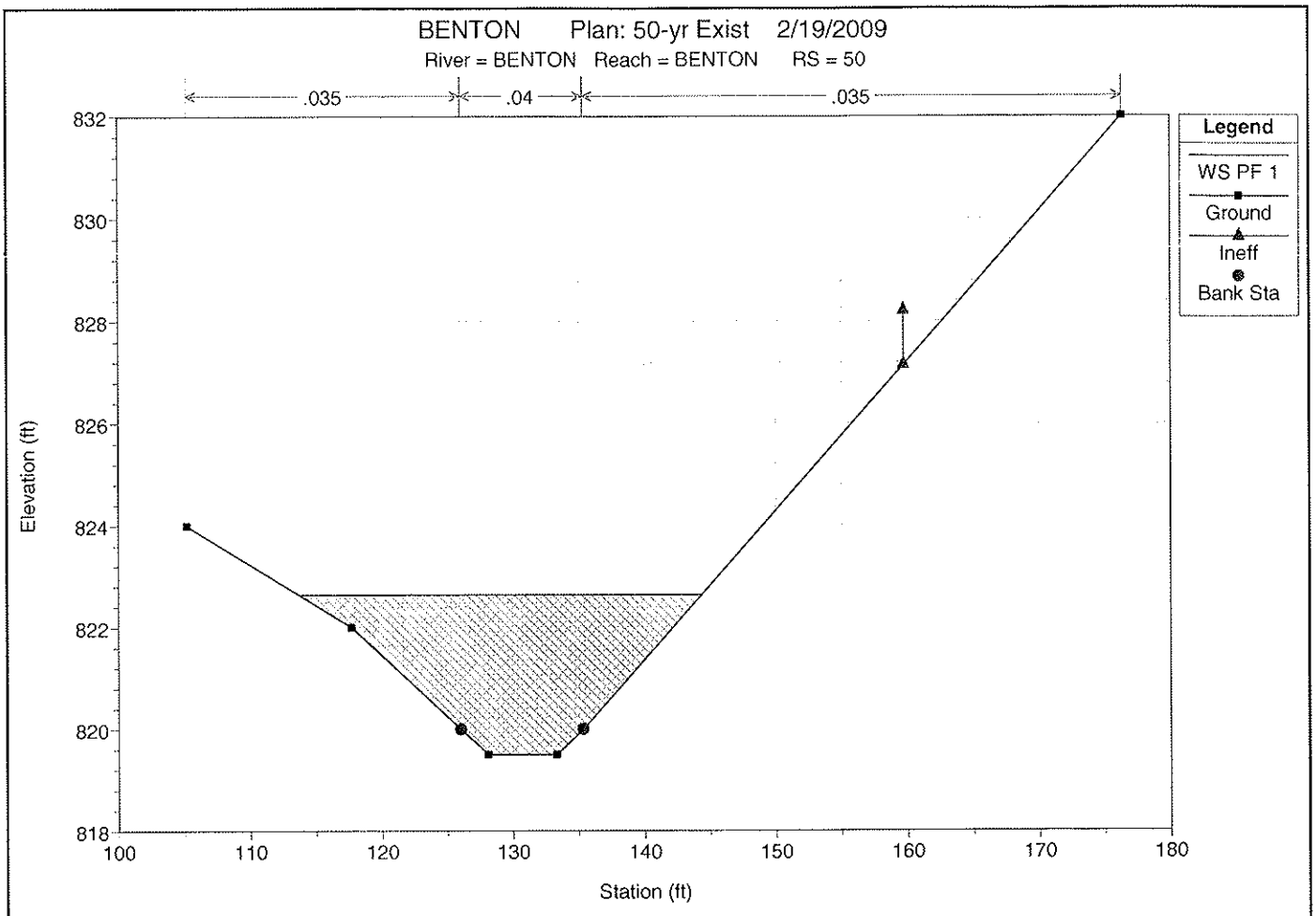

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 170
.03
.035
.045
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
855
850
845
840
835
830
100
120
140
160
180
200
220
Station (ft)

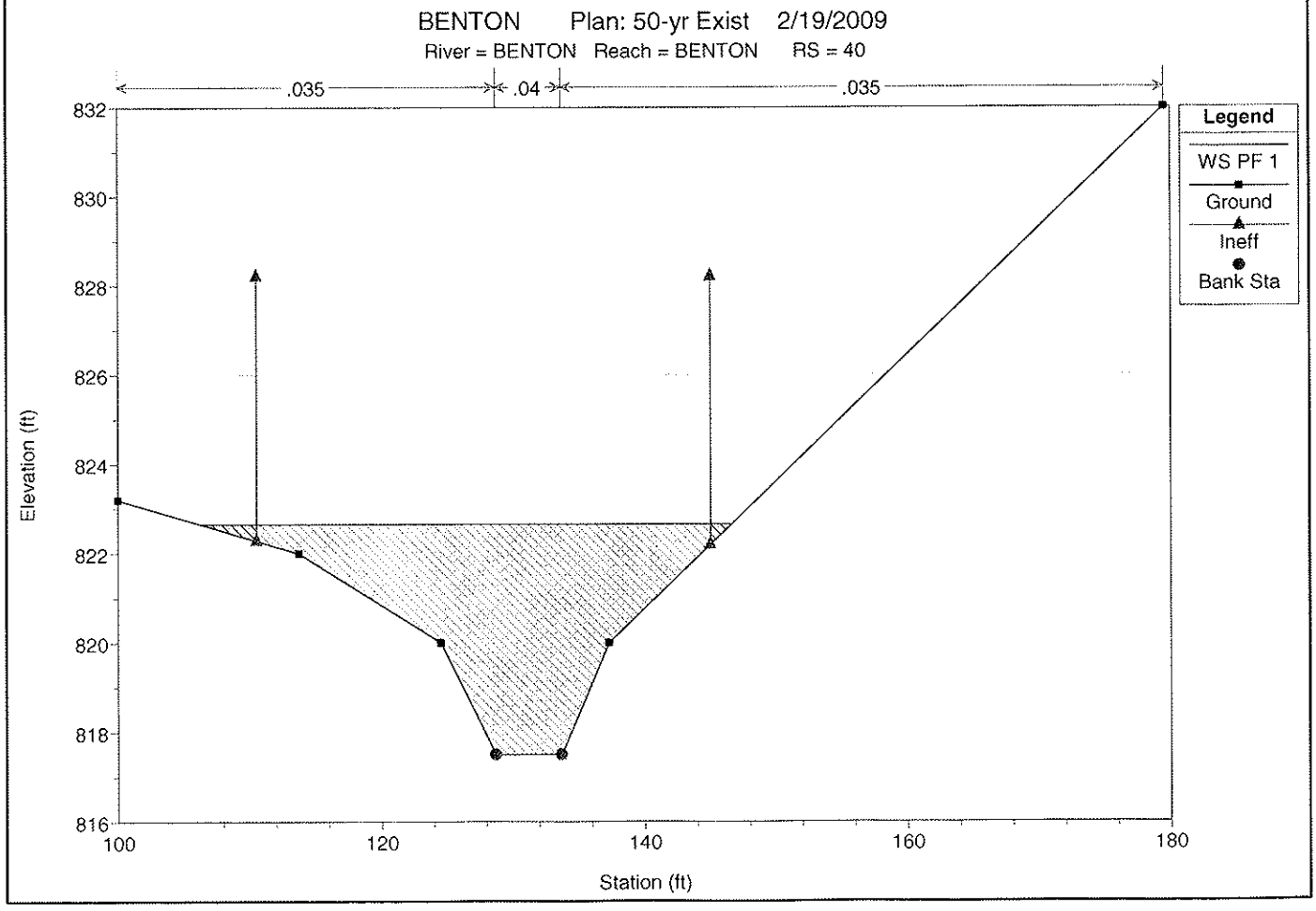

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 165
.025
.03
.035
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
844
842
840
838
836
834
832
830
100
120
140
160
180
200
220
Station (ft)

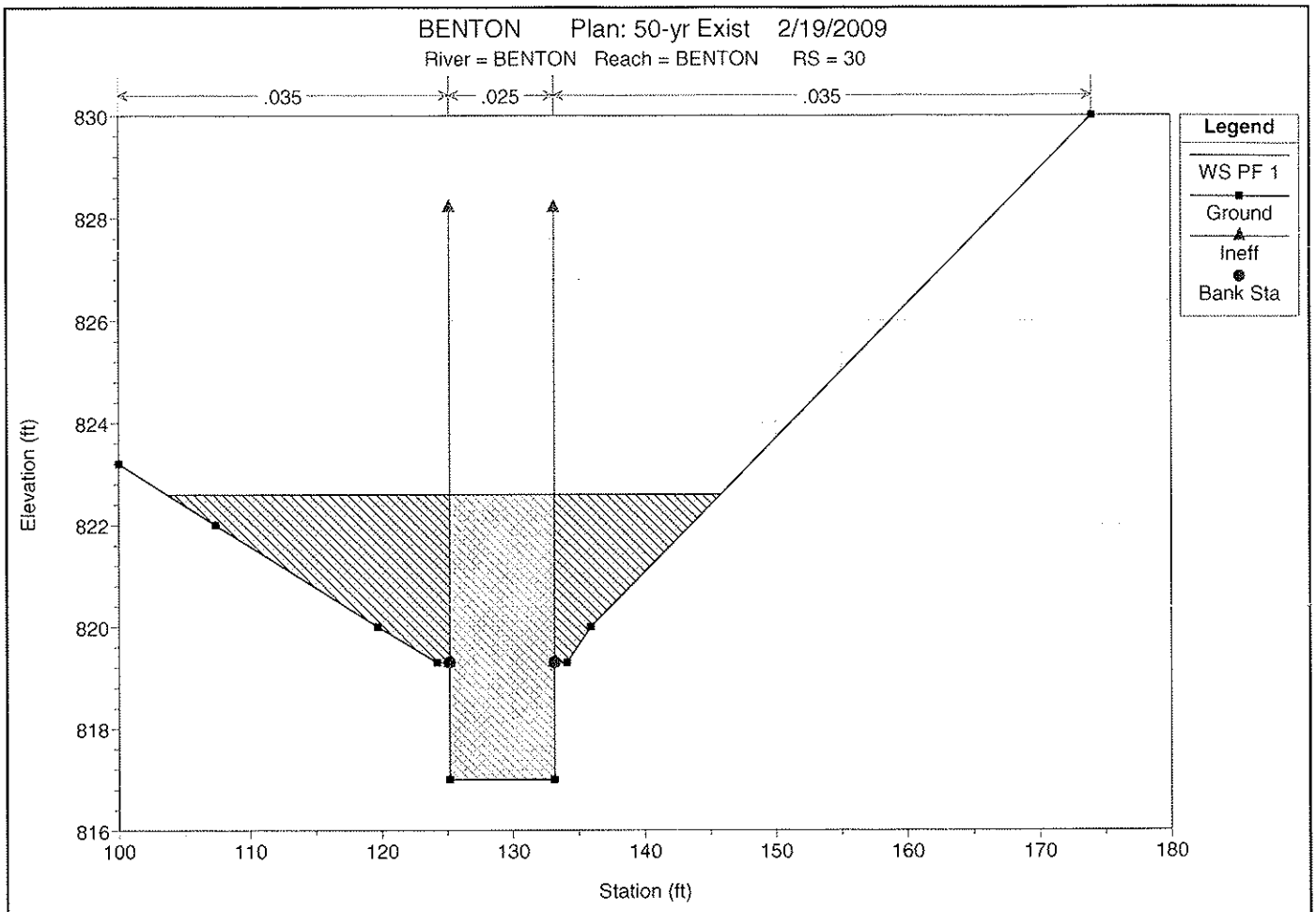

BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 155
.025
.03
.025
Legend
WS PF 1
Ground
Bank Sta
840
838
836
834
832
830
828
826
Elevation (ft)
100
120
140
160
180
200
Station (ft)
BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 150
.025
.035
.025
Legend
WS PF 1
Ground
Bank Sta
836
834
832
830
828
826
824
822
Elevation (ft)
100
120
140
160
180
200
220
Station (ft)


BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 125
.025
.035
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
100
120
140
160
180
Station (ft)


BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 100
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
830
828
826
824
822
820
818
100
110
120
130
140
150
160
170
Station (ft)


BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 50
.035
.04
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
100
110
120
130
140
150
160
170
180
Station (ft)


BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 40
.035
.04
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
816
100
120
140
160
180
Station (ft)


BENTON Plan: 50-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 30
.035
.025
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
830
828
826
824
822
820
818
816
100
110
120
130
140
150
160
170
180
Station (ft)

HEC-RAS Plan: 100-yr Exist River: BENTON Reach: BENTON Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	215	PF 1	103.80	873.50	875.01	875.34	876.08	0.060045	8.33	12.46	13.84	1.55
BENTON	210	PF 1	103.80	870.80	873.28	872.64	873.47	0.005619	3.47	29.92	20.87	0.51
BENTON	205	PF 1	103.80	871.30	872.47	872.47	872.82	0.022663	4.82	21.99	32.00	0.95
BENTON	200	PF 1	103.80	866.00	867.82	868.27	869.25	0.092518	9.60	10.82	11.86	1.77
BENTON	195	PF 1	103.80	860.00	861.13	861.54	862.52	0.054571	9.45	10.99	19.44	2.21
BENTON	190	PF 1	103.80	850.00	851.19	852.06	855.93	0.179873	17.46	5.94	9.98	3.99
BENTON	185	PF 1	103.80	840.00	841.43	842.45	846.86	0.430433	18.70	5.55	7.74	3.89
BENTON	180	PF 1	103.80	838.10	839.63	840.24	841.89	0.158076	12.06	8.61	11.26	2.43
BENTON	175	PF 1	103.80	836.60	838.52	838.80	839.49	0.027857	7.88	13.17	13.58	1.41
BENTON	170	PF 1	103.80	834.00	835.07	835.51	836.65	0.132082	10.11	10.27	19.26	2.44
BENTON	165	PF 1	103.80	830.10	831.48	831.74	832.32	0.036114	7.32	14.18	20.48	1.55
BENTON	160	PF 1	103.80	828.00	829.07	829.36	829.98	0.049293	7.64	13.59	23.37	1.77
BENTON	155	PF 1	103.80	826.00	827.94	827.96	828.26	0.019705	4.56	22.75	40.92	1.08
BENTON	150	PF 1	103.80	822.00	823.61	824.08	825.53	0.215039	11.11	9.34	20.19	2.88
BENTON	125	PF 1	103.80	819.80	823.96	821.58	823.99	0.000212	1.57	75.43	33.32	0.14
BENTON	100	PF 1	103.80	819.70	823.96		823.98	0.000102	1.54	85.92	32.69	0.13
BENTON	50	PF 1	103.80	819.50	823.96	821.11	823.97	0.000170	1.28	103.65	43.34	0.11
BENTON	40	PF 1	103.80	817.50	823.96	819.48	823.97	0.000060	1.00	132.75	51.22	0.07
BENTON	30	PF 1	103.80	817.00	823.90	818.73	823.96	0.000140	1.88	55.20	50.76	0.13

Headwater Depth for Concrete Pipe Culverts with Inlet Control

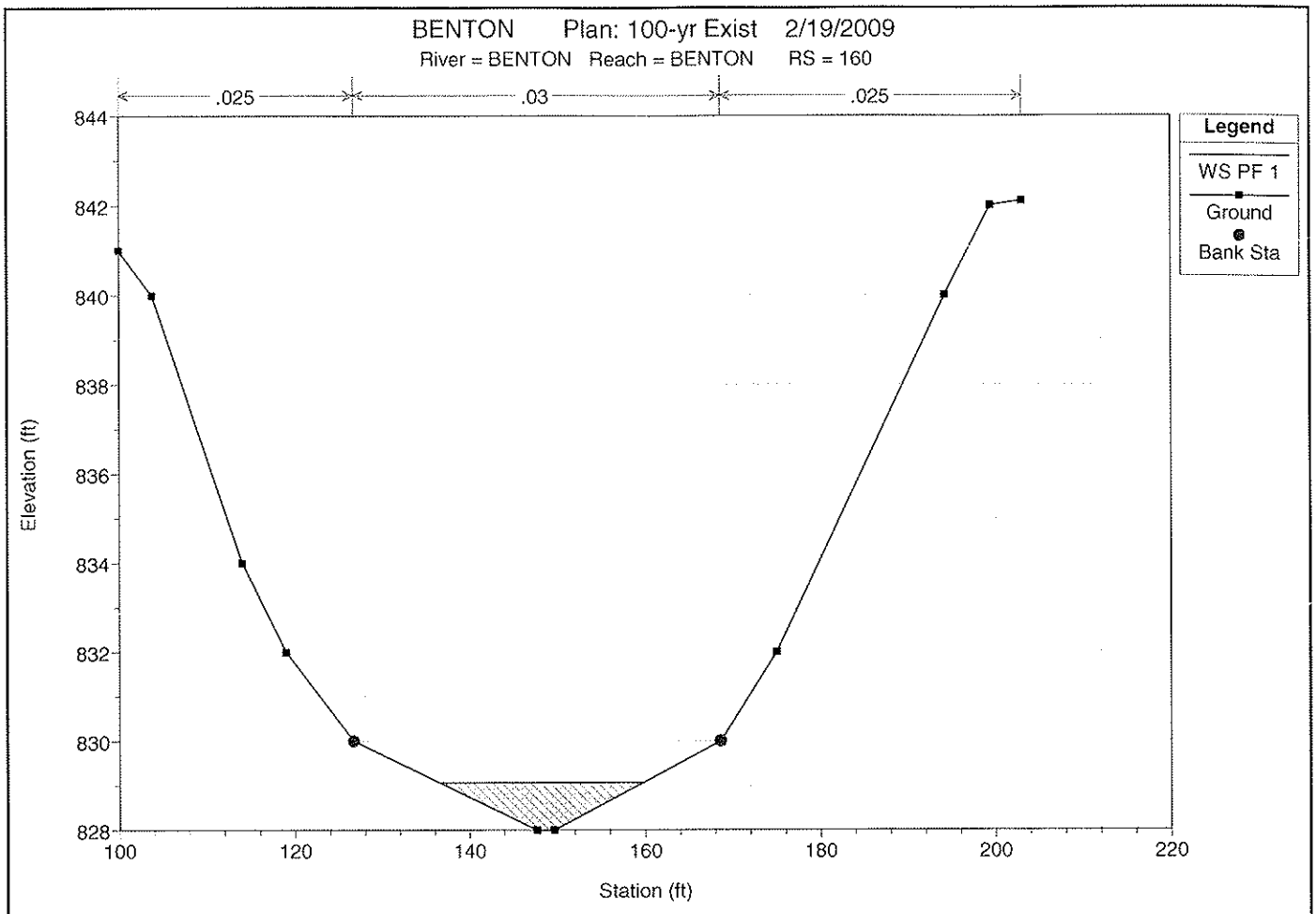
- (•) Square Edge with Headwall
- ( ) Groove End with Headwall
- ( ) Groove End Projecting

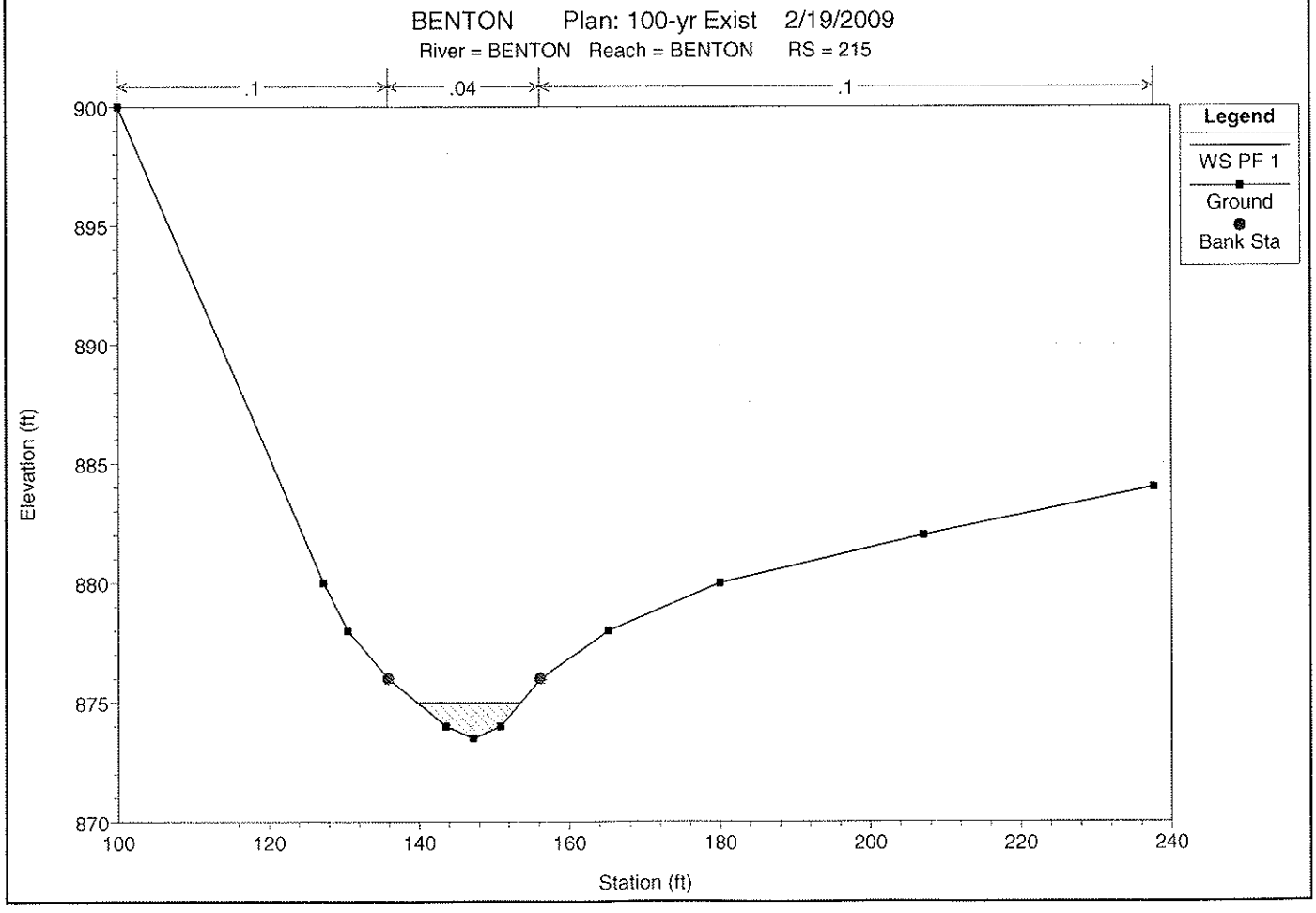
↘	3.110	Critical Depth (ft)
↘	11.490	Critical Velocity (ft/s)
↘	103.8	Q = Discharge (cfs) — 100-YR FLOW
↘	0.02	Culvert Barrel Slope (ft/ft)
↘	3.5	Culvert diameter (ft)
↘	6.943	Headwater (ft)

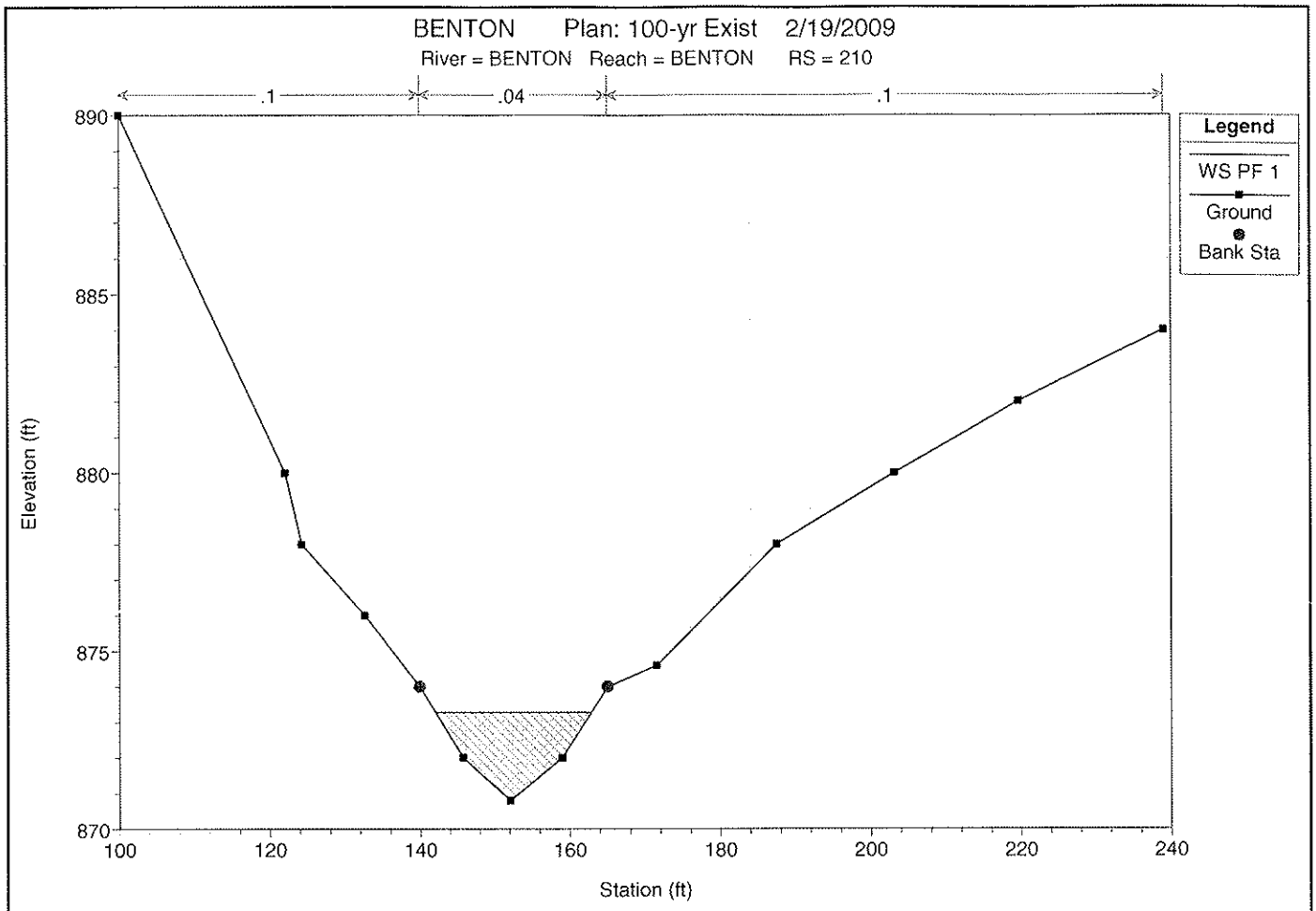
Calc (Critical Depth / Critical Velocity)

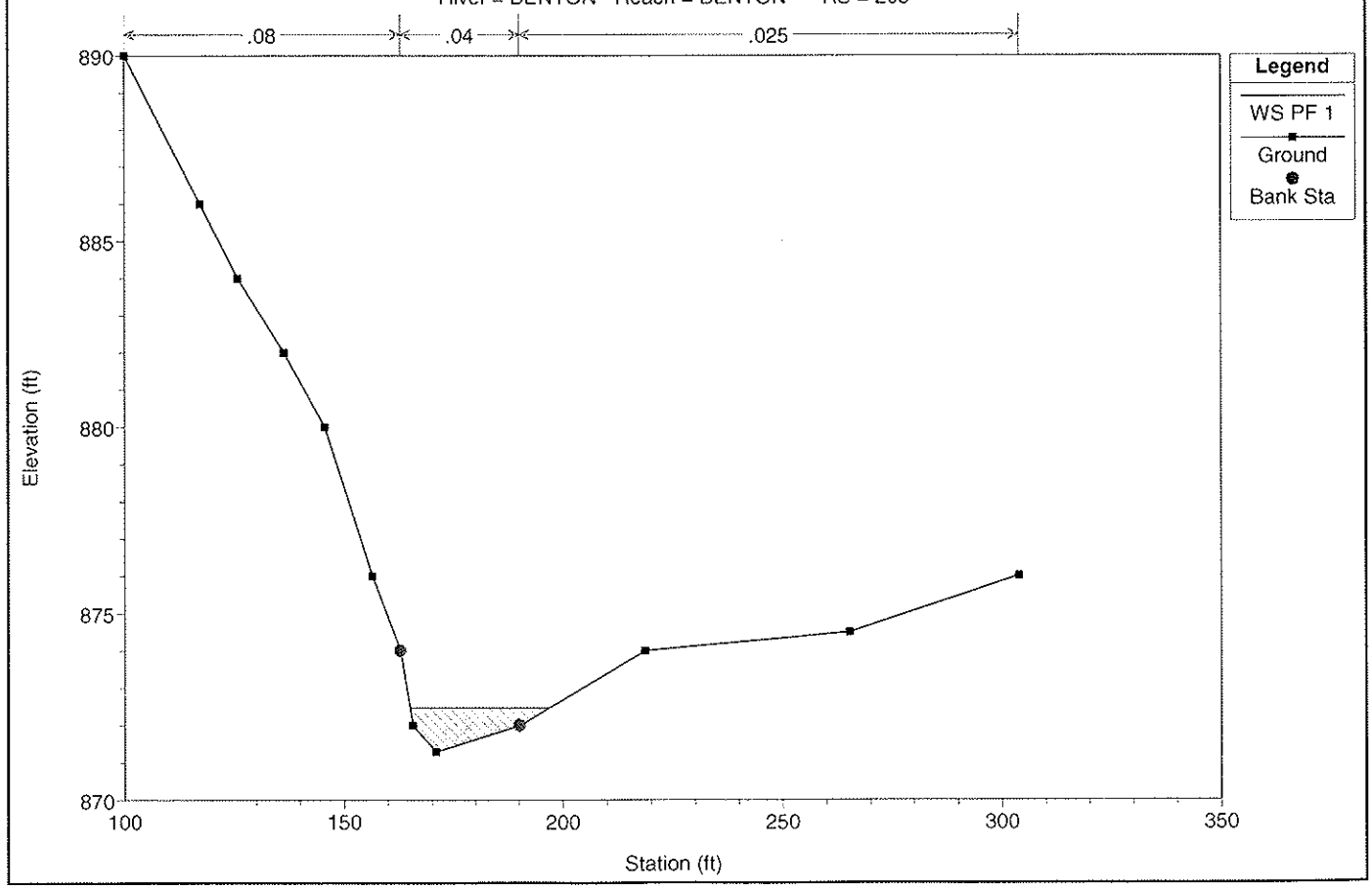
Calc

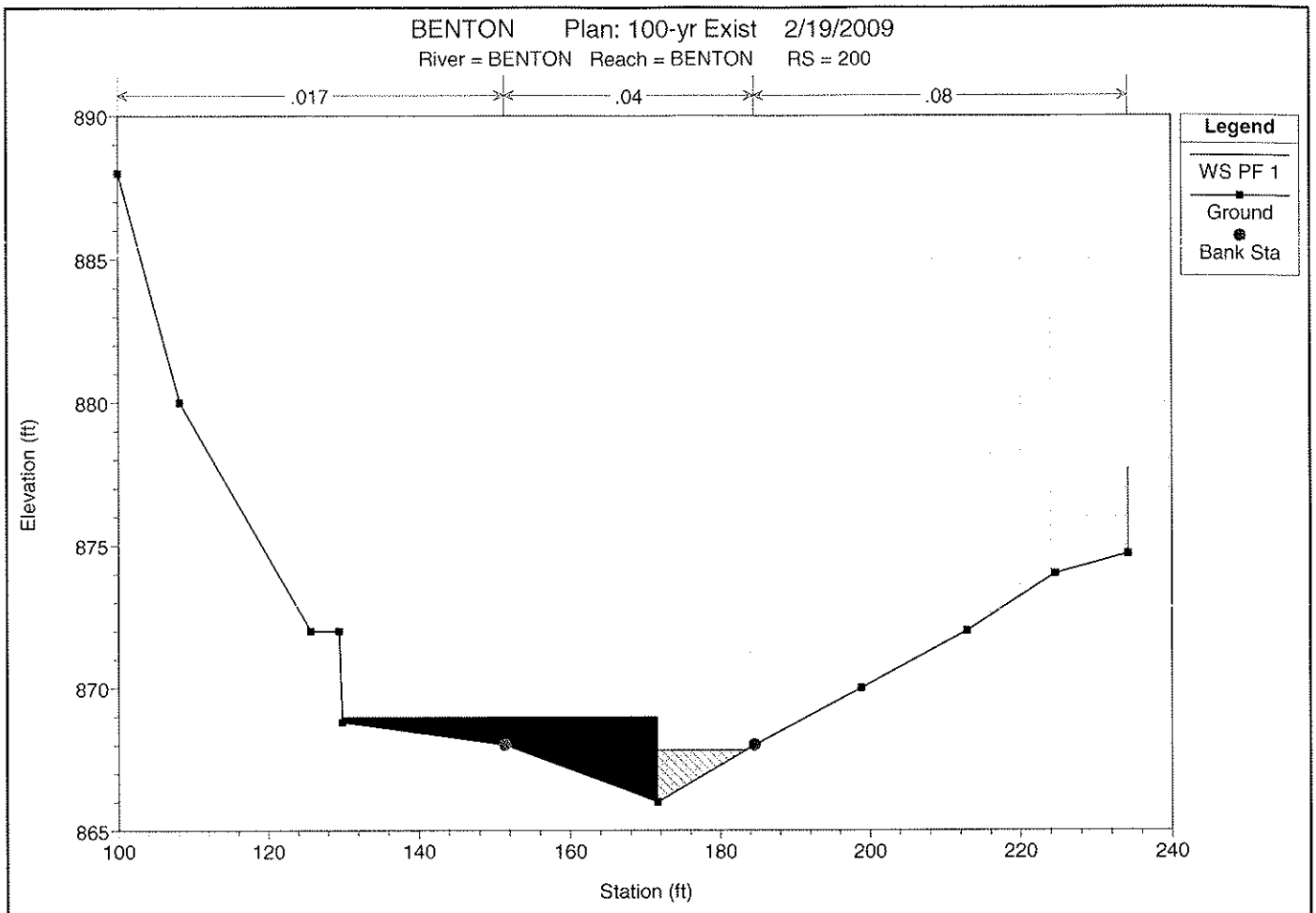
Units: (•) English ( ) Metric

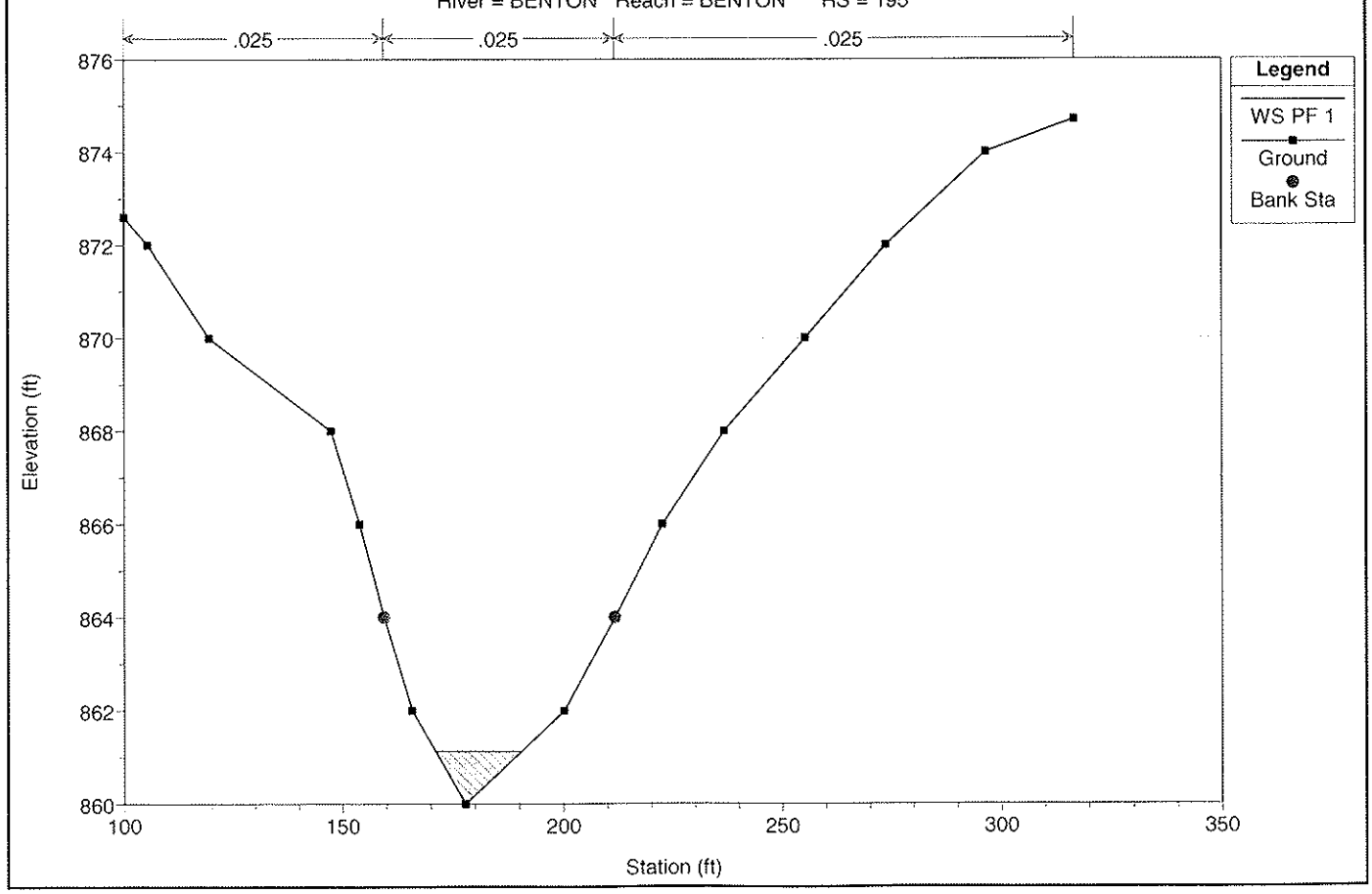

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 160
.025
.03
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
844
842
840
838
836
834
832
830
828
100
120
140
160
180
200
220
Station (ft)

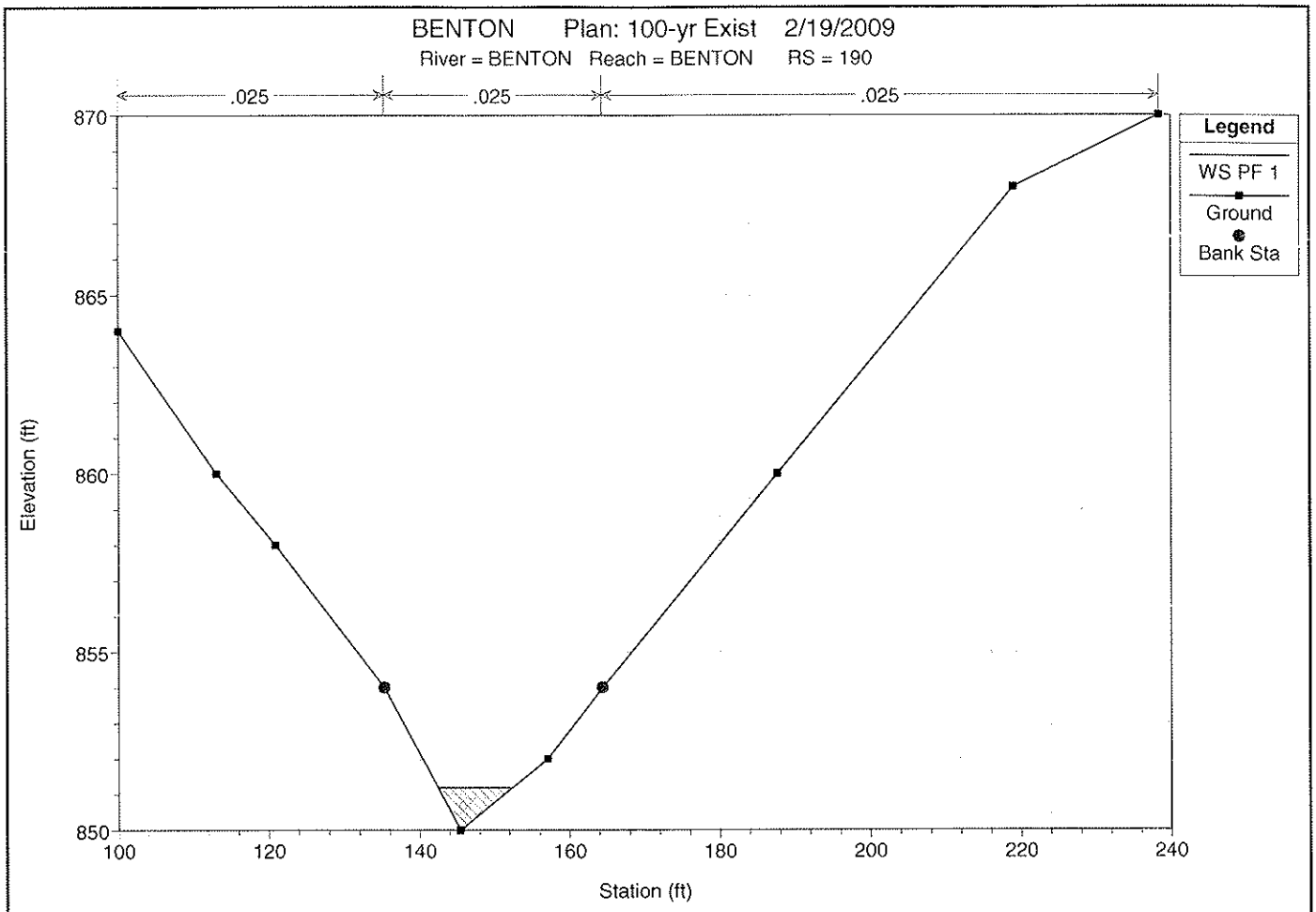

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 215
.1
.04
.1
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
900
895
890
885
880
875
870
100
120
140
160
180
200
220
240
Station (ft)

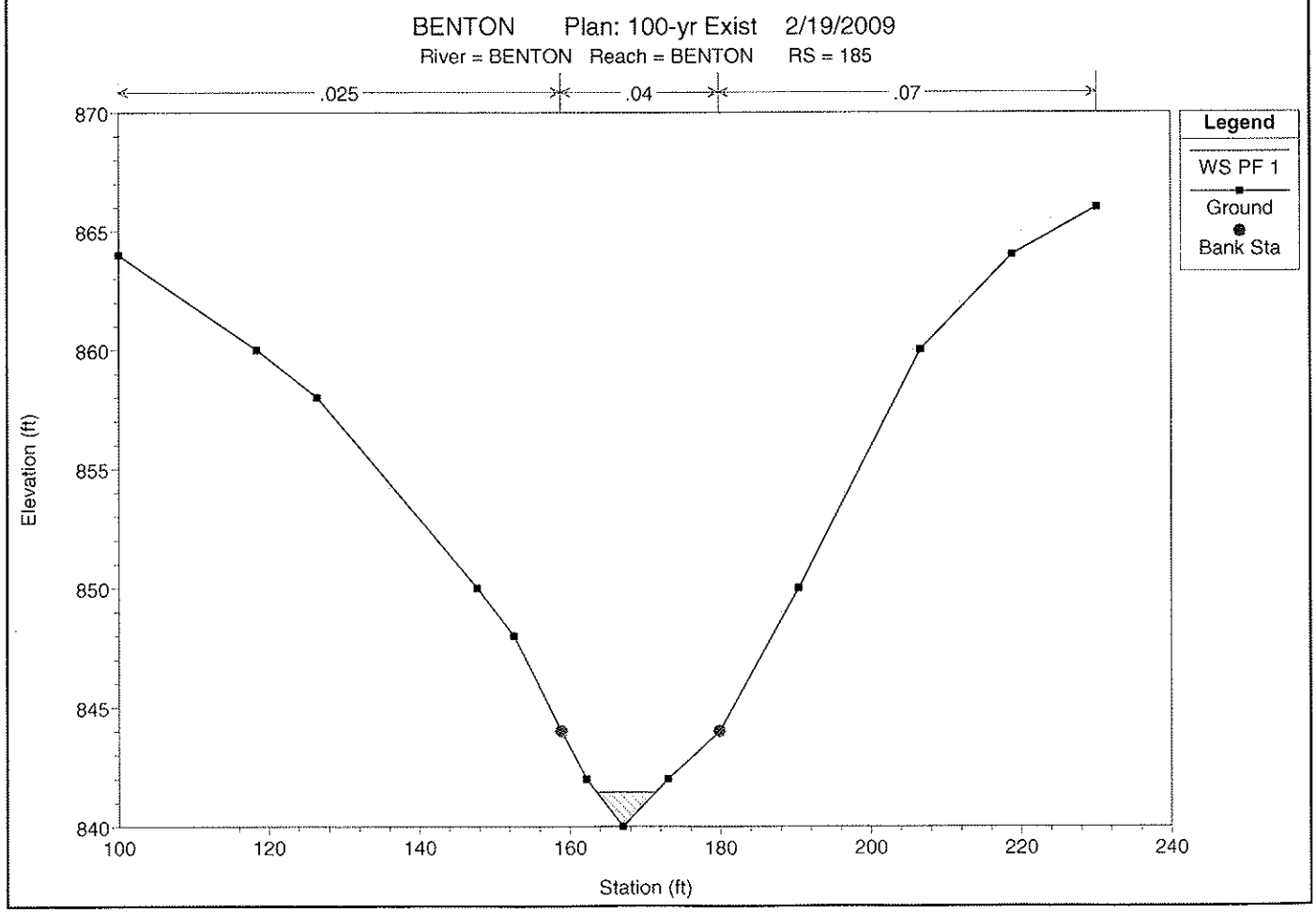

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 210
.1
.04
.1
Legend
WS PF 1
Ground
Bank Sta
890
885
880
875
870
Elevation (ft)
100
120
140
160
180
200
220
240
Station (ft)

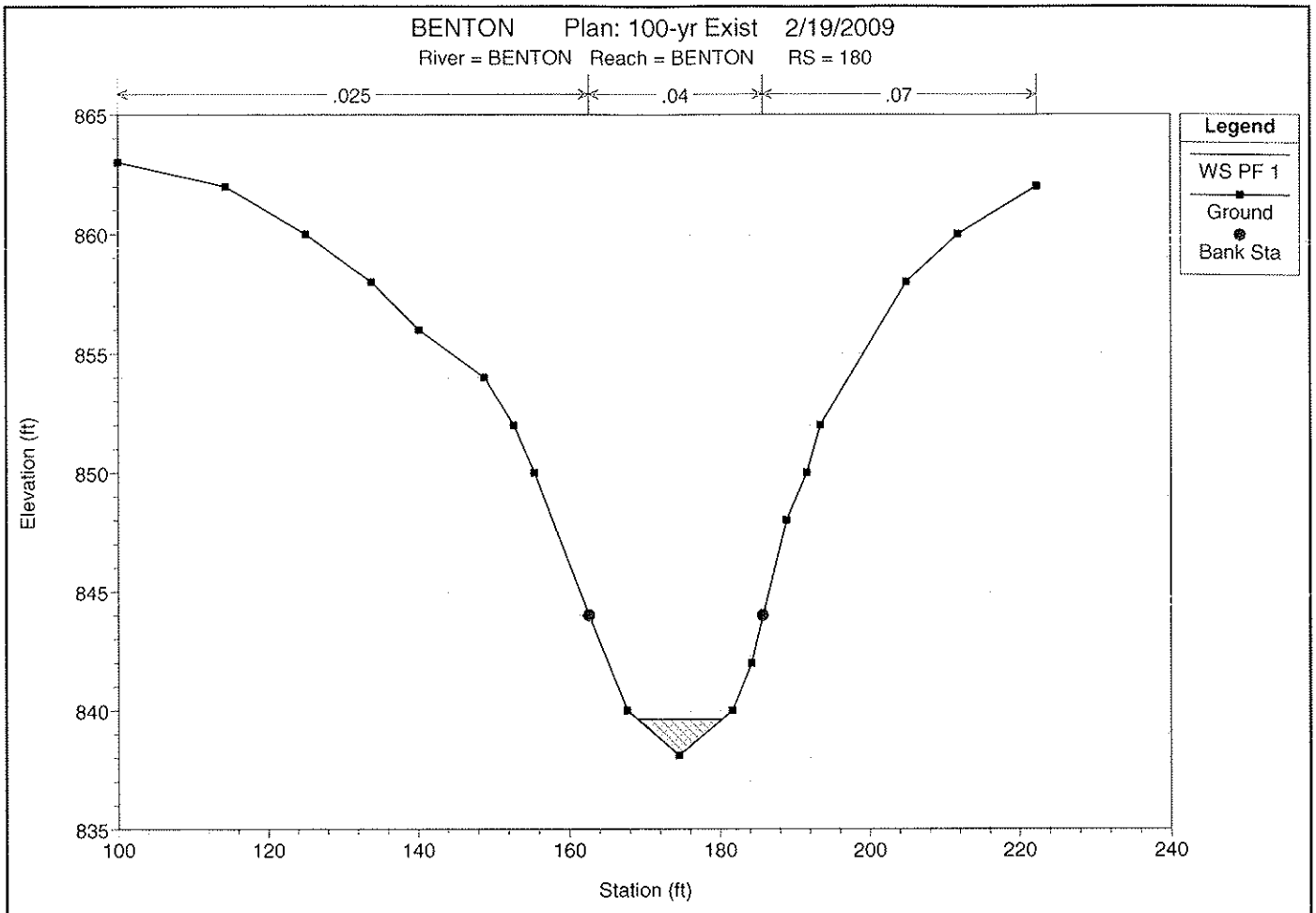

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 205
.08
.04
.025
Legend
WS PF 1
Ground
Bank Sta
890
885
880
875
870
Elevation (ft)
100
150
200
250
300
350
Station (ft)

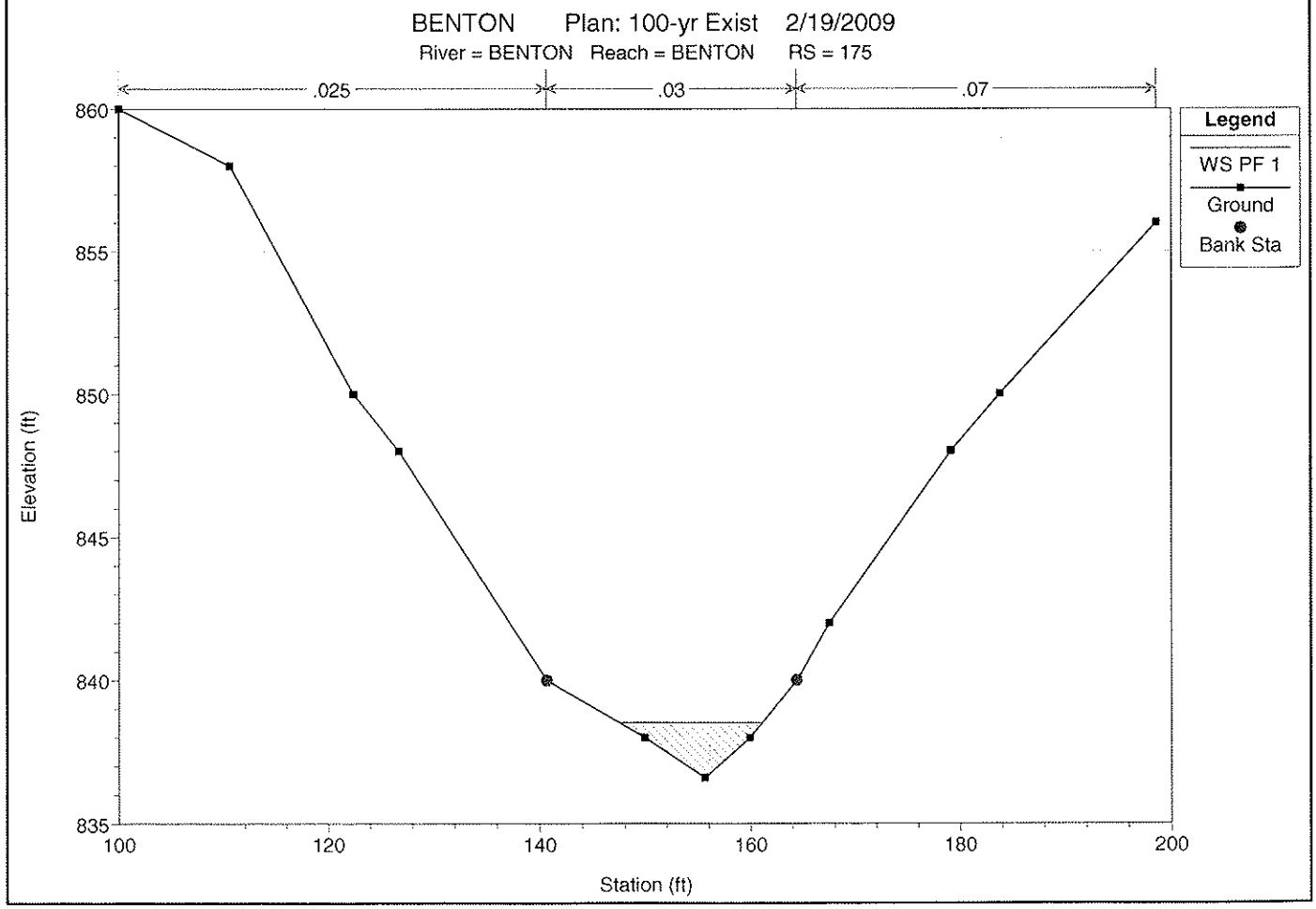

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 200
.017
.04
.08
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
890
885
880
875
870
865
100
120
140
160
180
200
220
240
Station (ft)

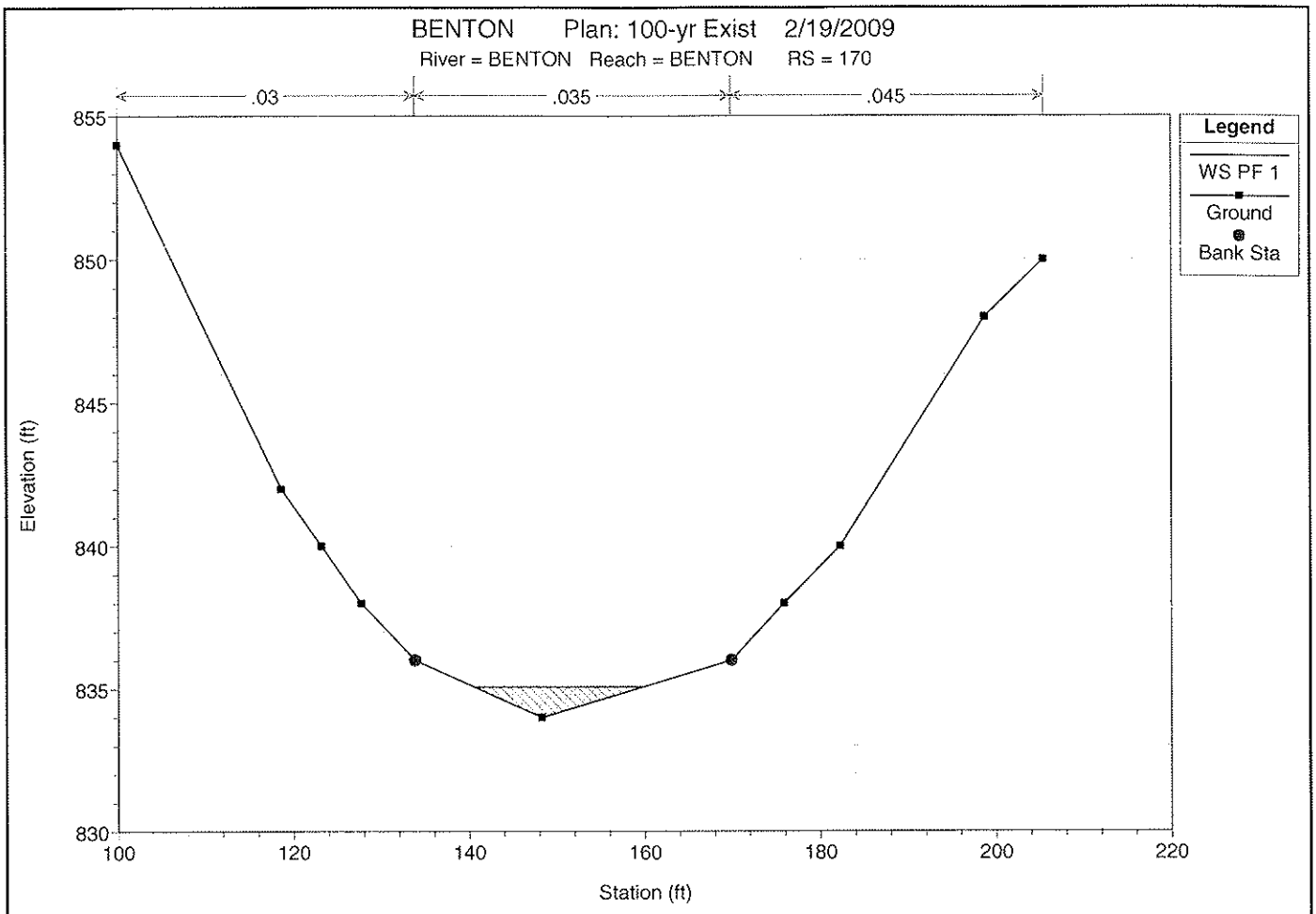

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 195
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
876
874
872
870
868
866
864
862
860
100
150
200
250
300
350
Station (ft)

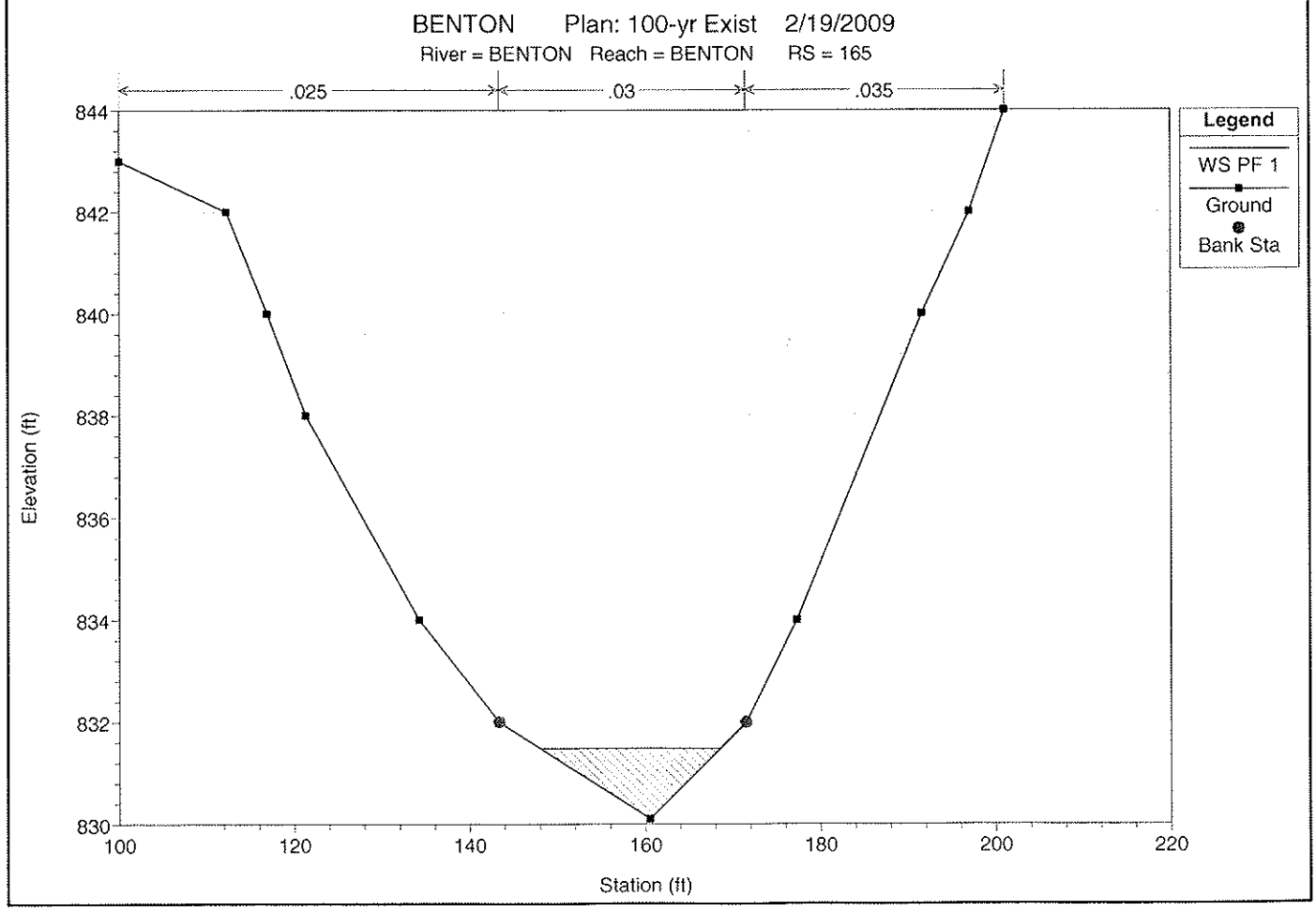

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 190
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
870
865
860
855
850
Elevation (ft)
100
120
140
160
180
200
220
240
Station (ft)

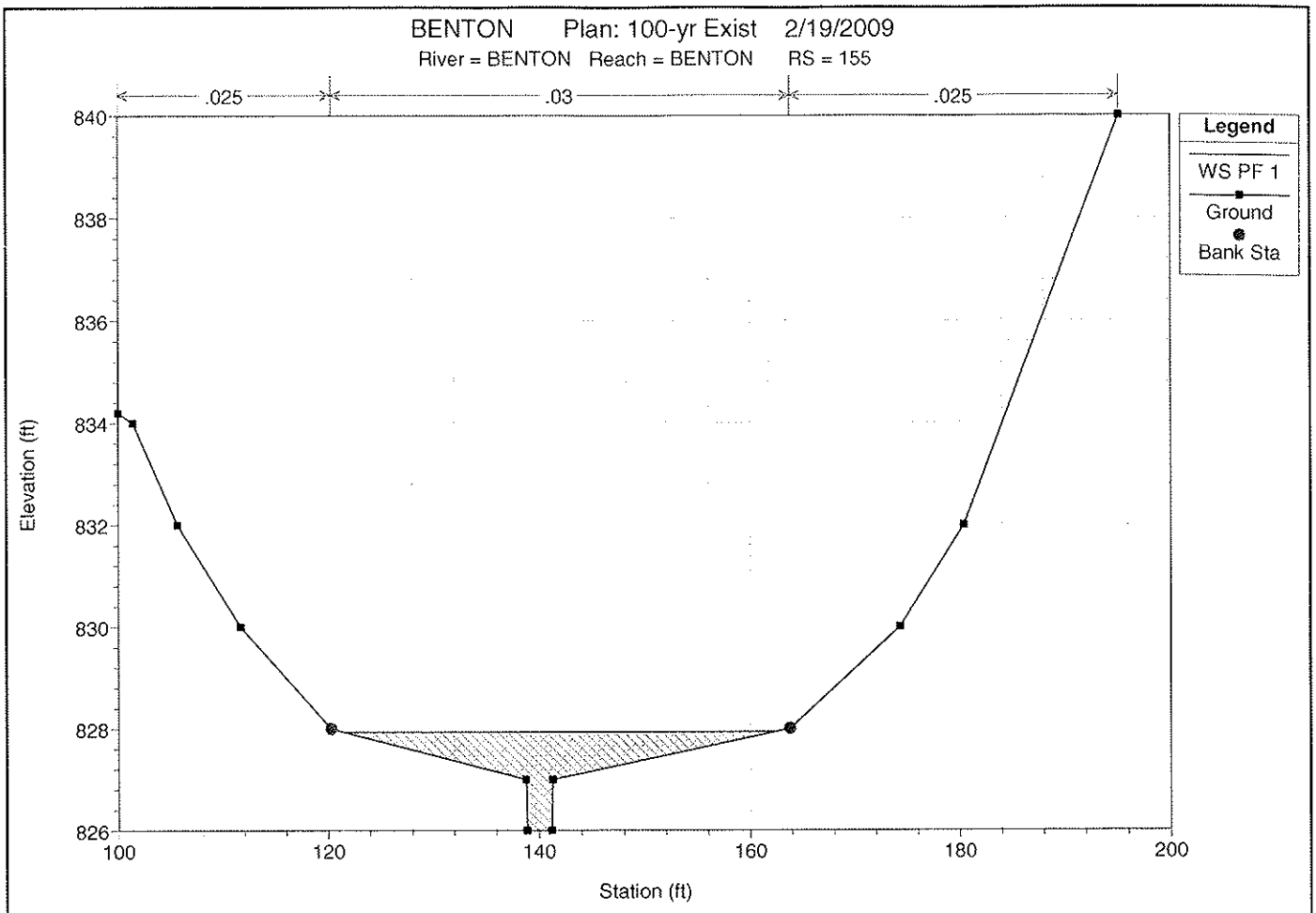

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 185
.025
.04
.07
Legend
WS PF 1
Ground
Bank Sta
870
865
860
855
850
845
840
Elevation (ft)
100
120
140
160
180
200
220
240
Station (ft)

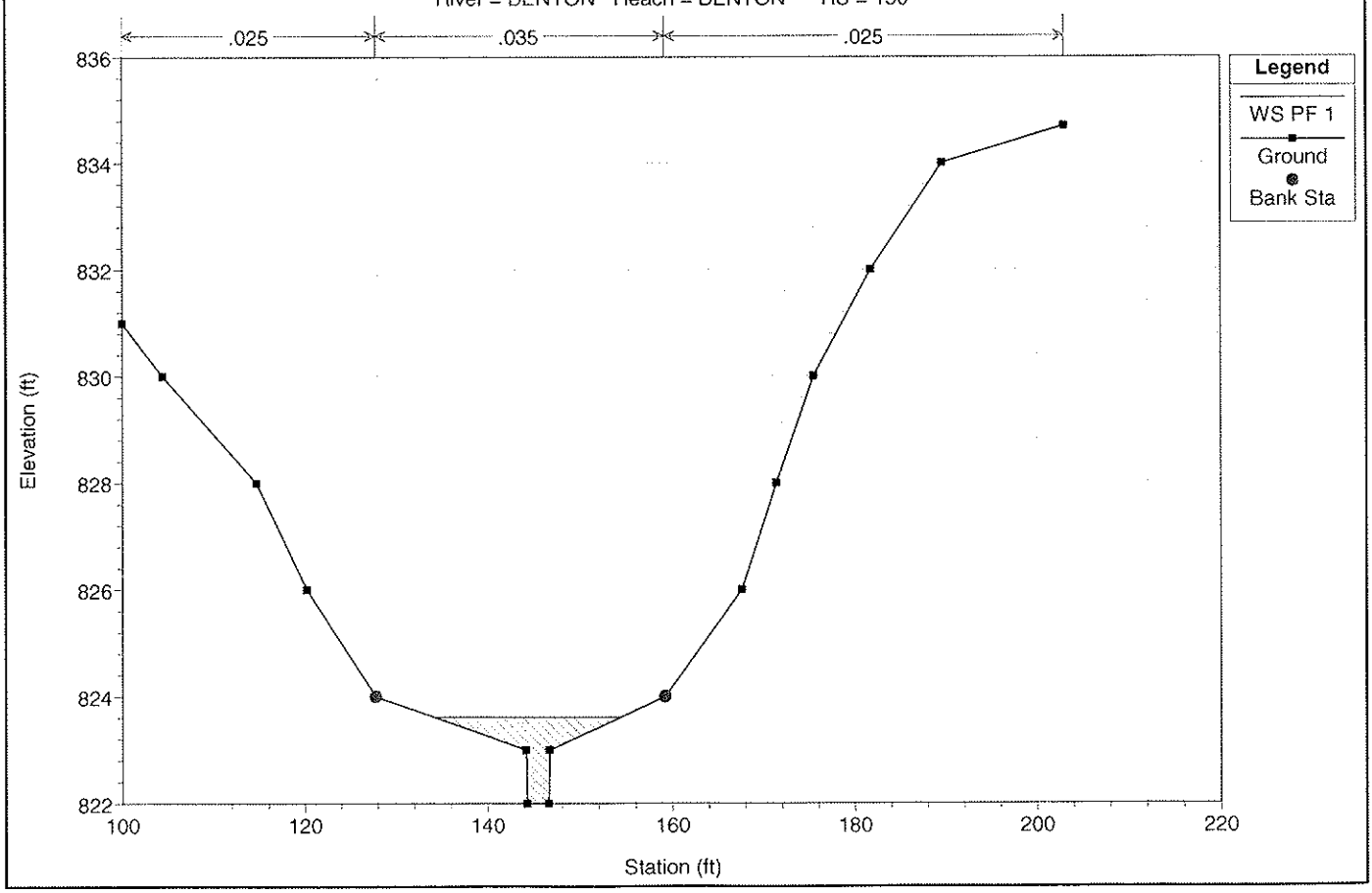

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 180
.025
.04
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
865
860
855
850
845
840
835
100
120
140
160
180
200
220
240

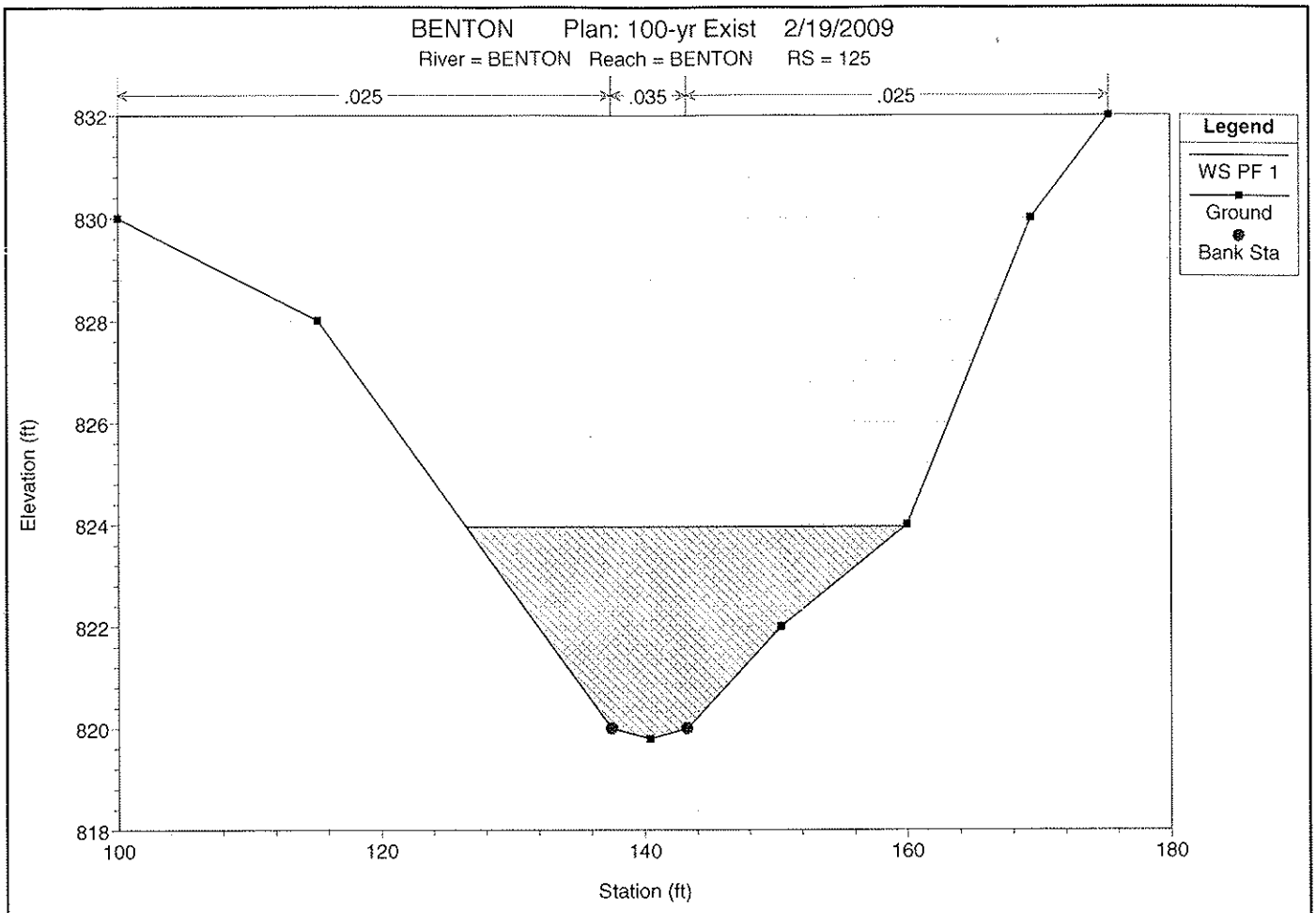

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 175
.025
.03
.07
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
860
855
850
845
840
835
100
120
140
160
180
200

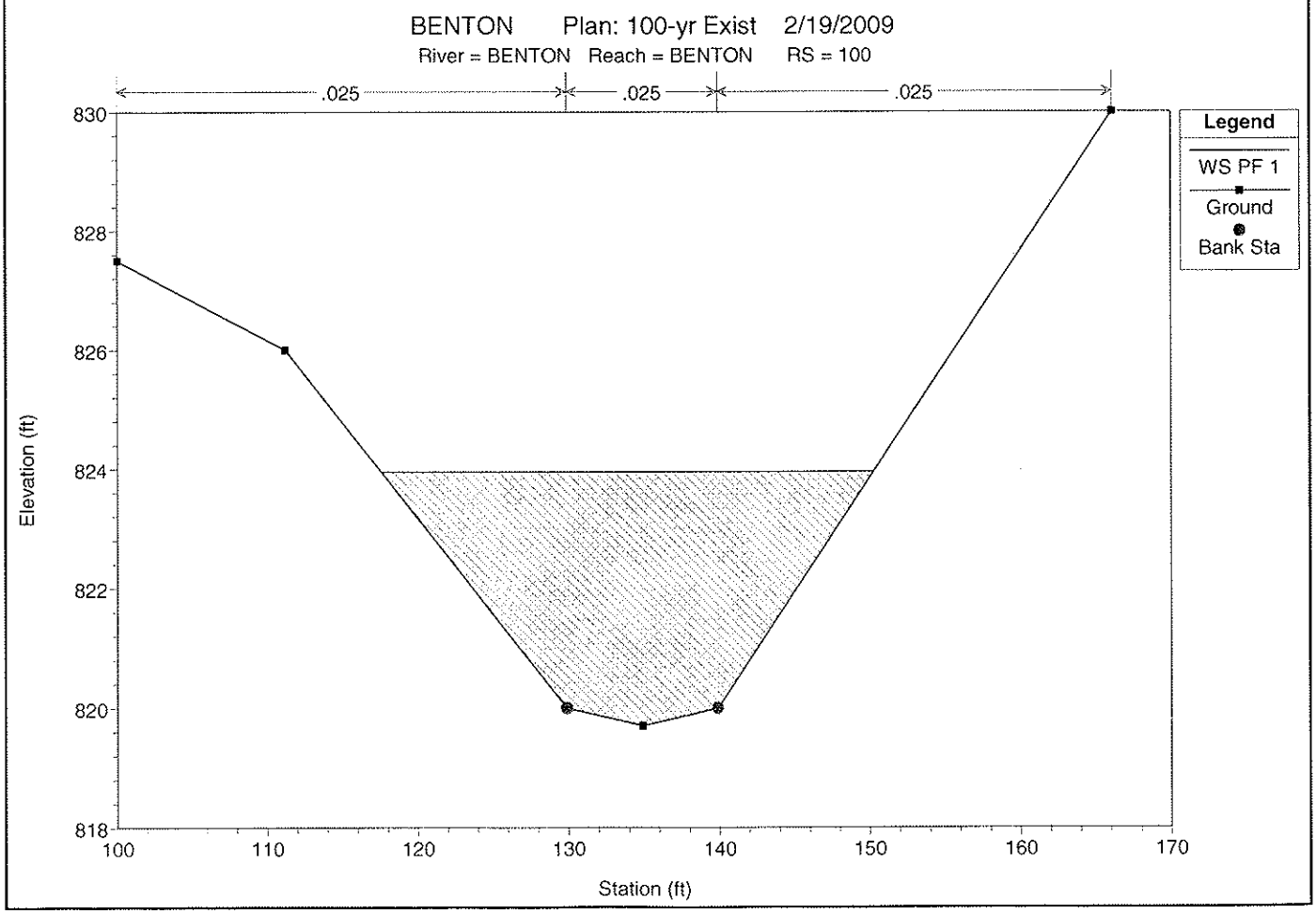

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 170
.03
.035
.045
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
855
850
845
840
835
830
100
120
140
160
180
200
220
Station (ft)

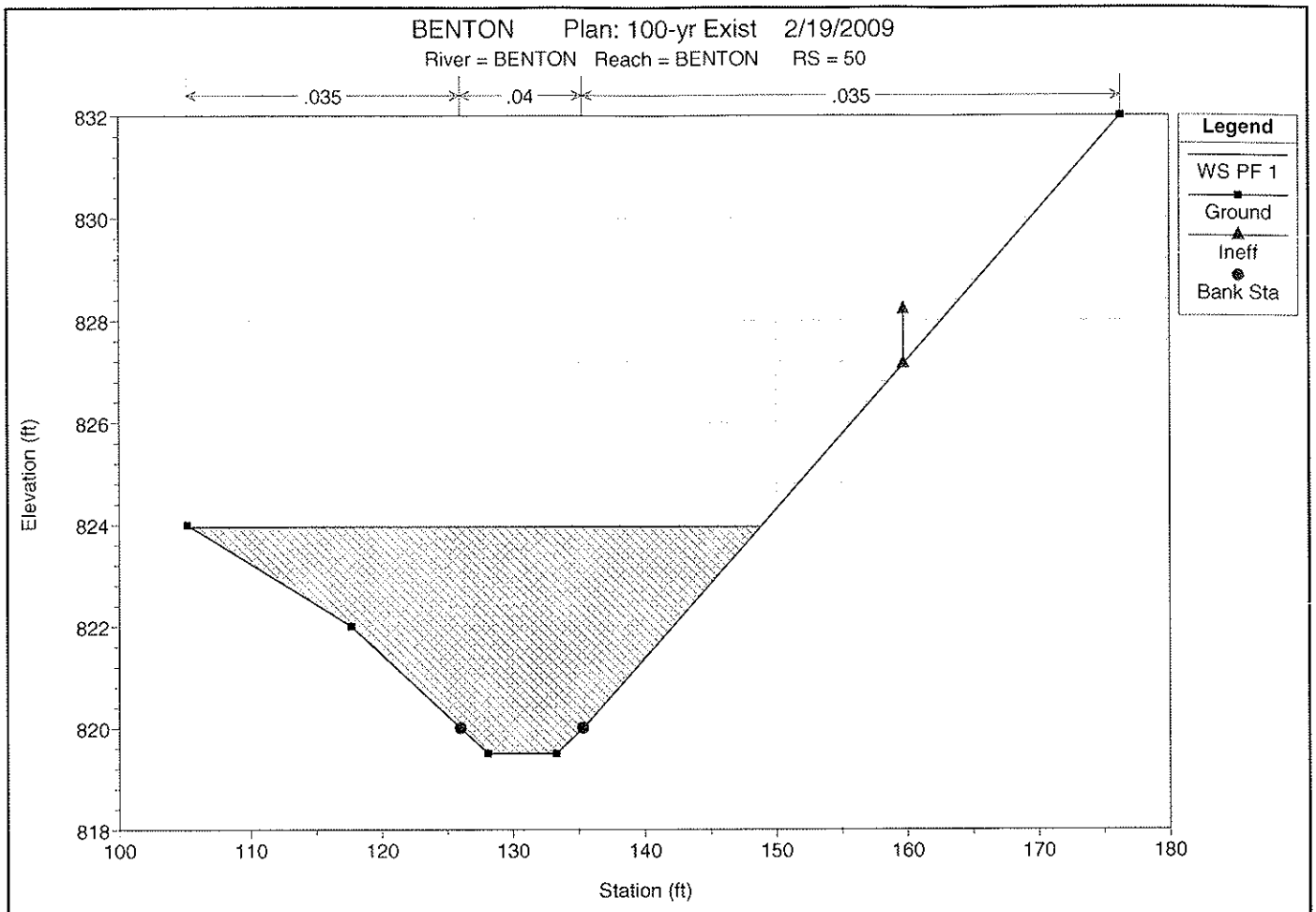

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 165
.025
.03
.035
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
844
842
840
838
836
834
832
830
100
120
140
160
180
200
220
Station (ft)

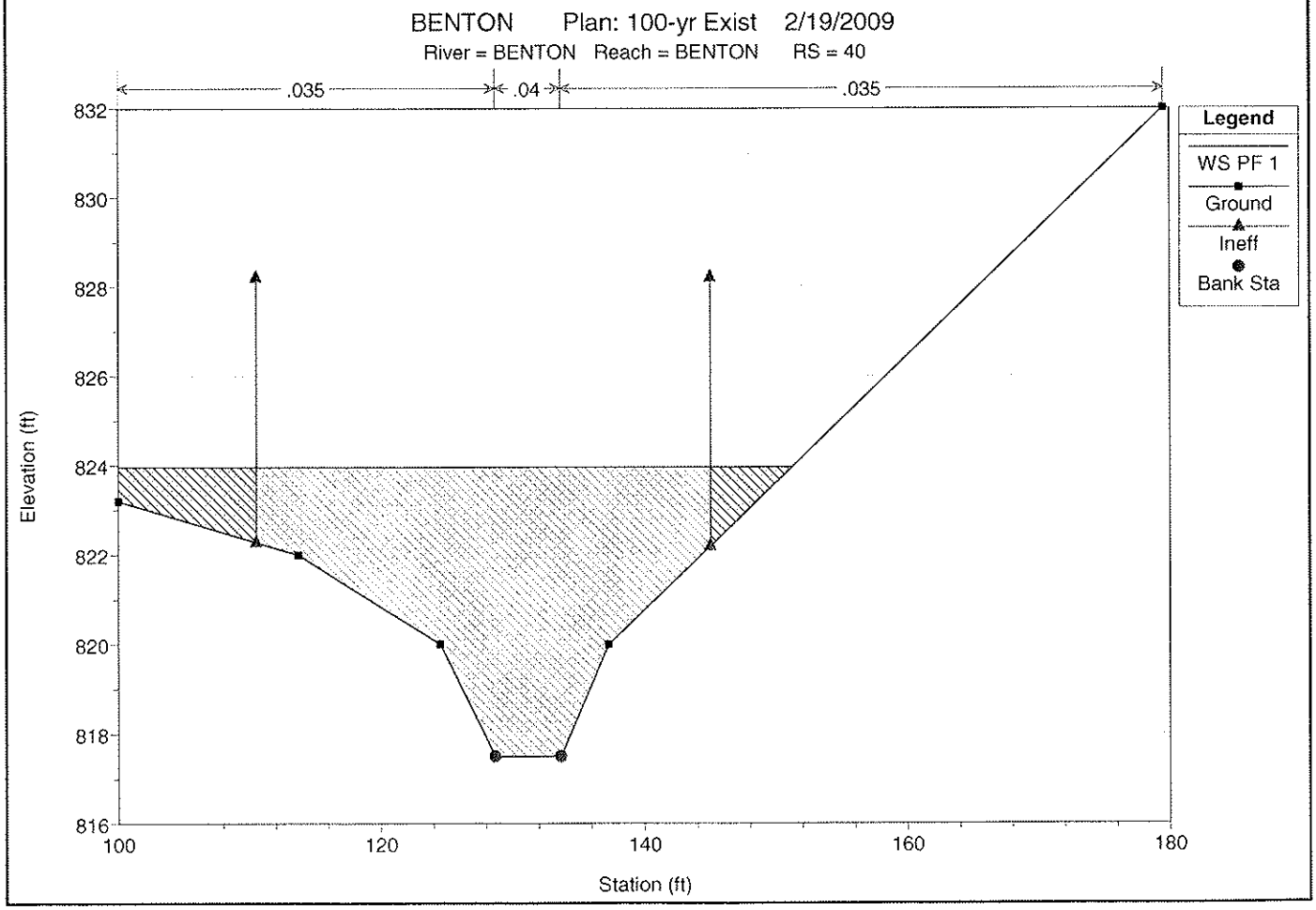

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 155
.025
.03
.025
Legend
WS PF 1
Ground
Bank Sta
840
838
836
834
832
830
828
826
Elevation (ft)
100
120
140
160
180
200
Station (ft)

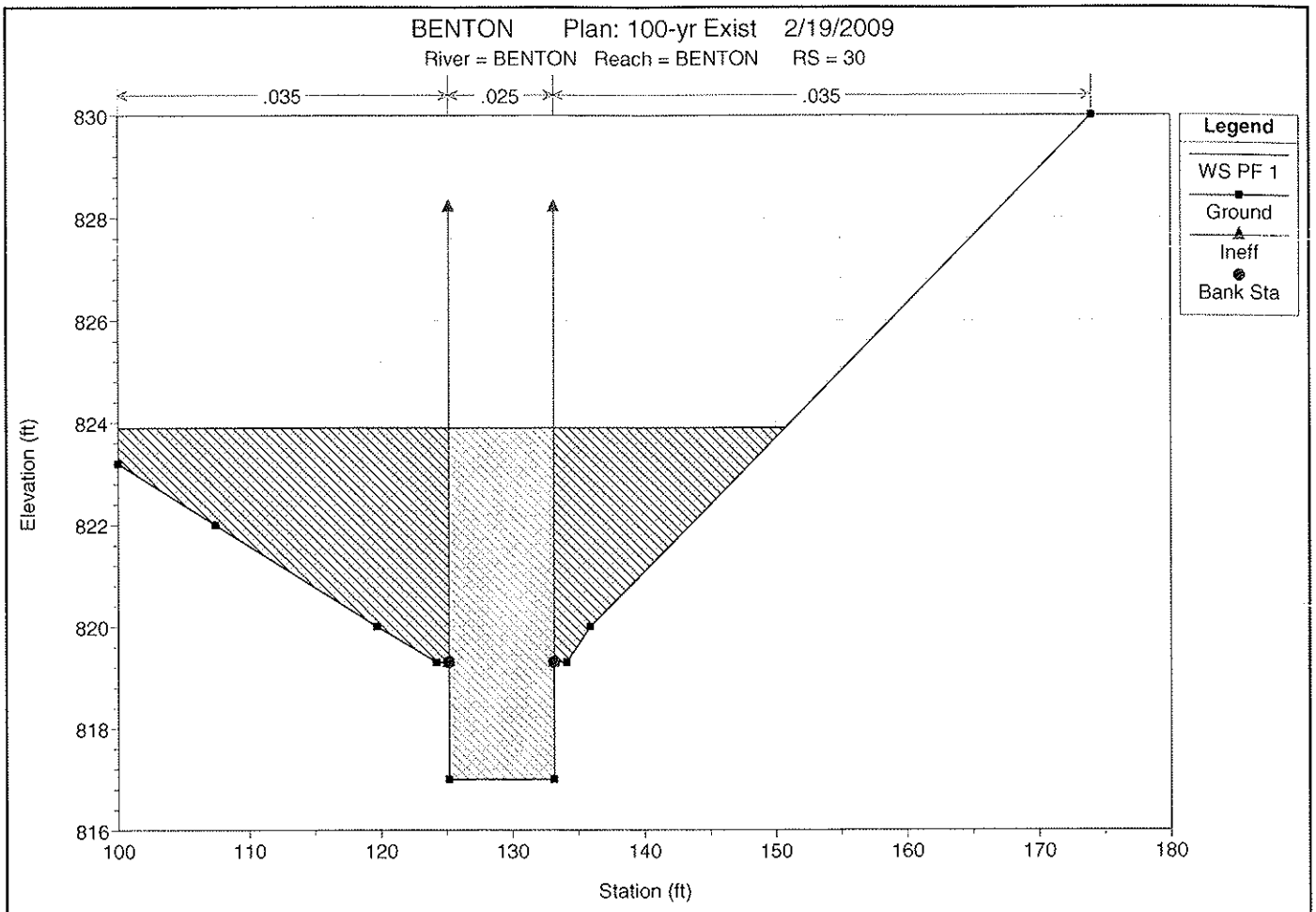

BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 150
.025
.035
.025
Legend
WS PF 1
Ground
Bank Sta
836
834
832
830
828
826
824
822
Elevation (ft)
100
120
140
160
180
200
220
Station (ft)


BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 125
.025
.035
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
100
120
140
160
180
Station (ft)


BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 100
.025
.025
.025
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
830
828
826
824
822
820
818
100
110
120
130
140
150
160
170
Station (ft)


BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 50
.035
.04
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
100
110
120
130
140
150
160
170
180
Station (ft)


BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 40
.035
.04
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
832
830
828
826
824
822
820
818
816
100
120
140
160
180
Station (ft)


BENTON Plan: 100-yr Exist 2/19/2009
River = BENTON Reach = BENTON RS = 30
.035
.025
.035
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
830
828
826
824
822
820
818
816
100
110
120
130
140
150
160
170
180
Station (ft)

HEC-RAS River: BENTON Reach: BENTON Profile: PF 1

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	215	PF 1	2-yr PROP	44.30	873.50	874.54	874.74	875.21	0.060031	6.55	6.76	10.84	1.46
BENTON	215	PF 1	2-yr Exist	44.30	873.50	874.54	874.74	875.21	0.060031	6.55	6.76	10.84	1.46
BENTON	210	PF 1	2-yr PROP	44.30	870.80	872.73	872.10	872.81	0.003524	2.30	19.25	17.60	0.39
BENTON	210	PF 1	2-yr Exist	44.30	870.80	872.75	872.10	872.83	0.003325	2.25	19.65	17.74	0.38
BENTON	205	PF 1	2-yr PROP	44.30	871.30	872.15	872.12	872.35	0.023172	3.55	12.57	27.00	0.89
BENTON	205	PF 1	2-yr Exist	44.30	871.30	872.12	872.12	872.35	0.030134	3.85	11.56	26.41	1.00
BENTON	200	PF 1	2-yr PROP	44.30	868.00	869.62	869.62	870.04	0.031607	5.18	8.54	10.54	1.01
BENTON	200	PF 1	2-yr Exist	44.30	866.00	867.35	867.62	868.23	0.085501	7.53	5.88	8.75	1.62
BENTON	195	PF 1	2-yr PROP	44.30	862.00	862.78	863.10	863.89	0.182678	8.44	5.25	13.43	2.38
BENTON	195	PF 1	2-yr Exist	44.30	860.00	860.82	861.10	861.73	0.054557	7.63	5.80	14.13	2.10
BENTON	190	PF 1	2-yr PROP	44.30	852.00	853.13	853.47	854.20	0.111393	8.29	5.34	9.46	1.94
BENTON	190	PF 1	2-yr Exist	44.30	850.00	850.82	851.47	854.60	0.234641	15.60	2.84	6.90	4.28
BENTON	185	PF 1	2-yr PROP	44.30	842.00	843.01	843.75	846.96	0.495862	15.94	2.78	5.48	3.94
BENTON	185	PF 1	2-yr Exist	44.30	840.00	841.06	841.75	844.36	0.390683	14.57	3.04	5.73	3.53
BENTON	180	PF 1	2-yr PROP	44.30	840.10	841.26	841.64	842.50	0.125704	8.94	4.95	8.54	2.07
BENTON	180	PF 1	2-yr Exist	44.30	838.10	839.27	839.64	840.47	0.120072	8.79	5.04	8.62	2.03
BENTON	175	PF 1	2-yr PROP	44.30	838.60	840.16	840.17	840.56	0.027443	5.09	8.70	11.10	1.01
BENTON	175	PF 1	2-yr Exist	44.30	836.60	838.03	838.17	838.60	0.024245	6.03	7.35	10.24	1.25
BENTON	170	PF 1	2-yr PROP	44.30	836.00	836.80	837.07	837.71	0.146053	7.67	5.77	14.43	2.14
BENTON	170	PF 1	2-yr Exist	44.30	834.00	834.75	835.08	835.91	0.152200	8.61	5.14	13.63	2.47
BENTON	165	PF 1	2-yr PROP	44.30	832.10	833.24	833.27	833.57	0.032672	4.59	9.65	16.89	1.07
BENTON	165	PF 1	2-yr Exist	44.30	830.10	831.12	831.27	831.63	0.033300	5.74	7.72	15.11	1.42
BENTON	160	PF 1	2-yr PROP	44.30	829.20	829.93	830.14	830.59	0.100676	6.50	6.82	16.60	1.79
BENTON	160	PF 1	2-yr Exist	44.30	828.00	828.75	828.94	829.36	0.051198	6.25	7.09	16.93	1.70
BENTON	155	PF 1	2-yr PROP	44.30	827.50	828.22	828.22	828.42	0.032871	3.58	12.39	31.97	1.01
BENTON	155	PF 1	2-yr Exist	44.30	826.00	827.63	827.63	827.84	0.018149	3.64	12.18	28.43	0.98
BENTON	153	PF 1	2-yr PROP	44.30	824.00	824.35	824.61	825.36	0.291054	8.06	5.52	22.22	2.81

HEC-RAS River: BENTON Reach: BENTON Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	150	PF 1	2-yr PROP	44.30	822.00	823.62	823.69	823.96	0.036825	4.63	9.57	20.52	1.19
BENTON	150	PF 1	2-yr Exist	44.30	822.00	823.27	823.69	825.06	0.268450	10.72	4.13	10.31	2.99
BENTON	125	PF 1	2-yr PROP	44.30	819.80	820.55	820.96	821.99	0.098561	9.98	4.67	9.21	2.18
BENTON	125	PF 1	2-yr Exist	44.30	819.80	820.67	820.96	821.59	0.050297	8.01	5.85	10.00	1.60
BENTON	100	PF 1	2-yr PROP	44.30	819.70	820.99	820.68	821.16	0.002800	3.43	14.19	15.67	0.57
BENTON	100	PF 1	2-yr Exist	44.30	819.70	820.99	820.68	821.16	0.002800	3.43	14.19	15.67	0.57
BENTON	50	PF 1	2-yr PROP	44.30	819.50	820.51	820.51	820.88	0.021065	4.99	9.39	13.18	0.93
BENTON	50	PF 1	2-yr Exist	44.30	819.50	820.51	820.51	820.88	0.021065	4.99	9.39	13.18	0.93
BENTON	40	PF 1	2-yr PROP	44.30	817.50	820.10	818.71	820.16	0.001043	2.27	23.55	13.68	0.25
BENTON	40	PF 1	2-yr Exist	44.30	817.50	820.10	818.71	820.16	0.001043	2.27	23.55	13.68	0.25
BENTON	30	PF 1	2-yr PROP	44.30	817.00	820.10	817.99	820.15	0.000366	1.79	24.80	17.20	0.18
BENTON	30	PF 1	2-yr Exist	44.30	817.00	820.10	817.99	820.15	0.000366	1.79	24.80	17.20	0.18

HEC-RAS River: BENTON Reach: BENTON Profile: PF 1

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	215	PF 1	10-yr PROP	68.90	873.50	874.76	875.02	875.62	0.060045	7.44	9.27	12.25	1.51
BENTON	215	PF 1	10-yr Exist	68.90	873.50	874.76	875.02	875.62	0.060045	7.44	9.27	12.25	1.51
BENTON	210	PF 1	10-yr PROP	68.90	870.80	872.99	872.35	873.12	0.004566	2.87	24.03	19.14	0.45
BENTON	210	PF 1	10-yr Exist	68.90	870.80	873.01	872.35	873.13	0.004367	2.82	24.41	19.26	0.44
BENTON	205	PF 1	10-yr PROP	68.90	871.30	872.32	872.28	872.57	0.021199	4.07	17.19	29.56	0.89
BENTON	205	PF 1	10-yr Exist	68.90	871.30	872.28	872.28	872.57	0.025782	4.33	16.13	28.99	0.97
BENTON	200	PF 1	10-yr PROP	68.90	868.00	869.94	869.94	870.43	0.029478	5.64	12.22	12.60	1.01
BENTON	200	PF 1	10-yr Exist	68.90	866.00	867.57	867.94	868.72	0.091295	8.62	7.99	10.19	1.72
BENTON	195	PF 1	10-yr PROP	68.90	862.00	862.90	863.31	864.39	0.202105	9.79	7.04	15.56	2.57
BENTON	195	PF 1	10-yr Exist	68.90	860.00	860.97	861.31	862.09	0.053585	8.47	8.14	16.73	2.14
BENTON	190	PF 1	10-yr PROP	68.90	852.00	853.35	853.75	854.61	0.103873	9.02	7.64	11.31	1.93
BENTON	190	PF 1	10-yr Exist	68.90	850.00	850.99	851.75	855.29	0.207297	16.63	4.14	8.33	4.15
BENTON	185	PF 1	10-yr PROP	68.90	842.00	843.22	844.08	847.83	0.455200	17.23	4.00	6.57	3.89
BENTON	185	PF 1	10-yr Exist	68.90	840.00	841.24	842.08	845.58	0.420457	16.73	4.12	6.67	3.75
BENTON	180	PF 1	10-yr PROP	68.90	840.10	841.44	841.94	843.13	0.141330	10.44	6.60	9.86	2.25
BENTON	180	PF 1	10-yr Exist	68.90	838.10	839.44	839.94	841.11	0.138477	10.36	6.65	9.90	2.23
BENTON	175	PF 1	10-yr PROP	68.90	838.60	840.45	840.46	840.95	0.027155	5.68	12.14	13.05	1.04
BENTON	175	PF 1	10-yr Exist	68.90	836.60	838.28	838.47	839.01	0.025557	6.88	10.02	11.89	1.32
BENTON	170	PF 1	10-yr PROP	68.90	836.00	836.95	837.28	838.08	0.144841	8.54	8.06	17.06	2.19
BENTON	170	PF 1	10-yr Exist	68.90	834.00	834.90	835.29	836.27	0.142769	9.39	7.34	16.27	2.46
BENTON	165	PF 1	10-yr PROP	68.90	832.10	833.44	833.49	833.86	0.033146	5.24	13.18	19.75	1.11
BENTON	165	PF 1	10-yr Exist	68.90	830.10	831.30	831.49	831.95	0.034580	6.50	10.60	17.71	1.48
BENTON	160	PF 1	10-yr PROP	68.90	829.20	830.09	830.34	830.89	0.097244	7.17	9.61	19.66	1.81
BENTON	160	PF 1	10-yr Exist	68.90	828.00	828.90	829.14	829.65	0.050297	6.94	9.93	20.00	1.74
BENTON	155	PF 1	10-yr PROP	68.90	827.50	828.37	828.37	828.61	0.030895	3.90	17.65	38.12	1.01
BENTON	155	PF 1	10-yr Exist	68.90	826.00	827.76	827.79	828.04	0.021319	4.27	16.12	33.64	1.09
BENTON	153	PF 1	10-yr PROP	68.90	824.00	824.44	824.77	825.73	0.260316	9.14	7.58	23.55	2.78
BENTON	150	PF 1	10-yr PROP	68.90	822.00	823.77	823.89	824.21	0.041315	5.33	12.93	24.80	1.30
BENTON	150	PF 1	10-yr Exist	68.90	822.00	823.46	823.89	825.14	0.221984	10.40	6.62	15.82	2.83

HEC-RAS River: BENTON Reach: BENTON Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	125	PF 1	10-yr PROP	68.90	819.80	820.78	821.25	822.34	0.072771	10.51	6.97	10.69	1.97
BENTON	125	PF 1	10-yr Exist	68.90	819.80	820.88	821.25	822.06	0.048175	9.16	8.02	11.30	1.63
BENTON	100	PF 1	10-yr PROP	68.90	819.70	821.48	820.93	821.64	0.001773	3.46	22.60	18.50	0.48
BENTON	100	PF 1	10-yr Exist	68.90	819.70	821.48	820.93	821.64	0.001773	3.46	22.60	18.50	0.48
BENTON	50	PF 1	10-yr PROP	68.90	819.50	821.39	820.79	821.54	0.003686	3.29	23.88	19.83	0.43
BENTON	50	PF 1	10-yr Exist	68.90	819.50	821.39	820.79	821.54	0.003686	3.29	23.88	19.83	0.43
BENTON	40	PF 1	10-yr PROP	68.90	817.50	821.43	819.07	821.47	0.000417	1.89	49.70	25.56	0.17
BENTON	40	PF 1	10-yr Exist	68.90	817.50	821.43	819.07	821.47	0.000417	1.89	49.70	25.56	0.17
BENTON	30	PF 1	10-yr PROP	68.90	817.00	821.40	818.32	821.46	0.000276	1.96	35.20	30.14	0.16
BENTON	30	PF 1	10-yr Exist	68.90	817.00	821.40	818.32	821.46	0.000276	1.96	35.20	30.14	0.16

HEC-RAS River: BENTON Reach: BENTON Profile: PF 1

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	215	PF 1	50 YR PROP	87.80	873.50	874.90	875.20	875.88	0.060042	7.96	11.03	13.15	1.53
BENTON	215	PF 1	50-yr Exist	87.80	873.50	874.90	875.20	875.88	0.060042	7.96	11.03	13.15	1.53
BENTON	210	PF 1	50 YR PROP	87.80	870.80	873.15	872.52	873.31	0.005283	3.24	27.12	20.07	0.49
BENTON	210	PF 1	50-yr Exist	87.80	870.80	873.17	872.52	873.33	0.005060	3.19	27.55	20.19	0.48
BENTON	205	PF 1	50 YR PROP	87.80	871.30	872.42	872.39	872.72	0.020290	4.38	20.43	31.23	0.89
BENTON	205	PF 1	50-yr Exist	87.80	871.30	872.39	872.39	872.71	0.023879	4.62	19.36	30.69	0.95
BENTON	200	PF 1	50 YR PROP	87.80	868.00	870.13	870.13	870.68	0.027623	6.00	14.69	13.90	1.00
BENTON	200	PF 1	50-yr Exist	87.80	866.00	867.71	868.11	869.03	0.092540	9.20	9.54	11.14	1.75
BENTON	195	PF 1	50 YR PROP	87.80	862.00	862.98	863.44	864.77	0.219870	10.74	8.18	16.77	2.71
BENTON	195	PF 1	50-yr Exist	87.80	860.00	861.06	861.44	862.33	0.054106	9.03	9.72	18.29	2.18
BENTON	190	PF 1	50 YR PROP	87.80	852.00	853.49	853.93	854.87	0.099028	9.41	9.33	12.50	1.92
BENTON	190	PF 1	50-yr Exist	87.80	850.00	851.11	851.93	855.65	0.190506	17.11	5.13	9.27	4.05
BENTON	185	PF 1	50 YR PROP	87.80	842.00	843.35	844.29	848.36	0.432988	17.97	4.89	7.26	3.86
BENTON	185	PF 1	50-yr Exist	87.80	840.00	841.35	842.29	846.32	0.427993	17.89	4.91	7.28	3.84
BENTON	180	PF 1	50 YR PROP	87.80	840.10	841.55	842.11	843.55	0.150422	11.35	7.74	10.68	2.35
BENTON	180	PF 1	50-yr Exist	87.80	838.10	839.55	840.11	841.55	0.149917	11.34	7.75	10.68	2.35
BENTON	175	PF 1	50 YR PROP	87.80	838.60	840.61	840.64	841.19	0.026969	6.14	14.32	14.15	1.05
BENTON	175	PF 1	50-yr Exist	87.80	836.60	838.42	838.65	839.28	0.026776	7.44	11.79	12.87	1.37
BENTON	170	PF 1	50 YR PROP	87.80	836.00	837.03	837.42	838.32	0.146267	9.11	9.64	18.65	2.23
BENTON	170	PF 1	50-yr Exist	87.80	834.00	835.00	835.42	836.49	0.136344	9.81	8.95	17.98	2.45
BENTON	165	PF 1	50 YR PROP	87.80	832.10	833.55	833.63	834.05	0.033392	5.65	15.63	21.50	1.14
BENTON	165	PF 1	50-yr Exist	87.80	830.10	831.40	831.64	832.16	0.035466	6.97	12.59	19.30	1.52
BENTON	160	PF 1	50 YR PROP	87.80	829.20	830.18	830.46	831.07	0.095824	7.58	11.59	21.57	1.82
BENTON	160	PF 1	50-yr Exist	87.80	828.00	829.00	829.27	829.84	0.049603	7.34	11.96	21.94	1.75
BENTON	155	PF 1	50 YR PROP	87.80	827.50	828.46	828.46	828.72	0.029629	4.08	21.50	42.06	1.01
BENTON	155	PF 1	50-yr Exist	87.80	826.00	827.88	827.89	828.17	0.018891	4.32	20.34	38.44	1.05
BENTON	153	PF 1	50 YR PROP	87.80	824.00	824.50	824.88	825.97	0.244193	9.75	9.05	24.46	2.76
BENTON	150	PF 1	50 YR PROP	87.80	822.00	823.86	823.99	824.38	0.044518	5.79	15.16	27.27	1.37
BENTON	150	PF 1	50-yr Exist	87.80	822.00	823.54	824.00	825.46	0.235309	11.14	7.88	17.98	2.96

HEC-RAS River: BENTON Reach: BENTON Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	125	PF 1	50 YR PROP	87.80	819.80	822.65	821.43	822.74	0.000947	2.56	38.41	23.42	0.27
BENTON	125	PF 1	50-yr Exist	87.80	819.80	822.65	821.43	822.74	0.000947	2.56	38.41	23.42	0.27
BENTON	100	PF 1	50 YR PROP	87.80	819.70	822.65		822.71	0.000348	2.20	48.24	25.23	0.23
BENTON	100	PF 1	50-yr Exist	87.80	819.70	822.65		822.71	0.000348	2.20	48.24	25.23	0.23
BENTON	50	PF 1	50 YR PROP	87.80	819.50	822.65	820.97	822.69	0.000634	1.94	55.14	30.67	0.20
BENTON	50	PF 1	50-yr Exist	87.80	819.50	822.65	820.97	822.69	0.000634	1.94	55.14	30.67	0.20
BENTON	40	PF 1	50 YR PROP	87.80	817.50	822.65	819.30	822.67	0.000157	1.39	87.76	40.41	0.11
BENTON	40	PF 1	50-yr Exist	87.80	817.50	822.65	819.30	822.67	0.000157	1.39	87.76	40.41	0.11
BENTON	30	PF 1	50 YR PROP	87.80	817.00	822.60	818.55	822.66	0.000200	1.96	44.80	42.11	0.15
BENTON	30	PF 1	50-yr Exist	87.80	817.00	822.60	818.55	822.66	0.000200	1.96	44.80	42.11	0.15

HEC-RAS River: BENTON Reach: BENTON Profile: PF 1

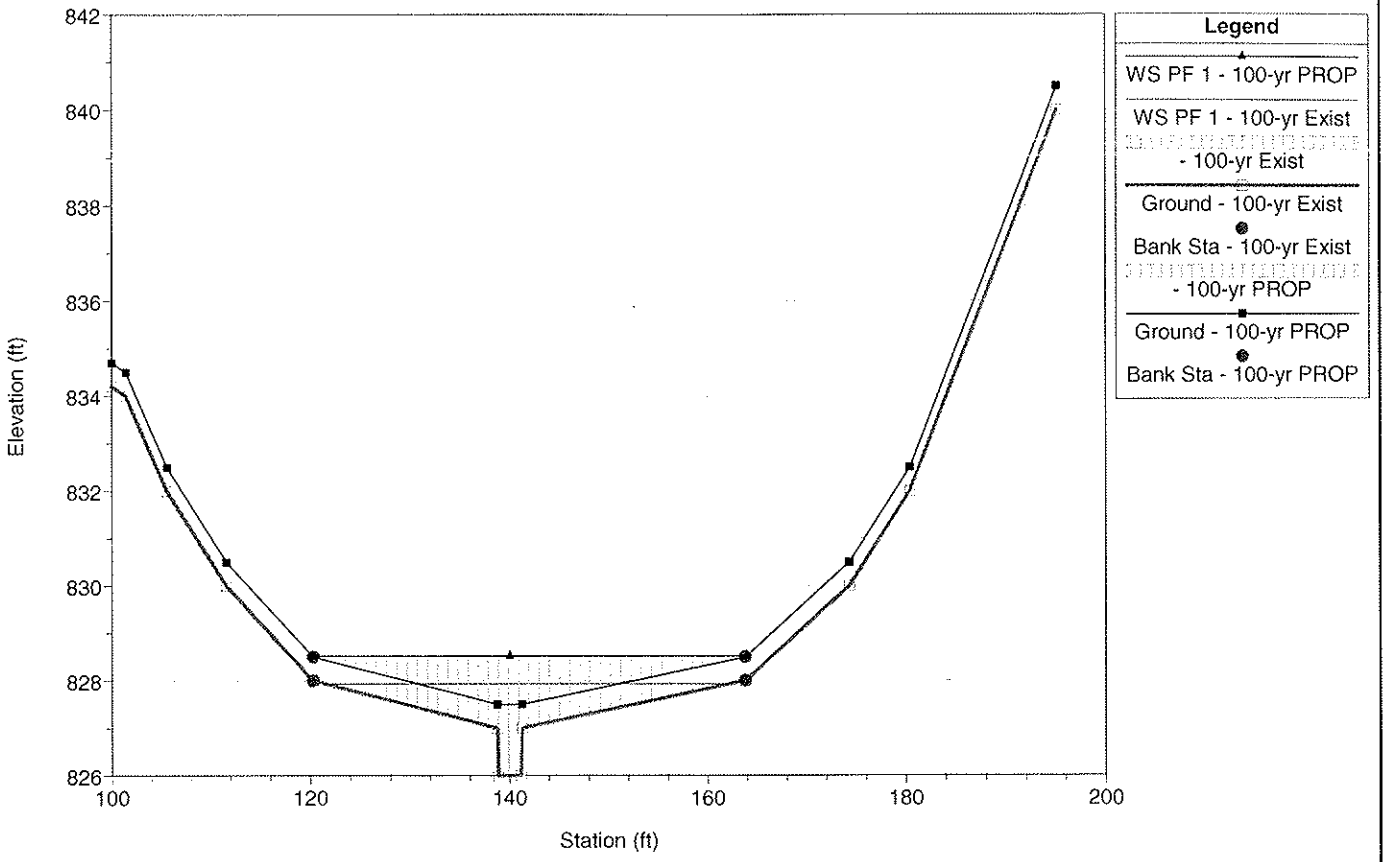
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	215	PF 1	100-yr PROP	103.80	873.50	875.01	875.34	876.08	0.060045	8.33	12.46	13.84	1.55
BENTON	215	PF 1	100-yr Exist	103.80	873.50	875.01	875.34	876.08	0.060045	8.33	12.46	13.84	1.55
BENTON	210	PF 1	100-yr PROP	103.80	870.80	873.26	872.64	873.45	0.005898	3.53	29.40	20.73	0.52
BENTON	210	PF 1	100-yr Exist	103.80	870.80	873.28	872.64	873.47	0.005619	3.47	29.92	20.87	0.51
BENTON	205	PF 1	100-yr PROP	103.80	871.30	872.51	872.47	872.83	0.019441	4.59	23.13	32.55	0.88
BENTON	205	PF 1	100-yr Exist	103.80	871.30	872.47	872.47	872.82	0.022663	4.82	21.99	32.00	0.95
BENTON	200	PF 1	100-yr PROP	103.80	868.00	870.27	870.27	870.88	0.026370	6.30	16.70	14.90	0.99
BENTON	200	PF 1	100-yr Exist	103.80	866.00	867.82	868.27	869.25	0.092518	9.60	10.82	11.86	1.77
BENTON	195	PF 1	100-yr PROP	103.80	862.00	863.04	863.55	864.98	0.219811	11.20	9.27	17.86	2.74
BENTON	195	PF 1	100-yr Exist	103.80	860.00	861.13	861.54	862.52	0.054571	9.45	10.99	19.44	2.21
BENTON	190	PF 1	100-yr PROP	103.80	852.00	853.59	854.06	855.08	0.098913	9.81	10.58	13.31	1.94
BENTON	190	PF 1	100-yr Exist	103.80	850.00	851.19	852.06	855.93	0.179873	17.46	5.94	9.98	3.99
BENTON	185	PF 1	100-yr PROP	103.80	842.00	843.45	844.45	848.68	0.409929	18.36	5.65	7.81	3.80
BENTON	185	PF 1	100-yr Exist	103.80	840.00	841.43	842.45	846.86	0.430433	18.70	5.55	7.74	3.89
BENTON	180	PF 1	100-yr PROP	103.80	840.10	841.63	842.24	843.87	0.155774	11.99	8.66	11.29	2.41
BENTON	180	PF 1	100-yr Exist	103.80	838.10	839.63	840.24	841.89	0.158076	12.06	8.61	11.26	2.43
BENTON	175	PF 1	100-yr PROP	103.80	838.60	840.70	840.79	841.39	0.028168	6.64	15.71	14.81	1.09
BENTON	175	PF 1	100-yr Exist	103.80	836.60	838.52	838.80	839.49	0.027857	7.88	13.17	13.58	1.41
BENTON	170	PF 1	100-yr PROP	103.80	836.00	837.11	837.52	838.49	0.137436	9.43	11.02	19.94	2.20
BENTON	170	PF 1	100-yr Exist	103.80	834.00	835.07	835.51	836.65	0.132082	10.11	10.27	19.26	2.44
BENTON	165	PF 1	100-yr PROP	103.80	832.10	833.63	833.73	834.20	0.034575	6.06	17.29	22.61	1.17
BENTON	165	PF 1	100-yr Exist	103.80	830.10	831.48	831.74	832.32	0.036114	7.32	14.18	20.48	1.55
BENTON	160	PF 1	100-yr PROP	103.80	829.20	830.26	830.57	831.20	0.092273	7.79	13.32	23.11	1.81
BENTON	160	PF 1	100-yr Exist	103.80	828.00	829.07	829.36	829.98	0.049293	7.64	13.59	23.37	1.77
BENTON	155	PF 1	100-yr PROP	103.80	827.50	828.53	828.53	828.81	0.029503	4.30	24.12	43.75	1.02
BENTON	155	PF 1	100-yr Exist	103.80	826.00	827.94	827.96	828.26	0.019705	4.56	22.75	40.92	1.08
BENTON	153	PF 1	100-yr PROP	103.80	824.00	824.56	824.96	826.12	0.224808	10.07	10.37	25.24	2.70
BENTON	150	PF 1	100-yr PROP	103.80	822.00	823.92	824.08	824.50	0.046797	6.14	16.91	29.07	1.42
BENTON	150	PF 1	100-yr Exist	103.80	822.00	823.61	824.08	825.53	0.215039	11.11	9.34	20.19	2.88

HEC-RAS River: BENTON Reach: BENTON Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
BENTON	125	PF 1	100-yr PROP	103.80	819.80	823.96	821.58	823.99	0.000212	1.57	75.43	33.32	0.14
BENTON	125	PF 1	100-yr Exist	103.80	819.80	823.96	821.58	823.99	0.000212	1.57	75.43	33.32	0.14
BENTON	100	PF 1	100-yr PROP	103.80	819.70	823.96		823.98	0.000102	1.54	85.92	32.69	0.13
BENTON	100	PF 1	100-yr Exist	103.80	819.70	823.96		823.98	0.000102	1.54	85.92	32.69	0.13
BENTON	50	PF 1	100-yr PROP	103.80	819.50	823.96	821.11	823.97	0.000170	1.28	103.65	43.34	0.11
BENTON	50	PF 1	100-yr Exist	103.80	819.50	823.96	821.11	823.97	0.000170	1.28	103.65	43.34	0.11
BENTON	40	PF 1	100-yr PROP	103.80	817.50	823.96	819.48	823.97	0.000060	1.00	132.75	51.22	0.07
BENTON	40	PF 1	100-yr Exist	103.80	817.50	823.96	819.48	823.97	0.000060	1.00	132.75	51.22	0.07
BENTON	30	PF 1	100-yr PROP	103.80	817.00	823.90	818.73	823.96	0.000140	1.88	55.20	50.76	0.13
BENTON	30	PF 1	100-yr Exist	103.80	817.00	823.90	818.73	823.96	0.000140	1.88	55.20	50.76	0.13

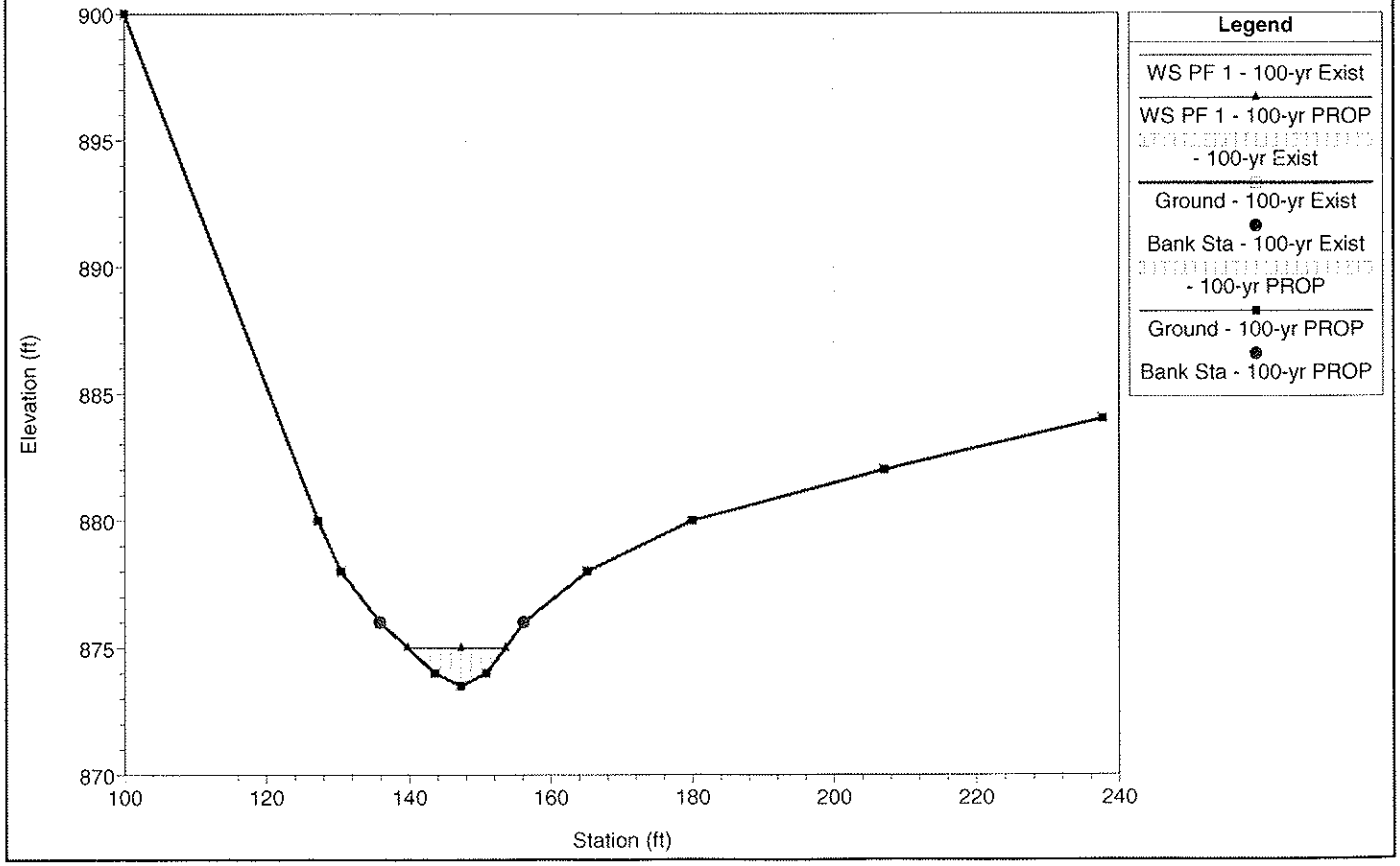
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 155



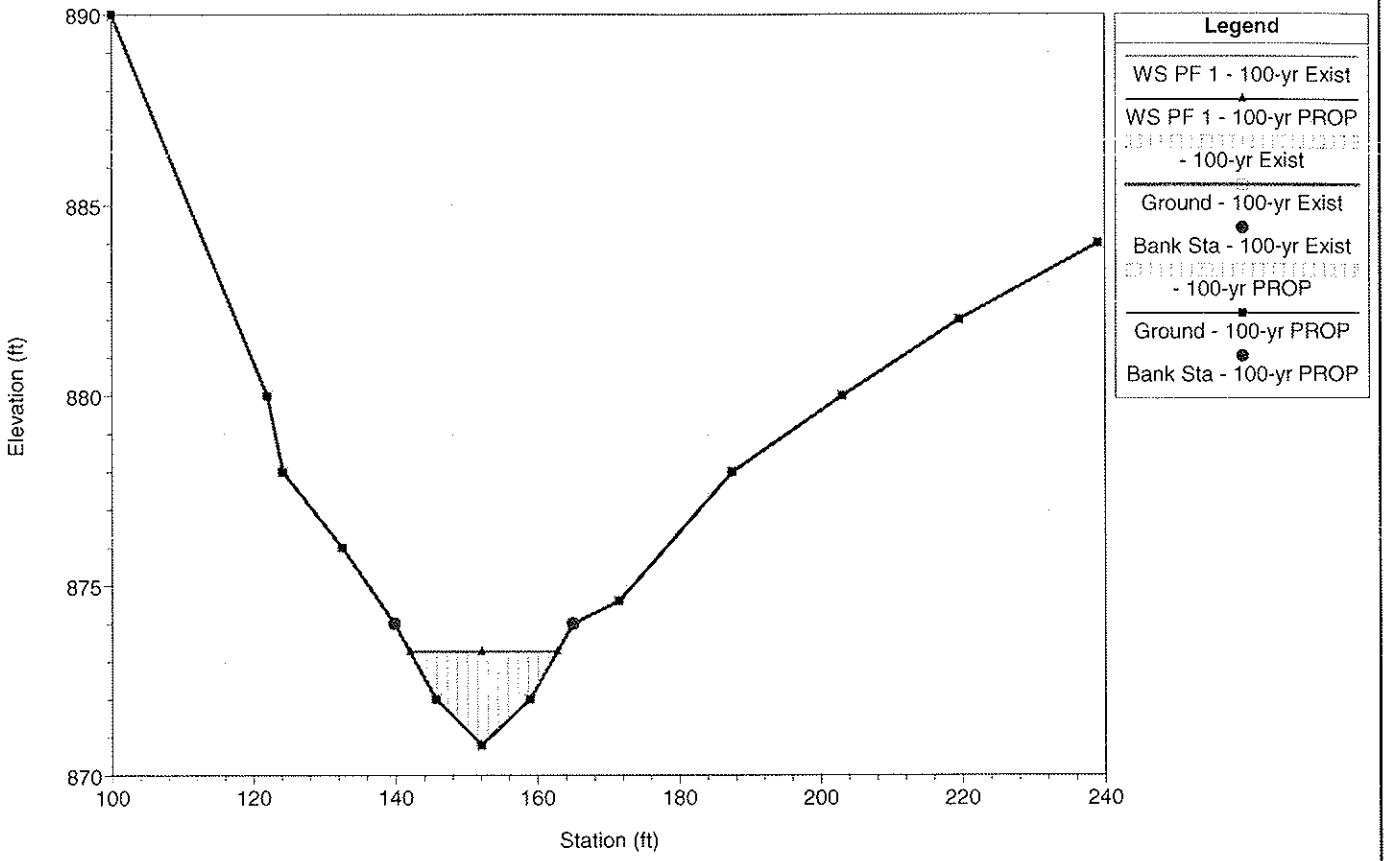
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 215



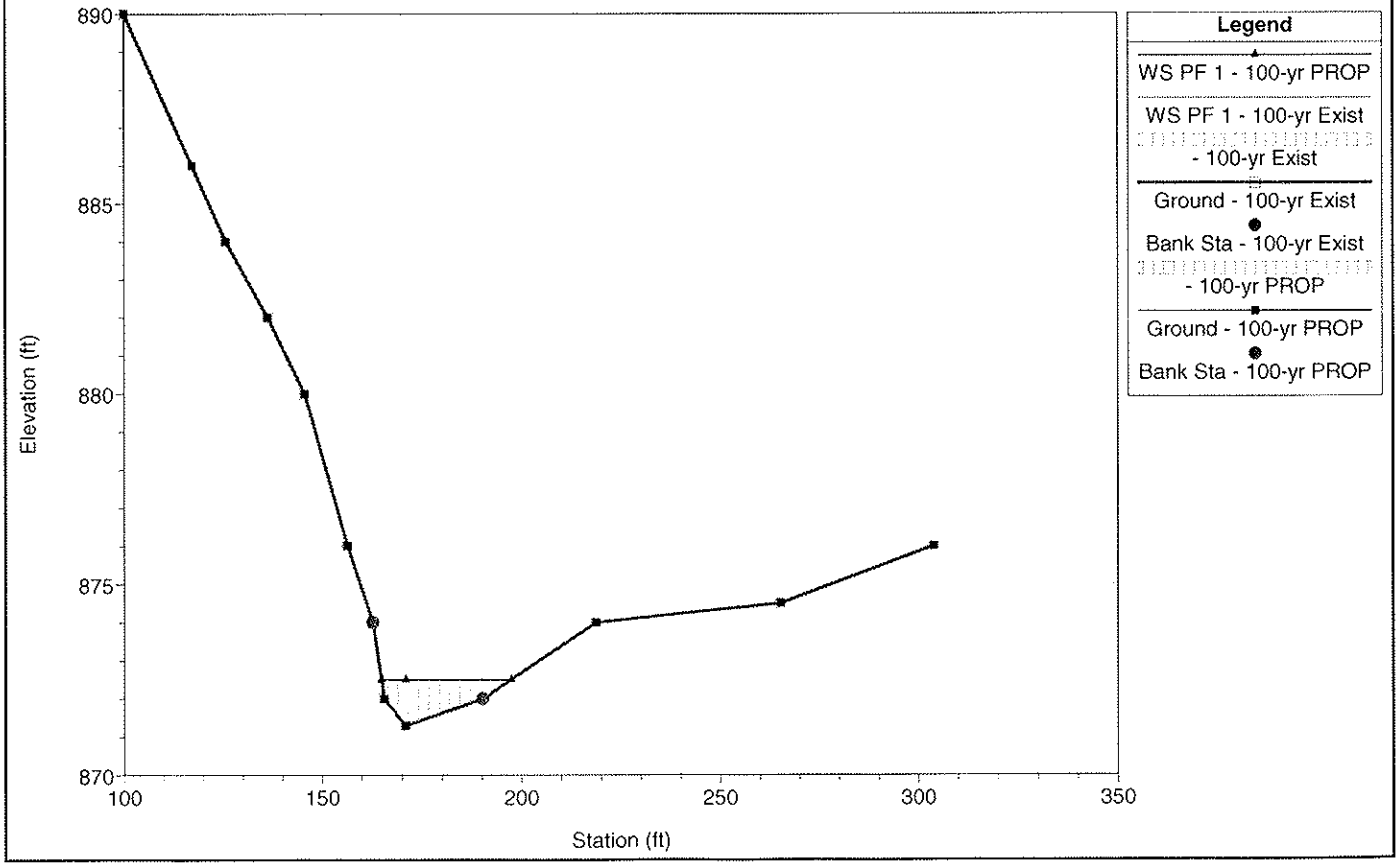
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 210



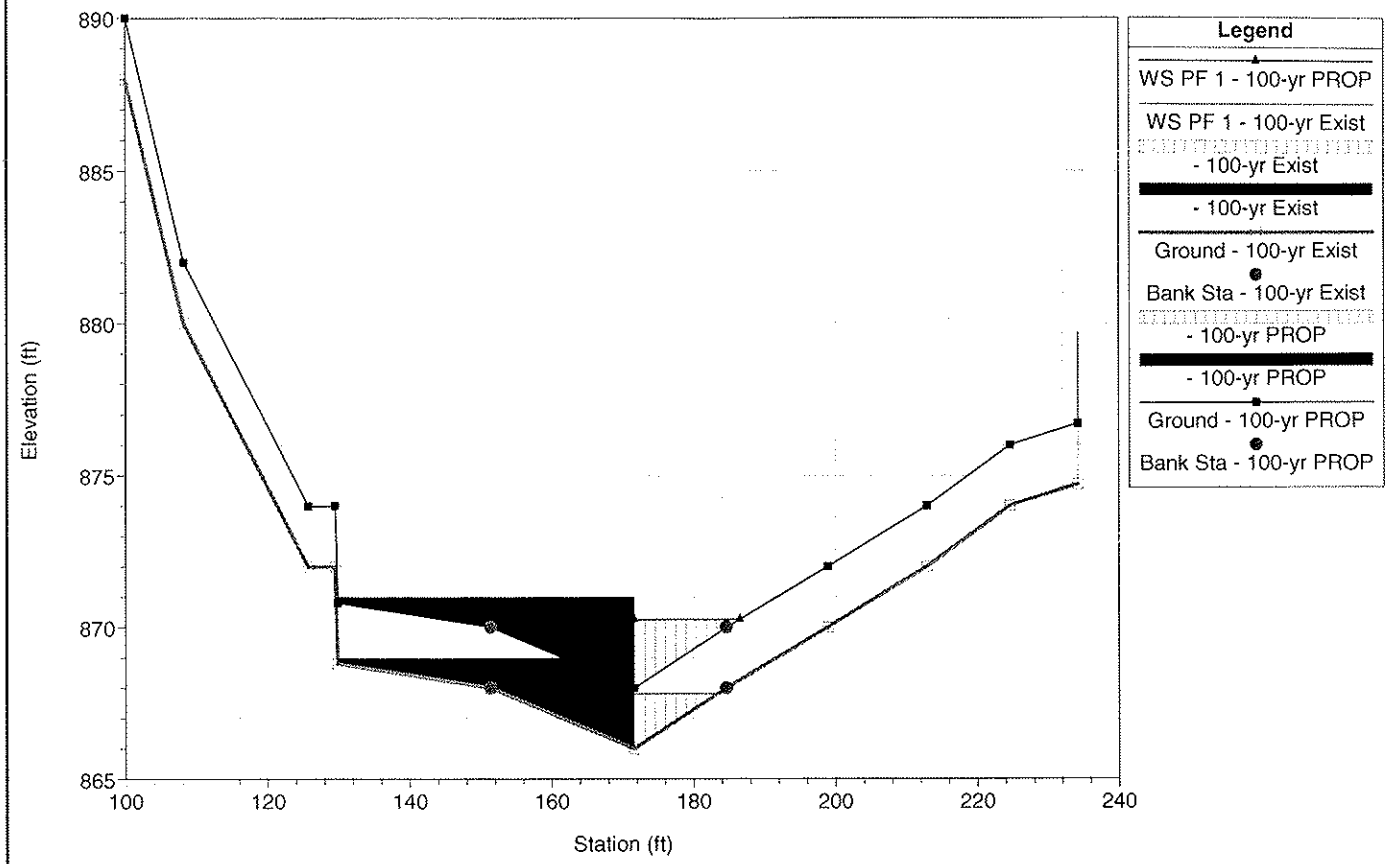
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 205



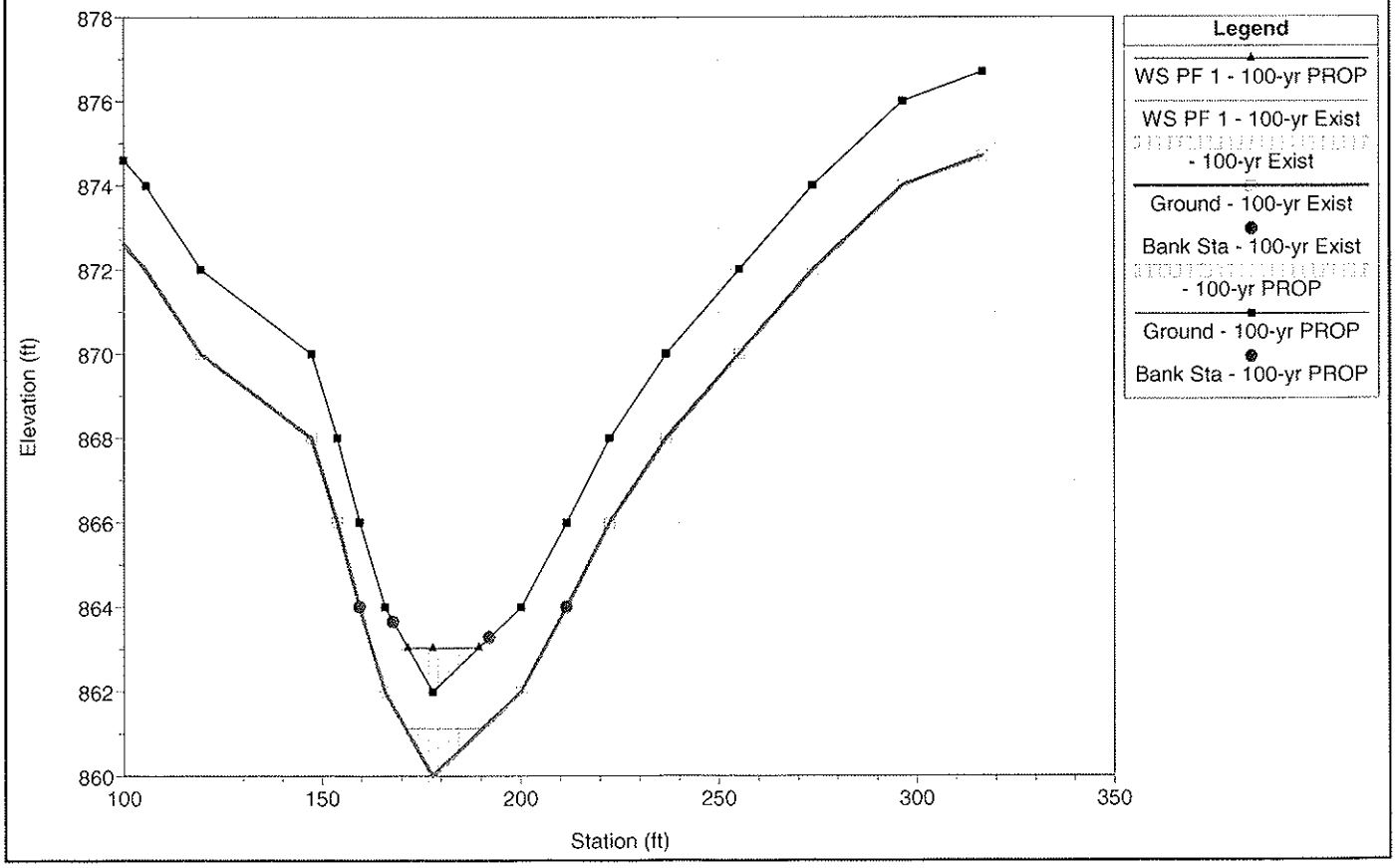
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 200



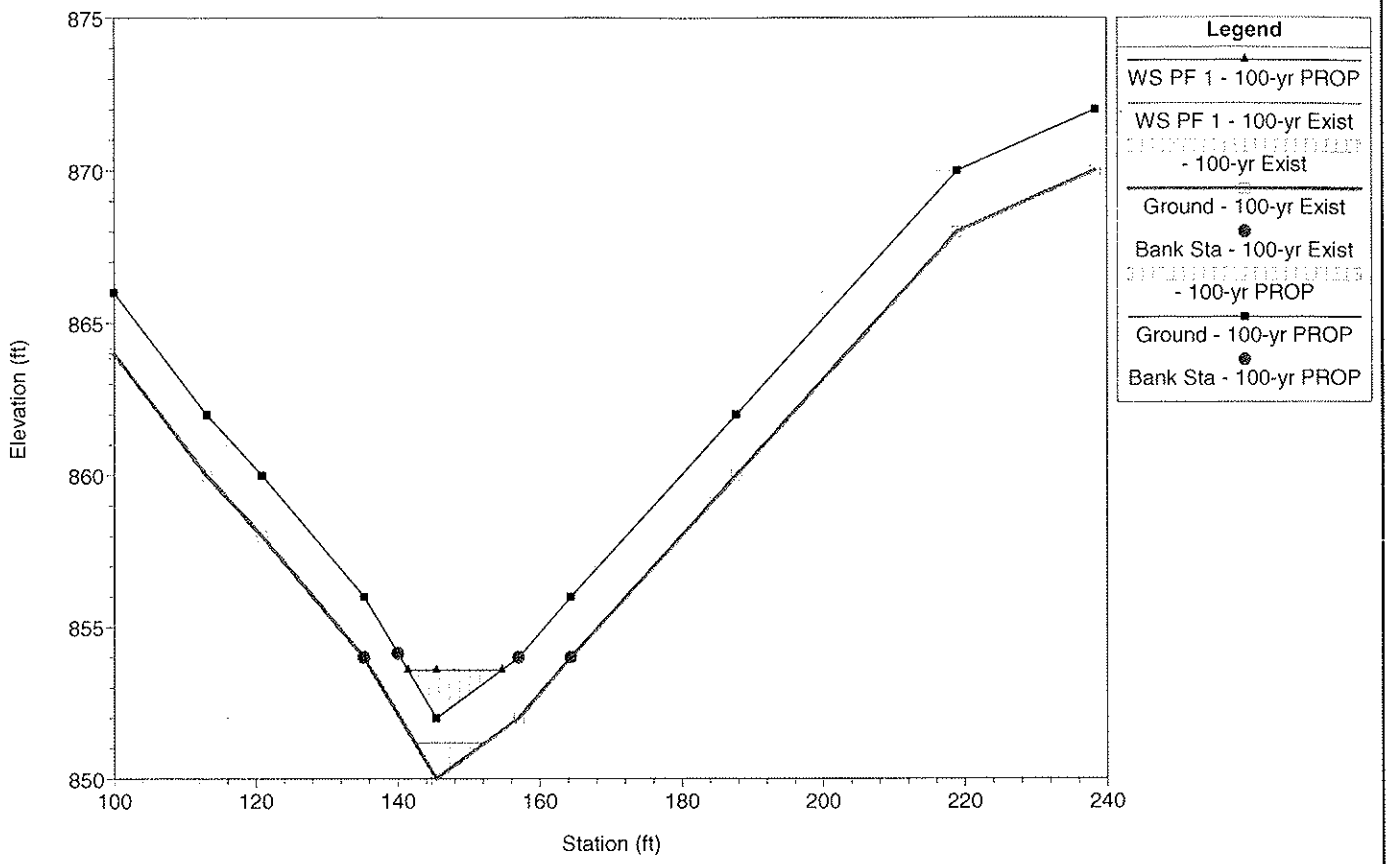
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 195



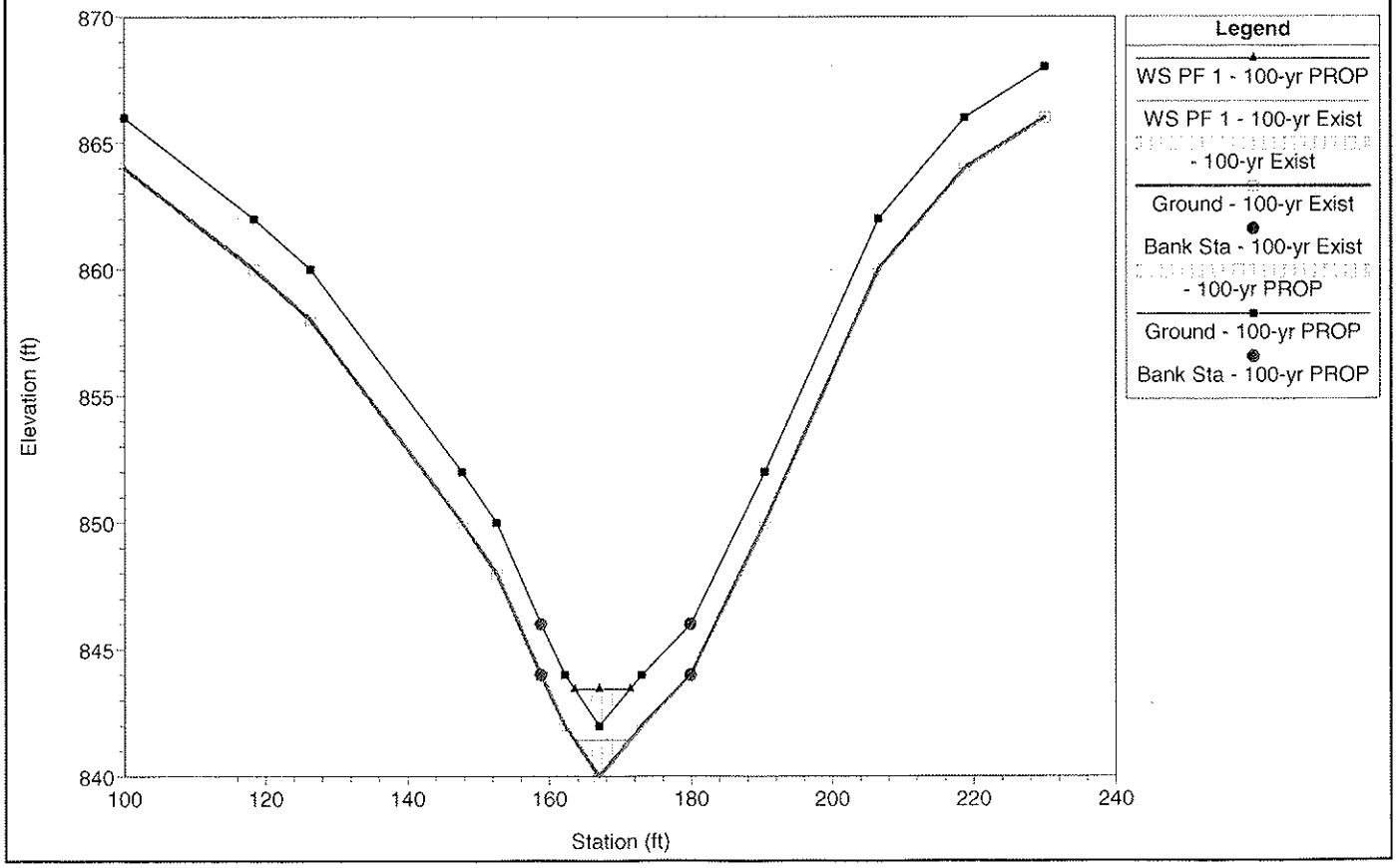
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 190



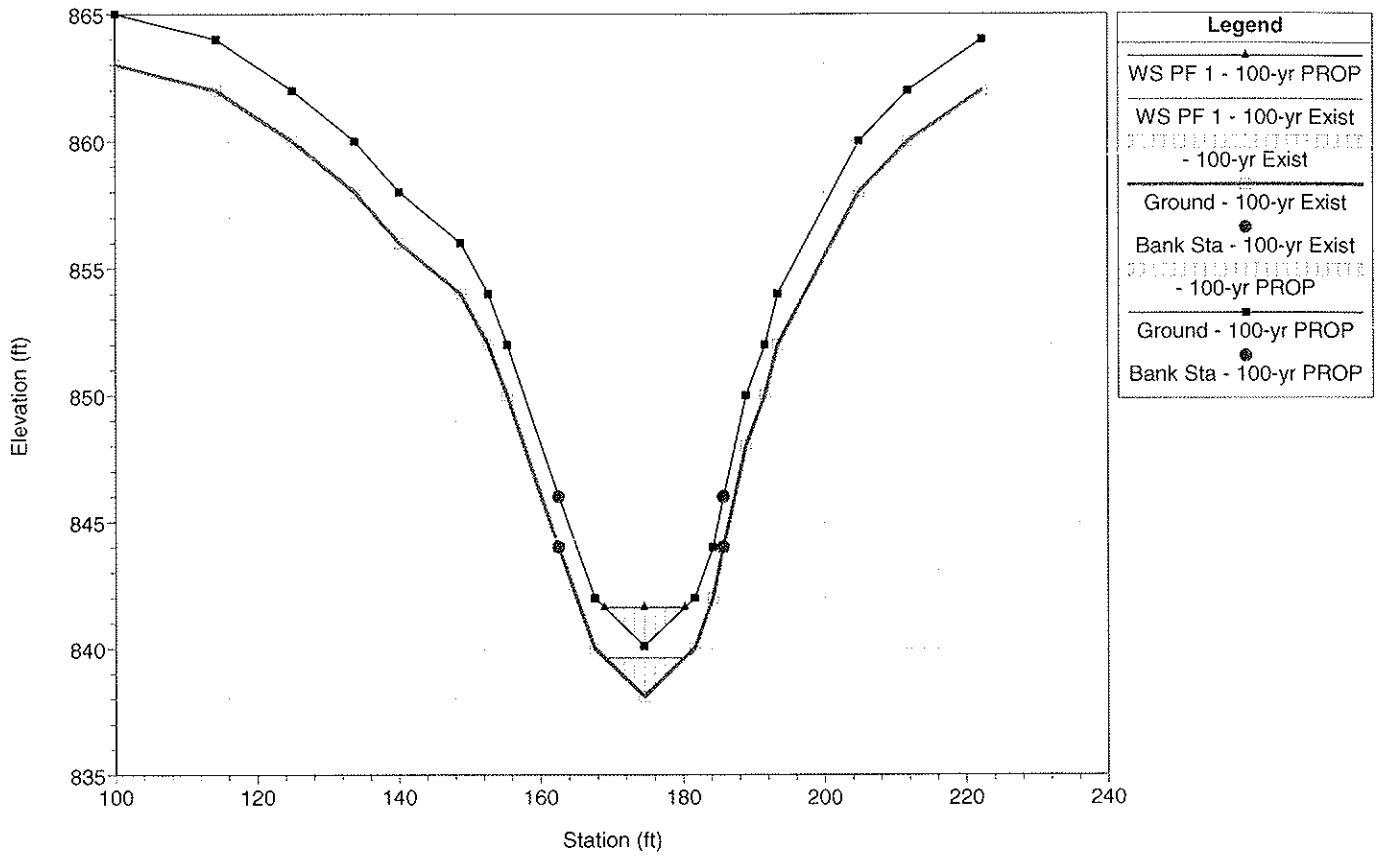
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 185



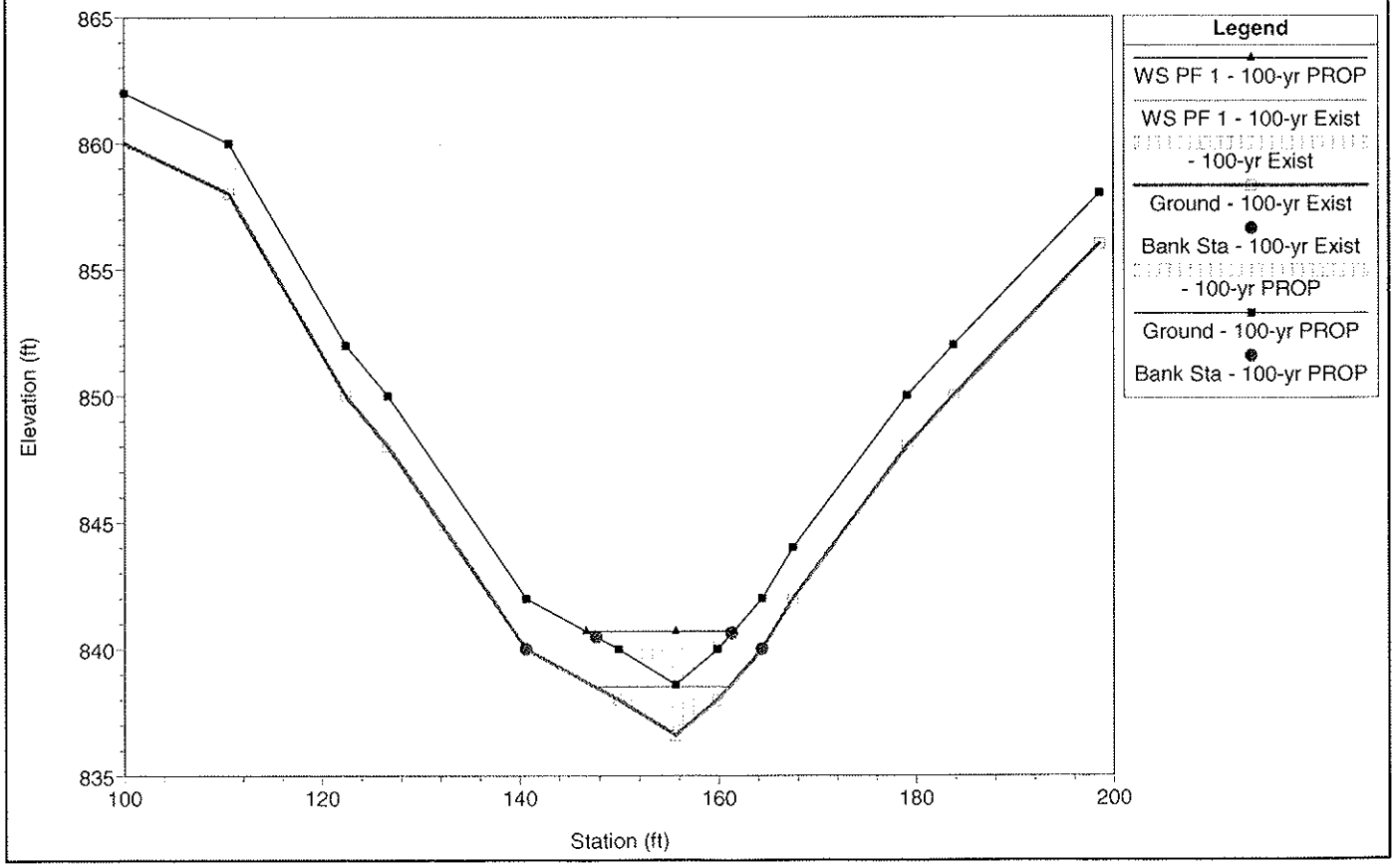
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 180



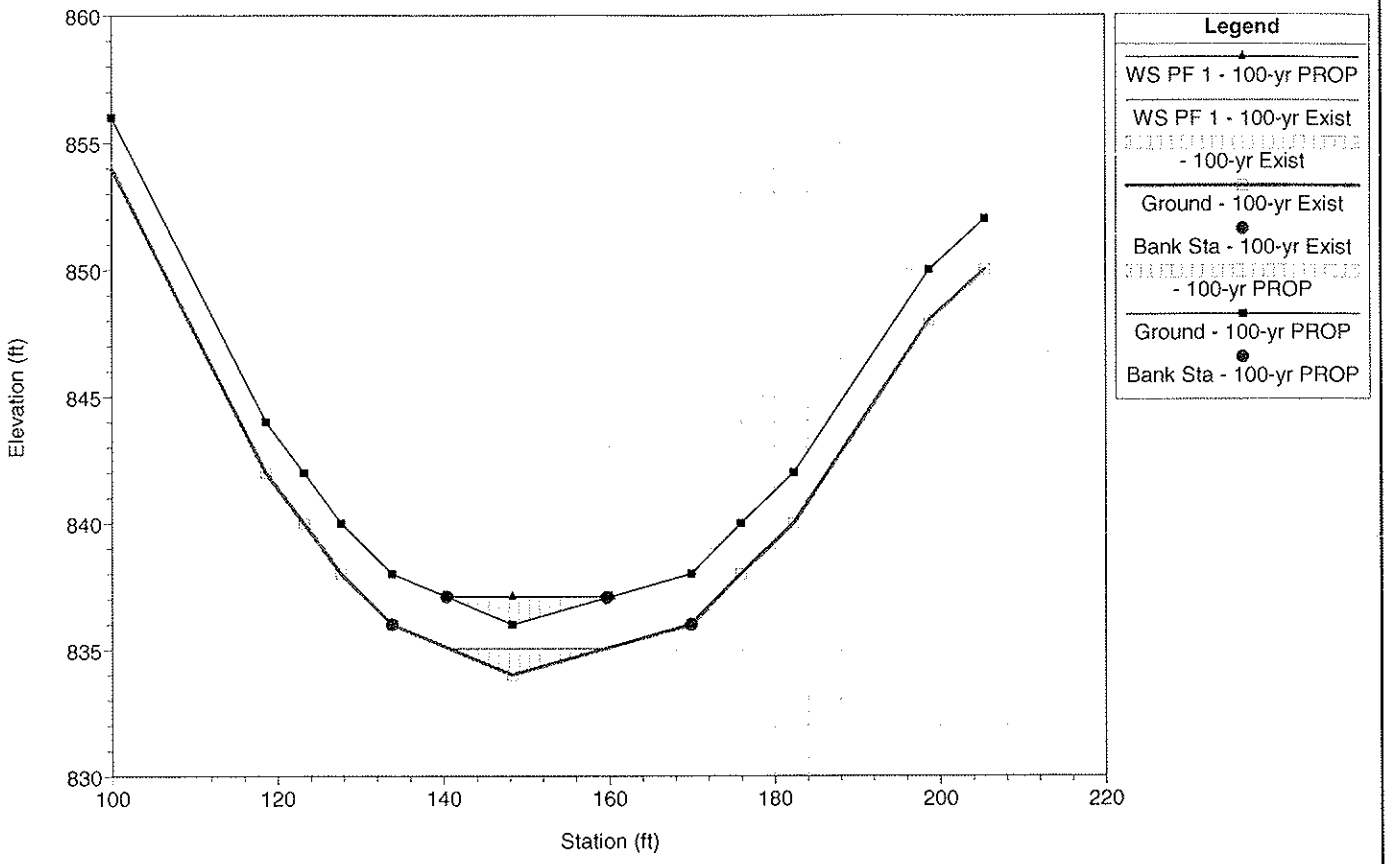
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 175



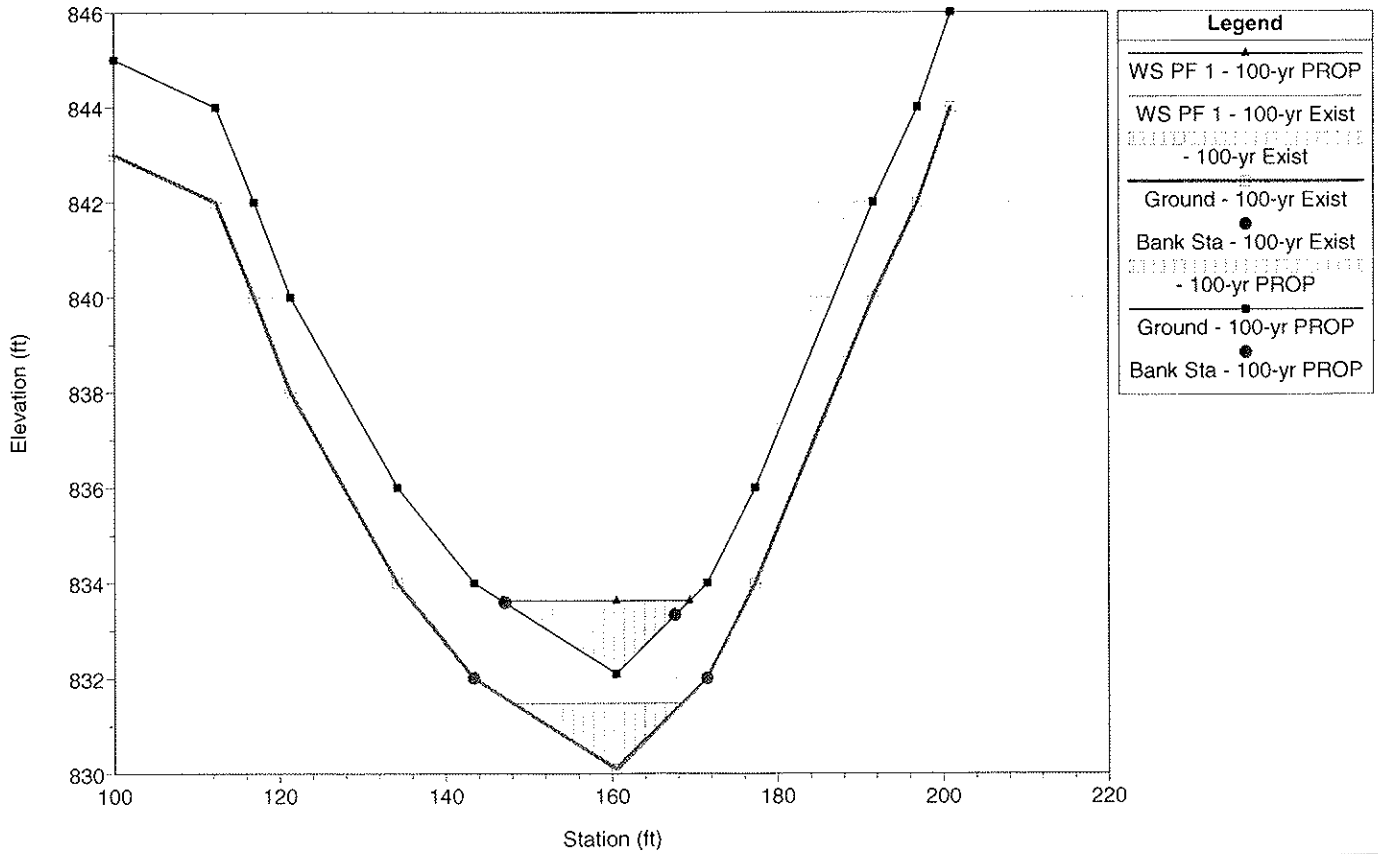
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 170



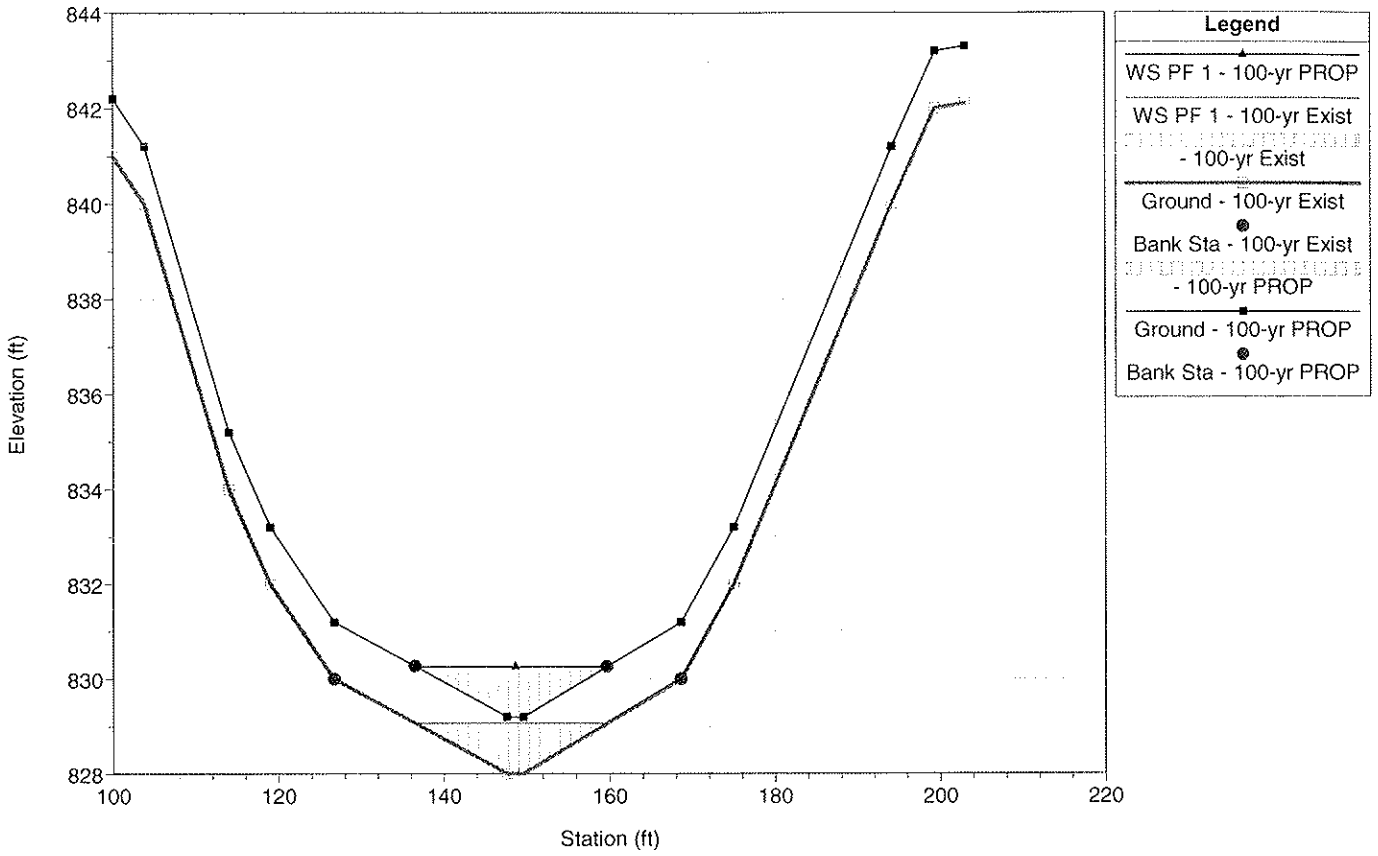
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 165



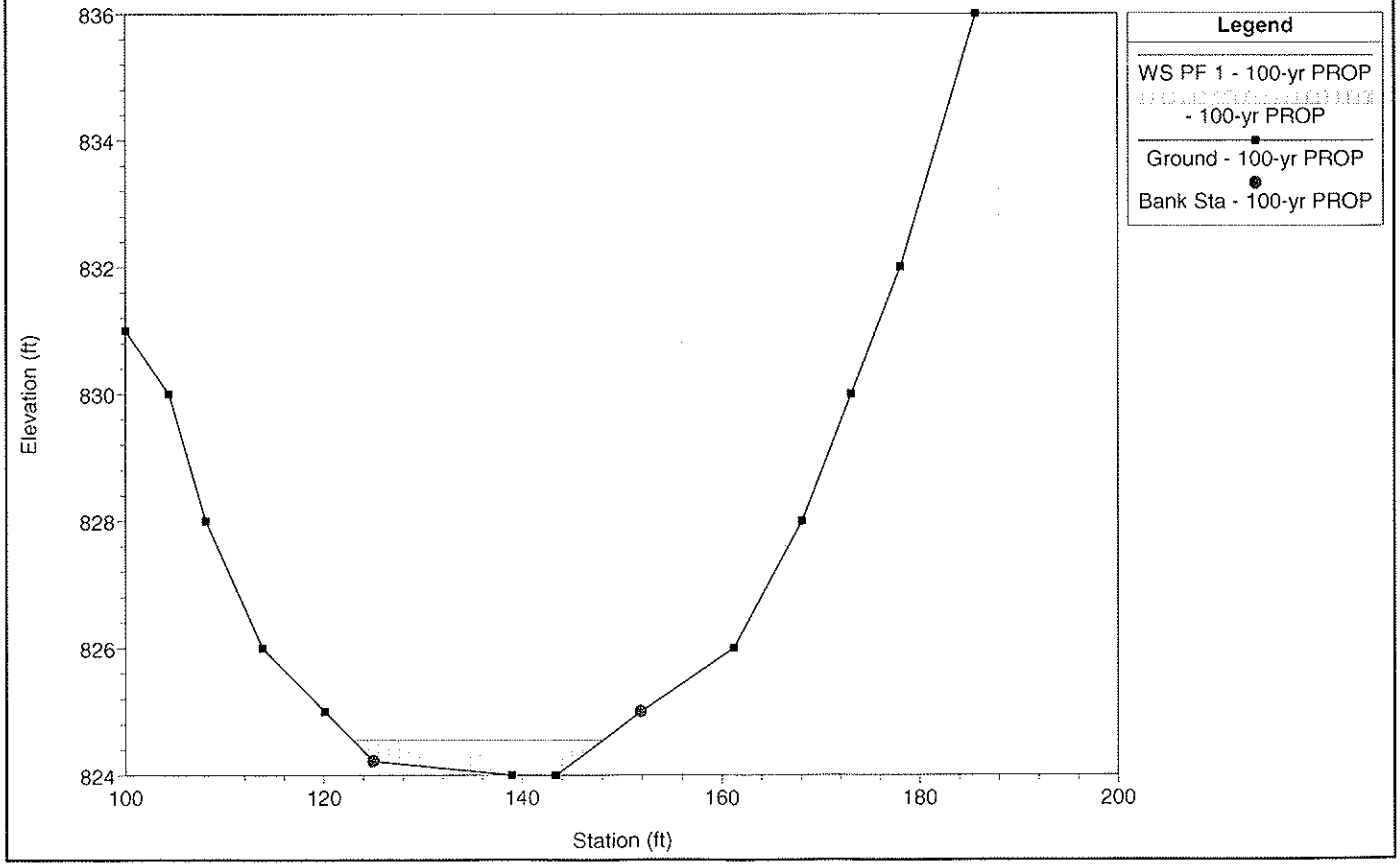
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 160



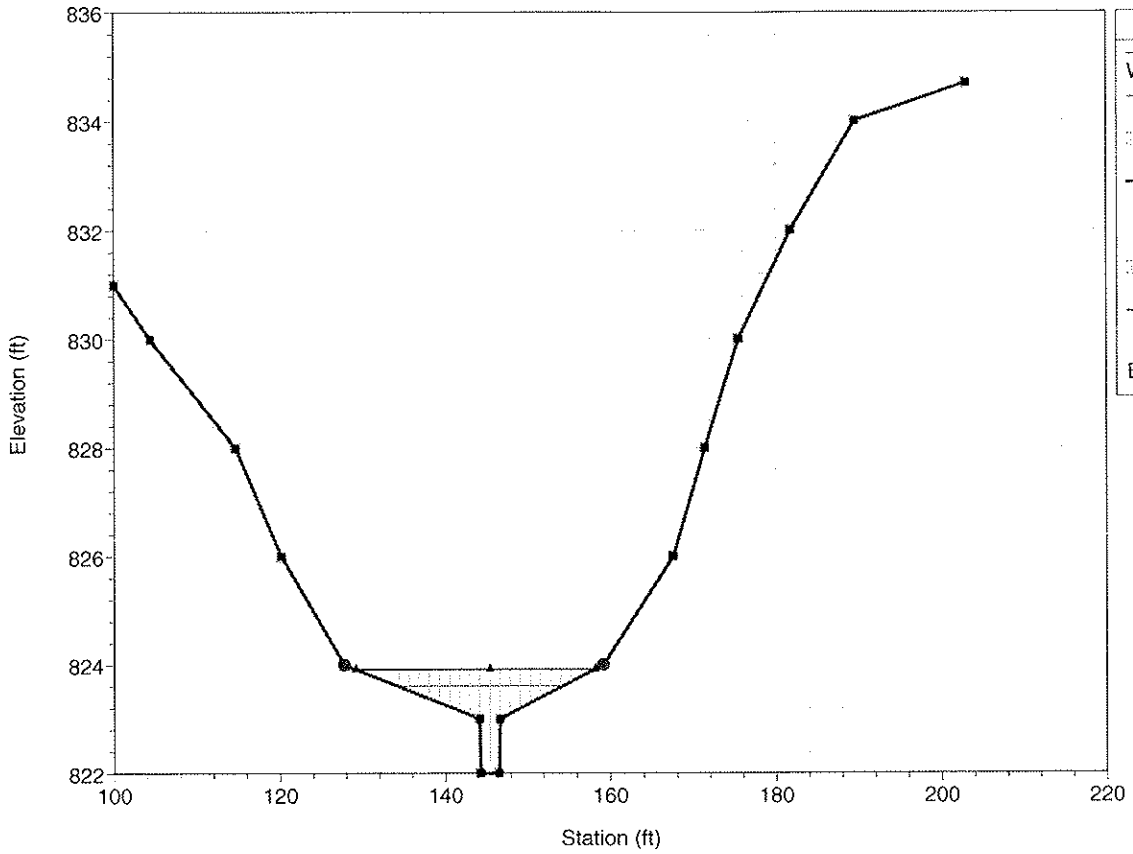
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 153 O' FILL - BEGIN FILL



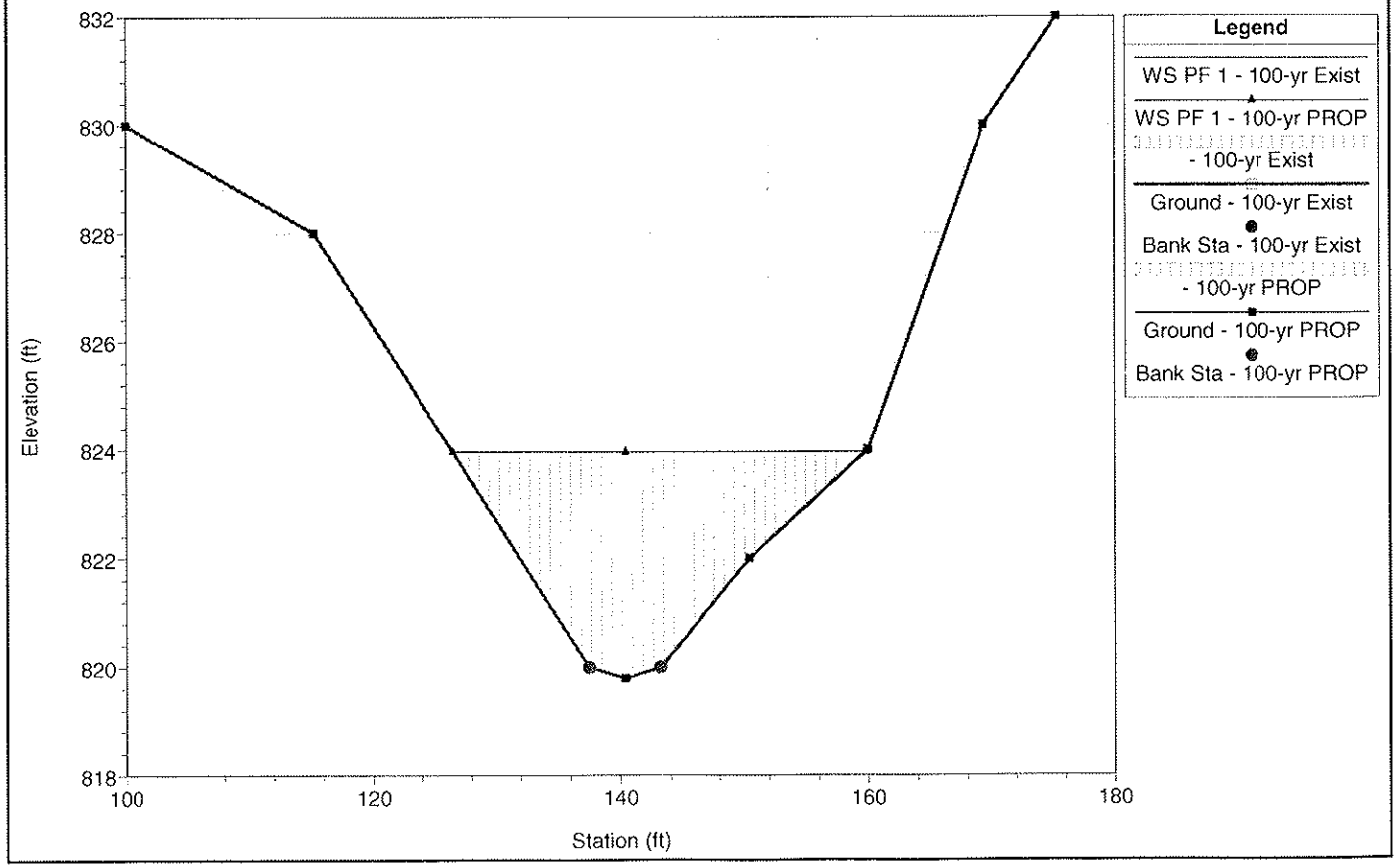
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 150



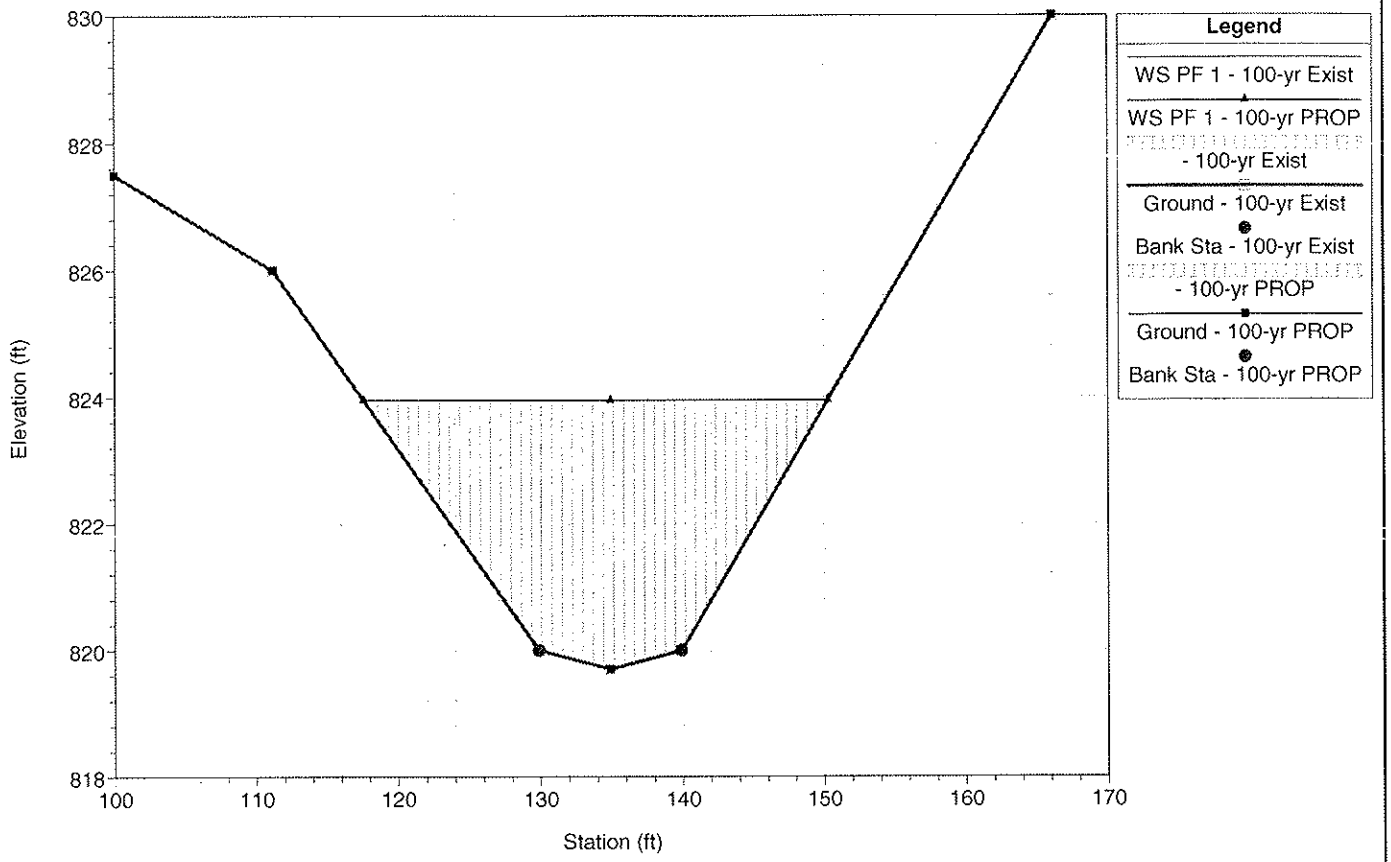
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 125



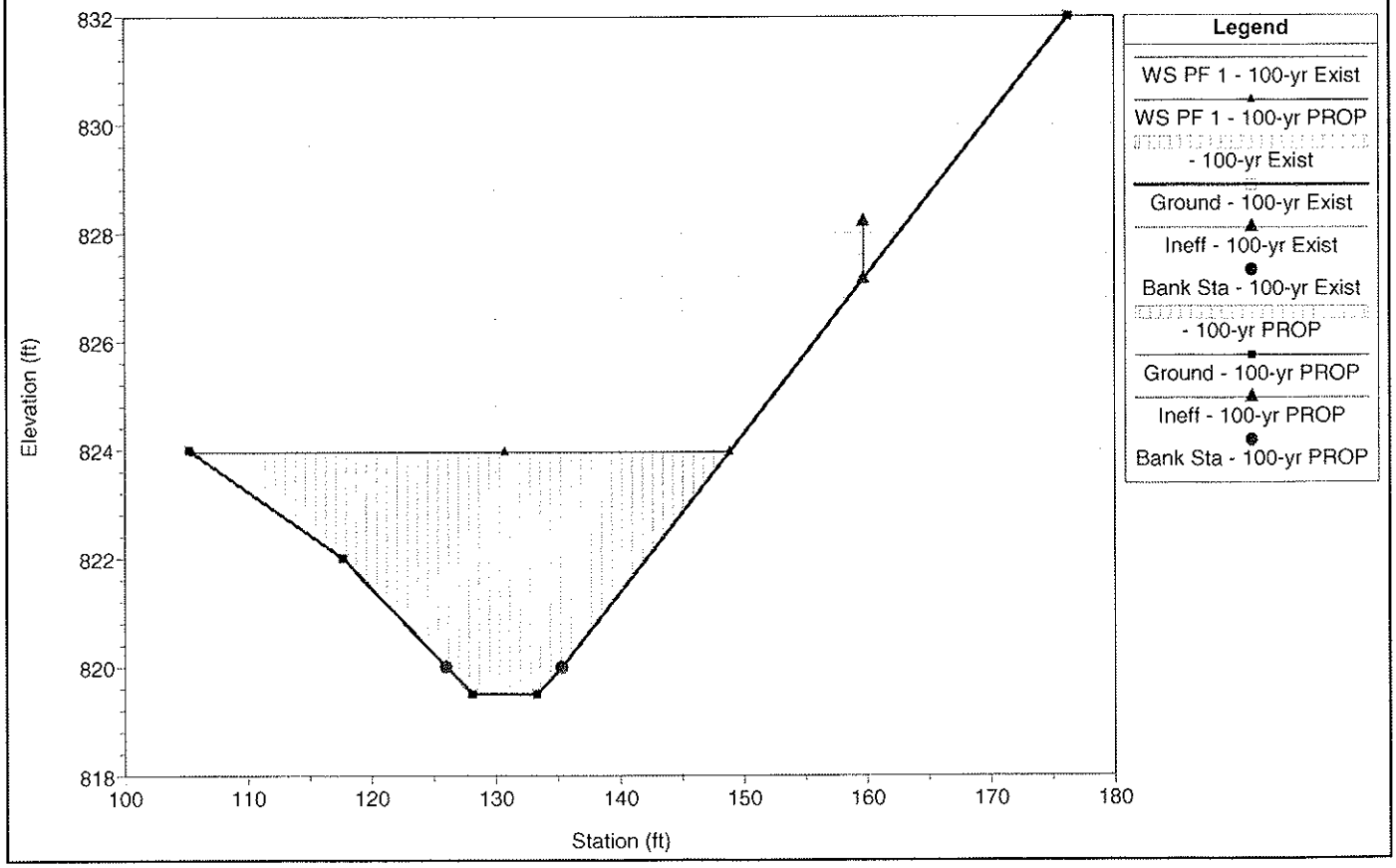
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 100



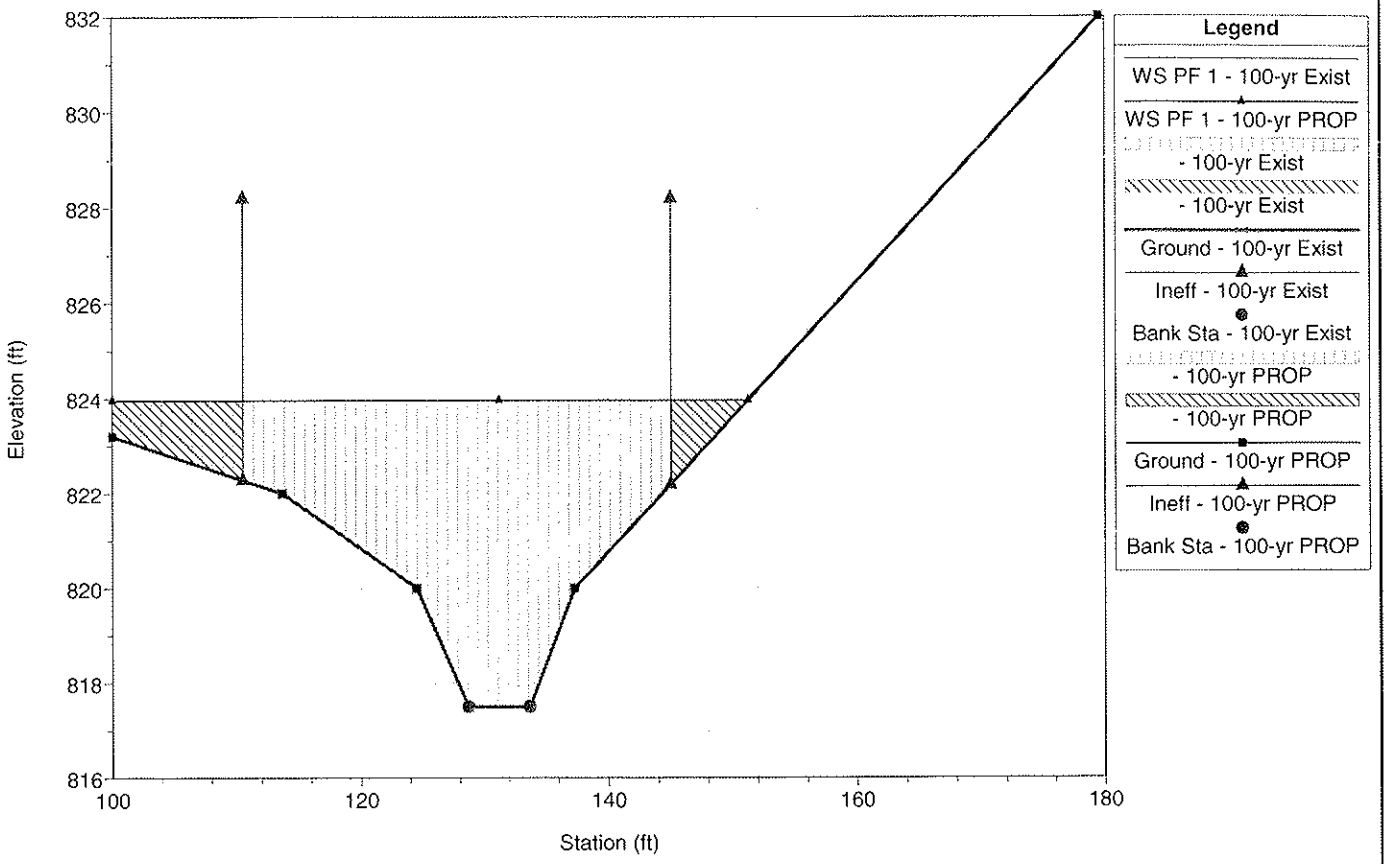
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 50



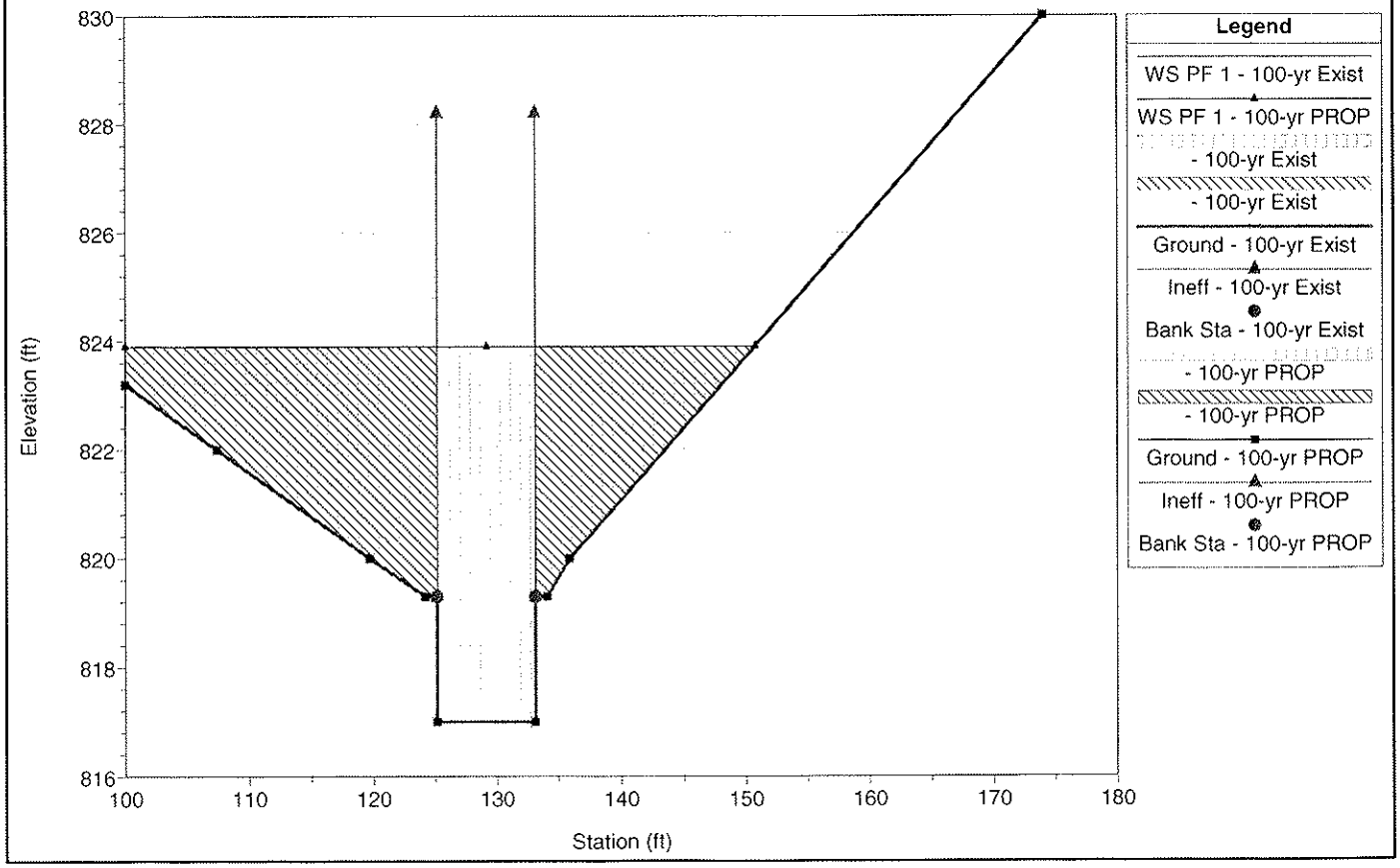
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 40



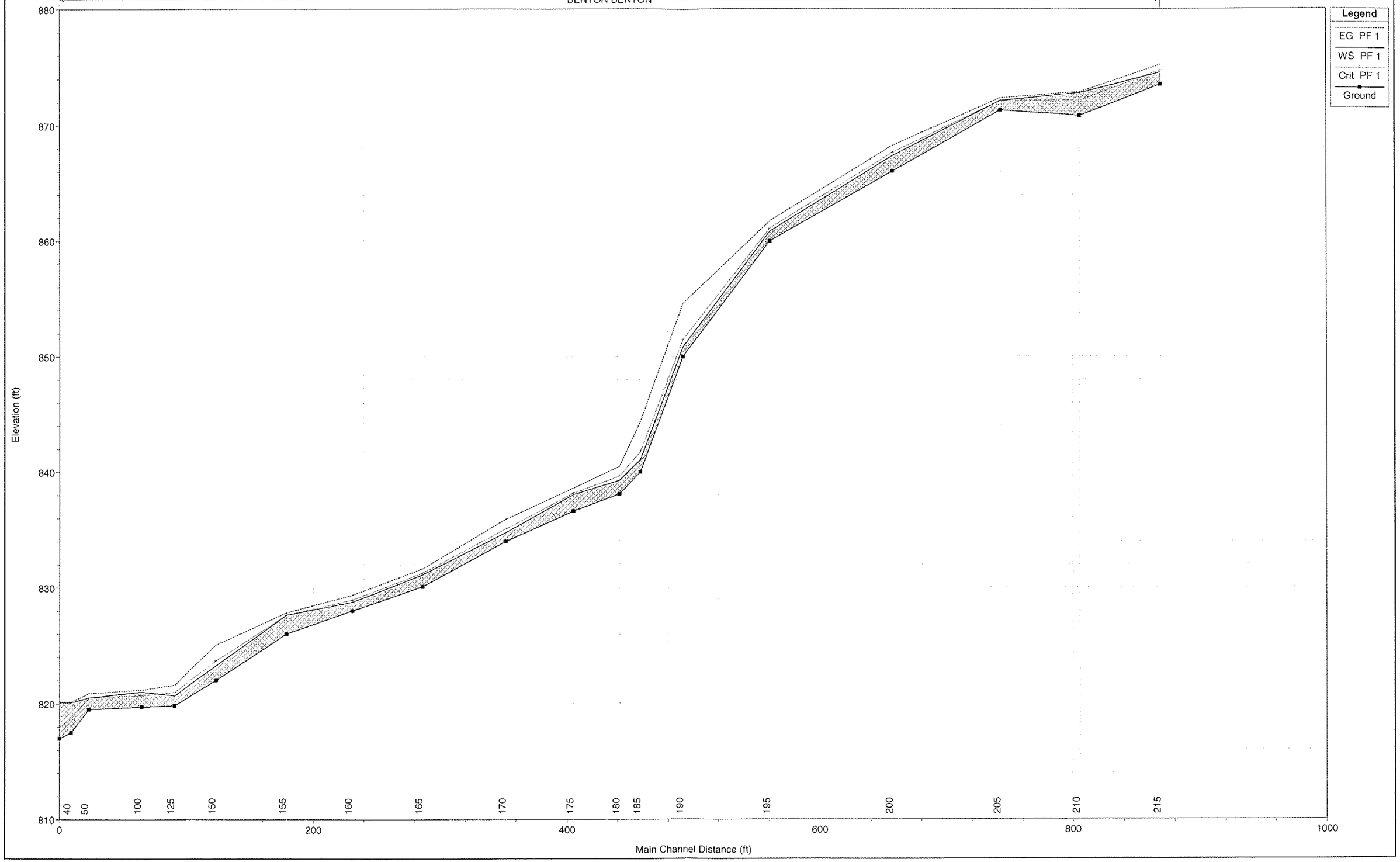
BENTON Plan: 1) 100-yr PROP 2) 100-yr Exist

River = BENTON Reach = BENTON RS = 30



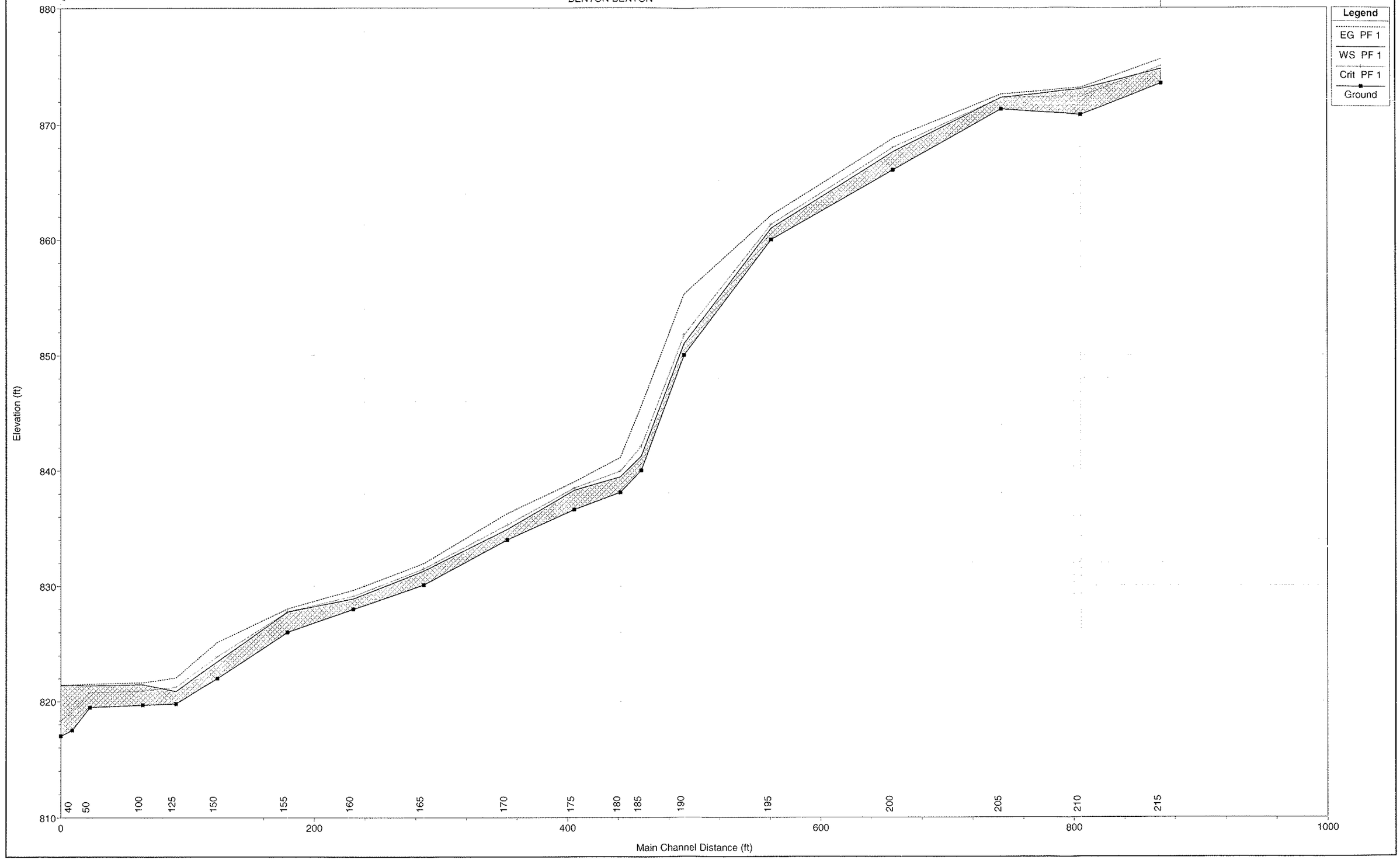
BENTON Plan: 2-yr Exist 2/19/2009

BENTON BENTON



BENTON Plan: 10-yr Exist 2/19/2009

BENTON BENTON



BENTON Plan: 50-yr Exist 2/19/2009

BENTON BENTON

Legend

EG PF 1

WS PF 1

Crit PF 1

Ground

Elevation (ft)

880
870
860
850
840
830
820
810

40 50 100 125 150 155 160 165 170 175 180 185 190 195 200 205 210 215

0 200 400 600 800 1000

Main Channel Distance (ft)

BENTON Plan: 100-yr Exist 2/19/2009

BENTON BENTON

Legend

EG PF 1

WS PF 1

Crit PF 1

Ground

Elevation (ft)

880
870
860
850
840
830
820
810

40 50 100 125 150 155 160 165 170 175 180 185 190 195 200 205 210 215

0 200 400 600 800 1000

Main Channel Distance (ft)

BENTON Plan: 1) 100-yr PROP 2/19/2009 2) 100-yr Exist 2/19/2009

BENTON BENTON

Legend

WS PF 1 - 100-yr PROP

WS PF 1 - 100-yr Exist

Ground

Ground

PROPOSED WS PF

PROPOSED GROUND

EXIST. WS PF

EXIST. GROUND

Elevation (ft)

880
870
860
850
840
830
820
810

40 50 100 125 150 153 155 160 165 170 175 180 185 190 195 200 205 210 215

0 200 400 600 800 1000

Main Channel Distance (ft)

APPENDIX E

LEGEND

- Boring location where burn ash-containing waste observed in fill
- Boring location where no burn ash-containing waste was observed in fill
- Boring location where no fill was observed
- (3.5) Indicates thickness of cover soil (in feet)
- NP No burn ash containing waste present
- GREEN Indicates no burn ash-containing waste present
- ORANGE Indicates burn ash-containing waste present
- Approximate location indicating 2 feet cover soil thickness
- Approximate Burn Site Footprint
- Parcel Boundary
- Floodplain
- Excavate 2 feet below existing grade to remove burn ash containing waste
- Designated Burn Ash Placement Area
- Capped Area
- Contours

DENSE BRUSH
TREES
DENSE TREES
BRUSH
870
850
860
840
830
900
910
890
880

2241634200
2241631800
2241631900
2241634100
2241631600
2241631500
2241630900
2241631000
2241630800
2241903600
2241904700
2241904100
2241901700

B1 (NP)
B2 (3.2)
B3 (2)
B4 (4.5)
B5 (2.5)
B6 (1)
B7 (0)
B8 (0)
B9 (2.5)
B10 (NP)
B11 (0)
B12 (NP)
B13 (7.5)
B14 (NP)
B15 (NP)
B16 (NP)
B17 (NP)
B18 (0)
B19 (0.5)
B20 (NP)
B21 (7)
B22 (0)
B23 (1.5)
B24 (NP)
B25 (0)
B26 (0)
SS1 (0)
SS2 (0)
SS3 (0)

>2 feet
<2 feet
<2 feet
>2 feet

SOURCES:
Ninyo & Moore, 2007

CONSOLIDATION AND CAPPING PLAN
BENTON BURN DUMP

URS

20 0 20 40 Feet
SCALE: 1" = 40' (1:480)
SCALE CORRECT WHEN PRINTED AT 11X17

CREATED BY: CL	DATE: 10-06-09	FIG. NO:
PM: RKS	PROJ. NO: 17326074.10003	E-1

Path: G:\gis\projects\1577\17326074\map_docs\mxd\Cover_Soil_Thickness_noaerial.mxd, 10/06/09, Camille_Lill

Subject Benton Dump Site

By CHS Checked By RKS

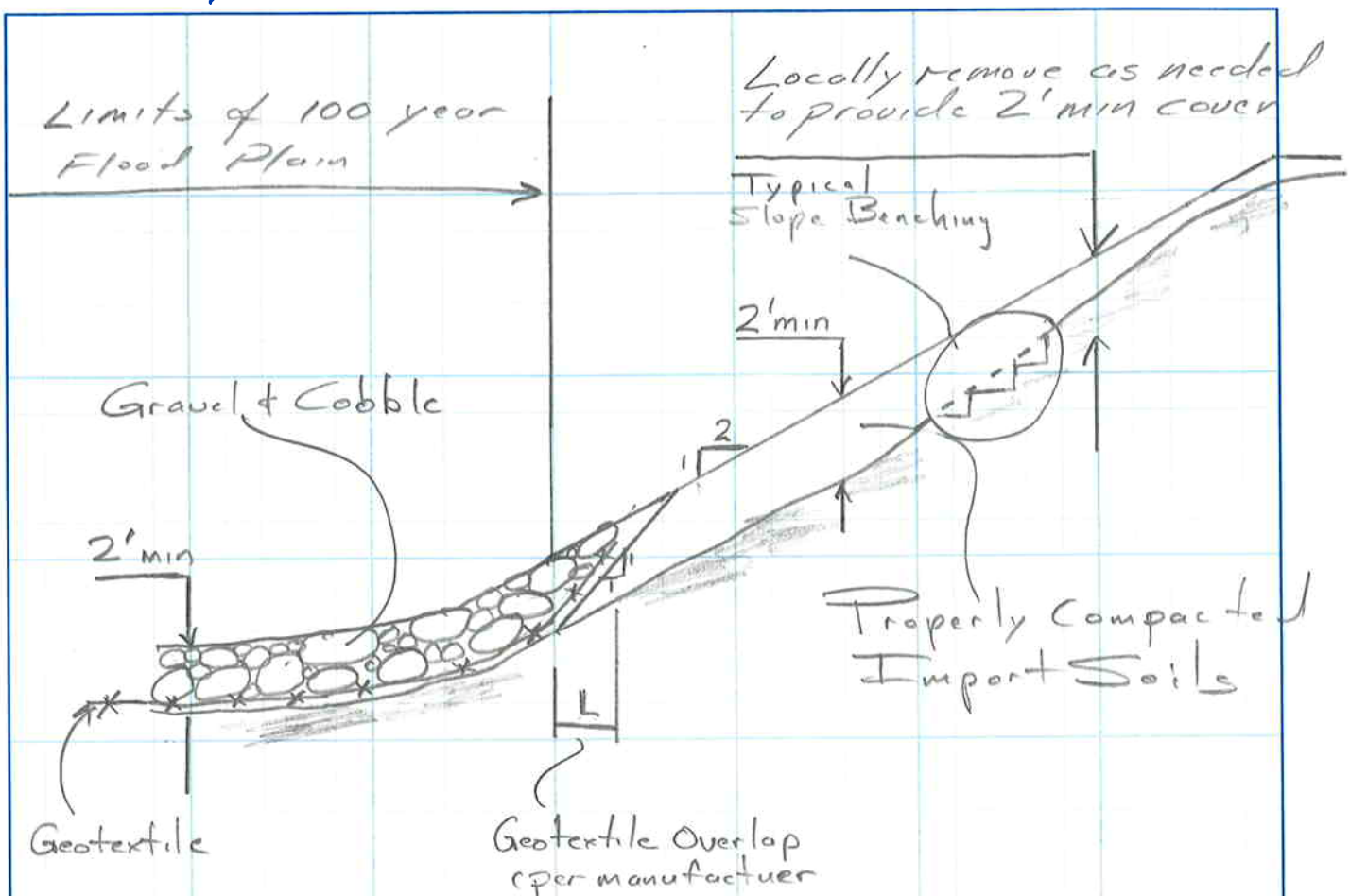
Date Feb 20, 09 Date 2/23/09

Project No. 17326078

Task No. 10003

File No.

Sheet 1 of 1



NTS

URS